

Cisco UCS C890 M5 Rack Server for SAP HANA

Last Updated: June 24, 2021

Contents

| | |
|----------------------|----|
| Executive summary | 3 |
| Solution overview | 3 |
| Technical overview | 5 |
| Solution design | 9 |
| Solution validation | 16 |
| Conclusion | 17 |
| For more information | 17 |

Executive summary

Organizations in every industry are generating and using more data than ever before, from customer transactions and supplier delivery information to real-time user-consumption statistics. Without reliable infrastructure that can store, process, and analyze big data sets in real time, companies may find themselves missing out on key business insights and risk being left at a competitive disadvantage.

Cisco® solutions for SAP® HANA using the Cisco UCS® C890 M5 Rack Server give users the power to harness complex information quickly and make better business decisions, enabling them to stay ahead of the competition. Our solutions accelerate business decision making with simplified management, reduce deployment risk, and reduce total cost of ownership (TCO). Unlock the full potential of your business by rapidly and intelligently gaining key insights from your data.

The dramatic growth in the amount of data in recent years requires larger solutions to keep and manage your data. Based on the Second Generation (2nd Gen) Intel® Xeon® Scalable processors, the high-performance Cisco UCS C890 M5 server is well suited for mission-critical business scenarios such as medium-size and large SAP HANA database management systems with high availability and secure multitenancy. The Cisco solutions provide a robust platform for SAP HANA workloads in either single-node (scale-up) configurations or, under the SAP conditions for SAP HANA Tailored Data Center Integration (TDI), multi-node (scale-out) configurations.

The SAP HANA platform provides a scalable database with advanced analytical capabilities and intuitive application-development tools in an in-memory data platform. SAP HANA supports nonvolatile Intel® Optane™ persistent memory, which brings together the low latency of memory and the persistence of storage. Persistent memory modules provide faster access to data and retain data across power cycles.

Solution overview

This section introduces the SAP HANA on Cisco UCS C890 M5 Rack Server solution.

Introduction

The SAP HANA on Cisco UCS C890 M5 Rack Server solution provides a prevalidated, ready-to-deploy infrastructure, reducing the time and complexity involved in configuring and validating a traditional data center deployment. The reference architecture detailed in this document demonstrates the resiliency and ease of deployment of an SAP HANA solution.

The SAP HANA in-memory database combines transactional and analytical SAP workloads, taking advantage of low-cost main memory (RAM), the data-processing capabilities of multicore processors, and fast data access. Cisco UCS C890 M5 servers are equipped with 2nd Gen Intel Xeon Scalable processors and support two different memory configurations: either with DDR4-only memory modules or mixed with Intel Optane persistent memory.

Intel Optane persistent memory represents an entirely new means of managing data for demanding workloads such as the SAP HANA platform. It runs at near-DRAM speeds, maintaining today's performance expectations, and delivers greater memory data density, enabling additional innovation and simpler IT landscapes. With its persistence, performance, and lower cost per gigabyte than conventional memory, Intel Optane persistent memory can help reduce TCO, reshape the way that businesses tier their data for database systems, and open new use cases for the speed and power of the SAP HANA platform.

Because it is nonvolatile, Intel Optane persistent memory enables you to keep the SAP HANA platform data loaded in main memory, even when power is off. This capability greatly reduces data reload times for the SAP HANA platform after downtime.

The SAP HANA solution combines Cisco hardware and software components optimized for SAP HANA workloads as preconfigured and validated architecture. The SAP HANA TDI option offers a more open and flexible way to integrate SAP HANA into the data center by reusing existing enterprise storage hardware, thereby reducing hardware costs. The Cisco UCS C890 M5 provides the advantages of an integrated computing and storage stack, and the standard configuration already enables the server for SAP HANA TDI deployments. SAP HANA TDI enables organizations to run multiple SAP HANA production systems on a shared infrastructure. It also enables customers to run SAP application servers and the SAP HANA database hosted on the same infrastructure.

Audience

The audience for this document includes sales engineers, field consultants, professional services staff, IT managers, partner engineers, and customers who want to take advantage of an SAP HANA infrastructure and gain insights into the technology, infrastructure, and possible design options.

Purpose of this document

This document provides a technical overview and describes the design principles for deploying and configuring an SAP HANA solution on Cisco UCS C890 M5 servers. The SAP HANA solution comes as a predesigned, best-practices architecture for integrated infrastructure solutions. It can easily be integrated into new or preexisting converged infrastructure solutions for SAP HANA TDI as well.

Solution summary

The Cisco UCS C890 M5 server for SAP HANA is a flexible, integrated infrastructure solution designed to support mission-critical workloads for which performance and memory size are key attributes. The seven-rack-unit (7RU) form-factor rack server delivers exceptional performance, supporting eight 2nd Gen Intel Xeon processors and 96 DIMM slots, which can be populated with a mixture of DRAM and Intel Optane persistent memory.

All prevalidated components are connected and configured according to best practices of Cisco and SAP SE. The solution offers resource options to scale up the memory capacity or to scale out in multi-node scale-out deployments for SAP HANA TDI. Additionally, with 16 hot-swappable 2.5-inch SAS-3 drive bays (with RAID cards), eight 25-Gbps SFP Ethernet ports, and four 32-Gbps Fibre Channel ports delivered as standard, this server is well suited for deployment in conjunction with existing enterprise storage solutions or with internal storage.

