SAP HANA und Storageanbindung

SAP Competence Center

Marian Plappert/ 28. April 2015

Agenda

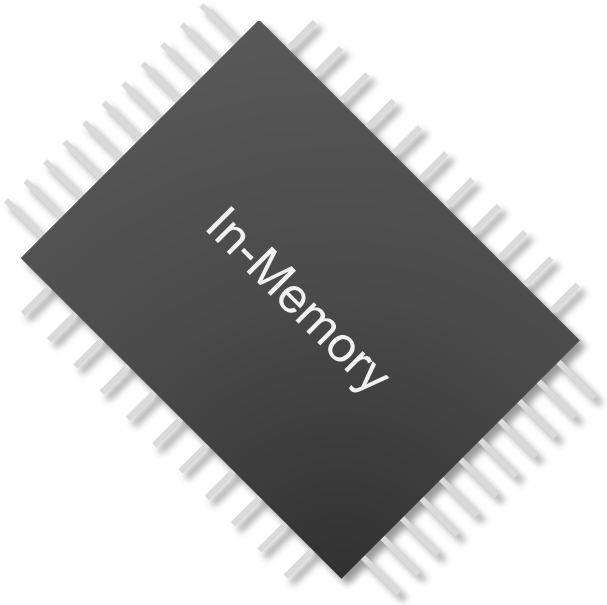
1. SAP HANA Einführung und Liefermethoden
2. Bedeutung von Storage für HANA
3. Anforderungen an den Storage durch die SAP
4. Umsetzung in Appliance und Tailored Data center Integration (TDI)
5. HP Storage Lösungen für SAP HANA TDI
6. Backup und Recovery

SAP HANA Einführung und Liefermethoden

What is SAP HANA?

SAP HANA is…

- a database platform from SAP
- an in-memory database
- data is compressed
- data is non-dedupable
- uses row and columnar storage
- runs on Linux (SLES or RHEL)
- has a defined processor architecture of Intel E5/E7
  (Westmere EX and IVY-Bridge EX)
- has a defined CPU-memory ratio
  (128 GB per CPU for BW and up to 512 GB per CPU for Suite – Westmere EX)
  (256 GB per CPU for BW and up to 768 GB per CPU for Suite – IVY-Bridge EX)



SAP HANA Begriffe

Scale-up System

- Skalierung innerhalb einer Maschine
- Physikalische Grenzen bei 2/4/8/16 Sockel
- Begrenzung des maximalen Memory gem. CPU-Memory Ratio
- Für analytische und transaktionale Daten einsetzbar

  → Suite on HANA (**SoH**)

  → Business Warehouse on HANA (**BWoH**)

Scale-out System

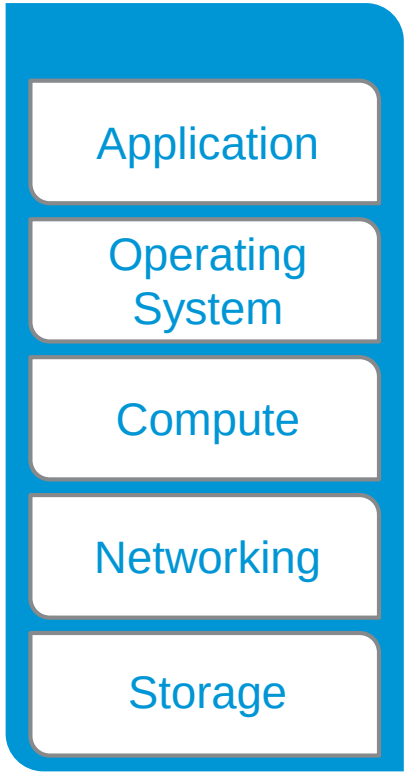
- Skalieren über Maschinen
- Min. 3 Knoten (1x Master, 2x Worker)
- Master-Knoten überschreitet teilweise 1TB/4s
- Ausschließlich analytische Daten → Business Warehouse on HANA (BWoH)*

*General Availabilty, in Einzelfällen sind auch SoH-Projekte in Rücksprache mit der SAP möglich

SAP HANA Liefermethoden

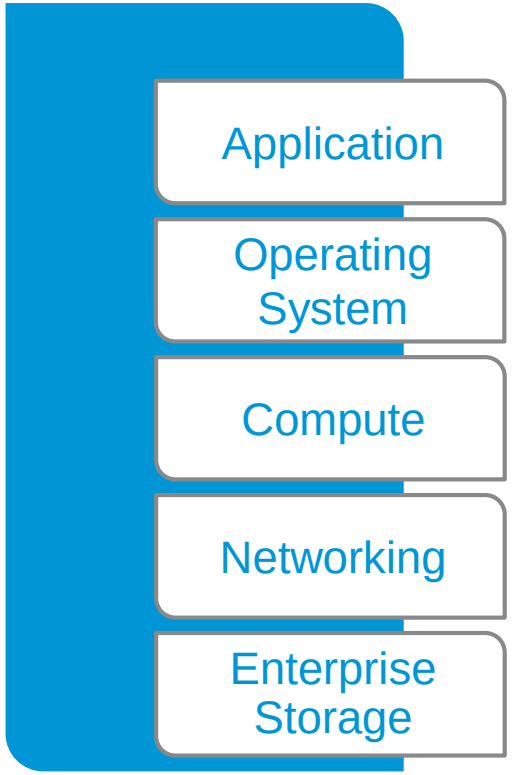
Appliance Delivery

Complete Solution **– Vendor Certified**

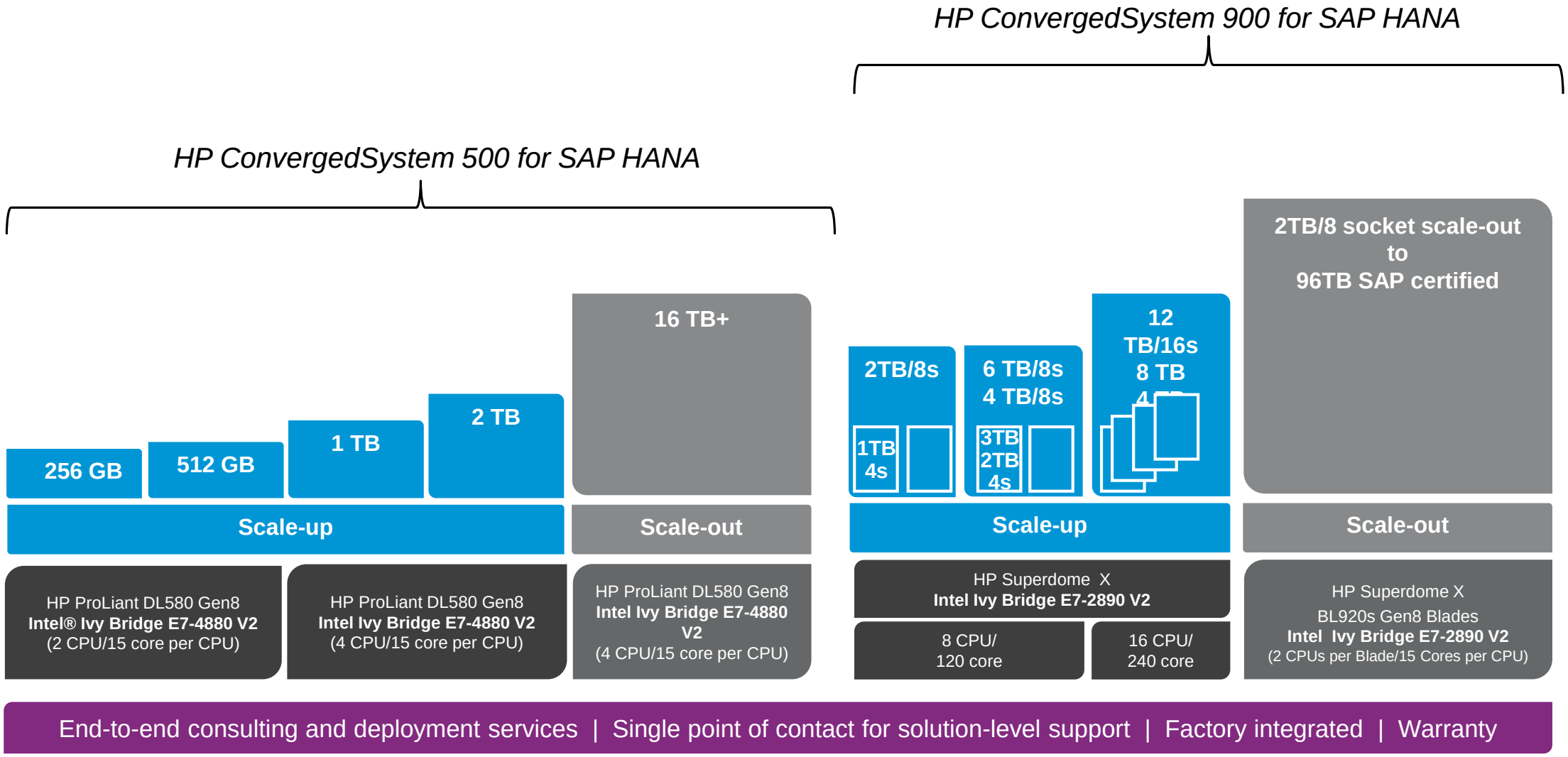


Tailored **D**ata center **I**ntegration (TDI)

