Hitachi Solution for the SAP HANA Platform using Hitachi UCP CI with Advanced Server DS7000 - Hardware Partitioning

Reference Architecture Guide

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Feedback

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Revision History

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Hitachi Solution for the SAP HANA Platform using Hitachi UCP CI with Advanced Server DS7000 – Hardware Partitioning

Reference Architecture Guide

Hitachi Solution for the SAP HANA Platform using Hitachi UCP CI with Advanced Server DS7000 is built with a unique modular architecture that can be configured and scaled to meet the needs of a wide variety of application workloads. Each module supports a pair of Intel Xeon Scalable processors, with up to 56 cores and 3 TB of memory per module. An 8-socket DS7000 server can support up to 224 cores and 12 TB of memory. Each model can be smoothly upgraded to the next, preserving your investment in hardware and software as your configuration grows, and compute modules can be individually configured to support a wide variety of compute and storage options. Hitachi Solution for the SAP HANA Platform makes full use of the huge memory capacity of the DS7000 to deliver real-world business benefits. With Hitachi Advanced Server DS7000 hardware partitioning capabilities, customers are protecting their investments in their SAP HANA landscape while keeping the maximum flexibility for their needs to grow their SAP HANA systems.

Hitachi Advanced Server DS7000 Series

A combination of extremely innovative and exclusive technologies, DS7000 x86 servers can respond flexibly, securely, and cost-effectively to all your storage challenges. Based on a reliable, powerful, and modular architecture using Intel Xeon Platinum 8176/8176M or 8180/8180M processors, DS7000 addresses extreme demands that are often believed to be completely irreconcilable: performance and elasticity, reliability and cost control. Immediate, real, measurable benefits: unique in the x86 world, DS7000 reaches the highest level of quality of service, performance, availability, and scalability to meet the three big challenges an IT Department is facing: Data Center optimization, IT modernization and Big Data efficient implementation.

- **Scalability**: The same technology can be used for any SAP HANA deployment for both Business Warehouse and S/4 HANA implementations. This protects investments, by providing a migration path for any architecture using SAP HANA, at any scale.

- **Flexibility**: DS7000 is certified for SAP HANA, whether in Tailored Datacenter Integration (TDI) mode or in appliance mode. Appliance mode provides pre-integrated hardware, storage, and software for fast deployment, backed by central support and agreed performance levels. TDI mode offers total flexibility to use any storage technology certified by SAP in its TDI program, or to reuse an existing SAN.

- **Quality of service**: DS7000 provides unique memory protection features, essential for mission critical systems. Thanks to a patented blade system, RAM and PCIe components can be hot-plugged or hot-swapped to facilitate maintenance activities while providing best-in-class high availability.

Figure 1 shows the currently SAP HANA certified Hitachi DS7000 models.

**Figure 1**
Hitachi Advanced Server DS7000 Hardware Partitioning

Concept
Software partitioning involves dividing the physical resources of a server into several parts, so that each part behaves as an independent server with its own CPU + memory, own operating system, and own storage connection.

Hitachi DS7000 supports partitioning based on a 2-processor Compute Module. Hitachi DS7000 enables the creation of between one and four hardware partitions, by combining the Compute Modules.

A hardware partition includes the Compute Modules assigned to it and the inputs/outputs that are physically connected inside each Compute Module.

Each hardware partition is completely autonomous.

Partitioning is managed by the BMC system without touching the hardware and can be easily configured using a web graphic interface to communicate with the server’s service processor controller.

Partitioning the Hitachi DS7000
The Hitachi DS7000 server must be powered off but the BMCs on each module are on. Then, there are two ways to partition the server, one per CLI and one per Web application.

Figure 2 shows an example of Hitachi DS7000 Hardware Partitioning based on the supported module granularity.

Figure 2

Each partition has the following characteristics:

- has its own dedicated resources like CPU, RAM, Network and HBA cards
- is electrically disconnected from all other partitions
- is disconnected from the modules which are part of another partition
- is running its own operating system
- can be re-partitioned into smaller partitions, following the rules for partitioning, without impacting the other partitions
Figure 3 shows a partitioned system with dedicated network and HBA cards for every partition.

**Figure 3**

![Partitioned System Diagram](image)

**Supported System Sizes**

Hardware partitioning support for the Hitachi DS7000 allows partitioning of systems in a DS7040 or DS7080 chassis on a per-module granularity. This results in the following supported configurations.

