VMware Cloud Foundation Architecture and Deployment Guide

VMware Cloud Foundation 3.0

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Contents

About the VMware Cloud Foundation Architecture and Deployment Guide

The *VMware Cloud Foundation Architecture and Deployment Guide* provides a high-level overview of the VMware Cloud Foundation product and its architecture. This document also describes the deployment process for Cloud Foundation.

Intended Audience

The *VMware Cloud Foundation Architecture and Deployment Guide* is intended for data center cloud administrators who deploy a Cloud Foundation system in their organization's data center. The information in this guide is written for experienced data center cloud administrators who are familiar with:

- Concepts of virtualization and software-defined data centers
- Networking and concepts such as uplinks, NICs, and IP networks
- Hardware components such as top-of-rack (ToR) switches, inter-rack switches, servers with direct attached storage, cables, and power supplies
- Methods for setting up physical racks in your data center
- Using the VMware vSphere® Web Client™ to work with virtual machines

Related Publications

The *VMware Cloud Foundation Planning and Preparation Guide* provides detailed information about the software, tools, and external services that are required for Cloud Foundation.

The *VMware Cloud Foundation Operations and Administration Guide* contains detailed information about how to administer and operate a Cloud Foundation system in your data center.

Your Cloud Foundation system includes various VMware software products and components. You can find the documentation for those VMware software products at docs.vmware.com.

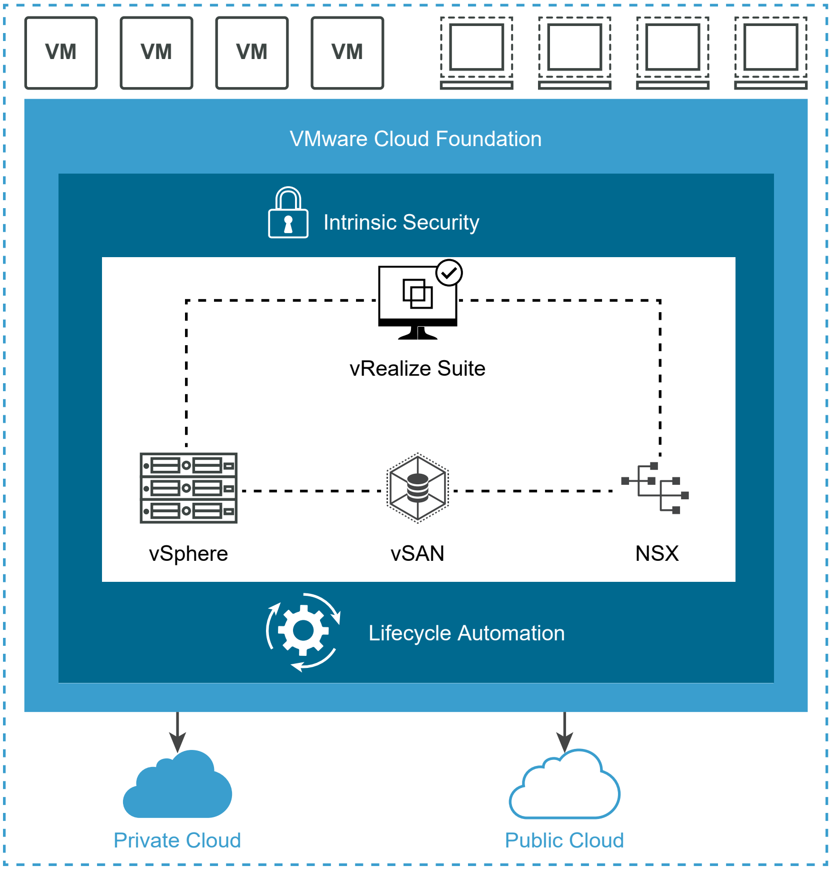
Cloud Foundation Glossary

The Cloud Foundation Glossary defines terms specific to Cloud Foundation.

About VMware Cloud Foundation

1

VMware Cloud Foundation is an integrated software stack that bundles compute virtualization (VMware vSphere), storage virtualization (VMware vSAN), network virtualization (VMware NSX for vSphere), and cloud management (VMware vRealize Suite) into a single platform that can be deployed on premises as a private cloud or run as a service within a public cloud. Cloud Foundation helps to break down the traditional administrative silos in data centers, merging compute, storage, network provisioning, and cloud management to facilitate end-to-end support for application deployment.



This guide focuses on the private cloud use case.

Cloud Foundation uses VMware vCenter Server for virtual machine (VM) management, monitoring, and provisioning. Cloud Foundation also integrates with other VMware products, including VMware vRealize Suite, VMware Integrated OpenStack, VMware Integrated Containers, and VMware Horizon

To manage the logical infrastructure in the private cloud, Cloud Foundation augments the VMware virtualization and management components with a new component, SDDC Manager. SDDC Manager automates the bring up, configuration, provisioning, and lifecycle management of the entire SDDC stack. From this interface, the IT administrator can provision new private cloud resources, monitor changes to the logical infrastructure, and manage life cycle and other operational activities.

Cloud Foundation enables data center cloud administrators to provision an application environment in a rapid, repeatable, automated way versus the traditional manual process.

This chapter includes the following topics:

- Cloud Foundation Components
- Simplified Resource Provisioning with Workload Domains
- Automated Software Bring-Up
- Automated Lifecycle Management

Cloud Foundation Components

Cloud Foundation delivers a natively integrated software-defined data center stack that includes the core infrastructure virtualization, vSphere, vSAN and NSX.

SDDC Manager

SDDC Manager automates the entire system lifecycle (from initial bring-up, to configuration and provisioning, to upgrades and patching), and simplifies day-to-day management and operations.

VMware vSphere

VMware vSphere uses virtualization to transform individual data centers into aggregated computing infrastructures that include CPU, storage, and networking resources. VMware vSphere manages these infrastructures as a unified operating environment and provides you with the tools to administer the data centers that participate in that environment.

The two core components of vSphere are ESXi and vCenter Server. ESXi is the virtualization platform where you create and run virtual machines and virtual appliances. vCenter Server is the service through which you manage multiple hosts connected in a network and pool host resources.

