Hewlett Packard Enterprise

Reference Architecture

HPE Reference Architecture for SAP S/4HANA on HPE Synergy and HPE Superdome Flex Solutions

Contents

Executive summary

SAP HANA® is a modern technology that offers an in-memory database, enables a radically different application architecture, and provides a new philosophy with regards to data model simplicity. SAP HANA offers a new way of solving current and future challenges with enterprise applications, such as real time data analysis of large amounts of data. More customers are transitioning to SAP HANA and are accelerating its use as a mission-critical platform.

HPE Superdome Flex Solutions for SAP HANA offer industry-leading performance and modular scalability, mission-critical reliability, and optimum cost-efficiency. Designed with memory-driven computing principles to uniquely handle the scale, performance and reliability demand of SAP S/4HANA®, enabling enterprises of any size to analyze and process massive amounts of data at the digital core in real time.

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.

HPE Synergy is the first infrastructure that allows composability, the ability to manipulate hardware in the same manner as we manipulate software today. HPE Synergy offers resource pools which can be customized at provisioning time for specific SAP application needs. HPE Synergy enables IT organizations to accelerate application and service delivery through a single interface that composes physical and virtual compute, storage, and fabric pools into any configuration for any application. Composable resources are provisioned together with their state (determined by variables such as BIOS settings, firmware, drivers, and protocols) and their OS and application image. This is useful for applications such as SAP HANA because it eliminates time-consuming provisioning processes and offers flexibility in resource usage.

This Reference Architecture describes how to best leverage the advantages of the industry leading HPE Superdome Flex Solutions for SAP HANA with the composability of HPE Synergy for the SAP S/4HANA application server. While the SAP HANA database is running on a server with high mission-critical reliability, the application server and additional application server instances for SAP S/4HANA can be provisioned quickly and repeatedly through the software-defined intelligence embedded in HPE Synergy Composer and HPE Synergy Image Streamer. Using the advantages of the composable concept of HPE Synergy, lifecycle activities like a workload switch and OS update can be performed.

Testing of this Reference Architecture showed that provisioning an SAP S/4HANA application is completed within 1 hour, using HPE Synergy Image Streamer technology, while the SAP HANA database is running on HPE Superdome Flex Solutions for SAP HANA. Additional application server instances can be deployed in less than 15 minutes.

HPE Synergy provides a flexible, simple and efficient option for SAP S/4HANA environments:

- Flexible: Customers can choose the best storage option for their environment, either shared storage (HPE 3PAR) or local disks (HPE Synergy D3940) can be leveraged with composable infrastructure capabilities
- Simple: Reduce complexity by using common composable infrastructure and manage it with HPE OneView
- Efficient: Consolidate and standardize infrastructure for mixed workloads, while still meeting high performance requirements

Target audience: This Hewlett Packard Enterprise white paper is designed for IT professionals who use, program, manage, or administer large databases that require high availability and high performance. Specifically, this information is intended for those who evaluate, recommend, or design new IT high-performance architectures.

Document purpose: The purpose of this document is to describe a fully tested Reference Architecture, highlighting the benefits of the combination of SAP HANA on HPE Superdome Flex Solutions for SAP HANA and the SAP S/4HANA application server running on a HPE Synergy compute module.

This Reference Architecture describes solution testing performed in April 2019.

Solution overview

HPE Synergy enables IT organizations to accelerate application and service delivery through a single interface that composes physical and virtual compute, storage, and fabric pools into any configuration for any application. Composable resources are provisioned together with their state (determined by variables such as BIOS settings, firmware, drivers, and protocols) and their OS and application image. This is useful for applications such as SAP HANA because it eliminates time-consuming provisioning processes and offers flexibility in resource usage.

The key components of this solution are HPE Superdome Flex Solutions for SAP HANA, HPE Synergy Composer, and HPE Synergy Image Streamer. The combination of these platforms and tools allows for automating the customization of an OS image and deployment of the SAP S/4HANA software to quickly and repeatedly provision one or several servers. After the SAP S/4HANA deployment, lifecycle activities like updating the operating system and switching workload to another HPE Synergy compute module can be executed in a standardized way for one or several servers.

This Reference Architecture is built upon the following composability concepts and capabilities of the HPE Synergy platform.

Fluid resource pools

HPE Synergy allows for the transformation of traditionally rigid physical systems into flexible virtual resource pools. HPE Synergy creates resource pools of "stateless" compute, storage and fabric capacity that can be configured almost instantly to rapidly provision infrastructure for a broad range of applications.

Software-defined intelligence

The software-defined intelligence in HPE Synergy reduces operational complexity and enables IT organizations to make needed programmatic changes quickly and confidently, with minimal human intervention. HPE Synergy abstracts operational details and replaces them with high-level, automated operations. HPE Synergy uses templates to automatically implement change operations such as updating firmware, adding additional storage to a service, or modifying a network.

Unified API

HPE Synergy delivers automation through a unified API that provides a single interface to discover, inventory, configure, provision, update, and diagnose the composable infrastructure in a heterogeneous environment. This fully programmable interface integrates into dozens of popular management tools such as Microsoft® System Center, VMware® vCenter, and open source automation and DevOps tools such as Chef, Docker, and OpenStack.

Design principles

The SAP HANA database shall be up and running on HPE Superdome Flex Solutions for SAP HANA. This database is being used in this Reference Architecture for the SAP S/4HANA application.

The application host for SAP S/4HANA can be deployed automatically using HPE Synergy Image Streamer, using artifact bundles described in this Reference Architecture. After the host has been created and the OS is running, the SAP S/4HANA application will be installed using credentials provided during the server profile creation. During the SAP S/4HANA installation, the database content is loaded into the SAP HANA database that is running on an HPE Superdome Flex Solutions for SAP HANA server. This is only possible, if the server created in the HPE Synergy Composer and the HPE Superdome Flex Solutions for SAP HANA server are part of the same network.

Solution components

The hardware and software components used for the Reference Architecture for deploying SAP S/4HANA on HPE Synergy and HPE Superdome Flex Solutions is described in this section.

Hardware

Table 1 shows the hardware components used for this Reference Architecture.

Table 1. Hardware components

Qty	Component	Purpose
1	HPE Superdome Flex Solutions for SAP HANA	HPE Superdome Flex Solutions for the SAP HANA database
1	HPE Synergy 1200 Frame	Infrastructure for compute, fabric, and management
1	HPE Synergy Composer	Infrastructure management
1	HPE Synergy Image Streamer	Infrastructure deployment
1	HPE Synergy 660 Gen10 Compute Modules	Bare-metal host for SAP S/4HANA application
2	HPE Synergy 480 Gen10 Compute Module	Bare-metal hosts for additional SAP S/4HANA applications
1	HPE Synergy D3940 Storage Module	Storage for SAP S/4HANA
1	HPE FlexFabric Switch	Top of Rack network connectivity
2	HPE VC SE 16Gb FC Module	Virtual Connect Modules
2	HPE VC SE 40Gb F8 Module	Virtual Connect Modules

Figure 1 shows the components that were used in this setup.

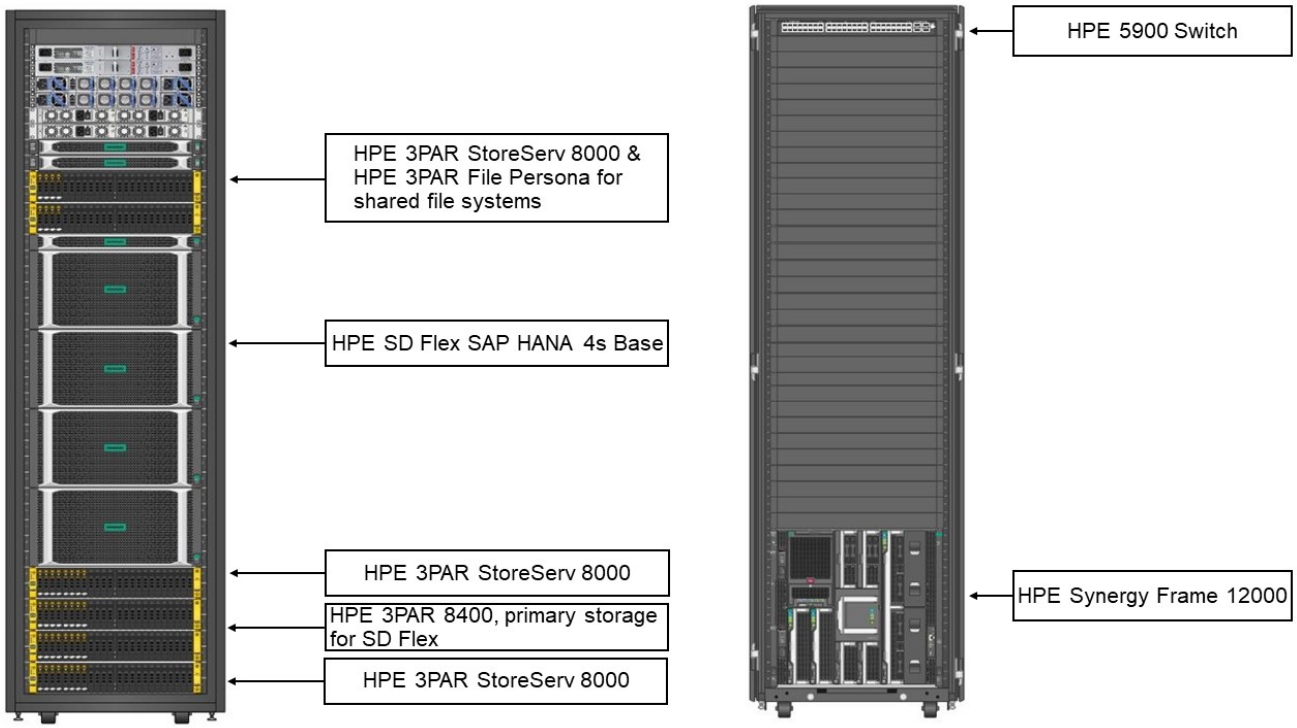

Figure 1. HPE Superdome Flex and HPE Synergy Frame, HPE 3PAR StoreServ 8000 SFF (2.5in) SAS Drive Enclosure, HPE 3PAR 8400 4-node Storage Base, and HPE 3PAR StoreServ 8000 SFF (2.5in) SAS Drive Enclosure

Note

While a single frame with a single HPE Synergy Image Streamer was used for this testing, the recommended production configuration for high availability is a pair of HPE Synergy Image Streamer appliances, and a pair of Virtual Connect SE 40Gb F8 Modules for Synergy, which provides Active-Active HA for volume storage. HPE Synergy Image Streamer used in production environments requires two Virtual Connect SE 40Gb F8 Modules for Synergy, two HPE Synergy Image Streamers and two HPE Synergy Composers.