The Intelligent Platform Management Interface (IPMI) provides remote access for multiple users and allows you to monitor system health and to manage server events remotely. Cisco Intersight™ functions will be made available through future software updates. Cloud-based IT operations management simplifies SAP environments.

Technical overview

This section provides a technical overview of the computing, network, storage, and management components in this SAP solution. For additional information about any of the components discussed in this section, refer to the “For more information” section at the end of this document.

Cisco Unified Computing System

The Cisco Unified Computing System™ (Cisco UCS) is a data center platform that integrates computing, networking, storage access, and virtualization resources into a cohesive system designed to reduce TCO and increase business agility. The system integrates a low-latency, lossless Ethernet unified network fabric with enterprise-class, x86-architecture servers. The system is an integrated, scalable, multi-chassis platform with a unified management domain for managing all resources.

The Cisco UCS C890 M5 server extends the Cisco UCS server portfolio comes with a standalone management web interface. The Cisco Intersight™ platform, which provides the benefits of software-as-a-service (SaaS) management and proactive support for Cisco UCS servers, and the enterprise storage platforms Hitachi Virtual Storage Platform (VSP), NetApp Data Storage, and Pure Storage FlashArray//X will become available through future software updates and will require no hardware adjustments to adopt. Cisco UCS Manager is not supported for the Cisco UCS C890 M5 Rack server.

Cisco Intersight platform

The Cisco Intersight solution, Cisco’s new systems management platform, delivers intuitive computing through cloud-powered intelligence. This platform offers a more intelligent level of management and enables IT organizations to analyze, simplify, and automate their IT environments in ways that were not possible with prior generations of tools. This capability empowers organizations to achieve significant TCO savings and to deliver applications faster to support new business initiatives.

The Cisco UCS platform uses model-based management to provision servers and fabric automatically, regardless of form factor. The Cisco Intersight platform works in conjunction with the Redfish Scalable Platforms Management API (Redfish) and the baseboard management controller (BMC). By simply associating a model-based configuration with a resource through service profiles, your IT staff can consistently align policy, server personality, and workloads. These policies can be created once and used by IT staff with little effort to deploy servers. The result is improved productivity and compliance and lower risk of failure due to inconsistent configuration.

The Cisco Intersight platform will be integrated with data center and hybrid cloud platforms and services to securely deploy and manage infrastructure resources across data center and edge environments.

Cisco Intersight delivers unique capabilities such as the following:

- Integration with the Cisco Technical Assistance Center (TAC) for support and case management
- Proactive, actionable intelligence for issues and support based on telemetry data
- Compliance check through integration with the Cisco Hardware Compatibility List (HCL)

For more information about the Cisco Intersight platform, see [Cisco Intersight Services SaaS systems management platform](#).

Cisco UCS C890 M5 Rack Server

The Intel Xeon processor-based Cisco UCS C890 M5 Rack Server (Figure 1) extends the capabilities of the Cisco UCS portfolio with an 8-socket rack server offering industry-leading performance and expandability. The server comes in a 7RU form factor, supports Intel Optane persistent memory, and works with virtualized and nonvirtualized applications to increase performance, flexibility, and administrator productivity.

App Direct mode and DDR4 memory module configuration enables the server with up to 36 TB of main memory for non-SAP HANA workloads and up to 18 TB of main memory for SAP HANA bare-metal installations.

The eight 25 Gigabit Ethernet Small Form-Factor Pluggable (SFP) Ethernet ports and the four 32-Gbps Fibre Channel ports offer additional capabilities. For example, you can integrate dedicated backup solutions, migrate data from a previous storage system, or attach the Cisco UCS C890 M5 server to Cisco MDS 9000 Family multilayer SAN switches for full integration into converged infrastructure solutions such as FlexPod and FlashStack for SAP HANA TDI.

Equipped with internal RAID-1 boot drives and 16 hot-swappable, small-form-factor (SFF) SAS drives, the storage- and I/O-optimized enterprise-class rack server delivers industry-leading performance for both virtualized and bare-metal installations.

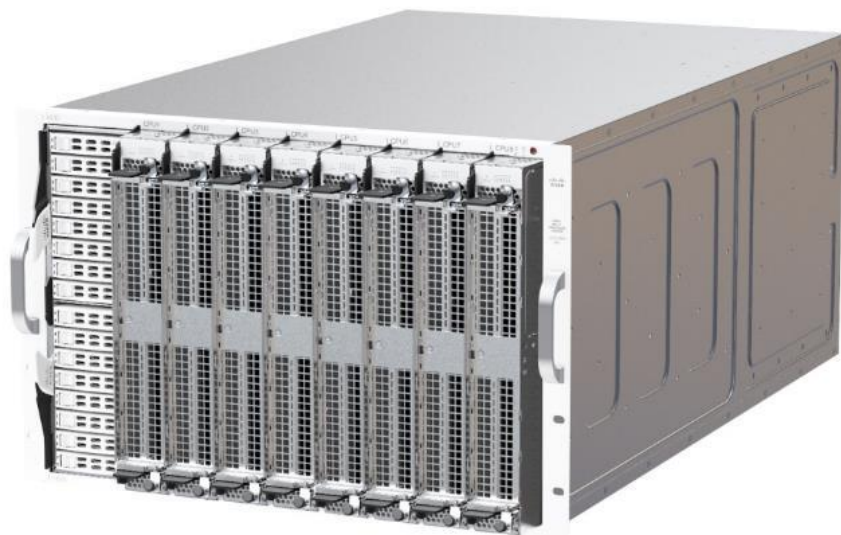


Figure 1.
Cisco UCS C890 M5 Rack Server

Multiple configuration options are available, including the following:

