HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus Servers Building Blocks for SAP Implementation

Intel® Xeon® Scalable 3rd Generation (Ice Lake) Processors

CONTENTS

EXECUTIVE SUMMARY

Hewlett Packard Enterprise is #1 in SAP HANA server deployments with approximately 40% of the market share for SAP systems. Ranked #1 in scale-up and scale-out capacity, Hewlett Packard Enterprise commands a wide margin, and leadership, in total SAP systems deployed, SAP HANA Appliances, Tailored Data center Integration (TDI), SAP BW/4HANA, and SAP S/4HANA.

With nearly 34,000+ servers deployed at thousands of SAP HANA customers worldwide, complemented by an unmatched services portfolio, Hewlett Packard Enterprise brings a unique understanding of SAP and SAP HANA environments that help the customers to de-risk their SAP HANA adoption journey.

Hewlett Packard Enterprise offers a differentiated infrastructure portfolio for SAP HANA designed to address a broad range of customer needs beginning with production systems for small and medium businesses to highly scalable solutions for mission-critical environments, including the application tier. For more information, see the Hewlett Packard Enterprise Solutions for SAP HANA page.

HPE Pointnext Services provide truly comprehensive SAP solutions for the Hybrid Cloud leveraging experience from over 1500 SAP HANA consulting projects and supporting over 25,000 SAP customers.

SAP HANA® is a modern technology that offers an in-memory database, enables a radically different application architecture, and provides a new philosophy about data model simplicity. SAP HANA offers a new way to solve 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.

Hewlett Packard Enterprise and SAP® work together to improve the enterprise capabilities of IT organizations, to meet their business needs, safeguarding their current investments in data center infrastructure, tools, and operational processes.

This document describes the implementation of the HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers with internal storage configurations based on Intel® Xeon® Scalable 3rd Generation processor (Ice Lake). These servers with internal storage support a wide variety of memory and disk configurations that SAP supports.

Target audience: This document is for Enterprise Solution Architects, Deployment or Implementation Engineers, and others to learn about the implementation of HPE Solution for SAP HANA using HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers.

Document purpose: This document describes the architectural and technical overview required while using HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers to deploy in-memory SAP HANA Database with Intel Xeon Scalable 3rd Generation processors.

HPE SAP HANA Solution Building Block described in this paper is based on an outcome-based model. HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus server's compute blocks are certified for SAP TDI implementation under SAP HANA TDI Phase V and VI.

INTRODUCTION

Hewlett Packard Enterprise building blocks provide customers with more flexibility and choices for integrating SAP HANA into their data centers. With the HPE building blocks for the SAP HANA approach, customers can choose their preferred hardware and infrastructure components from a menu of supported hardware. Significantly lower costs and easier integration of SAP HANA into data centers can be achieved by enabling customers to leverage existing hardware and operation processes in their data centers.

SAP HANA solutions are offered as building blocks for the following Intel Xeon architectures and platforms:

HPE ProLiant DL360 Gen10 Plus Server

The HPE ProLiant DL360 Gen10 server delivers security, agility, and flexibility without any compromise. With the right balance of expandability and density, the compact 1U server delivers enhanced performance. Designed for supreme versatility and resiliency while backed by a comprehensive warranty, the HPE ProLiant DL360 Gen10 Plus server is ideal for IT infrastructure, either physical, virtual, or containerized.

Powered by 3rd Generation Intel Xeon Scalable Processors, delivering up to 40 cores, 3200 MT/s memory, and introducing PCIe Gen4 and Intel Software Guard Extension (SGX) support to the dual-socket segment, the HPE ProLiant DL360 Gen10 Plus server delivers premium compute, memory, I/O, and security capabilities for customers focused on performance. Deploy this 2P secure platform for diverse workloads in space space-constrained environments.

HPE ProLiant DL380 Gen10 Plus Server

The HPE ProLiant DL380 Gen10 server is securely designed to reduce cost and complexity. The HPE ProLiant DL380 Gen10 Plus server offers unprecedented levels of performance for databases and analytical workloads. Run everything from the most basic to mission critical applications and deploy them with confidence. Designed for supreme versatility and resiliency, this 2U/2P platform is capable of deployment in multiple environments, built on 3rd Generation Intel Xeon Scalable Processors, and backed by a comprehensive warranty. Equipped with PCIe Gen4 capabilities, the HPE ProLiant DL380 Gen10 Plus server offers improved data transfer rates and higher networking speeds.

SOLUTION OVERVIEW

Hewlett Packard Enterprise offers a portfolio of infrastructure solutions for SAP HANA based on HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers built by using the latest Intel Xeon Scalable 3rd Generation processors. These servers deliver security, agility, and flexibility without any compromise. Deploy these secure platforms for diverse workloads in space-constrained environments.

The solution configurations and combinations mentioned in this document have been tested in a standard lab environment. Information on how these configurations is built is provided in the Solution Configuration section.

Table 1 shows the overview of solution configurations for HPE ProLiant DL380 Gen10 Plus and HPE ProLiant DL360 Gen10 Plus servers.

TABLE 1. Solution Configurations overview

Server	Component Description
HPE ProLiant DL380 Gen10 Plus server	2s/6TB DRAM and PMem with P816i-a Controller
	2s/4TB DRAM with SR932i-p Controller
	2s/768GB DRAM with 2xSR932i-p Controller and with Internal Dual-Purpose Storage
	2s/2TB DRAM with SR932i-p and P408e-p Controller with External Dual-Purpose Storage
HPE ProLiant DL360 Gen10 Plus server	2s/128GB DRAM with P816i-a Controller
	2s/4TB DRAM and PMem with SR932i-p Controller

The configurations above have been chosen based on the following criteria used during the testing process:

- Number of processors: 2

- Types of processors used for TDI configuration

- Type of SSDs used: SAS/SATA/NVMe 3.2TB SSD or 6.4TB SSD

- Supported memory combinations are mentioned in the Memory section of this document respectively

- Supported storage sizing options are mentioned in the Storage section of this document respectively

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NOTE

Design and implementation recommendations made in this document are only for SAP HANA implementations.

Hardware - HPE ProLiant DL360 Gen10 Plus Server

The HPE ProLiant DL360 Gen10 Plus server is built by using 2-socket Intel Xeon Scalable 3rd Generation processors with 3 Ultra Path Interconnect (Intel UPI) links per processor. HPE ProLiant DL360 Gen10 Plus server comes with a choice of maximum 3 PCIe Gen4 expansion slots, 10SFF drive cage bay, and high-performance all-DDR4 RAM supporting from 128GB to 8TB shared memory or a combination of DDR4 RAM and Persistent Memory with Intel® Optane™ Persistent Memory for Hewlett Packard Enterprise ranging from 3TB to 12TB of shared memory for SAP HANA solutions.

HPE ProLiant DL360 Gen10 Plus server solutions for SAP HANA support 2-socket Intel Xeon Scalable processors with 8 cores per socket for a maximum of 40 cores. For more information on the HPE ProLiant DL360 Gen10 Plus server, refer to the below links:

- HPE ProLiant DL360 Gen10 Plus server - Quickspecs

- HPE ProLiant DL360 Gen10 Plus server - Overview

- HPE ProLiant DL360 Gen10 Plus server - User Guide

- HPE ProLiant DL360 Gen10 Plus server - Specifications

Figure 1 shows the front and backplane view of a 2-socket HPE ProLiant DL360 Gen10 Plus server.

FIGURE 1. HPE ProLiant DL360 Gen10 Plus server front and backplane view

Hardware - HPE ProLiant DL380 Gen10 Plus Server

HPE ProLiant DL380 Gen10 Plus server comes with the choice of a maximum 8 PCIe Gen4 expansion slots, maximum 16SFF drive cage bay, and high-performance all-DDR4 RAM supporting from 128GB up to 8TB shared memory or a combination of DDR4 RAM and Persistent Memory supported with Intel Optane Persistent Memory ranging from 3TB up to 12TB of shared memory for SAP HANA solutions.

HPE ProLiant DL380 Gen10 Plus server solutions for SAP HANA support 2-socket Intel Xeon Scalable processors with 8 cores per socket for a maximum of 40 cores. For more information on the HPE ProLiant DL380 Gen10 Plus server, refer to the below links:

- HPE ProLiant DL380 Gen10 Plus server - Quickspecs

- HPE ProLiant DL380 Gen10 Plus server - Overview

- HPE ProLiant DL380 Gen10 Plus server - User Guide

- HPE ProLiant DL380 Gen10 Plus server - Specifications

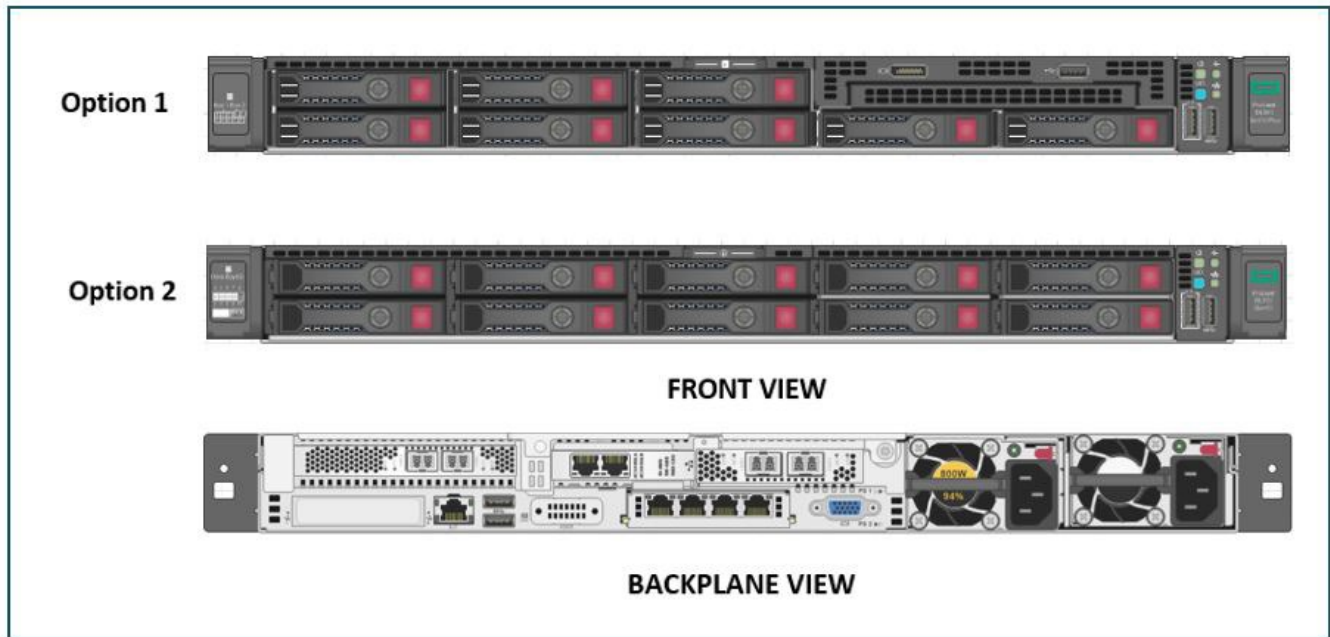Figure 2 shows the front and backplane view of a 2-socket HPE ProLiant DL380 Gen10 Plus server.
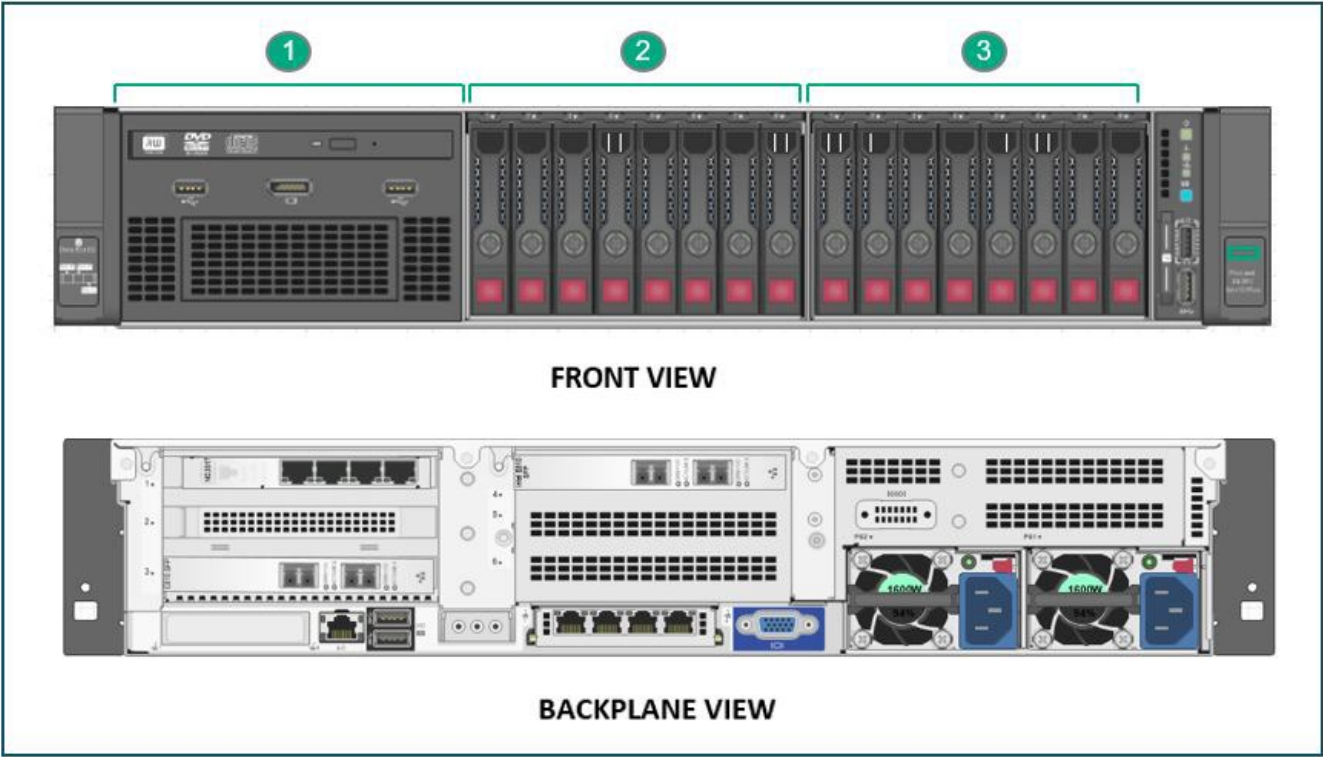
FIGURE 2. HPE ProLiant DL380 Gen10 Plus server front and backplane view

Table 2 shows the technical specifications of the HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers.

