HPE Solution Architecture for SAP HANA using HPE ProLiant DL560 Gen10 server

Built with Intel Xeon Scalable 2nd Generation Processor (Cascade Lake) architecture
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Executive summary

The HPE ProLiant DL560 Gen10 server for SAP HANA® Scale-up Pre-Defined Solutions with the Intel® Xeon® Scalable 2nd Generation Processor (Cascade Lake) architecture allows SAP® customers to harness the power of in-memory computing with SAP HANA applications for real-time business results, delivered on a mission-critical, optimized and high-performance infrastructure.

Hewlett Packard Enterprise offers multiple solutions for SAP HANA in the following delivery models:

- HPE ProLiant DL560 Gen10 for SAP HANA Scale-up Pre-Defined Solutions
- Tailored Datacenter Integration (TDI)

The HPE ProLiant DL560 Gen10 for SAP HANA Scale-up Pre-Defined Solutions are purpose built, optimized, and pre-integrated systems, designed with mission-critical reliability. These configurations are certified by SAP and are available in memory sizes ranging from 192.0GB up to 6.0TB RAM offering scalability and flexibility.

HPE ProLiant DL560 Gen10 for SAP HANA Scale-up Pre-Defined Solutions are available in the following processor and memory configuration sizes.

<table>
<thead>
<tr>
<th>Processor</th>
<th>Memory Configurations available</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Socket</td>
<td>192 / 384 / 576 / 768 / 1152 / 1536 / 3072 GB</td>
</tr>
<tr>
<td>6 Socket</td>
<td>192 / 384 / 768 / 1152 / 1536 / 2304 / 3072 / 6144 GB</td>
</tr>
</tbody>
</table>

Note

The following memory configurations are mixed DIMM solutions and come in following configurations:

- 1152GB - 24 x 16GB and 24 x 32GB RDIMMS with 2 socket
- 2304GB - 24 x 32GB RDIMMs and 24 x 64GB RDIMMs with 4 socket

These configurations include optimally configured software and hardware appliances for customers’ SAP application environment.

These configurations are available in pre-defined solutions delivery model and provide the following benefits:

- Fully vetted hardware and software infrastructure architected by Hewlett Packard Enterprise to host SAP HANA databases and certified by SAP
- Assembled and tested as a unit before shipment
- Hewlett Packard Enterprise on-site installation and configuration
- Each release is subject to a full suite of validation and verification tests
- Redundant network pathways for resilient highly available access to components and data
- Disk redundancy using parity
- Up to 28 cores per processor and 2.7GHz for high performance computing

An in-memory database requires high performance storage for data and log storage to preserve the integrity and availability of information across shutdown and fail-over scenarios.

Customers are adopting SAP HANA database quickly because they value the ability to aggregate and analyze data in real time. SAP HANA data compression in column stores, in-memory caching, and connections to big data technologies provide key elements in the formula for faster response times.
Target audience: This document is intended to assist chief information officers (CIOs), chief technology officers (CTOs), IT directors, data center managers, SAP solution architects, SAP database and basis administrators, storage administrators, and IT professionals who are involved in planning and deploying HPE ProLiant DL560 Gen10 for SAP HANA Scale-up Pre-Defined Solutions.

This document assumes the reader has experience with SAP HANA databases, familiarization with HPE ProLiant DL560 Gen10 server and an understanding of Linux® operating systems (SLES and RHEL).

Document purpose: The purpose of this document is to provide details on solution overview, design principles, solution components, and hardware involved to build an HPE ProLiant DL560 Gen10 Cascade Lake for SAP HANA Scale-up Pre-Defined Solutions.

Disclaimer: Products sold prior to the separation of Hewlett-Packard Company into Hewlett Packard Enterprise Company and HP Inc. on November 1, 2015 may have a product name and model number that differ from current models.

Solution overview

Hewlett Packard Enterprise and SAP have joined together to deliver SAP HANA in-memory database, and optionally in a resilient highly available configuration. The HPE ProLiant DL560 Gen10 for SAP HANA Scale-up Pre-Defined Solutions with the Intel Xeon Scalable 2nd Generation Processor architecture may be positioned as an operational data platform, or as a sidecar configuration for analytics.