VMware vSAN

VMware vSAN™ aggregates local or direct-attached data storage devices to create a single storage pool shared across all hosts in the vSAN cluster. vSAN eliminates the need for external shared storage, and simplifies storage configuration and virtual machine provisioning. Built in policies allow for flexibility in data availability.

NSX for vSphere

NSX for vSphere provides networking and security functionality for your vSphere environment which allows networks and network services to be abstracted from the physical infrastructure. The ability to manage the network through software allows for rapid changes and increased security policies to be implemented.

vRealize Suite

Cloud Foundation is integrated with the vRealize Suite of products.

vRealize Log Insight

Log Insight delivers heterogeneous and highly scalable log management with intuitive and actionable dashboards, sophisticated analytics, and broad third-party extensibility. It provides deep operational visibility and faster troubleshooting across physical, virtual and cloud environments.

Log Insight is installed by default for the management domain. You can add licenses to enable Log Insight for VI workload domains.

vRealize Automation

vRealize Automation is a cloud automation tool that accelerates the delivery of IT services through automation and pre-defined policies, providing high level of agility and flexibility for developers, while enabling IT teams to maintain frictionless governance and control. This is an optional component.

vRealize Operations Manager

vRealize Operations Manager delivers intelligent operations management with application-to-storage visibility across physical, virtual, and cloud infrastructures. Using policy-based automation, operations teams automate key processes and improve IT efficiency. This is an optional component.

Simplified Resource Provisioning with Workload Domains

Cloud Foundation introduces a new abstraction, workload domains, for creating logical pools across compute, storage, and networking. A workload domain consists of one or more vSphere clusters, provisioned automatically by SDDC Manager.

There are two types of workload domains - the management domain and VI workload domains.

The management domain is created during the bring-up process. It contains the Cloud Foundation management components. This includes an instance of vCenter Server and required NSX components (NSX Manager and three NSX Controller VM) for the management domain. All vRealize Suite components, such as vRealize Log Insight, vRealize Operations Manager and vRealize Automation, are installed in the management domain.

Cloud Foundation implements Virtual Infrastructure (VI) workload domains for user workloads. A VI workload domain can consist of one or more vSphere clusters. Each cluster starts with a minimum of three hosts and can scale up to the vSphere and vSAN maximums. SDDC manager automates creation of the workload domain and the underlying vSphere cluster(s). Each cluster is assigned user specified vSphere HA policy and vSAN failures to tolerate (FTT) values along with full network configuration by SDDC Manager during the workload domain creation. SDDC Manager also deploys three NSX controller VMs for each VI workload domain. These controller VMs communicate with a dedicated NSX Manager deployed in the management domain.

For each VI workload domain created, an additional vCenter Server instance and NSX Manager instance is deployed in the management domain to manage that VI workload domain.

Automated Software Bring-Up

You prepare your environment for Cloud Foundation by installing a baseline ESXi image on vSAN ReadyNodes. After the hosts are physically racked and cabled, Cloud Foundation uses the physical network details you provide (such as DNS, IP address pool, and so on) to automate the bring-up and configuration of the software stack. During bring-up, the management domain is created on the four hosts you specified. When the bring-up process completes, you have a functional management domain and can start provisioning VI workload domains.

Automated Lifecycle Management

SDDC Manager automates upgrade and patch management for the SDDC software stack.

VMware provides update bundles for the entire SDDC stack, ensuring compatibility of all patches with installed components in your Cloud Foundation environment. You can apply an update to the management domain or VI workload domains independent of the other workload domains. This makes the process non-disruptive to tenant VMs.

Cloud Foundation Architecture

2

Cloud Foundation supports two architecture models - standard and consolidated.

This chapter includes the following topics:

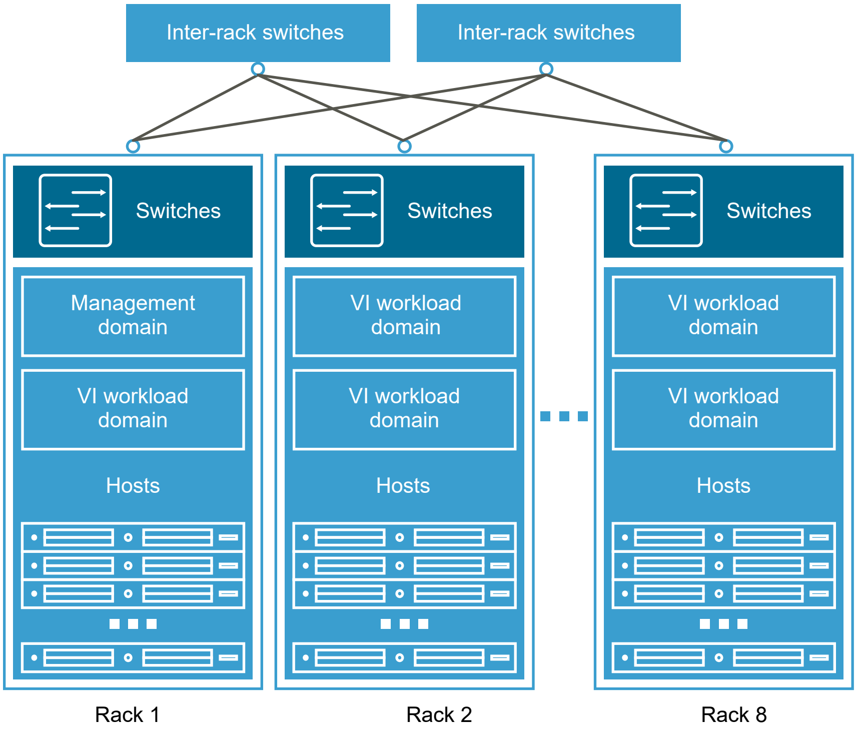
- Standard Architecture Model
- Consolidated Architecture Model

Standard Architecture Model

With the standard architecture model, management workloads run on a dedicated management domain and user workloads are deployed in separate virtual infrastructure (VI) workload domains. Each workload domain is managed by a separate vCenter Server instance which provides for scalability and allows for autonomous licensing and lifecycle management.

Standard architecture is the preferred model.

