



**Hewlett Packard**  
Enterprise

# HPE Reference Configuration for SAP S/4HANA on HPE Converged Data Center Infrastructure with Intel® Xeon® Processor Technology



# Contents

Executive summary.....	3
Introduction.....	4
Intel Xeon E7 v4 processor technology.....	4
Intel Xeon E5 v4 processor technology.....	4
SAP S/4HANA deployment.....	4
Solution overview.....	5
Solution components.....	7
Hardware.....	7
Software.....	8
Additional requirements.....	9
Setting up a VMware template.....	10
SAP software depot.....	10
Best practices for SAP HANA DB and S/4HANA deployment.....	12
Orchestrated deployment using HPE CSA.....	13
Manual deployment.....	13
Analysis and recommendations.....	13
Summary.....	14
Appendix A: Bill of materials for HPE CS500 and HPE ProLiant DL380.....	14
Appendix B: HPE CS500 integration for SAP HANA DB.....	16
HPE CS900 integration for SAP HANA DB.....	17
Appendix C: Manual deployment.....	18
VMware template deployment.....	18
Prepare SAP HANA DB automated installation.....	18
Run the automated SAP HANA database installation.....	19
Prepare SAP S/4HANA automated installation.....	19
Run the automated SAP S/4HANA installation.....	20
Installation progress and troubleshooting.....	20
Appendix D: SAP benchmark configuration.....	23
HPE ConvergedSystem 500 for SAP HANA on the SAP BW-AML standard application benchmark.....	23
HPE Integrity Superdome X on the two-tier SAP SD standard application benchmark.....	23
Glossary.....	24
Resources and additional links.....	25

## Executive summary

One of the main challenges enterprise IT organizations face is to provide simplified and agile solutions for highly customized mission critical implementations, such as ERP, CRM, etc. Intel® Xeon® processor technology is a solid foundation for such deployments. Methods that utilize automated system and software installations can provide the foundation for success and are especially useful for those customers who prefer to keep the critical applications and data on-premises. However, a common challenge with automated methods is identifying a design that incorporates infrastructure requirements as well as the corresponding “best practices” for the specific software installation, in addition to flexible configurations and error processing. A good automated methodology needs to cover all these topics.

SAP HANA® database (DB) is a modern technology by SAP® and offers as an in-memory database, enabling a radically different application architecture and a new philosophy with regards to the data model simplicity. SAP HANA DB offers a new way of solving current and future challenges with enterprise applications. More customers are transitioning to SAP HANA and are accelerating on utilizing it as a mission critical platform. In response, SAP has planned to convert all existing customers running traditional SAP applications to SAP HANA-based applications by the year 2025.

The SAP Business Suite for SAP HANA (SAP S/4HANA) family is optimized for the SAP HANA database. As a real-time ERP suite for digital business, SAP S/4HANA takes advantage of the capabilities of the in-memory database while providing instant insight by using real-time processes, dynamic planning and analysis. SAP S/4HANA comprises several business functions, such as Finance, Human Resource and other Line of Business (LOB) applications. In addition SAP Fiori, the user experience (UX) layer, provides a personalized, responsive and simple user experience across devices and deployment options. As of today (2016) about 70% of existing SAP customers continue to utilize and run on top of the traditional SAP Business Suite (non-HANA) and will transition to S/4HANA over the next few years.

Hewlett Packard Enterprise offers two certified SAP HANA appliances: HPE ConvergedSystem 500 for SAP HANA (CS500) and HPE ConvergedSystem 900 for SAP HANA (CS900), both with SAP HANA Database pre-installed. Powered by Intel Xeon E7 v4 architecture, these systems are optimized, tuned and configured with integrated software, hardware and full support, complete with best-in-class management. HPE CS500 for SAP HANA offers scale-up and scale-out appliances to support analytics and data warehousing workloads, as well as smaller application environments. With configurations for 128 GB to 68 TB, these systems offer best-in-class price/performance for SAP HANA. HPE CS900 for SAP HANA is ideal for large, mission-critical application environments. Scale-up configurations ranging from 512 GB to 16 TB offer massive capacity and amazing flexibility. Both platforms come with simplified and fast solution-level support, including dedicated HPE Centers of Excellence (CoE) for SAP HANA, and proactive and reactive services along with support for automated, unattended high-availability (HA) and disaster recovery (DR) with HPE Serviceguard. These platforms provide a positive customer experience with one packaged solution from Hewlett Packard Enterprise.

HPE CS500 for SAP HANA with the HPE ProLiant DL580 Gen9 and the HPE Integrity Superdome X have achieved significant performance results with Intel Xeon processor technology and its performance-boosting features. HPE CS500 for SAP HANA based on the HPE ProLiant DL580 Gen9 server has achieved world records on both Phase 2 Key Performance Indicators (KPIs) of the SAP BW-Advanced Mixed Load (AML) benchmark with leading scores for mean runtime and delta load/transformation with a run of 2 billion initial records. The HPE Integrity Superdome X achieved the 16-processor world record result on the two-tier SAP® Sales and Distribution (SD) standard application benchmark. Refer to [Appendix D: SAP benchmark configuration](#) for details.

This white paper provides detailed information and steps for customers who want to have automated on-premises SAP S/4HANA applications deployment with multiple configurations on the versatile HPE ConvergedSystem 500/900 and other servers.

Target audience: HPE employees and customers, as SAP experts that work on integrating SAP products with Hewlett Packard Enterprise products, customer's SAP Competence Center or Center of Excellence, resource supply managers/component designer, service designers, business managers, consumer administrators, operations staff, quality automation engineers, IT personnel, network managers, presales and sales personnel, and IT consultants interested in SAP should read this paper. Anyone wanting to learn about how to deploy SAP S/4HANA into an SAP HANA database running on an HPE ConvergedSystem 500/900 will benefit from reading this Reference Configuration, as well. This document assumes the reader has a basic understanding of several key data center technologies including, but not limited to: servers, storage, networking, power, solution management, virtualization, and hypervisors.

Document purpose: The purpose of this document is to describe a fully tested Reference Configuration and to outline the best practices and design considerations for an SAP S/4HANA implementation in an SAP HANA landscape with a content package developed by Hewlett Packard Enterprise engineers.

This white paper describes testing performed by Hewlett Packard Enterprise in August 2016.

## Introduction

Growing business needs and new requirements for IT in partnership with Line of Business (LOB), in delivering new services, are driving customers to reconsider the way they procure, deploy, and manage their enterprise applications. Every new IT solution that enters the market has several potential issues that can hamper its adoption including the question of “How does it fit into our current enterprise”? From an HPE ConvergedSystem for SAP HANA perspective and also from the Hewlett Packard Enterprise commitment to our customers, with the R&D partnership between HPE and SAP, we present a potential opportunity of how the SAP S/4HANA solution based on Intel Xeon processor technology can fit into the existing enterprise ecosystem.

### Intel Xeon E7 v4 processor technology

The Intel Xeon E7 v4 processor architecture is a foundation for the four-socket HPE SAP HANA solution. It includes several features that enhance performance and error recovery. There are two fully independent integrated Memory Controllers (MCs), each of which provides two fully independent memory channels and connects to its own Scalable Memory Buffer chip and six DDR4 DIMM slots. Since these memory channels are fully independent, all can run simultaneously at DRAM data transfer rates up to 1600 MT/s to provide the server with maximum memory bandwidth. Enhanced Machine Check Architecture (eMCA) allows firmware a first look at error logs to diagnose problems and take appropriate actions for the platform before OS and higher-level software involvement. Intel Xeon E7 v4 processors also provide the ability to recover from uncorrectable memory errors in the instruction and data execution path (Software Recovery Action Required, or SRAR) in addition to handling non execution path uncorrectable memory errors (Software Recovery Action Optional, or SRAO). In expanding on E7 processor memory error recovery including SAP HANA application recovery (Intel, 2011), Hewlett Packard Enterprise has done extensive development and testing of execution path recovery.

### Intel Xeon E5 v4 processor technology

Deployed in two-socket HPE ProLiant DL380 Gen9 and HPE ProLiant DL360 Gen9 servers, Intel Xeon E5 v4 processors include features that accelerate critical workloads such as database transactions and vector operations. The processors have Intel QuickPath Interconnect (QPI) Technology for fast, resilient system communications with up to 9.6 GT/s of QPI speed channel. They also include improvements in virtualization efficiency that can boost application performance and consolidation ratios in virtualized data centers and clouds. The HPE ProLiant DL380 Gen9 and HPE ProLiant DL360 Gen9 have achieved multiple world record benchmark results powered by Intel Xeon E5 v4 processor technology.