Hewlett Packard Enterprise offers configurations that support large data volumes on SAP HANA database. These are enterprise-class, real-time analytics, or Suite on HANA (SoH) solutions optimized to run SAP business application workloads. These configurations use industry-leading HPE ProLiant DL560 Gen10 Servers and include following socket, drives and memory configurations.

<table>
<thead>
<tr>
<th>2 Socket</th>
<th>4 Socket</th>
<th>SSD</th>
<th>Memory Configuration in GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Y</td>
<td>3</td>
<td>192, 384, 576, 768</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>4</td>
<td>1152, 1536</td>
</tr>
<tr>
<td>N</td>
<td>Y</td>
<td>5</td>
<td>2304</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>6</td>
<td>3072</td>
</tr>
<tr>
<td>N</td>
<td>Y</td>
<td>12</td>
<td>6144</td>
</tr>
</tbody>
</table>

Note

- 576GB Configuration is not available for 4 Sockets Server
- All SSDs are of 3.2TB size unless otherwise specified
**Dual-purpose configuration** – Dual-purpose storage is available by adding an optional additional storage (HPE D3710 Disk Enclosure) with 2 - 25 x 1.8TB HDDs or 2 - 25 x 3.2TB SSDs attached to the HPE ProLiant DL560 Gen10 Server using an HPE Smart Array P408e-p SR Gen10 Controller. The dual-purpose configuration is used for configuring non-production SAP HANA database instances for development, test, and QA environments.

![Figure 1. HPE ProLiant DL560 Gen10 for SAP HANA Scale-up rack with 1 x HPE ProLiant DL560 Gen10 Servers with Intel Xeon Scalable Processor architecture using the 3 to 24 internal disk storage option (left side) and an HPE ProLiant DL560 Gen10 for SAP HANA Scale-up rack with 1 x HPE ProLiant DL560 Gen10 Servers with Intel Xeon Scalable Processor architecture using 1 x HPE D3710 Disk Enclosures for dual-purpose configurations (right side).](image-url)
**Design objectives**

The following are the key design objectives of the HPE ProLiant DL560 Gen10 for SAP HANA Scale-up Configurations with the Intel Xeon Scalable Processor architecture.

- Industry leading high-density HPE ProLiant DL560 Gen10 Server with two-processor and four-processor configurations
- Choice of the following processors, based on the Intel Xeon Scalable Platform architecture required for SAP HANA appliance:
  - Intel Xeon-Platinum 8280
  - Intel Xeon-Platinum 8276
  - Intel Xeon-Platinum 8280M
  - Intel Xeon-Platinum 8276M
  - Intel Xeon-Platinum 8280L
  - Intel Xeon-Platinum 8276L
- Other Intel Xeon processors that are at least silver and at least 8 cores / processor are allowed for TDI
- HPE Integrated Lights-Out (iLO 5) for system management
- HPE SmartMemory Registered (RDIMM) and Load Reduced (LRDIMM) DDR4 memory for data-intensive application workloads
- Choice of Ethernet adapters offer range of networking bandwidth (1Gb to 10/25Gb) enabling customers to adapt and grow to changing business needs
- Choice for storage of ranging from 3 to 24 internal SSDs, please refer tables 1 and 2 in the “Solution overview” section above for disk distribution details.
- Take advantage of HPE pre-defined solutions for SAP HANA with high-density, low power consumption, and low total cost of ownership (TCO)
- Factory integrated hardware and software for ease of deployment
- Exceed SAP Certification Requirements for the best performance
- Redundant components for high availability (HA)
- Supported versions of SAP certified OS are:
  - SLES12 SP4 or above
  - SLES 15 or above
  - Red Hat Enterprise Linux 7.6 or above

To check the latest supported OS with updates for SAP HANA on DL560 Gen10, please refer the SAP Hardware directory.

**Solution components and hardware**

**HPE ProLiant DL560 Gen10 hardware overview, storage, and network connection details**

The following Table 3 explains the configuration details for HPE ProLiant DL560 Gen10 with 2 socket processor.