Figure 2-1. Sample Standard Architecture

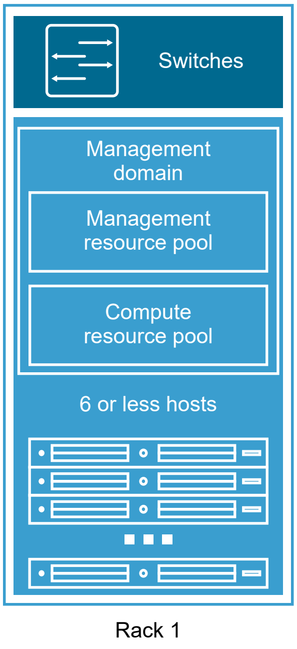


Consolidated Architecture Model

The consolidated architecture design targets smaller Cloud Foundation deployments and special use cases. In this design, the management and user workload domains run together on a shared management domain. The environment is managed from a single vCenter Server and vSphere resource pools provide isolation between management and user workloads. In a consolidated architecture model, care must be taken to ensure that resource pools are properly configured as the domain is shared by the management and compute workloads. The consolidated architecture does not support NSX-T or the automated deployment of Horizon and Enterprise PKS.

As you add additional hosts to a Cloud Foundation system deployed on a consolidated architecture, you can convert to the standard architecture by creating a VI workload domain and moving the user workload domain VMs from the compute resource pool to the newly created VI workload domain. After moving these VMs, you may need to update shares and reservations on the compute resource pool in the management domain.

Figure 2-2. Sample Consolidated Architecture



Preparing your Environment for Cloud Foundation

3

You must prepare your environment for deploying Cloud Foundation. See the *VMware Cloud Foundation Planning and Preparation Guide*.

Deploying Cloud Foundation 4

You begin the Cloud Foundation deployment process by deploying the Cloud Foundation Builder VM. You then download the deployment parameters sheet from the Cloud Foundation Builder VM. Complete the deployment parameters spreadsheet to define your network information, host details, and other required information. This spreadsheet is then converted to a Javascript Object Notation (JSON) file and uploaded to the Cloud Foundation Builder VM. The provided information is validated, and the automated phase of the deployment process begins.

Prerequisites

You must prepare your environment for deploying Cloud Foundation. See the *VMware Cloud Foundation Planning and Preparation Guide*.

Procedure

1 Deploy Cloud Foundation Builder VM

The Cloud Foundation Builder VM is a one-time use VM which deploys and configures the management domain and transfers inventory and control to SDDC Manager. During the deployment process, the Cloud Foundation Builder VM validates network information you provided in the deployment parameter spreadsheet such as DNS, network (VLANS, IPs, MTUs), and credentials. After the management domain is up and the SDDC Manager is running, the Cloud Foundation Builder VM must be powered off and archived.

2 Download and Complete Deployment Parameter Sheet

The deployment parameter spreadsheet provides a mechanism to specify the required deployment information specific to your environment. This includes information about your networks, hosts, license keys, and other information. The spreadsheet is downloaded from the Cloud Foundation Builder VM. The completed spreadsheet is then converted to a JSON file. The deployment parameter spreadsheet can be reused to deploy multiple Cloud Foundation instances of the same version.

3 Generate JSON File

The completed deployment parameter worksheet is converted to a JSON file format which is used during the Cloud Foundation deployment process.

4 Initiate the Cloud Foundation Bring-Up Process

During bring-up, the management domain is created on the ESXi hosts specified in the deployment configuration spreadsheet. The Cloud Foundation software components are automatically deployed, configured, and licensed using the information provided.

Deploy Cloud Foundation Builder VM

The Cloud Foundation Builder VM is a one-time use VM which deploys and configures the management domain and transfers inventory and control to SDDC Manager. During the deployment process, the Cloud Foundation Builder VM validates network information you provided in the deployment parameter spreadsheet such as DNS, network (VLANS, IPs, MTUs), and credentials. After the management domain is up and the SDDC Manager is running, the Cloud Foundation Builder VM must be powered off and archived.

You must deploy the Cloud Foundation Builder VM on a suitable platform. This can be on a laptop under VMware Workstation or VMware Fusion, or on an ESXi host. The Cloud Foundation Builder VM must have network access to all hosts on the management network. Approximately 11 to 350 gigabytes of storage is required to deploy the Cloud Foundation Builder VM.

The procedure here describes deploying the Cloud Foundation Builder VM on an ESXi host. Other deployment methods will have different procedures.

Prerequisites

In order to automate the deployment, the Cloud Foundation Builder VM must be on the same management network as the hosts to be used. It must also be able to access all required external services, such as DNS and NTP.

Procedure

1. Download the Cloud Foundation Builder VM OVA on the Windows machine.
2. Login to the vSphere Host Client.
3. In the navigator, select **Host**.
4. Click **Create/Register VM**.
5. On the Select creation type dialog box, select **Deploy a virtual machine from an OVF or OVA file** and click **Next**.
6. Enter a name for the VM.
7. Select **Click to select files or drag/drop**. Select the Cloud Foundation Builder VM OVA from your local file system and click **Open**.
8. Click **Next**.
9. On the Select Storage page, select the storage for the Cloud Foundation Builder VM and
10. On the License agreements dialog, click **I agree** and then click **Next**.
11. On the Select networks dialog, choose the port group associated with the VLAN ID used by the ESXi hosts where Cloud Foundation will be deployed and then click **Next**.
12. On the Customize template dialog, enter the following information for the Cloud Foundation Builder VM:
    - Root password

The root password must be a minimum of 8 characters and include at least one uppercase, one lowercase, one digit, and one special character.

- Admin user name and password

  The admin user name cannot be one of the following pre-defined user names:

  - root
  - bin
  - daemon
  - messagebus
  - systemd-bus-proxy
  - systemd-journal-gateway
  - systemd-journal-remote
  - systemd-journal-upload
  - systemd-network
  - systemd-resolve
  - systemd-timesync
  - nobody
  - sshd
  - named
  - rpc
  - tftp
  - ntp
  - smmsp
  - cassandra

  The admin password must be a minimum of 8 characters and include at least one uppercase, one lowercase, one digit, and one special character .

- IP Address
- Subnet Mask, for example `255.255.255.0`.
- Default Gateway
- Hostname
- IP address of the primary and secondary DNS servers (comma separated)

  Do not specify more than two servers.

