Hewlett Packard Enterprise

HPE Reference Architecture for deploying SAP HANA with HPE Synergy Image Streamer

Reference Architecture

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.

The demands of SAP HANA implementations continue to increase. Faster transaction processing speeds, scalable capacity, increased flexibility, and rapid SAP HANA deployment are required to meet the needs of today's business.

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 is a certified platform for SAP HANA, offering resource pools which can be customized at provisioning time for specific database needs. One or multiple servers with predefined resources for SAP HANA can be provisioned quickly, repeatedly, and simultaneously through the software-defined intelligence embedded in HPE Synergy Composer and HPE Synergy Image Streamer. An administrator can utilize HPE Synergy Image Streamer to develop a deployment plan to install and configure both the operating system and database software. A server profile defined in HPE Synergy Composer can use that deployment plan to configure a new or multiple bare-metal servers in a matter of minutes, compared to hours or days utilizing traditional infrastructure. As a result, infrastructure can be deployed faster, allowing for a quicker return on investment.

This Reference Architecture (RA) demonstrates how to use the functionality provided by HPE Synergy Composer and HPE Synergy Image Streamer to quickly deploy SAP HANA. More specifically, it shows the following benefits of utilizing HPE Synergy for SAP HANA solutions:

- Use HPE Synergy Composer with embedded HPE OneView to seamlessly manage the entire environment, including configuration of network resources required for SAP HANA, creation and management of the required storage, and to deploy the OS and database software on the compute nodes.
- Automate deployment of SAP HANA 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 HANA in less than three minutes, which is a significant reduction as compared to traditional deployment times of hours or days.

This Reference Architecture describes solution testing performed in October 2017.

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 usage of HPE Synergy Image Streamer to deploy SAP HANA.

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 using repeatable templates. 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 Synergy Composer and HPE Synergy Image Streamer. The combination of these tools allows for automating the customization of an OS image and deployment of the SAP HANA software to quickly and repeatedly provision 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.

Solution components

The hardware and software used for the Reference Architecture for deploying SAP HANA with HPE Synergy Image Streamer 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 Synergy 1200 Frame	Infrastructure for compute, fabric, and management
1	HPE Synergy Composer	Infrastructure management
1	HPE Synergy Image Streamer	Infrastructure deployment
2	HPE Synergy 680 Gen9 Compute Modules	Bare-metal hosts
1	HPE 3PAR StoreServ 8400	Storage for SAP HANA, version 3.2.2
1	HPE FlexFabric Switch	Top of Rack network connectivity
2	HPE VC SE 16Gb FC Module	Virtual Connect Module
2	HPE VC SE 40Gb F8 Module	Virtual Connect Module

Figure 1 shows the components that were used for this effort.

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 use in production environments requires a minimum of three HPE Synergy Frames with two Virtual Connect SE 40Gb F8 Modules for Synergy, two HPE Synergy Image Streamers, and two HPE Synergy Composers.