<table>
<thead>
<tr>
<th>Hardware Components</th>
<th>2S Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processors</td>
<td>2 x CPU</td>
</tr>
<tr>
<td>Model</td>
<td>8280/8276 (2cpu/28 core per CPU)</td>
</tr>
<tr>
<td>Memory</td>
<td>RDIMMs - 8GB, 16GB, 32GB, 64GB</td>
</tr>
<tr>
<td></td>
<td>LRDIMMs - 64GB, 128GB</td>
</tr>
</tbody>
</table>

To check the latest supported OS with updates for SAP HANA on DL560 Gen10, please refer the SAP Hardware directory.
Hardware Components

<table>
<thead>
<tr>
<th>Network</th>
<th>2S Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network</td>
<td>4 port 1Gb ALOM and 4 port 1Gb NIC</td>
</tr>
<tr>
<td></td>
<td>2 x 10Gb/25Gb Mellanox or</td>
</tr>
<tr>
<td></td>
<td>2 x 10Gb fiber cards or 2 x 10Gb copper cards</td>
</tr>
</tbody>
</table>

| Internal Storage Controller  | Controller - 1x p816i-a Smart Array Controller                          |
|                              | SSD – 3 -24 3.2TB SAS SSD                                               |

| External Storage Controller  | 1 x HPE Smart Array P408e-p SR Gen10 Controller                           |

| Storage                      | 1x HPE D3710 Array                                                       |
|                              | 2 - 25 x 1.8TB HDDs                                                      |
|                              | 2 – 25 x 3.2TB SSDs                                                       |

The following figure shows the rear-view and storage connection details of DL560 Gen10 with 2-socket processor and Dual-Purpose DAS D3710.

Figure 2. HPE ProLiant DL560 Gen10 2S Scale-up components with DP
The following table explains the configuration details for HPE ProLiant DL560 Gen10 with 4 socket processor.

<table>
<thead>
<tr>
<th>Hardware Components</th>
<th>4S Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processors</td>
<td>4 x CPU</td>
</tr>
<tr>
<td>Model</td>
<td>8280/8276 (4cpu/28 core per CPU)</td>
</tr>
</tbody>
</table>
| Memory              | RDIMMs - 8GB, 16GB, 32GB, 64GB  
LRDIMMs - 64GB, 128GB |
| Network             | 4 port 1Gb ALOM and 4 port 1Gb NIC  
4 x 10Gb/25Gb Mellanox OR  
4 x 10Gb fiber cards or 4 x 10Gb copper cards |
| Internal Storage Controller | Controller - 1x p816i-a Smart Array Controller  
SSD – 3 – 24x 3.2TB SAS SSD |
| External Storage Controller | 1 x HPE Smart Array P408e-p SR Gen10 Controller |
| Storage             | 1x HPE D3710 Array  
2 - 25 x 1.8TB HDDs  
2 – 25 x 3.2TB SSDs |

The following figure shows the rear-view and storage connection details of DL560 Gen10 with 4-socket processor and Dual-Purpose (DP) DAS D3710.

![Figure 3. HPE ProLiant DL560 Gen10 4S Scale-up components with Dual Purpose (DP)](image-url)
Network Configuration

1. Update network drivers and firmware from HPE ProLiant DL560 Gen10 for SAP HANA Scale-up Configurations I/O firmware (Custom ISO), if not done previously.


3. Using your preferred OS tool, create network bonds as depicted in the following Figure 4 and configure your network according to customer requirements.

Table 5. HPE SAP HANA networking recommendations

<table>
<thead>
<tr>
<th>Network name</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intranet</td>
<td>This is the private intranet that exposes the SAP application services to users.</td>
</tr>
<tr>
<td>Client network</td>
<td>The network used by SAP HANA clients to connect to and make queries through SQL or SAP application interfaces to access the SAP HANA analytics and database.</td>
</tr>
<tr>
<td>SG/LX network</td>
<td>This is the HPE Serviceguard quorum network used to monitor and initiate failover.</td>
</tr>
<tr>
<td>HANA shared network</td>
<td>This is a private network used for sharing information between SAP HANA internals. This network is most commonly used for NFS traffic between SAP HANA nodes in a scale-out deployment.</td>
</tr>
<tr>
<td>HANA system replication</td>
<td>This is the SAP HANA system replication network.</td>
</tr>
<tr>
<td>Data network</td>
<td>The data network is for data traffic primarily from SAP application servers.</td>
</tr>
<tr>
<td>Backup network</td>
<td>This is a dedicated private network used for backing up SAP HANA data and log volumes using the HPE StoreOnce Catalyst Plugin for SAP HANA. It can also be used with other file-based backup services to protect other types of system data.</td>
</tr>
<tr>
<td>Management network</td>
<td>This network supports connections to management interfaces for the infrastructure and server equipment. This includes the management ports on switches, arrays, server iLOs, and any managed device in the environment. This also includes a management interface on the SAP HANA servers.</td>
</tr>
</tbody>
</table>
The following figure gives the network card and bond details of the HPE ProLiant DL560 Gen10 server with 2 socket processor and HPE Ethernet 10Gb 2-port 562T Adapter.