Disaggregated Solution – **Customer Validated**



CS500 and CS900 solutions for SAP HANA



Bedeutung von Storage für HANA

Bedeutung von Storage für HANA: Persistenz

SAP HANA uses storage for several purposes

- **Data**: SAP HANA persists a **copy of the in-memory data**, by writing changed data in the form of so-called **savepoint blocks** to free file positions, using I/O operations from 4 KB to 16 MB (up to 64 MB when considering super blocks) depending on the data usage type and number of free blocks. Each SAP HANA service (process) separately writes to its own savepoint files, every five minutes by default.
- **Redo Log**: To ensure the recovery of the database with zero data loss in case of faults, SAP HANA records **each transaction in the form of a so-called redo log entry**. Each SAP HANA service separately writes its own redo-log files. Typical block-write sizes range from 4KB to 1MB.
- **SAP HANA installation**: This directory tree contains the run-time binaries, installation scripts and other support scripts. In addition, this directory tree contains the SAP HANA configuration files, and is also the default location for storing trace files and profiles. On distributed systems, it is created on each of the hosts.
- **Backups**: Regularly scheduled backups are written to storage in configurable block sizes up to 64 MB.

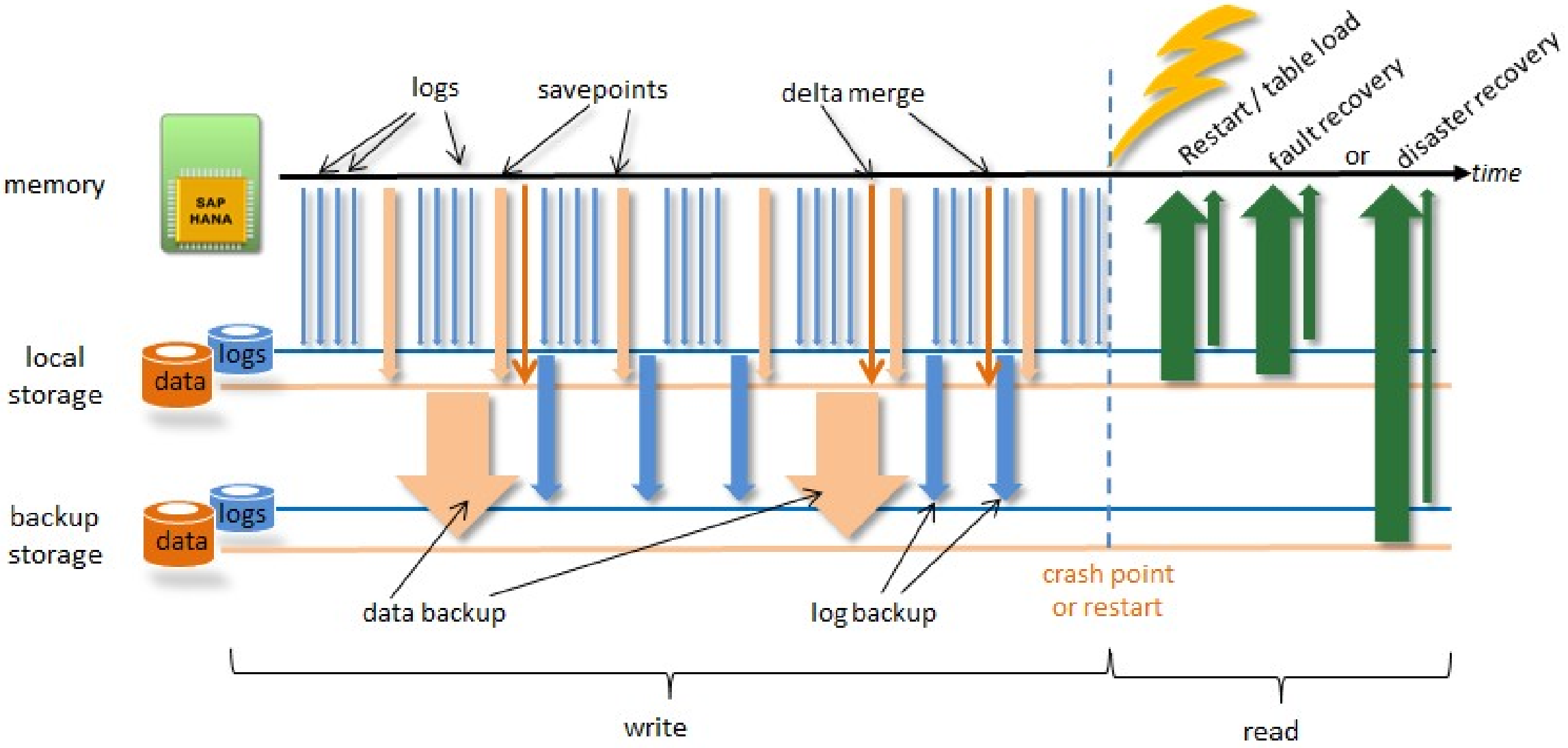
Each service of a distributed (multi-host) SAP HANA system manages its persistence independently. Logically, this is a **shared-nothing approach**.

Source: https://hcp.sap.com/content/dam/website/saphana/en_us/Technology%20Documents/Storage%20Whitepaper%202%204.pdf p. 4

SAP HANA Storage I/O Requirements

- As an in-memory database, SAP HANA uses storage primarily as a backing store, for the purpose of startup and fault recovery without data loss
- In terms of storage performance, both write and read operations need to be considered:
  - A **high write transfer rate** is important to keep up with the volume of write operations represented by the **savepoint persistence**, delta merge and backups
  - **Low write latency** is also critical as transactions are not complete until they have been written into the **redo log**
  - A **high read transfer rate** is important for a rapid **startup of the database** as well as in failover situations where a SAP HANA host takes over the persistence of another host, in particular with very large data sizes

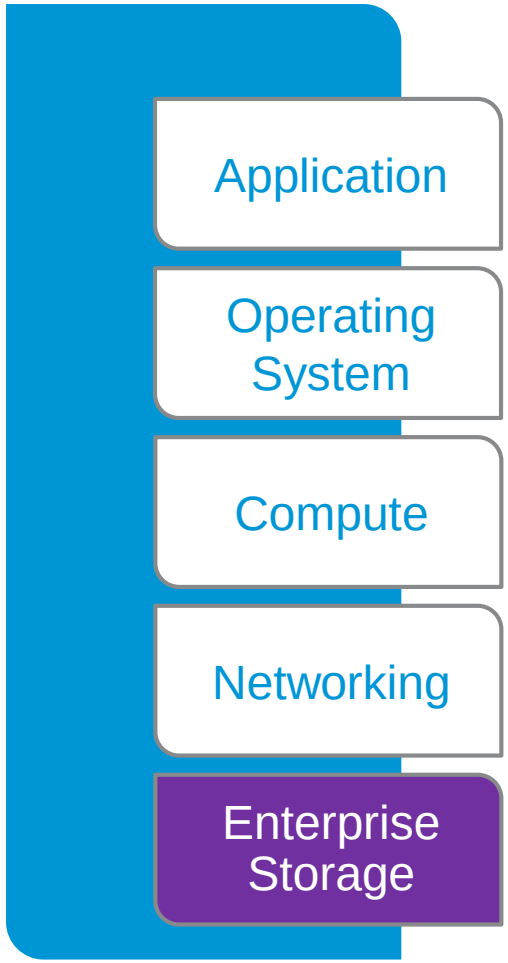
SAP HANA I/O Activity



Anforderungen an den Storage durch die SAP

SAP HANA TDI Storage

Requirements by SAP



Storage vendor

- Has to be certified by SAP
- For successful certification, two requirements must be met:
  - Fulfillment of KPIs as defined by SAP
  - Implementation/configuration of storage connector (SAP API for Block Access)

