Abstract
This solution guide describes how to deploy an SAP environment on an Enterprise Hybrid Cloud with VMware vRealize Automation as its core. This solution addresses the challenges of migration, provisioning, and operational efficiency that are specific to an SAP infrastructure.

H15807R

This document is not intended for audiences in China, Hong Kong, and Taiwan.
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Chapter 1  Executive Summary

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**Business challenge**

While many organizations have successfully introduced virtualization as a core technology within their data center, the benefits of virtualization have largely been restricted to the IT infrastructure owners. End users and business units within customer organizations have not experienced many of the benefits of virtualization, such as increased agility, mobility, and control.

Transforming from the traditional IT model to a cloud-operating model involves overcoming the challenges of legacy infrastructure and processes, such as:

- Inefficiency and inflexibility
- Slow, reactive responses to customer requests
- Inadequate visibility into the cost of the requested infrastructure
- Limited choice of availability and protection services

Many organizations manage growing and complicated SAP landscapes that include both traditional SAP applications on classic storage databases and SAP HANA on an in-memory database. In addition to monitoring, supporting, and maintaining an increased number of production (PRD) SAP applications, technology consultant teams must be able to provision multiple development and Quality Assurance (QA) environments to meet business needs such as development and testing, reporting, and troubleshooting.

To meet these challenges, public cloud providers have built technology and business models that cater to the requirements of end-user agility and control. Many organizations are under pressure to provide the same service levels within the secure and compliant confines of the on-premises data center. As a result, IT departments must create alternatives that are cost-effective and do not compromise enterprise requirements such as data protection (DP), disaster recovery (DR), and guaranteed service levels.

**Solution overview**

Enterprise Hybrid Cloud integrates the best of Dell EMC and VMware products and services, and enables IT organizations to accelerate the implementation and adoption of a hybrid cloud infrastructure, while still offering customer choice for the compute and networking infrastructure within the data center. Enterprise Hybrid Cloud caters to customers who want to preserve their investment and make better use of their existing infrastructure, and also to those customers who want to build out new infrastructures that are dedicated to a hybrid cloud.

This Enterprise Hybrid Cloud Foundation for SAP solution enables customers to use Enterprise Hybrid Cloud to perform the following tasks:

- One-click, self-service, end-to-end SAP provisioning from storage to instance
  - Standard and distributed SAP ERP installations
  - SAP Additional Application Server (AAS) instance added to an existing SAP system
  - Single and multi-node HANA installations
- SAP cloud monitoring and root-cause analysis
Chapter 1: Executive Summary

Key benefits

The Enterprise Hybrid Cloud for SAP solution offers several key benefits to customers:

- **Rapid implementation**—Enterprise Hybrid Cloud automates SAP installations from end to end. A standard or distributed SAP ERP system, or a single or multi-node HANA system, can easily become self-servicing with through the use of controlled parameters and clicks. This increases time-to-value for the customer while simultaneously reducing risks. The solution also provides IT as a service (ITaaS) with add-on modules for the following: backup, disaster recovery (DR), continuous availability (CA), virtual machine encryption, applications, application lifecycle automation for continuous delivery, ecosystem extensions, and more.

- **Supported solution**—Customers implementing Enterprise Hybrid Cloud receive enhanced Dell EMC support, further reducing any risk associated with the ongoing operations of the SAP hybrid cloud.

- **Optimized for SAP**—Extensive integration testing by Dell EMC has made Enterprise Hybrid Cloud simpler to use and manage and more efficient to operate.

Document purpose

This document describes the design and specific configurations of Enterprise Hybrid Cloud for an SAP environment. This guide focuses on the SAP-related architecture, design, and implementation best practices for deploying an SAP environment on an existing, fully functional Enterprise Hybrid Cloud foundation infrastructure.

Audience

This document is intended for:

- SAP implementation consultants, engineers, and administrators
- Technical architects and cloud solution engineers currently running or planning to implement an SAP environment in a cloud computing model

Readers are expected to have basic competency in the Dell EMC, VMware, and SAP products and components that make up Enterprise Hybrid Cloud.