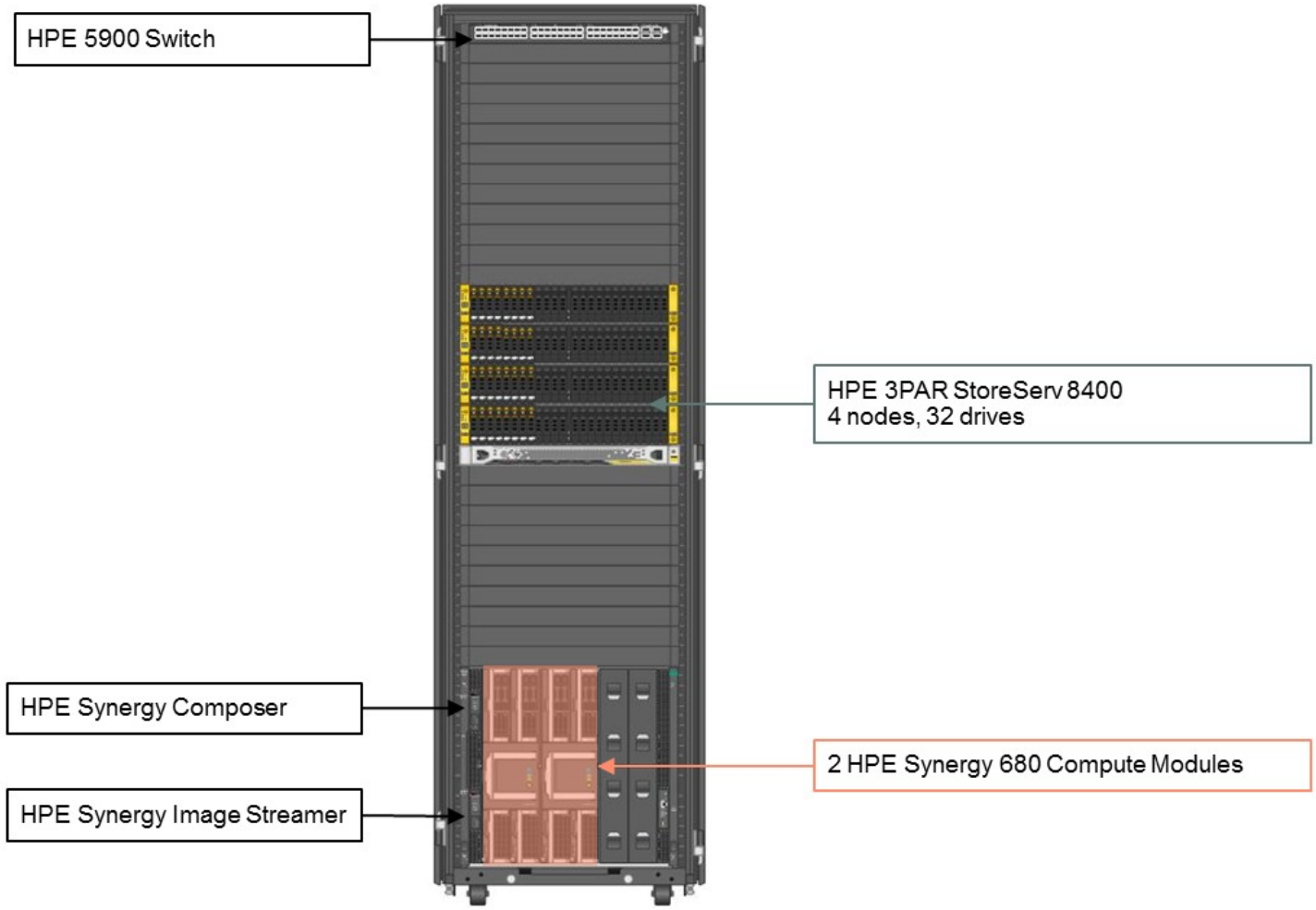

Figure 1. HPE Synergy and HPE 3PAR StoreServ configuration

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.

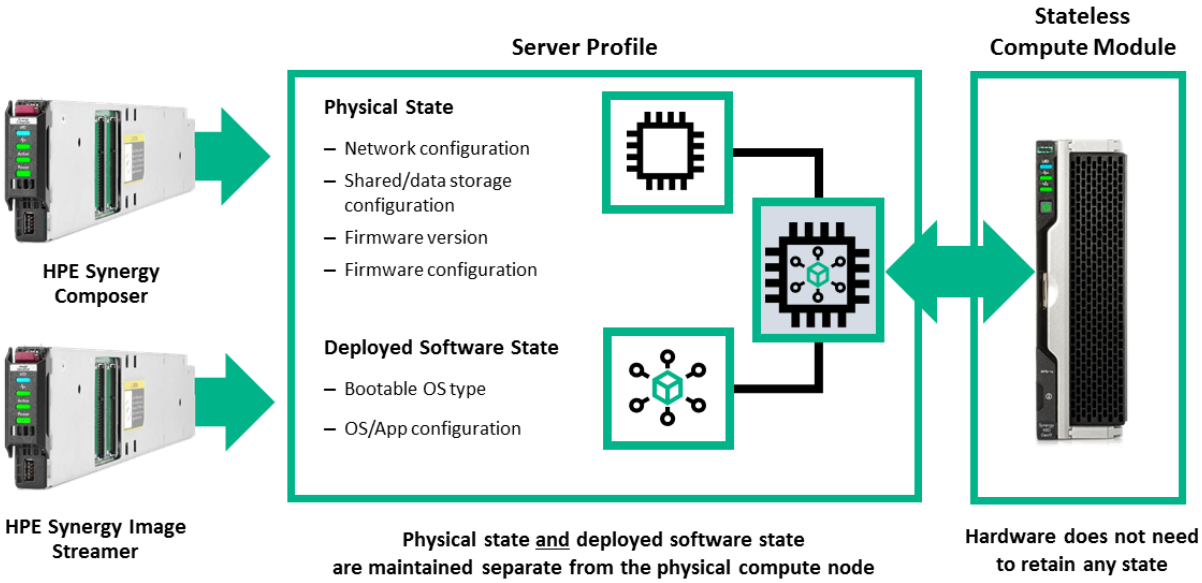

Figure 2. HPE Synergy Composer and HPE Synergy Image Streamer managing compute module with a server profile

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.

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

The deployment plan "HPE - SLES12 - SAP HANA DB deploy" provisions a physical compute node, using a user-defined golden image for SAP HANA and installs the database after the first boot as shown in Figure 3. To keep the OS image located on the HPE Synergy Image Streamer as lightweight as possible, the complete database is located on HPE 3PAR storage. Local storage is neither required nor recommended. The server profile has the entire state of the server, including the access to shared storage which enables swapping of workloads. Local storage may be used for temporary space but not for data that needs to be retained.