### SAP S/4HANA deployment

This paper describes an automated means of deploying SAP S/4HANA instances which can integrate seamlessly with HPE CS500 or HPE CS900 appliances built for SAP HANA in production environments. It also covers how a vanilla VM-based HANA Database can be deployed for light-weight operations. In addition, this paper gives an overview on how to perform SAP S/4HANA application installation on HPE ProLiant DL380/ DL360 servers with a VMware® environment. Table 1 shows a variety of possible hardware combinations.

Table 1. Possible hardware combinations

S/4HANA on	SAP HANA DB on	Use case
VMware or Bare Metal on HPE ProLiant DL380/DL360 servers	VMware or Bare Metal on HPE ProLiant DL380/ DL360 or HPE CS500 / CS900	Sandbox – starting environment – cost effective Small Business – possible Bare Metal use without VM
VMware environment on HPE ProLiant DL580	VMware environment on HPE ProLiant DL580 or HPE CS500 / CS900	Sandbox – starting environment Small Business – multi-VM environment

The paper also introduces an HPE developed Content Pack that can help you to automate the entire process. The details on how to deploy and configure the Content Pack in HPE Operations Orchestration and HPE Cloud Service Automation are covered in the Readme file of the Content Pack. Steps on how to create and maintain an SAP software repository is also covered.

This paper refers in some parts to features and options that will be part of the next Content Pack to be available in Q4 2016.

In terms of SAP HANA database, there is information covering both fronts:

- A standalone solution with one VM hosting the SAP HANA DB and an additional VM for the SAP S/4HANA system
- A dedicated HPE ConvergedSystem for SAP HANA (CS500 or CS900), hosting the SAP HANA database, and a VM hosting the SAP S/4HANA system

Of the various combinations in which SAP S/4HANA and SAP HANA DB can scale on industry-leading HPE infrastructure, this paper covers two combinations in detail. Other types of combinations are pending general release to the public; other combinations may change as required.

**Note**  
 The steps discussed in this paper are equally applicable to any compute virtualized environment, including the possible hardware combinations given in table 1 and shown in figure 1.

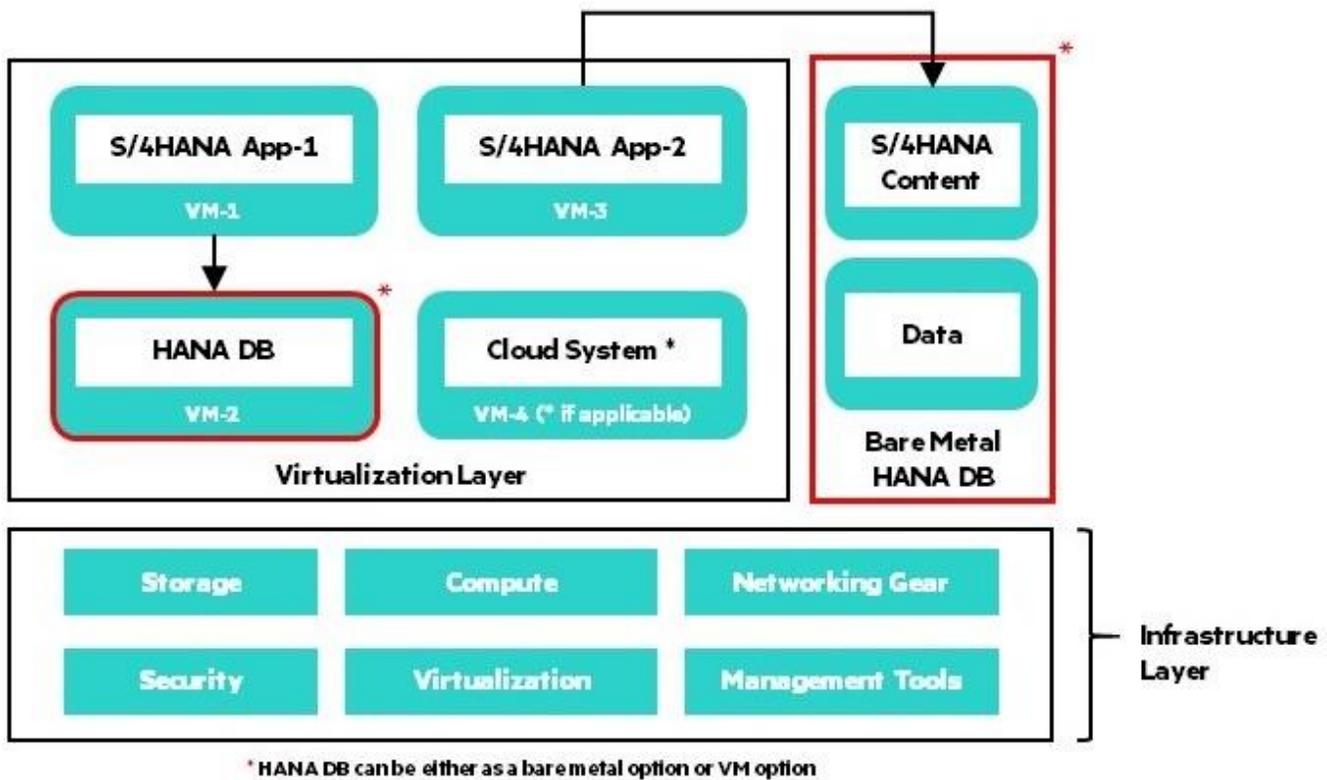


Figure 1. Architectural overview discussed in this paper

## Solution overview

This paper provides a verified and tested deployment of SAP S/4HANA in an orchestrated and automated way using HPE Operations Orchestration and HPE Cloud System Automation, covering the following tasks:

- Creating the VMware environment
- Obtaining the software from SAP
- Obtaining the HPE Content Pack
- Deploying optionally, SAP HANA DB and then SAP S/4HANA

Since the SAP S/4HANA deployment is VM-based, throughout this paper the hypervisor used is VMware ESXi and the management environment is VMware vCenter. There is no specific infrastructure that is required for the solution other than that required for VM environments.

SAP proved that HANA DB is a very stable environment and can be operational under critical environments. This paper can help Hewlett Packard Enterprise employees understand how an S/4HANA application can be integrated to work together with HPE ConvergedSystem for SAP HANA DB. It can also give some insight when working with customers who are already on HPE ConvergedSystem for SAP HANA who might consider migrating from a traditional application to SAP S/4HANA.

Specific details of the entire solution are provided in this paper. Two configurations will be looked at in more detail. Figure 2 shows an example of a general design in a full landscape showing SAP HANA DB either on an HPE CS500 or HPE CS900. Both servers include HPE 3PAR storage. The SAP S/4HANA application is running in a virtual machine on the HPE DL380/HPE DL360. This rack also includes HPE 3PAR storage. Other hardware configurations are also possible.