The target audience must have a reasonable understanding of cloud computing and be fully aware of what their end users expect. Considerations include security, monitoring, resource management, multitenancy, and service metering.

Essential reading

The following documents describe the architecture, components, features, and functionality of Enterprise Hybrid Cloud 4.1.1:

- *Enterprise Hybrid Cloud 4.1.1 Reference Architecture Guide*
We value your feedback!

Dell EMC and the authors of this document welcome your feedback on the solution and the solution documentation. Contact EMC.Solution.Feedback@dell.com with your comments.

Authors: Forrest Xi, Dax Chee, Sam Bu, Aighne Kearney
This chapter presents the following topics:

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Overview

This SAP application solution is built and validated on Enterprise Hybrid Cloud. The underlying physical environment is abstracted from the application layer by virtual and software-defined components. The architecture shown in Figure 1 is representative of the architecture and environments where the SAP application solution is deployed.

The management, network, and tenant workload resources for the solution are divided into several pods, as shown in Figure 1, with each pod performing a specific function, as described in this section.

### Core Pod

The Core Pod hosts a core set of resources that must exist before the remainder of the cloud can be deployed. These core resources include vCenter Server, Microsoft SQL Server 2012, and VMware NSX Manager. The Core Pod also contains Log Insight forwarders and vRealize Operations Manager collectors to localize and optimize the collection of logs and network usage.

### Automation Pod

The Automation Pod hosts the virtual machines that automate and manage the cloud infrastructure supporting the workloads consumed by the clouds tenants. The Automation Pod supports the components responsible for functions such as the user portal and automated provisioning, monitoring, metering, and reporting.

### NEI Pod

The Network Edge Infrastructure (NEI) Pod hosts the VMware NSX Edge™ appliances and VMware NSX Controllers and is only required if VMware NSX is in use. It becomes the convergence point at which the physical and virtual networks connect.

### Workload Pod

The workload pod for SAP applications is a dedicated VMware vSphere cluster with its own compute, storage, and network resources. This provides improved service availability and restricts where the virtual machines and SAP applications are running or installed.
Key components

Figure 2 shows the technology components of Enterprise Hybrid Cloud for SAP, including the vRealize Suite (Enterprise Edition) components and SAP add-ons. vRealize Suite combines multiple components into a single product to provide a complete set of cloud infrastructure capabilities. Used together, the vRealize Suite components provide virtualization, software-defined data center services, policy-based provisioning, disaster recovery, application management, and operations management for SAP landscapes.

The following components of Enterprise Hybrid Cloud are essential in this solution:

- VMware vRealize Suite, including:
  - VMware vRealize Automation
  - VMware vRealize Orchestrator
  - VMware vRealize Operations Manager
    - Dell EMC Storage Analytics
    - Blue Medora Management Pack for SAP
  - VMware vRealize Configuration Manager
  - VMware vRealize Business for Cloud
  - VMware vRealize Log Insight
- VMware vSphere ESXi and VMware vCenter Server
- VMware NSX for vSphere
- VMware Site Recovery Manager (existing DR customers only)
- EMC Avamar™ and Data Domain™ (backup customers only)
- EMC Data Protection Advisor™

Enterprise Hybrid Cloud provides DR using the following options:
- EMC RecoverPoint™ for Virtual Machines (DR customers only)

EMC RecoverPoint (DR customers only) Enterprise Hybrid Cloud provides storage options using the following EMC products:
- ViPR™, VNX™, VMAX™, ScaleIO™, VPLEX™, Isilon™, and XtremIO™

**Note:** For a full overview of the Enterprise Hybrid Cloud components, refer to the Enterprise Hybrid Cloud 4.1.1: Foundation Infrastructure Reference Architecture Guide.

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**Dell EMC, VMware, and SAP integration**

Enterprise Hybrid Cloud contains key integration points between Dell EMC and VMware products for SAP applications, enabling cloud features such as:
- Storage services
- Orchestration
- Service metering
- Operational management and monitoring

SAP services power the cloud solution through auto-provisioning using vRealize Automation and SAP-level operational monitoring through the Blue Medora vRealize Operations Management Pack for SAP. Figure 3 shows Dell EMC, VMware, and SAP integration.