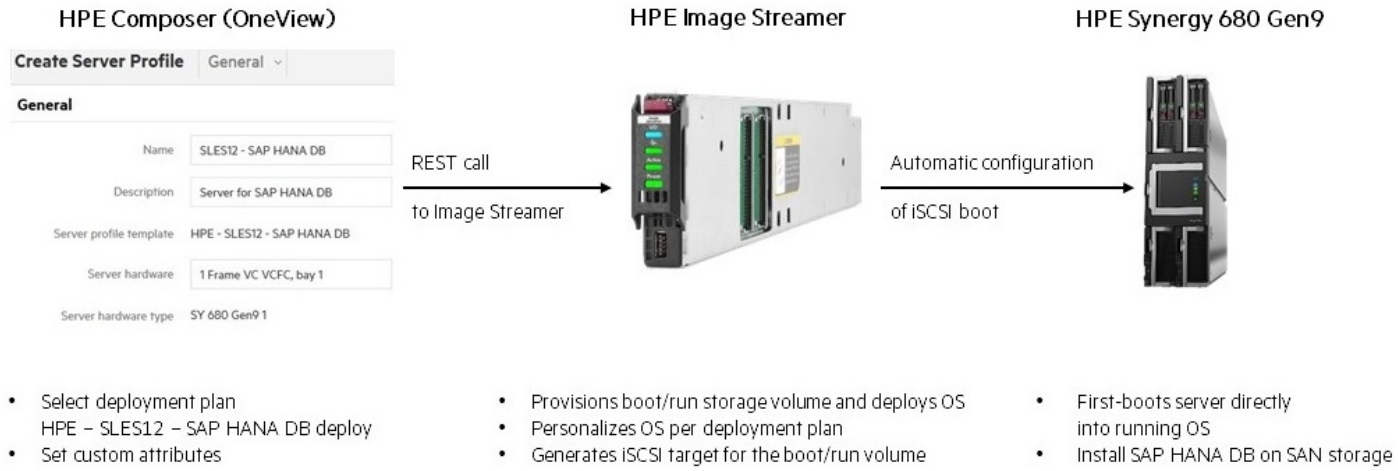

Figure 3. HPE Synergy Image Streamer flow

HPE Synergy Image Streamer supports a variety of operations for flexibility in how you handle your images. For example, you can capture golden images for your use, import golden images from another location, or modify some of your "known good" images for re-use. This flexibility allows you to easily establish your desired images for use. A variety of images can be used on HPE Synergy Image Streamer. Reference implementations provide artifacts for recent versions of VMware ESXi (5.0, 6.0, 6.5), and application images based on Red Hat® Enterprise Linux® (RHEL 7.2, 7.3) and SUSE Linux Enterprise Server (SLES 12 SP1) using ext3 and ext4 file systems. You can also enable your own specific images and image types using the tools provided with 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	3.10.04
HPE Synergy Image Streamer	3.10.02
HPE Synergy Image Streamer artifacts for SAP HANA	HPE-SLES12-SAP-HANA-DB-RA-2017-10-20-v3.1.zip
Operating System	SUSE Linux Enterprise Server for SAP Applications 12 SP2
SAP HANA	2.0 SPS02

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 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 HANA-based applications by the year 2025.

For this Reference Architecture deploying SAP HANA with HPE Synergy Image Streamer, SAP HANA 2.0 SPS02 was used.

Best practices and configuration guidance for the solution

To use the artifact bundle "HPE - SLES12 - SAP HANA DB," several initial steps have to be taken to create the right environment for provisioning SAP HANA databases. 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. This is used to install SUSE Linux Enterprise Server for SAP Applications 12 SP2. The OS volume then will 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 HANA during the deployment.

After the first boot, some OS kernel parameters required for SAP HANA will be set, the external 3PAR storage will be mounted and the installation of the database will start. Please note that the complete installation is done on 3PAR volumes, not on the local OS storage to avoid large and rapidly-growing smart clones.

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

1. Create SAP software media share.
2. Create network.
3. Download and import the artifact bundle.
4. Create a golden image.
5. Customize the deployment plan.
6. Create server profile template in HPE OneView.
7. Create a server profile.

Steps 1-6 have to be executed only once in the environment. Provisioning a server with SAP HANA using this environment is described in Step 7. The following sections describe all of the steps in detail.

Create SAP software media share

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

Download the SAP HANA media archives from the SAP Software Download Center. 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. 2.0 → Installation.

From that list you must obtain the following media files:

- SAP HANA Platf. Ed. 2.0 SPS02 Linux x86_64 1/4
- SAP HANA Platf. Ed. 2.0 SPS02 Linux x86_64 2/4
- SAP HANA Platf. Ed. 2.0 SPS02 Linux x86_64 3/4
- SAP HANA Platf. Ed. 2.0 SPS02 Linux x86_64 4/4

Extract the files into a dedicated directory on the software share (DepotSapDirectory) by executing the first media file.

Create network

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

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

- Image Streamer deployment network
- Management network
- SAN network

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.

Table 3. Networks for SAP HANA 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-b	Ethernet Uplink Set
Synergy SAN A-Side	Fibre Channel	none	Mezzanine 2:1	SAN A Uplink
Synergy SAN B-Side	Fibre Channel	none	Mezzanine 2:2	SAN B Uplink

Figure 4 shows the Connections section of the server profile for an SAP HANA server. Note that 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.