HPE Superdome Flex Solutions for SAP HANA

HPE Superdome Flex Server is a highly scalable and modular in-memory computing platform powerful enough to handle massive amounts of data for the enterprise. The platform scales easily and economically with four-socket processor building blocks from 4 to 32 processors and 768 GB to 48 TB of shared memory in a single system. HPE Superdome Flex is one of the most scalable certified configurations for SAP HANA use cases based on the Intel® Xeon® Scalable Processor family, with up to 20 sockets and 15 TB of memory per server.

HPE Synergy Composer

HPE Synergy Composer provides enterprise-level management to compose and deploy system resources to your application needs. This management appliance uses software-defined intelligence with embedded HPE OneView to aggregate compute, storage and fabric resources in a manner that scales to your application needs, instead of being restricted to the fixed ratios of traditional resource offerings.

HPE Synergy Image Streamer

HPE Synergy Image Streamer is a new approach for provisioning and updating composable infrastructure. This management appliance works with HPE Synergy Composer for fast software-defined control over physical compute modules with operating system and application deployment. HPE Synergy Image Streamer enables true stateless computing combined with the capability for image lifecycle management. This management appliance rapidly deploys and updates infrastructure.

HPE Synergy Image Streamer adds a powerful dimension to “infrastructure as code”—the ability to manage physical servers like virtual machines. In traditional environments, deploying an OS and applications is time-consuming because it requires building or copying the software image onto individual servers sequentially, possibly requiring multiple reboot cycles. In HPE Synergy, the tight integration of HPE Synergy Image Streamer with HPE Synergy Composer enhances server profiles with images and personalities for true stateless operation offering the possibility to provision several servers simultaneously.

HPE Synergy Composer, powered by HPE OneView, captures the physical state of the server in the server profile. HPE Synergy Image Streamer enhances this server profile (and its desired configuration) by capturing your golden image as the “deployed software state” in the form of bootable image volumes. These enhanced server profiles and bootable OS plus application images are software structures (infrastructure as code)—no compute module hardware is required for these operations. The bootable images are stored on redundant HPE Synergy Image Streamer appliances, and they are available for fast implementation onto multiple compute nodes at any time. This enables bare-metal compute modules to boot directly into a running OS with applications and allows multiple compute nodes to be quickly updated.

Figure 2 shows how HPE Synergy Composer and HPE Synergy Image Streamer manage a compute node via a server profile.

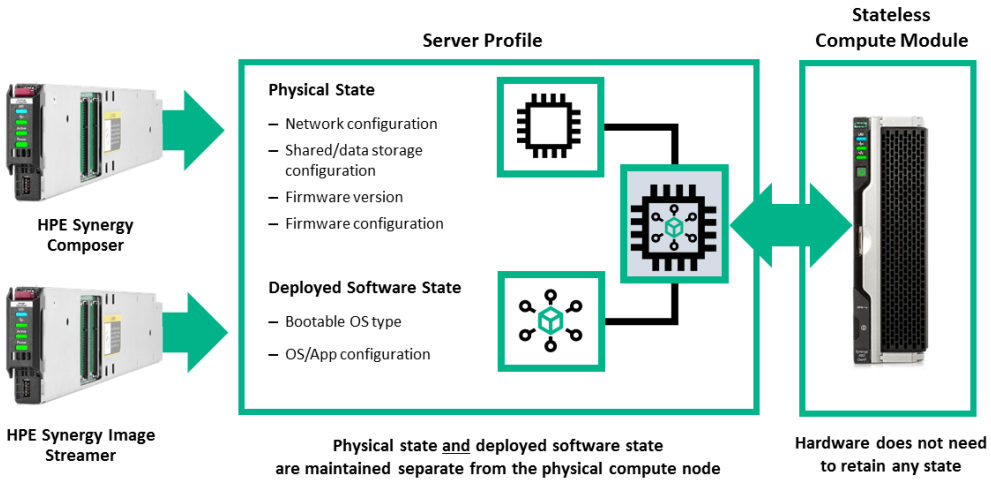

Figure 2. HPE Synergy Composer and HPE Synergy Image Streamer managing compute module with a server profile

HPE Synergy Image Streamer building blocks

HPE Synergy Image Streamer uses the following components for capture and deployment of images:

- **Plan script:** A guestfish[1] script used by OS build plans to personalize OS volumes based upon the values of custom attributes.
- **OS build plan:** A set of plan scripts used to modify the configuration of an OS volume during the deployment or capture process. Custom attributes may be set to default values that are not visible in the server deployment process.
- **Golden image:** OS and application software and including common OS and application configuration in the form of an already installed bootable OS volume. This is rapidly cloned during deployment and the per-server copy personalized to produce a ready-to-run OS volume specific to the server.
- **Deployment plan:** A combination of an OS build plan and golden image that is used by a server profile for the deployment of a server.

The deployment plans "HPE - SLES12 - SAP S4HANA - deploy" and "HPE - RHEL7.x - SAP S4HANA - deploy" provided with this Reference Architecture offer different lifecycle activity tasks for SAP S/4HANA using HPE Synergy Image Streamer.

Software

The software components listed in Table 2 were utilized in this Reference Architecture.

Table 2. Software list

Component	Version
HPE Synergy Composer	4.10.03
HPE Synergy Image Streamer	4.10.04
HPE Synergy Image Streamer artifacts for SAP HANA	HPE-SLES12-SAP-RA-2019-04-12-v4.1.zip HPE-RHEL7.x-SAP-RA-2019-04-12-v4.1.zip
Operating System	SUSE Linux Enterprise Server for SAP Applications 12 SP4 Red Hat Enterprise Linux for SAP Applications 7.6
SAP HANA	2.0 SPS03
SAP Application	SAP S/4HANA 1809

[1] For more information about the guestfish scripting language, see libguestfs.org/guestfish.1.html

Application software

SAP HANA is a modern technology by SAP® and is offered as an in-memory database, enabling a radically different application architecture and a new philosophy with regards to the data model simplicity. SAP HANA 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.

For this Reference Architecture SAP HANA 2.0 SPS03 and SAP S/4HANA 1809 were used.

Best practices and configuration guidance for the solution

The SAP HANA database must be installed and running on HPE Superdome Flex Solutions for SAP HANA before the deployment of the SAP S/4HANA application can start on a Synergy server. In the HPE Synergy Composer, a network has to be defined, in which also the HPE Superdome Flex must be a part of.

This Reference Architecture can be used for two Linux operating systems: SUSE Linux Enterprise Server and Red Hat Enterprise Linux. For both operating systems the same procedures are implemented in plan scripts. For readability reasons, this document will describe the deployment and update of SUSE Linux Enterprise Server and only highlights Red Hat specific differences.

To use the artifact bundle, several initial steps have to be taken to create the right environment for provisioning SAP S/4HANA application servers. An artifact bundle is a zip file that contains artifacts such as deployment plans, OS build plans and plan scripts to configure the server creation using HPE Synergy Image Streamer.

At first an empty OS volume has to be created. The operating system will be installed on to this volume. Then the OS volume will need to be captured as a golden image, which will be the basis for the OS deployment plan. The plan scripts will configure the networks and storage necessary for SAP S/4HANA during the deployment.

After the first boot, the storage will be mounted, some OS kernel parameters required for SAP S/4HANA will be set and the installation of the SAP S/4HANA application will start. Please note that the complete installation is done on persistent data, not on the local OS storage to avoid large and rapidly-growing smart clones.

For the lifecycle activity tasks updating the OS or switching workloads to a new server, the same deployment plans described in this Reference Architecture can be used and modified with changes of the golden image and custom attributes.

The concrete steps on how to do this are the following:

1. Create an SAP software media share
2. Create the network
3. Download and import the artifact bundle
4. Create a golden image
5. Customize the deployment plan
6. Create a server profile
7. Perform lifecycle activity

Steps 1-5 have to be executed only once, for the initial provisioning in the environment. Provisioning a server with SAP S/4HANA using this environment is described in Step 6. Step 7 describes how an OS update and workload switching are executed. The following sections describe all of the steps in detail.

Create an SAP software media share

To support repeatable, automated SAP S/4HANA installations with individual database settings for each server profile, it is crucial to store the SAP S/4HANA 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.

You can share the software depot on Windows® using the Common Internet File System (CIFS) or on Linux using the Network File System (NFS), both are described below:

1. Option: Software depot on Windows (CIFS):
   a. Create a folder on your Windows server for the software depot, e.g., C:\SWDEPOT
   b. To share the software depot folder, right-click SWDEPOT and select Share with → Specific people…
   c. Ensure that at least one user has full access to the folder by adding an appropriate user and sharing the folder.
2. Option: Software depot on Linux (NFS):
   a. Create a folder on your Linux server for the software depot:
      ```
      # mkdir /SWDEPOT
      ```
   b. Install the NFS Server package on your Linux host, if not already done.
   c. Modify the exports file:
      ```
      # vi /etc/exports
      ```
   d. Make the following entry for your share:
      ```
      /SWDEPOT *(fsid=0,ro,root_squash,sync)
      ```
   e. Run exportfs to make the changes effective:
      ```
      # exportfs -a
      ```

Download the SAP media archives

Once the software depot folder has been shared, you can begin storing SAP installation media.
The SAP Installation Guide describes where the correct media for the desired SAP release can be found. You can find the guide here: https://support.sap.com/sltoolset -> System Provisioning -> System Provisioning Scenarios -> Install a System using Software Provisioning Manager -> Installation Option of Software Provisioning Manager 2.0 SP 00 (or higher) -> Installation Guides - Application Server Systems

In general, the following media are required:

Software Provisioning Manager

SAP Kernel

SAP HANA database client software

Database Installation export

Optional: Language software

Download the files and extract them into a dedicated directory on the software share (DepotSapDirectory).

