



Hewlett Packard
Enterprise

HPE 3PAR StoreServ for SAP HANA tailored data center integration (TDI)

Integrating HPE 3PAR StoreServ 8000 and 20000 as
enterprise storage for SAP HANA

Contents

Executive summary.....	3
Introduction.....	3
Overview of SAP HANA.....	4
HPE 3PAR StoreServ 8000 and 20000 Storage overview.....	4
HPE 3PAR StoreServ All-flash offerings for SAP HANA TDI.....	5
HPE 3PAR StoreServ Storage availability.....	5
HPE 3PAR StoreServ Storage tier-1 data services.....	5
Solution components.....	6
SAP HANA supported server.....	6
SAP HANA enterprise storage.....	7
Capacity and sizing.....	7
HPE 3PAR StoreServ 8000 Storage with SSD configurations.....	7
HPE 3PAR StoreServ 20000 Storage with SSD configurations.....	8
HPE 3PAR StoreServ 8000 Storage with HDD configurations.....	9
HPE 3PAR StoreServ 20000 Storage with HDD configurations.....	11
Configuration guidance.....	12
Setup and installation requirements.....	12
Further server requirements.....	13
Installation and configuration.....	14
HPE 3PAR StoreServ Storage Virtual Volume definition.....	14
Creating a file system.....	14
SAP HANA installation on HPE 3PAR StoreServ Storage.....	15
SAP HANA shared file system on HPE 3PAR StoreServ.....	15
HPE 3PAR StoreServ for SAP HANA TDI in multi-tenant environments.....	16
Backup and recovery.....	16
Cloud.....	18
HPE 3PAR Virtual Domains Software.....	18
Quality of Service.....	18
Management with HPE OneView.....	19
HPE Technology Consulting Services.....	19
HPE Support.....	19
Summary.....	20

Executive summary

In today's fast-paced world, customers require deep insights into their business, marketplace and customers so they can respond quickly to changing market dynamics. Many enterprises are looking to obtain real business insights made possible with SAP® HANA. However, the move to SAP HANA can be complex; choice of the right business and technology partner is an important first step in this journey.

Along with our extensive analytics, cloud, mobility, and business process solutions, Hewlett Packard Enterprise is working closely with SAP to provide customers with seamless, secure, context-aware experiences for SAP environments. We're a leading certified global SAP Partner and a leader in SAP operations with over 1.7 million users and thousands of SAP experts worldwide. HPE Support Services manage selected portions of SAP's IT infrastructure to provide mission-critical services to SAP's business units.

For SAP HANA, Hewlett Packard Enterprise offers customers a complete set of fully integrated solutions and services with HPE ConvergedSystem for SAP HANA. For customers that wish to deploy their own SAP HANA environments, Hewlett Packard Enterprise also offers solutions based on SAP HANA tailored data center integration (TDI).

This technical white paper provides information on how to integrate HPE 3PAR StoreServ 8000 and 20000 storage systems with SAP HANA TDI using SAP specifications for enterprise storage. This paper describes key solution components, configuration, and implementation details and provides information on the unique architectural advantages of HPE 3PAR StoreServ Storage for SAP HANA TDI. The intended audience includes the IT professional seeking to design and implement a SAP HANA TDI environment. Readers of this technical white paper should have a functional understanding of SAP HANA concepts and technologies.

Introduction

To meet customers' needs for SAP HANA, Hewlett Packard Enterprise offers complete appliance delivery and TDI solutions. The HPE ConvergedSystem for SAP HANA is a fully integrated, optimized appliance solution that offers the performance and robustness needed to handle the challenges of a combined transaction and analytics platform. HPE ConvergedSystem for SAP HANA is an easy-to-implement, standardized, highly optimized solution with convenient preconfigured hardware and preinstalled software. The solution is fully validated by Hewlett Packard Enterprise and SAP.

When a more customized data center solution is desired as an alternative to appliance-based solutions, Hewlett Packard Enterprise offers solutions for SAP HANA TDI. The HPE 3PAR StoreServ Storage integration is fully certified and authorized by SAP. Although customers take responsibility for the validation of their SAP HANA environment with TDI, this approach offers a number of notable benefits:

- Reduced costs through use of existing hardware
- Ability to leverage existing skillsets, tools, and processes
- Maximum configuration flexibility

For customers considering the SAP HANA TDI approach, it is important to note that infrastructure setup, configuration, and performance validation are the responsibility of the customer or integrator.

Overview of SAP HANA

SAP HANA converges database and application platform capabilities in memory to accelerate transactions and analytics so that businesses can operate in real time. The key features of SAP HANA include:

- Database and data processing services: SAP HANA is an in-memory, columnar, massively parallel processing platform that provides a common database for OLTP and OLAP, reducing redundancy and latency.
- Real-time analytics: With OLAP and OLTP stored together, SAP HANA provides on-the-fly analysis so that users can make real-time decisions using data from SAP, custom, or third-party applications.
- Big Data warehousing: Customers can unleash the potential of Big Data by handling large volumes of structured and unstructured data in real time.

As the SAP HANA database resides in memory, storage has a different role. Instead of housing the database itself, storage for SAP HANA provides persistence. Persistence storage holds copies of the in-memory data, logs, and savepoint data.

While the role of storage for SAP HANA is different from traditional database storage, the demands of performance, availability, and tier-1 data services remain high.

HPE 3PAR StoreServ 8000 and 20000 Storage overview

HPE 3PAR StoreServ Storage is modern, purpose-built tier-1 storage. It provides a single product family from midrange to high-end, including all-flash options, supporting a single interoperable set of tier-1 data services. Figure 1 highlights the entire HPE 3PAR StoreServ Storage family. All HPE 3PAR StoreServ arrays are certified for SAP HANA TDI and they can be used as dedicated storage for SAP HANA or in environments where the HPE 3PAR array will be shared with SAP HANA and other applications.

The optional HPE 3PAR File Persona Suite can unlock the native file and object access capabilities within HPE 3PAR StoreServ 8000 or 20000 storage array. For SAP HANA TDI, this allows HPE 3PAR StoreServ storage to be used as block-level storage for data and log, and NFS storage for shared volumes such as HANA installation files.