NOTE
The offerings and features mentioned in Table 2 are tested and validated based on the SAP HANA specifications and implementations. For generic details refer to the HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 server's respective support links provided in the Hardware section.

TABLE 2. HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers' technical specifications overview

Server Hardware Component	HPE ProLiant DL380 Gen10 Plus Server - Component Description	HPE ProLiant DL360 Gen10 Plus Server - Component Description
Server front view	Box 1 - Universal Media Bay (optional) Box 2 – Up to 8SFF Drive Cage Bay Box 3 – Up to 8SFF Drive Cage Bay	Option 1 – Up to 8SFF Device Bay Numbering and Universal Media Bay (optional) Option 2 – Up to 10 SSD (8SFF + 2SFF) Device Bay Numbering
Server backplane view	6 Full Height PCIe and 2 Half Height PCIe Slots	1 Full Height PCIe and 2 Half Height PCIe Slots
Number of processors	Two Intel Xeon Scalable processors	Two Intel Xeon Scalable 3rd Generation processors
Processor core available	8 – 40	8 – 40
Processor cache	24 - 60MB L3, depending on processor	24 - 60MB L3, depending on processor
Form factor	2U	1U

Server Hardware Component	HPE ProLiant DL380 Gen10 Plus Server - Component Description	HPE ProLiant DL360 Gen10 Plus Server - Component Description
Memory type – DDR4	HPE 8GB Single Rank x4 PC4-3200AA-R Smart Kit HPE 16GB Single Rank x4 PC4-3200AA-R Smart Kit HPE 16GB Dual Rank x8 PC4-3200AA-R Smart Kit HPE 32GB Single Rank x4 PC4-3200AA-R Smart Kit HPE 32GB Dual Rank x4 PC4-3200AA-R Smart Kit HPE 64GB Dual Rank x4 PC4-3200AA-R Smart Kit HPE 128GB Quad Rank x4 PC4-3200AA-L Smart Kit HPE 256GB Octal Rank x4 PC4-3200AA-L 3DS Smart Kit	HPE 8GB Single Rank x4 PC4-3200AA-R Smart Kit HPE 16GB Single Rank x4 PC4-3200AA-R Smart Kit HPE 16GB Dual Rank x8 PC4-3200AA-R Smart Kit HPE 32GB Single Rank x4 PC4-3200AA-R Smart Kit HPE 32GB Dual Rank x4 PC4-3200AA-R Smart Kit HPE 64GB Dual Rank x4 PC4-3200AA-R Smart Kit HPE 128GB Quad Rank x4 PC4-3200AA-L Smart Kit HPE 256GB Octal Rank x4 PC4-3200AA-L 3DS Smart Kit
Memory type – PMem	Intel Optane 128GB Persistent Memory 200 series for HPE Intel Optane 256GB Persistent Memory 200 series for HPE Intel Optane 512GB Persistent Memory 200 series for HPE	Intel Optane 128GB Persistent Memory 200 series for HPE Intel Optane 256GB Persistent Memory 200 series for HPE Intel Optane 512GB Persistent Memory 200 series for HPE
Memory slots	Max. 32 DIMM slots	Max. 32 DIMM slots
Storage controllers	SmartRAID SR932i-p Gen10 Plus Controller HPE Smart Array P816i-a SR Gen10 Controller	SmartRAID SR932i-p Gen10 Plus Controller HPE Smart Array P816i-a SR Gen10 Controller
Storage drive description	16SFF	10SFF
Storage drive backplane	2U 8SFF SAS/SATA 12G BC Front Bay 1/2 Drive Cage Kit 2U 8SFF x4 Tri-Mode 24G U.3 BC Front Drive Cage Kit 2U 8SFF x1 Tri-Mode 24G U.3 BC Front Drive Cage Kit	8SFF SAS/SATA 12G BC Backplane Kit 8SFF x4 Tri-Mode 24G U.3 BC Backplane Kit 8SFF x1 Tri-Mode 24G U.3 BC Backplane Kit 8SFF x4 NVMe 16G U.2 BC Backplane Kit
Drive supported	2.5-inch SFF NVMe/SAS/SATA SSDs	2.5-inch SFF NVMe/SAS/SATA SSDs
Power supply type	HPE 800W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit HPE 1600W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit	HPE 500W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit HPE 800W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit HPE 1600W Flex Slot Platinum Hot Plug Low Halogen Power Supply Ki
Minimum dimensions (H x W x D)	44.55 x 73.03 x 8.74 cm	43.46 x 70.7 x 4.29 cm
Weight (metric)	14.76 kg	13.04 kg

CAPACITY AND SIZING

SAP HANA is an in-memory database that stores and processes the bulk of its data in the memory. Additionally, it provides protection against data loss by saving the data in persistent storage locations. For setting up an SAP HANA system, the storage layer must fulfill several requirements. This section discusses the different requirements and common design options for the storage subsystem. Especially while using high availability (HA) and disaster tolerance features, care must be taken in planning the persistent space.

Sizing is often performed at the early stage of the project where the business process and application requirements will be translated into hardware infrastructure requirements. Sizing activity includes consolidating the requirement of CPU, memory, storage, power, network, and I/O throughput.

As SAP HANA is an in-memory database, it is important to save a copy of the data against any data loss by saving it in persistent storage. SAP HANA will be used for various purposes like BW/DM/S4H etc. and the infrastructure required will vary. The persistent storage layer must fulfill various requirements. One major criterion is the SAP HANA Appliance or SAP HANA TDI Implementation. The section guides the consumer on how to consider the various sizing aspects.

For more information on SAP HANA Sizing, see SAP HANA Sizing.

Processor

Intel® Xeon® Scalable 3rd Generation processor is designed for advanced in-memory analytics, artificial intelligence, and high-density server infrastructure, new Intel Xeon Platinum 8300 processors deliver new levels of performance, platform capabilities, and industry-leading workload acceleration.

Ice Lake is built on the Sunny Cove microarchitecture. Intel released details of Ice Lake and stated that the Sunny Cove core Ice Lake would be focusing on single-thread performance, new instructions, and scalability improvements. Intel stated that the performance improvements would be achieved by making the core "deeper, wider, and smarter".

Figure 3 shows the Intel processor numbering for the Ice Lake processor.
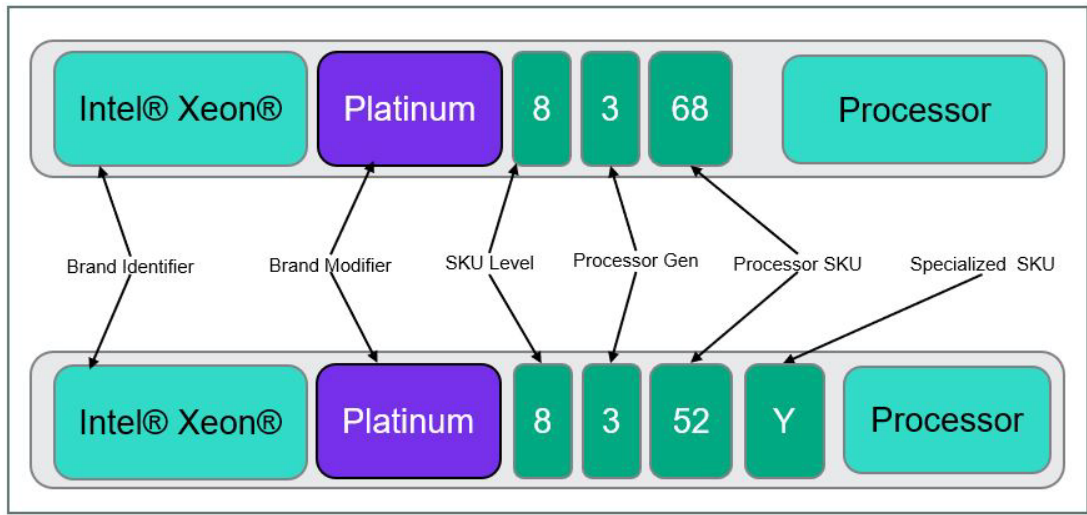
FIGURE 3. Intel processor numbering for Ice Lake processor

Table 3 shows the alphanumeric string which describes the characteristics of the Intel Xeon Processor.

TABLE 3. Alphanumeric string which describes the characteristics of Intel Xeon processor

Component	Description
SKU Level:	
8	Platinum
6, 5	Gold
Processor Generation:	
3	3rd Gen. Intel Xeon Scalable Processors (Ice Lake)
Specialized SKU:	
Y	Intel Speed Select Technology – Performance Profiles
P	Virtualization optimized (with a focus on clock frequency)
V	Virtualization optimized (with focus on high-density/low power)
N	Network function virtualization (NFV) optimized
U	Single socket optimized
S	Max SGX enclave size

NOTE

Regular Processors are recommended for SAP HANA use, not specialized SKU.

A few of the major innovations of Intel Xeon Scalable 3rd Generation CPU are as follows:

- Intel Xeon Platinum 8300 processors, Gold 6300 & 5300 processors

- Intel Optane persistent memory 200 series

- Enhanced DDR performance up to 3200 MT/s

- All CPU models support up to 6TB per socket (combined system memory and Optane persistent memory)

- Intel Deep Learning Boost

- Increased link speed between CPU sockets: 11.2GT/s UPI links

- Integrated hardware-based security improvements and total memory encryption

- In-memory applications will be benefitted from Intel Xeon Scalable 3rd Generation App Direct Mode.

For the implementation of SAP HANA, it is important to understand the processor requirements according to their specification, define the memory, and storage requirements.

Table 4 shows the Hewlett Packard Enterprise offerings for SAP HANA Appliance and TDI Implementation.

TABLE 4. Intel Xeon 3rd Generation processor offerings on HPE ProLiant DL380 Plus server and HPE ProLiant DL360 Gen10 Plus server for SAP HANA

HANA implementation Type	Processor Model	Speed (GHz)	Core/Socket	Per Socket Memory Capacity (TB)	CPU Cache (MB)	Memory Speed Max. (MHz)	TDP in Watt	Maximum Socket Support
Appliance/TDI	8380	2.3	40	6.0	60	3200	270	2
Appliance/TDI	8368	2.4	38	6.0	57	3200	270	2
TDI	8358	2.6	32	6.0	48	3200	250	2
TDI	6338	2.0	32	6.0	48	3200	205	2
TDI	6348	2.6	28	6.0	42	3200	235	2
TDI	6330	2.0	28	6.0	42	3200	205	2
TDI	5320	2.2	26	6.0	39	2933	185	2
TDI	6342	2.8	24	6.0	36	3200	230	2
TDI	4316	2.3	20	6.0	30	2667	150	2
TDI	6354	3.0	18	6.0	39	3200	205	2
TDI	4314	2.4	16	6.0	24	2667	135	2
TDI	6326	2.9	16	6.0	24	3200	185	2
TDI	6346	3.1	16	6.0	36	3200	205	2
TDI	4310	2.1	12	6.0	18	2667	120	2
TDI	5317	3.0	12	6.0	18	2933	150	2
TDI	6334	3.6	8	6.0	18	3200	165	2
TDI	8360Y	2.4	36	6.0	54	3200	250	2
TDI	8352V	2.1	36	6.0	54	2933	195	2
TDI	8352Y	2.2	32	6.0	48	3200	205	2
TDI	8358P	2.6	32	6.0	48	3200	240	2
TDI	6338N	2.2	32	6.0	48	2667	185	2
TDI	8352S	2.2	32	6.0	48	3200	205	2

HANA implementation Type	Processor Model	Speed (GHz)	Core/Socket	Per Socket Memory Capacity (TB)	CPU Cache (MB)	Memory Speed Max. (MHz)	TDP in Watt	Maximum Socket Support
TDI	6330N	2.2	28	6.0	42	2667	165	2
TDI	5318Y	2.1	24	6.0	36	2933	165	2
TDI	6336Y	2.4	24	6.0	36	3200	185	2
TDI	5318N	2.1	24	6.0	36	2667	150	2
TDI	5318S	2.1	24	6.0	36	2933	165	2
TDI	4309Y	2.8	8	6.0	12	2667	105	2
TDI	5315Y	3.2	8	6.0	12	2933	140	2

Memory

SAP HANA is an in-memory database application and can run the workload upon the large pool of memory. SAP HANA looks for a compute node with homogenous and symmetric assembly of DIMMs across channels and maximizes utilization of all memory channels per processor.

Memory per core ratio is defined by SAP and at regular intervals, SAP releases the T-shirt sizes for SAP HANA defining the memory per core ratio.

In addition to the SAP T-shirt sizes, it is important to understand the hardware and their capabilities to support the SAP T-shirt sizing to run the SAP HANA in-memory database.

Based on the SAP T-shirt sizing and HPE hardware capabilities, there are a set of offerings available, and these are defined in the following sections.

Table 5 shows the DDR4 memory type and size options available with this solution.

TABLE 5. DDR4 DRAM Memory type and size

DDR4 Memory Module
HPE 8GB Single Rank x4 PC4-3200AA-R Smart Kit
HPE 16GB Single Rank x4 PC4-3200AA-R Smart Kit
HPE 16GB Dual Rank x8 PC4-3200AA-R Smart Kit
HPE 32GB Single Rank x4 PC4-3200AA-R Smart Kit
HPE 32GB Dual Rank x4 PC4-3200AA-R Smart Kit
HPE 64GB Dual Rank x4 PC4-3200AA-R Smart Kit
HPE 128GB Quad Rank x4 PC4-3200AA-L Smart Kit
HPE 256GB Octal Rank x4 PC4-3200AA-L 3DS Smart Kit

In Table 6 the first column shows the Pure DRAM size offerings and then the next column shows the number of DIMMs and their combinations.