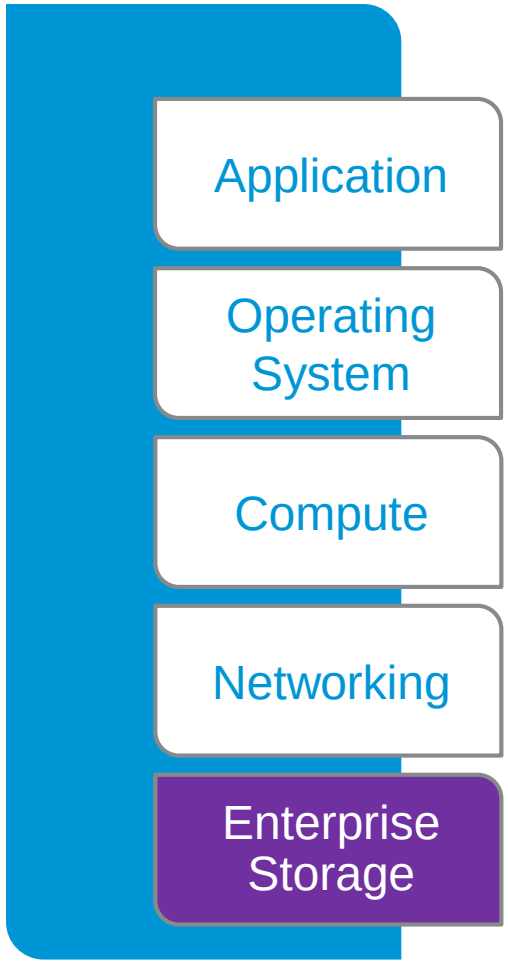
Customer

- Has to validate solution with Hardware Configuration Check Tool provided by SAP (optional/highly recommended*))
- No pre-certified storage configurations for TDI in place
- See SAP Note 1943937

*Required by SAP for production support issues related to low throughput rate or high latency time

SAP HANA TDI Storage

Storage sizing



HANA Persistence storage sized at approximately 3x RAM size (= 2x overall table size)

- **Data**
  - 1x RAM size
- **Log**
  - Systems ≤ 512 GB RAM size → Disk space for logs = 0,5x RAM size
  - Systems > 512 GB RAM size → Disk space for logs ≥ 512 GB
- **Shared**
  - 1x RAM size

Source: SAP HANA Storage Whitepaper

http://www.saphana.com/docs/DOC-4071

SAP HANA TDI Storage

Requirements by SAP: KPIs

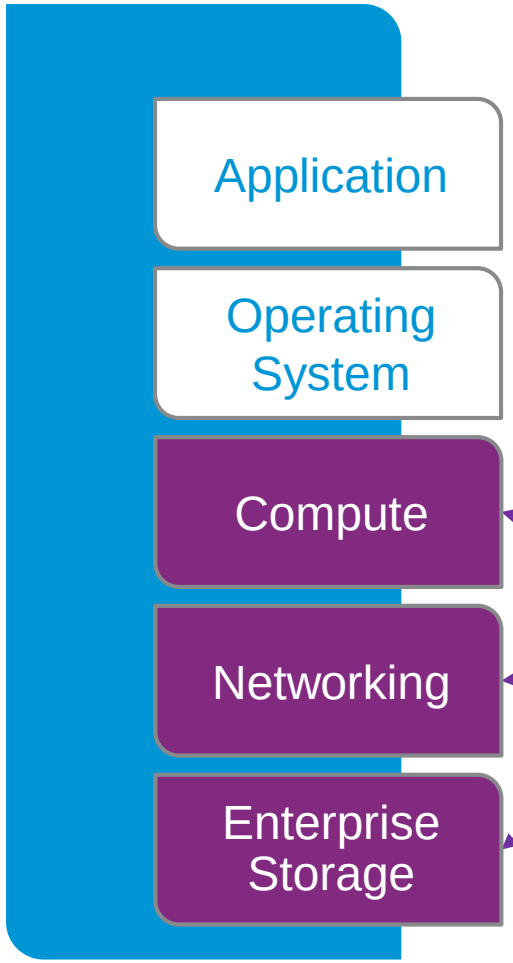
Volume	Block Sizes	Test File Size	KPIs			
			Initial Write (MB/s)	Overwrite (MB/s)	Read (MB/s)	Latency (µs)
Log	4K	5G	n.a.	30	n.a.	1000
	16K	16G	n.a.	120	n.a.	1000
	1M	16G	n.a.	250	250	n.a.
Data	4K	5G	n.a.	n.a.	n.a.	n.a.
	16K	16G	40	100	n.a.	n.a.
	64K	16G	100	150	250	n.a.
	1M	16G	150	200	300	n.a.
	16M	16G	200	250	400	n.a.
	64M	16G	200	250	400	n.a.

Other KPIs for Appliances
→ More discs required

Source: http://help.sap.com/hana/SAP_HANA_Administration_guide_en.pdf p. 276

SAP Hardware Configuration Check Tool For SAP HANA TDI

Required by SAP for Production Support Issues*



SAP Note

1943937 - Hardware Configuration Check Tool - Central Note

Version 5 **Validity:** 31.10.2014 - active

SAP HANA HW Configuration Check Tool

2 Test Modules

This section includes a description of the available modules and what they do.
The current version of the tool has the following modules:

- Landscape Test
- File System Test
- Network Test

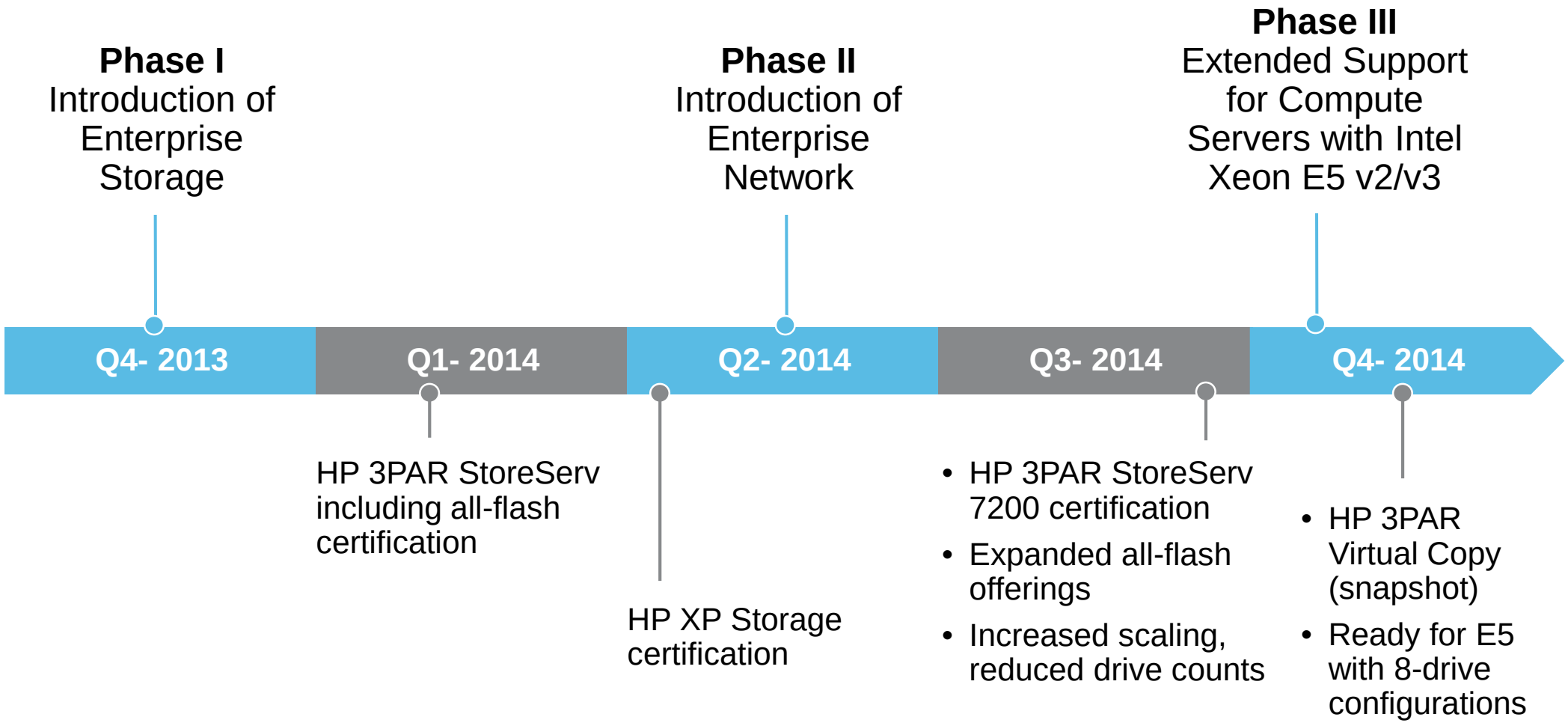
This framework provides tests and reports for new single host and scale out systems to determine if the hardware you intend to use **meets the minimum performance criteria required to run SAP HANA in production use**.