HPE 3PAR StoreServ is eliminating boundaries

- 1**
- ONE Operating System
 - ONE Interface
 - ONE Feature Set
 - Block, file, and object access

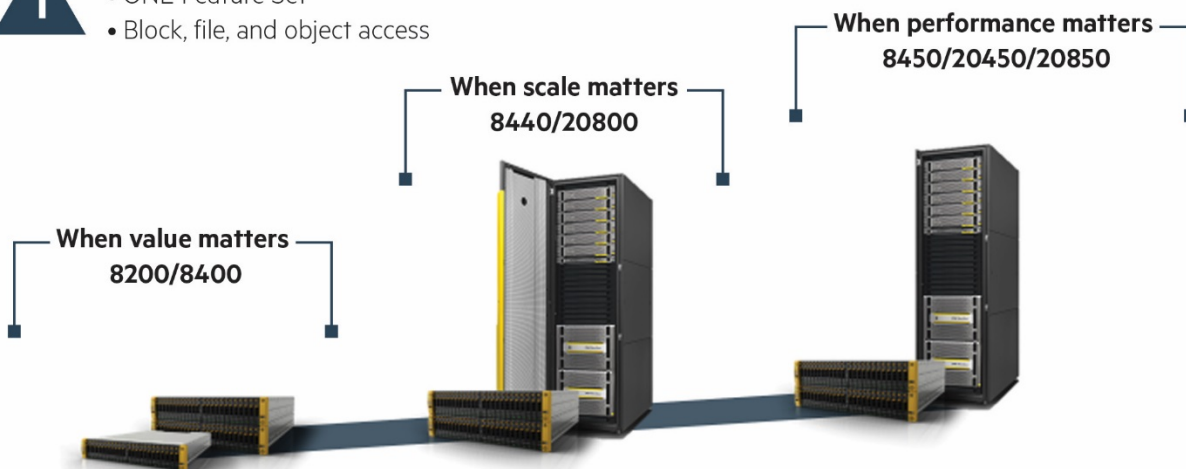


Figure 1. HPE 3PAR StoreServ Storage family

The HPE 3PAR StoreServ 8000 array family are cost-optimized performance arrays with high performance, modular footprint, low power consumption, and allow co-racking with servers, perfect for a single-rack TDI solution. The StoreServ 20000 is a scale-optimized array offering extreme performance for data-intensive workloads such as HANA, greater port scalability, and larger capacity for greater application consolidation. Both the HPE 3PAR 8000 and 20000 arrays support multi-tenancy for sharing the array with HANA and non-HANA workloads.

HPE 3PAR StoreServ All-flash offerings for SAP HANA TDI

The HPE 3PAR StoreServ 8000 and 20000 All-flash arrays are the third generation HPE 3PAR StoreServ all-flash arrays certified for SAP HANA TDI. HPE 3PAR All-flash solutions for TDI start with as few as eight SSDs with the HPE 3PAR StoreServ 8200 All-flash starter kit. The HPE 3PAR StoreServ All-flash array offers industry-leading performance with sub-millisecond latencies. All-flash performance is complemented by HPE 3PAR StoreServ Storage wide-striping where all server nodes have access to all drives without performance-restricted disk groups imposed by competitive offerings. Additionally, HPE 3PAR StoreServ All-flash offers the ability to turn off in-line deduplication that is a performance hindrance for SAP HANA.

The HPE 3PAR StoreServ Storage ASIC accelerates I/Os to allow HPE 3PAR StoreServ all-flash storage systems to offer reduced power consumption, thermal output, and physical space requirements compared to other AFAs. SSD-based arrays also offer higher reliability with a five-year drive warranty compared to a three-year warranty for HDDs.

These offerings are part of the complete HPE 3PAR StoreServ Storage portfolio, offering tier-1 data services for all HPE 3PAR StoreServ Storage array models.

HPE 3PAR StoreServ Storage availability

For many customers, SAP HANA is mission-critical. HPE 3PAR StoreServ Storage meets the high-availability and resiliency demands of SAP HANA. HPE 3PAR StoreServ Storage is architected for 99.9999 percent availability with full hardware redundancy, supporting availability objectives for the most demanding SAP HANA environments. HPE 3PAR StoreServ Storage scales past two controllers to offer increased resiliency. As a truly active/active technology, all controllers share the workload between them, offering predictable performance with no management overhead. Controller node pairs are connected to dual-ported drive enclosures owned by that pair. In addition, unlike other approaches, the system offers both hardware and software fault tolerance by running a separate instance of the HPE 3PAR operating system on each controller node, thus enhancing the availability of customer data. With this design, software and firmware failures—a significant cause of unplanned downtime in other architectures—are greatly reduced. Planned resilience reduces the impact of unplanned failures, which can be especially harmful if storage is shared between SAP HANA and other applications.

HPE 3PAR StoreServ Storage tier-1 data services

As customer adoption grows for SAP HANA, the combined compute and analytics capabilities become more and more central to customers' environments. Data services demands are high for even the smallest SAP HANA databases. HPE 3PAR StoreServ Storage and HPE 3PAR StoreServ all-flash products offer the same enterprise and service provider grade tier-1 data services whether in an eight-drive HPE 3PAR StoreServ 8200 Storage array or a multi-petabyte HPE 3PAR StoreServ 20000.

HPE 3PAR StoreServ Storage offers several products that can be used for service-level optimization. These solutions match data to the most cost-efficient resource capable of delivering the needed service level at any given time. These capabilities are particularly critical for multi-tenant or shared-storage SAP HANA TDI environments.

HPE 3PAR Dynamic Optimization software allows storage administrators to move volumes to different RAID levels and drive types. This RAID conversion happens within the HPE 3PAR StoreServ Storage system transparently and non-disruptively. The agility of HPE 3PAR Dynamic Optimization makes it easy to alter storage decisions, particularly where SAP HANA is part of a mixed application environment.

HPE 3PAR StoreServ Priority Optimization software allows SAP HANA customers the freedom to configure, optimize, and reconfigure for improved control, efficiency, and effectiveness—all without disturbing your users or applications. This suite rebalances, redistributes, and refreshes storage non-disruptively with features that provide autonomic storage tiering, dynamic data mobility, and assured performance for your most mission critical applications—reducing cost and increasing agility in multi-tenant environments. HPE 3PAR StoreServ Quality of Service (QoS) protects mission-critical applications such as SAP HANA by specifying minimum performance goals and threshold limits including I/O per second, bandwidth, and latency.