- NTP servers (comma separated)

13 Review the deployment details and click **Finish**.

14 After the Cloud Foundation Builder VM is deployed, SSH in to the VM with the admin credentials provided in step 12.

15 Ensure that you can ping the ESXi hosts.

16 Verify that the Cloud Foundation Builder VM has access to the required external services, such as DNS and NTP by performing forward and reverse DNS lookups for each host and the specified NTP servers.

Download and Complete Deployment Parameter Sheet

The deployment parameter spreadsheet provides a mechanism to specify the required deployment information specific to your environment. This includes information about your networks, hosts, license keys, and other information. The spreadsheet is downloaded from the Cloud Foundation Builder VM. The completed spreadsheet is then converted to a JSON file. The deployment parameter spreadsheet can be reused to deploy multiple Cloud Foundation instances of the same version.

Procedure

1 In a web browser on the Windows machine that is connected to the Cloud Foundation Builder VM, navigate to `https://`*`Cloud_Builder_VM_IP`*`:8008`.

The VMware Cloud Foundation page appears.

2 Enter the admin credentials you provided when you deployed the Cloud Foundation Builder VM and then click **Log In**.

3 Confirm that your environment meets each criteria in the pre-bring-up checklist and select the check boxes. Fix any issues before proceeding.

4 Click **Next**.

5 Read the End-User License Agreement and accept it. Click **Next**.

6 Click **Download Deployment Parameter Sheet**.

7 Complete the worksheet. See About the Deployment Parameter Sheet.

About the Deployment Parameter Sheet

The deployment parameter Excel sheet contains tabs categorizing the information required for deploying Cloud Foundation. The information provided is used to create the management domain.

The fields in yellow contain sample values that you can overwrite as appropriate. If a cell turns red, the required information is missing, or validation has failed. All other information (including default values) are for your reference only. Modifying any of these fields can lead to deployment errors.

Prerequisites Checklist Tab

This tab is a summary of infrastructure configuration requirements that need to be satisfied before deploying Cloud Foundation.

The Cloud Foundation Builder VM runs a platform audit before starting deployment to check if the requirements listed on this tab are met. If the audit fails, you cannot proceed with the deployment.

Physical Hardware

Servers must be racked and cabled. ESXi version as mentioned in the *VMware Cloud Foundation Release Notes* must be installed on each host.

For additional details on hardware requirements, see the *VMware Cloud Foundation Planning and Preparation Guide*.

ESXi Configuration

All ESXi hosts must be configured with the following settings:

- Static IP address assigned to the management interface (vmk0)
- Management network portgroup configured with correct VLAN ID
- VM network portgroup configured with the same VLAN ID as the management network
- TSM-SSH service enabled and policy set to `Start and Stop with Host`
- NTP service enabled, configured, and policy set to `Start and Stop with Host`

vSAN Configuration

All disks must be available for use. If you are using All Flash drives, one SDD must have `SetCapacityFlash=true`.

Management Workloads Tab

This tab provides an overview of the components deployed by the Cloud Foundation Builder VM. The sizes and versions are not editable and are provided for reference only.

Input required:

- In column L, update the six red fields with your license keys. Ensure the license key matches the product and version listed in each row.

  The required license keys are:

  - vSphere/vCloud Suite
  - vSAN
  - vCenter Server
  - NSX for vSphere
  - SDDC Manager
  - vRealize Log Insight

Users and Groups Tab

This tab details the accounts and initial passwords for the Cloud Foundation components. You must provide input for each yellow box. A red cell may indicate that validations on the password length has failed.

Input Required

Update the Default Password field for each user (including the automation user in the last row). Passwords can be different per user or common across multiple users. The tables below provide details on password requirements.

Table 4-1. Password Complexity

Password	Complexity
Virtual Infrastructure Layer	
Default Single-Sign on Domain User	SSO
vCenter Server and Platform Services Controller virtual appliance root account	SSO
NSX Manager Administrator account	Standard
Operations Management Layer	
vRealize Log Insight admin account	vRLI
vRealize Log Insight root account	Standard
SDDC Manager	
SDDC Manager appliance root account	Standard
SDDC Manager super user	Standard
SDDC Manager REST API user	Standard
SDDC Manager automation	SSO

Table 4-2. Password Requirements based on Complexity

Password Type	Requirements Based on Complexity
Standard	1 Length 8-12 characters 2 Must include: ■ mix of upper-case and lower-case letters ■ a number ■ a special character ■ exclude_char
SSO (accounts in SSO vsphere.local)	1 Length 8-20 characters 2 Must include: ■ mix of upper-case and lower-case letters ■ a number ■ a special character
vRLI	1 Length 8-12 characters 2 Must include: ■ mix of upper-case and lower-case letters ■ a number ■ a special character 3 Must not include a character repeated more than twice

Hosts and Networks tab

In this tab, specify details of your existing networking infrastructure. This information is configured on the appropriate Cloud Foundation components.

Management Cluster

This section covers the VLANs, gateways, MTU, and expected IP ranges and subnet mask for each network you have configured on the Top of Rack switches in your environment.

Table 4-3. Input Required

VLAN	Portgroup Name - Do not modify	CIDR Notation	Gateway	MTU
Enter VLAN ID for management network. The VLAN ID can be between 0 and 4094.	SDDC-DPortGroup-Mgmt	Enter CIDR notation for management network	Enter gateway IP for management network	Enter MTU for management network. The MTU can be between 1500 and 9000.
Enter VLAN ID for vMotion network The VLAN ID can be between 0 and 4094.	SDDC-DPortGroup-vMotion	Enter CIDR notation for vMotion network	Enter gateway IP for vMotion network	Enter MTU for vMotion network The MTU can be between 1500 and 9000.

Table 4-3. Input Required (continued)

VLAN	Portgroup Name - Do not modify	CIDR Notation	Gateway	MTU
Enter VLAN ID for vSAN network The VLAN ID can be between 0 and 4094.	SDDC-DPortGroup-VSAN	Enter CIDR notation for vSAN network	Enter gateway IP for vSAN network	Enter MTU for vSAN network The MTU can be between 1500 and 9000.
Enter VLAN ID for VXLAN network The VLAN ID can be between 0 and 4094.	VXLAN (VTEP) - DHCP Network	n/a Cloud Foundation uses DHCP for VTEPs, so VXLAN CIDR is not required.	n/a Cloud Foundation uses DHCP for VTEPs, so VXLAN gateway is not required.	Enter MTU for VXLAN network The MTU can be between 1500 and 9000.