- 2nd Gen Intel Xeon Scalable processors with up to 28 cores per socket and support for eight-processor configurations
- 96 DIMM slots with Intel Optane persistent memory support
- Up to 16 hot-swappable SAS drives and up to 8 internal 2.5-inch SAS drives
- Two 12-Gbps MegaRAID SAS controller cards for internal boot and SAP HANA data disk drives
- Two Broadcom LPe32002 dual-port 32-Gbps Fibre Channel host bus adapter (HBA)
- Eight 25 Gigabit Ethernet SFP Ethernet ports

- One quad-port 25 Gigabit Ethernet Mellanox ConnectX-4 network interface card (NIC)
- Two dual-port 25 Gigabit Ethernet Mellanox ConnectX-4 NICs
- Five 1600-watt (W) N+2 redundant power supplies

The Cisco UCS C890 M5 server is well-suited for a wide range of enterprise workloads, including big data and analytics, medium- and large-sized databases, virtualization, application consolidation, and high-performance appliances.

LSI MegaRAID SAS RAID controller

LSI MegaRAID 12-Gbps RAID controllers are high-performant and intelligent PCI SAS controllers. They use the proven Small Computer System Interface (SCSI) protocol set and provide reliable and trusted RAID disk protection for all critical applications.

Equipped with two MegaRAID SAS controller cards, the Cisco UCS C890 M5 server for SAP HANA appliance provides RAID-1 fault tolerance for the Linux operating system. A RAID-5 disk strip set with parity data across all 10 disk drives provides the data protection and high data throughput required to meet the key performance metrics for SAP HANA disk volumes.

Mellanox ConnectX-4 network controller

The 4-port Mellanox based super I/O module (SIOM) form-factor NIC provides exceptional high performance for the most demanding data centers, public and private clouds, and SAP HANA applications. The 25 Gigabit Ethernet NIC is fully backward compatible with 10 Gigabit Ethernet networks and supports bandwidth demands for both virtualized infrastructure in the data center and cloud deployments.

The 25 Gigabit Ethernet NIC typically is sufficient to run an SAP HANA database on a single host. The situation for a distributed system, however, can be complex, with multiple hosts located at a primary site having one or more secondary sites and supporting a distributed multiterabyte database with full fault and disaster recovery.

SAP HANA defines different types of network communication channels to support the different SAP HANA scenarios and setups:

- Client zone: The various clients, such as SQL clients on SAP application servers, browser applications using HTTP/S to the SAP HANA XS server, and other data sources (such as business intelligence systems) need a network communication channel to the SAP HANA database. SAP recommends at least a 10 Gigabit Ethernet connection for the client and application server network.
- Internal zone: The internal zone covers the communication between hosts in a distributed SAP HANA system as well as the communication used by SAP HANA system replication between two sites. SAP recommends a dedicated 10 Gigabit Ethernet network connection for the internode and replication network connection.
- Storage zone: Although SAP HANA holds most of its data in memory, the data is also saved in persistent storage locations. In most cases, the preferred storage solution involves separate, externally attached storage subsystem devices capable of providing dynamic mount points for the various hosts, according to the overall landscape. A SAN is used for storage connectivity. In distributed environments, an additional shared Network File System (NFS) network is required as well.

To support the various SAP HANA scenarios, two additional 25 Gigabit Ethernet dual-port SFP28 network controller cards or, optionally, 40 Gigabit Ethernet dual-port SFP28 network controller cards extend the capabilities of the baseline configuration of the Cisco UCS C890 M5 server.

Broadcom LPe32002 Fibre Channel host bus adapter

The dual-port Broadcom LPe32002 16- and 32-Gbps Fibre Channel HBA addresses the demanding performance, reliability, and management requirements of modern networked storage systems that use high-performance and low-latency solid-state storage drives or hard-disk drive arrays.

The Emulex Generation 6 Fibre Channel HBAs with dynamic multicore architecture offer higher performance and more efficient port utilization than other HBAs by applying all ASIC resources to any port as the port requires them. The two Fibre Channel HBAs enable the integration of the Cisco UCS C890 M5 server into Cisco's converged infrastructure solutions for SAP HANA TDI.

Intelligent Platform Management Interface

The IPMI provides remote access for multiple users and allows you to monitor system health and to manage server events remotely.

Installed on the motherboard, IPMI operates independently from the operating system and allows users to access, monitor, diagnose, and manage the server through console redirection.

These are some of the main elements that IPMI manages:

- BMC built-in IPMI firmware
- Remote server power control
- Remote Serial over LAN (SOL) technology (text console)
- BIOS and firmware upgrade processes
- Hardware monitoring
- Event log support

The Cisco Intersight SaaS systems management platform provides end-to-end management of all the devices in the Cisco UCS domain it manages. Cisco Intersight functions for the Cisco UCS C890 M5 server will become available through software updates in the future and will not require any hardware adjustments to adopt.

Solution design

The section describes the SAP HANA appliance and TDI system requirements defined by SAP SE for the SAP HANA architecture.