*Usage of tool highly recommended and required by SAP for production support issues related to low throughput rate or high latency time

SAP HANA Tailored Data center Integration (TDI) evolution – overview

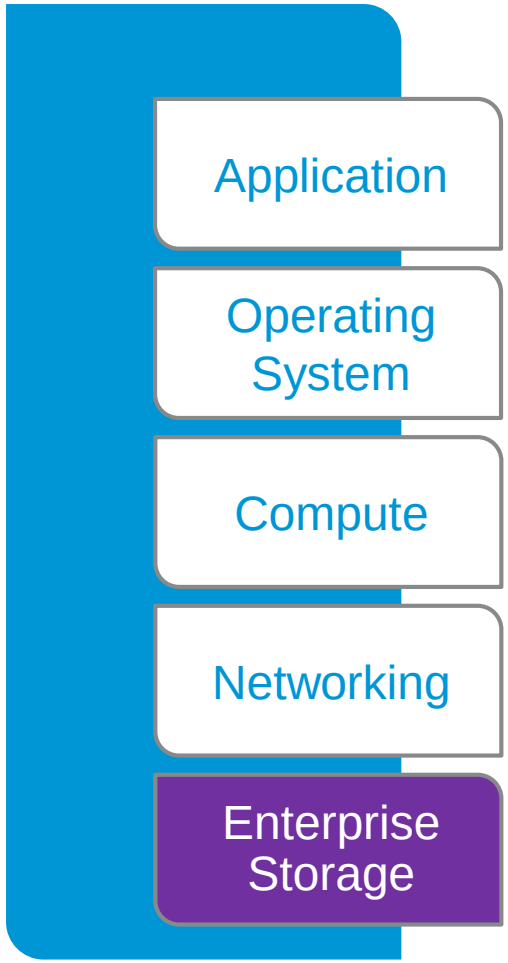
SAP
Driving adoption

HP Storage
Expanding Solution



SAP HANA TDI – Phase I

HP Storage Certified Solutions



Only certified Enterprise Storage Systems are supported

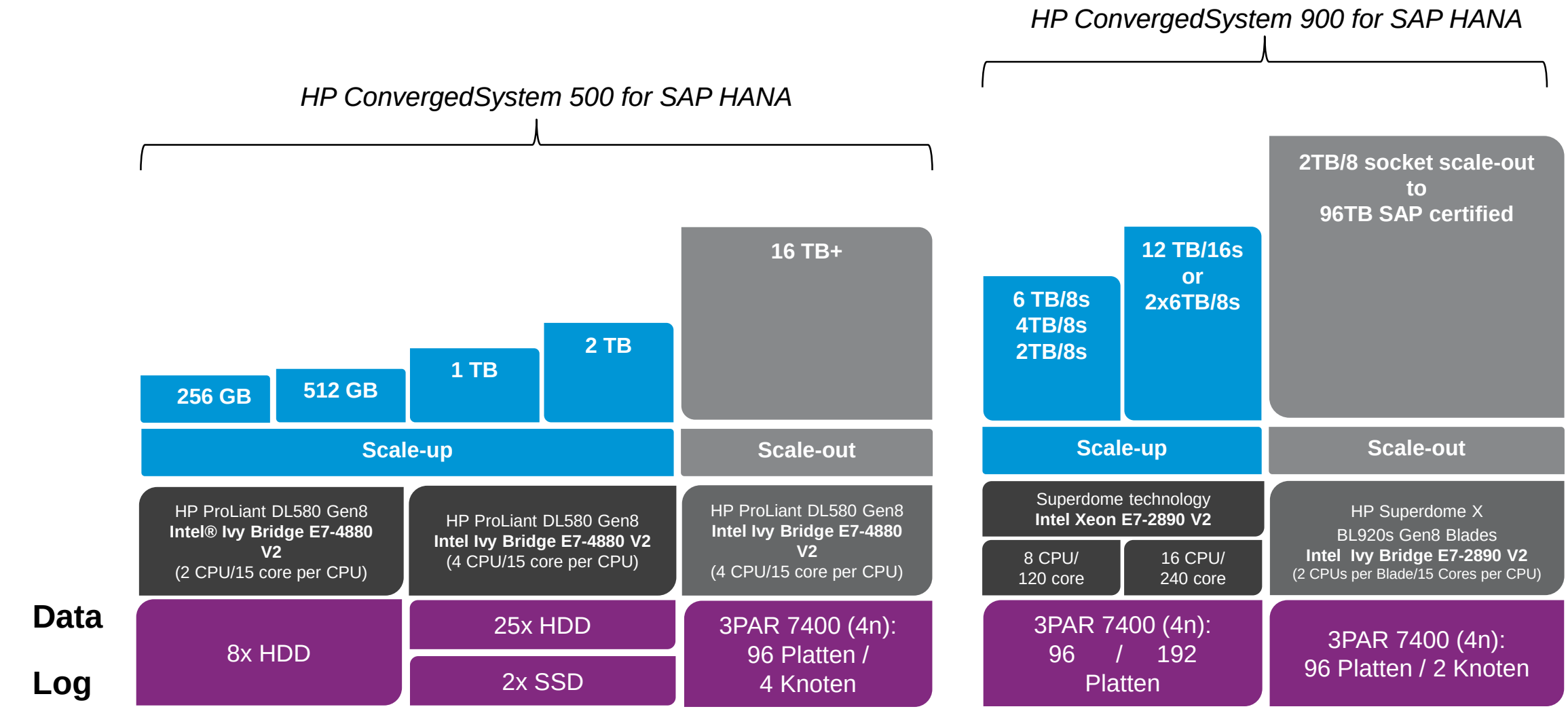
http://scn.sap.com/docs/DOC-60278

HP certified storage solutions

Partner Name	Storage solution name	Model (used for test)	Comments	Storage connector
Hewlett-Packard Company	HP 3 PAR StoreServ	HP 3PAR StoreServ 7200	Scale out from up to 4 SAP HANA nodes per HP 3PAR StoreServ 7200(c) array up to 16 SAP HANA nodes per HP 3PAR StoreServ 10800 8-node array (up to 32 for scale-up). Supported HP 3PAR StoreServ models include HP 3PAR StoreServ 7200(c), 7400(c), 7440c, 7450(c), 10400 and 10800. Includes 3PAR StoreServ all-flash configurations.	SAN Fibre Channel
Hewlett-Packard Company	HP XP Storage	HP XP7	Scale out to 16 nodes per HP XP disk array; HP XP Storage Family includes the XP7 and XP P9500	SAN Fibre Channel

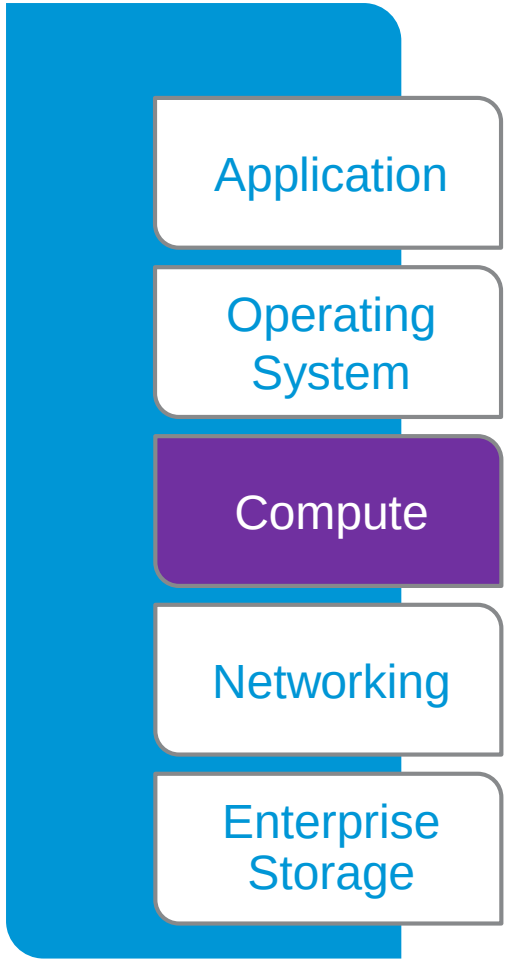
Umsetzung in Appliance und Tailored Data center Integration (TDI)

Umsetzung in Appliance



Umsetzung in TDI (I)

