

SAP High-Performance Analytic Appliance on the Cisco Unified Computing System

What You Will Learn

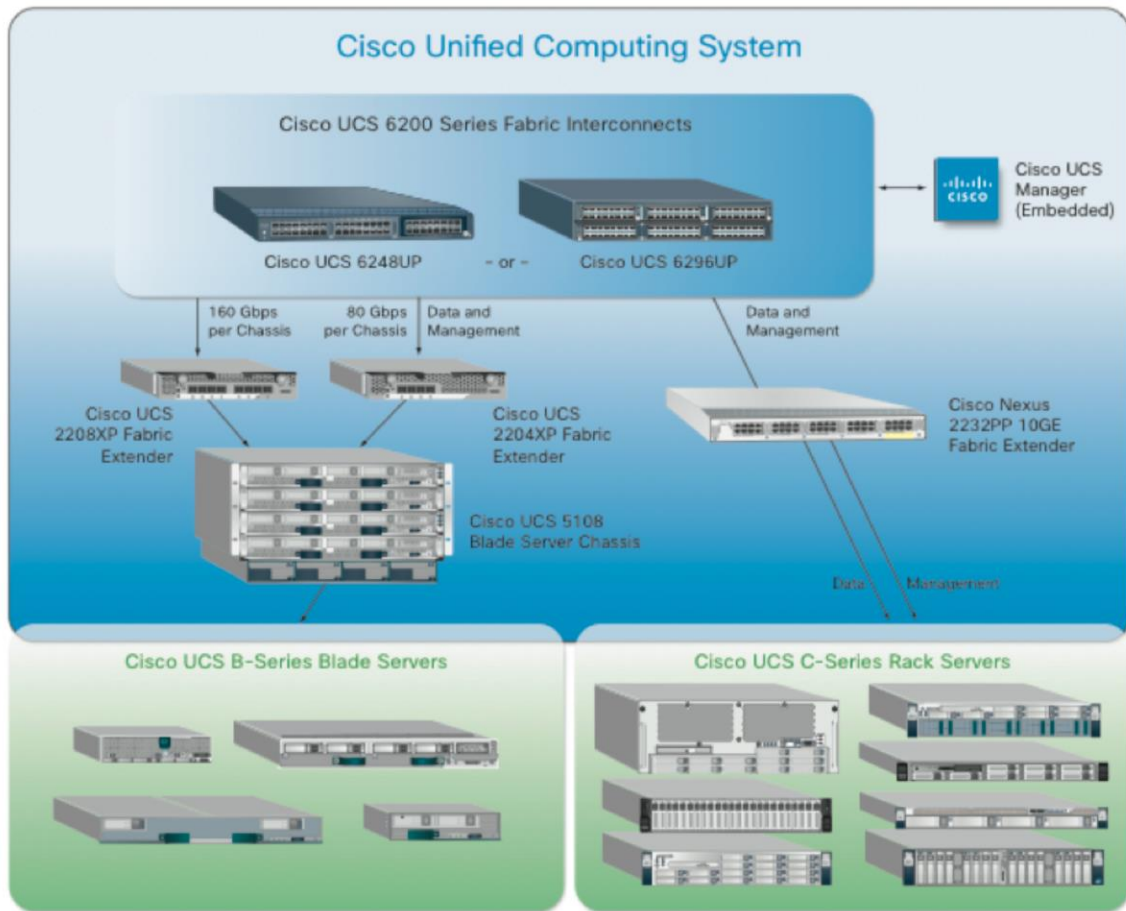
The SAP High-Performance Analytic Appliance (HANA) is a new non-intrusive hardware and software solution that provides real-time access for SAP business applications and integration of analytics into business processes based on an innovative in-memory computing architecture. This in-memory technology enables the processing of massive quantities of real-time data in the main memory of a server to provide immediate results from analysis and transactions.

Cisco has developed a full portfolio of SAP HANA solutions based on the Cisco Unified Computing System™ (Cisco UCS®). The portfolio ranges from small-scale solutions supporting 128 GB of memory to large-scale solutions supporting up to 8 terabytes (TB) of usable memory with 16 nodes, validated as of March 2012. Depending on the compression factors, validated Cisco® appliance solutions can support databases of up to 56 TB. With a single Cisco UCS platform, a SAP HANA appliance can be scaled to 48 computing nodes, with 24 TB of memory or 192 TB of uncompressed data (validated on request).