SAP HANA appliance and SAP HANA Tailored Data Center Integration

Cisco provides a selection of SAP HANA certified servers based on Cisco UCS B-Series Blade Servers and C-Series Rack Servers. The Cisco UCS C890 M5 server is certified as a SAP HANA appliance single-host (scale up) server. Although a preconfigured, pretested, and certified SAP HANA scale up infrastructure offers some benefits, only main memory and internal disk size in this setup scales. SAP increases flexibility and provides an alternative to SAP HANA appliances with SAP HANA TDI, which includes many kinds of virtualization, network, and storage technology options.

With SAP HANA TDI, you can consolidate the storage requirements for the whole SAP landscape, including SAP application servers, in a single, central, high-performance enterprise storage array. Although you must understand the limits and requirements of an SAP HANA TDI environment, both the FlashStack for SAP HANA TDI solution and the FlexPod for SAP HANA TDI solution have been validated and tested by Cisco based on SAP HANA-certified hardware and can be viewed like an SAP HANA appliance deployment. The Cisco UCS C890 M5 server-based SAP HANA deployment can be easily integrated into FlashStack and FlexPod solutions.

SAP provides documentation for SAP HANA TDI environments, explaining the six phases of SAP HANA TDI and the hardware and software requirements for the entire stack. See [SAP HANA Tailored Data Center Integration-Overview](#).

The SAP HANA Hardware and Cloud Measurement Tool ([HCMT](#)) helps you measure and analyze the hardware design and ensure that the SAP HANA deployment meets the desired system and performance requirements defined by SAP. Specific SAP HANA hardware certifications are required for the computing and storage components of the converged infrastructure solution; see the [Certified and Supported SAP HANA Hardware](#) portal.

Hardware requirements for the SAP HANA database

Hardware and software requirements to run SAP HANA systems are defined by SAP. Cisco Validated Designs use guidelines provided by SAP, Cisco, and the solution partners involved.

CPU

The Cisco UCS C890 M5 server supports 2nd Gen Intel Xeon Scalable processors (Cascade Lake) CPUs. It can be configured with either half or the full number of supported Intel Xeon Scalable CPUs. The server is available with either Intel Xeon Platinum 8276 or 8280L CPUs, both consisting of 28 cores per CPU and certified for SAP HANA environments.

Memory

The Cisco UCS C890 M5 server supports full DDR4 DRAM memory or mixed DRAM and Intel Optane persistent memory configurations. SAP HANA 2.0 SPS03 Revision 35 and later allows for various memory capacity ratios in a mixed Intel Optane persistent memory and DRAM memory configuration.

SAP HANA stores its column store data primarily in the nonvolatile Intel Optane persistent memory area which operates in AppDirect mode. If the column store data size exceeds the size of the Intel Optane persistent memory area, SAP HANA writes the column store data into the standard DRAM memory area. In contrast SAP HANA, writes the row store data into the DRAM memory area. Intel Optane persistent memory area is not allowed for row store data even when sufficient space would be available.

For this reason, you must perform appropriate SAP HANA memory sizing before considering an Intel Optane persistent memory configuration. Detailed information about configuration and management is available in the white paper [Cisco UCS: Configuring and Managing Intel Optane Data Center Persistent Memory Modules](#).

Using DDR4 DRAM memory only, the Cisco UCS C890 M5 server supports up to 6 TB for SAP Business Warehouse on HANA (BWoH/BW4H) and up to 12 TB for SAP Business Suite on HANA (SoH/S4H).

Using App Direct mode with Intel Optane persistent memory and DDR4 DRAM modules, the Cisco UCS C890 M5 server supports the following configurations:

- Up to 30 TB for SAP Business Warehouse on HANA (BWoH/BW4H).
- Up to 36 TB for SAP Business Suite on HANA (SoH/S4H).

At the present time, SAP HANA has an address limitation of 24 TB in main memory only.

Network

An SAP HANA data center deployment can range from a database running on a single host to a complex distributed system. Distributed systems can be complex, with multiple hosts located at a primary site having one or more secondary sites and supporting a distributed multiterabyte database with full fault and disaster recovery.

SAP recommends separating the network into different zones for the client, storage, and host-to-host communication. Refer to the document [SAP HANA Network Requirements](#) for more information and sizing recommendations.

Storage

SAP HANA is an in-memory database that uses storage devices to save a persistent copy of the data for startup and fault recovery without data loss. The choice of the specific storage technology depends on requirements such as size, performance, and high availability. The SAP HANA appliance with a Cisco UCS C890 M5 server is certified with internal SAS storage with RAID-5 redundancy. In an SAP HANA TDI scenario, the server can connect to any storage array certified as SAP HANA enterprise storage.

Infrastructure overview

The scalable Intel-based Cisco UCS C890 M5 Rack server (Figure 2 and Figure 3) is well suited for critical business solutions such as medium-size and large database management systems. It is also well suited for use as a consolidation platform running a huge number of different applications using virtualization technologies. The server offers a high level of data security plus availability features, including hot-pluggable SAS disk modules, hot-pluggable system fans, and power supplies. The 7RU server hosts eight main boards with a single 2nd Gen Intel Xeon Scalable processor (Cascade Lake) on each main board.