**Figure 3. Dell EMC, VMware, and SAP integration points**

Figure 3 shows how SAP Software Provisioning Manager (SWPM) offers the execution of many system provisioning tasks and covers a broad range of platforms and products. The colors in the diagram represent different components as follows:
- Blue—Enterprise Hybrid Cloud components
- Orange—application components
- Green—integration points to Dell EMC components
- Gray—integration points to VMware components

SAP and most of its supported databases provide unattended installation features in which scripts can be used to predefine the configuration and start installation. These scripts are integrated into vRealize Automation for end-to-end orchestration, from storage provisioning to full SAP installation.
The Blue Medora vRealize Operations Management Pack for SAP extracts and exposes an SAP system's key metrics to vRealize Operations Manager, enabling administrators to gain visibility into SAP-level performance without logging in to the actual system.

Software resources

0 lists the application software components and supporting services specific to the Enterprise Hybrid Cloud for SAP solution. For a complete list of Enterprise Hybrid Cloud 4.1.1 software requirements, refer to the EMC Simple Support Matrix at EMC Online Support.
Table 1. Solution resources

<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating system software</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUSE Linux Enterprise Server for SAP Applications</td>
<td>12 SP1</td>
<td>Optimized and resilient operating system for SAP applications</td>
</tr>
<tr>
<td><strong>Application software</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAP ERP</td>
<td>Enhancement Package (EHP) 7 for ERP 6.0</td>
<td>SAP ERP application software</td>
</tr>
<tr>
<td>SAP HANA</td>
<td>1.0 SP12</td>
<td>SAP HANA in-memory database</td>
</tr>
<tr>
<td><strong>Third party management software</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue Medora vRealize Operations Management Pack for SAP</td>
<td>6.0.1</td>
<td>SAP adapter for vRealize Operations Manager to monitor SAP performance</td>
</tr>
</tbody>
</table>
### Table 2. Solution resources

<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating system software</strong></td>
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<tr>
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<td>6.0.1</td>
<td>SAP adapter for vRealize Operations Manager to monitor SAP performance</td>
</tr>
<tr>
<td>Pack for SAP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter 3  Self-Service SAP Provisioning

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Overview

Enterprise Hybrid Cloud offers templates and tools to customize automated tasks. This section describes the high-level process and methodology used to successfully deploy SAP systems by using vRealize Orchestrator with the vRealize Automation Service Catalog and the Enterprise Hybrid Cloud self-service portal.

This chapter explores several real-world applications, including:

- Self-service SAP provisioning, a fully automated installation of an SAP ERP standard or distributed system
- Auto-provisioning one or more new additional application server instances and integrating them into an existing SAP system
- Provisioning a single-node or multi-node HANA database on vSphere 6.0

Provisioning SAP ERP on Oracle

This section describes the process of provisioning SAP ERP on Oracle-SuSE Linux Enterprise Server (SLES) from the service catalog, including:

- Standard SAP ERP 6.0 EHP7 SR2
- Distributed SAP ERP 6.0 EHP7 SR2
- AAS for SAP ERP 6.0 EHP7 SR2

Prerequisites

Before you configure self-service provisioning, ensure that all of the following requirements are met:

- Enterprise Hybrid Cloud Foundation package installed and initialized.
- SAP installation media downloaded from the SAP Service Marketplace. SAP user credentials and authorization are required to download the installation media. For SAP ERP 6.0 EHP7 SR2, the following installation media are required:
  - SAP SWPM 1.0 for Linux X86_64 (service pack 10 and above)
  - SAP UC Kernel 742 (51049350_5)
  - SAP ERP 6.0 EHP7 SR2 Installation export DVD 1 and 2 (51048902)
  - Oracle RDBMS 12.1.0.2 for Linux X86_64 (51047708)
  - Oracle CLIENT 12.1.0.2 (51050177)
  - A mountable network file system (NFS) folder to store the SAP installation media and parameter files for unattended installation. The automation script mounts this file system to the newly created virtual machines.
  - A virtual machine template created with the minimum hardware requirements:
    - 1 vCPU
    - 2 GB RAM
    - 1 Paravirtual SCSI controller
- 1 hard disk with 64 GB capacity
- SUSE Linux 12 SP1 for SAP Application installed and configured on the virtual machine you previously created according to SAP Note 1984787. Refer to SAP documentation for links and access details.
- vRealize Automation agent installed on the virtual machine, and the virtual machine converted to a template.

Manually deploying a standard SAP ERP system involves many steps. Performing these steps reliably and repeatedly is a challenge. This solution automates the steps by using a combination of out-of-the-box workflows, prebuilt templates, and scripts so that users can easily request a standard SAP ERP system with just a few mouse clicks.

Figure 4 shows a standard SAP ERP request form from the service catalog. In this example, the user has requested a standard SAP ERP system with two vCPUs and 8 GB memory.

Figure 4. Standard SAP ERP request form

In addition to CPU and memory properties, the service collects inputs from the user that will drive the installation and configuration of the standard SAP system. These properties are configurable only during provisioning. Table 3 describes the properties.
Table 3. Service catalog property descriptions for a standard SAP system request

<table>
<thead>
<tr>
<th>Property</th>
<th>Property type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master password</td>
<td>Required</td>
<td>The password for the root user and SAP system.</td>
</tr>
<tr>
<td>Machine name</td>
<td>Required</td>
<td>The virtual machine vCenter name and the operating system (OS) host name. Must be unique within the Enterprise Hybrid Cloud environment.</td>
</tr>
<tr>
<td>System ID</td>
<td>Required</td>
<td>The SAP (and database) system ID.</td>
</tr>
<tr>
<td>Auto start</td>
<td>Optional</td>
<td>If enabled, the SAP system is started automatically every time the operating system (OS) is started.</td>
</tr>
<tr>
<td>Enable DB backup</td>
<td>Optional</td>
<td>If enabled, Avamar plugin for SAP is installed and configured. Refer to Enterprise Hybrid Cloud 4.1.1 for SAP: Data Protection for more information.</td>
</tr>
<tr>
<td>Oracle compression</td>
<td>Optional</td>
<td>If enabled, row-level compression is applied using Advanced Row Compression after no modification has taken place for the number of days specified in the property Compress after (days).</td>
</tr>
<tr>
<td>Compress after (days)</td>
<td>Optional</td>
<td>Frequency of compression. Valid only if Oracle compression is enabled.</td>
</tr>
</tbody>
</table>

Users can change storage options for the standard SAP ERP system. To change storage capacity and storage reservation policy, click the Storage tab and edit each hard disk, as shown in Figure 5.

Figure 5. Storage option

The automated standard SAP ERP provisioning service process includes the following steps:

1. Clone a virtual machine from a preconfigured virtual machine template.
2. Prepare the OS by setting the hostname, allocating its IP address, and creating file systems.
3. Install the Oracle 12c database.
4. Install SAP ERP in standard mode, where all the instances are deployed on a single host.
Figure 6 shows the process flow of a standard SAP installation.

Figure 6.  Process flow of a standard SAP installation

When the provisioning process is complete, you can access the SAP virtual machine from the **Items** menu in the vRealize Automation portal.

In addition to deploying standard SAP ERP, this solution also automates deploying a distributed SAP ERP system with just a few mouse clicks.

A distributed SAP system contains at least three instances: PAS, ASCS, and DB. Figure 7 shows a distributed SAP ERP request form that has been requested from the service catalog.

![Distributed SAP ERP request form](image)

Figure 7.  Distributed SAP ERP request form
The properties that drive the installation and configuration of the distributed SAP system are located in each instance of the system and are very similar to that of a standard SAP system catalog. These properties are configurable only during provisioning. Table 4 provides a description of the properties.