Create the network

HPE Synergy helps to define and configure networking and allows management of the network connections as part of the profile hardware state. It also assures that network connectivity changes are correctly handled as part of a workload switch.

The following networks are required in the Synergy environment for use in the server profiles that deploy SAP S/4HANA:

- Image Streamer deployment network
- Management network
- Network to HPE Superdome Flex Solutions for SAP HANA

Table 3 summarizes the configuration for each network used in this RA. All networks were created with a preferred bandwidth of 2.5 Gb/second and a maximum bandwidth of 20 Gb/second since they all share a single Virtual Connect SE 40Gb F8 Module.
The Network to the HPE Superdome Flex Solutions for SAP HANA server needs to be setup with a VLAN ID. The same VLAN ID needs to be provided during the Network creation in the HPE Synergy Composer.

Table 3. Networks for SAP S/4HANA deployments

Network name	Type	VLAN	Port	Uplink set
Image Streamer Deploy 99	Ethernet	99	Mezzanine 3:1-a	Image Streamer Deploy Uplink Set
Management 100	Ethernet	100	Mezzanine 3:1-b	Ethernet Uplink Set
Management 100	Ethernet	100	Mezzanine 3:2-a	Ethernet Uplink Set
SDFlex Management 108	Ethernet	108	Mezzanine 3:2-b	Ethernet Uplink Set
SDFlex Management 108	Ethernet	108	Mezzanine 3:1-c	Ethernet Uplink Set

Figure 3 shows the Connections section of the server profile for an SAP S/4HANA server.

Note

The Image Streamer deployment network is automatically added to the server profile when an OS deployment plan is selected. The iSCSI boot configuration is also automatically added to the profile.

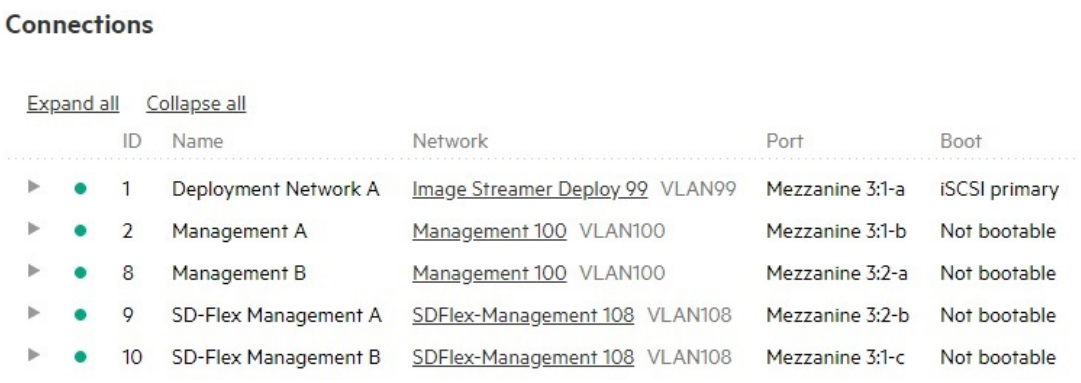

Figure 3. Network connections

Download and import the artifact bundle

From the HPE GitHub site for Image Streamer reference architectures, in the folder RA-SAP, download the zip file for your OS. For SLES this will be HPE-SLES12-SAP-RA-2019-04-12-v4.1.zip, for Red Hat this will be HPE-RHEL7.x-SAP-RA-2019-04-12-v4.1.zip and add it to your Image Streamer in the artifact bundles. Make sure to use the correct GitHub branch for the firmware version in the Image Streamer.
Add the right zip archive to the Image Streamer and extract it.

Create a golden image

The following steps are required to create an OS image for deploying SAP S/4HANA. See also the description of the HPE Synergy Image Streamer Foundation Artifacts Documentation.

Note

An OS deployment plan must be in place to create an empty OS volume for Step 1 below.

---

1. Create an HPE OneView server profile with the latest HPE Foundation OS deployment plan from the Foundation artifact bundle. Set the volume size to at least 10 GB and assign the profile to a compute node. An empty OS volume will be created.
2. Install the desired operating system, SUSE Linux Enterprise Server for SAP Applications 12 SP4 or Red Hat Enterprise Linux for SAP Applications 7.6, on the empty volume.
3. The root filesystem should be ext3 or ext4 and it is assumed that the root partition / is located on /dev/sda3. If the root partition is not on that device, then the plan scripts “HPE - SLES12 - SAP - mount generalize” and “HPE - SLES12 - SAP - mount and validate” or “HPE - RHEL7.x - SAP - mount generalize” and “HPE - RHEL7.x - SAP - mount and validate” need to be adjusted.
4. Configure the OS according to SAP OS recommendations.

Note

The install script that is part of the plan script “HPE - Linux - SAP - create install script” will disable the firewall. If the firewall needs to be enabled, edit the plan script and delete the corresponding lines.

Relevant SAP documentation

Check the latest SAP S/4HANA 1809 installation guide for important SAP Notes and OS prerequisites.

Note

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

Relevant SAP notes

- 2369910 – SAP software on Linux: General information
- 2625407 – SAP S/4HANA 1809: Release Information Note
- 2568783 – Release Note for Software Provisioning Manager 2.0
- 1793345- Sizing for SAP Suite on HANA

Relevant SLES documentation

- 1984787 – SUSE Linux Enterprise 12: Installation notes
- SUSE Linux Enterprise Server for SAP Applications 12 SP4
- 1275776 – Linux - Preparing SLES for SAP environments
- Saptune documentation - Saptune[2] is part of SLES for SAP applications 12 SP4. Make sure to use at least saptune version 1.1.6

Relevant RHEL documentation

- 2002167 – Red Hat Enterprise Linux 7.x - Installation and Upgrade
- 2526952 – Red Hat Enterprise Linux for SAP Solutions
- Overview of Red Hat Enterprise Linux for SAP Solutions[3]

After the OS has been customized according to the steps listed above, the Image Streamer "Create golden image" interface is used to create an image which is stored on the Image Streamer appliance. Use the following steps to create the golden image:

1. Shut down the OS.
2. Find the OS volume number in the HPE OneView server profile created in Step 1 above. It is listed under the OS Deployment section of the profile.
3. On the Image Streamer Golden Images screen, select "Create golden image" and specify a name (e.g. "SLES-12SP4-SAP"), description, OS volume, and Capture OS build plan as shown in Figure 4. The Capture OS build plans "HPE - SLES12 - SAP - generalize" and "HPE - RHEL7.x - SAP - generalize" create the golden image. Make sure to use one of these build plans when capturing the OS; using "as is" will not remove the server specific settings and will interfere with later deployment personalization.

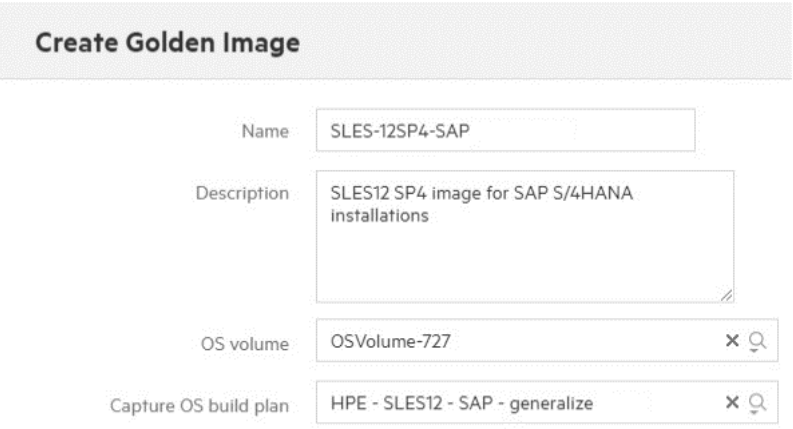

Figure 4. Golden Image creation

Note

For golden image creation, the capture OS build plans "HPE - SLES12 - SAP - generalize" and "HPE - RHEL7.x - SAP - generalize" may only be used for empty operating systems.

[2] The install script that will start the SAP HANA or SAP application installation will also call saptune with the right SAP profiles.
[3] The install script that will start the SAP HANA or SAP application installation will also call tuned with the right SAP profiles.

Customize the deployment plan

The imported deployment plan provided by HPE is read only. To be able to customize the deployment plan for your environment it has to be copied. Once copied, the values for the plan attributes can be changed to reflect your environment as shown in Figure 5. Make sure to check that all attributes have the correct values. Please note that for readability reasons not all of the custom attributes are shown here. Details can be found in Table B-3 in Appendix B: Plan scripts and custom attributes for OS build plan.

Some of the attributes, like the Software Depot Host, are always the same in the environment and therefore can be set once and then be hidden for the server deployment. Use the newly created golden image as the default golden image in the deployment plan as shown in figure 5.

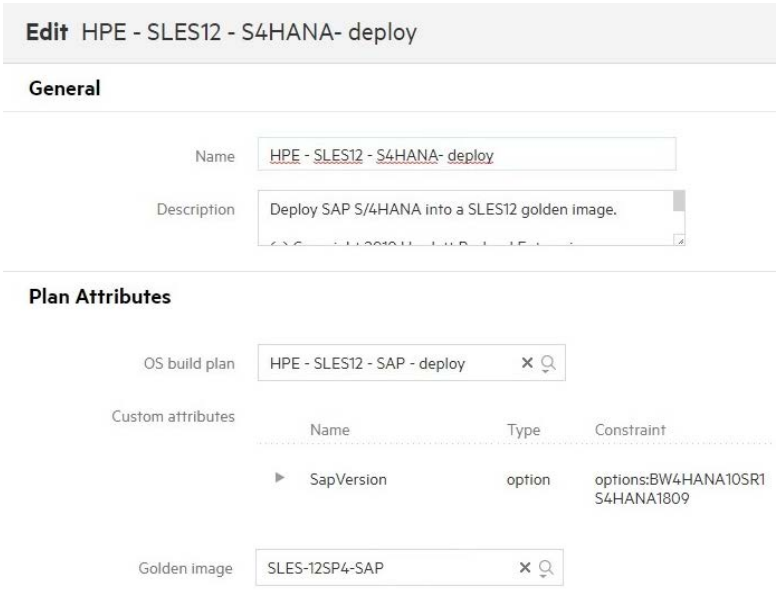

Figure 5. Extract of deployment plan configuration

Parameters for the SAP S/4HANA installation can be changed by using a configuration file that is located in the software depot. Details about the usage of the configuration file can be found in Appendix D: Customized installation options for SAP S/4HANA.