Management Hosts

Specify the IP addresses of the ESXi hosts where the management domain is to be configured. In a standard deployment, only four hosts are required in the management domain. Cloud Foundation can also be deployed in a consolidated method. In the consolidated deployment method, all workloads are deployed in the management domain instead of a separate workload domain. As such, additional hosts may be required to provide the capacity needed. In this section, only enter values for the number of hosts desired in the management domain.

Table 4-4. Input Required

Host Name	IP Address
esx-1	Enter IP address of first ESXi host where Cloud Foundation is to be deployed.
esx-2	Enter IP address of second ESXi host
esx-3	Enter IP address of third ESXi host
esx-4	Enter IP address of fourth ESXi host
esx-5	This is optional. Enter n/a in this field if you are deploying Cloud Foundation on four hosts only.
esx-6	This is optional. Enter n/a in this field if you are deploying Cloud Foundation on four hosts only.

Inclusion Ranges

Specify IP inclusion ranges for the vSAN and vMotion networks of the management domain. IP addresses from the specified range are automatically assigned to hosts. Ensure that the IP ranges include sufficient IP addresses for the initial deployment - number of IP addresses must be at least equal to or more than the number of hosts where Cloud Foundation will be deployed.

You can enter IP addresses as a range or as a set of values separated by commas. As an example, if you specify the range start value as 192.168.1.1 and end as 192.168.1.20, a total of 20 IP addresses would be used.

Do not use special IP addresses, such as the network or broadcast address.

IPs for the vMotion range must be part of the VLAN configured with the SDDC-Dswitch-Private-vmotion. IPs for the vSAN range must be part of the VLAN configured for the SDDC-Dswitch-Private-vsan. All IPs within the range must be available for use or IP conflicts will occur. It is a good practice to validate this prior to starting a deployment.

Table 4-5. Input Required

Portgrpup Name - Do not modify	Start	End
SDDC-DPortGroup-vMotion	Enter start of IP address range for vMotion network.	Enter end of IP address range.
SDDC-DPortGroup-vMotion-IPs	Enter comma separated IP addresses (outside the specified IP address range) that can be used.	
SDDC-DPortGroup-VSAN	Enter start of IP address range for vMotion network.	Enter end of IP address range.
SDDC-DPortGroup-VSAN -IPs	Enter comma separated IP addresses that can be used.	

Cloud Foundation Builder VM

The Cloud Foundation table displays a field with an IP address of the Cloud Foundation. This IP address is not the actual IP address of the VM and can be ignored.

Deploy Parameters Tab

In this tab, specify IP addresses for the software components to be deployed as well as other configuration information.

Existing Infrastructure Details

Your existing DNS infrastructure is used to provide forward and reverse name resolution for all hosts and VMs in the Cloud Foundation SDDC. External NTP sources are also utilized to synchronize the time between the software components.

Table 4-6. Infrastructure

Parameter	Value
DNS Server #1	Enter IP address of first DNS server.
DNS Server #2	Enter IP address of second DNS server. If you have only one DNS server, enter n/a in this cell.
NTP Server #1	Enter IP address of first NTP server.
NTP Server #2	Enter IP address of second NTP server. If you have only one NTP server, enter n/a in this cell.
Default ESXi User & Password	The user name is displayed in the Host name column. Do not modify. In the IP address cell, enter root password for the ESXi management host specified on the Hosts and Networks Tab. This is the password which you configured on the hosts during ESXi installation.

Table 4-7. Single-Sign-On Site Name

Parameter	Value
Single-sign-on Site Name	Enter an abbreviation for the physical region where this installation is based. The site name is used by the Platform Service Controller.

Table 4-8. DNS Zone

Parameter	Value
Root DNS Zone	Enter root domain name for your SDDC management components.
Child DNS Zone	Enter child domain name for your SDDC management components. If you do not use a child DNS zone, enter n/a in this cell.

vSphere Infrastructure

Specify host names and IP addresses for the vCenter and Platform Service controllers. The sheet contains sample host names, but you can update them with names that meet your naming standards. This host name is one part of the FQDN - the second part of the FQDN is the root or child DNS zone name provided above.

The specified host names and IP addresses must be resolvable using the DNS servers provided earlier, both forward (hostname to IP) and reverse (IP to hostname), otherwise the bring-up process will fail.

Table 4-9. Management Cluster

Parameter	Host Name	IP Address
vCenter Server	Enter a host name for the vCenter Server.	Enter the IP address for the vCenter Server that is part of the management VLAN. This is the same VLAN and IP address space where the vCenter, PSC, and ESXi management VMKernels reside.
Platform Service Controller	Enter a host name for the Platform Service Controller.	Enter the IP address for the Platform Service Controller that is part of the management VLAN. This is the same VLAN and IP address space where the vCenter, PSC, and ESXi management VMKernels reside.
Second Platform Service Controller	Enter a host name for the second Platform Service Controller.	Enter the IP address for the Platform Service Controller that is part of the management VLAN. This is the same VLAN and IP address space where the vCenter, PSC, and ESXi management VMKernels reside.

Table 4-10. vCenter Objects

Parameter	Value
Datacenter Name - Management	Enter a name for the management datacenter.
Cluster Name - Management	Enter a name for the management cluster.

Table 4-10. vCenter Objects (continued)

Parameter	Value
vSphere Distributed Switch - Management	Enter a name for the management vSphere distributed name.
Default vSS Portgroup Name	Do not change the default value `VM Network`.

In the Virtual Networking - ESXi Hosts section below, the default settings are appropriate for servers with two physical NICs. Modify these values as appropriate if you have a different number of physical NICs.

Table 4-11. Virtual Networking - ESXi Hosts

Parameter	Value
Physical NIC to Assign to vDS - Management	Select the physical NIC to assign to the management vDS.
VMKernel Adaptor for Management	Select the vmkernel adaptor to assign to the management network.
vSphere Standard Switch - Management	Do not modify.
vmnic Allocated to vSS - Management	Select the physical NIC to assign to the management vSS.