To further accommodate growth and change for SAP HANA, Hewlett Packard Enterprise offers unparalleled ease of scaling with HPE 3PAR Peer Motion Software. For SAP HANA TDI environments, HPE 3PAR Peer Motion allows HPE 3PAR StoreServ Storage arrays to be added to an existing environment. For HPE ConvergedSystem for SAP HANA, HPE 3PAR Peer Motion allows for a seamless appliance upgrade. HPE 3PAR Peer Motion is the first non-disruptive, do-it-yourself data migration tool for enterprise block storage. Unlike traditional block migration approaches, HPE 3PAR Peer Motion enables online storage volume migration between any HPE 3PAR StoreServ Storage systems non-disruptively and without complex planning or dependency on extra tools.

HPE 3PAR Peer Motion allows all HPE 3PAR StoreServ Storage systems for SAP HANA to participate in peering relationships with each other in order to provide the following flexibility benefits:

- Federated workload balancing—moves workloads from overutilized assets to underutilized ones
- Federated asset management—non-disruptively adds new storage to the infrastructure or migrates data from older systems to newer ones

HPE 3PAR StoreServ Virtual Copy snapshot technology is also another key data service for SAP HANA offered on HPE 3PAR StoreServ Storage all-flash and HDD arrays. As the size of SAP HANA databases grow, backup and recovery become increasingly cumbersome, particularly as incremental or differential backups are not supported until SAP HANA SPS 10. HPE 3PAR Virtual Copy Software flexibly delivers instant point-in-time (PIT) copies of the SAP HANA database for near-instant backup and recovery from snapshot. This all occurs while the database is running with negligible impact to performance.

HPE 3PAR StoreServ Storage supports autonomic storage management for SAP HANA environments. This is done by the HPE 3PAR operating system. It helps simplify, automate, and expedite storage management by handling provisioning, tiering, and change management autonomously and intelligently, at a subsystem level, and without administrator intervention. The system's user interfaces have been developed to offer autonomic administration, which means that the interfaces allow an administrator to create and manage physical and logical resources without requiring any overt action. Provisioning does not require any preplanning, yet the system constructs volumes intelligently based on available resources, unlike manual provisioning approaches that require planning and the manual addition of capacity to intermediary pools.

For SAP HANA TDI, the combination of all-flash and traditional HDD offerings, superior performance with wide-striping, high availability, stand-out tier-1 features, and single architecture makes HPE 3PAR StoreServ Storage an unparalleled choice of platform for SAP HANA tailored data center integration. HPE 3PAR StoreServ Storage is backed by HPE Support Services with global experts, deeply knowledgeable on both Hewlett Packard Enterprise technologies and SAP applications and environments.

Solution components

SAP HANA supported server

Until recently, SAP HANA implementations have been delivered as highly optimized appliances. The appliance approach offers a well-defined out-of-the-box hardware and software solution designed to satisfy the high-performance needs of an in-memory database solution. HPE ConvergedSystem for SAP HANA is the most complete offering for customers seeking a preconfigured hardware and software solution, enabling rapid implementation by a chosen hardware partner that is fully supported by SAP and Hewlett Packard Enterprise.

With SAP HANA TDI, SAP carefully defines the specifications of the hardware to help ensure SAP HANA performance and stability. The supported SAP HANA servers for TDI are the validated appliance servers that have the same bill of material as the validated SAP HANA appliances, but without the storage systems. A list of validated servers can be found on the Certified SAP HANA Hardware Directory. TDI allows for greater flexibility in the choice of storage solution. Using approved enterprise storage, customers can combine storage and servers from different vendors for a single SAP HANA instance. It is also possible to use one enterprise storage array for multiple independent SAP HANA implementations.

SAP builds on open source and industry standards for processors, memory, and operating systems as the core platform for SAP HANA to drive TCO reduction. SUSE Linux®, SUSE Linux Enterprise Server (SLES) 11 SP3, or SLES for SAP applications SP3 or Red Hat® Enterprise Linux for SAP HANA 6.5 are the supported operating systems. Intel® Xeon® E7, Xeon v2, Xeon v3, Xeon E5 v2 and Xeon E5 v3 processors are the currently supported processors. Different vendor configurations for single-node SAP HANA scale-up configurations and SAP HANA scale-out configurations have been validated by SAP.

SAP HANA enterprise storage

In an SAP HANA TDI environment, the storage requirement given in the “SAP HANA Storage Requirements” white paper needs to be fulfilled. All internal disks can be removed from the configuration as the log and data volumes reside on the enterprise storage array.

To provide I/O access to the HPE 3PAR StoreServ Storage, appropriate host bus adapters are required within the server system. These are described on the HPE Single Point of Connectivity (SPOCK) website at hpe.com/storage/spock.

For more information about the validated hardware platforms, check the [Certified SAP HANA® Hardware Directory](#).

Capacity and sizing

HPE 3PAR StoreServ Storage capacity sizing for SAP HANA TDI should be based on the sizing rules given in the [SAP HANA Storage Requirements](#) white paper from SAP. These sizing rules should be applied based on the memory needed for the SAP HANA database.

HPE 3PAR StoreServ 8000 Storage with SSD configurations

Tables 1 and 2 show HPE 3PAR StoreServ 8000 Storage arrays with SSD configurations.

Table 1. HPE 3PAR StoreServ 8XX0 2-node with SSD

NUMBER OF SAP HANA SERVERS	DRIVE TYPE			ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
	920 GB MLC	1.92 TB cMLC	3.84 TB cMLC	
2	8	8	8	Yes
3	8	8	8	Yes
4	8	8	8	Yes
5	10	10	10	Yes
6	12	12	12	No
8	16	16	16	No
10	20	20	20	No

Table 2. HPE 3PAR StoreServ 84X0 4-node with SSD

NUMBER OF SAP HANA SERVERS	DRIVE TYPE			ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
	920 GB MLC	1.92 TB cMLC	3.84 TB cMLC	
2	16	16	16	Yes
3	16	16	16	Yes
4	16	16	16	Yes
5	16	16	16	Yes
6	16	16	16	Yes
8	16	16	16	Yes
10	20	20	20	No
12	24	24	24	No
14	28	28	28	No
16	32	32	32	No
18	38	38	38	No
20	40	40	40	No

HPE 3PAR StoreServ 20000 Storage with SSD configurations

Tables 3 and 4 show HPE 3PAR StoreServ 20000 Storage arrays with SSD configurations.