**Table 4. Service Catalog properties for a distributed SAP system request**

<table>
<thead>
<tr>
<th>Instance</th>
<th>Property</th>
<th>Property type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCS</td>
<td>Master password</td>
<td>Required</td>
<td>The password for root user and SAP system.</td>
</tr>
<tr>
<td></td>
<td>Machine name</td>
<td>Required</td>
<td>The virtual machine vCenter name and the OS host name. Must be unique within the Enterprise Hybrid Cloud environment.</td>
</tr>
<tr>
<td></td>
<td>System ID</td>
<td>Required</td>
<td>The SAP (and database) system ID.</td>
</tr>
<tr>
<td></td>
<td>Auto start</td>
<td>Optional</td>
<td>If enabled, the SAP system is started automatically every time the OS is started.</td>
</tr>
<tr>
<td>Oracle DB instance</td>
<td>Machine name</td>
<td>Required</td>
<td>The virtual machine vCenter name and the OS host name. Must be unique within the Enterprise Hybrid Cloud environment.</td>
</tr>
<tr>
<td></td>
<td>Enable DB backup</td>
<td>Optional</td>
<td>If enabled, Avamar plugin for SAP is installed and configured. Refer to Enterprise Hybrid Cloud 4.1.1 for SAP: Availability and Data Protection for more information.</td>
</tr>
<tr>
<td></td>
<td>Oracle compression</td>
<td>Optional</td>
<td>If enabled, row-level compression is applied using Advanced Row Compression after no modification has occurred for the number of days specified in the property Compress after (days).</td>
</tr>
<tr>
<td></td>
<td>Compress after (days)</td>
<td>Optional</td>
<td>Valid only if Oracle compression is enabled.</td>
</tr>
<tr>
<td>PAS</td>
<td>Machine name</td>
<td>Required</td>
<td>The virtual machine vCenter name and the OS host name. Must be unique within the Enterprise Hybrid Cloud environment.</td>
</tr>
</tbody>
</table>
Users can change storage options for each instance in the distributed SAP ERP system. To change the storage capacity and storage reservation policy, click the Storage tab in each instance and edit each hard disk, as shown in Figure 8.

![Storage option](image)

**Figure 8. Storage option**

The automated distributed SAP ERP provisioning service process includes the following steps:

1. Clone virtual machines from a preconfigured virtual machine template.
2. Prepare the operating system (OS) on each instance by setting the hostname, allocating the IP address, and creating the file systems.
3. Install the ASCS instance and export the SAP global file system /sapmnt, which will be mounted on the DB and PAS instance.
4. Install the Oracle 12c database.
5. Install PAS and enable SSH access without password to the DB instance.

Figure 9 shows the process flow of a distributed SAP installation.
After the provisioning process is complete, you can access the SAP virtual machines from the Items menu in the vRealize Automation portal.

An SAP system can be scaled out by adding more AAS instances. This solution automates deploying AAS for SAP ERP with just a few mouse clicks.

Figure 10 shows an AAS for SAP ERP request form that has been requested from the service catalog.
Some of the properties that drive the installation and configuration of the AAS for SAP ERP are configurable only during provisioning. Table 5 describes these properties.

Table 5. Service Catalog properties description for an SAP AAS request

<table>
<thead>
<tr>
<th>Property</th>
<th>Property type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master password</td>
<td>Required</td>
<td>The password for the root user and SAP system.</td>
</tr>
<tr>
<td>Machine name</td>
<td>Required</td>
<td>The virtual machine vCenter name and the OS host name. Must be unique within the Enterprise Hybrid Cloud environment.</td>
</tr>
<tr>
<td>System ID</td>
<td>Required</td>
<td>The system ID of an existing SAP system to which you will add AAS.</td>
</tr>
<tr>
<td>Global host name</td>
<td>Required</td>
<td>The hostname of the SAP global host which exports the shared file system: /sapmnt</td>
</tr>
</tbody>
</table>
### Property | Property type | Description
--- | --- | ---
Global host IP | Required | The IP address of SAP global host which exports the shared file system: `/sapmnt`
ASCS hostname | Optional | The hostname of the ASCS instance. If this property is left blank, the hostname of the SAP global host is used as the ASCS hostname.
ASCS IP | Optional | The IP address of the ASCS instance. If this property is left blank, the IP address of SAP global host is used as the ASCS IP address.
ASCS root password | Optional | The root user password of the ASCS instance. If this property is left blank, the master password is used as the ASCS root password.
Auto start | Optional | If enabled, the SAP system is started automatically every time the OS is started.