NSX

Enter IP addresses and host names for NSX installation.

Table 4-12. Management Cluster

Parameter	Value
NSX Manager	Enter the host name and IP address for the NSX Manager. The host name can match your naming standards but must be registered in DNS with both forward and reverse resolution matching the specified IP. The IP address must be part of the management VLAN. This is the same VLAN and IP address space where the vCenter, PSC, and ESXi management VMKernels reside.
NSX Controller IP Pool Start Address	In IP Address, enter the starting IP address of the IP address range. Each IP in the range, including the starting and ending IP address, must be unused in your environment.
NSX Controller IP Pool End Address	In IP Address, enter the end IP address of the IP address range. Each IP in the range, including the starting and ending IP address, must be unused in your environment.

Table 4-13. Management - Segment IDs and Multicast Ranges

Parameter	Value
NSX Segment ID Range	Default values for the segment ID range. The segment ID range is used for NSX virtual wires. These are not exposed outside of the NSX environment. Only modify these values if the default range is being used in another NSX deployment within your environment.

vRealize Log Insight

Enter host names and IP addresses for vRealize Log Insight load balancer and the three physical nodes. Each IP address must be part of the management VLAN. This is the same VLAN and IP address space where the vCenter, PSC, and ESXi Management VMKernals reside. Each host name and IP address must be registered with your DNS server for both forward and reverse lookup.

The specified host names and IP addresses must be resolvable using the DNS servers provided earlier, both forward (hostname to IP) and reverse (IP to hostname), otherwise the bring-up process will fail.

Table 4-14.

Parameter	Value
vRLI Load Balancer	Enter host name and IP address of vRealize Log Insight load balancer.
vRLI Node #1 (Master)	Enter host name and IP address of vRealize Log Insight master node.
vRLI Node #2 (Worker)	Enter host name and IP address of the vRealize Log Insight worker node.
vRLI Node #3 (Worker)	Enter host name and IP address of the vRealize Log Insight worker node.

SDDC Manager

Enter the host name, IP address, and subnet mask of the SDDC Manager VM.

Parameter	Value
SDDC Manager Host name	Enter a host name for the SDDC Manager VM. The specified host name must be registered with your DNS server for both forward and reverse resolution, and it must be resolvable from the Cloud Foundation Builder VM.
SDDC Manager IP Address	Enter an IP address for the SDDC Manager VM. The IP address must be registered with your DNS server for both forward and reverse resolution, and must be part of the management VLAN.
SDDC Manager Subnet Mask	Enter the subnet mask for the SDDC Manager VM.
Host Pool Name	Enter the network pool name for the management domain network pool.

Generate JSON File

The completed deployment parameter worksheet is converted to a JSON file format which is used during the Cloud Foundation deployment process.

Procedure

1. Using a file transfer utility, upload the deployment parameters sheet to the `/home/admin` directory on the Cloud Foundation Builder VM.

   Given the sensitivity of data in the deployment parameters sheet, you must treat it with appropriate care.

2. Using SSH, login to the Cloud Foundation Builder VM as the admin user with credentials provided during the VM deployment.

3. Copy the deployment parameter sheet to the directory where it needs to be converted to the JSON format.

   ```
   sudo cp /home/admin/xlsx_file /opt/vmware/sddc-support/cloud_admin_tools/
   JsonGenerator
   ```

4. Navigate to the folder that contains the JSON generator.

   ```
   cd /opt/vmware/sddc-support/cloud_admin_tools/JsonGenerator/
   ```

5. Run the following command.

   ```
   sudo python JsonGenerator.pyc -i /opt/vmware/sddc-support/cloud_admin_tools/
   JsonGenerator/xlsx_file -d vcf-ems
   ```

   The JSON file is placed in the `/opt/vmware/sddc-support/cloud_admin_tools/Resources/vcf-ems` directory.

6. Copy the JSON file to the following directory so that it can be accessed by the admin user:

   ```
   sudo mv /opt/vmware/sddc-support/cloud_admin_tools/Resources/vcf-ems/vcf-
   ems.json /home/admin/
   ```

7. Change the file ownership:

   ```
   sudo chown admin:users /home/admin/vcf-ems.json
   ```

8. Using a file transfer utility, download the `/home/admin/vcf-ems.json` file to the computer where you are accessing the Cloud Foundation Builder UI.

Initiate the Cloud Foundation Bring-Up Process

During bring-up, the management domain is created on the ESXi hosts specified in the deployment configuration spreadsheet. The Cloud Foundation software components are automatically deployed, configured, and licensed using the information provided.

Procedure

1. Log in to the Cloud Foundation Builder VM with your admin credentials by navigating to `https://`*`Cloud_Builder_VM_IP`*`:8008`.

2. Click **Upload Config File**. Select the bringup.JSON file you generated earlier and click **Open**.

3 After the configuration file is uploaded, click **Validate** to validate the uploaded file.

   The following audit tasks are performed and validation results are displayed on the UI.

   - SDDC JSON validation

     Validates JSON correctness, syntax, null values, and missing fields or components.

   - License validation

     Validates format, validity, and expiry for ESX, VSAN, vCenter Server, NSX, and Log Insight license keys.

   - Password validation

     Validates specified passwords. Checks for minimum length, invalid characters, and format.

   - Network configuration

     Validates CIDR to IP address validity, IP addresses in use, gateways, invalid or missing VLANs, invalid or missing MTU, IP pools, and network spec availability for all components.

   - Host validation

     Validates SSH access and policy, NTP configuration and policy, DNS configuration, VMNIC availability, vSwitch availability, VM network portgroup , and VLAN check on each host.

   - DNS validation

     Validates forward and reverse lookup for all hosts in bringup json.

   - Network connectivity validation

     Validates that the vSAN and vMotion VLANs, MTUs, and gateways specified in the bringup.JSON file are correctly configured.

   - vSAN disk validation

     Validates that required disks for VSAN are available for use.

   - ESXi version validation

     Validates ESXi version installed on the hosts and compares against the VCF-EMS manifest located in `/opt/evosddc/bundle/scripts/manifest.json` on the Cloud Foundation Builder VM.