Table 3. HPE 3PAR StoreServ 20X50 4-node with SSD

NUMBER OF SAP HANA SERVERS	DRIVE TYPE			ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
	920 GB MLC	1.92 TB cMLC	3.84 TB cMLC	
2	16	16	16	Yes
3	16	16	16	Yes
4	16	16	16	Yes
5	16	16	16	Yes
6	16	16	16	Yes
8	16	16	16	Yes
10	20	20	20	Yes
12	24	24	24	No
14	28	28	28	No
16	32	32	32	No
18	36	36	36	No
20	40	40	40	No
22	44	44	44	No
24	48	48	48	No

Table 4. HPE 3PAR StoreServ 20X50 8-node with SSD

NUMBER OF SAP HANA SERVERS	DRIVE TYPE			ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
	920 GB MLC	1.92 TB cMLC	3.84 TB cMLC	
2	32	32	32	Yes
3	32	32	32	Yes
4	32	32	32	Yes
5	32	32	32	Yes
6	32	32	32	Yes
8	32	32	32	Yes
10	32	32	32	Yes
12	32	32	32	Yes
14	32	32	32	Yes
16	32	32	32	Yes
18	40	40	40	Yes
20	40	40	40	Yes
22	48	48	48	Yes
24	48	48	48	Yes
26	56	56	56	No
28	56	56	56	No
30	64	64	64	No
32	64	64	64	No

NUMBER OF SAP HANA SERVERS	DRIVE TYPE			ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
	920 GB MLC	1.92 TB cMLC	3.84 TB cMLC	
34	72	72	72	No
36	72	72	72	No
38	80	80	80	No
40	80	80	80	No
42	88	88	88	No
44	88	88	88	No
46	96	96	96	No
48	96	96	96	No
50	104	104	104	No
52	104	104	104	No
54	112	112	112	No
56	112	112	112	No

HPE 3PAR StoreServ 8000 Storage with HDD configurations

Tables 5 through 8 show HPE 3PAR StoreServ 8000 Storage arrays with HDD configurations.

Table 5. HPE 3PAR StoreServ 8XX0 2-node with HDD

NUMBER OF SAP HANA SERVERS	MINIMUM NUMBER OF 600 GB AND 1.2 TB HDDS	ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
2	16	Yes
3	24	Yes
4	32	Yes
5	40	Yes
6	48	No
8	64	No
10	80	No

Table 6. HPE 3PAR StoreServ 84X0 4-node with HDD

NUMBER OF SERVERS	MINIMUM NUMBER OF 600 GB AND 1.2 TB HDDS	ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
2	16	Yes
3	24	Yes
4	32	Yes
5	40	Yes
6	48	Yes
8	64	Yes
10	80	Yes
12	96	No
14	112	No
16	128	No
18	144	No
20	160	No

Table 7. HPE 3PAR StoreServ 8XX0 2-node with HDD (HWC-ES 1.1)

NUMBER OF SAP HANA SERVERS	MINIMUM NUMBER OF 600 GB AND 1.2 TB HDDS	ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
2	24	Yes
3	36	Yes
4	48	Yes
5	60	Yes
6	72	No
8	96	No
10	120	No

Table 8. HPE 3PAR StoreServ 84X0 4-node with HDD (HWC-ES 1.1)

NUMBER OF SERVERS	MINIMUM NUMBER OF 600 GB AND 1.2 TB HDDS	ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
2	24	Yes
3	36	Yes
4	48	Yes
5	60	Yes
6	72	Yes
8	96	Yes
10	120	Yes
12	144	No
14	168	No
16	192	No
18	216	No
20	240	No

HPE 3PAR StoreServ 20000 Storage with HDD configurations

Tables 9 and 10 show HPE 3PAR StoreServ 20000 Storage arrays with HDD configurations.

Table 9. HPE 3PAR StoreServ 20800 4-node with HDD

NUMBER OF SAP HANA SERVERS	MINIMUM NUMBER OF 600 GB AND 1.2 TB HDDS	ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
2	16	Yes
3	24	Yes
4	32	Yes
5	40	Yes
6	48	Yes
8	64	Yes
10	80	Yes
12	96	No
14	112	No
16	128	No
18	144	No
20	160	No
22	176	No
24	192	No

Table 10. HPE 3PAR StoreServ 20800 8-node with HDD

NUMBER OF SAP HANA SERVERS	MINIMUM NUMBER OF 600 GB AND 1.2 TB HDDS	ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
2	32	Yes
3	32	Yes
4	32	Yes
5	40	Yes
6	48	Yes
8	64	Yes
10	80	Yes
12	96	Yes
14	112	Yes
16	128	Yes
18	144	Yes
20	160	Yes
22	176	Yes
24	192	Yes
26	208	No
28	224	No
30	240	No
32	256	No
34	272	No
36	288	No

NUMBER OF SAP HANA SERVERS	MINIMUM NUMBER OF 600 GB AND 1.2 TB HDDS	ADDITIONAL NON-SAP HANA WORKLOADS SUPPORTED?
38	304	No
40	320	No
42	336	No
44	352	No
46	368	No
48	384	No
50	400	No
52	416	No
54	432	No
56	448	No

Note that the following apply to the HPE 3PAR StoreServ Storage models shown in tables 1 through 10:

- Unless otherwise specified, all certifications are with SAP HANA-HWC-ES 1.0 test environment.
- For HWC-1.1 test with HDD configurations, RAID 1 was used. All other sizing was done with RAID 5. RAID 1 may require additional drives.
- When choosing 600 GB drives for HDD configurations, be cautious to insure the array is adequately sized for capacity “[SAP HANA Storage Requirements](#)” white paper
- Additional non-SAP HANA workloads that are supported refer to sharing an HPE 3PAR array with both SAP HANA and other applications.
- The standard configuration does not support a high-availability cage. If one is required, more drives and shelves will be needed. Further details can be found in the [HPE 3PAR StoreServ Storage best practices guide](#).
- Both encrypted and non-encrypted drive types are supported.
- The sizing listed in the tables is based on key performance indicators (KPIs) for SAP HANA Analytics; for SAP HANA ERP workloads, additional drives may be required.
- Results are subject to change if SAP changes KPIs or sizing guidelines for SAP HANA TDI.

Configuration guidance

Setup and installation requirements

SAP Connector API

The SAP HANA implementation with HPE 3PAR StoreServ Storage arrays uses the SAP Connector API to access the SAP HANA persistence server. This SAP HANA built-in Fibre Channel (FC) client provides direct FC access to the SAP HANA data and log files for the SAP HANA nodes and enables high throughput and low-latency access to the SAP HANA database.