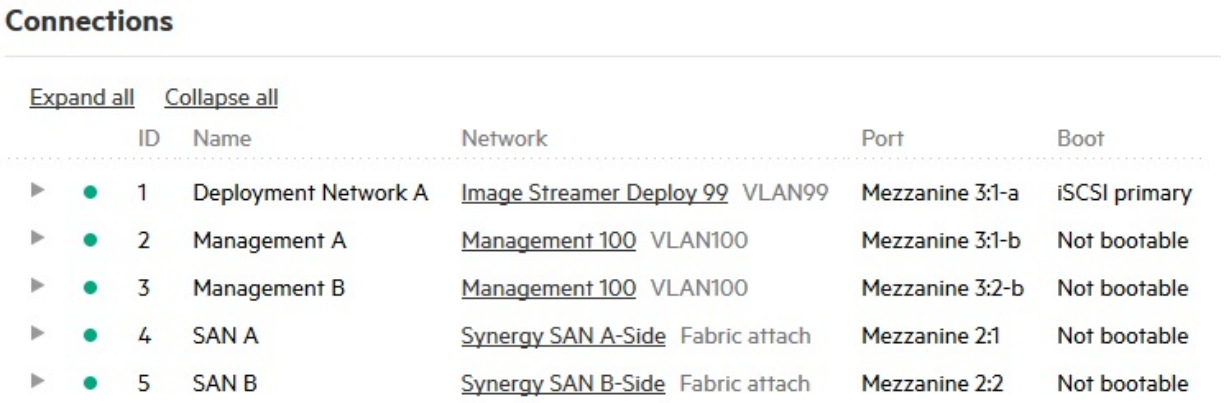

Figure 4. Network connections

Download and import the artifact bundle

From the HPE GitHub site for Image Streamer reference architectures, download the zip file HPE-SLES12-SAP-HANA-DB-RA-2017-10-20-v3.1.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.

After adding the zip archive, the artifact bundle has to be extracted.

The artifact bundle includes:

- Deployment plan: HPE - SLES12 - SAP HANA DB – deploy - 2017-10-20
- OS build plan: HPE - SLES12 - SAP HANA DB – deploy - 2017-10-20
- OS Build plan: HPE - SLES12 - SAP HANA DB – generalize - 2017-10-20
- Plan scripts

Create golden image

The following steps are required to create a SLES 12 SP2 image for deploying SAP HANA.

Note

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

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1. Create an HPE OneView server profile with OS deployment plan “HPE – Foundation 1.0 – create empty OS volume-2017-03-24” 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 SUSE Linux Enterprise Server for SAP Applications 12 SP2 into the empty volume.
3. The root filesystem should be ext4 and it is assumed that the root partition / is mounted on /dev/sda3. If the root partition is not on that device, then the plan scripts “HPE - SLES12 - SAP HANA DB - mount generalize” and “HPE - SLES12 - SAP HANA DB - mount and validate” need to be adjusted.
4. Configure the OS according to SAP OS recommendations.

Note
The plan script “HPE - SLES12 - SAP HANA DB - manage security services” will disable the firewall.

If the firewall needs to be enabled, refer to SAP note 2477204: FAQ: SAP HANA Services and Ports, and open the required ports in the OS for the golden image.

In the plan script “HPE - SLES12 - SAP HANA DB - manage security services”, delete the lines that disable the firewall.

Relevant SAP documentation
On the SAP HANA Platform webpage (http://help.sap.com/hana_platform), check the latest SAP HANA Master Guide and SAP HANA Server Installation and Update Guide for important SAP Notes and additional information about the setup.

To meet the SAP HANA KPIs, several kernel parameters and OS settings need to be modified.
Plan script “HPE - SLES12 - SAP HANA DB - update OS settings” will set the correct kernel parameters.

Be sure to take a close look at SAP Note 2382421: Optimizing the Network Configuration on HANA- and OS-Level.
Saptune is part of SLES for SAP Applications 12 SP2. Make sure to use at least saptune version 1.1.6.

For SAP HANA storage calculation and requirements, check the latest SAP document: SAP HANA TDI-Storage Requirements.

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
- 1788665 – SAP HANA Support for virtualized / partitioned (multi-tenant) environments
- 2205917 – SAP HANA DB: Recommended OS settings for SLES12/SLES for SAP Applications 12
- 2382421 – Optimizing the Network Configuration on HANA- and OS-Level
- 2477204 – FAQ: SAP HANA Services and Ports
- 1984787 – SUSE Linux Enterprise 12: Installation notes

Relevant SLES documentation

- SUSE Linux Enterprise Server for SAP Applications 12 SP2
- Saptune documentation

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, as shown in Figure 5. Do the following 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 ("SLES-12SP2-SAP"), description, OS volume, and Capture OS build plan as shown in Figure 5. The Capture OS build plan "HPE - SLES12 - SAP HANA DB - generalize" was used to create the golden image. Make sure to use this build plan when capturing the OS; using "as is" will not remove the server specific settings and will interfere with later deployment personalization.