For a DS7040 server chassis:

- 1 × 4-socket system
- 2 × 2-socket systems
- 1 × 2-socket system + 1 × dummy module

And in a DS7080 server chassis:

- 1 × 8-socket system
- 2 × 4-socket systems
- 4 × 2-socket systems
- 1 × 4-socket system + 1 × 2-socket system + 1 × dummy module
- 1 × 4-socket system + 2 × 2-socket systems
- 1 × 6-socket system + 1 × 2-socket system
- 1 × 6-socket system + dummy module
A Hitachi DS7000 hardware partition always includes the whole module; partitioning a module into multiple systems is not supported.

**Supported Configurations for SAP HANA**

Following the reference architecture of the Hitachi Appliance models, Hitachi Solution for the SAP HANA Platform in a Scale-up Configuration using Hitachi Advanced Server DS7000, each partition has to be configured and installed in the same way as the corresponding non-partitioned appliances to guarantee performance and ensure Hitachi Vantara’s quality standards.

**SAP HANA Scale-up Partitions**

Figure 4 shows the placement of the PCIe network and HBA cards as well as the different connections for network and storage connections.

**Figure 4**
The DS7000 basic building block is based on Hitachi SAP HANA appliances is comprised of:

- 2 processors (28-core 8176/M or 28-core 8180/M)
- 12 memory DIMMs per CPU, 24 per compute module
- 5 I/O blades for PCIe adapters
- 4 native 1 GbE Ethernet ports

The first compute module of each partition acts as the master module and other modules can be added as slaves to add more resources. Figure 5 details the PCIe components of all DS7000 configurations.

**Figure 5**

<table>
<thead>
<tr>
<th>Master</th>
<th>CPU 0</th>
<th>CPU 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>RP8</td>
<td>RP8</td>
</tr>
<tr>
<td>1</td>
<td>RP8</td>
<td>RP8</td>
</tr>
<tr>
<td>2</td>
<td>RP8</td>
<td>RP8</td>
</tr>
<tr>
<td>3</td>
<td>RP8</td>
<td>RP8</td>
</tr>
<tr>
<td>4</td>
<td>HBA 2</td>
<td>ETH 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HBA 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ETH 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RAID SAS</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Storage</th>
<th>Network</th>
<th>Storage</th>
<th>Network</th>
<th>RAID / SAS</th>
</tr>
</thead>
</table>

For the usage of the 10 GbE network connections for SAP HANA nodes, please refer to Table 1 and follow the best practices for Hitachi DS7000 Scale-up Appliances and HANA TDI systems:

- Connect the following to Cisco Nexus 93180YC-EX switches or to any other external switches:
  - Port 0 of 10 GbE Mellanox Connect-4x LX PCIe card to two different Cisco Nexus 93180YC-EX switches.
  - Bond the corresponding two ports, eth9901 and eth9902, as bond0 at the operating system level using active-active network bond mode with the following options:
    
    ```bash
    mode= 802.3ad miimon=100 xmit_hash_policy=2 updelay=5000 lACP_rate=fast
    
    This acts as the client network for the SAP HANA node.
    
    - If additional 10 GbE network connections are required, connect Port 1 of both 10 GbE Mellanox Connect-4x LX PCIe cards to the Cisco Nexus 93180YC-EX switches or to any other external switches.
For all sizes, PCIe slots 1 and 3 of the master module are used to create a bond. All other slots and ports can be used per customer discretion.

TABLE 1. NETWORK SETUP

<table>
<thead>
<tr>
<th>Network Card</th>
<th>Port</th>
<th>Network Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCIe_Slot_1 of Master Module</td>
<td>0</td>
<td>Client network for the SAP HANA node (eth9902)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Free for use as additional 10 GbE network for backup, SAP HANA system replication, or other purposes</td>
</tr>
<tr>
<td>PCIe_Slot_3 of Master Module</td>
<td>0</td>
<td>Client network for the SAP HANA node (eth9901)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Free for use as additional 10 GbE network for backup, SAP HANA system replication, or other purposes</td>
</tr>
</tbody>
</table>

Note — The management network and client network can be on the same network switch or a separate network switch, depending on the network environment.