For scale-out scenarios, an HA shared NFS service needs to be available for the SAP HANA configuration, log, and trace files to be stored. For 3PAR StoreServ TDI configurations addition of the HPE 3PAR File Persona Suite allows the array to be used for both data storage and NFS access. Other configurations are also possible for different solution implementations.

Built-in high availability

The SAP FC client used with the HPE 3PAR StoreServ Storage system configuration provides a highly available SAP HANA deployment. If one SAP HANA node fails, the defined stand-by node will request access to the data and log devices of the failed node and automatically recovers the SAP HANA persistence of the failed node to enable continued SAP HANA operations.

Tested RAID configurations and Common Provision Group options

In the sizing shown earlier (see tables 1 through 10), RAID 5 was used for all configurations. If RAID 1 is preferred, additional drives may be required. Table 11 provides more detail on the tested RAID configurations, which are listed by the number of drives per controller.

As an example, a Common Provisioning Group (CPG) creates a virtual pool of Logical Disks (LDs) that allows VVs to share the CPG’s resources and allocates space on demand. You can create fully provisioned VVs and TPVVs that draw space from the CPG’s logical disk pool. CPGs enable fine-grained, shared access to pooled logical capacity. Instead of pre-dedicating logical disks to volumes, the CPG allows multiple volumes to share the buffer pool of LDs.

Table 11. Tested RAID configurations and CPG options

NUMBER OF DRIVES* PER HPE 3PAR ARRAY CONTROLLER	RAID CONFIGURATION	CPG OPTIONS
4	R5 3+1, step size 256 KiB	-ssz 4 -ss 256
6	R5 5+1, step size 256 KiB	-ssz 6 -ss 256
8	R5 7+1, step size 256 KiB	-ssz 8 -ss 256
> 8	R5 4+1, step size 256 KiB	-ssz 5 -ss 256

* Applies to SSD and HDD drives independent of drive size

Further server requirements

Multipath implementation

To access a block device from an SAP HANA physical Linux server, multipathing capabilities need to be installed and configured. The multipathing configuration in the /etc/multipath.conf file needs to be edited as follows:

```
# The defaults section
defaults {
    polling_interval 10
}

# For 3PAR device
devices {
    device {
        vendor            "3PARdata"
        product           "VV"
        no_path_retry     0
        path_grouping_policy group_by_prio
        prio              "alua"
        hardware_handler  "1 alua"
        path_selector     "service-time 0"
        rr_weight         uniform
        rr_min_io_rq      1
        path_checker      tur
        failback          immediate
    }
}
```

Udev tuning

To set the correct Linux I/O scheduler parameters create a file called /etc/udev/rules.d/10-3par.rules with the following entry:

```
ACTION=="add|change", KERNEL=="dm-*", \
PROGRAM="/bin/sh -c 'grep 3PARdata /sys/block/$name/slaves/*/device/vendor'", \
ATTR{queue/nr_requests}="4096", ATTR{queue/scheduler}="noop"
```

Installation and configuration

The following initial HPE 3PAR StoreServ Storage configuration steps are needed prior to the SAP HANA installation for enterprise storage TDI.

HPE 3PAR StoreServ Storage Virtual Volume definition

For each SAP HANA server, a data and log Virtual Volume has to be defined and exported to all SAP HANA servers or server blades. Figure 2 provides an example of the four Hewlett Packard Enterprise scale-out configurations as seen in HPE 3PAR Management Console Software. The characteristics of the VVs in terms of RAID level are shown as well. The size of the VVs is the same as the amount of memory being used in the four Hewlett Packard Enterprise scale-out servers.

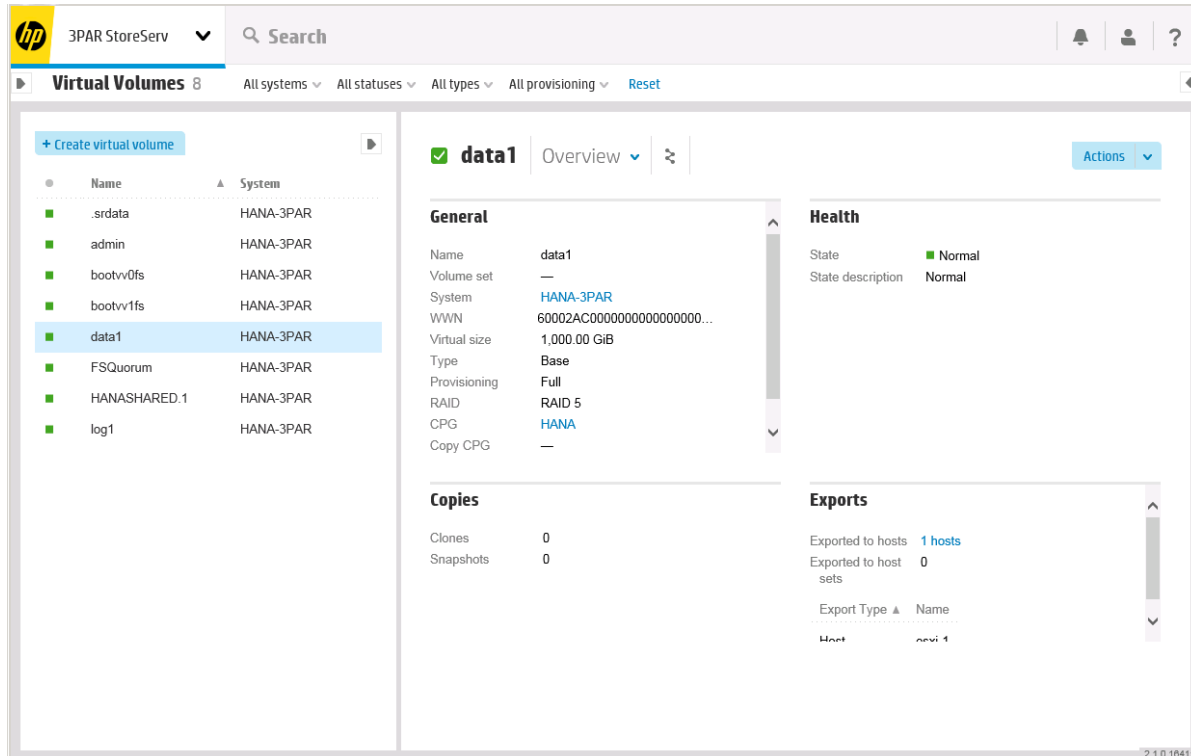


Figure 2. HPE 3PAR Management Console with Virtual Volume defined

Figure 2 shows the defined space for the SAP HANA data and log files.