**Figure 4.** HPE ProLiant DL560 2S Scale-up network configuration for 562T adapter
The following figure shows the network card and bond details of the HPE ProLiant DL560 Gen10 server with 2-socket processor and HPE Ethernet 10Gb 2-port 562SFP Adapter or HPE Ethernet 10/25Gb 2-port 640SFP Adapter:

**Figure 5.** HPE ProLiant DL560 Gen10 2S Scale-up network configuration for 562SFP or 640SFP adapter
The following figure shows the network card and bond details of the HPE ProLiant DL560 Gen10 server with 4-socket processor and HPE Ethernet 10Gb 2-port 562T Adapter:

![Network Diagram](image)

Figure 6. HPE ProLiant DL560 Gen10 4S Scale-up network configuration for 562T adapter
The following figure shows the network card and bond details of the HPE ProLiant DL560 Gen10 server with 4 socket processor and HPE Ethernet 10Gb 2-port 562SFP Adapter or HPE Ethernet 10 / 25Gb 2-port 640SFP Adapter.

**Figure 7.** HPE ProLiant DL560 Gen10 4S Scale-up network configuration for 562SFP or 640SFP adapter
Storage Layout
The following figures show the disk connectivity details; if you notice that, all the supported disk configurations are not represented here.

The disk details shown are for 3 SSDs, 8 SSDs, and 12 SSDs only in Figures 8, 9, and 10.

Refer to Table 2 and Table 3 in the “Solution Overview” section that explains all supported disks and ratios with respect to processors and memory.

The HPE ProLiant DL560 Gen10 server with 2 socket processor and 3 x 3.2TB SSD.

Figure 8. HPE DL560 Gen10 Scale up 3 x 3.2TB SSD disks [2S]

The HPE ProLiant DL560 Gen10 server with 4 socket processor and 8 x 3.2TB SSD.

Figure 9. HPE ProLiant DL560 Gen10 Scale up 8 x 3.2TB SSD disks [4S]
The HPE ProLiant DL560 Gen10 server with 4 socket processor and 12 x 3.2TB SSD.

![HPE DL560 Gen10 for SAP HANA](image)

Figure 10. HPE ProLiant DL560 Gen10 Scale up 12 x 3.2TB SSD disks [45]

**Storage description and protection options**

When looking at the SAP HANA database solution, there are many key hardware and software components that need to be protected.

The SAP HANA database server includes different sources of data to protect. This includes SAP HANA data, logs, shared configuration files, SAP HANA user data and the boot OS. Table below shows each of these storage description and protection options.

**Table 5. Storage description and protection options for SAP HANA**

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
<th>Typical Location</th>
<th>Protection Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>The data directory is where the SAP HANA database data is persisted to disk. Every five minutes the latest changes in the database are updated to this directory. Note: An SAP HANA full data backup does not include logs and configuration settings.</td>
<td>/hana/data</td>
<td>SAP HANA data backup, SAP HANA data snapshots, Backint for SAP HANA, storage snapshots, and storage replication.</td>
</tr>
<tr>
<td>Log</td>
<td>The log directory is where individual database transactions are logged as they are updated to the in-memory database. These transaction files are persisted to the log directory until logs are stored. They are preserved as long as there is storage space.</td>
<td>/hana/log</td>
<td>SAP HANA log backup, Backint for SAP HANA, storage replication.</td>
</tr>
<tr>
<td>Shared</td>
<td>The shared directory stores the copy of the SAP HANA database server configuration and is typically part of a shared-storage configuration using NFS or some other sharing technology.</td>
<td>/hana/shared</td>
<td>Traditional file backup, storage replication.</td>
</tr>
<tr>
<td>User</td>
<td>User and SAP HANA user executable files for administering and managing the SAP HANA database.</td>
<td>/usr/sap</td>
<td>Traditional file backup, storage replication.</td>
</tr>
<tr>
<td>OS Boot</td>
<td>The primary boot volume for the operating system.</td>
<td>/</td>
<td>Traditional file backup, mirrored drives, partition cloning, storage replication.</td>
</tr>
</tbody>
</table>
Dual Purpose

In case of HA/DR Dual Purpose, the additional SmartRAID controller and HPE D3710 have to be installed and configured accordingly. Proceed as for the previous Controller by configuring the volumes and creating the required file systems.