Server requirements



Servers listed as Entry Level System

- Intel E5-26xx v2/v3
- Only Single Node
- Only 2 Socket-Systems
- 2x E5-26xx Processors with min. of 8 Cores
- Max. 768 GB Memory (SoH) / 512 GB Memory (BW)
- **Internal discs allowed:** 3-7 hard drives for Data and Log
- No restrictions from SAP for use in test, development or production environment

Umsetzung in TDI (II)

	HDD					SSD		
# Hosts	7200c	7400c (2n)	7400c (4n)	10400	10800	7200c	7400c (2n)	7400c (4n)
2	24	24	24	24	24	8	8	8
3	36	24	24	24	24	12	12	12
4	48	36	36	36	36	16	16	16
5		48	48	48	48		20	20
6		72	54	64	64		24	24
8			96	72	72			32
10			120	96	96			40
12			144	128	128			48
16				160	160			
32					320			

HP Storage Lösungen für SAP

HANA TDI

HP Storage Solutions for SAP HANA – Overview

Platform Solution

ConvergedSystem for SAP HANA

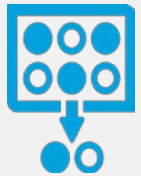
HP Converged System 500 and 900 for SAP HANA with HP 3PAR StoreServ

SAP HANA tailored data center integration (TDI)

HP 3PAR StoreServ

HP XP7 Storage

Backup and Recovery



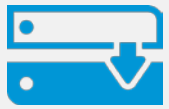
HP StoreOnce Backup

HP StoreEver Storage

HP Data Protector

Performance

Scale



Availability

Tier-1 Features

Converged Infrastructure

HP 3PAR StoreServ

Eliminating boundaries for SAP HANA tailored data center integration

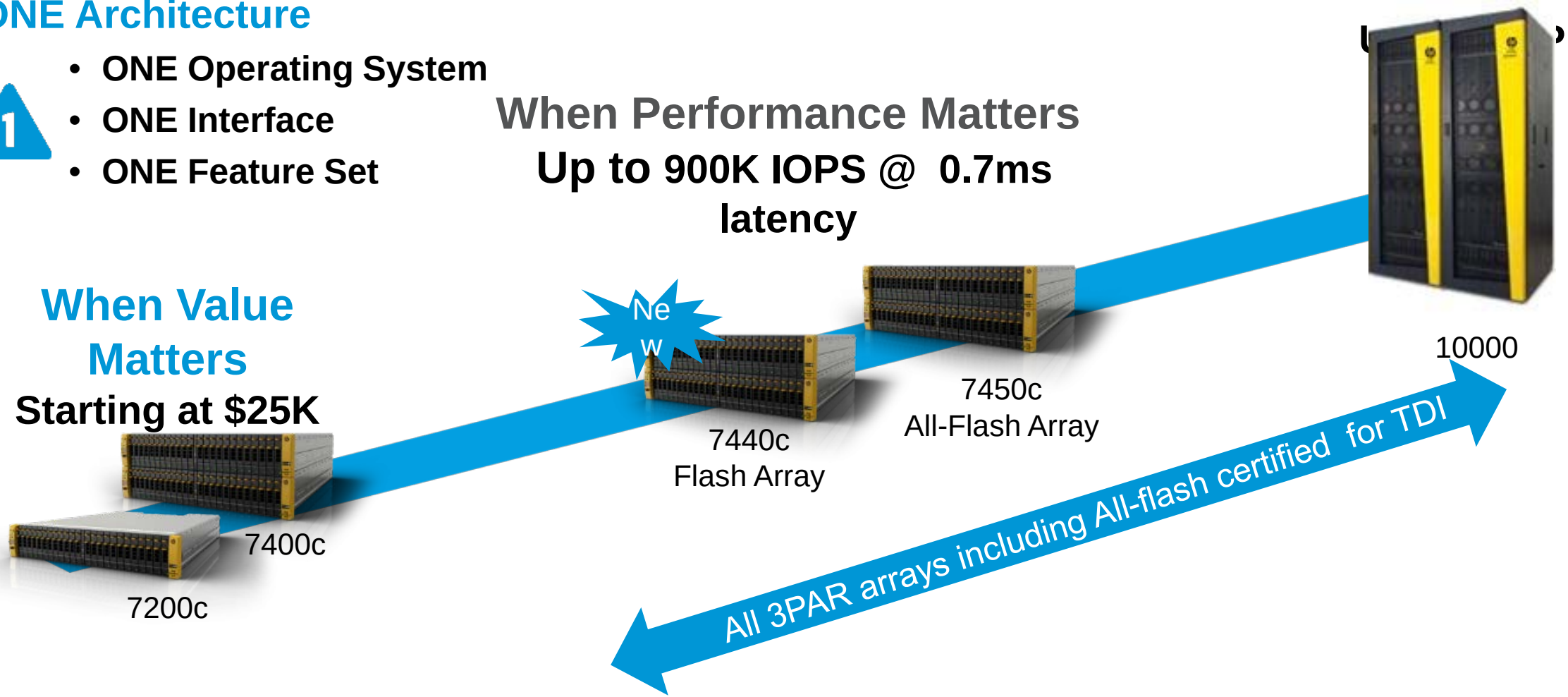
Polymorphic Simplicity
ONE Architecture

- **ONE Operating System**
- **ONE Interface**
- **ONE Feature Set**

When Value Matters
Starting at $25K

When Performance Matters
Up to 900K IOPS @ 0.7ms latency

When Scale Matters
U PB



HP 3PAR StoreServ

All HP 3PAR StoreServ models certified for SAP HANA TDI

Performance
- All-flash configurations
- System wide striping

Availability
- Full hardware redundancy
- 6-Nines Guarantee*

Efficiency
- 60% reduction in space and power**
- Thin provisioning

Tier-1 data services
- Priority Optimization
- Peer Motion
- Virtual copy

SAP® Certified
Hardware for SAP HANA®

*6-Nines Guarantee for qualified customers with purchase of 4-node HP 3PAR StoreServ array
** Compare of 3PAR SSD configuration vs. EMC VNX7600 HDD configuration for 4-HANA server node scale-up configuration

HP 3PAR All-Flash for SAP HANA TDI

Why HP 3PAR All-flash for SAP HANA TDI

- 7200c All-flash starter kit and 7450 All-flash certified with as few as eight drives for scaling up to 12 HANA nodes
- 60% reduced space and power consumption compared to equivalent EMC VNX7600 HDD configuration*
- 3PAR Tier-1 featureset including Thin Provisioning and QoS for shared-application implementations
- Higher reliability with 5-year SSD drive warranty all backed by 99.9999% 3PAR StoreServ availability guarantee**

HP 3PAR StoreServ 7200
All-flash Starter Kit

HP 3PAR StoreServ
7450 All-flash

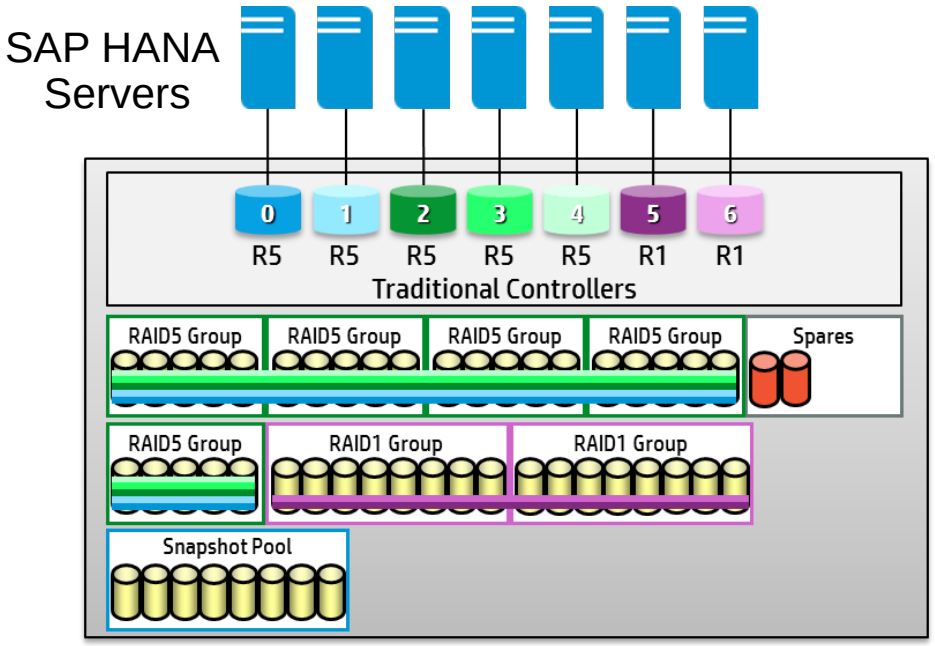
Industry's first all-flash offering for TDI