**AAS automated installation workflow**

Users can change storage options for an AAS instance. To change the storage capacity and storage reservation policy, click the **Storage** tab and edit each hard disk.

The automated AAS for SAP ERP provisioning service process includes the following steps:

1. Clone the virtual machine from a preconfigured virtual machine template.
2. Prepare the OS by setting the hostname, allocating the IP address, and creating the file systems.
3. Mount the SAP shared file system, `/sapmnt`, from the SAP global host.
4. Look up the instance details and parameters from SAP profiles.
5. Install AAS and enable SSH access without password to the DB instance.
6. After the provisioning process is complete, you can access the SAP virtual machine from the **Items** menu in the vRealize Automation portal.

**Provisioning the SAP HANA database**

This section describes the process of provisioning the SAP HANA database from the service catalog, including:

- Single-node HANA database 1.0 SP12
- Multi-node HANA database 1.0 SP12

**Note:** SAP HANA on vSphere for production needs certification and careful design of compute and storage devices. The certified hardware list for a physical environment also applies to a virtualization environment. Ensure that you follow the instructions for setting up hardware in the certification guides for SAP appliances or TDI before deploying an SAP HANA database for production.
Before you configure self-service provisioning, ensure that the following requirements are met:

- Enterprise Hybrid Cloud Foundation package is installed and initialized
- SAP installation media is downloaded from the SAP Service Marketplace. Accessing the download page on SAP Service Marketplace requires an SAP S user ID and proper production licenses. For SAP HANA database 1.0 SP12, the following installation media is required:
  - SAP HANA Platform Edition 1.0 SP12 (51051151)
  - A mountable network file system (NFS) folder to store the SAP installation media
  - (Optional) A mountable NFS folder to serve as a HANA shared file system, /hana/shared.
  - A virtual machine created with minimum hardware requirements, as follows:
    - 1 vCPU
    - 2 GB RAM
    - 1 VMware Paravirtual SCSI controller
    - 1 hard disk with 64 GB capacity
  - SUSE Linux 12 SP1 for SAP Application installed and configured on the virtual machine that you created according to SAP Notes 1984787 and 2205917. Refer to SAP documentation for links and access details.
  - vSphere SDK for Perl 6.0 U2 installed on the virtual machine.
  - vRealize Automation agent installed on the virtual machine, and this virtual machine converted into a template.

This solution automates deploying HANA database in single-node or multi-node systems with just a few clicks. A single-node system is the simplest system installation type. It is possible to run an SAP HANA system entirely on one virtual machine and then scale the system up as needed. A multi-node HANA system is a system with more than one host, which can be configured as additional active worker hosts. This provides workload balance between different nodes.

Figure 11 shows a HANA database request form that has been requested from the service catalog. To request a multi-node HANA database, set the number of nodes to a value greater than 1.
Chapter 3: Self-Service SAP Provisioning

Figure 11. SAP HANA database request form

Table 6 describes the properties that drive the installation and configuration of the SAP HANA database. These properties are configured only once during provisioning.
### Table 6. Service Catalog properties for an SAP HANA request