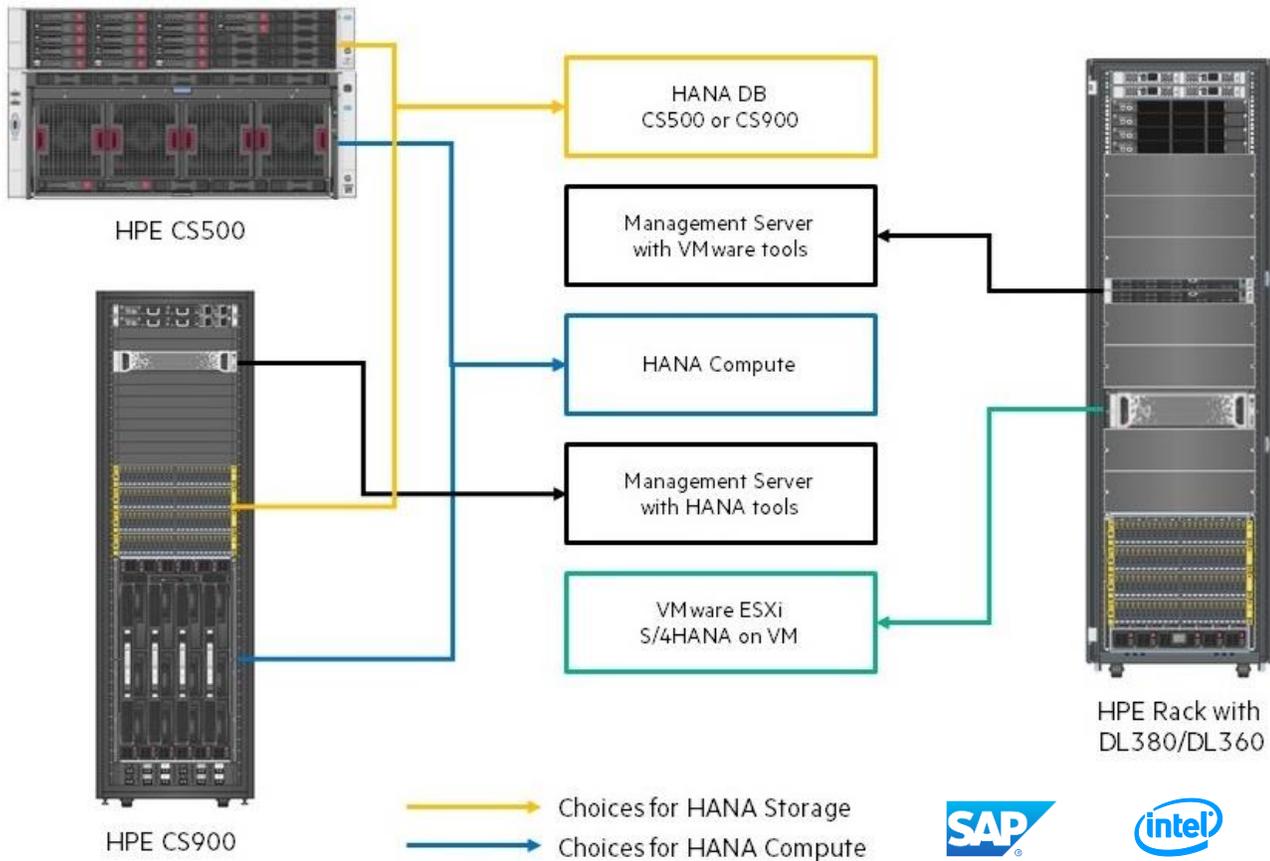


Figure 2. General design in a full landscape with SAP HANA DB on HPE CS500/HPE CS900 (image is for representational purposes only)

Figure 3 shows an example of a completely virtualized environment in an HPE rack with DL380/DL360 and 3PAR storage. SAP HANA DB and SAP S/4HANA are running on VMs. There are various combinations in which this can be done with SAP HANA DB and SAP S/4HANA applications as mentioned in table 1.

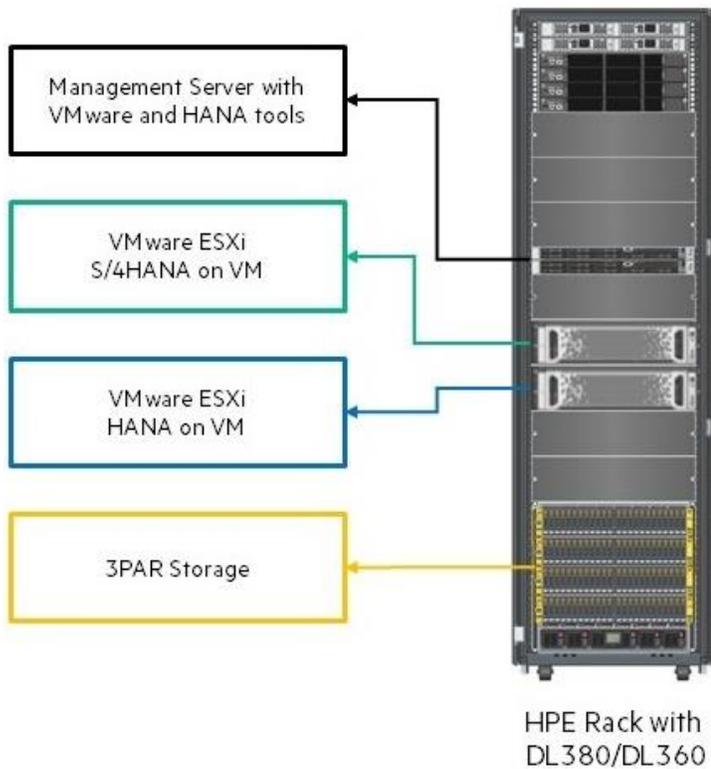


Figure 3. General design of SAP HANA DB and S/4HANA on VM

## Solution components

This section describes the configuration and setup details of the environment on which the content of this paper is built. This content involves how we configure and automate the SAP S/4HANA installation on an SAP HANA DB, on a VM environment or to an HPE CS500 or HPE CS900 for SAP HANA database system.

### Hardware

There are two hardware recommendations proposed and discussed throughout the paper.

If your platform will host SAP S/4HANA with a distributed SAP HANA DB, then the recommendation is to use any system that supports a VM, such as an HPE ProLiant DL360 or DL380 Gen9 server. There will be multiple VMs that will be spun out through the automation models.

### Compute

The compute block is where the entire operation and execution will take place. If you are using your own VM environment, the host on which you are going to work upon is referred to as compute. It could be any server, such as a single HPE ProLiant DL360, DL380, or a group of servers.

### Management servers

You will need a management server. Usually this will be the machine on which your management stack for managing your VMs and hosts will be residing. This typically is a Microsoft® Windows® environment on which all the networking is configured to communicate with the ESXi host which you are considering as compute.

The management servers are virtualized and they provide management functions for VMware vSphere vCenter, SAP HANA studio, HPE iLO, HPE OneView (if applicable), and others.

The solution described in this white paper utilizes HPE ProLiant DL380 Gen9 servers as management servers as shown in figure 4.



Figure 4. HPE ProLiant DL380 Gen9 server provides the management server used in the solution

### Storage

In a scenario where the environment is a custom-built VM host environment, the storage block attached to the host may vary. It could be direct attached, on board drives or even fibre attached. Most of the environments we evaluated were built with HPE 3PAR StoreServ storage, as shown in figure 5.



Figure 5. HPE 3PAR StoreServ storage array provides the storage block used in the solution

### Software

The management setup should be compatible with running VMware vSphere 5.5 and ensures the host and VMs have all the management connectivity needed to administer the solution.

#### HPE OneView

HPE OneView is an end-to-end converged infrastructure management platform. This single management approach to system control is simpler to operate than multiple disjointed tools. It is architected using a RESTful API and message brokering to provide a truly scalable management platform, designed from the ground up for converged system platforms. This approach enables extensibility and HPE has developed a VMware plugin for vCenter, further streamlining end-to-end management of converged virtualized systems into a single interface. Figure 6 shows an HPE OneView management interface.

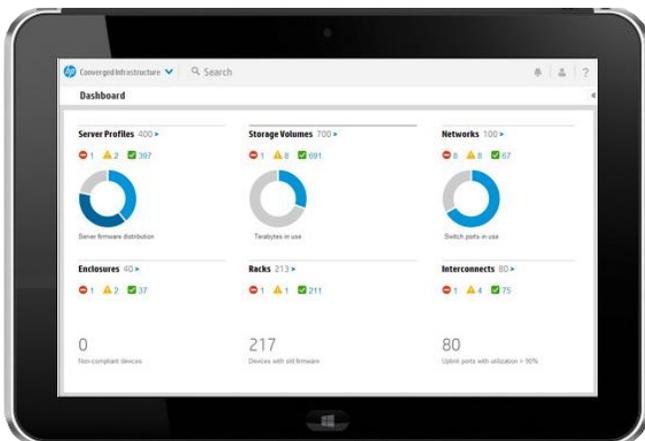


Figure 6. HPE OneView management interface on a handheld tablet

The vCenter plugin provides easy access in vCenter to health, inventory and configuration monitoring. It also provides visual mapping of virtualized workloads to network, and storage resources reducing the time it takes to locate components that need attention.

#### HPE Operations Orchestration

HPE Operations Orchestration (HPE OO) is a leading IT process automation solution designed to increase automation adoption in a traditional data center and hybrid cloud environment. It offers choice for automating IT tasks, operations and processes and provides the most comprehensive integration capabilities and out-of-box content.

#### HPE Cloud Service Automation

HPE Cloud Service Automation (CSA) provides open, heterogeneous, extensible enterprise-grade cloud service lifecycle management to design and orchestrate full stack services. It provides the possibility to automate and simplify the deployment and management of your choice of hybrid IT services.

#### VMware vCenter Server

VMware vCenter Server provides a centralized platform for managing your VMware vSphere environments so you can automate and deliver a virtual infrastructure with confidence. This is required to maintain the compute hosts if it is not just a single ESXi host. The vSphere client cannot manage multiple ESXi hosts at the same time, therefore we used vCenter Server.

#### VMware vSphere Client

VMware vSphere is a leading server virtualization platform with consistent management for virtual data centers. Deliver business value from day one with powerful server virtualization, breakthrough availability, safe automated management and intelligent operational insight that adapts to your environment. Automate workload placement and resource optimization based on preset customizable templates. This is required to maintain the compute host or the entire compute cluster via vCenter. It comes with many features, such as managing hosts, monitoring, managing and creating required resources, etc.

#### SAP HANA studio

SAP HANA studio is used to administrate the SAP HANA database. It can be installed directly on the SAP HANA DB server or on a remote system connecting to the SAP HANA DB.