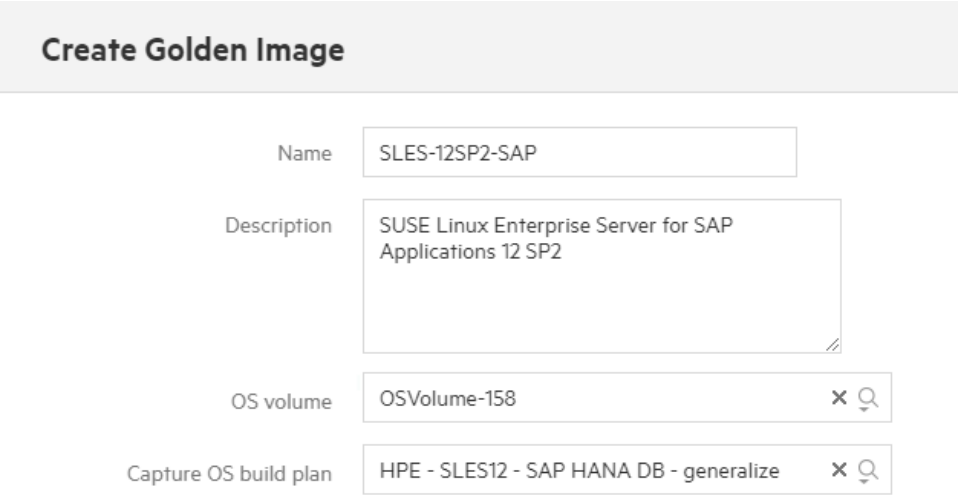

Figure 5. Golden Image creation

Note

For golden image creation, the capture OS build plan "HPE - SLES12 - SAP HANA DB - generalize" may only be used for empty OS systems.

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 6. Make sure to check that all attributes have the correct values. Please note that for readability reasons not all of the plan attributes are shown here. Details can be found in Table B-2 in Appendix B.

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 SLES-12SP2-SAP golden image as the default golden image in the deployment plan.

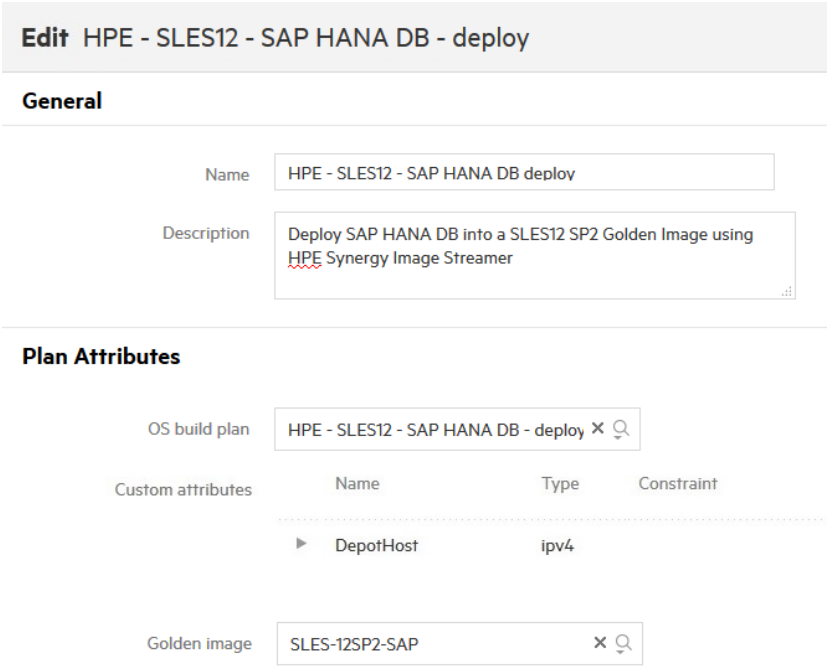

Figure 6. Deployment plan configuration

Parameters for the SAP HANA installation can be changed by configuring a configuration file that must be located in the software depot. Details about the usage of the configuration file can be found in Appendix C: Customized SAP HANA installation options.

Create server profile template in HPE OneView

It is a best practice to create a server profile template and use this to create the server profiles for later server provisioning. By using the Server Profile Template feature within HPE OneView, you can specify and maintain a single configuration for the system firmware, BIOS, and boot-order at time of initial deployment as well as orchestrate updates to that configuration as needed. This provides a location to centrally manage and update configuration settings, such as system firmware, and provides assurance that each server is running with the same configuration and has event and health data being exposed up to HPE OneView.

The server profile template is created once in OneView Server Profile Templates. After the entire environment is set up it can be leveraged for each server profile provisioning for SAP HANA. Each server profile can have different custom attributes for the database.

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

- Server hardware type
- Enclosure group
- OS Deployment Plan with custom attributes as listed in Table B-2
- Connections
- SAN Storage

For this RA, external 3PAR storage was used to host the SAP HANA application data. To reduce costs, local storage is neither needed nor recommended for SAP HANA.

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

SAP HANA storage calculation

The following calculations are based on the SAP document: SAP HANA Storage Requirements. For more information, check the latest version.

Capacity-based storage sizing for SAP HANA systems greater than 1 TB:

- Data (/hana/data): 1.2 x RAM
- Log (/hana/log): 0.5 TB
- Shared (/hana/shared): 1 TB

Example formula for a HANA system with 1 TB of RAM = 1.2 x 1 TB + 0.5 TB + 1.0 TB = 2.7 TB. In this example the system needs 2.7 TB persistent storage capacity for the /hana directory.

For a server profile creation, a new 3PAR volume has to be created.