TABLE 6. DRAM memory offerings for Ice Lake based solutions

Total Memory (GB)	2 CPU Memory Configuration (Kits)
128	16 x 8GB
256	16 x 16GB or 32 x 8GB
512	16 x 32GB or 32 x 16GB
768[1]	16 x 16GB and 16 x 32GB
1024	16 x 64GB or 32 x 32GB
1536[2]	16 x 32GB and 16 x 64GB
2048	16 x 128GB or 32 x 64GB
4096	16 x 256GB or 32 x 128GB
8192	32 x 256GB – not supported with core-to-memory ratio

[1] Mixed memory configuration of 16GB RDIMM DDR4 and 32GB RDIMM DDR4. Populated with ½ each type
[2] Mixed memory configuration of 32GB RDIMM DDR4 and 64GB RDIMM DDR4. Populated with ½ each type

Figure 4 shows the memory offerings for Ice Lake-based solutions according to the defined T-shirt sizing for SAP HANA Appliance on Ice Lake by SAP. Pure DRAM-based solutions are supported by SAP from 128GB to 2TB for BW and from 128GB to 4TB for Suite/S4.
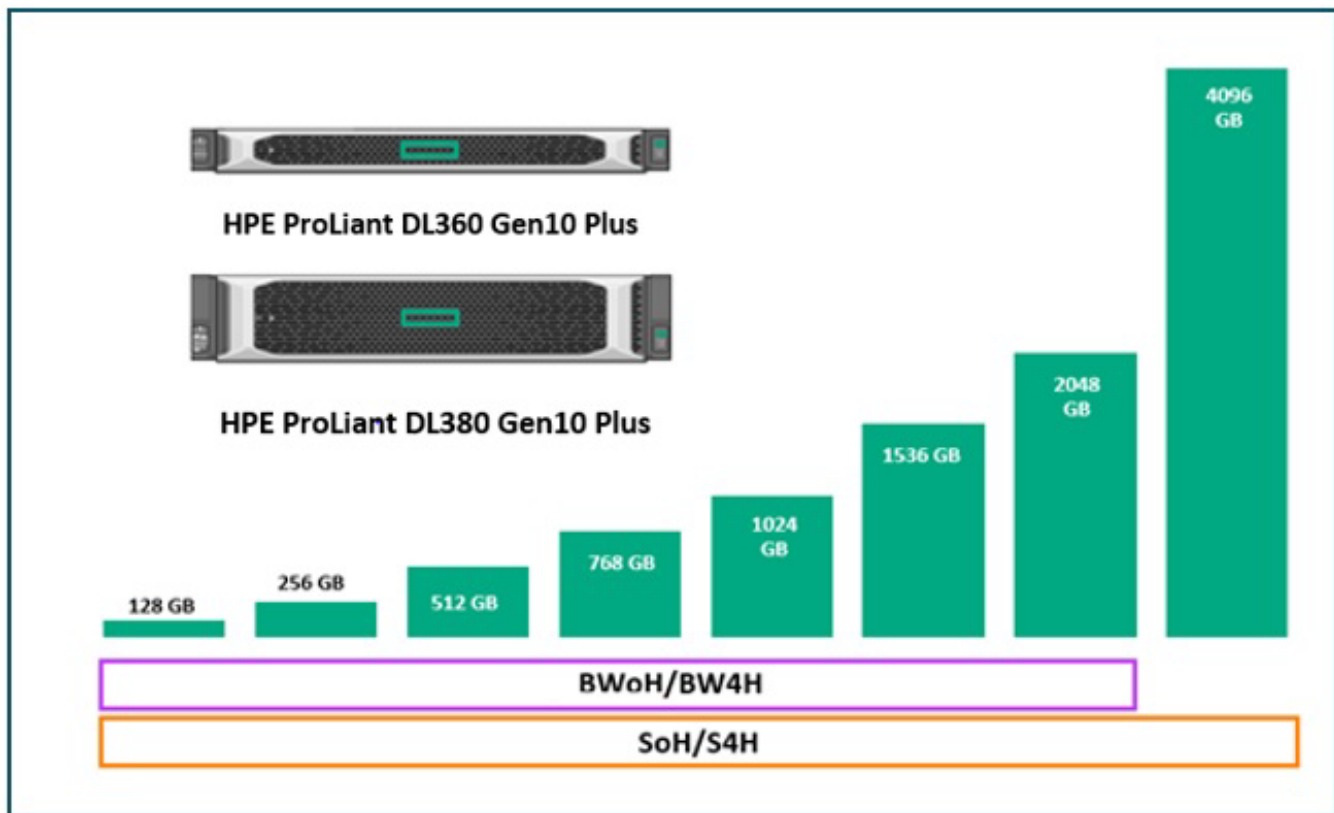

FIGURE 4. DRAM memory offerings for Ice Lake-based solutions

For more details on sizing, see the SAP Sizing portal.

Persistent Memory

Persistent Memory describes technologies that store data in the dual in-line memory module (DIMM) format (memory that resides on the memory bus), that's accessed by using memory instructions, and is non-volatile (data is retained even after power is removed). Hewlett Packard Enterprise is delivering this technology in a new HPE Persistent Memory module format, featuring Intel® Optane™ DC persistent memory.

Persistent Memory possesses properties of both dynamic random-access memory (DRAM) and storage, but it doesn't replace the DRAM. Figure 5 shows the Persistent Memory and memory types by their tier. Here, as shown persistence memory is a tier between DRAM and flash storage. What makes HPE Persistent Memory technology stand out is that it is fast enough for the processor to access directly without stopping for the block I/O required for traditional storage.
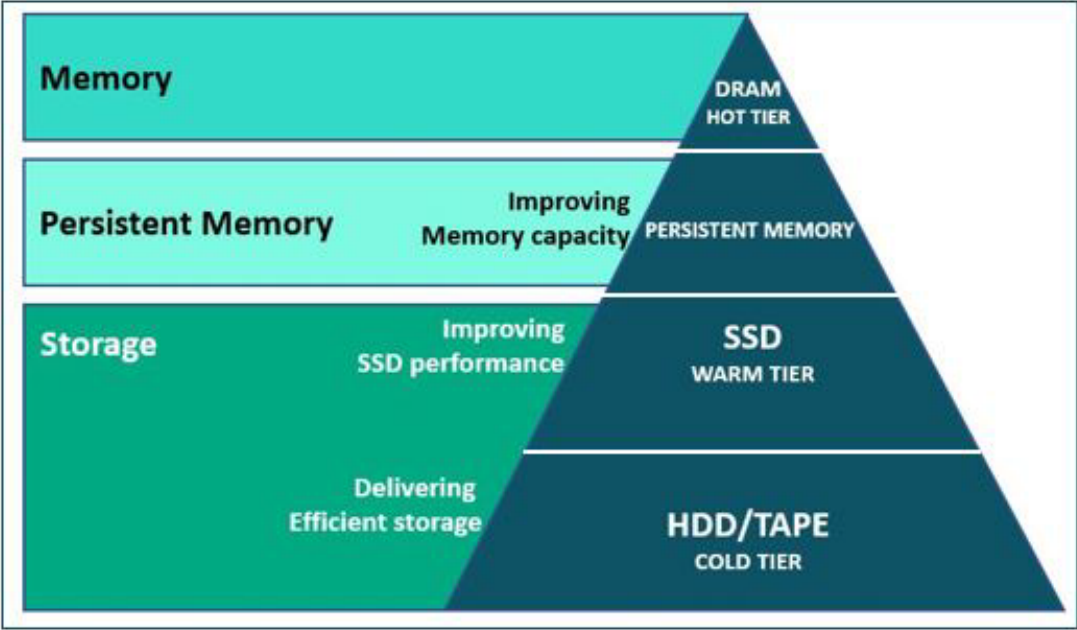

FIGURE 5. HPE Persistent Memory and remaining memory types by tier

Applications can access Persistent Memory–resident data structures, as they do with traditional memory, eliminating the need for page blocks of data to be swapped back and forth between the memory and storage. Persistent Memory cannot replace DRAM memory completely and SAP HANA must be used in conjunction with DRAM to operate. To leverage this lower-latency, higher speed data access, we need a software architecture that allows applications to connect with the different ranges of Persistent Memory.

NOTE
HPE Persistent Memory is only supported on Gold and Platinum Processors.

Table 7 shows the HPE Persistent Memory modules and the available sizes with this solution:

TABLE 7. Persistent Memory types and sizes

Persistent Memory Modules
Intel Optane 128GB persistent memory 200 series for HPE
Intel Optane 256GB persistent memory 200 series for HPE
Intel Optane 512GB persistent memory 200 series for HPE

Table 8 shows the recommended memory solution offerings with DRAM + PMem combination.

TABLE 8. DRAM + Persistent Memory offerings

Total Memory (GB)	2 CPU Memory Configuration (Kits)
3072	16 x 64GB (DRAM) and 16 x 128GB (PMem)
4096	16 x 128GB (DRAM) and 16 x 128GB (PMem)
5120	16 x 64GB (DRAM) and 16 x 256GB (PMem)
6144	16 x 128GB (DRAM) and 16 x 256GB (PMem)
6144	16 x 256GB (DRAM) and 16 x 128GB (PMem)
8192	16 x 256GB (DRAM) and 16 x 256GB (PMem)
10240	16 x 128GB (DRAM) and 16 x 512GB (PMem)
12288	16 x 256GB (DRAM) and 16 x 512GB (PMem)

Figure 6 shows the DRAM + Persistent Memory offerings. This is based on the recommended ratio of 1:1, 1:2, 1:4, and 2:1 DRAM to PMem.
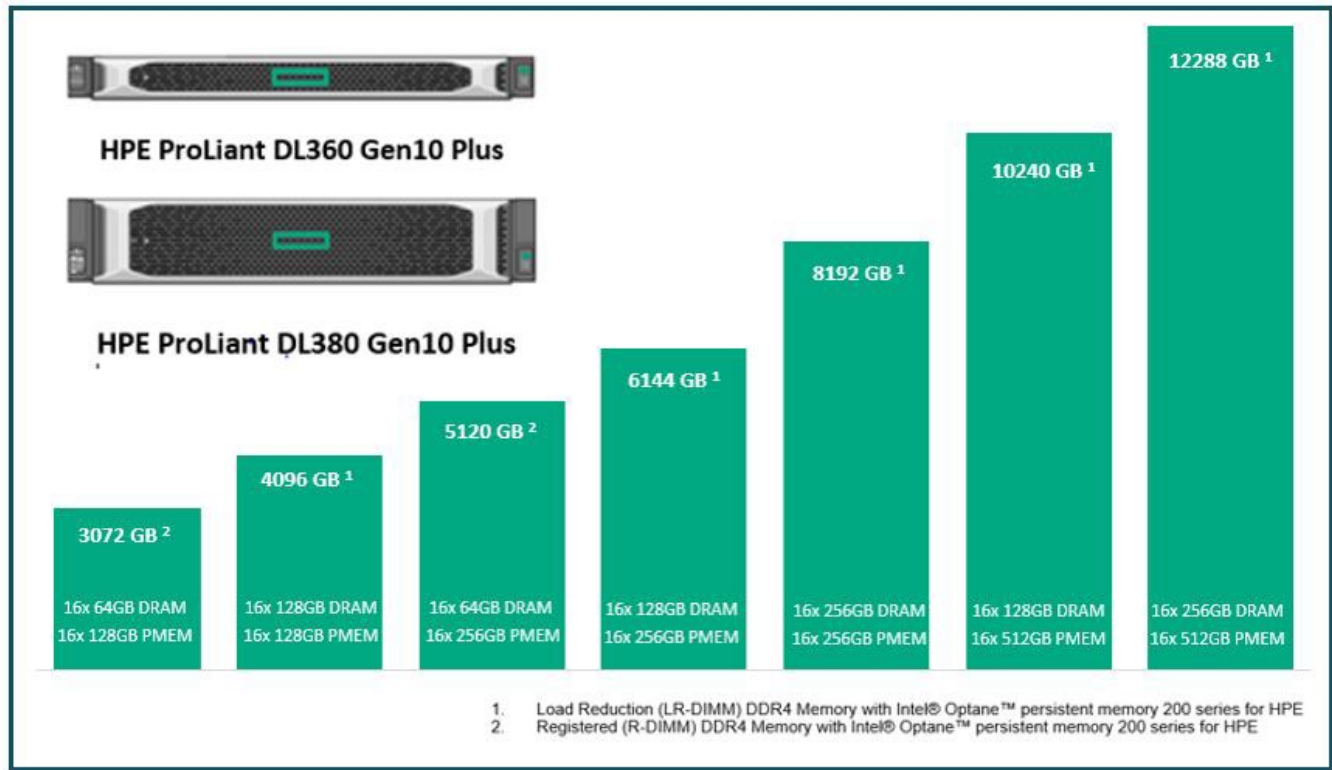

FIGURE 6. DRAM + Persistent Memory offerings

NOTE
2:1 DRAM to PMem offering is shown in Table 8 for 6TB (6144GB) memory. It is however not illustrated in the bar graph in Figure 6.

Storage Controller

HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers are available with two storage controller options to fulfill the customer's requirements.

NOTE

To achieve optimal throughput and Input or Output operations per second (IOPS), the described configurations for controller choice and its implementations are based on the best practices defined by the HPE SAP HANA solutions team. Users can choose a variety of different storage controllers which are available in the OCA Menu for their specific requirements.