In the automated SAP S/4HANA installation scenario, the SAP HANA studio can be installed together with the SAP HANA database server. However, an additional SAP HANA studio instance can be installed in the landscape to administrate several SAP HANA instances.

### Additional requirements

Along with having all this infrastructure and software ready, there are some other major key requirements that have to be taken care of before starting the SAP S/4HANA installation.

#### DHCP server

A DHCP server has to be fully configured and be running in the environment to provide the right IP addresses within the expected range. There is no requirement to enforce where this DHCP is running, it could be on a Windows or a Linux® setup.

#### DNS server

A DNS server has to be fully configured and be running in the environment to translate (resolve) the human-readable domain names and hostnames into the corresponding numeric Internet Protocol (IP) addresses. There is no requirement to enforce where this DNS is running, it could be on a Windows or a Linux setup.

#### DNS entry by DHCP

The DHCP and DNS servers have to be in sync to dynamically create a DNS entry for each IP allocated. This will ensure that all the hostnames that are auto generated on the DHCP allocated pool are resolvable within the environment.

#### NTP server

A NTP server has to be fully configured and be running in the environment to serve the right time zone details and also to keep all the devices in sync. There is no requirement to enforce where this NTP is running, it could be on a Windows or a Linux setup.

## Setting up a VMware template

### System sizing

For guidelines and recommendations regarding SAP system sizing, see the presentation “Sizing SAP S/4HANA using the Quick Sizer Tool” at <http://go.sap.com/documents/2016/10/26db7b76-8f7c-0010-82c7-eda71af511fa.html>.

### Operating system requirements

Additional operating system packages, kernel settings, and other configurations are required for the SAP HANA database and the SAP S/4HANA systems.

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## Note

You must have access to the SAP support webpages to view and download the necessary SAP Notes.

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To access the SAP support pages where SAP Notes are stored, you must have at least an SAP S-User with credentials for support access. If you do not have such an account, contact your company's SAP super-administrator or contact SAP and provide your company's contract information number.

### Relevant SAP documentation

On the SAP HANA Platform webpage ([http://help.sap.com/hana\\_platform](http://help.sap.com/hana_platform)), check the latest SAP HANA Master Guide and SAP HANA Server Installation Guide for important SAP Notes and additional information about the setup.

Read also the Installation Guide on the SAP S/4HANA webpage <https://help.sap.com/s4hana>.

### Relevant SAP Notes

- [171356](#) – SAP software on Linux: General information
- [1680045](#) – Release Note for Software Provisioning Manager
- [1788665](#) – SAP HANA Support for virtualized / partitioned (multi-tenant) environments
- [1995460](#) – SAP HANA on VMware vSphere in production
- [SCN: What is sapconf](#) – Example on how to use the sapconf tool to set the right OS parameter on SUSE Linux

### Create a VMware template

Create a new VMware virtual machine for your SAP S/4HANA system. If you plan to deploy the SAP HANA database also on a VM, then you need to create an additional virtual machine for the database server.

For operating system, choose between SUSE Linux Enterprise Server and Red Hat® Enterprise Linux. For the network configuration you could create two network adapters – one for the management and another for the production network. Make sure to also install the latest VMware Tools after the operating system installation finishes. When you are done, shut down the VM and then you could convert it to a VM template.

## SAP software depot

### Software depot creation

To support repeatable, automated SAP installations, it is crucial to store all necessary installation media at a central location – a software depot. Depending on your environment, you can host the software depot on any server that is reachable in your environment.

### Download the SAP media archives

Once the software depot folder has been shared, you can begin storing SAP installation media. SAP customers can get a copy of the installation media from the SAP Software Download Center (<https://support.sap.com/swdc>). Ensure that the appropriate media archives are downloaded as some of them are operating system dependent.

### SAP S/4HANA SR1 on-premise edition

For an SAP S/4HANA SR1 on-premise edition, browse to the [SAP Software Download Center](#) and click on the left menu on **Installations and Upgrades** → **Software Downloads** → **By Alphabetical Index (A-Z)** → **S** → **SAP S/4HANA** → **SAP S/4HANA ON-PREMISE 1511 SR1** → **Installation** → **SAP HANA**.

From that list you must obtain the following media files:

- Operating system independent media archives:
  - SAP S/4HANA ON-PREMISE 1511 SR1 Installation Export I 1/2
  - SAP S/4HANA ON-PREMISE 1511 SR1 Installation Export I 2/2
  - SAP S/4HANA ON-PREMISE 1511 SR1 Installation Export II 1/2
  - SAP S/4HANA ON-PREMISE 1511 SR1 Installation Export II 2/2
  - SAP Hana Client 1.00 SP11 for SAP S/4HANA On-Premise 1511 SR1
- Operating system dependent media archives:
  - SAP DC Kernel 7.45 Linux X86\_64 64 Bit

### SAP Software Provisioning Manager (SWPM)

Next you will also need to download the SAP Software Provisioning Manager (SWPM) tool, which is responsible for the installation of SAP S/4HANA or SAP Business Suite products.

On the left menu of the [SAP Software Download Center](#), click **Support Packages and Patches** → **Software Downloads** → **By Alphabetical Index (A-Z)** → **S** → **Software Provisioning Manager** → **Software Provisioning Manager 1.0** → **Support Package Patches**

Select your OS (Linux on x86\_64 bit) from the drop down menu.

From here you must get the latest version of the SAP Software Provisioning Manager for NetWeaver, 7.0x or later. (At the time of writing, this was the latest available version.)

- SWPM 1.0 SP18 for NW higher than 7.0x

### SAP HANA Platform edition

If you plan an automated deployment of SAP HANA database on a VMware based system or on bare metal, then you also need to download the SAP HANA database media archives from the [SAP Software Download Center](#). On the left menu, click **Installations and Upgrades** → **Software Downloads** → **By Alphabetical Index (A-Z)** → **H** → **SAP In-Memory (SAP HANA)** → **HANA Platform Edition** → **SAP HANA PLATFORM EDITION** → **SAP HANA PLATFORM EDIT. 1.0** → **Installation**.

From that list you must obtain the following media files:

- SAP HANA Platf. Ed. 1.0 SPS12 (SAP HANA DB 1.00.121.0) 1/3
- SAP HANA Platf. Ed. 1.0 SPS12 (SAP HANA DB 1.00.121.0) 2/3
- SAP HANA Platf. Ed. 1.0 SPS12 (SAP HANA DB 1.00.121.0) 3/3

### Software depot directory structure

Create a folder for each SAP product you want to install. For our example, we copied the desired SAP media archives in the S4HANA-1511 folder on the software depot.

Extract the downloaded media archives into the folder. Next, verify that the CDLABEL and LABEL files are available inside each of these folders. Otherwise the automated installation will fail because the SAP installer SWPM will not find the appropriate media files. The following screen capture shown in figure 7 is an example of the content of the Kernel directory Kernel\_745\_Linux\_x86\_64.

Name	Date modified	Type	Size
DATA_UNITS	12/14/2015 1:32 PM	File folder	
CDLABEL.ASC	11/18/2015 8:57 AM	ASC File	1 KB
CDLABEL.EBC	11/18/2015 9:03 AM	EBC File	1 KB
COPY_TM.HTM	10/22/2015 10:01 ...	HTML Document	5 KB
COPY_TM.TXT	10/22/2015 10:01 ...	Text Document	2 KB
LABEL.ASC	11/18/2015 8:57 AM	ASC File	1 KB
LABEL.EBC	11/18/2015 9:03 AM	EBC File	1 KB
LABELIDX.ASC	2/2/2015 2:02 PM	ASC File	1 KB
MD5FILE.DAT	11/18/2015 9:03 AM	DAT File	5 KB
MID.XML	10/20/2015 12:04 ...	XML Document	73 KB
SHAFILE.DAT	11/18/2015 9:04 AM	DAT File	7 KB
VERSION.ASC	11/18/2015 8:57 AM	ASC File	1 KB
VERSION.EBC	11/18/2015 9:03 AM	EBC File	1 KB

Figure 7. Media folder structure example

For more details on how to create the Software depot take a look at the Readme documentation of the Content Pack.

### Customized SAP installation options

In many customer scenarios the default values for an SAP HANA DB or S/4HANA installation do not fulfill the companies' requirements. The Content Pack offering now solves this requirement by providing the option to hand over special configuration files for SAP HANA database or S/4HANA installations. With these configuration files many individual installation requirements can be fulfilled.

For more details on how to make use of these functionalities provided with the SAP Software Provisioning Manager SP18, take a look at the Readme documentation of the Content Pack.

## Best practices for SAP HANA DB and S/4HANA deployment

This section describes the automated SAP S/4HANA installation in a VM with a pre-existing SAP HANA database on an HPE CS500 or HPE CS900 system. If you want to deploy the SAP HANA database on a virtual machine, then you could also automate this installation task as described in the next section.