The server can serve up to 16 SAS disks, which can be accessed from the left-front side. The SAP HANA appliance configuration consists of ten 3.2-TB SSDs to comply with SAP storage requirements for the SAP HANA data, log, and shared volumes in a 6-TB main memory server configuration. The larger 12-TB main memory server configuration consists of ten 6.4-TB SSDs.

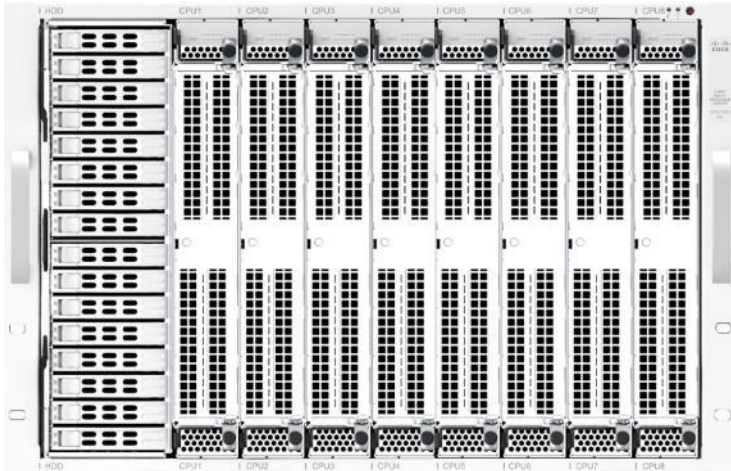


Figure 2.
Cisco UCS C890 M5 Rack Server: Front view



Figure 3.
Cisco UCS C890 M5 Rack Server: Rear view

Validated components of this integrated architecture are as follows:

- Cisco UCS C890 M5 server: High-powered, versatile rack server with eight CPUs
- Cisco UCS C890 M5 server: Mixed memory configuration with Intel Optane persistent memory and DDR4 DRAM modules
- IPMI: Intelligent platform management independent of the operating system, allowing users to access, monitor, diagnose, and manage the server through console redirection

Examples of alternative components of the architecture include the following:

- Dual-port Broadcom LPe32002 16- and 32-Gbps Fibre Channel HBA: Connects Fibre Channel-based SAN enterprise storage and integrates with FlexPod and FlashStack solutions

- Cisco MDS 9396T 32-Gbps 96-Port Fibre Channel Switch: 32-Gbps-capable Fibre Channel connectivity within the architecture, as well as interfacing with resources present in an existing data center

SAP HANA design considerations

Multiple implementation options are available specific to SAP HANA TDI integration.

SAP HANA single-node system (scale up)

The SAP HANA scale-up solution is the simplest installation type. In general, this solution provides the best SAP HANA performance. All data and processes are located on the same server and do not require additional network considerations for internode communication, for example. This solution requires one server either with local redundant storage or integrated into the converged infrastructure in a FlashStack or FlexPod solution, for example.

Network requirements depend on the integration into the data center infrastructure and on any specific use case of the SAP HANA platform. The minimum requirement for the client or SAP application network to access the host is 1 Gbps. The network interfaces of the Cisco UCS C890 M5 server provide 25 Gbps network connectivity for the client network zone.

Fibre Channel attached storage requires a Fibre Channel HBA with a minimum of 8 Gbps in addition to the client network. The Fibre Channel HBA of the Cisco UCS C890 M5 server provides 32 Gbps connectivity to the storage network zone.

The Cisco UCS C890 M5 server architecture with NFS attached storage requires a transfer speed of at least 10 Gbps for the storage network zone: 25- or 40-Gbps network connectivity is recommended.

Cisco recommends dedicated network connections of at least 10 Gbps for all additional uses cases, such as system replication and backup solutions.

Converged infrastructure solutions scale with the size and number of available ports of the Cisco MDS 9000 Family multilayer SAN switches and the Cisco Nexus® network switches, and with the capacity and storage controller capabilities of the enterprise storage resources. For the computing nodes the enterprise storage requires SAP HANA certification as well. The certification scenarios and their limitations are documented in the SAP Certified and Supported SAP HANA Hardware directory.

SAP HANA multi-node system (scale out)

An SAP HANA scale up installation with a high-performance Cisco UCS C890 M5 server is the preferred deployment for large SAP HANA databases. Nevertheless, you will need to distribute the SAP HANA database to multiple nodes if the amount of main memory is not enough to keep the SAP HANA database in memory. Multiple independent servers are combined to form one SAP HANA system, distributing the load among multiple servers.

In a distributed system, typically each index server is assigned to its own host to achieve the best performance. You can assign different tables to different hosts (database partitioning), or you can split a single table across hosts (table partitioning). SAP HANA comes with an integrated high-availability option, configuring one single server as standby host.

The scale out solution can use either Fibre Channel-attached or NFS-attached enterprise storage. To access the shared SAP HANA binaries, NFS storage is required independent from the storage connectivity of the SAP HANA log and data volumes. In the event of a failover to the standby host, the SAP HANA Storage Connector API manages the remapping of the logical volumes. Redundant connectivity to the

corporate network over the LAN (Ethernet) and to the storage over the LAN or SAN always must be configured.

Network requirements for this deployment option are higher than for SAP HANA scale-up systems. In addition to the client and SAP application access and storage network, a SAP HANA scale out solution requires a node-to-node network and an NFS network connection to the NFS or Fibre Channel-attached enterprise storage array.