- **SmartRAID SR932i-p Gen10 Plus Controller (Trimode Controller):** The SR932i-p Gen10 Plus is the industry's most versatile, highest performing, and secure PCIe RAID Adapter for applications ranging from SMB to Enterprise and mission-critical applications. The SR932i-p Gen10 Plus adapter is built around the trusted SmartRAID (SR) storage stack and offers 16-lanes of PCIe Gen4 host bandwidth with 32 Tri-Mode (SAS/SATA/NVMe) lanes. The SR932i-p Gen10 Plus adapter is tailored for maximum performance for RAID and HBA applications, enabling up to 46GB/s bi-directional throughput and up to 3.5M IOPS, giving the adapter the necessary capabilities and flexibility to meet the needs of the most demanding applications.

- **HPE Smart Array P816i-a SR Gen10 Controller:** The HPE Smart Array P816i-a SR Gen10 Controller supports 12Gb/s SAS and PCIe 3.0. It is ideal for maximizing performance while supporting advanced RAID levels with up to 4GB flash-backed write cache (FBWC). These controllers operate in a mixed mode that combines RAID and HBA/JBOD operations simultaneously. The Smart Array SR Gen10 controller portfolio can support up to 16 internally attached drives on a single controller allowing connection to SAS or SATA drives without having to use the SAS Expander card. This Smart Array SR Gen10 Controller also offers encryption for data-at-rest on any drive with HPE Smart Array SR Secure Encryption and provides enterprise-class storage performance, reliability, security, and efficiency needed to address your evolving data storage needs.

Figure 7 shows the SmartRAID SR932i-p Gen10 Plus and HPE Smart Array P816i-a SR Gen10 Controller.

1. SmartRAID SR932i-p Gen10 Plus
2. HPE Smart Array P816i-a SR Gen10 Controller

* Components shown are just for representation purpose, physical hardware may be different from the ones shown here
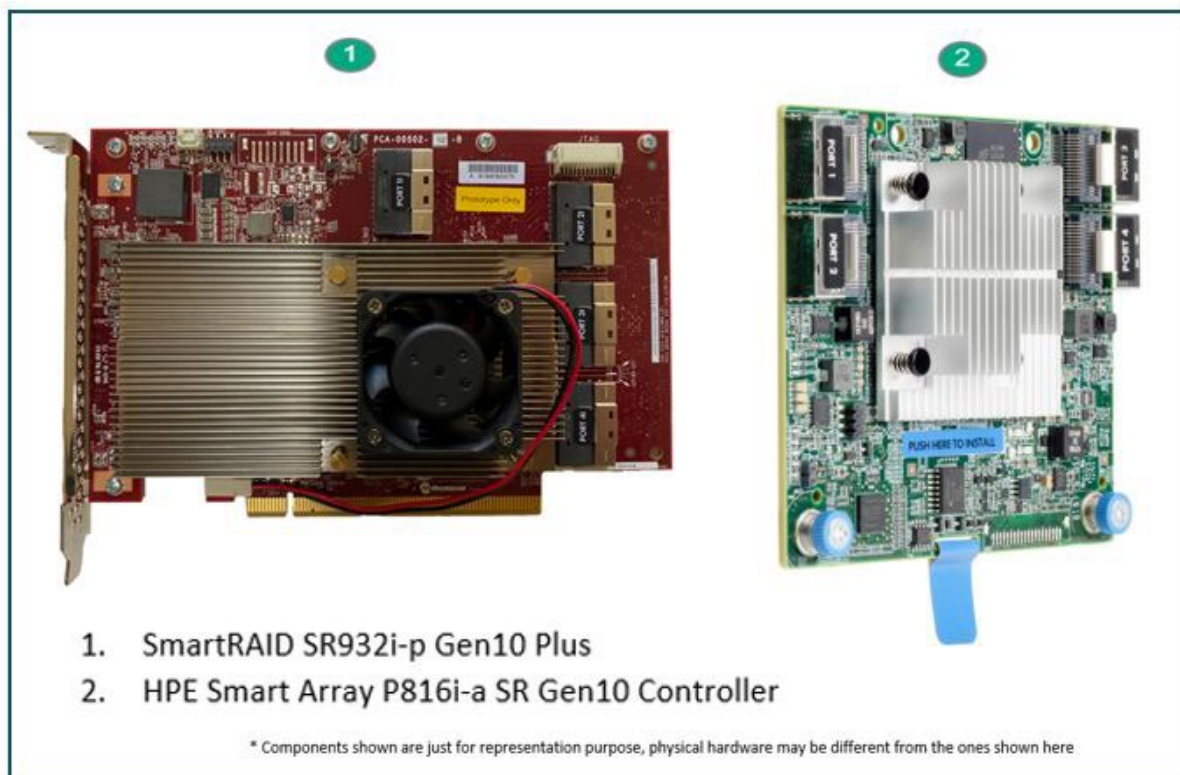
FIGURE 7. SmartRAID SR932i-p Gen10 Plus and HPE Smart Array P816i-a SR Gen10 Controller

Table 9 shows the Storage Controller offerings and features.

NOTE

The offerings and features mentioned in Table 9 are tested and validated based on the SAP HANA specifications and environment. For generic details, refer to the respective controller's QuickSpecs.

TABLE 9. Storage Controller offerings and features

Feature	SR932i-p Microchip SmartRAID	P816i-a Microchip SmartRAID
Platform	Gen10 Plus (except AMD Rome)	Gen10
Host Interface	x16 PCI Gen4	x16 PCI Gen3
Storage Interface	4x8 SlimSAS	4x4 mini-SAS
RAID Support	0/1/5/6/10/50/60	0/1/5/6/10/50/60
Total Number of SAS Ports	16	16
Drive Support	16G NVMe, 24G SAS, 6G SATA	16G NVMe, 24G SAS, 6G SATA
Encryption	Yes (CBE - RAID Only)	Yes
Mixed Mode (RAID & HBA)	Yes	Yes
Flash Backed Write Cache	Yes (144b 8GB)	Yes (4GB)
SSD Enhancement	Smart Path & SmartCache	Smart Path & SmartCache
Host Tools (GUI & CLI)	HPE Smart Storage Administrator (SSA)	HPE Smart Storage Administrator (SSA)
Smart Update Manager (SUM)	Yes	Yes
BIOS Support	Yes (BIOS Utility, Legacy Boot, OBSE)	Yes (BIOS Utility, Legacy Boot, OBSE)
iLO Support	Yes (IML, Alert, AHS, Redfish Rd/Wr, FW Update)	Yes (IML, Alert, AHS, Redfish® Rd/Wr, FW Update)

Apart from the two-storage controller mentioned above, SAP HANA customers can maximize the storage density, isolate the operating system, and data stores for SAP HANA applications by using the HPE NS204i-p as an NVMe-based OS boot solution which is also known as Tinker Card. For more details on this card refer to the Technical paper BLOG.

Major advantages of HPE NS204i-p includes:

- Dedicated HW RAID1 OS Resiliency– if one OS drive fails the business keeps going.

- Storage Density - frees up to 2 storage bays enabling greater platform storage density.

- VMware® and MSFT Storage Spaces Direct requesting dedicated RAID1 OS boot solutions.

- SSD Flash Storage - considered more resilient than traditional HDD spinning storage.

Table 10 shows the Tinker Card offerings and features.

TABLE 10. Tinker Card offerings and its features

Feature	NS204i-p
Form Factor	PCIe Stand Up
Mixed Mode	NO – Preconfigured RAID1
PCIe Gen4	PCIe Gen3
PCIe Host Interface	x8 (x4 electrical)
Device Lane Count	2
NVMe RAID	Yes
12G and 24G SAS	N/A
Write-back Cache	No, includes 2 x 480GB M.2
Encryption	SED (Snap +)
Hardware Root of Trust	FW RoT
U.3 Universal Drive Bays	N/A
Performance (RAID 5 Seq Writes)	OS Boot Only - RAID1
Platform Support	Gen10 and Gen10 Plus

Figure 8 shows the front view of the HPE NS204i-p Tinker Card.
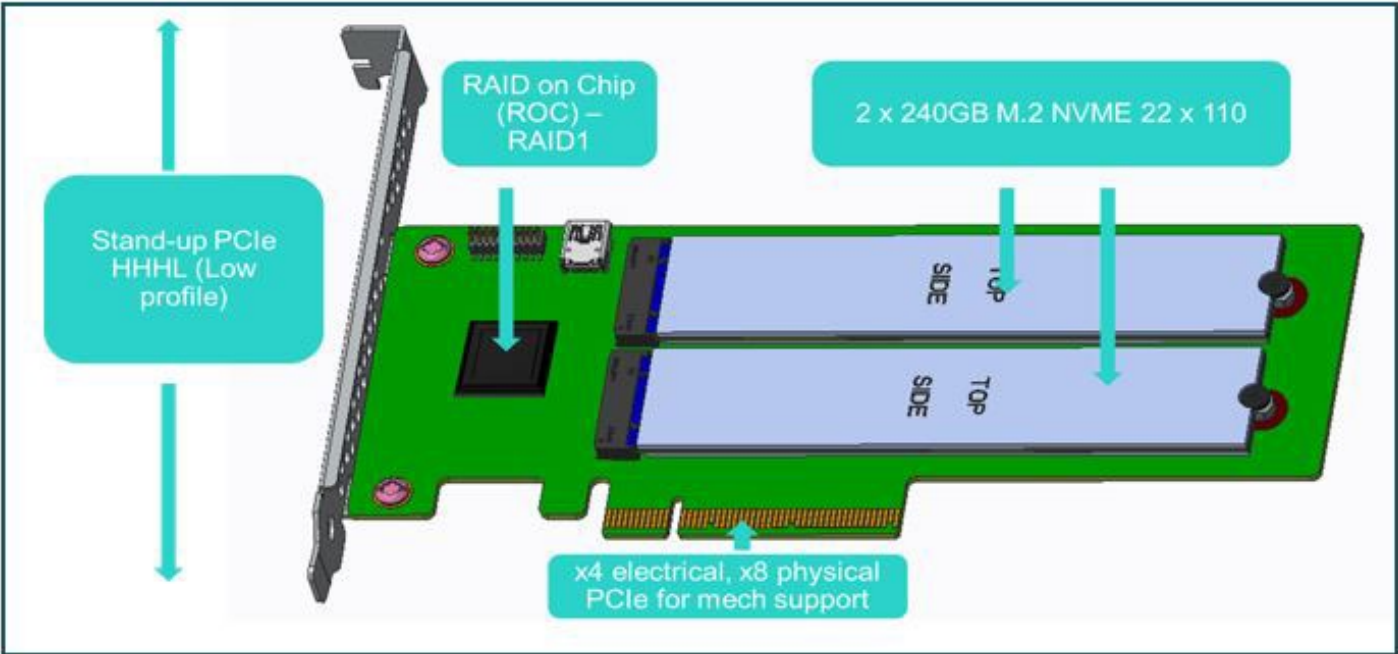

FIGURE 8. HPE NS204i-p Tinker Card

Storage

SAP HANA is an in-memory database that stores and processes the bulk of its data in the memory. Additionally, it protects against data loss by saving the data in persistent disk storage. For setting up the SAP HANA system, the storage layer must fulfill several requirements. This section of the document describes the requirements of persistent disk storage for SAP HANA Tailored Data Center Integration (TDI) and Appliance Implementation on HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers.

Hewlett Packard Enterprise recommends the best practices and sizing recommendations to achieve optimal performance on HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers for SAP HANA implementation.

For more information, see the SAP HANA Sizing Portal and the SAP HANA TDI - Storage Requirements.

Storage Sizing Chart for TDI Implementation

This is the standard and minimum required sizing for SAP HANA TDI Implementation for HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers. As per the customer requirements, the sizing of these volumes can be changed.

Table 11 provides the overall formula used to estimate the minimum storage requirement for a TDI Implementation.

TABLE 11. Formula to derive TDI Storage requirement

Purpose	Sizing Formula
Operating System	256GB of Drive/Volume for Operating System
/usr/sap	64GB
LOG	[systems ≤ 512GB] Size redo log = 1/2 x RAM [systems > 512GB] Size redo log (min) = 512GB
SHARED	Size installation (single node) = MIN (1 x RAM; 1TB)
DATA	Size data = 1.2 x Total Server Memory

Table 12 lists the SSD requirement for TDI Implementation of HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers. The SSD numbers are determined based on the formulas described in Table 11 and the DATA Volumes are considered as 1.2 times than that of the server's memory. Numbers of the disks are proposed based on the size but not according to the controller choice and scenarios described.

TABLE 12. Minimum storage requirement for SAP HANA TDI Implementation

Memory Type	Total Memory (GB)	For TDI, Total Space Required	800GB All SSD	1.6TB ALL SSD	2.4TB ALL SSD	3.2TB ALL SSD	6.4TB ALL SSD
DRAM	128	666	3 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5
DRAM	256	1075	3 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5
DRAM	512	1894	4 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5
DRAM	1024	3021	6 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5
DRAM	2048	4250	7 - RAID 5	4 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5
DRAM	4096	6707	12 - RAID 50	6 - RAID 5	4 - RAID 5	4 - RAID 5	3 - RAID 5
DRAM	8192	11622		10 - RAID 50	6 - RAID 5	5 - RAID 5	3 - RAID 5
Mix DRAM	768	2714	5 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5
Mix DRAM	1536	3635	7 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5	3 - RAID 5
DRAM + PMem	3072	5478	10 - RAID 5	5 - RAID 5	4 - RAID 5	3 - RAID 5	3 - RAID 5
DRAM + PMem	4096	6707	12 - RAID 50	6 - RAID 5	4 - RAID 5	4 - RAID 5	3 - RAID 5
DRAM + PMem	5120	7936	14 - RAID 50	7 - RAID 5	5 - RAID 5	4 - RAID 5	3 - RAID 5
DRAM + PMem	6144	9165	14 - RAID 50	8 - RAID 5	6 - RAID 5	5 - RAID 5	3 - RAID 5

Memory Type	Total Memory (GB)	For TDI, Total Space Required	800GB All SSD	1.6TB ALL SSD	2.4TB ALL SSD	3.2TB ALL SSD	6.4TB ALL SSD
DRAM + PMem	8192	11622		10 - RAID 50	7 - RAID 5	5 - RAID 5	3 - RAID 5
DRAM + PMem	10240	14080		12 - RAID 50	8 - RAID 5	6 - RAID 5	4 - RAID 5
DRAM + PMem	12288	16538		14 - RAID 50	10 - RAID 50	7 - RAID 5	4 - RAID 5

Hewlett Packard Enterprise recommends using Solid State Drives configured in RAID 5, 50, or 6 for SAP HANA implementation. Though there are a variety of drive options available in the TDI menu, following the minimum storage requirement for TDI Implementation shown in Table 12 is recommended.