Additional information on this management topic can be found in the actual [HPE StoreServ Management Console Software User Guide](#).

Creating a file system

After scanning the operation systems to make the exported Virtual Volumes visible as Linux devices, create a file system on top of these Linux devices. Hewlett Packard Enterprise uses the XFS file system for the SAP HANA data and log files.

Following is a sample command to create a file system on one of the disk volumes:

```
# mkfs.xfs /dev/disk/by-id/scsi-360002ac0000000000000000200003c7e
```

This step needs to be completed on all devices dedicated to SAP HANA data and log files.

SAP HANA installation on HPE 3PAR StoreServ Storage

The final preparation before starting an SAP HANA standard installation procedure is the mapping of the exported HPE 3PAR StoreServ Virtual Volumes to the SAP HANA data and log partitions. This is done in a customized global.ini file to be placed in the SAP HANA installation directory /usr/sap/install.

Following is an HPE 3PAR StoreServ Storage Virtual Volume that is identified as an OS device:

```
# ls /dev/disk/by-id/scsi-360002ac0000000000000001600003c7e
/dev/disk/by-id/scsi-360002ac000000000000000200003c7e
```

Following is a sample of the global.ini file required for the SAP HANA installation:

```
[storage] ha_provider = hdb_ha.fcClient ha_provider_path=/sapmnt/install
partition_1_data wwid = 360002ac000000000000000200003c7e
partition_1_log wwid = 360002ac000000000000000600003c7e
partition_2_data wwid = 360002ac000000000000000300003c7e
partition_2_log wwid = 360002ac000000000000000700003c7e
partition_3_data wwid = 360002ac000000000000000400003c7e
partition_3_log wwid = 360002ac000000000000000800003c7e
partition_*_* prType = 5
```

Once all of the above prerequisites have been implemented, the SAP HANA standard installation procedure can then be executed to create an SAP HANA instance on top of the HPE 3PAR StoreServ Storage array.

SAP HANA shared file system on HPE 3PAR StoreServ

With the HPE 3PAR File Persona Suite, Hewlett Packard Enterprise provides native file and object access capabilities within a HPE 3PAR StoreServ Storage array. For SAP HANA TDI, this allows HPE 3PAR StoreServ block storage to be used for both data and log storage and NFS access for shared volumes such as HANA binaries and configuration files.

If not already done, initialize the HPE 3PAR File Services by using the startfs command. Create a Virtual File Server and File Share for your SAP HANA instance, for instance:

```
HANA-3PAR cli% showfshare nfs -d
Share Name           : HANA
File Provisioning Group : HANASHARED
Virtual File Server  : HANASHARED
File Store           : home
Share Directory      : HANA
Full Directory Path  : /HANASHARED/HANASHARED/home/HANA
State                : normal
Clients              : *
Options              : wdelay, insecure, crossmnt, sync, hide, no_all_squash, rw, root_squash, subtree_check,
no_auth_nlm, sec=sys
Comment              : ---
```

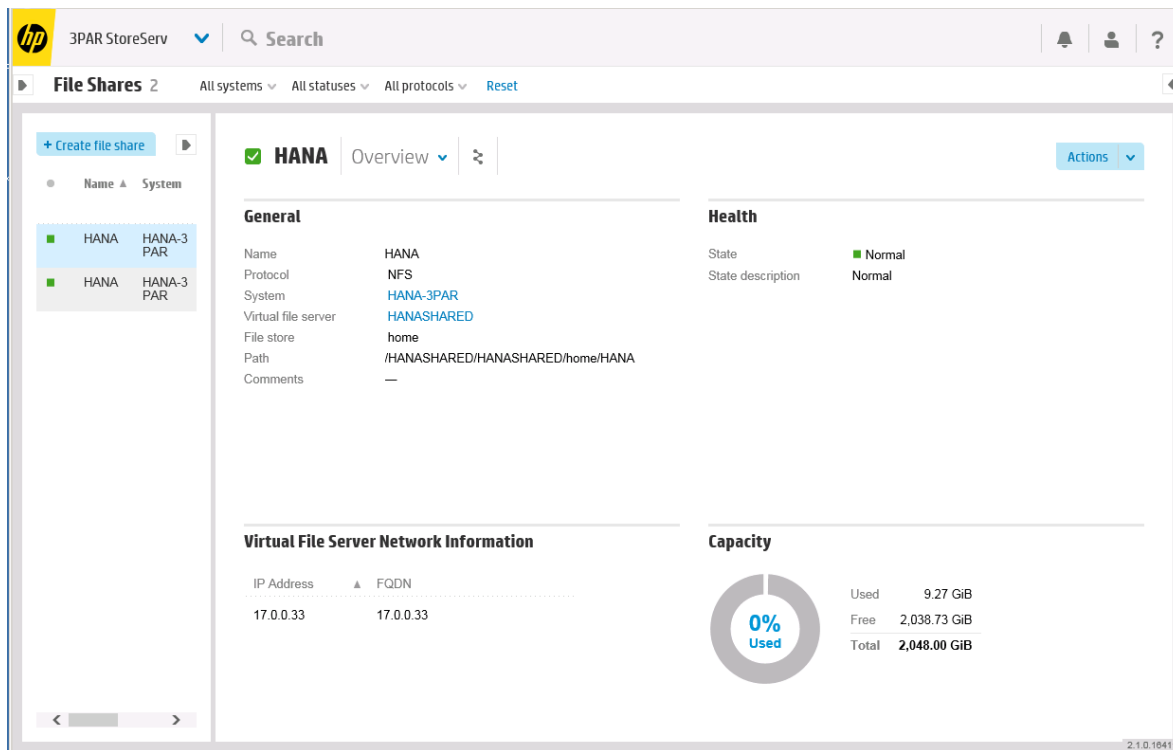


Figure 3: HANA File Share Creation

The NFS share will be mounted to the HANA node to store binaries and configuration files, and mounted as read-only SMB share as well in a cross-protocol environment to the Windows® management server to install or update the SAP HANA Studio software. To create persistence, add the share name on the HANA server to the fstab configuration file. To mount the above created file share on the SAP HANA system, use the following format: `HANA : # mount 17.0.0.33:/HANASHARED/HANASHARED/home/HANA /hana/shared`

When using LDAP or local users instead of using Active Directory to authenticate to the share from a Windows system, authenticate from the Windows management server client system using the format `LOCAL_CLUSTER\admin`.