Create a server profile

For creating a server profile, the following information is necessary:

- Server hardware type
- Enclosure group
- OS Deployment Plan with custom attributes as listed in Table B-3
- Connections

For this RA, the HPE Synergy D3940 Storage Module was used to host the SAP S/4HANA application data. Using a persistent storage[4] helps to reduce costs and will reduce disk consumption on the Image Streamer.

The server profile has the entire state of the server, including the access to shared storage which enables switching of workloads. Local storage on the server may be used for temporary space but not for data that needs to be retained.

[4] Using HPE 3PAR StorServ is also possible with the artifact bundles described in this RA.

For a server profile creation, a new data volume has to be created as shown in figure 6.

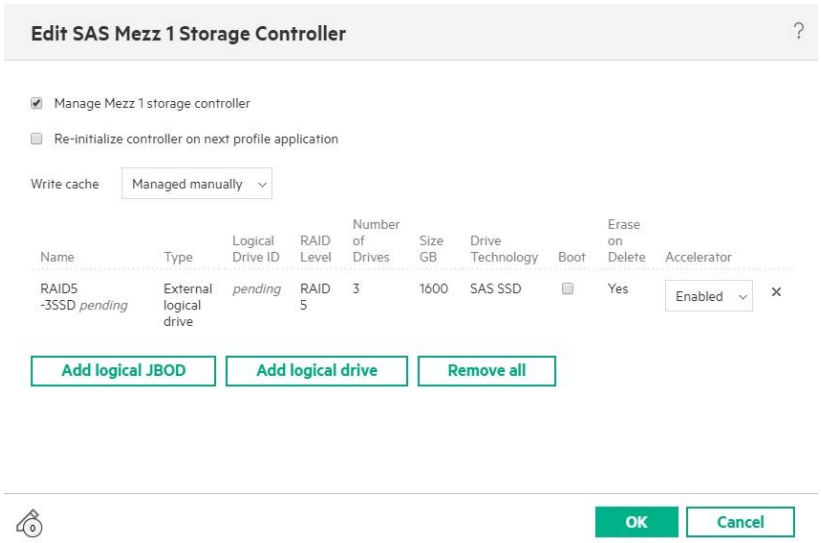

Figure 6. Storage creation in HPE OneView Server Profile

Figure 7 shows an extract of the Create Server Profile Screen in HPE OneView. Several more customization options are available for server profile creation, but are not shown here for readability reasons. Set all visible custom attributes here. For a detailed list of attributes see Table B-3.

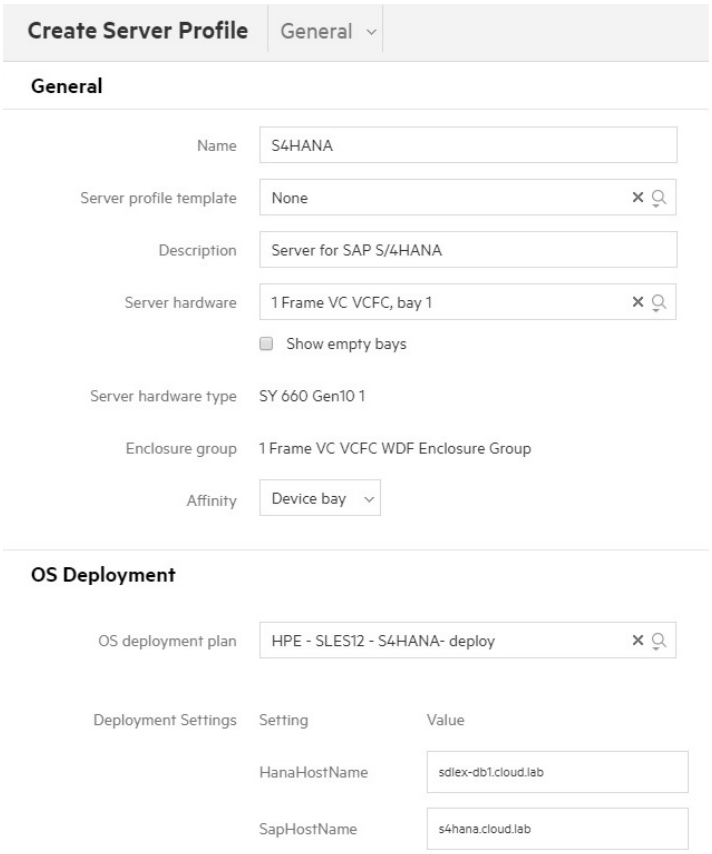

Figure 7. Create Server Profile

Once the server profile is assigned to an available server, the deployment process will begin. A smart clone of the golden image is created as a new volume and presented to the server. The server is powered up and automatically boots the newly created volume. The build plan and plan scripts that are part of the deployment plan will customize the server with the configured attributes and finally call the installation script for SAP S/4HANA. This will install the SAP application into the newly created server. After the installation is complete, relevant OS settings are stored to a directory on the persistent storage and a systemd service is created to save any SAP S/4HANA relevant OS changes at every OS shutdown. This will enable the lifecycle activities.

Perform Lifecycle activity

Once an SAP S/4HANA server is up and running, lifecycle management tasks will occur, such as adding an additional application server instance, updating the OS or switching workloads. They can be handled easily and automated using HPE Composable Infrastructure, reducing downtime and administration time. The same deployment plans that have been used to create the systems can be used in a modified way to perform lifecycle activity.

Note

It is required to store the SAP relevant data on persistent data storage, for this Reference Architecture an HPE Synergy D3940 Storage Module has been used. If the data is NOT stored on persistent storage, the data will be lost and the system can't be used any more.

For any maintenance activity, do NOT change the following custom attributes. Changing these attributes will lead to an inconsistent system - HanaHostName, HanaSID, SapSID, LvmVolumeGroupName and all LvmVolumeNames.

Additional application server instance

Additional SAP application server can also be installed on a newly created server, using the deployment plans "HPE - SLES12 - SAP S4HANA - deploy" or "HPE - RHEL7.x - SAP S4HANA - deploy". It is recommended to create a copy of the previously created deployment plan and set the custom attribute "HostFunction" to "aas" and the "SapGlobalHost" to the FQDN name of the SAP system for which the additional application server instance shall be created.

During the server profile creation, the custom attribute "SapHostName" needs a new hostname for the additional application server and an unused instance number has to be set for the custom attribute "SapInstanceNumber". Figure 8 shows an extract of the custom attributes for the creation of the server profile for an additional application server instance.

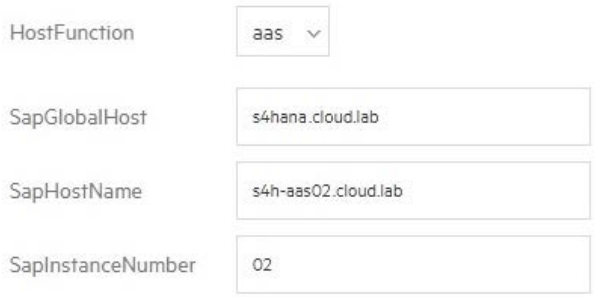

Figure 8. Create Server Profile for additional application server instance.

With this modified deployment plan, a new server is being deployed and an additional application server instance gets installed for the existing SAP system.

OS update

Updating the OS using HPE Synergy Image Streamer is done by creating a new deployment plan with a new golden image. Create the new golden image as described in chapter Create a golden image. Make sure the golden image complies with the SAP OS recommendations for the desired SAP S/4HANA version. Include the new golden image in the new deployment plan.

The existing server has to be powered off, then the server profile can be edited by choosing the new OS deployment plan. Make sure to keep the already existing data volume and keep the important custom attributes (see note above).

The server will be recreated with the new golden image. This reduces the impact of the disk usage on the Image Streamer.

The server update will be finished in less than 2 minutes. After less than 5 minutes the server will be up and running and the SAP S/4HANA application will be started on the new OS version.

Note
Manual adaptation of the deployment plans “HPE - SLES12 - SAP S4HANA - deploy” and “HPE - RHEL7.x - SAP S4HANA - deploy” are required in case of additional installed applications or modified OS settings.

The deployment plans “HPE - SLES12 - SAP S4HANA - deploy” and “HPE - RHEL7.x - SAP S4HANA- deploy” will only restore the standard SAP S/4HANA environment, additional data will get lost if not stored on persistent data.

In this Reference Architecture, only changing the minor OS version has been tested. If changing the major OS version, e.g. from SLES12 to SLES15 is required, this approach has to be thoroughly tested with a test system.

Switching workloads
During the lifetime of an SAP S/4HANA application, different hardware requirements might be necessary.

Switching workloads from one server to another can be done without creating a special deployment plan. Combining switching the servers with an OS update can be executed by creating a new deployment plan.

To move the workload from one server to another the current server has to be powered off. Keep in mind that the SAP S/4HANA application data is stored on a persistent data storage and does not get deleted.

Note
Manual adaptation of the deployment plans “HPE - SLES12 - SAP S4HANA - deploy” and “HPE - RHEL7.x - SAP S4HANA - deploy” are required in case of additional installed applications or modified OS settings.

These deployment plans will only restore the standard SAP S/4HANA environment, additional data will get lost if not stored on persistent data.

Now the server profile can be edited. Change the server hardware type to the desired one. Thoroughly read the notification and confirm it, then select the new server hardware.

If a new operating system shall be provisioned in addition, a new deployment plan can be chosen in addition.

Recheck the server profile settings e.g. for the network connections and update the server profile.

The server profile will be reassigned to the new server hardware. After the server reassignment and first boot the OS specific parameters for SAP S/4HANA will be restored and the application will be started.

After powering off the server, the whole process, for changing the hardware type from an HPE Synergy 480 Gen10 server to a Synergy 660 Gen10 server will take 8 minutes, followed by 5 minutes boot time. The SAP application will be down for only 13 minutes plus manual configuration time of the server profile and then starts automatically on the new server hardware. Startup times of the SAP S/4HANA application depend on the database size.