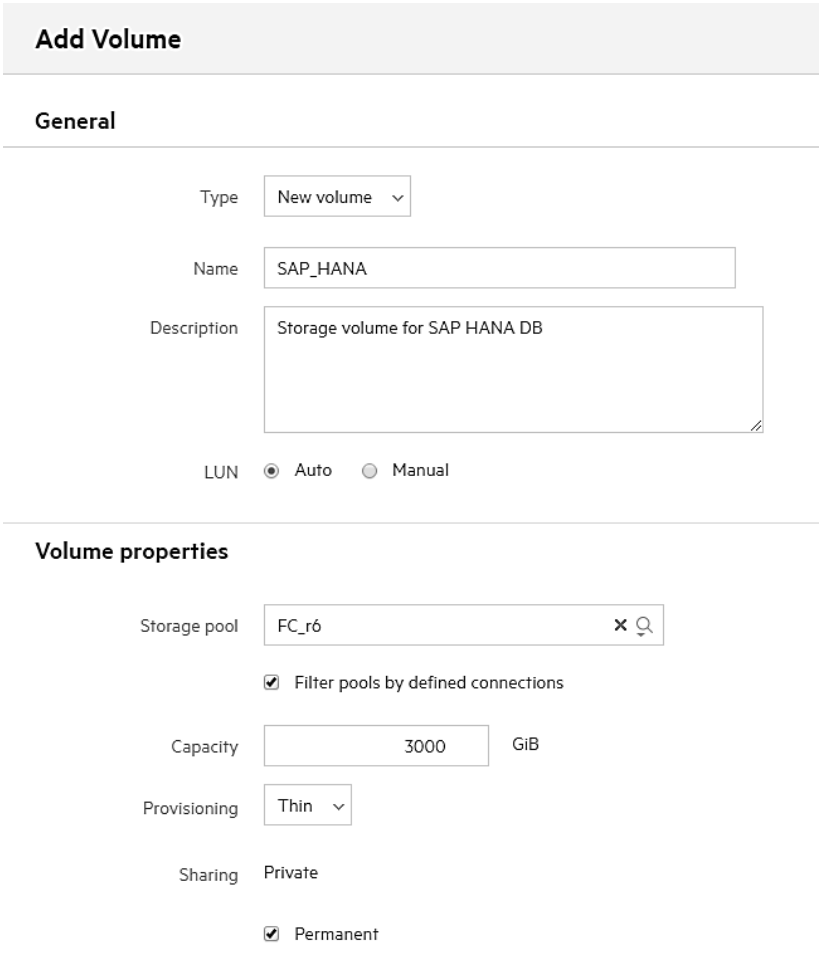

Figure 7. Storage creation in HPE OneView Server Profile template

Create server profile

Using the previously created server profile template, you can deploy your SLES12 - SAP HANA DB server profile.

- Create a new server profile from the template you created.
- Set all visible custom attributes. For a detailed list of attributes see Table B-2.

Figure 8 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.

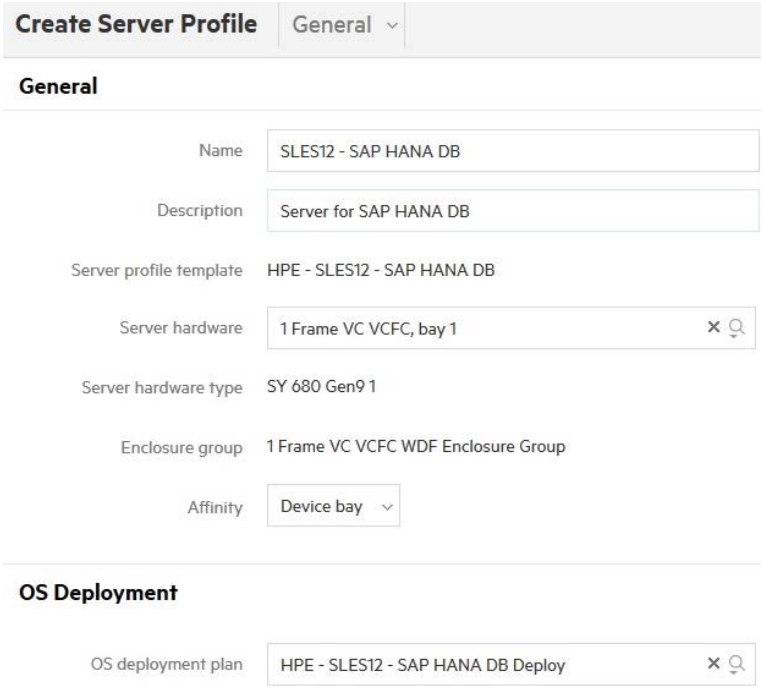

Figure 8. Create Server Profile

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 HANA. This will install the database into the newly created server.

Capacity and sizing

Traditional OS provisioning for SAP HANA 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 HANA installation in the traditional environment.

Deploying a server for an SAP HANA 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 HANA database using Software Defined Infrastructure is fast, consistent, and repeatable.

Figure 9 shows the creation of the HPE - SLES12 - SAP HANA DB server profile. It completed after 2 minutes and 49 seconds. This includes the validation and creation of the SAN storage (6 seconds), update of the network (23 seconds), creation of the OS volume (11 seconds), and applying the server profile (2 minutes and 9 seconds).