*Four SAP HANA server node configuration: 12-SSD 7450 compared to 40-HDD VNX7600

**6-Nines Guarantee for qualified customers with purchase of 4-node HP 3PAR StoreServ array

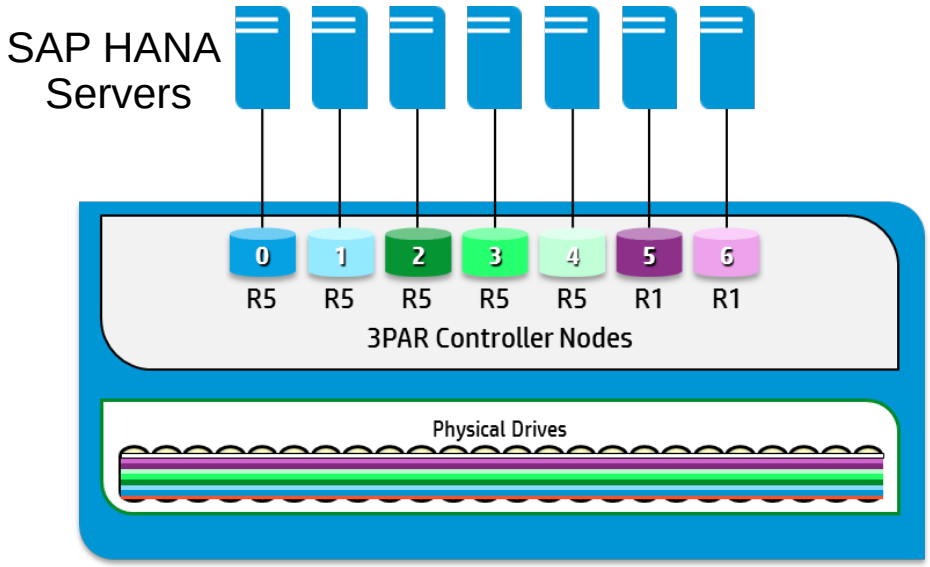
HP 3PAR StoreServ performance advantage for SAP HANA TDI

Traditional Storage Array



- Groups of drives are dedicated to SAP HANA servers
- Sub-optimal resource utilization
- Limited performance capability

HP 3PAR Array with wide striping

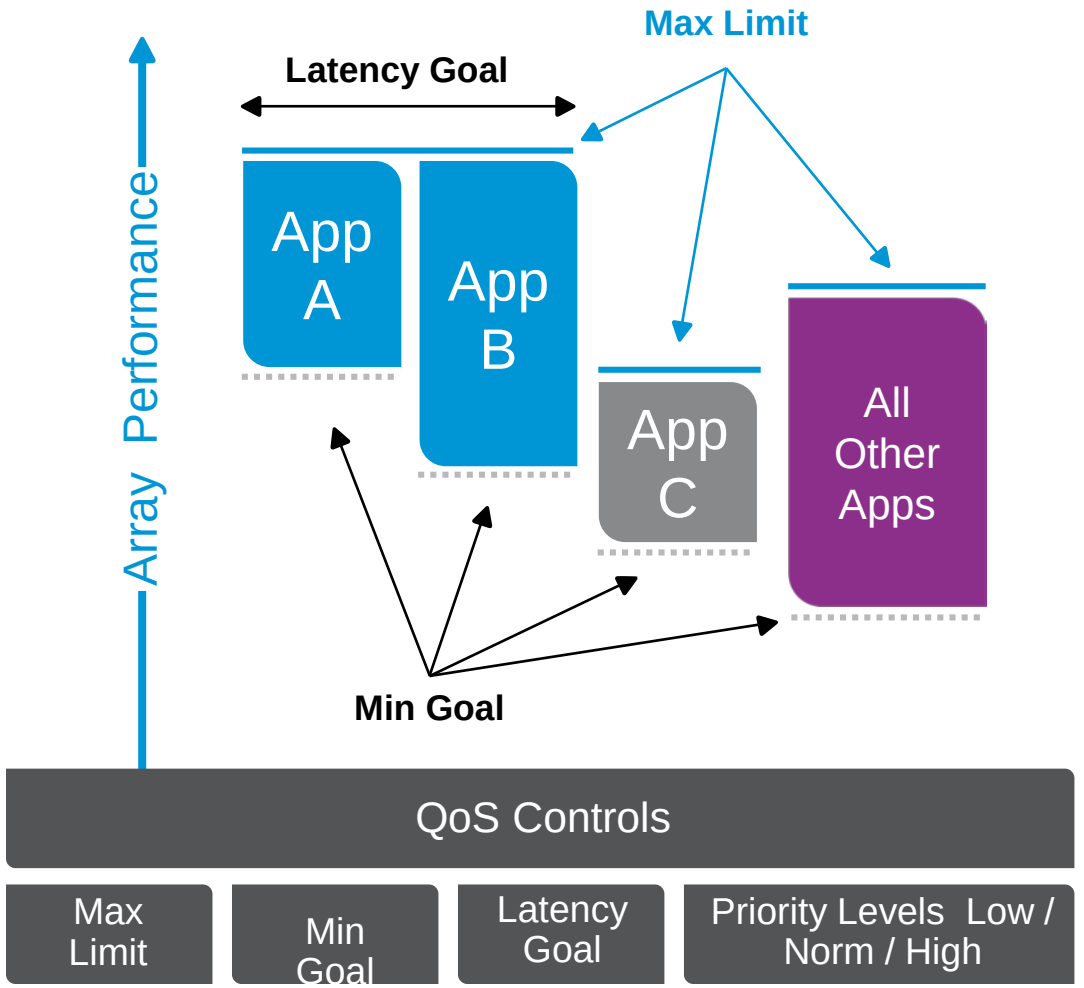


- Data is wide striped across all drives
- All drives are accessible to all SAP HANA servers
- Maximum performance capability

Assure SAP HANA Quality of Service with Priority Optimization

Deploy multi-tenant environments with confidence

- Protect SAP HANA and other mission critical applications
- Deliver predictable service levels on a shared array
- Assure service levels for Premium Tier
- Deliver Bronze service level for low-cost tenants
- Consolidate test/development on production system



HP 3PAR Peer Motion for SAP HANA

Ease of growth and scaling for SAP HANA databases

Non-disruptive addition of 3PAR storage to SAP HANA DB

- Granular level migration enables addition of 3PAR arrays to growing HANA environment, without disruption

Non-disruptive migration from small to large SAP HANA appliance

- Migrate your HANA DB to larger environment without outage

Backup und Recovery

Why backups for SAP HANA?

- Cheap implementation of HA & DR
- HANA Replication concept is not a backup
- Savepoints on Persistence is not a backup
- Protects against failures in persistence layer
- Recover the database to an earlier point in time
- Creation of database copy for Test/DEV systems
- Fulfill audit and compliance regulations