SAP HANA Scale-out Partitions

For SAP HANA Scale-out deployments, the reference architecture Hitachi Solution for the SAP HANA Platform in a Scale-out Configuration using Hitachi Advanced Server DS7040, is representative for Scale-out deployments with more than 4-sockets per server or partition.
Figure 6 shows the solution overview for the scale-out configuration using 1.5 TB SAP HANA nodes or 3 TB SAP HANA nodes.

Following the concept of this reference architecture, partitions with 4-sockets or larger can also be used as scale-out nodes in SAP HANA Scale-out deployments with up to 16 active worker nodes.
Refer to Figure 7 for the placement of the PCIe network and HBA cards in the master module and the first non-master module.

Figure 7

Hitachi Advanced Server DS7040 PCIe Numbering (Back)

Hitachi Advanced Server DS7040 populated with PCIe cards (Back)

- Mellanox Connect-4x LX 2-port 10 GbE Network Card
- Emulex LPE 31002 16 GB/s PCIe HBA Card
For details see the distribution of the PCIe network and HBA cards listed in Table 2.

**TABLE 2. HITACHI ADVANCED SERVER DS7040 CONFIGURATION (EITHER 1.5 TB OR 3 TB HANA NODES)**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Scale-out Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network ports</td>
<td>2 × 2-port Mellanox Connect X-4 LX PCIe cards per each compute Module in the following locations:</td>
</tr>
<tr>
<td></td>
<td>▪ PCIE Slot 1</td>
</tr>
<tr>
<td></td>
<td>▪ PCIE Slot 3</td>
</tr>
<tr>
<td>Fibre Channel Ports</td>
<td>2 × 2-port LPE31002-M6 16 Gb/s PCIe cards on Module 0 for each HANA node in the following locations:</td>
</tr>
<tr>
<td></td>
<td>▪ PCIE Slot 0</td>
</tr>
<tr>
<td></td>
<td>▪ PCIE Slot 2</td>
</tr>
</tbody>
</table>

The master module has an identical distribution with the Scale-up master module, additional PCIe network cards are added to the first non-primary module to satisfy the additional network requirements of SAP HANA scale-out installations.

**Virtualized SAP HANA in Partitions**

Virtualizing SAP HANA systems or even complete landscapes in HANA TDI environments is possible in different ways. All hypervisors that are supported by SAP and Hitachi can also be run within a DS7000 partition created using the hardware partitioning described in this document. For SAP HANA on VMware vSphere, Hitachi provides a reference architecture, [Hitachi Solution for the SAP HANA Platform using Intel Xeon Scalable Processors and VMware vSphere](https://www.hitachi.com/us/en/solutions/enterprisesolutions/sap-hana-platform.html), which also holds true in partitions. However, when running a hypervisor within a partition, make sure to configure your virtual machines within a compute module where possible and not across compute module boundaries where possible. Of course, you have to span the virtual machine over two modules when it becomes bigger than two CPU sockets.
Figure 8 shows two examples of how to distribute virtual machines in a partition.

Figure 8

How to Manage Hardware Partitions

There are two ways to partition the system – via the command line interface or via the BMC Server Hardware Console (SHC). You can find detailed steps and documentation in the Hitachi Advanced Server DS7000 - Using the Hardware Console Guide (MK-97HAS7003) and the Hitachi Advanced Server DS7000 Remote Hardware Management - CLI Reference Guide (MK-97HAS7005).

Partitioning using the Server Hardware Console

The partitioning interface in the SHC is shown in Figure 9.

Figure 9

Using the SHC, you can configure the partitions on the server as seen in this example. From the Configuration tab, click Global Settings > Partitioning to open the Platform Partitioning page.
Before beginning the partitioning of a server make sure that all modules are powered off. When the server is already partitioned, and the existing partitions will be changed, only the modules of the affected partitions need to be powered off. If a module is powered on, it cannot be moved to another partition or added into a newly created partition.

When partitioning the server, all the available modules must be put into a new partition and each module can only be part of one partition. It is not possible to split a module over more than one partition, that is the first CPU into partition Part-0 and the second CPU into partition Part-1.

The module with the lowest module number becomes the master module of the new partition. The server name can be changed for each partition separately.

Make sure to follow the reference architecture guides for the Hitachi Solution for the SAP HANA Platform for every partition by having the PCIe network and HBA cards in the master module for SAP HANA scale-up instances and in modules 0 and 1 of each partition for SAP HANA scale-out instances.