NOTE
For SAP HANA implementation, a maximum number of disks supported in the HPE ProLiant DL380 Gen10 Plus server is up to 16, and for the HPE ProLiant DL360 Gen10 Plus server is up to 10.

Storage sizing chart for SAP HANA Appliance Implementation
As per the customer requirement, storage sizing can be changed for appliance implementation. Table 13 shows the overall formula used to estimate the minimum storage requirement for SAP HANA appliance implementation for one SAP HANA SID.

TABLE 13. Formula to derive the storage requirement for Appliance configurations

Purpose	Sizing Formula
Operating system	320GB of drive/volume for an operating system
/usr/sap	64GB
LOG	[systems ≤ 512GB] Size redo log = 1/2 x RAM [systems > 512GB] Size redo log (min) = 512GB
SHARED	Size installation (single node) = MIN (1 x RAM)
DATA	Size data = 3 x Total Server Memory

Table 14 shows the number of SSD's required for appliance implementation of HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers. The SSD numbers are determined based on the formula described in Table 13 and the DATA Volumes are considered as 3 times than that of the server's memory. The number of disks proposed is based on the size but not according to the controller's choice. The recommended servers in this paper have used RAID 5 or 50.

TABLE 14. Total Memory and No. of SSD's required

Memory Type	Total Memory (GB)	No. of 3.2TB SSD And RAID Level	No. of 6.4TB SSD And RAID Level
DRAM	128	3 - RAID 5	3 - RAID 5
DRAM	256	3 - RAID 5	3 - RAID 5
DRAM	512	3 - RAID 5	3 - RAID 5
DRAM	1024	4 - RAID 5	3 - RAID 5
DRAM	2048	5 - RAID 5	3 - RAID 5
DRAM	4096	8 - RAID 5	4 - RAID 5
DRAM	8192	14 - RAID 50	7 - RAID 5

Memory Type	Total Memory (GB)	No. of 3.2TB SSD And RAID Level	No. of 6.4TB SSD And RAID Level
Mix DRAM	768	3 - RAID 5	3 - RAID 5
Mix DRAM	1536	5 - RAID 5	3 - RAID 5
DRAM + PMem	3072	6 - RAID 5	4 - RAID 5
DRAM + PMem	4096	7 - RAID 5	4 - RAID 5
DRAM + PMem	5120	10 - RAID 50	5 - RAID 5
DRAM + PMem	6144	12 - RAID 50	6 - RAID 5
DRAM + PMem	8192	14 - RAID 50	7 - RAID 5
DRAM + PMem	10240	16 - RAID 50	8 - RAID 5
DRAM + PMem	12288	20 - RAID 50	12 - RAID 50

NOTE

For SAP HANA implementation, the maximum number of disks supported in the case of the HPE ProLiant DL380 Gen10 Plus server is up to 16, and for the HPE ProLiant DL360 Gen10 Plus server, it's up to 10.

Dual-purpose non-production storage

HPE D3710 disk enclosure

HPE D3710 offers flexible modular solutions to simplify capacity expansion and tiered external storage systems. It offers hot-pluggable SAS and SATA Small Form Factor (SFF) Drive up to 25 drives in an enclosure. This external storage can help to expand the capacity of storage and can help the user to create non-production SAP HANA instances for development, QA, and other purposes. This is used with the SAP HANA system replication secondary site.

Each D3710 includes the standard components D3710 base enclosure with redundant power supplies and fan modules, two integrated 12GB SAS I/O Modules, HD Mini-SAS cables, and two PDU interconnect cords.

For more details, see the HPE D3000 Enclosures more specifically to D3710 Quickspecs.

Figure 9 shows the HPE D3710 disk enclosure.

FIGURE 9. HPE D3710 front view

HPE D3710 disk enclosure features are as follows:

- Modular platform provides investment protection

- Support storage capacity up to 60TB SAS (2.4TB SAS)

- Hassle-free expansion

- Hot-pluggable drives and power modules

- 12GB SAS host connectivity enables higher data transfer

- HPE SSD Smart Path feature

- Additional drives can be configured as spares

- HPE Secure Encryption is available

- The system is not interrupted as the disk provides enhanced power and cooling facilities. This results in increased reliability in case of any power supply or fan failure.

HPE D3710 disk enclosure with HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers can be purposed for non-production SAP HANA instance with the following controllers as options:

- **Controller Option 1:** SmartRAID SR932i-p Gen10 Plus Controller (Trimode Controller)

  - With this setup, the SR932i-p controller will be placed in Slot 5 of the server for the HPE ProLiant DL380 Gen10 Plus server.

  - In this option, the dual-purpose storage will be connected within the server and the 2 internal ports or connectors of the controller will be used to connect to the drive cage box 2 of the server.

  – The controller and backplane must be separated for production and dual-purpose. Production and dual-purpose are not allowed to mix on the same controller or backplane.

Figure 10 shows the HPE ProLiant DL380 Gen10 Plus and HPE Smart Array P408i-p SR Gen10 Controller, the 2 internal ports from the SR932i-p controller will be connected to the drive cage box 2 of the server.
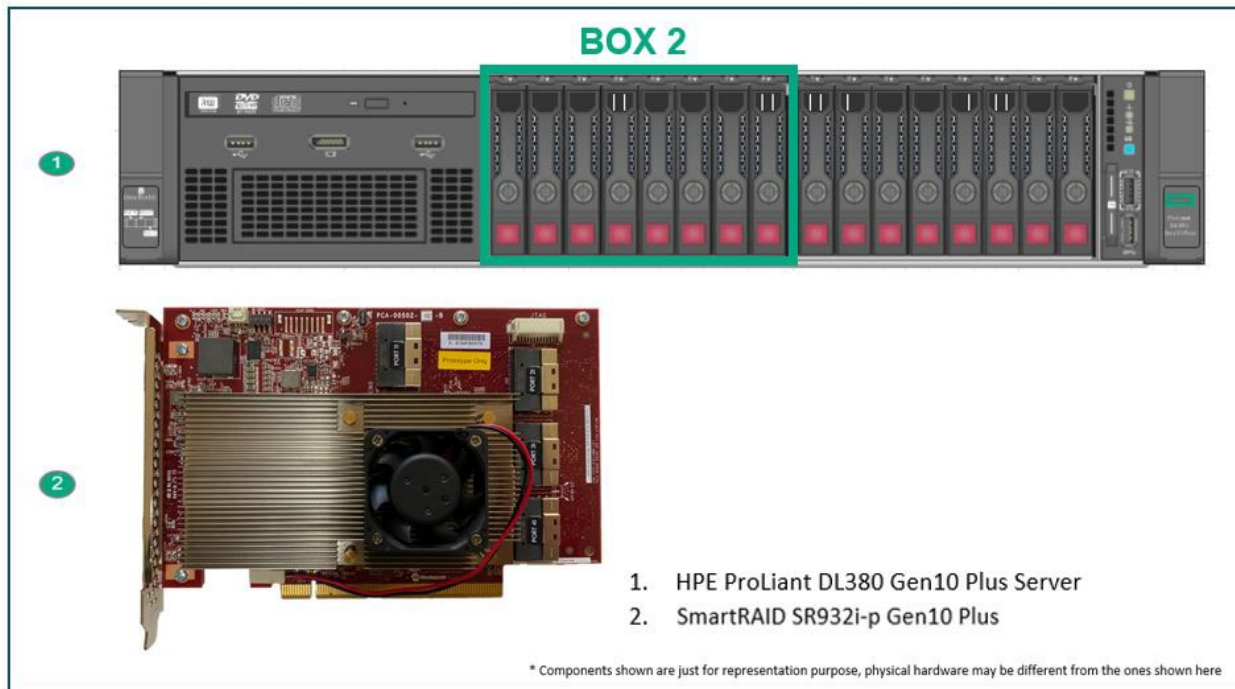

FIGURE 10. HPE ProLiant DL380 Gen10 Plus and HPE SmartRAID SR932i-p Gen10 Plus Controller

- **Controller Option 2:** HPE Smart Array P408e-p SR Gen10 Controller

  - With this setup, the P408e-p SR controller will be placed in Slot 5 of the server for the HPE ProLiant DL380 Gen10 Plus server.

  - This controller has 8 external SAS lanes and 2 external ports or connectors.

- In this option, the dual-purpose HPE D3710 disk enclosure will be connected externally. P408e-p SR controller is connected to Slot 5 of the HPE ProLiant DL380 Gen10 Plus server and 2 external ports from the controller are utilized to connect the external HPE D3710 disk enclosure.

- The controller and backplane must be separate for production and dual-purpose. Production and dual-purpose are not allowed to mix on the same controller or backplane.

Figure 11 shows the HPE ProLiant DL380 Gen10 Plus and HPE D3710 disk enclosure, the P408e-p SR controller will be connected to slot 5 of the server and 2 external ports from the P408e-p SR controller will be connected to the HPE D3710 disk enclosure.
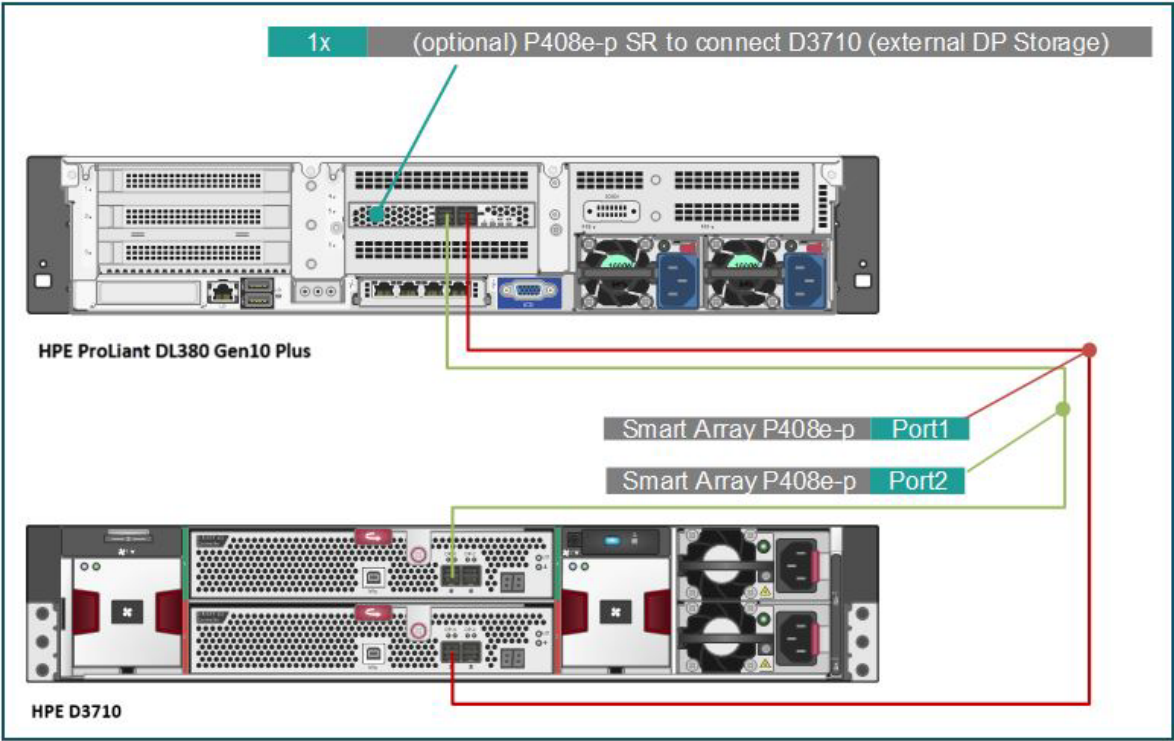

FIGURE 11. HPE ProLiant DL380 Gen10 Plus with HPE Smart Array P408e-p SR Gen10 Controller and External Dual-Purpose Storage

Table 15 shows the Storage Controller offerings and features.

NOTE
The offerings and features mentioned in Table 15 are tested and validated based on the SAP HANA specifications and environment. For generic details, refer to the respective controller's QuickSpecs.

TABLE 15. Storage Controller offerings and features

Feature	SR932i-p	P408e-p SR
Internal SAS lanes	x2 16 lanes or x4 32 lanes	NA
External SAS lanes	NA	8
Ports/Connectors	4 (mini-SAS)	2 (mini-SAS HD)
Cache size (FBWC)	8GB	4GB

Feature	SR932i-p	P408e-p SR
I/O slot: PCI Express 3.0	x8 link	x8 link
RAID Support	0/1/5/6/10/50/60	0/1/5/6/10/50/60
Mixed Mode (RAID & HBA/JBOD)	Yes	Yes
HPE Smart Array SR Secure Encryption (license)	Optional	Optional
SSD Enhancement	Yes (Smart Path & SmartCache)	Yes (Smart Path & SmartCache)
Host Tools (GUI & CLI)	HPE Smart Storage Administrator (SSA)	HPE Smart Storage Administrator (SSA)
Smart Update Manager (SUM)	Yes	Yes
BIOS Support	Yes (BIOS Utility, Legacy Boot, OBSE)	Yes (BIOS Utility, Legacy Boot, OBSE)
iLO Support	Yes (IML, Alert, AHS, Redfish Rd/Wr, FW Update)	Yes (IML, Alert, AHS, Redfish Rd/Wr, FW Update)

3SOLUTION CONFIGURATIONS

This section describes an overview of the types of solution configurations of HPE ProLiant DL380 Gen10 Plus and HPE ProLiant DL360 Gen10 Plus servers. In addition, information on how these configurations are built is also provided.