Business Benefits

Cisco UCS is a single unified system entirely programmable through unified, model-based management that dramatically simplifies and accelerates the deployment of enterprise-class applications and services. All Cisco UCS and SAP HANA appliances are intelligent infrastructure that can be managed through an embedded, single management plane across multiple Cisco UCS rack and blade servers (Figure 1), radically simplifying operations and reducing costs.

Figure 1. The Cisco Unified Computing System



The main features of Cisco UCS are:

- Model-based management applies personality and configures server, networking, and storage connectivity resources. Cisco service profiles, which define the model, let you easily provision servers simply by applying a desired configuration to physical infrastructure. The configuration is applied quickly, accurately, and automatically, improving business agility and staff productivity and eliminating a major source of errors that can cause downtime.
- Cisco Fabric Extender Technology (FEX-Technology) reduces the number of system components that need to be purchased, configured, managed, and maintained by condensing three network layers into one. It eliminates both blade server and hypervisor-based switches by connecting fabric interconnect ports directly to individual blade servers and virtual machines. Virtual networks are now managed exactly like physical networks, but with massive scalability. This capability represents a radical simplification compared to traditional systems, reducing capital and operating costs while increasing business agility, simplifying and accelerating deployment, and improving performance.

Solution

For the systems that surround your SAP HANA installation, Cisco UCS offers hardware state abstraction that transparently integrates the server, storage, and networking resources used for any application, virtualized or not, thus eliminating the waste that can be caused by dedicating pools of resources to a specific purpose. In addition, Cisco UCS Manager makes controlling and reassigning resources fast and easy. For applications other than in-memory applications, dynamic server provisioning—a unique and important benefit of Cisco UCS—enables the use of a pay-as-you-grow procurement model and helps reduce overall costs. To meet virtualization requirements, the application-specific integrated circuit (ASIC) design of Cisco UCS servers employs Cisco Extended Memory Technology, increasing the amount of memory that can be addressed in Cisco UCS far beyond that of any comparable server.

Single-Node Offerings with Cisco UCS C-Series Rack Servers

Extra-small (XS) and small (S) appliances are based on the Cisco C260 M2 Rack Server with two Intel Xeon processors E7-2870 (2.4 GHz) and 128 or 256 GB of usable memory. This configuration is primarily used for development, testing, and small production SAP HANA systems with uncompressed data sets of up to 1.75 TB. The Cisco UCS appliance incorporates a persistency layer, based on internal SAS and SSD drives that require no additional drivers in the Linux kernel.

The medium-sized (M) appliance is based on the Cisco C460 M2 High-Performance Rack server with four Intel Xeon processors E7-4870 (2.4 GHz) and 512 GB of usable memory. This configuration is excellent for use in midsized and larger production environments. The persistency layer is provided by 12 internal SAS drives and two Fusion-io cards to avoid possible bottlenecks in duo-card configurations sharing the same PCI slot.

Table 1 summarizes the three single-node offerings.

Table 1. Single-Node Offerings

Size	Server Model	Memory	Number of CPUs	Storage
XS	Cisco UCS C260 M2	128 GB	2	10 x 600-GB SAS drives and 6 x 100-GB SSDs
S	Cisco UCS C260 M2	256 GB	2	10 x 600-GB SAS drives and 6 x 100-GB SSDs
M	Cisco UCS C460 M2	512 GB	4	12 x 600-GB SAS drives and 2 x 320-GB Fusion-io drives

Scale-Out Offerings with Cisco UCS B-Series Blade Servers

The scale-out appliance is uniquely scalable. It allows customers to easily adapt to the growing demands of their individual environments by incrementally adding Cisco B440 M2 High-Performance Blade Servers with four Intel Xeon processors E7-4870 (2.4 GHz) and up to 512 GB usable memory each, as needed. For every four Cisco UCS blade servers, the persistency layer is provided by EMC VNX5300 or NetApp FAS3240HA storage, depending on customer preference.

Table 2 summarizes the scale-out offerings.

Table 2. Scale-Out Offerings

Server	RAM Supported for SAP HANA	Theoretical Maximum In-Memory Data Set with SAP HANA		
		3-to-1 compression	5-to-1 compression	7-to-1 compression
4 Cisco UCS B440 M2	4 x 512 GB	6 TB	10 TB	14 TB
8 Cisco UCS B440 M2	8 x 512 GB	12 TB	20 TB	28 TB
12 Cisco UCS B440 M2	12 x 512 GB	18 TB	30 TB	42 TB
16 Cisco UCS B440 M2	16 x 512 GB	24 TB	40 TB	56 TB
...
40 Cisco UCS B440 M2	40 x 512 GB	60 TB	100 TB	140 TB
...