Note
The hardware key required for the SAP HANA and SAP license remains the same, as long as the MAC address of the Management network remains the same. This is guaranteed if the workload switch is performed by editing the server profile.
If the server profile is being deleted and the system is being recreated, the hardware key changes and the SAP license will be invalid.

Capacity and sizing

Traditional OS provisioning for SAP S/4HANA includes OS installation, network and kernel configuration, and several server reboots. Depending on the requirements this can take 4-6 hours. These steps have to be done for each new SAP S/4HANA installation in the traditional environment.

Deploying a server for an SAP S/4HANA installation using HPE OneView server profiles with HPE Synergy Image Streamer deployment plans is very fast and easy. Setting up a golden image with the right settings needs to be done only once. Later on, the server profile can be created in minutes. The deployment of a new SAP S/4HANA application using Software Defined Infrastructure is fast, consistent, and repeatable.

Figure 9 shows the creation of the S4HANA - S4H server profile. The server profile creation task was completed in 4 minutes and 57 seconds. This includes the validation and creation of the local storage (48 seconds), update of the network (28 seconds), creation of the OS volume (15 seconds), applying the server profile (3 minutes and 16 seconds) and power cycling the server (10 seconds).

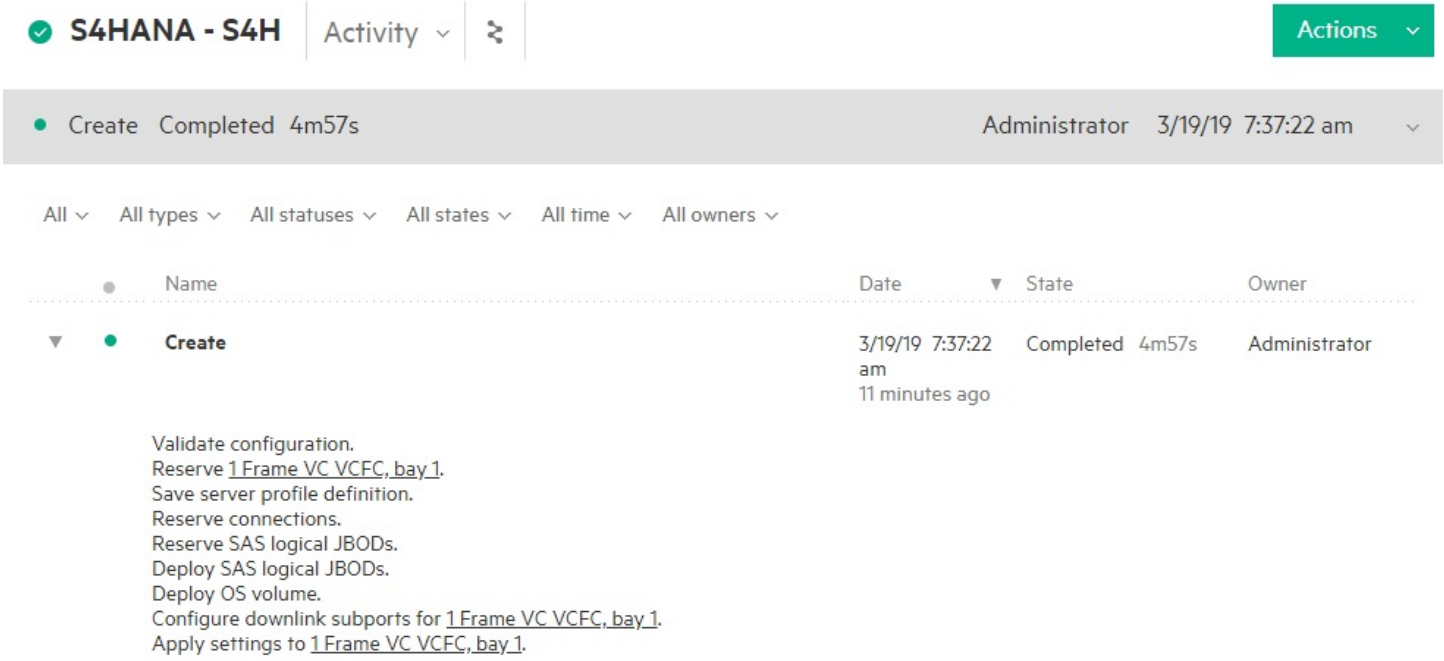

Figure 9. Server creation step

Subsequently the server is powered on and will boot. The boot time will vary depending on the server used. The HPE Synergy 660 Gen10 compute module used in this Reference Architecture took approximately 5 minutes to boot.

Following the boot time, the SAP S/4HANA installation will start. The installation time depends on the network speed to the SAP HANA database and the performance of the database server. In our test scenario the installation finished after 30 minutes.
Summing up all the steps to create a new server with a running SAP S/4HANA application takes approximately 50 minutes.

Additional application server can be deployed in the same way, a new server profile with one running additional application server instance is available after 15 minutes.

The work of an IT service provider or administrator does not generally end after the provisioning of a system. Maintenance activities like OS updates occur over time. In a traditional environment this has to be done on each single system.

Using HPE Synergy Image Streamer capabilities, only one golden image with the required Operating System version has to be created and all server profiles can be updated with this new golden image.

Over the time, resource requirements may change, the load of the SAP S/4HANA system may grow, requiring more CPU power or physical memory.
Using the capabilities of HPE's Composable Infrastructure and the deployment plans described in this Reference Architecture, switching workloads to another server with the right hardware resources can be done very fast and smooth.

A combination of the described maintenance tasks will result in a combination of the previously described deployment times.

The deployment and update times shown in Table 4 do not contain SAP S/4HANA installation times as they depend on the SAP S/4HANA infrastructure.

Table 4. Deployment and update times until SAP HANA start

Task	Profile creation	Server boot	Comment
Initial SAP S/4HANA provisioning	4 min 57	3 min on SY480 5 min on SY660	SAP S/4HANA standard installation takes ~30 minutes in addition
Additional SAP S/4HANA application server instance provisioning	4 min 41	3 min on SY480 5 min on SY660	SAP S/4HANA additional application server instance installation takes ~5 minutes in addition
OS update	1 min 00	3 min on SY480 5 min on SY660	SAP S/4HANA startup and update time depends on database size
Switching workload	5min 23s	5 min on SY660	SAP S/4HANA startup and update time depends on database size
OS update + switching workload	3 min 32	5 min on SY660	SAP S/4HANA startup and update time depends on database size

In traditional data centers, setting up one server, installing the OS, configuring storage and network and installing SAP S/4HANA would take 4-6 hours. The benefit of using Software Defined Infrastructure can be seen when several SAP S/4HANA systems or additional application server need to be provisioned. Provisioning one server with a running SAP S/4HANA system is done in less than one hour. The provisioning is standardized and can be repeated as often as it is required.
If several additional application server instances are required, the provisioning can be done in a fast, easy and repeatable way.

Analysis and recommendations

This Reference Architecture for SAP S/4HANA on HPE Synergy and Superdome Flex was created using HPE Superdome Flex Solutions for SAP HANA and HPE Synergy 660 Gen10 and HPE Synergy 480 Gen10 compute modules for the hardware provisioning for SAP S/4HANA application server. Other Synergy compute modules with a newer processor generation like Intel Cascade lake that are certified for SAP may also be used.

HPE Synergy D3940 Storage Module was used for storing the SAP S/4HANA application data. This saves costs, because no additional external storage is required. The server profile has the entire state of the server, including the access to shared storage which enables switching of workloads. Data that needs to be retained must be located on a persistent storage. Using persistent storage helps to make it possible to switch workloads and update the operating system of existing SAP S/4HANA systems.

Using HPE Superdome Flex Solutions for SAP HANA for the SAP HANA database offers industry-leading performance and modular scalability, mission-critical reliability, and optimum cost-efficiency. Designed with memory-driven computing principles to uniquely handle the scale, performance and reliability demands of SAP S/4HANA®, HPE Superdome Flex Solutions for SAP HANA enable enterprises of any size to analyze and process massive amounts of data at the digital core in real time.

Using this Reference Architecture will help to provision and maintain bare-metal servers for SAP S/4HANA in significantly less time compared to traditional provisioning. More specifically, it shows the following benefits of utilizing HPE Synergy for SAP S/4HANA solutions:

- Manage the entire environment seamlessly, including configuration of network resources required for SAP S/4HANA, creation and management of the required storage, and deploying the OS and database software on the compute nodes, by using HPE Synergy Composer with embedded HPE OneView.

- Automate deployment of SAP S/4HANA by using HPE Synergy Image Streamer technology. Testing shows that HPE Synergy Composer plus HPE Synergy Image Streamer allows administrators to deploy a new system for SAP S/4HANA in less than four minutes, which is a significant reduction as compared to traditional deployment times of hours or days.
- Automate switching of workloads for SAP S/4HANA servers by using HPE Synergy Image Streamer technology. Testing shows that switching workloads from an HPE Synergy 480 Gen10 compute module to an HPE Synergy 660 Gen10 compute module finished in ~ 8 minutes. Reducing administrator activities and system downtime.
- Automate operating system version changes using HPE Synergy Image Streamer technology. Updating the OS in a landscape with several servers, in a traditional environment, can take several hours to days, whereas it will only take minutes using HPE Synergy Image Streamer. Testing shows that changing the OS version to a newer one, by using a deployment plan with a golden image takes less than four minutes.

In addition to the described installation scenario in this Reference Architecture, the Image Streamer artifact bundles also can be used for the following scenarios:

- Besides HPE Synergy D3940 Storage Module, also HPE 3PAR StoreServ can be used as persistent data storage. In the deployment plan, the custom attribute “Storage” has to be set to “HPE 3PAR StoreServ”.
- Provisioning a standalone SAP HANA database on a HPE Synergy compute module. In this case the custom attribute “SapHostFunction” has to be set to “db”. All other SAP application related custom attributes can be filled with dummy values.
- Provisioning a standard SAP S/4HANA installation, including the SAP HANA database on one host. In this case, the SAP HANA hostname and the SAP S/4HANA hostname must be the same. The SAP HANA database does not have to be preinstalled.
- Installing SAP BW/4HANA, instead of SAP S/4HANA. In this case, the custom attribute “SapVersion” has to be set to “BW4HANA10SR1” and the right installation media must be available in the Software Depot directory.