NOTE

SAP HANA Solutions based on HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers are a building block offering. The OCA menu has a wide range of choices, and the mentioned configurations are recommendations only.

Hardware Configuration of HPE ProLiant DL380 Gen10 Plus Server with 2s/6TB DRAM and PMem with P816i-a Controller

The following configuration consists of 2s/6TB DRAM and PMem memory with 6x6.4TB SSDs. This server is configured with the minimum required storage space for building block implementation for a 2-socket and 6TB memory configuration.

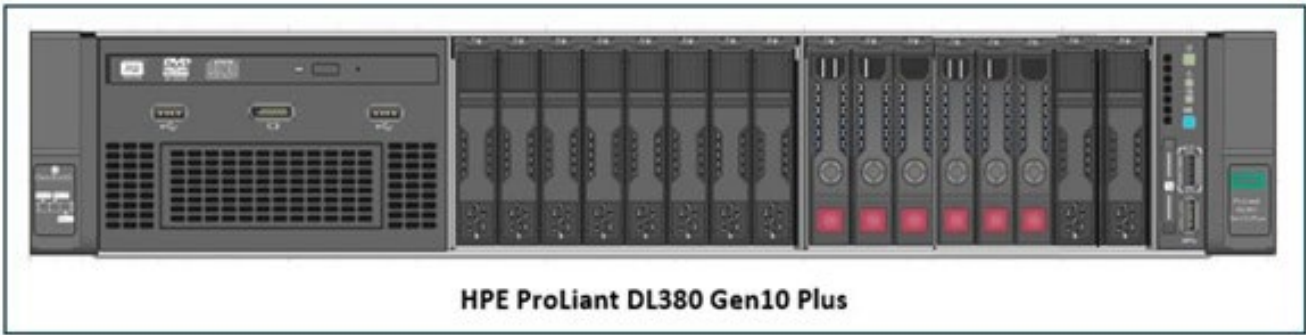Figure 12 shows an HPE ProLiant DL380 Gen10 Plus server with 6x6.4TB SSDs.

FIGURE 12. HPE ProLiant DL380 Gen10 Plus server with 6x6.4TB SSDs

Table 16 shows the server hardware components used for the 2s/6TB configuration.

TABLE 16. Components used for 2s/6TB configuration

Component	Quantity	Component Description
Server	1	HPE ProLiant DL380 Gen10 Plus server for SAP HANA Compute Block
Processor	2	Intel Xeon-Platinum 8368 2.4GHz 38-core 270W Processor for HPE
Memory – DRAM	16	HPE 128GB (1x128GB) Quad Rank x4 DDR4-3200 CAS-22-22-22 Load-Reduced Smart Memory Kit
Memory – PMem	16	Intel Optane 256GB persistent memory 200 series for HPE
Storage controller	1	Smart Array P816i-a SR Gen10 (16 Internal Lanes/4GB Cache/SmartCache) 12G SAS Modular Controller
Storage battery pack	1	HPE 96W Smart Storage Lithium-ion Battery with 145mm Cable Kit
Storage drive options	6	HPE 6.4TB SAS 12G Mixed Use SFF BC PM## SSD (or)
		HPE 6.4TB SAS 24G Mixed Use SFF BC PM## SSD
Storage backplane	1	2U 8SFF SAS/SATA 12G BC Front Bay 1/2 Drive Cage Kit
Primary riser Kit	1	x8/x16/x8 Primary FIO Riser Kit
Secondary riser Kit	1	x8/x16/x8 Secondary Riser Kit
Network card	4	Intel Ethernet 1Gb 4-port BASE-T OCP3 Adapter for HPE
		Intel Ethernet 1Gb 4-port BASE-T Adapter for HPE
		Intel Ethernet 10/25Gb 2-port SFP28 Adapter for HPE
		Broadcom Ethernet 10/25Gb 2-port SFP28 Adapter for HPE
Power supply module	2	800W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit

Hardware Configuration of HPE ProLiant DL380 Gen10 Plus Server with 2s/4TB DRAM and SR932i-p Controller

The following configuration consists of 2s/4TB DRAM memory with 8x3.2TB SSDs. This server is configured with the minimum required storage space for building block implementation with a 2-socket and 4TB memory configuration.

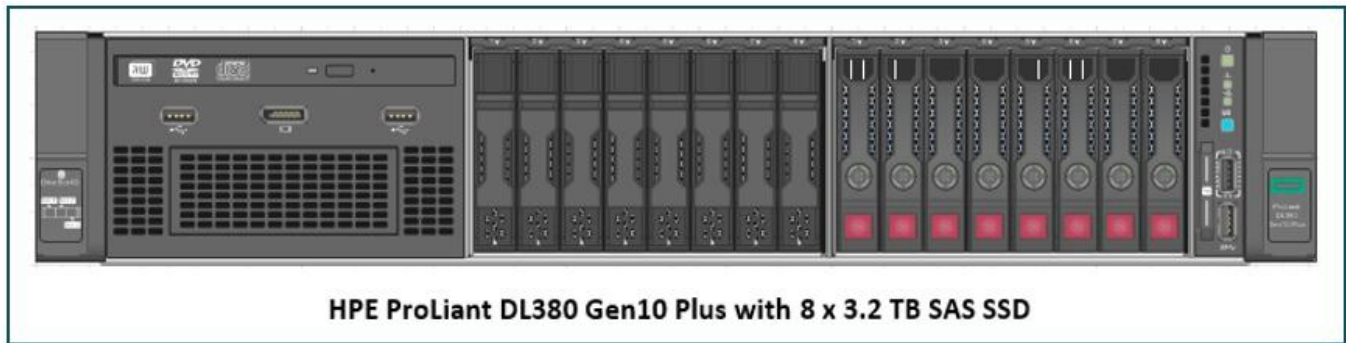Figure 13 shows an HPE ProLiant DL380 Gen10 Plus server with 8x3.2TB SSDs.

HPE ProLiant DL380 Gen10 Plus with 8 x 3.2 TB SAS SSD

FIGURE 13. HPE ProLiant DL380 Gen10 Plus server with 8x3.2TB SSDs

Table 17 shows the server hardware components used for the 2s/4TB configuration.

TABLE 17. Components used for 2s/4TB configuration

Component	Quantity	Component Description
Server	1	HPE ProLiant DL380 Gen10 Plus server for SAP HANA Compute Block
Processor	2	Intel Xeon-Gold 6338 2.0GHz 32-core 205W Processor for HPE

Component	Quantity	Component Description
Memory – DRAM	32	HPE 128GB (1x128GB) Quad Rank x4 DDR4-3200 CAS-22-22-22 Load-Reduced Smart Memory Kit
Storage controller	1	Microchip SmartRAID SR932i-p x32 Lanes 8GB Wide Cache NVMe/SAS 24G Controller for HPE Gen10 Plus server
Storage battery pack	1	HPE 96W Smart Storage Lithium-ion Battery with 145mm Cable Kit
Storage drive options	8	HPE 3.2TB SAS 24G Mixed Use SFF BC PM## SSD (or)
		HPE 3.2TB SAS 12G Mixed Use SFF BC PM## SSD (or)
		HPE 3.2TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 PE## SSD (or)
		HPE 3.2TB NVMe Gen4 High-Performance Mixed Use SFF BC U.3 CM6 SSD (or)
		HPE 3.2TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 CD6 SSD
Storage backplane	1	2U 8SFF x4 Tri-Mode 24G U.3 BC Front Drive Cage Kit
Primary riser kit	1	x8/x16/x8 Primary FIO Riser Kit
Secondary riser kit	1	x8/x16/x8 Secondary Riser Kit
Network card	4	Intel Ethernet 1Gb 4-port BASE-T OCP3 Adapter for HPE
		Intel Ethernet 1Gb 4-port BASE-T Adapter for HPE
		Intel Ethernet 10/25Gb 2-port SFP28 Adapter for HPE
		Broadcom Ethernet 10/25Gb 2-port SFP28 Adapter for HPE
Power supply module	2	HPE 800W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit

Hardware Configuration of HPE ProLiant DL380 Gen10 Plus Server with 2s/768GB DRAM, 2xSR932i-p Controller, and with Internal Dual-Purpose Storage

The following configuration consists of 2s/768GB Mixed DRAM memory configuration. 3x6.4TB SSDs are added for production storage in Box 3 and in the case of non-production dual-purpose storage, 3x6.4TB SSDs are added in Box 2. This server is configured with the minimum required storage space for building block implementation for a 2-socket and 768GB memory configuration. In this solution, one SR932i-p controller will be used as a production storage controller which is connected to box 3 and another SR932i-p controller will be used for connecting internal dual-purpose storage which will be connected to box 2.

Figure 14 shows an HPE ProLiant DL380 Gen10 Plus server with 3x6.4TB SSDs in box 3 for production storage and 3x6.4TB SSDs in box 2 for non-production storage (Internally connected dual-purpose).
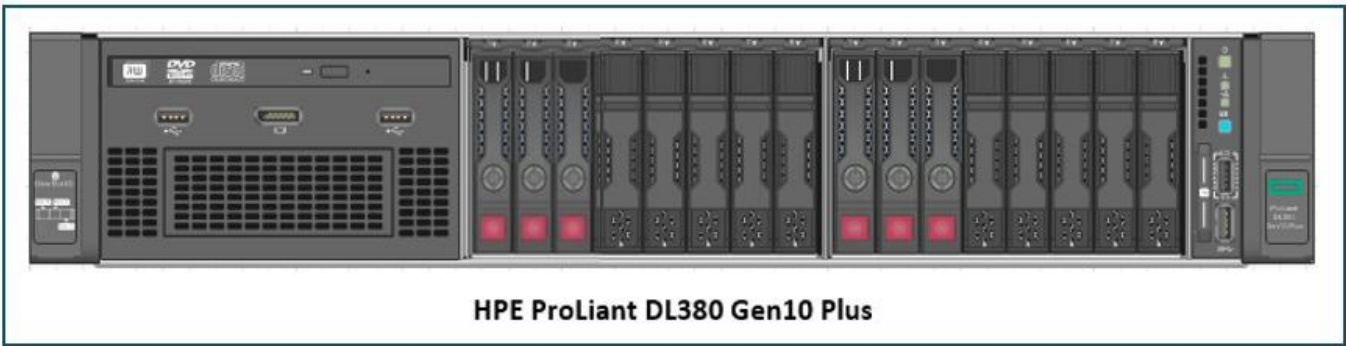

FIGURE 14. HPE ProLiant DL380 Gen10 Plus server front view

Table 18 shows the server hardware components used for 2s/768GB configuration.

TABLE 18. Components used for 2s/768GB configuration

Component	Quantity	Component Description
Server	1	HPE ProLiant DL380 Gen10 Plus server for SAP HANA Compute Block

Component	Quantity	Component Description
Processor	2	Intel Xeon-Platinum 8368 2.4GHz 38-core 270W Processor for HPE
Memory – DRAM	16	HPE 16GB (1x16GB) Dual Rank x8 DDR4-3200 CAS-22-22-22 Registered Smart Memory Kit
	16	HPE 32GB (1x32GB) Dual Rank x4 DDR4-3200 CAS-22-22-22 Registered Smart Memory Kit
Storage controller	1	Microchip SmartRAID SR932i-p x32 Lanes 8GB Wide Cache NVMe/SAS 24G Controller for HPE Gen10 Plus server
Storage battery pack	1	HPE 96W Smart Storage Lithium-ion Battery with 145mm Cable Kit
Storage drive options **(Production storage)**	3	HPE 6.4TB SAS 24G Mixed Use SFF BC PM## SSD (or)
		HPE 6.4TB SAS 12G Mixed Use SFF BC PM## SSD (or)
		HPE 6.4TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 PE## SSD (or)
		HPE 6.4TB NVMe Gen4 High-Performance Mixed Use SFF BC U.3 CM6 SSD (or)
		HPE 6.4TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 CD6 SSD
Storage backplane	1	2U 8SFF x 4 Tri-Mode 24G U.3 BC Front Drive Cage Kit
Primary riser kit	1	x8/x16/x8 Primary FIO Riser Kit
Secondary riser kit	1	x8/x16/x8 Secondary Riser Kit
Tertiary riser kit	1	x16 Tertiary Riser Kit
Network card	4	Intel Ethernet 1Gb 4-port BASE-T OCP3 Adapter for HPE
		Intel Ethernet 1Gb 4-port BASE-T Adapter for HPE
		Intel Ethernet 10/25Gb 2-port SFP28 Adapter for HPE
		Broadcom Ethernet 10/25Gb 2-port SFP28 Adapter for HPE
Power supply module	2	HPE 1600W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit
Dual-purpose storage **(Non-production storage)**	1	Internal Drive cage Box 2 (Internal Dual-purpose Storage)
Dual-purpose storage controller	1	Microchip SmartRAID SR932i-p x32 Lanes 8GB Wide Cache NVMe/SAS 24G Controller for HPE Gen10 Plus
Dual-purpose storage drive option	3	HPE 6.4TB SAS 24G Mixed Use SFF BC PM## SSD (or)
		HPE 6.4TB SAS 12G Mixed Use SFF BC PM## SSD (or)
		HPE 6.4TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 PE## SSD (or)
		HPE 6.4TB NVMe Gen4 High-Performance Mixed Use SFF BC U.3 CM6 SSD (or)
		HPE 6.4TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 CD6 SSD
Storage backplane for dual-purpose	1	2U 8SFF x 4 Tri-Mode 24G U.3 BC Front Drive Cage Kit

Hardware Configuration of HPE ProLiant DL380 Gen10 Plus Server with 2s/2TB DRAM, SR932i-p, P408e-p Controller and with External Dual-Purpose Storage

The following configuration consists of 2s/2TB DRAM memory with 3x6.4TB SSDs. This server is configured with the minimum required storage space for building block implementation for a 2-socket and 2TB memory configuration.