Minimum connectivity requirements are as follows:

- At least 1 Gigabit Ethernet for (access) network
- At least 10 Gigabit Ethernet NFS for the storage network for the SAP HANA shared file and for SAP HANA data and log files if only NFS-attached storage is used
- At least 10 Gigabit Ethernet for node-to-node network
- 16-Gbps Fibre channel storage connection if Fibre Channel-attached storage is used for SAP HANA data and log files

Cisco recommends dedicated at least 10-Gbps network connections for all additional uses cases, such as system replication and backup solutions.

The maximum number of active SAP HANA nodes in an SAP HANA scale out configuration depends on the SAP application and is limited by SAP to 4 active SAP HANA servers for SAP Suite for HANA and 16 active SAP HANA servers for SAP Business Warehouse for HANA. Additional nodes usually are supported by SAP after an additional validation.

Cisco UCS server design considerations

The Cisco UCS C890 M5 Rack server is well suited for any SAP workload, bare-metal or virtualized, and manages SAP HANA databases up to their limit of 24 TB of main memory. In addition to the default reliability, availability, and serviceability (RAS) features, the configuration design of the server includes redundant boot storage and network connectivity. Optional NICs and Fibre Channel HBAs extend the connectivity options for more bandwidth and access.

Beside a standalone SAP HANA appliance configuration with internal storage, the server easily integrates as a computing resource in a converged infrastructure solution like FlashStack and FlexPod. The Mellanox FlexBoot feature, a multiprotocol remote boot technology based on the Preboot Execution Environment (PXE) standard offers flexible remote boot options.

Both storage options—internal and external—have benefits relevant to the data center architecture. Here are some questions to consider:

- Do you want to use dedicated or shared resources?
- Will the solution be integrated into established operations?
- Do you want backup and restore and disaster-recovery options?

SAP HANA database bare-metal installations can run along with virtualized SAP application workloads, which are common in the data center. Additional rules and limitations apply when the SAP HANA database is virtualized, such as the number of virtual CPUs (vCPUs) and memory limits. SAP Note [2652670](#) provides links and information you can refer to when installing the SAP HANA platform in a virtual environment using VMware vSphere virtual machines.

The recommended, minimum disk space requirements for SAP HANA TDI installations are as follows:

- For SAP HANA scale up configurations, you need approximately 2.5 times the size of the main memory.
- For SAP HANA scale out configurations, you need 1.5 times the size of the main memory plus 1 time the size of the main memory for every four active SAP HANA nodes.

The SAP Quick Sizer report provides detailed information about the required persistent storage capacity for each SAP HANA instance.

Thus, hosting multiple SAP HANA scale up and scale out systems and additional SAP application servers requires proper sizing of the infrastructure with a clear computing node-to-storage system ratio. You determine the number of computing nodes per SAP HANA certified enterprise storage array based on the total number of active SAP HANA nodes in the SAP system landscape. You also must correspondingly scale the associated computing and storage resources and the networking components based on port availability and use.

Operating system

This Cisco UCS C890 M5 Rack server is certified for Red Hat Enterprise Linux (RHEL) for SAP Solutions and SUSE Linux Enterprise Server (SLES) for SAP Applications. The Linux operating systems fully support the 2nd Gen Intel Xeon Scalable processors (Cascade Lake), including Intel Optane persistent memory.

These are the initial operating system releases certified:

- SUSE Linux Enterprise Server for SAP Applications 15 SP2
- Red Hat Enterprise Linux 8.2 for SAP Solutions

Refer to [SAP Note 2235581: SAP HANA: Supported Operating Systems](#) to find the minimum SAP HANA revision supported by the operating system of your choice. Cisco will work with SAP to keep the supported and certified Linux version current during the lifecycle of the server.

High availability

Multiple approaches are available to increase the availability and resiliency of the Cisco UCS C890 M5 solution for SAP HANA, to protect against interruptions and prevent outages from happening in the first place. Here are just a few hardware-based configuration recommendations to eliminate any single point of failure:

- Storage array with RAID-protected disk volumes
- Hot-swappable disks
- Dual network cards with active-passive network bond configuration
- Redundant and hot-swappable power supplies
- Redundant data paths and dual controllers for NFS- or Fibre Channel-attached enterprise storage

Software-based recommendations include SAP HANA embedded functions such as the use of an SAP HANA standby host in a scale out scenario or SAP HANA system replication to another host, ideally part of a Linux cluster setup, which can reduce downtimes to minutes. Designs that include redundancy entail trade-offs between risk and cost, so choose the right balance for your data center operations requirements.

Most IT emergencies are caused by hardware failures and human errors, and a working disaster-recovery strategy is recommended as well. An SAP HANA certified software solution such as [Veeam Backup & Replication](#) integrates seamlessly with native SAP HANA backint backups and provides disaster-recovery support. Other software-based solutions are Commvault and Cohesity Data Platform.

Other examples of solutions that provide disaster-recovery support are enterprise storage-based snapshots solutions, such as NetApp SnapVault.

SAP application monitoring with Cisco AppDynamics

Cisco AppDynamics® is an application performance monitoring (APM) platform that helps you understand and optimize the performance of your business, from its software to infrastructure to business journeys.

The AppDynamics APM platform enables you to monitor and manage your entire application-delivery ecosystem, from the mobile app or browser client request through your network, back-end databases and application servers and more. AppDynamics APM gives you a single view across your application landscape, letting you quickly navigate from the global perspective of your distributed application down to the call graphs and exception reports generated on individual hosts.