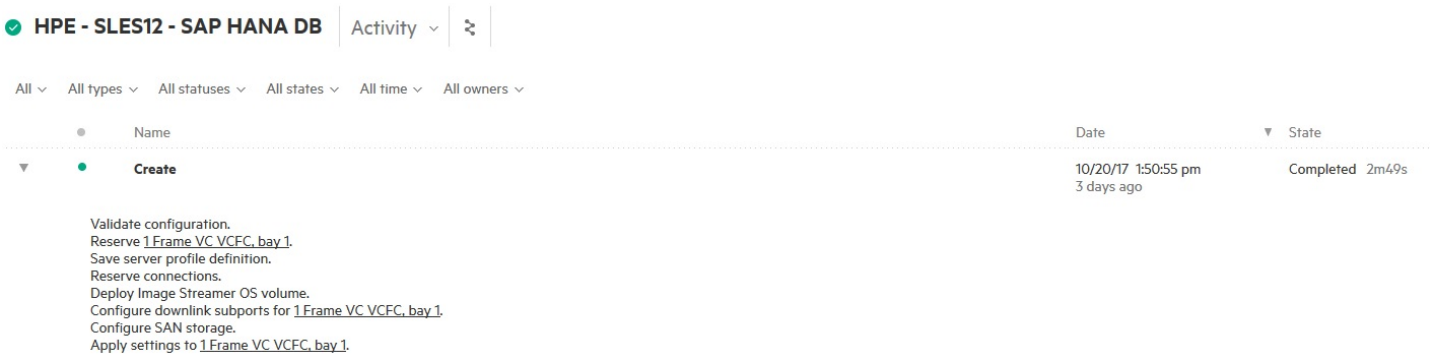

Figure 9. Server creation step

Subsequently the server is powered on and will boot. The boot time will vary depending on the server used. The HPE Synergy 680 Gen9 Compute Module used in this Reference Architecture took approximately 21 minutes to boot.

Following the boot time, database installation will start. The installation takes approximately 6 minutes.

Summing up all the steps to create a new server with a running SAP HANA database takes approximately 30 minutes.

The benefit of using Software Defined Infrastructure is even better when multiple SAP HANA databases are required. The provisioning of multiple servers can run in parallel, being started by one administrator. A provisioning of 10 servers may be done in less than one hour showing the big benefit that each server and database has in a standardized environment.

In traditional data centers, setting up a server and installing the OS and SAP HANA would take between 4-6 hours. This process can hardly be parallelized. Provisioning 10 servers can easily take several days.

Analysis and recommendations

This Reference Architecture for deploying SAP HANA using HPE Synergy Image Streamer was created using HPE Synergy 680 Gen9 Compute Modules for the hardware provisioning. Other servers, such as HPE Synergy 660 Gen10, once they are certified for SAP HANA, may also be used.

HPE 3PAR storage was used for storing the SAP HANA application data therefore local storage is not needed for this solution. This saves costs, because no additional storage is required. The server profile has the entire state of the server, including the access to shared storage which enables swapping of workloads. Local storage may be used for temporary space but not for data that needs to be retained.

The sizing for SAP HANA systems may vary depending on the customer needs. Please refer to the SAP sizing tool.

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

- HPE Synergy Composer with embedded HPE OneView seamlessly manages the entire environment, including configuration of network resources required for SAP HANA, creation and management of the required storage, and deploying the OS and database software on the compute nodes.
- Automate deployment of SAP HANA 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 HANA in less than three minutes, which is a significant reduction as compared to traditional deployment times of hours or days.

Summary

This Reference Architecture described how an SAP HANA database can be deployed in a highly composable environment using the artifact bundle "HPE - SLES12 - SAP HANA DB" for the HPE Synergy Image Streamer.

This document showed the setup required to apply the artifact bundle "HPE - SLES12 - SAP HANA DB" in an HPE Synergy Image Streamer environment. Necessary prerequisites for the golden image creation and customization of attributes for the plan scripts were listed.

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 bundle "HPE - SLES12 - SAP HANA DB" shown in this Reference Architecture configured the network and storage resources required for an SAP HANA server. After the first boot, the SAP HANA database 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 Plan "HPE - SLES12 - SAP HANA DB – deploy."

Tests showed that the server provisioning, including a new installation of SAP HANA using the artifact bundle "HPE - SLES12 - SAP HANA DB", took approximately 30 minutes. Traditional provisioning of a server in a TDI scenario and following SAP HANA TDI installation will take hours for one server.

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

Setting up a complete landscape with the requirement of several SAP HANA databases would consume several days in the traditional environment. Thanks to the repeatability of the HPE Synergy deployment this can be run in parallel, and, depending on the amount of required systems, would take roughly one hour.

Implementing a proof-of-concept

As a matter of best practice for all deployments, HPE 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
		HPE Synergy Compute Module components
2	834482-B21	HPE SY 680 Gen9 4S Configure-to-Order Compute Module
6	834500-B21	HPE Synergy 620/680 Gen9 Intel® Xeon® E7-8880 v4 Processor Kit
2	834500-L21	HPE Synergy 620/680 Gen9 Intel® Xeon® E7-8880 v4 FIO Processor Kit
2	814068-B21	HPE Smart Array P240nr/1GB FIO Ctrlr
4	785067-B21	HPE 300GB 12G SAS 10K 2.5in SC ENT HDD
192	805358-B21	HPE 64GB 4Rx4 PC4-2400T-L Kit
4	777452-B21	HPE Synergy 3830C 16G FC HBA
4	777430-B21	HPE Synergy 3820C 10/20Gb Converged Network Adapter
		Storage
1	H6Z01B	HPE 3PAR 8400 4N+SW Storage Base
2	H6Z26A	HPE 3PAR StoreServ 8000 SFF(2,5in) SAS Drive Enclosure
32	K2P94B	HPE 3Par 8000 1.8TB 10K SFF HDD
1	L7F20A	HPE 3PAR All-in Sgl-sys SW Current Media
1	K2R28A	HPE 3PAR StoreServ SPS Service Processor

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 HANA DB deploy".