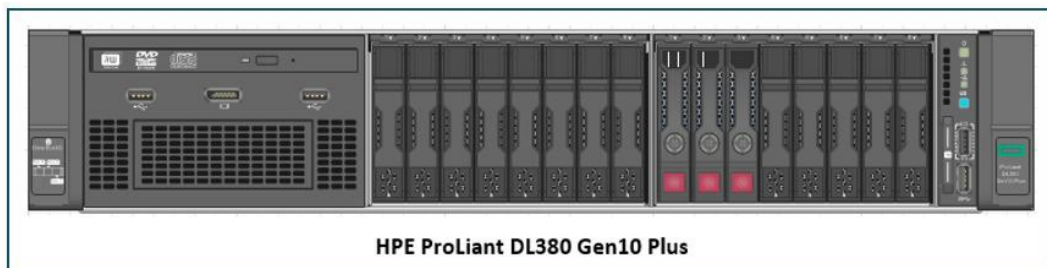Figure 15 shows an HPE ProLiant DL380 Gen10 Plus server with 3x6.4TB SSDs.

FIGURE 15. HPE ProLiant DL380 Gen10 Plus server with 3x6.4TB SSDs

Table 19 shows the server hardware components used for this 2s/2TB configuration.

TABLE 19. Components used for 2s/6TB configuration

Component	Quantity	Component Description
Server	1	HPE ProLiant DL380 Gen10 Plus server for SAP HANA Compute Block
Processor	2	Intel Xeon-Platinum 8358P 2.6GHz 32-core 240W Processor for HPE
Memory – DRAM	32	HPE 64GB (1x64GB) Dual Rank x4 DDR4-3200 CAS-22-22-22 Registered Smart Memory Kit
Storage controller	1	Microchip SmartRAID SR932i-p x32 Lanes 8GB Wide Cache NVMe/SAS 24G Controller for HPE Gen10 Plus server
Storage battery pack	1	HPE 96W Smart Storage Lithium-ion Battery with 145mm Cable Kit
Storage drive options **(Production storage)**	3	HPE 6.4TB SAS 24G Mixed Use SFF BC PM## SSD (or) HPE 6.4TB SAS 12G Mixed Use SFF BC PM## SSD (or) HPE 6.4TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 PE## SSD (or) HPE 6.4TB NVMe Gen4 High-Performance Mixed Use SFF BC U.3 CM6 SSD (or) HPE 6.4TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 CD6 SSD
Storage backplane	1	2U 8SFF x1 Tri-Mode 24G U.3 BC Front Drive Cage Kit
Primary riser kit	1	x8/x16/x8 Primary FIO Riser Kit
Secondary riser kit	1	x8/x16/x8 Secondary Riser Kit
Network card	4	Intel Ethernet 1Gb 4-port BASE-T OCP3 Adapter for HPE Intel Ethernet 1Gb 4-port BASE-T Adapter for HPE Intel Ethernet 10/25Gb 2-port SFP28 Adapter for HPE Broadcom Ethernet 10/25Gb 2-port SFP28 Adapter for HPE
Power supply module	2	HPE 800W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit
Dual-purpose storage **(Non-production storage)**	1	HPE Solutions D3710 Storage Block
Dual-purpose storage controller	1	HPE Smart Array P408e-p SR Gen10 (8 External Lanes/4GB Cache) 12G SAS PCIe Plug-in Controller
Dual-purpose storage drive option	3	HPE 6.4TB SAS 12G Mixed Use SFF BC PM## SSD (or) HPE 6.4TB SAS 24G Mixed Use SFF BC PM## SSD
Storage backplane for dual-purpose	1	2U 8SFF SAS/SATA 12G BC Front Bay 1/2 Drive Cage Kit

Hardware Configuration of HPE ProLiant DL360 Gen10 Plus Server with 2s/128GB DRAM and with P816i-a Controller

The following configuration consists of 2s/128GB DRAM memory with 3x3.2TB SSDs. This server is configured with the minimum required storage space for building block implementation for a 2-socket and 128GB memory configuration.

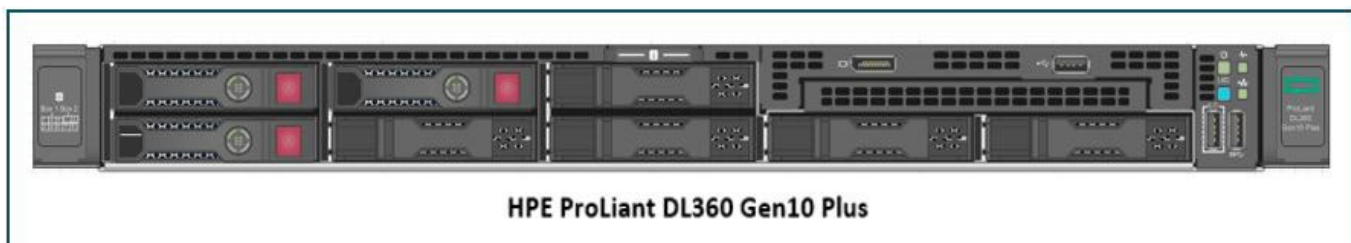Figure 16 shows an HPE ProLiant DL360 Gen10 Plus server with 3x3.2TB SSDs.

FIGURE 16. HPE ProLiant DL360 Gen10 Plus server with 3x3.2TB SSDs

Table 20 shows the server hardware components used for 2s/128GB configuration.

TABLE 20. Components used for 2s/128GB configuration

Component	Quantity	Component Description
Server	1	HPE ProLiant DL360 Gen10 Plus server for SAP HANA Compute Block
Processor	2	Intel Xeon-Gold 6348 2.6GHz 28-core 235W Processor for HPE
Memory – DRAM	16	HPE 8GB (1x8GB) Single Rank x8 DDR4-3200 CAS-22-22-22 Registered Smart Memory Kit
Storage controller	1	Smart Array P816i-a SR Gen10 (16 Internal Lanes/4GB Cache/SmartCache) 12G SAS Modular Controller
Storage battery pack	1	HPE 96W Smart Storage Lithium-ion Battery with 145mm Cable Kit
Storage drive options	3	HPE 3.2TB SAS 24G Mixed Use SFF BC PM## SSD (or) HPE 3.2TB SAS 12G Mixed Use SFF BC PM## SSD (or) HPE 3.2TB SAS 12G Mixed Use SFF BC SS## SSD
Storage backplane	1	HPE ProLiant DL360 Gen10 Plus 8SFF SAS/SATA 12G BC Backplane Kit
Primary riser kit	1	HPE ProLiant DL36X Gen10 Plus Full Height Riser Kit
Secondary riser kit	1	HPE ProLiant DL36X Gen10 Plus Low Profile Riser Kit
Network card	3	Intel Ethernet 1Gb 4-port BASE-T OCP3 Adapter for HPE Intel Ethernet 10/25Gb 2-port SFP28 Adapter for HPE Broadcom Ethernet 10/25Gb 2-port SFP28 Adapter for HPE
Power supply module	2	800W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit

Hardware Configuration of HPE ProLiant DL360 Gen10 Plus Server with 2s/4TB DRAM and PMem with SR932i-p Controller

The following configuration consists of 2s/4TB DRAM and PMem memory with 4x6.4TB SSDs. This server is configured with the minimum required storage space for building block implementation for a 2-socket and 4TB memory configuration.

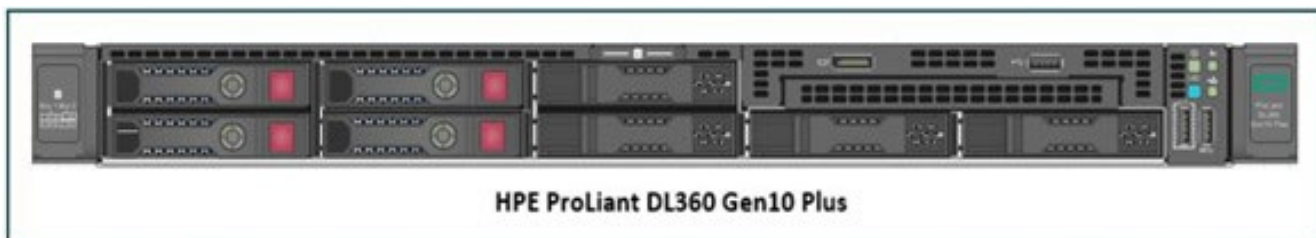Figure 17 shows an HPE ProLiant DL360 Gen10 Plus server with 4x6.4TB SSDs.

FIGURE 17. HPE ProLiant DL360 Gen10 Plus server with 4x6.4TB SSDs

Table 21 shows the server hardware components used for the 2s/4TB configuration.

TABLE 21. Components used for 2s/4TB configuration

Component	Quantity	Component Description
Server	1	HPE ProLiant DL360 Gen10 Plus server for SAP HANA Compute Block
Processor	2	Intel Xeon-Gold 6338 2.0GHz 32-core 205W Processor for HPE
Memory – DRAM	16	HPE 128GB (1x128GB) Quad Rank x4 DDR4-3200 CAS-22-22-22 Load-Reduced Smart Memory Kit
Memory – PMem	16	Intel Optane 128GB PMem 200 for HPE
Storage controller	1	Microchip SmartRAID SR932i-p x32 Lanes 8GB Wide Cache NVMe/SAS 24G Controller for HPE Gen10 Plus

Component	Quantity	Component Description
Storage battery pack	1	HPE 96W Smart Storage Lithium-ion Battery with 145mm Cable Kit
Storage drive options	4	HPE 6.4TB SAS 24G Mixed Use SFF BC PM## SSD (or)
		HPE 6.4TB SAS 12G Mixed Use SFF BC PM## SSD (or)
		HPE 6.4TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 PE## SSD (or)
		HPE 6.4TB NVMe Gen4 High-Performance Mixed Use SFF BC U.3 CM6 SSD (or)
		HPE 6.4TB NVMe Gen4 Mainstream Performance Mixed Use SFF BC U.3 CD6 SSD
Storage backplane	1	HPE ProLiant DL360 Gen10 Plus 8SFF x4 NVMe 16G U.2 BC Backplane Kit
Primary riser kit	1	HPE ProLiant DL36X Gen10 Plus Full Height Riser Kit
Secondary riser kit	1	HPE ProLiant DL36X Gen10 Plus Low Profile Riser Kit
Network card	2	Intel Ethernet 1Gb 4-port BASE-T OCP3 Adapter for HPE
		Broadcom Ethernet 10/25Gb 2-port SFP28 Adapter for HPE
Power supply module	2	HPE 1600W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit

NETWORK REQUIREMENTS

As SAP HANA is an in-memory database, its services and components communicate via independent network channels. It is recommended to have a well-defined network topology to allocate the network bandwidth and throughput. In addition to it, apply network security and performance measures as required.

Components of the SAP HANA landscape communicate via different network channels. It is recommended by SAP to have a well-defined network topology to control, limit, and isolate the network access and usage to only those communication channels required for the implementation scenarios.

The independent and secured network channels that we can use are as follows:

- Client Network Zone

    – SQL Client Communication

    – HTTP Client Communication

    – Management Network

- Internal Network Zone

- Internode Network

    – System Replication

    – Storage Replication

    – Backup Network

- Storage Network Zone

    – Shared/NFS Network

- Fiber Channel Network

For more information, see the SAP HANA Network Requirements Technical paper.

Network Configuration for HPE ProLiant DL360 Gen10 Plus Server

For the HPE ProLiant DL360 Gen10 Plus server, the network configuration and bonding recommendations are available in three options. The major differences are:

- Option 1

    – Only Network Cards selection

- Option 2 and 3

  – A mix of Fiber Channel HBA and Network Cards selection

- Different choice of bonding creation for each option

NOTE

SAP HANA solutions based on HPE ProLiant DL360 Gen10 Plus server is a building block offering. The OCA Menu has a wide range of choices, and these network configurations are recommendations only.

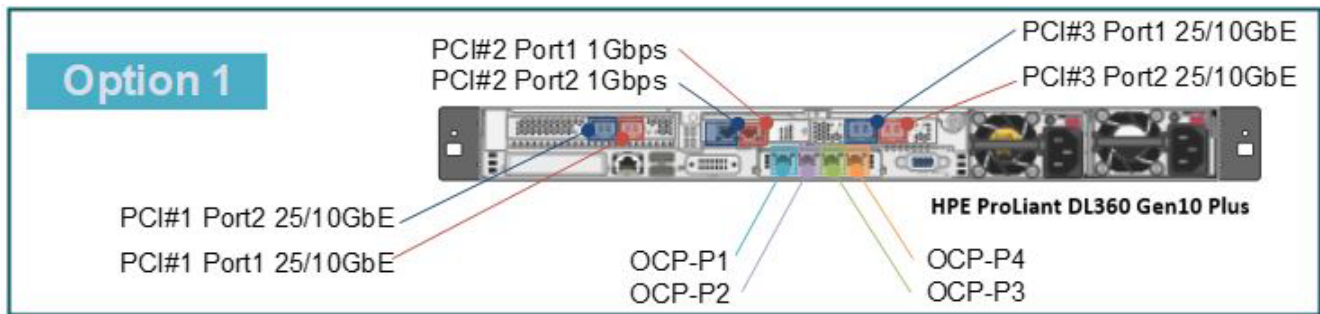Figure 18 shows Option 1 of the recommended network configuration.

FIGURE 18. HPE ProLiant DL380 Gen10 Plus server network details

Table 22 shows the bonding NICs details for the Option 1 network configuration.