Table 2 shows the major software components used in this Reference Configuration.

Table 2. Software component versions

Component	Version
HPE Operations Orchestration	10.60
HPE Cloud Service Automation	4.60
VMware ESXi Server	5.5
VMware vCenter Server	5.5
VMware vSphere Client	5.5

## Orchestrated deployment using HPE CSA

There are multiple ways to set up an SAP S/4HANA environment.

In this paper we cover two tested options. The first option is an SAP HANA DB running on a VMware virtual machine for light-weight data operations. The second option uses either HPE ConvergedSystem CS500 or HPE CS900 as a dedicated system for the database.

If the requirement is to have a robust and a scalable database, the HPE CS500 and HPE CS900 are ideal.

For the orchestrated deployment, HPE CSA will take care of the infrastructure, copy configuration files to the server and start the deployment of SAP S/4HANA.

### VMware-based SAP HANA DB and S/4HANA deployment

If you also decide to deploy the SAP HANA database on a virtual machine, then you could automate this step. If you want to use an SAP HANA Database on an HPE CS500 or CS900 system, see [SAP HANA DB on HPE CS500/CS900 and VMware based SAP S/4HANA](#).

### Download the Content Pack

In the HPE Live Network: <https://hpln.hpe.com/contentoffering/request-to-fulfill-value-stream-with-sap> several Content Packs are available.

For the SAP S/4HANA deployment, including the SAP HANA DB installation, choose the Content Pack SAP S/4HANA System that will be available in the last quarter of calendar year 2016.

Extract the downloaded zip archive and continue to implement the content into HPE OO and HPE CSA as described in the Readme file of the Content Pack.

### SAP HANA DB on HPE CS500/CS900 and VMware based SAP S/4HANA

If you have an HPE CS500 or HPE CS900 with a running SAP HANA database that you want to use for this scenario, then you need to make sure, that the network connectivity to the compute device where the SAP S/4HANA should be installed is possible.

No additional configuration is necessary on the SAP HANA DB host. You only have to provide the necessary information for the SAP HANA DB, such as hostname, SAP HANA DB SID and Instance Number, and the SAP HANA master password. The rest will be taken care of by the automation and the SAP installer.

### Download the Content Pack

In the HPE Live Network: <https://hpln.hpe.com/contentoffering/request-to-fulfill-value-stream-with-sap> several Content Packs are available.

For the SAP S/4HANA deployment into an existing SAP HANA DB, e.g., on HPE CS500 or HPE CS900, choose the Content Pack SAP S/4HANA on existing HANA DB.

Extract the downloaded zip archive and implement the HPE OO and HPE CSA content as described in the Readme file of the Content Pack.

## Manual deployment

In some use cases the deployment of the SAP HANA DB or S/4HANA installation must not be done using HPE CSA. In this case, the installation can be done, e.g., on an existing server or VM using the standalone installation script. The installation script (install\_SAP.sh) can be obtained by downloading the Content Pack, e.g., S/4HANA; and, it is part of the zip file.

See section for details on how to run the manual deployment.

## Analysis and recommendations

As described in this document, there are multiple possible scenarios for an SAP HANA DB with an SAP S/4HANA application on HPE Converged Data Center Infrastructure like HPE CS500 or CS900.

In many business scenarios, the same SAP HANA DB and SAP S/4HANA applications have to be installed several times; for example, in training or testing scenarios or the classical Development-Quality Assurance-Production environment. In these cases, several deployments of an SAP HANA DB or SAP S/4HANA application are required. Using the orchestrated deployment is of great benefit here. The initial setup for the environment has to be done only once, thereafter each deployment of SAP HANA DB and SAP S/4HANA can be initiated by clicks in the CSA Marketplace. In other cases where no orchestration tool is available, the manual automated deployment of SAP HANA DB and SAP S/4HANA on HPE Converged Data Center Infrastructure can be chosen as explained in the [Appendix C: Manual deployment](#) section. Installing several systems with the described approach will also reduce the required time noticeably.

If you already have a running SAP HANA DB on an HPE CS500 or CS900, follow the steps described in the [SAP HANA DB on HPE CS500/CS900 and VMware based SAP S/4HANA](#) section.

In the case of a standalone solution with one VM hosting the SAP HANA DB and an additional VM for the SAP S/4HANA system, read section [VMware-based SAP HANA DB and S/4HANA deployment](#) for details.

Other scenarios, like installing an SAP HANA DB in a VM or SAP S/4HANA on bare metal, are also possible with the described steps.

In all cases, input is required for the deployments. The Readme file of the Content Pack gives details about the parameters, their possible values and meaning.

New installation options provided by SAP for the unattended installation with SWPM-SP18 are also included in the solution described in this paper. Refer the Readme file of the Content Pack for more detail.

The approach described in this paper can also be used for automating the installation of a standard SAP system with standard SAP databases like MaxDB, Sybase, Oracle or DB2 on HPE hardware.

## Summary

Today's growing business needs dictate fast and flexible service deployments to keep pace with new Line of Business (LOB) requirements. Customers are reconsidering the way they procure, deploy and manage their SAP HANA and S/4HANA applications.

The Reference Configuration presented here described an orchestrated way of deploying SAP S/4HANA instances that can integrate seamlessly with HPE CS500 or HPE CS900 appliances built for SAP HANA in production environments. It also covers how a vanilla VM-based SAP HANA database can be deployed for light-weight operations. For individual installation scenarios, customized installation options can be used.

After the initial setup of hardware, software and environment (like software depot), each automated deployment of SAP HANA DB and SAP S/4HANA will take only hours compared to days in a manual approach.

For more information on configurable product offerings and requirements, refer to the [Resources and additional links](#) section at the end of this paper or contact any of our worldwide sales offices.

## Appendix A: Bill of materials for HPE CS500 and HPE ProLiant DL380

The hardware used in this Reference Configuration was an HPE CS500 with a pre-installed SAP HANA DB and an HPE ProLiant DL380 for the virtualized SAP S/4HANA system. Other hardware setup is also possible.

---

### Note

Part numbers are at time of testing and subject to change. The bill of materials does not include complete support options or other rack and power requirements. If you have questions regarding ordering, please consult with your HPE Reseller or HPE Sales Representative for more details. [hpe.com/us/en/services/consulting.html](http://hpe.com/us/en/services/consulting.html)

---

Table A-1. HPE CS500 Bill of Materials

Quantity	Part number	Description
1	MOS56A	HPE CS500 SAP HANA Scale-up Appliance
1	MOS66A	HPE Virtual Rack
1	MOS71A	HPE SAP HANA Compute Node
4	684532-B21	HPE 1500W Common Slot Platinum Plus Hot Plug Power Supply Kit
1	698537-B21	HPE 4GB FBWC FIO Kit for P-series SA
8	788360-B21	HPE DL580 Gen9 12 DIMMs Memory Cartridge
37	791034-B21	HPE 1.8TB 12G SAS 10K rpm SFF (2.5-inch) SC Dual Port Enterprise 3yr Warranty Hard Drive
1	684208-B21	HPE Ethernet 1Gb 4-port 331FLR FIO Adapter
1	647594-B21	HPE Ethernet 1Gb 4-port 331T Adapter
1	BD505A	HPE iLO Adv incl 3yr TS U 1-Svr Lic
64	726722-B21	HPE 32GB (1x32GB) Quad Rank x4 DDR4-2133 CAS-15-15-15 Load Reduced Memory Kit
1	816643-B21	HPE DL580 Gen9 Intel Xeon E7-8890 v4 1P Kit
3	816643-L21	HPE DL580 Gen9 Intel Xeon E7-8890 v4 FIO 1P Kit
4	764284-B21	HPE InfiniBand FDR/Ethernet 10Gb/40Gb 2-port 544+QSFP Adapter
8	655874-B21	HPE QSFP/SFP+ Adaptor Kit
8	455883-B21	HPE BLc 10G SFP+ SR Transceiver
4	791034-B21	HPE 1.8TB 12G SAS 10K rpm SFF (2.5-inch) SC Dual Port Enterprise 3yr Warranty Hard Drive
3	822555-B21	HPE 400GB 12G SAS MU-3 SFF SC SSD
1	739405-B21	HPE DL580 5 SFF Drive Backplane Kit
2	NOU73A	SLES SAP 2Skt/1-2 VM 3yr 24x7 Flx LTU