Summary

This Reference Architecture described how an SAP S/4HANA application can be deployed, leveraging the benefits of SAP HANA running on HPE Superdome Flex Solutions for SAP HANA. The deployment is done in a highly composable environment, using the artifact bundles “HPE - SLES12 - SAP” and “HPE - RHEL7.x - SAP” for the HPE Synergy Image Streamer.

This document showed the setup of HPE Superdome Flex Solutions for SAP HANA and the HPE’s Composable Infrastructure. Necessary prerequisites for the network setup, golden image creation and customization of attributes for the plan scripts were listed. Adaptations of the deployment plan to perform lifecycle activity tasks were described.

The fluid resource pools and software-defined intelligence of HPE Synergy allow administrators to rapidly compose any configuration required, reducing deployment time repeatedly from hours or days to minutes.

The artifact bundles shown in this Reference Architecture configured the network and storage resources required for an SAP S/4HANA server. After the first boot, the SAP S/4HANA application was installed.

In this document, recommendations were given on how to create a golden image being used by the server profile together with the OS deployment plans “HPE - SLES12 - SAP S4HANA - deploy” and “HPE - RHEL7.x - SAP S4HANA - deploy”.

Strategies are described how the lifecycle management tasks for existing SAP S/4HANA application servers can be simplified using HPE Synergy Composable Infrastructure. Updating the operating system revision, as well as switching workloads to another server can be done separately or combined using the deployment plans “HPE - SLES12 - SAP S4HANA - deploy” and “HPE - RHEL7.x - SAP S4HANA - deploy”.

Tests showed that the server provisioning, including a new installation of SAP S/4HANA using the artifact bundle “HPE - SLES12 - SAP”, took approximately 50 minutes. Traditional provisioning of a server in a TDI scenario and following SAP S/4HANA application installation will take hours for one server.

Tests of maintenance activities showed similar timelines: less than four minutes for switching workloads and for updating the OS.

Provisioning using the HPE Synergy Composer and HPE Synergy Image Streamer capability reduce this time significantly.

Maintaining a large landscape of SAP S/4HANA application servers can get very complex. Each server and system has to be maintained manually, consuming up to days in traditional environments. Adapting the hardware to new resource needs can get very time consuming.

Using the capabilities of HPE Composable Infrastructure these activities can be done in a smooth, standardized, repeatable and fast way.

Implementing a proof-of-concept

As a matter of best practice for all deployments, Hewlett Packard Enterprise recommends implementing a proof-of-concept using a test environment that matches as closely as possible the planned production environment. In this way, appropriate performance and scalability characterizations can be obtained. For help with a proof-of-concept, contact an HPE Services representative (hpe.com/us/en/services/consulting.html) or your HPE partner.

Appendix A: Bill of materials

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

Table A-1. Bill of materials

Qty	Part number	Description
		HPE Synergy Frame components
1	797740-B21	HPE Synergy 12000 Configure-to-order Frame with 1x Frame Link Module 10x Fans
1	804942-B21	HPE Synergy Frame Link Module
6	798095-B21	HPE Synergy 12000F 2650W AC Ti PS
1	804353-B21	HPE Synergy Composer
1	804937-B21	HPE Synergy Image Streamer
1	JG838A	HPE 5900CP 48XG 4QSFP+ Switch
2	794502-B23	HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy
2	779227-B21	HPE Virtual Connect SE 16Gb FC Module for HPE Synergy
	Q9Q89A	**HPE Synergy 660 Compute Module components**
2	871931-B21	HPE SY 660 Gen10 4S Configure-to-Order Compute Module
8	872138-B21	HPE Synergy 480/660 Gen10 Intel® Xeon-Gold 6142 Processor Kit
2	872138-L21	HPE Synergy 480/660 Gen10 Intel® Xeon-Gold 6142 FIO Processor Kit
4	785067-B21	HPE 300GB 12G SAS 10K 2.5in SC ENT HDD
32	815101-B21	HPE 64GB 4Rx4 PC4-2666V-L Smart Kit
2	777452-B21	HPE Synergy 3830C 16G FC HBA
2	777430-B21	HPE Synergy 3820C 10/20Gb Converged Network Adapter
2	804424-B21	HPE Smart Array P204i-c SR Gen10 Ctrlr
	Q9Q88A	**HPE Synergy 480 Compute Module components**
1	871940-B21	HPE SY 480 Gen10 Configure-to-Order Compute Module
2	873381-B21	HPE Synergy 480/660 Gen10 Intel® Xeon-Gold 6130 Processor Kit
1	873381-L21	HPE Synergy 480/660 Gen10 Intel® Xeon-Gold 6130 FIO Processor Kit
2	872475-B21	HPE 300GB SAS 10K SFF SC DS HDD

Qty	Part number	Description
8	815100-B21	HPE 32GB 2Rx4 PC4-2666V-R Smart Kit
1	777452-B21	HPE Synergy 3830C 16G FC HBA
1	777430-B21	HPE Synergy 3820C 10/20Gb Converged Network Adapter
1	804424-B21	HPE Smart Array P204i-c SR Gen10 Ctrlr
		Storage
1	835386-B21	HPE Synergy D3940 CTO Storage Module
1	757323-B21	HPE Synergy D3940 Redundant I/O Adapter
2	755985-B21	HPE Synergy 12Gb SAS Connection Module with 12 Internal Ports
24	872479-B21	HPE 1.2TB SAS 10K SFF SC DS HDD
12	872382-B21	HPE 1.6TB SAS 12G MU SFF SC DS SSD
		HPE Superdome Flex Solutions for SAP HANA
		Rack
1	H7C27A	HPE 42U 610mm x 1156mm D Rack
1	Q2T93A	HPE 42U 610mm x 1156mm Ext D Rack
2	Q2N07A	HPE SAP HANA Rack Management Controller (RMC)
4	H7C28A	HPE D-Rack 21xOutlets 3ph 240V NA/JP PDU
		4S Chassis per Compute Rack
8	Q2N05B	HPE Superdome Flex 4s Base Chassis
4	R0W96A	Intel Xeon-Platinum 8276 (2.3GHz/28-core/165W) Processor Kit
24	R0X06A	HPE SD Flex AH 64GB LRDIMS DIMM Kit
1	Q2N41A	HPE SD Flex DVD-RW Drive
1	Q2N09A	HPE Superdome Flex PCIe Low Profile 16-slot 4 Riser Config Kit
2	P9D94A	HPE SN1100Q 16Gb 2P FC HBA
2	817753-B21	HPE Ethernet 10/25Gb 2P 640SFP28 Adapter
2	647594-B21	HPE Ethernet 1Gb 4-port 331T Adapter
2	C7535A	HPE Ethernet 4ft CAT5e RJ45 M/M Cable
2	N0U73A	SLES SAP 2Skt/1-2 VM 3yr 24x7 Flx LTU
1	Q7N12A	HPE Foundation SW 2 SLES Lic RTU
2	Q2N16A	HPE Superdome Flex 16-socket Interconnect and Scale Activation Kit
		HPE Solutions for SAP HANA FlexFabric 5950 48SFP28 8QSFP28 Switch
2	JH402A	HPE 5950 48SFP28 8QSFP28 Switch
10	JH389A	HPE X712 Back(pwr side) to Front(port side) HV2 Fan Tray
4	JC680A	HPE 58x0AF 650W AC Power Supply
2	JL271A	HPE X240 100G QSFP28 to QSFP28 1m Direct Attach Copper Cable
4	JD092B	HPE X130 10G SFP+ LC SR Transceiver
4	QK733A	HPE Premier Flex LC/LC OM4 2f 2m Cbl
2	C7536A	HPE Ethernet 14ft CAT5e RJ45 M/M Cable
		HPE Solutions for SAP HANA FlexFabric 5950 48SFP28 8QSFP28 Switch

Qty	Part number	Description
2	JG510A	HPE 5900AF 48G 4XG 2QSFP+ Switch
4	JC680A	HPE 58x0AF 650W AC Power Supply
4	JC683A	HPE 58x0AF Frt(prt) Bck(pwr) Fan Tray
2	JG326A	HPE FlexNetwork X240 40 Gbps QSFP+ DAC Cable
4	JD095C	HPE FlexNetwork X240 10G SFP+ to SFP+ 0.65m DAC cable
4	C7535A	HPE Ethernet 4ft CAT5e RJ45 M/M Cable
4	C7536A	HPE Ethernet 14ft CAT5e RJ45 M/M Cable
		HPE Solutions for SAP HANA with StoreFabric SN6600B 32Gb 48/48 FC Switch
2	Q0U56B	HPE SN6600B 32Gb 48/48 FC Switch
96	QK724A	HPE B-series 16Gb SFP+SW XCVR
		HPE DL360 Gen10 SAP HANA BC/TDI Svr
1	867959-B21	HPE DL360 Gen10 8SFF CTO Server
1	P02574-L21	HPE DL360 Gen10 4210 FIO Kit
1	P02574-B21	HPE DL360 Gen10 4210 Kit
8	P00920-B21	HPE 16GB 1Rx4 PC4-2933Y-R Smart Kit
4	872479-B21	HPE 1.2TB SAS 10K SFF SC DS HDD
1	804331-B21	HPE Smart Array P408i-a SR Gen10 Ctrlr
1	P01366-B21	HPE 96W Smart Storage Battery 145mm Cbl
1	P9D94A	HPE SN1100Q 16Gb 2p FC HBA
1	652503-B21	HPE Ethernet 10Gb 2P 530SFP+ Adptr
2	455883-B21	HPE BladeSystem c-Class 10Gb SFP+ SR Transceiver
1	867998-B21	HPE Gen10 1U Security Bezel Kit
1	874543-B21	HPE 1U Gen10 SFF Easy Install Rail Kit
1	873770-B21	HPE DL3xx Gen10 Rear Serial Cable Kit
1	734811-B21	HPE 1U CMA for Easy Install Rail Kit
2	865414-B21	HPE 800W FS Plat Ht Plg LH Pwr Sply Kit
1	BD505A	HPE iLO Adv incl 3yr TS U 1-Svr Lic
1	871147-B21	MS WS16 Std FIO Npi en SW
		HPE Solutions for SAP HANA with 3PAR StoreServ 8200 2-node Storage
1	K2Q35B	HPE 3PAR StoreServ 8200 2N Storage Base
1	H6Z26A	HPE 3PAR StoreServ 8000 SFF(2.5in) SAS Drive Enclosure
2	E7Y70A	HPE 3PAR StoreServ 8000 2-port 10Gb Ethernet Adapter
1	L7F20A	HPE 3PAR All-in Sgl-sys SW Current Media
		HPE Solutions for SAP HANA with 3PAR StoreServ 8400 4-node Storage
1	H6Z01B	HPE 3PAR StoreServ 8400 4-node Storage Base
2	H6Z26A	HPE 3PAR StoreServ 8000 SFF(2.5in) SAS Drive Enclosure
16	K2P91B	HPE 3PAR 8000 3.84TB SFF SSD
1	L7F20A	HPE 3PAR All-in Sgl-sys SW Current Media