AppDynamics has an agent-based architecture running on the SAP application server. After the agents are installed, you see a dynamic flow map or topography of your application. AppDynamics uses the concept of traffic lights to indicate the health of your application (green indicates that the application is good, yellow indicates that it is slow, and red indicates potential problems), with dynamic baselining. AppDynamics measures application performance based on business transactions, which essentially are the main functions of the application. When the application deviates from the baseline, AppDynamics captures and provides deeper diagnostic information to help you troubleshoot more proactively and reduce the mean time to repair (MTTR).

More information is available online at

<https://docs.appdynamics.com/display/SAP/SAP+Monitoring+Using+AppDynamics>.

Solution validation

This section describes validated scenarios and hardware. It also discusses the customer experience services that Cisco offers for the solution.

Test scenarios

The following solution scenario has been validated and tested:

- SAP HANA scale-up solution

The solution deployment guide provides installation procedures for SLES for SAP Applications and RHEL for SAP Solutions, following best practices from Cisco, SUSE, Red Hat, and SAP. All SAP HANA appliance requirements have been tested and meet the key performance metrics and redundancy requirements. Tested requirements include the following:

- Cisco UCS server setup and configuration
- Storage setup and configuration
- Local boot
- Operating system configuration for SAP HANA
- Installation and configuration of SAP HANA 2.0 SPS05 Revision 54
- Performance tests using the SAP Hardware Configuration Check Tool ([HCMT](#))

Validation and certification for the SAP HANA scale-out solution will be available soon.

Validated hardware

Table 1 summarizes the hardware and software versions used in the solution validation. Note that Cisco and SAP have interoperability matrixes that you should reference to determine that the solution is qualified for support. Links to this documentation are available in the “For more information” section of this document.

Table 1. Hardware and software versions used in this solution

| Component | | Software |
|------------------|-----------------------------------|-------------------------------------|
| Computing | Cisco UCS C890 M5 Rack Server | Firmware Revision: 6.73.07 |
| Operating system | SUSE Linux operating system | SLES for SAP Applications 15 SP2 |
| | Red Hat operating system | RHEL for SAP Solutions 8.2 |
| Storage | MegaRAID SAS 3108 RAID controller | Firmware Package Build 24.21.0-0126 |
| | MegaRAID SAS 9361 RAID controller | Firmware Package Build 24.22.0-0091 |

Cisco Customer Experience Services: Cisco Solution Support

Cisco Solution Support includes both support for Cisco products and solution-level support, resolving complex issues in multivendor environments on average 43 percent more quickly than with product support alone. Cisco Solution Support is a critical element in data center administration to help rapidly resolve any problem encountered while maintaining performance, reliability, and return on investment. This

service centralizes support across your multivendor Cisco environment for both our products and solution partner products deployed in your ecosystem. Whether you experience a problem with a Cisco or a solution partner product, just call us. Our experts are the primary point of contact and own the case from first call to resolution.

For more information, go to https://www.cisco.com/c/m/en_us/customer-experience/support/solution-support.html.

Conclusion

Cisco uses best-in-class server and network components as a foundation for a variety of enterprise application workloads. With Cisco UCS C890 M5 Rack Servers for SAP HANA, you can deploy a flexible, integrated infrastructure solution designed for mission-critical workloads for which performance and memory size are key attributes.

The eight-socket server delivers exceptional performance and is sized, configured, and deployed to match the SAP HANA appliance key performance metrics demanded by SAP SE. With standard configuration options including 16 hot-swappable 2.5-inch SAS-3 drive bays (with RAID cards), eight 25-Gbps SFP Ethernet ports, and four 32-Gbps Fibre Channel ports, this server is well suited for deploying in conjunction with existing enterprise storage solutions or with internal storage.

Software- and hardware-based design options to meet your high-availability and disaster-recovery requirements are available and can be combined with SAP application monitoring using Cisco AppDynamics to detect problems in real time before they affect customers.

For more information

For additional information, see the resources listed in this section.

Cisco Unified Computing System

- Cisco UCS C890 M5 Rack Server data sheet:
<https://www.cisco.com/c/en/us/products/collateral/servers-unified-computing/ucs-c-series-rack-servers/datasheet-c78-744647.html>
- Broadcom LPe32002 dual-port Fibre Channel HBA:
<https://www.broadcom.com/products/storage/fibre-channel-host-bus-adapters/lpe32002-m2>
- Broadcom MegaRAID SAS 3108-8i SAS RAID controller:
<https://www.supermicro.com/manuals/other/AOC-S3108L-H8iR.pdf>
- Broadcom MegaRAID SAS 9361-16i RAID controller:
<https://www.broadcom.com/products/storage/raid-controllers/megaraid-sas-9361-16i>
- Intel Optane persistent memory and SAP HANA platform configuration:
<https://www.intel.com/content/www/us/en/big-data/partners/sap/sap-hana-and-intel-optane-configuration-guide.html>
- Cisco UCS for SAP HANA with Intel Optane Persistent Memory Module:
<https://www.cisco.com/c/dam/en/us/products/servers-unified-computing/ucs-b-series-blade-servers/whitepaper-c11-742627.pdf>
- Cisco Intersight platform:
<https://www.cisco.com/c/en/us/products/servers-unified-computing/intersight/index.html>