Table A-2. HPE ProLiant DL380 Gen9 8SFF CTO Server Bill of Materials

Quantity	Part number	Description
2	719064-B21	HPE DL380 Gen9 8SFF CTO Server
2	719064-B21 ABA	U.S. - English localization
2	817967-L21	HPE DL380 Gen9 Intel Xeon E5-2699 v4 FIO Kit
2	817967-B21	HPE DL380 Gen9 Intel Xeon E5-2699 v4 Kit
16	805351-B21	HPE 32GB 2Rx4 PC4-2400T-R Kit
10	765466-B21	HPE 2TB 12G SAS 7.2K 2.5in 512e SC HDD
2	665243-B21	HPE Ethernet 10Gb 2P 560FLR-SFP+ Adptr
2	761874-B21	HPE Smart Array P840/4G FIO Controller
4	726825-B21	HPE Smart Array P441/4G Controller
2	783009-B21	HPE DL380 Gen9 8SFF SAS Cable Kit
2	733660-B21	HPE 2U SFF Easy Install Rail Kit
2	720478-B21	HPE 500W FS Plat Ht Plg Pwr Supply Kit
2	BD505A	HPE iLO Adv incl 3yr TSU 1-Svr Lic

## Appendix B: HPE CS500 integration for SAP HANA DB

CS500 is an HPE ConvergedSystem offering with a small to medium SAP HANA DB workload. Powered by the latest Intel® architecture, these scale-up and scale-out appliances are designed to support analytics and data warehousing workloads, as well as smaller business application environments. With configurations ranging from 128 GB to 24 TB, these systems offer best-in-class price/performance for SAP HANA workloads. These systems are ready for SAP S/4HANA, and they include HPE factory configuration, testing, and rapid onsite deployment services. They are simplified and have fast solution-level support, including dedicated Centers of Excellence (CoE) for SAP HANA, and proactive and reactive services. CS500 supports automated, unattended, high-availability and disaster tolerance with HPE Serviceguard.

As shown in figure B-1, each HPE CS500 is pre-configured with multiple networking capabilities to connect to various scenarios. Table B-1 lists the CS500 network types.

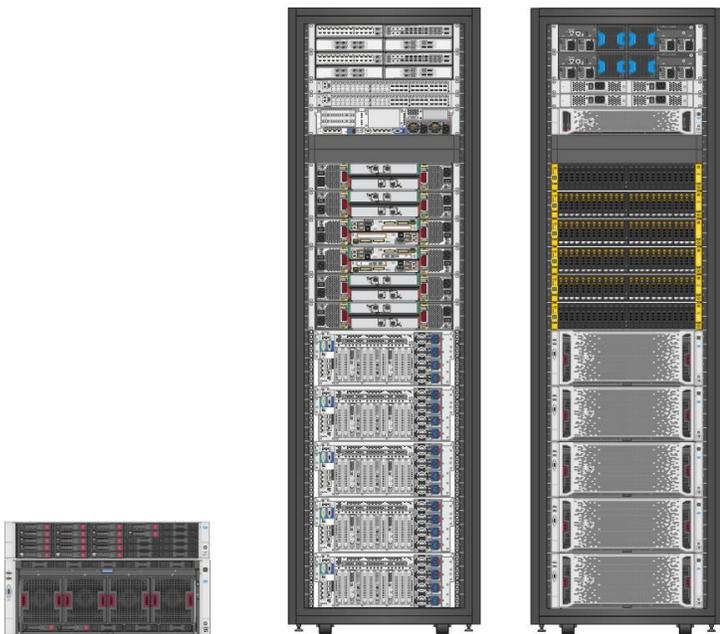


Figure B-1. HPE CS500 scale up and HPE CS500 scale out configurations

Table B-1. CS500 network types

Network name	Purpose
Data	Used within the environment to manage and access data
Replication	Dedicated network to be used if the environment has replication functionality
BI	Dedicated network to be used if the environment is placed within a BI landscape. This is one of the networks on which you can have the Application and DB communicating
Backup	Dedicated network to be used if the environment has backup functionality
Management	All the devices usually will be on this network, used for management. This is one of the networks on which you can have the Application and DB communicating
User	All the devices usually will be on this network, used for specific use cases
Quorum	Dedicated network to be used if the environment has Serviceguard functionality

## HPE CS900 integration for SAP HANA DB

CS900 is an HPE ConvergedSystem offering with a medium to large SAP HANA database workload. Powered by the latest Intel architecture, this appliance is designed to support large business application environments that require mission-critical capabilities. With configurations ranging from 0.5 TB to 12 TB, it delivers massive capacity and amazing flexibility for your data management requirements. These systems are ready for SAP S/4HANA, and they include HPE factory configuration, testing, and rapid onsite deployment services. They are simplified and have fast solution-level support, including dedicated Centers of Excellence (CoE) for SAP HANA, and proactive and reactive services. CS900 supports automated, unattended high-availability and disaster tolerance with HPE Serviceguard.

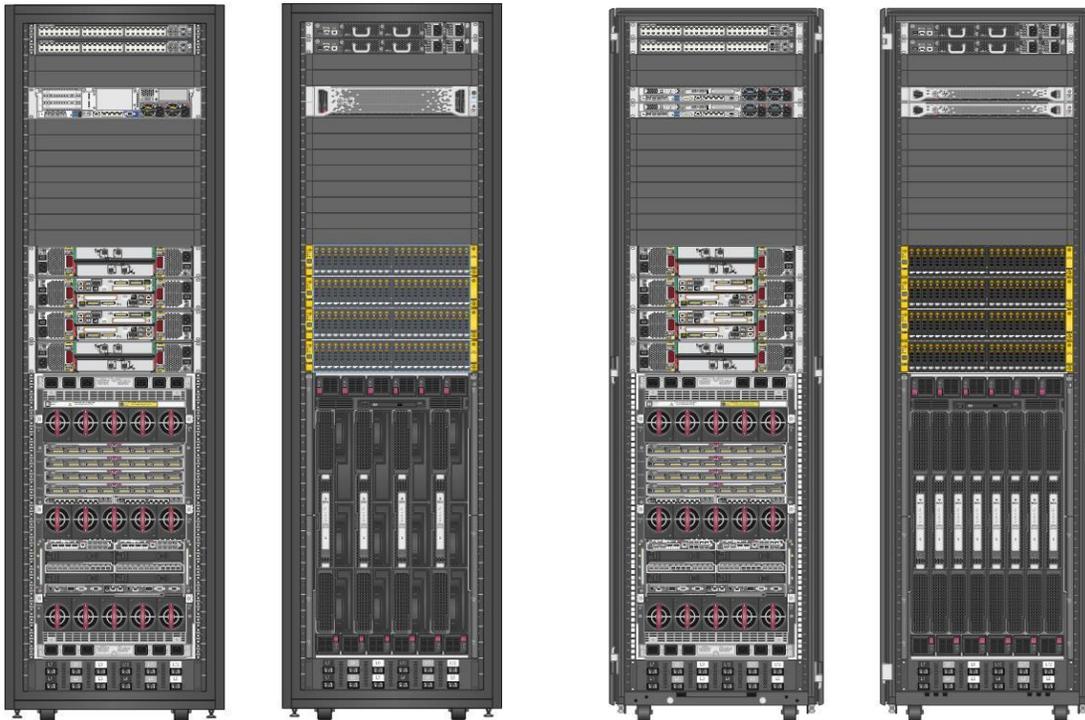


Figure B-2. HPE CS900 scale up and HPE CS900 scale out configurations

Each HPE CS900 is pre-configured with multiple networking capabilities to connect to various scenarios.

Table B-2. HPE CS900 network types

Network name	Purpose
Data	Used within the environment to manage and access data
Replication	Dedicated network to be used if the environment has replication functionality
BI	Dedicated network to be used if the environment is placed within a BI landscape. This is one of the networks on which you can have the Application and DB communicating
Backup	Dedicated network to be used if the environment has backup functionality
Management	All the devices usually will be on this network, used for management. This is one of the networks on which you can have the Application and DB communicating
User	All the devices usually will be on this network, used for specific use cases
Quorum	Dedicated network to be used if the environment has Serviceguard functionality

## Appendix C: Manual deployment

In some use cases the deployment of the SAP HANA DB or S/4HANA installation must not be done using HPE CSA. In this case, the installation can be done, e.g., on an existing server or VM using the standalone installation script. The installation script (install\_SAP.sh) can be obtained by downloading the Content Pack, e.g., S/4HANA; and, it is part of the zip file. Information about the required parameters can be found in the Readme file of the Content Pack.

### VMware template deployment

First you need to deploy the VMware template which you already prepared in the [Setting up a VMware template](#) section.

1. From the VMware vSphere client, select the VMware template you want to deploy, and then right-click to select Deploy Virtual Machine from this Template.
2. For the Guest Customization option of the deployment wizard, select Customize using an existing customization specification and choose the newly created Customization Specification (e.g., CSA\_SAP) from the list and click Next.
3. When the deployment is complete, verify the host is up and running and you are able to connect to the system via VMware console or secure shell (ssh). Also check that the system has valid IP addresses assigned to the network interfaces and the DNS name resolution is working.