The basic configuration of the Cisco scale-out offering consists of redundant Cisco Fabric Interconnects with embedded infrastructure management, a Cisco UCS C220 M3 High-Density Rack Server to handle management functions and to host SAP HANA Studio, a Cisco 2911 Integrated Services Router (ISR) for secure remote management, and one enclosure with support for up to four Cisco UCS B440 M2 blade servers. The basic configuration can easily be scaled through the addition of extension bundles, each providing another blade enclosure for up to four more Cisco UCS B440 M2 blade servers each and the corresponding storage from EMC or NetApp.

All Cisco UCS servers are interconnected with a low-latency, 10-Gbps Ethernet fabric with supports both IP and Fibre Channel over Ethernet (FCoE) connections through redundant Cisco Fabric Interconnects. The Cisco Fabric Interconnect, with embedded management, is the core of Cisco UCS and reduces both the number of network hops and network latency—critical to SAP HANA performance.

Cisco UCS and the storage devices are connected to a pair of Cisco Nexus[®] 5500 platform multiprotocol switches. The Cisco Nexus 5548UP Switch offers 48 unified ports that can function as 10 Gigabit Ethernet ports with FCoE capabilities, Gigabit Ethernet ports, or native 4/8-Gbps Fibre Channel (depending on the inserted optics) ports. The Cisco Nexus 5548UP Switch has a low-latency cut-through design that provides predictable, consistent traffic performance regardless of packet size, traffic pattern, or enabled features on 10 Gigabit Ethernet interfaces with latency of less than 2 microseconds for switched traffic and 4.8 microseconds for routed traffic. Additional scalability, with the same features, can be accomplished with the Cisco Nexus 5596UP Switch, which can provide a density of 96 unified ports in two rack units (2RUs). All these features are critical for SAP HANA solutions to provide the best performance together with high availability. The Cisco Nexus 2000 Series Fabric Extenders work in conjunction with a Cisco Nexus 5500 platform parent switch to deliver cost-effective and highly scalable 100/1000 Megabit Ethernet and 10 Gigabit Ethernet. The fabric extender is essentially an extension of the parent Cisco Nexus switch fabric. Logically, it behaves like a remote line card, with the fabric extender and the parent Cisco Nexus switch together forming a distributed modular system with a single point of management.

Figures 2 and 3 show the configurations with EMC and with NetApp storage.