The following figure provides the details of disks connected to External DAS D3710 with 13 x 1.8TB HDD. Number of disks can vary from 2 to 25 and can be 3.2TB SSDs.

Software

HPE Insight Remote Support

HPE Insight Remote Support is a software solution that supports the HPE ProLiant DL560 Gen10 for SAP HANA and enables reactive and proactive remote support to improve the availability of supported servers, storage systems, and other devices in customers' data centers. HPE Insight Remote Support relies on several Hewlett Packard Enterprise components and communication between various software applications within the customer enterprise and between the customer enterprise and Hewlett Packard Enterprise to deliver support services. Agent software components are installed on the SAP HANA and auxiliary servers providing a holistic management for both virtual and physical environments.

Services

All the configurations in the HPE ProLiant DL560 Gen10 for SAP HANA are available as a standard offering with Factory Express Level 4 services that leverage Hewlett Packard Enterprise factory integration capabilities and skills on SAP HANA database. These services include installation of SUSE® Linux Enterprise Server and Red Hat® Enterprise Linux operating system software and SAP HANA database software at the factory, and on-site installation and configuration. With HPE Factory Express Deployment service, the majority of the integration is performed in the Hewlett Packard Enterprise factory so the solution is delivered pre-built and tested to the highest level of quality, ready to plug in and switch on. Hewlett Packard Enterprise helps customers in reducing the deployment time with hardware built to exact specifications, and tested as a complete solution, then shipped as a turn-key solution from the Hewlett Packard Enterprise factory and ready-to-run in their data center. This means the customers receive a pre-integrated, pre-tested, ready-to-use solution. The goal is to put our expertise to work for customers’ business, and thus saving time, money, and resources while it frees staff to focus on customers’ core business.

The HPE ProLiant DL560 Gen10 for SAP HANA Scale-up Configurations with the Intel Xeon Scalable Processor architecture are based on the following Hewlett Packard Enterprise services:

- HPE Factory Integration through HPE Pointnext Factory Express Deployment Services that provide hardware integration, validation, and on-site installation
- HPE Pointnext Deployment Accelerator Service for SAP HANA to get you up and running on SAP HANA quickly
- HPE Pointnext Proactive Care provides a single source support for the complete HPE ProLiant DL560 Gen10 for SAP HANA system, including the software

Once the configuration is purchased, a process is started. To order, contact your Hewlett Packard Enterprise sales representative.
• A site preparation document with all the pertinent information is filled in that is required to assemble and configure the configuration to conform to the site environment.

• The configuration is assembled, racked, cabled, software is loaded, and the configuration is tested at the HPE Factory Express integration facility.

• The configuration is carefully packaged and shipped to the site.

• An HPE Customer Engineer unpacks the configuration, moves it into location, and connects it to the site.

• An HPE team is engaged to assist with final configuration and bringing SAP HANA database online.

Hewlett Packard Enterprise Services covers the complete lifecycle including design, factory integration, on-site deployment, in-field add-on upgrades and reconfiguration, and proactive and reactive support.

After this point, if additional service engagements have been ordered, these services may take over to help extract, transform, and load data from existing systems into SAP HANA database and help integrate SAP HANA with existing systems.

**Licensing considerations**

The following software requires licensing in this configuration:

• SAP HANA in-memory database

• SAP HANA Studio/Cockpit

• HPE ProLiant Support Pack (SPS)

All the configurations in the HPE ProLiant DL560 Gen10 for SAP HANA Scale-up contain a copy of the SAP in-memory appliance software by SAP. Each SAP product is subject to its respective SAP end-user license agreement. The HPE computer product license does not contain a license to SAP HANA database software by SAP. You are not licensed to use the copy of the SAP HANA database software by SAP contained in the Hewlett Packard Enterprise computer system until you have purchased or have available for use the appropriate license from SAP or its authorized distributors. Contact your SAP representative to obtain the applicable license rights to use the SAP software.
Resources and additional links
HPE Reference Architectures, hpe.com/info/ra

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