<table>
<thead>
<tr>
<th>Property</th>
<th>Property type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of nodes</td>
<td>Required</td>
<td>The total number of nodes. If the number of nodes is one, a single-node HANA database is deployed. If the number of nodes is greater than one, a multi-node HANA database is deployed, including one standby node. For example, if the number of nodes is three, the multi-node HANA database will consist of two worker nodes and one standby node.</td>
</tr>
<tr>
<td>Number of CPUs</td>
<td>Required</td>
<td>The number of vCPUs on each node.</td>
</tr>
<tr>
<td>Memory size</td>
<td>Required</td>
<td>The size of memory on each node, measured in GB.</td>
</tr>
<tr>
<td>Storage reservation policies for OS, data and log volume</td>
<td>Required</td>
<td>The storage reservation policy for each volume which is created by the storage provisioning service.</td>
</tr>
<tr>
<td>HANA SID</td>
<td>Required</td>
<td>The HANA database system ID.</td>
</tr>
<tr>
<td>Master password</td>
<td>Required</td>
<td>The password for the root user and users in HANA system.</td>
</tr>
<tr>
<td>System number</td>
<td>Required</td>
<td>The HANA database system number.</td>
</tr>
<tr>
<td>DB mode</td>
<td>Required</td>
<td>You can choose to provision a HANA database in single-container mode or multiple-container mode (also known as multitenant database containers). The default mode is single-container.</td>
</tr>
<tr>
<td>Mount source for /hana/shared</td>
<td>Required</td>
<td>The mount source for HANA shared directory. It can be a local disk or an NFS share. The list of mount source options are pre-configured in vRO workflow and can be customized according to the customer’s requirements. If the user chooses LOCAL, depends on the node count, the following task will be performed: For a single-node HANA database, a new hard disk is created on and then mounted to /hana/shared. For a multi-node HANA database, a new hard disk is created on and then mounted to /hana/shared and exported as NFS share. The additional nodes mount the exported /hana/shared folder on the primary node.</td>
</tr>
</tbody>
</table>

The capacity of the data, log, and HANA shared disks are calculated based on memory size using the following formula:

- \( \text{Size}_{\text{data}} = \text{Size}_{\text{memory}} \)
- \( \text{Size}_{\log} = \text{Size}_{\text{data}} / 2 \)
- Single-node: \( \text{Size}_{\text{hanashared}} = \text{Size}_{\text{data}} + \text{Size}_{\log} + \text{MIN}(\text{Size}_{\text{memory}}, \ 1 \text{TB}) \)
- Multi-node: \( \text{Size}_{\text{hanashared}} = \text{Size}_{\text{data}} + \text{Size}_{\log} + 1 \times \text{Size}_{\text{memory}} \) per 4 nodes
The automated HANA database provisioning service process includes the following steps:

1. Add new SCSI controller for data and log disks.
2. Prepare the OS by setting the hostname, allocating the IP address, and creating the file systems.
3. Generate the installation configuration file.
4. Install the SAP HANA database.
5. When the provisioning process is complete, you can access the SAP virtual machines from the Items menu in the vRealize Automation portal.
This chapter presents the following topics:

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Overview of Enterprise Hybrid Cloud monitoring

Using multiple management interfaces to gather performance and capacity information is not a practical solution when you maintain thousands of SAP systems. The challenge of maintaining multiple SAP systems requires end-to-end visibility (from back-end storage to SAP application level) across the entire cloud.

The Enterprise Hybrid Cloud solution for SAP provides the following capabilities:

- Real-time performance monitoring and analysis
- Dell EMC ViPR integration
- Reporting
- Configuration validation and compliance
- Scheduling and sending reports through email messages
- SAP monitoring using the Blue Medora vRealize Operations Management Pack for SAP

This section focuses on real-time performance monitoring and analysis. For details about the other capabilities listed here, refer to the Enterprise Hybrid Cloud 4.1.1 Reference Architecture Guide.
SAP monitoring

SAP tenant administrators can use role-based performance dashboards to analyze individual metric behaviors and determine the health of an enterprise, in part or as a whole.

Blue Medora vRealize Operations Management Pack for SAP enables vRealize Operations Manager to collect health and performance metrics. It provides a unified view of the health, risk, and efficiency of the infrastructure and the SAP applications. Real-time monitoring, which is displayed as widgets, improves the quality of service and provides early detection of issues that are related to performance, capacity, and configuration.