Figure 2. Configuration with EMC Storage for 12 Servers

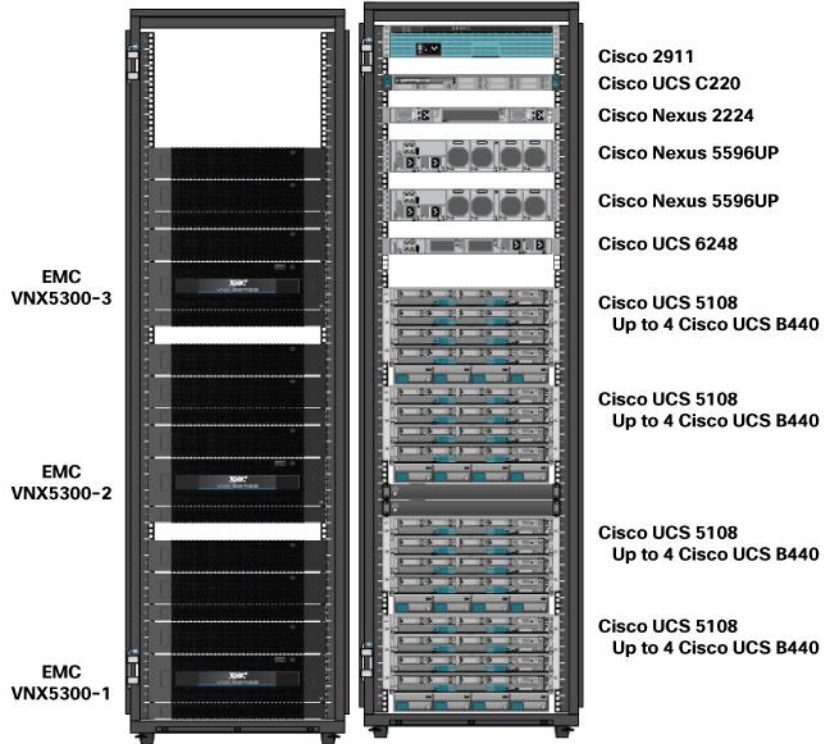
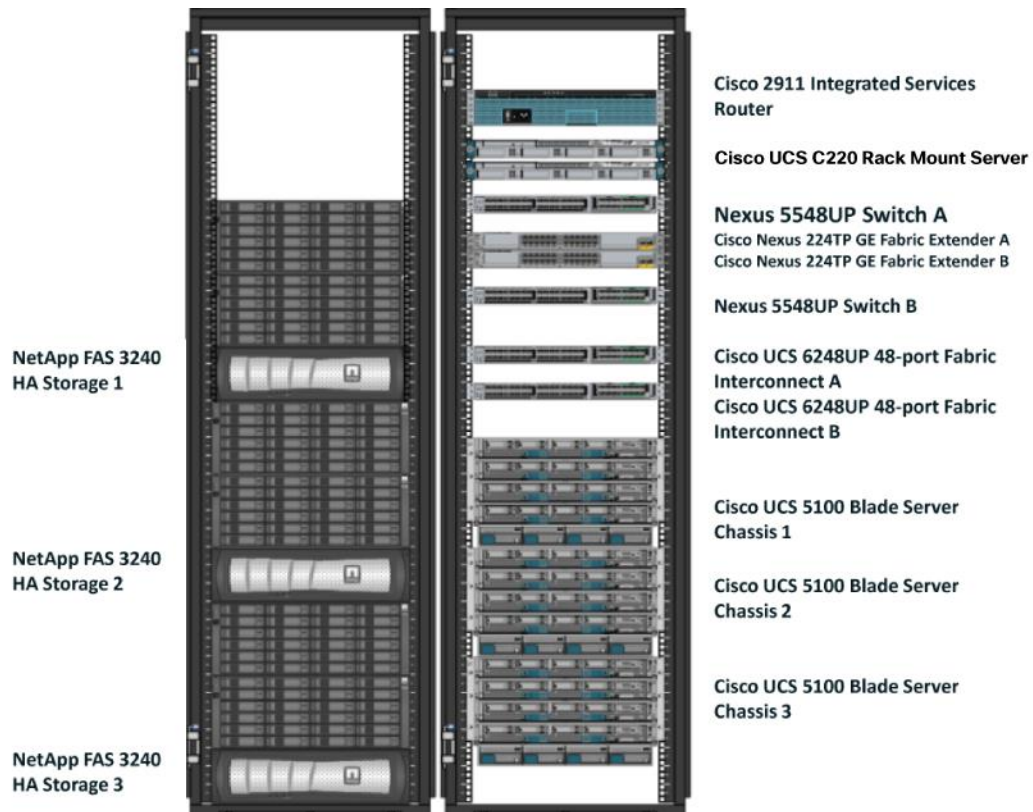


Figure 3. Sample Configuration with NetApp Storage for 12 Servers



High Availability

The Cisco UCS scale-out solution for SAP HANA has built-in redundancy, providing no single point of failure. Failure of a component such as a Cisco Nexus 5548UP and 5596UP or Cisco UCS Fabric Interconnect will reduce the I/O bandwidth, but it has no effect on functions.

The SAP HANA software stack on a scale-out solution has built-in software high availability based on a master-slave implementation. To handle a server failure, a standby server definition also is available. If an active server fails, the master name server will initiate restart of the failed application stack on the standby server (Figure 4).

Figure 4. Standby Server Definition for Restart of Failed Application Stack

Host	Host Active	Host Status	NameServer * Config Role	NameServer Actual Role	IndexServer * Config Role	IndexServer Actual Role	Failover Status	Failover Group *
wdfd00241544a	yes	ok	master 1	master	worker	master		default
wdfn00260135a	yes	ok	master 2	slave	worker	slave		default
wdfv00241544a	yes	ok	master 3	slave	worker	slave		default
wdfv00241544b	yes	◇ ignore	slave	slave	standby	standby		default