Qty	Part number	Description
		First Infrastructure Rack Cables
8	QK734A	HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 5m Cable
6	QK733A	HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 2m Cable
2	JD096C	HPE X240 10G SFP+ SFP+ 1.2m DAC Cable
2	JD096C	HPE X240 10G SFP+ SFP+ 1.2m DAC Cable
4	C7535A	HPE Ethernet 7ft CAT5e RJ45 M/M Cable
12	C7535A	HPE Ethernet 7ft CAT5e RJ45 M/M Cable
4	C7536A	HPE Ethernet 14ft CAT5e RJ45 M/M Cable
4	C7537A	HPE Ethernet 25ft CAT5e RJ45 M/M Cable
		Customer Network Uplinks
8	JL293A	HPE X190 25G SFP28 LC SR 100m MM XCVR
8	QK735A	HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 15m Cable

Appendix B: Plan scripts and custom attributes for OS build plan

Table B-1 lists the plan scripts included in the OS Build Plan "HPE - SLES12 - SAP S4HANA - deploy".

Table B-1. Plan script names included in the artifact bundle SLES12

Plan script name	Type	Comment
HPE - SLES12 - SAP - mount and validate	General	Mounts the root partition and validates the golden image for SUSE.
HPE - Linux - SAP - configure multiple NICs	Deploy	Configures the network and sets gateway.
HPE - Linux - SAP - change root password	Deploy	Sets the root user password.
HPE - Linux - SAP - configure hostname	Deploy	Updates the hostname.
HPE - Linux - SAP - manage security services	Deploy	Enables or disables security services.
HPE - Linux - SAP - partition disk using LVM	Deploy	Partitions the storage using the LVM parameters described in Table B-3.
HPE - Linux - SAP - create local input file	Deploy	Creates the input file required for the SAP HANA and SAP application installation
HPE - Linux - SAP - create install script	Deploy	Creates the installation script install_SAP.sh. The script will mount the software depot, create the SAP HANA and SAP application config file, start the SAP HANA and/or SAP application installation or database update and create backup services for SAP specific OS settings. The script will be executed after the first boot of the OS.
HPE - SLES12 - SAP - unmount	General	Cleans up the temporary directory created during mount and unmounts the root partition.
HPE - SLES12 - SAP - mount generalize	Capture	Mount root partition for generalization.
HPE - Linux - SAP - generalize host	Capture	Remove host specific configuration.
HPE - SLES12 - SAP - generalize network	Capture	Remove network settings.
HPE - Linux - SAP - unmount generalize	Capture	Unmount root partition after generalization.

Table B-2 lists the plan scripts included in the OS Build Plan "HPE - RHEL7.x - SAP S4HANA - deploy".

Table B-2. Plan script names included in the artifact bundle RHEL 7.x

Plan script name	Type	Comment
HPE - RHEL7.x - SAP - mount and validate	General	Mounts the root partition and validates the golden image for Red Hat.
HPE - Linux - SAP - configure multiple NICs	Deploy	Configures the network and sets gateway.
HPE - Linux - SAP - change root password	Deploy	Sets the root user password.
HPE - Linux - SAP - configure hostname	Deploy	Updates the hostname.
HPE - Linux - SAP - manage security services	Deploy	Enables or disables security services.
HPE - Linux - SAP - partition disk using LVM	Deploy	Partitions the storage using the LVM parameters described in Table B-3.
HPE - Linux - SAP - create local input file	Deploy	Creates the input file required for the SAP HANA and SAP application installation
HPE - Linux - SAP - create install script	Deploy	Creates the installation script install_SAP.sh. The script will mount the software depot, create the SAP HANA and SAP application config file, start the SAP HANA and/or SAP application installation or database update and create backup services for SAP specific OS settings. The script will be executed after the first boot of the OS.
HPE - RHEL7.x - SAP - unmount	General	Cleans up the temporary directory created during mount and unmounts the root partition.
HPE - RHEL7.x - SAP - mount generalize	Capture	Mount root partition for generalization.
HPE - Linux - SAP - generalize host	Capture	Remove host specific configuration.
HPE - RHEL7.x - SAP - generalize network	Capture	Remove network settings.
HPE - Linux - SAP - unmount generalize	Capture	Unmount root partition after generalization.

Table B-3 lists the custom attributes and default values of the OS Build Plan "HPE - SLES12 - SAP - deploy" and "HPE - RHEL7.x - SAP - deploy".

Table B-3. Custom attributes of OS Build Plan "HPE - SLES12 - SAP - deploy" and "HPE - RHEL7.x - SAP - deploy"

Custom attribute name	Type	Description	Default/ example value	Visible on deployment
DepotCifsPassword	Password	Password for the CIFS software share. For NFS, either delete this attribute in plan script "HPE - RHEL7.x - SAP - create local input file" or "HPE - SLES12 - SAP - create local input file" or enter a dummy value.	password	No
DepotCifsUsername	String	Username for the CIFS software share. For NFS, either delete this attribute in plan script "HPE - RHEL7.x - SAP - create local input file" or "HPE - SLES12 - SAP - create local input file" or enter a dummy value.	Administrator	No
DepotHost	IPv4 Address	IP-Address of the software share	172.16.12.22	No
DepotLocalMountpoint	String	Local mount point on the deployed host for the software share. The directory will be created during deployment.	/swdepot	No
DepotMountType	Option	Network protocol for the software share. Either "CIFS" or "NFS" is supported	cifs	No
DepotSapDirectory	String	Directory on the software share that contains the SAP installation media.	S4HANA1809	No
DepotShareName	String	Name of the software share	SWDEPOT	No
HanaHostName	String	FQDN hostname of the SAP HANA server	hanahost.cloud.lab	Yes

Custom attribute name	Type	Description	Default/ example value	Visible on deployment
HanaInstanceNumber	String	The two-digit SAP HANA Database Instance Number. Rules for SAP Instance Number apply.	00	Yes
HanaMasterPassword	Password	The master password of the SAP HANA database that will be used for all SAP HANA users.	password	Yes
HanaSID	String	The SAP System Identification of the SAP HANA database host. Rules for SAP System ID definition apply.	HDB	Yes
HanaUpdate	Option	Defines if the SAP HANA database shall be updated. Possible values are “True” and “False”.	False	No
HostFunction	Option	Defines which SAP function shall be installed. Possible values: “standard” for SAP Primary Application Server “db” for SAP HANA only installation “aas” for additional SAP Application Server	standard	Yes
InstallDirectory	String	Local directory for the SAP installation. The installation script, local input file, and all installation log files will be stored here.	/root/hpe_ai	No
LvmVolumeGroupName	String	Name of the LVM volume group for the SAP installation.	sapdata	No
LvmVolumeNameHana	String	Name of the LVM partition for /hana directory.	hana	No
LvmVolumeNameSap	String	Name of the LVM partition used for /usr/sap directory.	sap	No
LvmVolumeNameSapmnt	String	Name of the LVM partition used for /sapmnt directory	sapmnt	No
LvmVolumeNameSwap	String	Name of the LVM partition used for swap space.	swap	No
LvmVolumeSizeHana	Number	Size of the LVM partition required for /hana in GiB.	200	No
LvmVolumeSizeSap	Number	Size of the LVM partition required for /usr/sap in GiB.	20	No
LvmVolumeSizeSapmnt	Number	Size of the LVM partition required for /sapmnt in GiB.	100	No
LvmVolumeSizeSwap	Number	Size of the LVM partition required for swap space in GiB.	20	No
NewRootPassword	Password	New Password for the root user.	password	Yes
NIC1	NIC	NIC1 on the management network.	none	Yes
NIC2	NIC	NIC2 on the management network.	none	Yes
NIC3	NIC	NIC3 on the management network for the SD Flex server.	none	Yes
NIC4	NIC	NIC4 on the management network for the SD Flex server.	none	Yes
SapGlobalHost	String	FQDN hostname of the SAP global host.	globalhost.cloud.lab	Yes
SapHostName	String	FQDN hostname for the SAP Application Server.	saphost.cloud.lab	Yes
SapInstanceNumber	Number	The two-digit SAP Instance Number. Rules for SAP Instance Number apply.	01	Yes
SapMasterPassword	Password	Master Password for the SAP Application.	password	Yes
SapSID	String	The SAP System Identification of the SAP Application. Rules for SAP System ID definition apply.	S4H	Yes
SapStack	Option	Defines if the ABAP or JAVA Stack of a release shall be installed. Possible values are “ABAP” or “JAVA”	ABAP	No
SapTestRun	Option	Defines if the SAP installation shall be started in a test run. Possible Values: “false”: Complete installation is executed.	false	No

Custom attribute name	Type	Description	Default/ example value	Visible on deployment
		"host_preparation": host is prepared, but SAP installer not started. "sap_summary": SAP installer is stopped after the summary phase.		
SapVersion	String	Defines which SAP Version shall be installed. Possible Values are "S4HANA1809" or "BW4HANA10SR1".	S4HANA1809	No
SSH	Option	Defines if SSH will be enabled on the deployed OS. Possible values are "Enabled" or "Disabled"	Enabled	No
StartInstanceAfterReboot	Option	Sets the autostart option for SAP Instances after a system reboot. Possible values are "Yes" and "No".	Yes	Yes
Storage	Option	Defines which persistent storage shall be used. Possible values are "HPE 3PAR StoreServ" and "HPE Synergy D3940"	HPE 3PAR StoreServ	Yes

Appendix C: Customized SAP HANA installation options

In an installation or update scenario where the default values for an SAP HANA installation or update do not fit the requirements, a configuration file can be provided to be used. Parameters, e.g., database mode (single_container versus multi_container), database isolation, system usage, maximum memory allocation, and many more, can be edited in the configuration file.