   - NTP configuration Validation

     Validates NTP configuration for all ESX hosts.

   - IP Pools Validation

     Validates the following:

     - Pool defines enough IP addresses such that there is one IP address available for each host used for bring-up.

     - Start and end of IP inclusion pools are within the subnet specified for vSAN and vMotion.

   - IP addresses provided in inclusion pool are not in use.

   To access the bring-up log file, SSH to the Cloud Foundation Builder VM as root and open the `/opt/vmware/bringup/logs/vcf-bringup-debug.log` file.

   If there is an error during the validation and the Next button is grayed out, you can either make corrections to the environment or edit the JSON file and upload it again. Then click **Re-Try** to perform the validation again.

   If any warnings are displayed and you want to proceed, click **Acknowledge** and then click **Next**.

4. Click **Begin Bring-Up**.

   During the bring-up process, the following tasks are completed.

   - PSC, vCenter Server, vSAN, vRealize Log Insight, and NSX components are deployed.
   - The management domain is created, which contains the management components - SDDC Manager, all vCenter Servers, and NSX Managers and Controllers.

   The status of the bring-up tasks is displayed in the UI. You can download the list of tasks by clicking **Download**.

   After bring-up is completed, a green bar is displayed indicating that bring-up was successful. A link to the SDDC Manager UI is also displayed.

   If there are errors during bring-up, see Chapter 5 Troubleshooting Cloud Foundation Deployment for guidance on how to proceed.

5. Navigate to the SDDC Manager Dashboard by clicking the link displayed on the UI.

6. Verify the following:

   - View management domain details.
   - Log in to vCenter Server and verify the management cluster, vSAN cluster, and deployed VMs.

7. Power off and delete the Cloud Foundation Builder VM.

Troubleshooting Cloud Foundation Deployment

5

You can run the SoS tool and review bring-up log files to troubleshoot deployment issues.

This chapter includes the following topics:

SoS Tool Options for Cloud Builder

You can run SoS tool operations in the Cloud Builder VM to debug a failed bring-up of Cloud Foundation.

The Cloud Builder VM is available only until the SDDC Manager service is running in a successfully deployed Cloud Foundation. After a successful bring-up, run the SoS tool through SDDC Manager. See Supportability and Serviceability (SoS) Tool in the *VMware Cloud Foundation Operations and Administration Guide*.

To run the SoS tool, SSH in to the Cloud Builder VM using the root account, and navigate to the `/opt/vmware/sddc-support` directory and type `./sos` followed by the options required for your desired operation.

```
./sos --option-1 --option-2 ... --option-n
```

SoS Tool Help Options

Use these options to see information about the SoS tool itself.

Option	Description
`--help` `-h`	Provides a summary of the available SoS tool options
`--version` `-v`	Provides the SoS tool's version number.

SoS Tool Generic Options

These are generic options for the SoS tool.

Option	Description
`--configure-sftp`	Configures SFTP for logs.
`--debug-mode`	Runs the SoS tool in debug mode.
`--force`	Allows SoS operations from theCloud Foundation Builder VM after bring-up. **Note** It is recommended that you do not use this option.
`--history`	Displays the last twenty SoS operations performed.
`--log-dir` *`LOGDIR`*	Specifies the directory to store the logs.
`--log-folder` *`LOGFOLDER`*	Specifies the name of the log directory.
`--setup-json` *`SETUP_JSON`*	Custom setup-json file for log collection. SoS prepares the inventory automatically based on the environment where it is running. If you want to collect logs for a pre-defined set of components, you can create a `setup.json` file and pass the file as input to SoS. A sample JSON file is available on the Cloud Builder VM in the `/opt/vmware/sddc-support/` directory.
`--zip`	Creates a zipped tar file for the output.

SoS Tool Options for JSON Generator

Option	Description
`--jsongenerator`	Invokes the JSON generator utility.
`--jsongenerator-input` *`JSON_GENERATOR_INPUT`*	Specify the input file to be used by the JSON generator utility.
`--jsongenerator-design` *`JSON_GENERATOR_DESIGN`*	Specify the design file for the SDDC architecture.
`--jsongenerator-logs` *`JSONGENERATORLOGS`*	Set the directory to be used for logs. Optional.

SoS Tool Options for Platform Audit

Option	Description
`--platformaudit`	Invokes the platform audit operation.
`--platformaudit-input` *`FILE`*	Specify the input file to be used by the platform audit utility.
`--platformaudit-tree`	Displays a list of available audit tests.
`--platformaudit-modules` *`MODULE1,MODULE2,MODULE3`*	Specify the specific audit tests to run. If specifying multiple tests, separate the modules with commas.
`--platformaudit-dependency`	Execute audit tests with dependencies.
`--platformaudit-reason`	Outputs reasons for failed or skipped tests.
`--platformaudit-output` *`OUTPUT`*	Saves the output to the specified file.

SoS Tool Options for Health Check

These SoS commands are used for checking the health status of various components or services, including connectivity, compute, and storage.

Option	Description
`--certificate-health`	Verifies that the component certificates are valid (within the expiry date).
`--connectivity-health`	Performs a connectivity health check to inspect whether the different components of the system such as the ESXi hosts, Virtual Center Servers, Log Insight VM, NSX Manager VMs, PSC VMs, SDDC Manager VM can be pinged.
`--compute-health`	Performs a compute health check.
`--general-health`	Verifies ESXi entries across all sources, checks the Postgres DB operational status for hosts, checks ESXi for error dumps, and gets NSX Manager and cluster status.
`--get-host-ips`	Returns server information.
`--health-check`	Performs all available health checks.
`--services-health`	Performs a services health check to confirm whether services are running

SoS Tool Log File Options

Option	Description
`--api-logs`	Collects output from APIs.
`--cassandra-logs`	Collects logs from the Apache Cassandra database only. Apache Cassandra processes run in each of the infrastructure virtual machines, the ones with ISVM in their names. These ISVM VMs run in your installation's primary rack.
`--cloud-builder-cassandra-logs`	Collects Cassandra database logs from the Cloud Builder VM only.
`--cloud-builder-logs`	Collects Cloud Builder logs.
`--dump-only-sddc-java-threads`	Collects only the Java thread information from the SDDC Manager.
`--esx-logs`	Collects logs from the ESXi hosts only. Logs are collected from each ESXi host available in the deployment.
`--no-clean-old-logs`	Use this option to prevent the tool from removing any output from a previous collection run. By default, before writing the output to the directory, the tool deletes the prior run's output files that might be present. If you want to retain the older output files, specify this option.
`--no-health-check`	Skips the health check executed as part of log collection.
`--nsx-logs`	Collects logs from the NSX Managerand NSX Controller instances only.
`--psc-logs`	Collects logs from the Platform Services Controller instances only.
`--rvc-logs`	Collects logs from the Ruby vSphere Console (RVC) only. RVC is an interface for ESXi and vCenter. **Note** If the Bash shell is not enabled in vCenter, RVC log collection will be skipped . **Note** RVC logs are not collected by default with ./sos log collection.
`--sddc-manager-logs`	Collects logs from the SDDC Manager only.
`--test`	Collects test logs by verifying the files.