HPE 3PAR StoreServ for SAP HANA TDI in multi-tenant environments

With HPE 3PAR StoreServ Storage, you can securely partition resources within a shared infrastructure in order to pool physical storage resources for lower storage costs without compromising security or performance.

The HPE 3PAR StoreServ Storage platform was built from the ground up to deliver multi-tenant capacity that supports massive consolidation with ultra-high performance. The multi-controller scalability and extreme flexibility built into HPE 3PAR StoreServ Storage makes deploying and maintaining separate storage silos to deliver different QoS levels a thing of the past. Unlike application-centric approaches to storage, one-click autonomic rebalancing on HPE 3PAR StoreServ Storage enables you to enhance QoS levels without service disruption, pre-planning, or the need to purchase separate arrays to support different service levels. To support multiple tenants and workloads, HPE 3PAR StoreServ Storage provides secure administrative segregation of users, hosts, and application data.

Backup and recovery

A complete data backup or storage snapshot is required to protect against data loss resulting from corrupt storage. A data backup writes the payload (that is the actual data and not unused space) in the data area and log area to different backup destinations. A storage snapshot captures the whole content of the data area. Data backups and storage snapshots are created while the SAP HANA database is running. While a backup is being created, the impact on system performance is negligible, and users can continue to work normally.

The operating system as well as the SAP HANA configuration needs to be backed up. This needs to be part of the standard backup concept for operating systems.

SAP HANA itself has two types of backups, which are both needed to recover the database to a specific point in time

- Data backups can be triggered manually or scheduled in the SAP HANA Studio, DBA Cockpit, or by SQL commands. A data backup effectively replicates a database savepoint to the backup destination.
- Log backups occur automatically when a log segment (a log segment is represented by a file on disk with a fixed size) fills up or a configurable time threshold is exceeded. The log segment is copied to the backup destination. This may happen in parallel to a data backup.

SAP HANA offers three options to back up the database:

- File system: An external shared file system can be used as the backup target for all nodes of an SAP HANA installation and is the easiest way to implement a backup solution within an SAP HANA environment. It is recommended by SAP that the shared file system for the backup should not use the same storage as the database.¹ This solution can be used for log and data backups. Hewlett Packard Enterprise offers HPE StoreOnce backup systems, which can be configured as an NFS target. Learn more about [HPE StoreOnce technology](#).
- Backint: An Enterprise Backup Solution (EBS) can be used via the Backint for SAP HANA. This EBS needs to be certified with SAP HANA. Learn more about all [certified solutions](#). To search the list of solutions, enter the search term HANA-BRINT and you will then see a list of partners. Click a partner name, for example, Hewlett Packard Enterprise. Then click "SAP Certified Solutions" to get a list of all of Hewlett Packard Enterprise's SAP-Certified Solutions. All backups are transferred to third-party provider software, which transports the data and log backups to the backup storage device, for example, tape or virtual tape library. The benefit of the Backint approach is that all backup jobs are monitored in the EBS. Hewlett Packard Enterprise has certified its backup solution, HPE Data Protector (version 7.0, 8.1 and 9.0), for SAP HANA Backint. This solution can be used with HPE StoreEver tape libraries as well as HPE StoreOnce products. The benefit of an HPE StoreOnce product is the deduplication of data, which can be either source or target based. Hewlett Packard Enterprise currently offers reference architectures for implementing SAP HANA with HPE StoreOnce Storage using either [HPE Data Protector](#) or [Symantec NetBackup](#).
- Storage snapshot: SAP HANA can use storage snapshots for backup since SPS 07. The SAP HANA database will put itself into a backup mode prior to a storage snapshot using integrated scripting solutions. A snapshot has the benefit that it can be created with minimal impact to the SAP HANA system. Additionally, a restore from a snapshot is faster than a recovery via file or Backint. This backup solution is used with data backups only. Log backups are faster and are considered a good method to speed up the overall backup process for SAP HANA. Note that additional storage capacity² is required to implement a snapshot backup solution. Hewlett Packard Enterprise offers HPE 3PAR Virtual Copy Software to implement this backup solution.

In addition to supporting file system-based backups and Backint backups with third-party software, and snapshot capability with HPE 3PAR StoreServ Virtual Copy, Hewlett Packard Enterprise offers an additional options for customers.

- HPE StoreOnce Plug-in for SAP HANA: Also leveraging Backint, the plug-in for SAP HANA enables optimized protection for SAP HANA databases. It enables the Database Administrator (DBA) to backup/restore directly to/from a Catalyst store on a StoreOnce Backup appliance. The result is flexible, high-performance protection, managed by the DBA, that can be configured to meet the protection needs of the specific databases independently or in addition to organization-wide data protection processes. The plug-in is integrated with Backint for SAP HANA to enable backups to be efficiently transferred from the SAP HANA database to the StoreOnce backup target. Once the backup target is created, backup, restore, and other data protection tasks can be executed through SAP HANA Studio and/or the SAP HANA CLI. The HPE StoreOnce Plug-in for SAP HANA must be installed using the SAP HANA operating system user, not the root user. The plug-in has guided installation and configuration for fast setup. This plug-in has a zero cost license to use but a Catalyst license must be purchased and installed for all appliances that host the target StoreOnce store(s). It is supported for use with all StoreOnce appliances running the required StoreOnce software version.

¹ For more information, refer to SAP Note 1820529.

² SAP estimates a 10 percent daily change rate.

Cloud

HPE 3PAR Virtual Domains Software

HPE 3PAR Virtual Domains Software is a virtual machine software tool that delivers protected access and robust storage services for different applications and user groups, also known as virtual private arrays. By providing protected, administrative segregation of users and hosts within a consolidated, massively parallel HPE 3PAR StoreServ Storage, HPE 3PAR Virtual Domains Software allows individual user groups and applications to affordably achieve greater storage service levels (performance, availability, and functionality) than previously possible. HPE 3PAR Virtual Domains Software is ideal for SAP HANA TDI environments where storage will be shared with non-SAP HANA workloads.