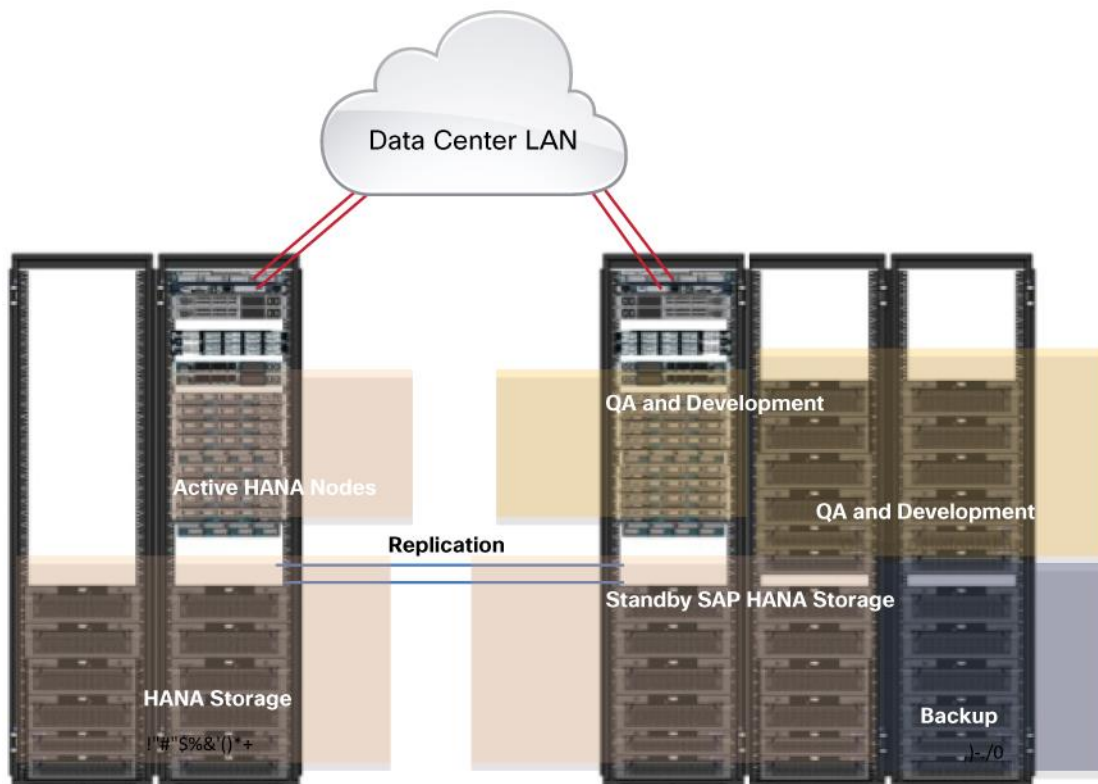
In addition to the standby server function of SAP HANA, Cisco UCS provides another level of redundancy with the unique Cisco UCS service profiles and a cold-standby spare server. Each Cisco UCS appliance for SAP HANA can be configured with up to four additional Cisco UCS B440 blade servers, and each of these servers can be a warm-standby device, with a booted OS and ready to start a SAP HANA node, or each can be a cold spare server, taking over the server identity if a blade server fails.

Disaster Tolerance

A single scale-out solution cannot be stretched across multiple rooms in one data center or across multiple data centers. To handle a disaster scenario, SAP offers the SAP HANA Disaster Tolerance (DT) solution. To implement a SAP HANA DT solution, a complete scale-out solution must be installed on the second side. All data must be replicated with storage methodologies from the first side to the second side. The Cisco solutions include replication of all operating system and Cisco UCS configuration information. In case of a disaster, the required Cisco UCS configuration will be imported, the replicated operating systems are booted, and the SAP HANA system will be started as on the original Cisco UCS on the first side.

You can use the server on the second side in regular operations as well, running a nonproduction SAP HANA system on it. You can add a set of storage devices to the existing solution and create an independent set of service profiles connected to this storage to run, for example, a quality assurance (QA) system. In the event of a disaster, the QA system will be stopped, and the physical servers can be reused to run the production system as described in the previous paragraph (Figure 5).

Figure 5. Sample Disaster Tolerance configuration for SAP HANA



For More Information

- Cisco Unified Computing System: <http://www.cisco.com/go/ucs>
- Cisco UCS HANA appliances: <http://www.cisco.com/go/sap>
- Cisco data center and virtualization solutions:
<http://www.cisco.com/en/US/netsol/ns340/ns394/ns224/solutions.html>

To contact Cisco for addition information about SAP on Cisco UCS, please email saponcisco@cisco.com.



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