TABLE 22. Bonding NICs details for the Option 1 network configuration

Bond	Bonding NIC 1	Bonding NIC 2	Speed
bond1	PCI#1 Port1	PCI#3 Port2	10/25GbE
bond2	OCP-P1	PCI#2 Port1	1GbE
bond3	PCI#3 Port1	PCI#1 Port2	10/25GbE
bond4	PCI#2 Port2	OCP-P2	1GbE

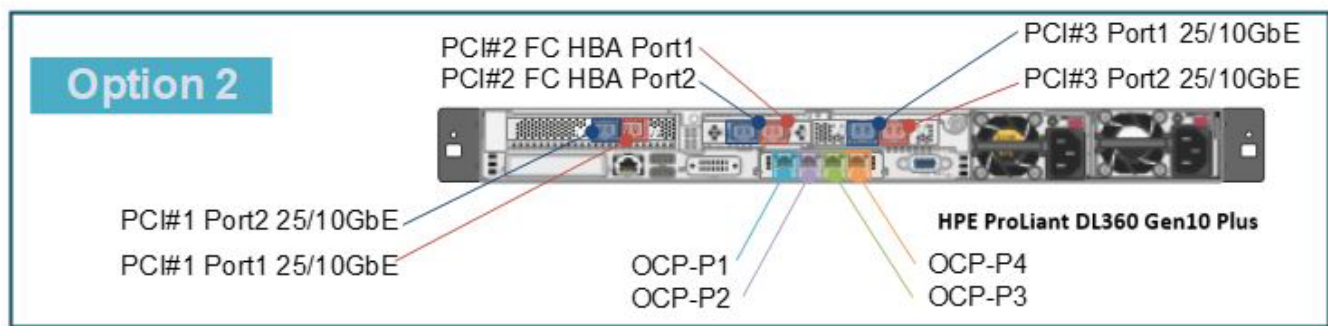Figure 19 shows Option 2 of the recommended network configuration.

FIGURE 19. HPE ProLiant DL360 Gen10 plus server network details

Table 23 shows the bonding NICs details for the Option 2 network configuration.

TABLE 23. Bonding NICs details for the Option 2 network configuration

Bond	Bonding NIC 1	Bonding NIC 2	Speed
bond1	OCP-P1	OCP-P2	1GbE
bond2	OCP-P3	OCP-P4	1GbE
bond3	PCI#1 Port1	PCI#3 Port1	10/25GbE
bond4	PCI#3 Port2	PCI#1 Port2	10/25GbE

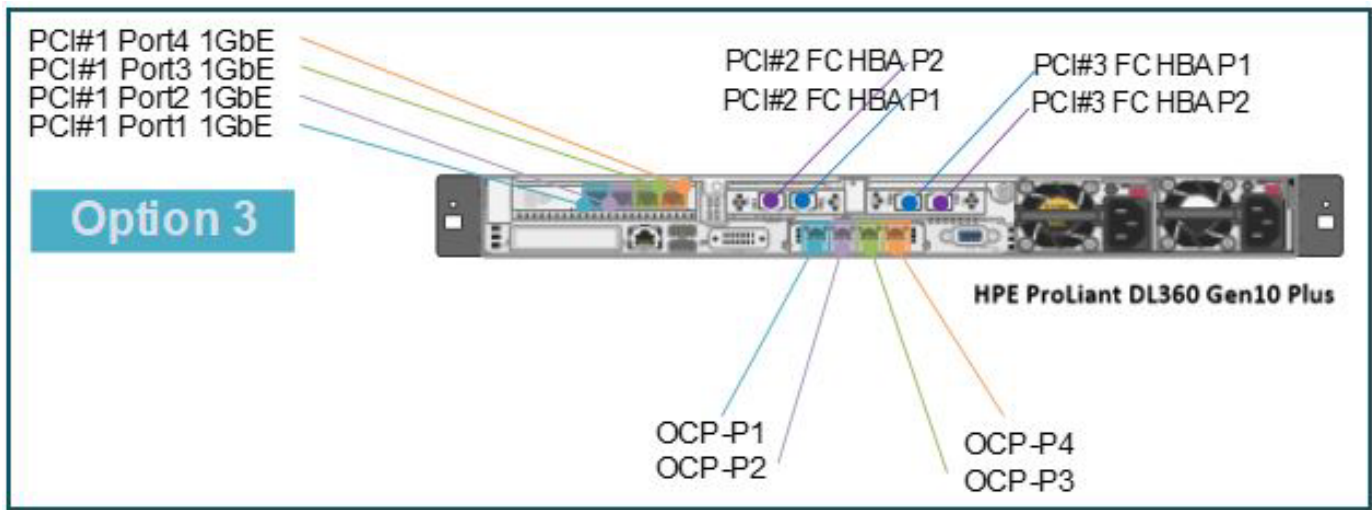Figure 20 shows Option 3 of recommended network configuration.

FIGURE 20. HPE ProLiant DL360 Gen10 Plus Server network details

Table 24 shows the bonding NICs details for the Option 3 network configuration.

TABLE 24. Bonding NICs details for the Option 3 network configuration

Bond	Bonding NIC 1	Bonding NIC 2	Speed
bond1	OCP-P1	PCI#1 Port1	1GbE
bond2	PCI#1 Port4	OCP-P4	1GbE
bond3	OCP-P2	PCI#1 Port2	1GbE
bond4	PCI#1 Port3	OCP-P3	1GbE

Network Configuration for HPE ProLiant DL380 Gen10 Plus Server

Figure 21 shows the recommended network configuration for SAP HANA implementation and it is covering all the network zones defined by the SAP HANA network requirement Technical paper. The configuration defined here is best suited for the HPE ProLiant DL380 Gen10 Plus server.

NOTE

SAP HANA solutions based on HPE ProLiant DL380 Gen10 Plus server is a building block offering. The OCA Menu has a wide range of choices, and these network configurations are recommendations only.
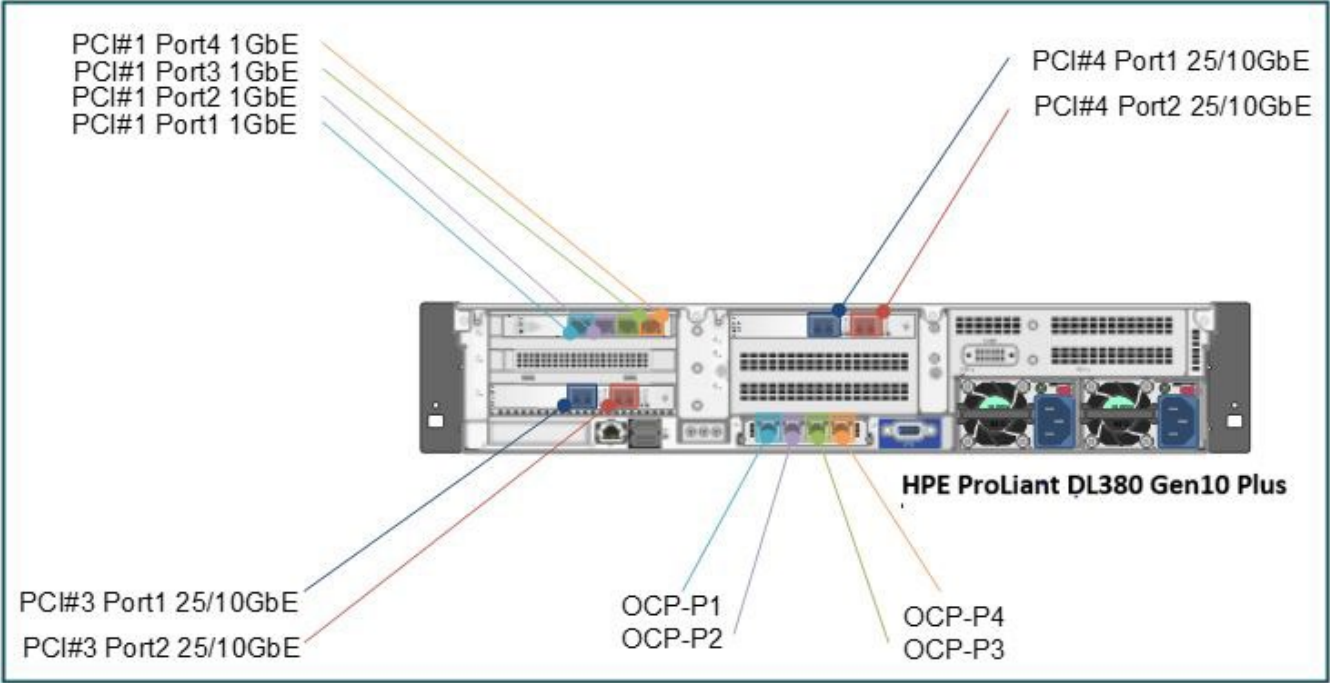

FIGURE 21. HPE ProLiant DL380 Gen10 Plus server network details

Table 25 shows the network zone and bonding NICs details.

TABLE 25. Network zone and bonding NICs details

Network Zone	Bond	Bonding NIC 1	Bonding NIC 2	Speed
data10	bond2	PCI#4 Port1	PCI#3 Port1	10/25GbE
user/BI Client	bond3	PCI#1 Port4	OCP-P4	1GbE
management/quorum	bond4	PCI#1 Port2	OCP-P2	1GbE
replication	bond6	PCI#3 Port2	PCI#4 Port2	10/25GbE
backup	bond7	PCI#1 Port3	OCP-P3	1GbE
data1	bond8	PCI#1 Port1	OCP-P1	1GbE

Network, Bond, and VLAN for SAP HANA

To provide high availability (HA), it is important to create bonds between more than one physical NIC. If there are options to use the high-speed Network Adapters, it is a better choice to use the VLAN configuration over the bonding network. It is also important to restrict the maximum utilization of each VLAN.

Table 26 shows the Network bond or VLAN for SAP HANA purposes.

TABLE 26. Network bond or VLAN for SAP HANA purposes

Network Zone	Purpose	Bandwidth and Bond/VLAN
DATA 10	Purposed for data traffic from other SAP applications. Generally, this network is connected to SAP application servers and other source systems, which are supposed to interact with the HANA landscape	10Gbps / Bond or VLAN; 2 NIC Port
DATA 1	Same as DATA 10 with 1Gbps	1Gbps / Bond or VLAN; 2 NIC Port
Management network	To connect to the landscape and handle the management task	1Gbps / Bond or VLAN; 2 NIC Port
Backup	Dedicated backup link to take the backup of HANA landscape log, data, and shared volumes	10Gbps / Bond or VLAN; 2 NIC Port
User/BI	Purposed to external connection for SAP HANA client to run SQL queries and/or for external application to connect to SAP HANA for fetching the analytical data	10Gbps / Bond or VLAN; 2 NIC Port
Replication	Network connections network two HANA Landscape to replicate the HANA Landscape from primary to secondary HANA system	10Gbps / Bond or VLAN; 2 NIC Port
Quorum for SG	Required if HPE Serviceguard is used to automate failover process across two systems, used to manage the failover and failback of HANA Landscape	10Gbps / Bond or VLAN; 2 NIC Port

SOFTWARE

Before deploying SAP HANA, the server must be certified by SAP and it must be listed in SAP Hardware Directory with information about supportability. During this process, the combination of certified hardware, Operating System, and compatible version of SAP HANA will be deployed. To ensure supportability the following software has been used during the SAP Certification Process.

Operating System
During the launch of the HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers for SAP HANA, the supported Operating Systems are:

- SuSE Linux® Enterprise Server 15 SP2

- Red Hat® Enterprise Server 8.2

- Refer to this link for the latest OS support matrix and the minimum supported OS version

Applying the SPP
Apply the SPP and ensure that firmware and drivers are matching to the latest available version.

To apply SPP, follow the SPP documentation or manuals available at support.hpe.com.

SAP HANA Hardware and Cloud Measurement Tools
SAP HANA hardware and cloud measurement tools (HCMT) are a new set of tools that can help the user to measure and analyze hardware or cloud systems performance parameters required before deploying SAP HANA. HCMT is the preferred tool to be used while applying for SAP HANA Certification for hardware.

The HCMT tools consist of the following components:

- SAP HANA hardware and cloud measurement tool

- SAP HANA hardware and cloud measurement analysis

For more details, see SAP Note: 2493172.

Tuning the SAP HANA Operating System

See the following SAP Notes to adhere to the requirement to install SAP HANA Database:

- For recommended OS settings for SLES 15, refer to the SAP Note: 2684254

- For recommended OS settings for RHEL 8, refer to the SAP Note: 2777782

- To optimize the Network Configuration on SAP HANA and OS Level, refer to the SAP Note: 2382421

- For the supported operating system, refer to the SAP Note: 2235581

- To prepare SLES for SAP environments, refer to the SAP Note: 1275776

SERVICE AND SUPPORT

Hewlett Packard Enterprise is the world's number one vendor for SAP HANA not just because of the sales of the server and the solutions provided but also for post-sales support. Post-sales, Hewlett Packard Enterprise provides world-class and expert service for SAP HANA installation, deployment, and integration. The services in lifecycle support through the dedicated team of experts in the solutions area around the SAP Software Stack. Service and support highlights are briefly outlined here. For more details, see the HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers Quickspecs.

- Installation, integration, and deployment services for SAP HANA
  - HPE Installation Service for HPE Installation and Startup Service
  - HPE Factory Express Integration Service for SAP HANA
  - HPE Rapid Deployment Services for SAP HANA
- HPE Pointnext Operational Services for SAP HANA
- HPE COE Service for SAP HANA
- HPE Service Credits (Lifecycle Service)

SUMMARY

HPE ProLiant DL360 Gen10 Plus and HPE ProLiant DL380 Gen10 Plus servers are industry-leading compute building blocks and serve equips enterprises of all sizes to power critical SAP S/4HANA and SAP BW/4HANA workloads. Its ranked #1 in Scale-up capacity for SAP HANA in-memory database.

This document has shown the SAP HANA landscape and HPE offerings surrounding the SAP HANA Database.

The solution highlighted in this Technical paper is economical, efficient, and flexible for short-term and long-term analytics. Using Hewlett Packard Enterprise's award-winning servers, storage, networking infrastructure, and support services, mission-critical applications will be functioning at their best while protecting them from the worst.

RESOURCES AND ADDITIONAL LINKS

HPE Reference Architectures, hpe.com/info/ra

HPE Servers, hpe.com/servers

HPE Storage, hpe.com/storage

HPE Networking, hpe.com/networking

HPE QuickSpecs Homepage, https://www.hpe.com/psnow/document-types?doctype=quickspecs&cc=us&lc=en&f=1&s=1

HPE portfolio for SAP HANA, https://www.hpe.com/us/en/solutions/sap-hana.html

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

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

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