Key features and benefits

Protected, virtual private arrays to simplify storage:

- Prevents the costly purchase and time-consuming management of separate physical resources—either within a monolithic storage system or with multiple, dedicated modular storage arrays.
- Enables the creation of up to 1,024 protected, virtual private arrays within a single, massively scalable HPE 3PAR StoreServ Storage by delivering a simple, efficient, and scalable approach to protected segregation within a consolidated platform.
- Allows you to enjoy the benefits of storage consolidation—including greater resource utilization, reduced administration, centralized backup and reduced energy and floor space consumption—while meeting diverse and distributed storage requirements.
- Is fully integrated with HPE 3PAR Remote Copy Software for simple and protected access to replicated volumes
- HPE 3PAR System Reporter Software for simple historical performance and capacity utilization reporting by virtual domain, and with Lightweight Directory Access Protocol (LDAP) support for centralized user authentication and authorization.

Quality of Service

HPE 3PAR Priority Optimization Software enables the selection of service levels for applications, virtual domains, and workloads as business requirements dictate. It protects mission-critical applications such as SAP HANA by specifying service-level objectives and service-level caps for I/Os per second and bandwidth.

You can also define latency goals for your most mission-critical applications. If these goals are not met, HPE 3PAR Priority Optimization Software automatically adjusts the service levels of lower-priority applications and workloads to help ensure necessary Quality of Service (QoS) levels for your highest-priority applications.

Key features and benefits

- Helps ensure QoS for your most mission-critical applications; protects from poor performance
- Creates and modifies threshold limits, including I/O per second, bandwidth, and latency to meet business needs
- Configures QoS with mission-critical apps as “high” and others as “medium” or “low” priority
- Configures thresholds by volume set with real-time enforcement measured in seconds or sub-seconds
- Provides easy configuration with autonomic service-level objectives for a Virtual Volume set
- Enables you to specify the relative performance of each workload on HPE 3PAR StoreServ Storage to:
- Control and balance the distribution of the powerful HPE 3PAR StoreServ Storage disk bandwidth across multiple production and test and development workloads on a single system
- Avoid resource contention in the storage system by throttling the I/O of one or more workloads to allow the performance of others
- Manage end-user application performance expectations even with only one workload present

Management with HPE OneView

To eliminate infrastructure complexity, HPE OneView automates the delivery and operations of IT services—transforming everyday management of server, storage, and network resources in physical and virtual environments. Based on the unique Hewlett Packard Enterprise architecture, HPE OneView improves IT administrator efficiency by converging management of Hewlett Packard Enterprise server, storage, and networking resources. It speeds IT service rollouts and helps actively prevent error-induced downtime through a template-based, software-defined approach to management. HPE OneView also saves time by acting as an automation hub that performs infrastructure configuration and management tasks at the request of other applications. HPE OneView capabilities are available with both HPE ConvergedSystem for SAP HANA as well as SAP HANA TDI implementations that include HPE 3PAR StoreServ Storage, HPE Servers, and HPE Networking.

HPE Technology Consulting Services

HPE Technology Consulting Services has been delivering SAP infrastructure solutions to customers for over two decades. By using our framework for custom SAP HANA solutions, the goal is to help customers quickly realize ROI and TCO objectives. For SAP HANA TDI, knowledge and expertise of both SAP HANA and HPE Storage solutions are leveraged. Storage-specific knowledge includes consulting for primary (persistence storage) and backup and recovery for SAP HANA. The framework is delivered uniformly worldwide, so customers can expect the same experience at any and all locations. SAP HANA TDI can appear to be complex, but this framework, comprised of five phases, breaks down any complexity. Each phase has activities and deliverables to help ensure customers' technical and business requirements are met. These five phases are:

- Analysis and strategy: The most important phase—sets the business content and requirements for the entire effort.
- Architect and validate: This phase brings all the components together and verifies that requirements are being met.
- Detail design: This phase sets the stage for a successful implementation based on the best and most effective solution.
- Implement: This phase provides for a rapid deployed mission-critical infrastructure built and tested for SAP HANA.
- Manage: This final phase of the framework that focuses on operational excellence.

The key to this framework is that Hewlett Packard Enterprise resources are used to supplement—not replace—a customer's staff during the project. Hewlett Packard Enterprise consultants will bring facilitation experience, subject-matter expertise, and specific technology experience to the process.

Learn more about [HPE Technology Consulting Services](#).

HPE Support

With HPE ConvergedSystem for SAP HANA, Hewlett Packard Enterprise delivers the highest-level specialized support, delivered by a team of Hewlett Packard Enterprise SAP experts. We collaborate extensively with SAP on testing and certification of these certified SAP HANA offerings. This support approach is designed for fixed appliances with defined configurations.

HPE Technology Support Services also offers a complete support offering for SAP HANA TDI with HPE 3PAR StoreServ Storage. This includes standard Hewlett Packard Enterprise support with a choice of support levels.

Hewlett Packard Enterprise recommends HPE Proactive Care with the HPE Personalized Support Option for all Hewlett Packard Enterprise components; this support recommendation provides a single point of contact for support of all Hewlett Packard Enterprise components. Alternatively, if you are looking for customized support for your entire IT environment, Hewlett Packard Enterprise recommends HPE Datacenter Care. HPE Datacenter Care Primary Services Provider, a building block of Datacenter Care, helps customers support and operate a multivendor environment with a single point of contact, reducing the complexity of dealing with multiple hardware and software support vendors.

Learn more about [HPE Proactive Care Services](#) and [HPE Datacenter Care Services](#).

Summary

HPE 3PAR StoreServ offers an industry-leading offering for SAP HANA TDI with both HDD and performance-optimized all-flash offerings. All HPE 3PAR StoreServ solutions offer unparalleled resiliency, availability, and tier-1 data services. All Hewlett Packard Enterprise solutions for SAP HANA are backed by decades of expertise in delivering HPE Technology Consulting Services and HPE Technology Support Services for mission-critical SAP environments. Learn more about [HPE Storage solutions for SAP and SAP HANA](#).

Learn more at

hpe.com/us/en/storage/flash-hybrid.html



Sign up for updates

★ Rate this document



© Copyright 2015 Hewlett Packard Enterprise Development LP. The information contained herein is subject to change without notice. The only warranties for Hewlett Packard Enterprise products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. Hewlett Packard Enterprise shall not be liable for technical or editorial errors or omissions contained herein.

SAP is the trademark or registered trademark of SAP SE in Germany and in several other countries. Linux is the registered trademark of Linus Torvalds in the U.S. and other countries. Red Hat is a registered trademark of Red Hat, Inc. in the United States and other countries. Intel Xeon is a trademark of Intel Corporation in the U.S. and other countries. Windows is either a registered trademark or trademark of Microsoft Corporation in the United States and/or other countries.

4AA6-3269ENW, December 2015