Network and management

- Cisco MDS 9000 Family multilayer switches:
<http://www.cisco.com/c/en/us/products/storage-networking/mds-9000-series-multilayer-switches/index.html>
- Design a Reliable and Highly Available Fibre Channel SAN (white paper):
<https://www.cisco.com/c/en/us/products/collateral/storage-networking/mds-9700-series-multilayer-directors/white-paper-c11-738426.html>
- Quad-port 25 Gigabit Ethernet controller:
<https://www.supermicro.com/en/products/accessories/addon/AOC-S25G-m2S.php>
- Dual-port 25 Gigabit Ethernet controller:
<https://www.supermicro.com/en/products/accessories/addon/AOC-S25G-m2S.php>
- Dual-port 40 Gigabit Ethernet controller:
https://www.supermicro.com/manuals/other/datasheet-AOC-S40G-i1Q_i2Q.pdf

SAP HANA

- SAP HANA platform on SAP Help portal:
https://help.sap.com/viewer/p/SAP_HANA_PLATFORM
- SAP HANA TDI overview:
<https://www.sap.com/documents/2017/09/e6519450-d47c-0010-82c7-eda71af511fa.html>
- SAP HANA TDI storage requirements:
<https://www.sap.com/documents/2015/03/74cdb554-5a7c-0010-82c7-eda71af511fa.html>
- SAP HANA network requirements:
<https://www.sap.com/documents/2016/08/1cd2c2fb-807c-0010-82c7-eda71af511fa.html>
- SAP HANA business continuity with SAP HANA system replication and SUSE cluster:
<https://www.cisco.com/c/en/us/solutions/collateral/data-center-virtualization/sap-applications-on-cisco-ucs/whitepaper-C11-734028.html>
- SAP HANA high availability with SAP HANA system replication and RHEL cluster:
<https://www.cisco.com/c/en/us/solutions/collateral/data-center-virtualization/sap-applications-on-cisco-ucs/whitepaper-c11-735382.pdf>

Interoperability matrixes

- Cisco UCS hardware compatibility matrix:
<https://ucshcltool.cloudapps.cisco.com/public/>
- Cisco Nexus and Cisco MDS interoperability matrix:
<https://www.cisco.com/c/en/us/td/docs/switches/datacenter/mds9000/interoperability/matrix/intmatrix/Matrix1.html>
- SAP Note 2235581: SAP HANA: Supported Operating Systems:
<https://launchpad.support.sap.com/#/notes/2235581>
- SAP certified and supported SAP HANA hardware:
<https://www.sap.com/dmc/exp/2014-09-02-hana-hardware/enEN/index.html>

About the Cisco Validated Design Program

The Cisco Validated Design (CVD) program consists of systems and solutions designed, tested, and documented to facilitate faster, more reliable, and more predictable customer deployments. For more information, go to:

<http://www.cisco.com/go/designzone>.

ALL DESIGNS, SPECIFICATIONS, STATEMENTS, INFORMATION, AND RECOMMENDATIONS (COLLECTIVELY, "DESIGNS") IN THIS MANUAL ARE PRESENTED "AS IS," WITH ALL FAULTS. CISCO AND ITS SUPPLIERS DISCLAIM ALL WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE. IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THE DESIGNS, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

THE DESIGNS ARE SUBJECT TO CHANGE WITHOUT NOTICE. USERS ARE SOLELY RESPONSIBLE FOR THEIR APPLICATION OF THE DESIGNS. THE DESIGNS DO NOT CONSTITUTE THE TECHNICAL OR OTHER PROFESSIONAL ADVICE OF CISCO, ITS SUPPLIERS OR PARTNERS. USERS SHOULD CONSULT THEIR OWN TECHNICAL ADVISORS BEFORE IMPLEMENTING THE DESIGNS. RESULTS MAY VARY DEPENDING ON FACTORS NOT TESTED BY CISCO.

CCDE, CCENT, Cisco Eos, Cisco Lumin, Cisco Nexus, Cisco StadiumVision, Cisco TelePresence, Cisco WebEx, the Cisco logo, DCE, and Welcome to the Human Network are trademarks; Changing the Way We Work, Live, Play, and Learn and Cisco Store are service marks; and Access Registrar, Aironet, AsyncOS, Bringing the Meeting To You, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, CCVP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unified Computing System (Cisco UCS), Cisco UCS B-Series Blade Servers, Cisco UCS C-Series Rack Servers, Cisco UCS S-Series Storage Servers, Cisco UCS Manager, Cisco UCS Management Software, Cisco Unified Fabric, Cisco Application Centric Infrastructure, Cisco Nexus 9000 Series, Cisco Nexus 7000 Series, Cisco Prime Data Center Network Manager, Cisco NX-OS Software, Cisco MDS Series, Cisco Unity, Collaboration Without Limitation, EtherFast, EtherSwitch, Event Center, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, iQuick Study, LightStream, Linksys, MediaTone, MeetingPlace, MeetingPlace Chime Sound, MGX, Networkers, Networking Academy, Network Registrar, PCNow, PIX, PowerPanels, ProConnect, ScriptShare, SenderBase, SMARTnet, Spectrum Expert, StackWise, The Fastest Way to Increase Your Internet Quotient, TransPath, WebEx, and the WebEx logo are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at <https://www.cisco.com/go/offices>.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: <https://www.cisco.com/go/trademarks>. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)