### Prepare SAP HANA DB automated installation

Before running the automated SAP HANA database installation script, it is necessary to copy the installation script to the database host and to create a file with the mandatory input parameters, so that the installation script knows what to execute.

Transfer the installation script install\_SAP.sh via ftp or scp to your newly created database VM and make sure it is located in the installation directory, e.g., /tmp.

Next, create the local\_input.ini file with the mandatory input parameters and make sure this file also resides in the installation directory along with the install\_SAP.sh script. For a detailed description of all input parameters, refer to the Readme file of the Content Pack

Below is an example local\_input.ini file which you could use and make your adjustments:

```
#
# Software Depot parameters
#
scrDepotHost=' ci fs: 172. 16. 1. 2'
scrDepotName=' SWDEPOT'
scrDepotSapDirectory=' S4HANA-1511-SR1'
scrCifsUsername=' Administrator'
scrCifsPassword=' MySecretWindowsPassword'
#
# Global parameters
#
scrDryRun=' false'
scrMultiplatformOS=' false'
scrHostFunction=' db'
scrDatabaseVendor=' HDB'
scrGlobalHost=' '
#
# SAP HANA Database parameters
#
scrHostnameFQDN_HDB=' hostname'
scrIPAddr_HDB=' 172. 16. 12. 189'
scrDeploymentIPAddr_HDB=' 172. 16. 12. 189'
scrSID_HDB=' HDB'
scrInstanceNumber_HDB=' 00'
scrMasterPW_HDB=' '
```

See the Readme file of the Content Pack for details on how to use expert installation options.

## Run the automated SAP HANA database installation

When you have finished creating the `local_input.ini` file and the script file `install_SAP.sh` is also already on the system, you can start the automated SAP HANA database installation.

Change to the installation directory, e.g., `/tmp`, and execute the following command as root user:

```
# sh install_SAP.sh
```

The automated SAP HANA database installation starts and should run until the installation finishes successfully. If the installation aborts or you want to track the progress, see the [Installation progress and troubleshooting](#) section.

Before and during the SAP HANA DB or SAP S/4HANA installation, several files are stored in the installation directory. Some of them are prerequisites for the automated installation, some contain important content like the password or the secure storage key values. See the Readme file of the Content Pack for more details.

## Prepare SAP S/4HANA automated installation

First you need to deploy the VMware template which you already prepared in the [Setting up a VMware template](#) section.

Before running the automated installation script, it is necessary to copy the installation script to the host and to create a file with the mandatory input parameters, so that the installation script knows what to execute.

Transfer the installation script `install_SAP.sh` via ftp or scp to your newly created database VM and make sure it is located in the installation directory, e.g., `/tmp`.

Next, create the `local_input.ini` file with the mandatory input parameters and make sure this file also resides in the installation directory along with the `install_SAP.sh` script. For a detailed description of all input parameters, refer to the Readme file of the Content Pack.

Below is an example `local_input.ini` file which you could use and make your adjustments:

```
#
# Software Depot parameters
#
scrDepotHost=' ci fs: 172. 16. 1. 2'
scrDepotName=' SWDEPOT'
scrDepotSapDirectory=' S4HANA-1511-SR1'
scrCifsUsername=' Administrator'
scrCifsPassword=' MySecretWindowsPassword'
#
# Global parameters
#
scrDryRun=' false'
scrMultipleOS=' false'
scrHostFunction=' standard'
scrDatabaseVendor=' HDB'
scrGlobalHost=' '
#
# SAP Instance parameters
#
scrHostnameFQDN=' hostname'
scrIpAddr=' 172. 16. 12. 190'
scrDeploymentIpAddr=' 172. 16. 12. 190'
scrSID=' S4H'
scrSID_DB=' '
scrInstanceNumber=' 00'
scrSapApplication=' CORE'
scrSapVersion=' S4HANAONPREM1511SR1'
```

```
scrSapStack=' ABAP'  
scrMasterPW=' '  
#  
# SAP HANA Database parameters  
#  
scrHostnameFQDN_HDB=' hostname_hdb'  
scrIpAddr_HDB=' 172. 16. 12. 189'  
scrDeploymentIpAddr_HDB=' 172. 16. 12. 189'  
scrSID_HDB=' HDB'  
scrInstanceNumber_HDB=' 00'  
scrMasterPW_HDB=' HDB-Password'
```

## Run the automated SAP S/4HANA installation

When you have finished creating the `local_input.ini` file and the script file `install_SAP.sh` is also already on the system, you can start the automated SAP S/4HANA installation.

See the Readme file of the Content Pack for additional installation options.

Change to the installation directory, e.g., `/tmp`, and execute the following command as root user:

```
# sh install_SAP.sh
```

The automated SAP S/4HANA installation starts and should run until the installation finishes successfully. If the installation aborts or if you simply want to track the progress, check the [Installation progress and troubleshooting](#) section.

Before and during the SAP HANA DB or SAP S/4HANA installation, several files are stored in the installation directory. Some of them are prerequisites for the automated installation, some contain important content like the password or the secure storage key values. See the Readme file of the Content Pack for more details.

## Installation progress and troubleshooting

Read this section if the installation aborts or you want to check what the installation is doing. In the following steps, the installation directory is assumed to be `/tmp`.

1. In the system preparation phase (pre-SAP installation):
  - a. Check `/tmp/sap_installation.log`. If the line `Calling sapinst` or `Installing SAP HANA DB` shows up, then the system preparation finished successfully.
  - b. If there are errors, check the `/tmp/sap_dev_installation.log` and `/tmp/sap_error.log` files for troubleshooting.
2. During the SAP HANA database installation:
  - a. Check the log file `/tmp/sap_hdb_installation.log` to track the progress of the installation.
  - b. If there are any errors, check the `/tmp/sap_dev_installation.log` and `/tmp/sap_error.log` files for troubleshooting.
  - c. The installation finished successfully when the line `HDB Installation finished successfully` shows up in the log file.
3. During the SAP S/4HANA installation:
  - a. Check the `/tmp/sapinst_instdir/sapinst_dev.log` file for errors. If an exception occurred, it will show in the last lines of the file. Make a `tail -f /tmp/sapinst_instdir/sapinst_dev.log` to see what happened or search for the term `ERROR` in the log file.
  - b. If the `/tmp/sapinst_instdir/summary.html` file exists, the SAP installer finished the preparation phase and is already installing the product.
  - c. During the import of the database content, the `/tmp/sapinst_instdir/import_monitor.java.log` file can be tracked. When the import is finished, go back to `sapinst_dev.log`.
  - d. The installation finished successfully when the line `SAP Installation finished successfully` shows up in the log file.

### Manual SAP S/4HANA installation with the SAP installation GUI

If an exception is returned during the automated SAP installation, the best practice is to start the SAP installation manually with the SAP graphical user interface (SAP GUI) and check where the installer stopped and why. You have three options on how to accomplish that; but first stop the automated installation process if it is still running and then check for processes called sapinst and install\_SAP.sh.

1. Option: The target server/virtual machine operating system has a desktop environment (X-Window).
  - a. Connect to the desktop (X-Window) of your server.
  - b. Open a terminal as root user.
  - c. Go to the installation log directory: /tmp/sapinst\_instdir/.
  - d. Execute the SAP installer within this log directory:  
/nfsmnt/<YOUR\_SAP\_SW\_DIRECTORY>/<SWPM\_DIRECTORY>/sapinst  
The installation resumes at the point where it stopped.
2. Option: The server does not have a desktop environment, but you have another Linux host with X-Window.
  - a. Connect to your server via shell.
  - b. Go to the installation log directory: /tmp/sapinst\_instdir/.
  - c. Execute the SAP installer within this log directory with the parameter -nogui:  
/nfsmnt/<YOUR\_SAP\_SW\_DIRECTORY>/<SWPM\_DIRECTORY>/sapinst -nogui
  - d. Connect to the desktop (X-Window) of another Linux host.
  - e. Open a terminal as a root user.
  - f. Mount the Software Depot or copy the necessary SAP SWPM (Software Provisioning Manager) Linux media directory to the system.
  - g. Execute the SAP graphical user interface installer:  
/nfsmnt/<YOUR\_SAP\_SW\_DIRECTORY>/<SWPM\_DIRECTORY>/sapinstgui
  - h. Provide the host name of your installation server, keep the default port, and click Next.
  - i. On the next screen, enter the root credentials of the server.  
The installation resumes at the point where it stopped.
3. Option: The server does not have a desktop environment, but you have a Windows system.
  - a. Connect to your server via shell.
  - b. Go to the installation log directory: /tmp/sapinst\_instdir/.
  - c. Execute the SAP installer within this log directory with the parameter -nogui:  
/nfsmnt/<YOUR\_SAP\_SW\_DIRECTORY>/<SWPM\_DIRECTORY>/sapinst -nogui
  - d. Connect to your Windows system.
  - e. Mount the Software Depot or copy the necessary SAP SWPM (Software Provisioning Manager) Windows media directory to the system.
  - f. Execute the SAP graphical user interface installer. Navigate to the appropriate SWPM directory and execute sapinstgui.exe.
  - g. Provide the host name of your installation server, keep the default port, and click Next.
  - h. On the next screen, enter the root credentials of the server.  
The installation resumes at the point where it stopped.