Architecture details

SAP HANA DB in-memory layer

SQL data and undo log information

Persistence layer

Undo log and automatic savepoints

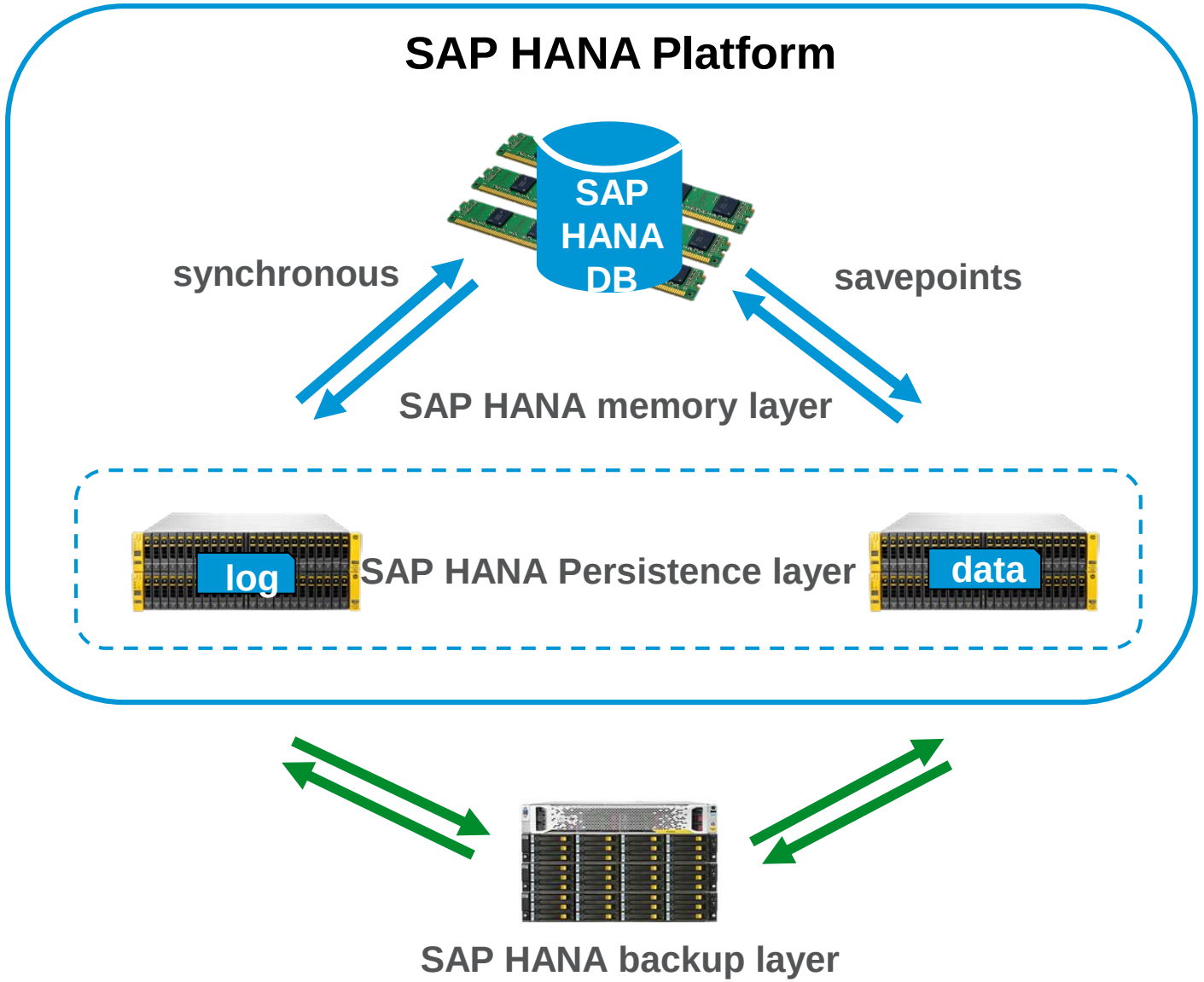
Backup layer

Logical errors/ corruption

User error

Catastrophic failure

Media break

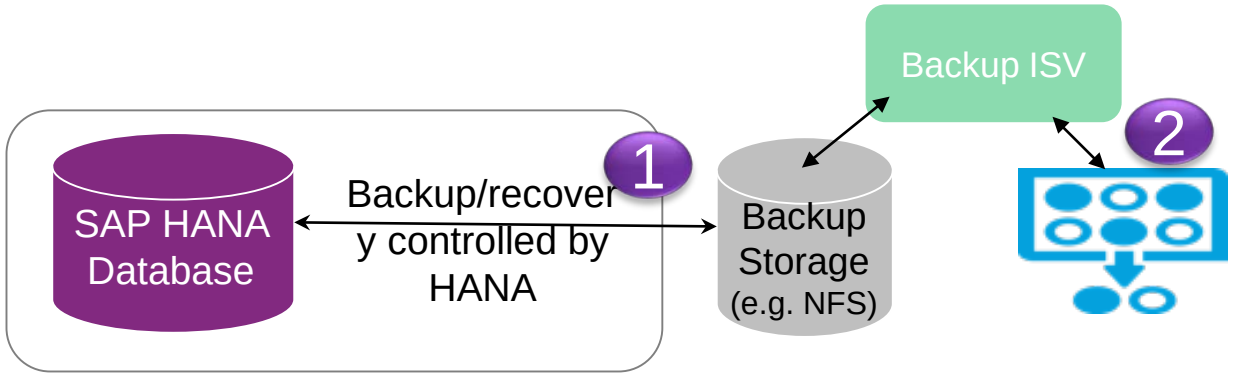


SAP HANA Backup and Recovery

Two options for SAP HANA backups

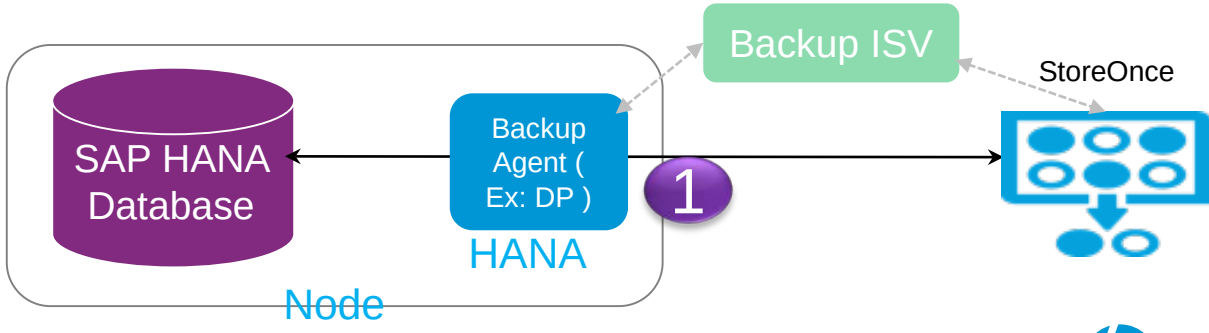
Backup to file system

- Two stage backup
  - Backup to NAS Share
  - Copy data from NAS to backup device(StoreOnce) using Backup application
- Complex Process
- Two Stage recovery – Slow !!



Backup with 3rd party backup tool

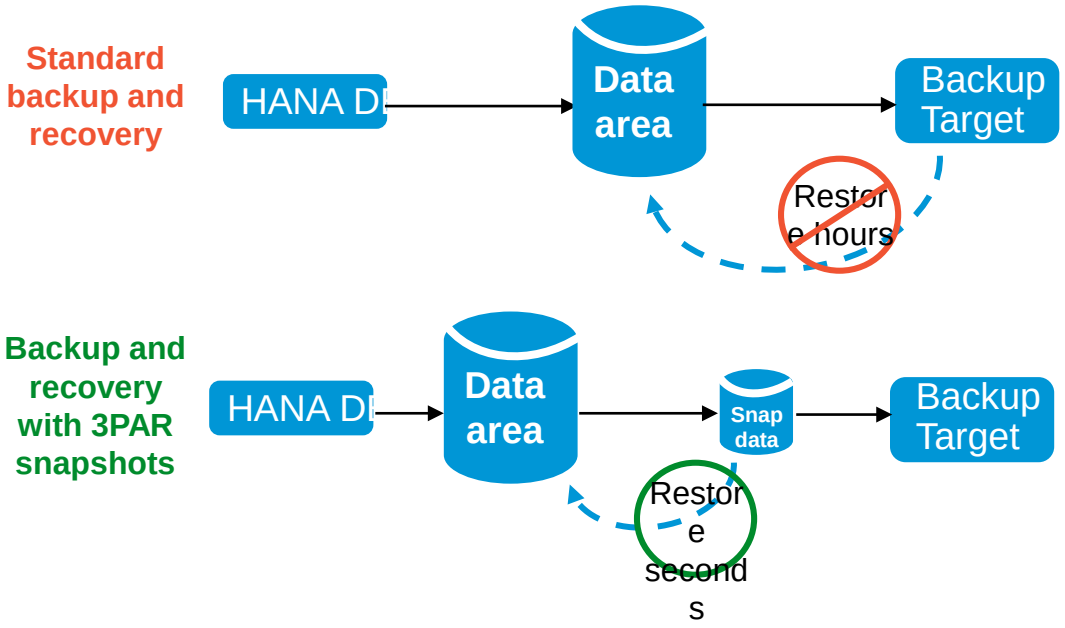
- "Backint for SAP HANA" is an API that can be implemented by 3rd party backup agent
- Provides functions for backup (both data and log backups), recovery, query and delete
- 3rd party backup agent runs on SAP HANA server; communicates with 3rd party backup server
- Removes administrative burden of backups; increased functionality with agents