This configuration file for SAP HANA can be created once, modified, and then reused for any following SAP HANA deployments by storing it in the media directory (DepotSapDirectory).

Note
The name of the hdb configfile may not be changed and must be hdblcm.conf for installation and hdblcm_update.conf for update. It must be located in the DepotSapDirectory where the SAP installation media is stored.

How to create the SAP HANA database installation config file

```
# <DepotSapDirectory>/SAP_HANA_PLATFORM_20_SPS03/DATA_UNITS/HDB_LCM_LINUX_X86_64/hdblcm --
action=install --dump_configfile_template=<DepotSapDirectory>/hdblcm.conf
```

This will create a config file where individual parameters for an SAP HANA installation can be set. Save the file in the media directory (DepotSapDirectory) of your SAP HANA database.

Edit the file and modify the required parameters. A small extract is shown below:

```
# Directory containing a storage configuration
storage_cfg=

# Database Isolation [ Default: low; Valid values: low | high ]
db_isolation=low

# System Usage [ Default: custom; Valid values: production | test | development | custom ]
system_usage=custom
```

Key point
Providing only one parameter in an otherwise empty hdblcm.conf file will not work. To make sure the installation works, the best practice would be to generate the template file and modify the required parameters.

Values in the hdblcm.conf file that conflict with values of the local_input.ini will be overwritten, as listed below in Table C-1.

The configuration file will be detected by the installation script and the values will be used for the SAP HANA installation. The default settings are listed in Table C-1. Values in <> are taken from the custom attributes.

Table C-1. Configuration variables for SAP HANA installation

Configuration variable	Default value	Changeable
components	client,server	Yes, additional values possible
hostname	<DomainName>	No
sid	<HanaSID>	No
number	<HanaInstanceNumber>	No
use_master_password	yes	No
master_password	<HanaMasterPassword>	Yes
action	install	No
autostart	<HanaStartAfterReboot>	Yes

How to create the SAP HANA database update config file

```
#<DepotLocalMountpoint>/<DepotSapDirectory>/SAP_HANA_PLATFORM_20_SPS03/DATA_UNITS/HDB_LCM_LINUX_X86_64
/hdblcm --action=update --
dump_configfile_template=<DepotLocalMountpoint>/<DepotSapDirectory>/hdblcm_update.conf
```

This will create a config file where individual parameters for an SAP HANA installation can be set. Save the file in the media directory (DepotSapDirectory) of your SAP HANA database.

Edit the file and modify the required parameters. A small extract is shown below:

```
# Directory containing a storage configuration
storage_cfg=

# Database Isolation ( Default: low; Valid values: low | high )
db_isolation=low

# System Usage ( Default: custom; Valid values: production | test | development | custom )
system_usage=custom
```

Key point

Providing only one parameter in an otherwise empty hdblcm_update.conf file will not work. To make sure the installation works, the best practice would be to generate the template file and modify the required parameters.

Values in the hdblcm.conf file that conflict with values of the local_input.ini will be overwritten, as listed below in Table C-2.

The configuration file will be detected by the installation script and the values will be used for the SAP HANA installation. The default settings are listed in Table C-2. Values in <> are taken from the custom attributes.

Table C-2. Configuration variables for SAP HANA installation

Configuration variable	Default value	Changeable
components	client,server	Yes, additional values possible
hostname	<DomainName>	No
sid	<HanaSID>	No
use_master_password	yes	No
master_password	<HanaMasterPassword>	No
password	<HanaMasterPassword>	Yes
system_user_password	<HanaMasterPassword>	Yes
action	update	No

Appendix D: Customized installation options for SAP S/4HANA

In an installation scenario where the default values for an S/4HANA installation do not fit the requirements, a configuration file (inifile) can be used for the installation. This option is officially supported by SAP starting with Software Provisioning Manager SP18, see SAP Note 2230996 for more details.

How to create the SAP S/4HANA installation configuration file

This inifile can be created once and then reused for any following S/4HANA deployments by storing it in the media directory. For each SAP product an individual inifile could be used. There are two ways to create the inifile:

1. Using SWPM

   Start the installation of S/4HANA manually. Go through the installation process and provide the individual values that are required. Stop the installation at the summary.
   Save the file inifile.params that is located in the SAP installation directory as
   `<DepotSapDirectory>/inifile_<SapVersion>_<SapApplication>_<DatabaseVendor>.params`

   This inifile can be used in another installation scenario, using either the same input or with modified content.

2. Create manual entries

   Create a text file and enter the required parameter for the individual setup; e.g., if not using the full qualified domain name enter this line into the config file:

   ```
   NW_getFQDN.setFQDN = false
   ```

   Several other parameter can be set in this configuration file.
   Save the created file as
   `<DepotSapDirectory>/inifile_<SapVersion>_<SapApplication>_<DatabaseVendor>.params`

Note
The name of the inifile must follow this naming convention and may not be changed:
`inifile_<SapVersion>_<SapApplication>_<DatabaseVendor>.params`

It must be located in the DepotSapDirectory where the S/4HANA installation media is stored.

Settings in the inifile that conflict with values of the local_input.ini will be overwritten, as explained in the section Default values for SAP inifile.

The created inifile will be detected by the automated installation and the values will be used for the SAP S/4HANA installation.

Default values for SAP inifile

See the tables in this section for an overview of default values in the automated SAP installation scenario.

For all SAP installations the parameters below are used. In addition, the parameter for the specific installation scenario (like standard, or distributed) are taken into account.

Table D-1 Default general SAP inifile parameters

Parameter name	Default value	Customizable in inifile parameters
NW_GetMasterPassword.masterPwd	scrMasterPW	No
NW_GetSidNoProfiles.sapmnt	SAPMNT_DIR	No
NW_GetSidNoProfiles.sid	scrSID_SAP	No
NW_getFQDN.FQDN	Domain name detected by script[5]	No
NW_getFQDN.setFQDN	true	Yes
archives.downloadBasket	SAP Archive Directory	Yes

SAP standard installation, single host (standard)

Table D-2. Default "standard" SAP installation parameters

Parameter name	Default value	Changeable
NW_ABAP_SSFS_CustomKey.ssfsKeyInputFile	File to generated sec_store_key	No
NW_CI_Instance.ciInstanceNumber	scrInstanceNumber_SAP	Yes
NW_CI_Instance.ascsVirtualHostname	Hostname extracted from scrHostnameFQDN_SAP	No
NW_CI_Instance.scsVirtualHostname	Hostname extracted from scrHostnameFQDN_SAP	No
NW_CI_Instance.ciVirtualHostname	Hostname extracted from scrHostnameFQDN_SAP	No
NW_SLD_Configuration.configureSld	False	Yes
HDB_Server_Install.installationComponents	server	Yes
NW_HDB_getDBInfo.dbhost	Hostname extracted from scrHostnameFQDN_HDB	No
NW_HDB_getDBInfo.dbsid	scrSID_HDB	No
NW_HDB_getDBInfo.instanceNumber	scrInstanceNumber_HDB	No
NW_HDB_getDBInfo.systemPassword	scrMasterPW_HDB	Yes
NW_HDB_getDBInfo.systemDbPassword	scrMasterPW_HDB	Yes
NW_HDB_DBClient.clientPathStrategy	LOCAL	Yes
NW_liveCache.useLiveCache	False	Yes
NW_Recovery_Install_HDB.sidAdmName	<hdb>adm	No
NW_Recovery_Install_HDB.sidAdmPassword	scrMasterPW_HDB	Yes

Additional default database installation parameters apply as listed in section **Database specific parameters**.

[5] Value may be empty if the parameter NW_getFQDN.setFQDN=false

Additional application server instance (aas)

Table D-3. Default "aas" SAP installation parameters

Parameter name	Default value	Customizable in inifile.params
NW_readProfileDir.profileDir	/${SAPMNT_DIR}/${scrSID}/profile	No
NW_readProfileDir.profilesAvailable	True	No
NW_AS.instanceNumber	scrInstanceNumber_SAP	Yes
NW_DI_Instance.virtualHostname	Hostname extracted from scrHostnameFQDN_SAP	No
storageBasedCopy.hdb.instanceNumber	scrInstanceNumber_HDB	No
storageBasedCopy.hdb.systemPassword	scrMasterPW_HDB	Yes
NW_HDB_getDBInfo.systemDbPassword	scrMasterPW_HDB	Yes
NW_HDB_DBClient.clientPathStrategy	LOCAL	Yes

Glossary

Name	Description
CIFS	Common Internet File System
DB	Database
HPE	Hewlett Packard Enterprise
NFS	Network File System
NIC	Network Interface Card
RA	Reference Architecture
SAP	Systems, Applications & Products in Data Processing
SID	SAP System Identification
SSH	Secure Shell

Resources and additional links

HPE Reference Architectures, hpe.com/info/ra

HPE Synergy, hpe.com/synergy

HPE Synergy Reference Architecture, hpe.com/info/synergy-ra

HPE Servers, hpe.com/servers

HPE Storage, hpe.com/storage

HPE Networking, hpe.com/networking

HPE Technology Consulting Services, hpe.com/us/en/services/consulting.html

HPE Github site for Foundation artifact bundle https://github.hpe.com/ImageStreamer/image-streamer-tools/tree/master/foundation/artifact-bundles

HPE GitHub site for image streamer reference architecture, https://github.com/HewlettPackard/image-streamer-reference-architectures

SAP HANA Platform (Core), http://help.sap.com/hana_platform

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

SAP S/4HANA 1809 Installation Guide https://help.sap.com/doc/6b11678926d3409bbfea8897cb34d10f/1809.000/en-US/INST_OP1809.pdf

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

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

SAP HANA Storage Requirements, sap.com/documents/2015/03/74cdb554-5a7c-0010-82c7-eda71af511fa.html

SAP Benchmark Certification for HPE Synergy 660 Gen10, https://www.sap.com/dmc/benchmark/2018/Cert18019.pdf

To help us improve our documents, please provide feedback at hpe.com/contact/feedback

a00072365enw, April 2019