Option	Description
`--vc-logs`	Collects logs from the vCenter Server instances only. Logs are collected from each vCenter server available in the deployment.
`--vm-screenshots`	Collects screen shots from all VMs.

Sample Output

The following text is a sample output from an `--ntp-health` operation.

```
root@cloud-builder [ /opt/vmware/sddc-support ]# ./sos --ntp-health --skip-known-host --force
Welcome to Supportability and Serviceability(SoS) utility!

User passed --force flag, Running SOS from Cloud Builder VM, although Bringup is completed
and SDDC Manager is available. Please expect failures with SoS operations.
Health Check : /var/log/vmware/vcf/sddc-support/healthcheck-2018-08-24-10-49-05-7911
Health Check log : /var/log/vmware/vcf/sddc-support/healthcheck-2018-08-24-10-49-05-7911/sos.log
SDDC Manager : sddc-manager.vrack.vsphere.local
NTP : GREEN
+-----+-----------------------------------------+------------+-------+
| SL# |                   Area                  |   Title    | State |
+-----+-----------------------------------------+------------+-------+
|  1  |    ESXi : esxi-1.vrack.vsphere.local    |  ESX Time  | GREEN |
|  2  |    ESXi : esxi-2.vrack.vsphere.local    |  ESX Time  | GREEN |
|  3  |    ESXi : esxi-3.vrack.vsphere.local    |  ESX Time  | GREEN |
|  4  |    ESXi : esxi-4.vrack.vsphere.local    |  ESX Time  | GREEN |
|  5  |     PSC : psc-1.vrack.vsphere.local     | NTP Status | GREEN |
|  6  |     PSC : psc-2.vrack.vsphere.local     | NTP Status | GREEN |
|  7  | vCenter : vcenter-1.vrack.vsphere.local | NTP Status | GREEN |
+-----+-----------------------------------------+------------+-------+

Legend:

 GREEN - No attention required, health status is NORMAL
 YELLOW - May require attention, health status is WARNING
 RED - Requires immediate attention, health status is CRITICAL

Health Check completed successfully for : [NTP-CHECK]
```

The following text is sample output from a `--vm-screenshots` log collection operation.

```
root@cloud-builder [ /opt/vmware/sddc-support ]# ./sos --vm-screenshots
     --skip-known-host --force
Welcome to Supportability and Serviceability(SoS) utility!

User passed --force flag, Running SOS from Cloud Builder VM, although Bringup is completed
and SDDC Manager is available. Please expect failures with SoS operations.
Logs : /var/log/vmware/vcf/sddc-support/sos-2018-08-24-10-50-20-8013
Log file : /var/log/vmware/vcf/sddc-support/sos-2018-08-24-10-50-20-8013/sos.log
Log Collection completed successfully for : [VMS_SCREENSHOT]
```

Bring-Up Log Files

The table below provides the location of bring-up log files.

Task	Log File Location
Cloud Foundation Builder VM	`/opt/vmware/bringup/logs/vcf-bringup.log` `/opt/vmware/bringup/logs/vcf-bringup-debug.log`
JSON generation	`/opt/vmware/sddc-support/cloud_admin_tools/logs/JsonGenerator.log`
JSON file validation	`/opt/vmware/sddc-support/cloud_admin_tools/logs/PlatformAudit.log`
Bring-up tasks	`/var/log/vmware/vcf/bringup/vcf-bringup-debug.log`

6 Cloud Foundation Glossary

Term	Description
bring-up	Initial configuration of a newly deployed Cloud Foundation system. During the bring-up process, the management domain is created and the Cloud Foundation software stack is deployed on the management domain.
commission host	Adding a host to Cloud Foundation inventory. The host remains in the free pool until it is assigned to a workload domain.
dirty host	A host that has been removed from a cluster in a workload domain. A dirty host cannot be assigned to another workload domain until it is cleaned up.
decommission host	Remove an unassigned host from the Cloud Foundation inventory. SDDC Manager does not manage decommissioned hosts.
free pool	Hosts in the Cloud Foundation inventory that are not assigned to a workload domain
host	An imaged server.
inventory	Logical and physical entities managed by Cloud Foundation.
Lifecycle Manager (LCM)	Automates patching and upgrading of the software stack.
management domain	Cluster of physical hosts that contains the management component VMs
network pool	Automatically assigns static IP addresses to vSAN and vMotion vmkernel ports so that you don't need to enter IP addresses manually when creating a VI workload domain or adding a host or cluster to a workload domain.
patch update bundle	Contains bits to update the appropriate Cloud Foundation software components in your management or VI workload domain.
SDDC Manager	Software component that provisions, manages, and monitors the logical and physical resources of a Cloud Foundation system.
SDDC Manager VM	Virtual machine (VM) that contains the SDDC Manager services and a shell from which command line tools can be run. This VM exposes the SDDC Manager UI.
server	Bare metal server in a physical rack. After imaging, it is referred to as a host.
unassigned host	Host in the free pool that does not belong to a workload domain.
workload domain	A policy based resource container with specific availability and performance attributes that combines vSphere, vSAN and NSX into single a consumable entity. A workload domain can be created, expanded, and deleted as part of the SDDC lifecycle operations. It can contain cluster(s) of physical hosts with a corresponding vCenter to manage them. The vCenter for a workload domain physically lives in the management domain.