HP Storage innovations for SAP HANA backup and recovery

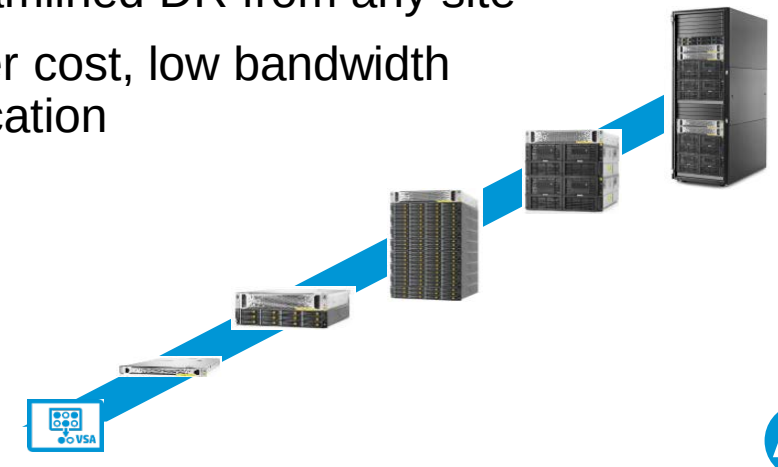
HP 3PAR StoreServ

HP 3PAR StoreServ Virtual Copy for near instant backup and recovery



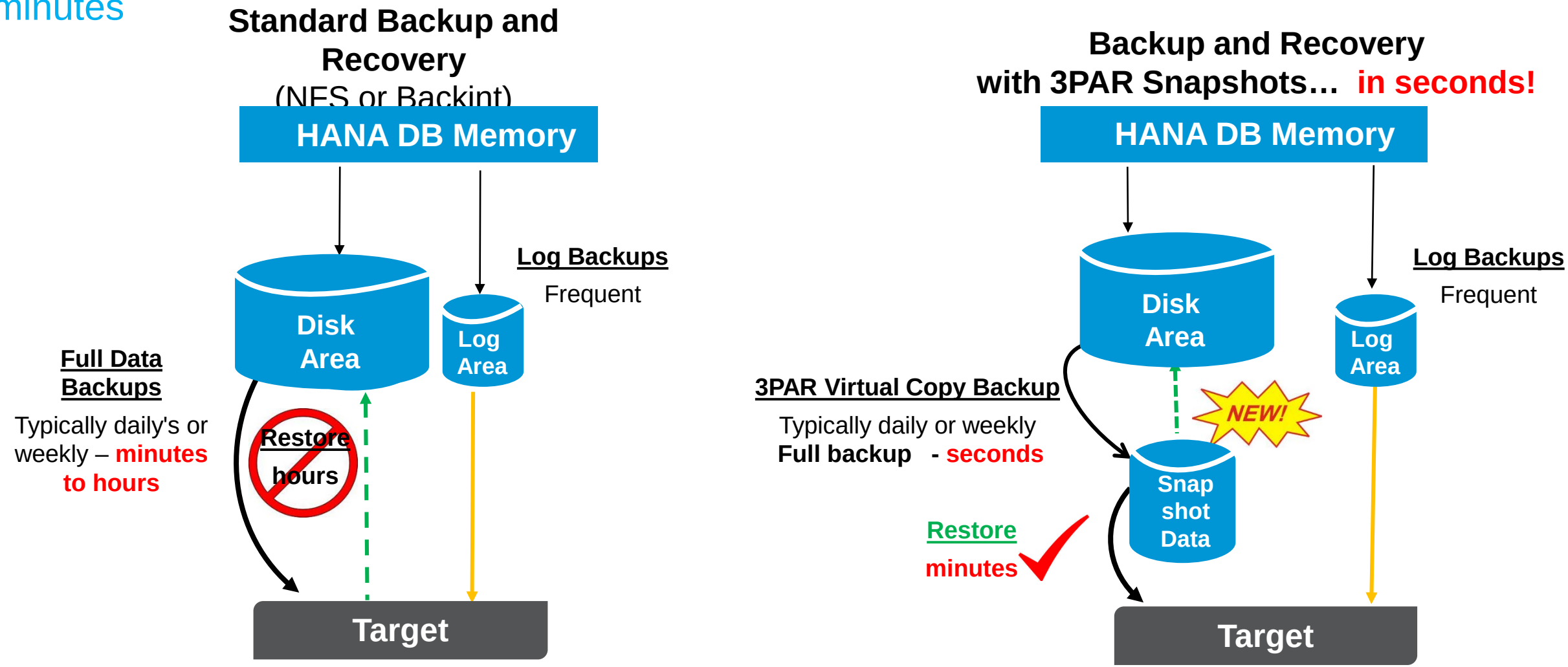
HP StoreOnce

- Direct backups to StoreOnce eliminates 2-step process
- StoreOnce Catalyst for faster backup and recovery
- Streamlined DR from any site
- Lower cost, low bandwidth replication



Backup your SAP HANA Database in seconds…

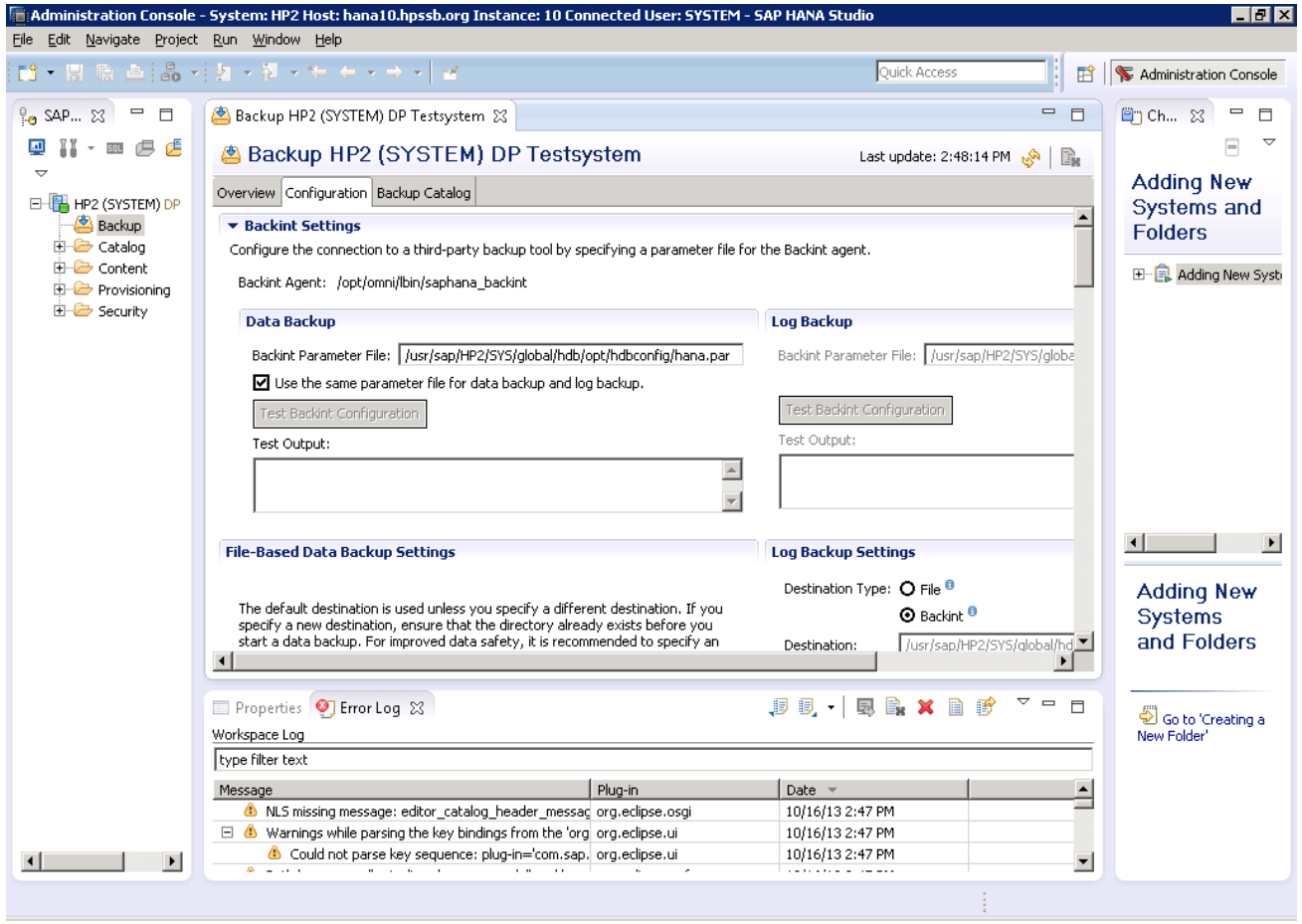
HP 3PAR StoreServ Virtual Copy snapshots for backup and recovery in seconds to minutes



HP Data Protector and SAP HANA

Key features

- SAP certified integration for HP Data Protector and SAP HANA
- BackINT API integration for full application admin control
- Control backup & recovery process through SAP HANA GUI
- Manage backup logistics to SAP HANA like device/media management
- Support backup to any secondary storage tier supported by Data Protector



… Questions ?