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

Plan script name	Type	Comment
HPE - SLES12 - SAP HANA DB - mount and validate	General	Mounts the root partition and validates the golden image.
HPE - SLES12 - SAP HANA DB - configure multiple NICs	Deploy	Configures the network.
HPE - SLES12 - SAP HANA DB - change root password	Deploy	Sets the root user password.
HPE - SLES12 - SAP HANA DB - configure hostname	Deploy	Updates the hostname and configures the gateway.
HPE - SLES12 - SAP HANA DB - manage security services	Deploy	Deactivates the firewall and sets ssh settings.
HPE - SLES12 - SAP HANA DB - partition SAN disk using LVM	Deploy	Partitions the attached SAN storage using the LVM parameters described in Table B-2.
HPE - SLES12 - SAP HANA DB - update OS settings	Deploy	Customize kernel parameters and block devices for SAP HANA.
HPE - SLES12 - SAP HANA DB - create local input file	Deploy	Creates the input file required for the SAP HANA installation
HPE - SLES12 - SAP HANA DB - create install script	Deploy	Copies the installation script install_SAP.sh for installing SAP HANA to the OS. The script will mount the software depot, create the SAP HANA config file, and start the installation. The script will be executed after the first boot of the OS.
HPE - SLES12 - SAP HANA DB - unmount	General	Unmounts the root partition.
HPE - SLES12 - SAP HANA DB - mount generalize	Capture	Mounts root partition for generalization.
HPE - SLES12 - SAP HANA DB - generalize host	Capture	Removes host specific configuration.
HPE - SLES12 - SAP HANA DB - generalize network	Capture	Removes network settings.
HPE - SLES12 - SAP HANA DB - unmount generalize	Capture	Unmounts root partition after generalization.

Table B-2 lists the custom attributes and default values of the OS Build Plan "HPE - SLES12 - SAP HANA DB - deploy".

Table B-2. Custom attributes of OS Build Plan "HPE - SLES12 - SAP HANA DB - 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 - SLES12 - SAP HANA DB - 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 - SLES12 - SAP HANA DB - create local input file" or enter a dummy value.	Administrator	No
DepotHost	IPv4 Address	IP-Address of the software share	e.g., 172.16.12.22	No
DepotLocalMountpoint	String	Local mountpoint 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 HANA installation media	SYNERGY	No
DepotShareName	String	Name of the software share	SWDEPOT	No
DomainName	FQDN	Full hostname (FQDN) for the deployed OS	hostname.domainname	Yes
HanaInstanceNumber	String	The two-digit SAP HANA Database Instance Number. Rules for SAP Instance Number apply.	e.g., 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.	e.g., HDB	Yes
HanaStartAfterReboot	Option	Sets the autostart option for HANA after a system reboot. Possible values are yes and no.	Yes	Yes
InstallDirectory	String	Local installation directory for the SAP HANA database. The installation script, local input file, and all installation logfiles will be stored here.	/root/hpe_ai	No
LvmVolumeGroupName	String	Name of the LVM volume group for the SAP HANA database 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
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.	100	No
LvmVolumeSizeSap	Number	Size of the LVM partition required for /usr/sap in GiB.	5	No
LvmVolumeSizeSwap	Number	Size of the LVM partition required for swap space in GiB.	20	No
ManagementNIC1	NIC	NIC1 on the management network	none	Yes
ManagementNIC2	NIC	NIC2 on the management network	none	Yes
NewRootPassword	Password	New Password for the root user	Password	Yes
SSH	Option	Defines if SSH will be enabled on the deployed OS. Possible values are Enabled or Disabled	Enabled	No

Appendix C: Customized SAP HANA installation options

In an installation scenario where the default values for an SAP HANA installation do not fit the requirements, a configuration file can be provided to be used for the SAP HANA installation. 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) and naming it hdblcm.conf.

Note
The name of the hdb configfile must be hdblcm.conf and may not be changed.

It must be located in the DepotSapDirectory where the SAP HANA installation media is stored.

How to create the SAP HANA database config file

```
# <DepotSapDirectory>/SAP_HANA_PLATFORM_10_SPS12/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:

```
# Database Mode [ Default: single_container; Valid values: single_container | multiple_containers ]
db_mode=single_container

# 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
The complete hdblcm.conf file template must be included for an SAP HANA database installation, even if not all parameters are customized. Providing only one parameter in an otherwise empty file will not work.

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>	No
action	install	No
autostart	<HanaStartAfterReboot>	Yes

Glossary

Name	Description
CIFS	Common Internet File System
DB	Database
HPE	Hewlett Packard Enterprise
KPI	Key Performance Indicator
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 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 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

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