Deliver Agile and Highly Reliable SAP HANA Deployments on VMware vSphere and Hitachi Unified Compute Platform

WHITE PAPER
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Introduction

In today’s dynamic business climate, companies in all industry sectors need to react quickly to changing business conditions and new economic situations. SAP® HANA™ is an in-memory database and applications platform. It helps businesses strengthen their competitive position by processing high volumes of operational and transactional data in real time.

When SAP HANA launched in 2011, businesses often adopted it in parallel with existing databases. The release of SAP HANA as a platform on Business Warehouse (BW) accelerated reporting and other BW processes. Today, thousands of businesses are transitioning their core Enterprise Resource Planning (ERP) and SAP Business Suite applications to work with SAP HANA.

Supporting mission-critical applications with SAP HANA requires:

• Readiness across the stack, from application to infrastructure platform.
• Flexible solutions that address changing business needs.
• Quick delivery of business value with minimal impact on the organization.
• Simple operational procedures.
• Budgetary alignment.

With SAP production support for the SAP HANA platform on VMware vSphere®, businesses can simplify their deployment and increase agility by extending virtualization to SAP HANA as they have done to other SAP applications. VMware and Hitachi Data Systems are working together to ensure that SAP HANA deployments running on vSphere and Hitachi Unified Compute Platform (UCP) deliver agility, high performance, throughput and efficiency.

Benefits of running SAP HANA virtualized deployments on vSphere and UCP include:

• Fast time-to-value. UCP reference architectures and SAP HANA virtualization templates from VMware can reduce deployment times from days or weeks to hours and ensure consistency across environments. UCP offers an entire SAP HANA solution with preinstalled SAP and VMware software.
• Simplicity, efficiency, low total cost of ownership. IT can manage SAP HANA virtualization in the same way as the rest of a software-defined data center (SDDC) for a big reduction in operational complexity. VMware vRealize™ Operations Manager™ helps IT monitor both virtualized SAP HANA and Hitachi storage solutions certified for SAP HANA (Hitachi Unified Storage and Hitachi Virtual Storage Platform G1000) for deep visibility into virtualized SAP HANA deployments.
• High service levels with excellent performance. UCP uses Hitachi storage, Hitachi Compute Blade servers and Brocade or Cisco networking components to deliver the highest possible service levels. VMware support for SAP HANA virtualization allows IT to further optimize service level agreements (SLAs). For example, the advanced VMware vSphere vMotion® feature allows the live migration of SAP HANA across multiple hosts in minutes with zero downtime. If a host for a SAP HANA VM fails, VMware vSphere High Availability (HA) can automatically restart the VM on a suitable host.
• Flexibility and scalability. UCP solutions use a highly scalable Hitachi blade architecture that can grow along with a business. Underlying Hitachi storage solutions embody all of the scalability and management features that businesses use in production environments, such as storage virtualization and Hitachi Dynamic Tiering. Adopting vSphere in these architectures simplifies deployment of new SAP HANA virtualization instances.
• Full maintenance and support. As businesses deploy SAP HANA solutions, they receive the full support of SAP, VMware and Hitachi Data Systems. SAP routes support calls to the appropriate partner.

Tens of thousands of SAP customers already run their critical SAP applications on VMware vSphere. And many of the largest SAP customers use Hitachi storage platforms for SAP data. To take advantage of the scalability and robustness of SAP virtualization, businesses around the world are turning to UCP.
Hitachi and VMware each have long-term alliances with SAP and a 13-year strategic global partnership with each other. Hitachi Data Systems integrates VMware software into many of its solutions. It is an Elite Partner in VMware’s Technology Alliance Partner program and a participant in VMware-Ready Partner programs for Storage Infrastructure Services.

This paper demonstrates the value of deploying the SAP HANA platform on VMware vSphere with several UCP converged infrastructure solutions. It is written for architects and IT decision-makers involved in procuring and setting up an SAP HANA landscape. SAP Basis administrators and SAP line-of-business owners also may benefit from this paper. The paper assumes a high-level understanding of SAP HANA, SAP products and technologies, vSphere and UCP.

**SAP HANA Platform and Deployment Options**

As SAP HANA evolved its application support capabilities, its deployment options changed as well, from an initial appliance-only model to a customized SAP HANA Tailored Datacenter Integration (TDI) model. This section explores SAP HANA capabilities and some of the architectural options businesses use to deploy SAP HANA solutions.