Enabling this solution requires configuration of vRealize Operations Manager and customization of the Blue Medora interface. You can find the procedures in the Enterprise Hybrid Cloud 4.1.1: Reference Architecture Guide and in the related product documentation.

Customized monitoring dashboard

The Operations Manager monitoring dashboard is easy to customize, providing you with a clear, uncluttered view of the SAP cloud environment. You can find the procedures in the relevant product documentation. Figure 12 shows an example of a customized dashboard for the SAP tenant administrator.

![Figure 12. vRealize Operations performance dashboard for SAP tenant administrator](image)

This example shows statistics for two SAP systems, DX1 and EP1.
The widgets in Figure 12 are numbered 1 through 6 and display the following:

1. Health overview, which shows the health status of a tenant’s SAP infrastructure

2. SAP system realtime KPIs, which include the following counters:
   - SAP Dialog response time
   - Database response time
   - Total online SAP users
   - Batch utilization

3. Tenant generic scoreboards, which shows the workload and read/write latency of the DX1 and EP1 systems

4. Metric graphs of the DX1 and EP1 systems showing:
   - CPU utilization
   - Space usage under the /oracle folder
     The blue line indicates that the file system of DX1 systems is full, and the tenant administrator can reclaim the space or assign more space to the /oracle folder.
   - Swap space usage

5. Health workload scorecard

6. Health tree of Tenant A’s SAP application instances
Chapter 5  Conclusion

This chapter presents the following topics:

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Conclusion

Enterprise Hybrid Cloud enables an IT organization to balance the criticality requirements of each SAP virtual machine in the environment against the TCO, while maintaining management autonomy and data privacy.

Enterprise Hybrid Cloud for SAP shows higher operational efficiency than conventional provisioning and monitoring procedures for:

- **Self-service provisioning**—Enterprise Hybrid Cloud provides tools that automate virtual machine lifecycle processes from the creation of a virtual machine through installing full SAP ERP and HANA systems, greatly reducing the manual effort required.

- **Cloud monitoring**—Enterprise Hybrid Cloud gives you full, user-friendly visibility across all components in the environment, from the storage level up to SAP level.

Enterprise Hybrid Cloud provides a preconfigured, easy-to-deploy environment with most of the characteristics that IT users expect when interacting with public cloud portals that are validated for SAP system landscape architectures and operational requirements. By providing full integration between public and private cloud environments, Enterprise Hybrid Cloud lets you implement a hybrid cloud-computing environment in a faster, simpler, and cheaper way.

To meet evolving business scenarios and changing IT requirements, Enterprise Hybrid Cloud for SAP provides a foundation that is based on industry standards and has an open and flexible core. This foundation gets enterprises ready for the unexpected and is the right choice when uncertainty demands careful risk management of IT investments.
Chapter 6  References

This chapter presents the following topics:

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EMC documentation

The following documentation on EMC.com provides additional and relevant information about Enterprise Hybrid Cloud 4.1.1:

- Enterprise Hybrid Cloud 4.1.1 Administration Guide
- Enterprise Hybrid Cloud 4.1.1 Concepts and Architecture Guide
- Enterprise Hybrid Cloud 4.1.1 Reference Architecture Guide
- Enterprise Hybrid Cloud 4.1.1 Availability and Data Protection for SAP
- Enterprise Hybrid Cloud 4.1.1 Infrastructure and Operations Management Guide
- Enterprise Hybrid Cloud 4.1.1 Security Management Guide

SAP documentation

The following documentation on SAP Service Marketplace provides additional and relevant information about the installation of SAP Systems with Unattended Mode. An SAP Service Marketplace account is required.

- SAP Note 950619 - Installation of SAP Systems with Unattended Mode
- SAP Note 1984787 - SUSE LINUX Enterprise Server 12: Installation notes
- SAP Note 2205917 - SAP HANA DB: Recommended OS settings for SLES 12 / SLES for SAP Applications 12
- SAP Note 2315348 - Single SAP HANA VM on VMware vSphere 6 in production
- SAP HANA on VMware vSphere