### Verifying the SAP S/4HANA installation

You will need an SAP Client GUI to connect to the newly installed SAP S/4HANA system. Use the SAP System ID (SID), Instance Number, and Master Password to check that the SAP S/4HANA system was installed based on the parameters you supplied. To verify the SAP installation,

1. Open the SAP log on the user interface and enter the required parameters.

Note

The parameters can be found in the local\_input.ini file or on the HPE CSA Marketplace under My Services.

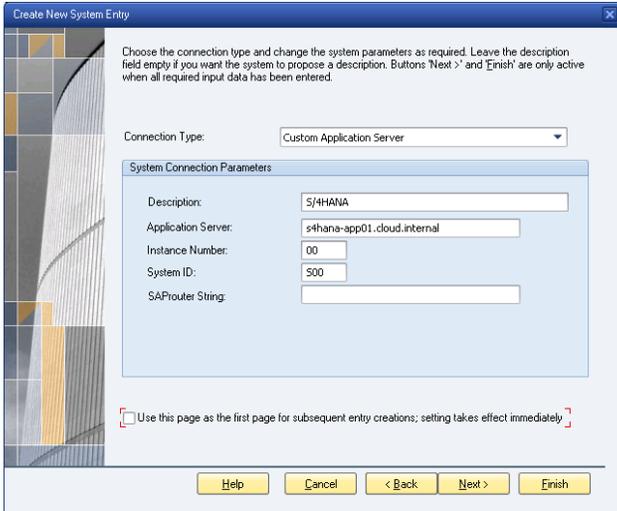


Figure C-1. SAP S/4HANA System Entry screen

2. Log on with the SAP Master Password.

Note

The Master Password can be found in the installation directory in the master\_password.txt file or the HPE CSA Marketplace under My Services.

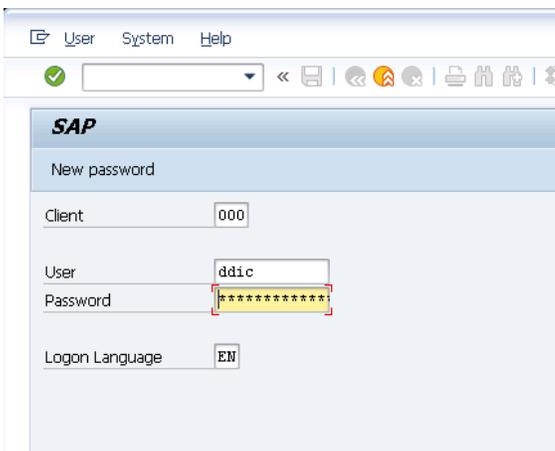


Figure C-2. SAP Logon screen

## Appendix D: SAP benchmark configuration

### HPE ConvergedSystem 500 for SAP HANA on the SAP BW-AML standard application benchmark

The SAP BW-AML standard application benchmark performed by HPE in Houston, TX, USA, with a total of 2,000,000,000 records, was certified by SAP on May 11, 2017, Certification #2017009, with the following data:

Table D-1. Results and configuration of HPE ConvergedSystem 500 for SAP HANA on the SAP BW-AML standard application benchmark

Benchmark component	Results	Servers	Configurations
Benchmark Phase 1		Database server	
Number of initial records	2,000,000,000	HPE ConvergedSystem 500 for SAP HANA (HPE ProLiant DL580 Gen9)	4 processors/96 cores/192 threads, Intel Xeon E7-8894 v4 processors, 2.40 GHz, 1024 GB main memory
Throughput/hour (Advanced query navigation steps)	36,130		OS/Database/SAP software : SUSE Linux Enterprise Server 12 operating system, SAP HANA 1.0, SAP NetWeaver 7.50
CPU utilization of database server	98%	Application servers	
Benchmark Phase 2		HPE ProLiant BL460c Gen9	2 processors/8 cores/16 threads, Intel Xeon E5-2637 v4 processors, 3.50 GHz, 384 GB main memory
Total runtime delta load/transformation time test	225 seconds	HPE ProLiant BL660c Gen9	4 processors/88 cores/176 threads, Intel Xeon E5-4669 v4 processors, 2.20 GHz, 1024 GB main memory
Normalized mean runtime single query test	5.42 seconds / billion records	HPE ProLiant DL380 Gen9	2 processors/44 cores/88 threads, Intel Xeon E5-2699 v4 processors, 2.20 GHz, 256 GB main memory

### HPE Integrity Superdome X on the two-tier SAP SD standard application benchmark

The SAP SD standard application benchmark performed by HPE in Houston, TX, USA, was certified on September 15, 2016, Certification #2016044, with the following data:

HPE Integrity Superdome X with Intel Xeon E7-8890 v4 2.20 GHz processors: 16 processors/384 cores/768 threads, 4.0 TB RAM; Red Hat Enterprise Linux 7.2; SAP ASE 16; SAP enhancement package 5 for SAP ERP 6.0; 117,611 SAP SD users and 644,830 SAPS

For more information, visit [sap.com/benchmarks](http://sap.com/benchmarks).

## Glossary

Name	Description
ABAP	Advanced Business Application Programming
CIFS	Common Internet File System
DB	Database
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
ERP	Enterprise Resource Planning software
FTP	File Transfer Protocol
GUI	Graphical User Interface
HA	High Availability
HPE	Hewlett Packard Enterprise
HPE CS500	HPE ConvergedSystem 500 for SAP HANA
HPE CS900	HPE ConvergedSystem 900 for SAP HANA
HPE CS9	HPE CloudSystem 9
HPE CSA	HPE Cloud Service Automation
JDBC	Java Database Connectivity
KM	Knowledge Management
KPI	Key Performance Indicator
NFS	Network File System
NIC	Network Interface Controller
NTP	Network Time Protocol
SAP	Systems, Applications & Products in Data Processing
SCP	Secure Copy
SID	SAP System Identification
SSH	Secure Shell
SWPM	SAP Software Provisioning Manager
VM	Virtual Machine

## Resources and additional links

For more information on configurable product offerings and requirements, contact any of our worldwide sales offices or visit one of the following websites.

HPE Reference Architectures, [hpe.com/info/ra](http://hpe.com/info/ra)

HPE ConvergedSystem for SAP HANA (CS500 and CS900), [hpe.com/us/en/integrated-systems/converged/big-data.html](http://hpe.com/us/en/integrated-systems/converged/big-data.html)

SAP HANA Platform (Core), [http://help.sap.com/hana\\_platform](http://help.sap.com/hana_platform)

SAP S/4HANA, on-premise edition, <https://help.sap.com/s4hana>

SAP Notes, <http://support.sap.com/notes>

SAP Software Download Center, <https://support.sap.com/swdc>

CSA Content Pack for SAP on HPE Live Network, <https://hpln.hpe.com/contentoffering/request-to-fulfill-value-stream-with-sap>

HPE Cloud System Automation, [hpe.com/software/csa](http://hpe.com/software/csa)

HPE Servers, [hpe.com/servers](http://hpe.com/servers)

HPE Storage, [hpe.com/storage](http://hpe.com/storage)

HPE Technology Consulting Services, [hpe.com/us/en/services/consulting.html](http://hpe.com/us/en/services/consulting.html)

HPE 3PAR Priority Optimization white paper, <http://h20195.www2.hpe.com/V2/GetDocument.aspx?docname=4AA4-7604ENW>

HPE 3PAR StoreServ Architecture, <http://h20195.www2.hpe.com/V2/GetDocument.aspx?docname=4AA3-3516ENW>

HPE Converged Infrastructure Solution Sizer Suite, <http://h20195.www2.hpe.com/V2/GetDocument.aspx?docname=4AA6-2732ENW>

SAP System sizing: Quick sizer tool, <http://service.sap.com/sizing>

Sizing for SAP S/4HANA, <http://go.sap.com/documents/2016/10/26db7b76-8f7c-0010-82c7-eda71af511fa.html>

HPE Server Performance Benchmarks, [hpe.com/servers/benchmarks](http://hpe.com/servers/benchmarks)

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