**SAP HANA Platform**

SAP HANA is a data source-agnostic, in-memory data platform and application development platform that converges and optimizes database and application platform capabilities. It also provides advanced capabilities for analyzing large data volumes in near real time. SAP HANA massively accelerates the performance of existing SAP applications by eliminating data redundancy and latency. It uses one architecture to perform transactions, business analytics, predictive text analytics, spatial processing, and sentiment data processing.

SAP HANA allows businesses to accelerate business intelligence (BI) modeling from any data source while achieving better operational planning, simulation and forecasting. They can also improve decision-making with near real-time analysis that uses SAP Enterprise Central Component (ECC) or Customer Relationship Management (CRM) transactional data.

The SAP HANA platform drives applications and analytics with high-speed response times and true interactivity. It also simplifies application development and rapid processing across big data sources and structures. By eliminating the divide between transactions and analytics, SAP HANA allows businesses to:

- Go deep within data sets to ask complex and interactive questions.
- Go broad by working simultaneously with enormous datasets of different types and from different sources.

At its core, the SAP HANA database is fundamentally different from other databases. The SAP HANA database engine manages data in a multi-core architecture for data distribution across all cores and maximum RAM locality with scale-out (horizontal) and scale-up (vertical) functionality.

With SAP HANA SP09, SAP now supports multi-temperature data. This framework allows IT to partition SAP HANA data and keep only a portion in memory while maintaining the remaining data in a Sybase IQ database for user transparency. This approach results in a lower total cost of ownership, since in memory systems are more expensive than disk-based architectures.
SAP HANA Deployment Architectures – From Appliances to SAP HANA Tailored Datacenter Integration Model

It its initial release, SAP HANA was exclusively delivered as an appliance by certified SAP HANA partners, including Hitachi Data Systems. The partners combined servers, storage and networking in a pre-configured solution.

The appliance model offers some benefits. It simplifies procurement of infrastructure for SAP HANA, because one platform vendor delivers all of the components. And it simplifies support, because the vendor supports all of the components below SAP HANA. Importantly, SAP tests and certifies the appliance to ensure it meets SAP HANA key performance indicators (KPIs).

The appliance model also has drawbacks. For example, businesses with pre-existing server and storage standards often cannot find an appliance that incorporates both standards. In addition, appliance architectures lack flexibility. For example, resource-sharing on the storage layer is not permitted in the SAP HANA appliance model in production environments. This drawback got highlighted with the advent of SAP production support for VMware vSphere 5.5 in May 2014: Key features of VMware, such as vMotion or VMware vSphere Distributed Resource Scheduler™ (DRS), require shared storage.
To allow storage array sharing across various SAP HANA compute nodes and environments, SAP introduced the SAP HANA Tailored Datacenter Integration (SAP HANA TDI) program. SAP HANA TDI provides significantly increased flexibility and choice. Businesses can use SAP HANA TDI-certified storage arrays for SAP HANA and then combine servers that are part of certified SAP HANA appliances.

The TDI model solves the flexibility issue by allowing storage-sharing in production environments, but leaves businesses looking for a way to ensure performance and quick deployment. In a best-of-both-worlds approach, a business continues to work with one vendor and take full advantage of the vendor’s reference architectures, solutions and support structures. This ensures a flexible architecture and reduces complexity. For example, running SAP HANA on vSphere with SAP-HANA certified Hitachi Compute Blade servers and SAP HANA-certified Hitachi storage arrays offers quick delivery and deployment based on tested reference architectures. Hitachi Data Systems verifies on site that the solution meets SAP’s KPI requirements.

Enabling Products and Technologies

To create an effective SAP HANA virtualization solution, businesses are combining the SAP HANA platform with the VMware vSphere 5.5 virtualization infrastructure and Hitachi Unified Compute Platform.

VMware vSphere

vSphere is an industry-leading virtualization and cloud computing platform that delivers the highest efficiency and choice in the industry. By permitting IT to meet SLAs, it lowers the total cost of ownership for the most demanding business-critical applications.

vSphere virtualization creates a layer of abstraction between the resources an application and operating system require and the underlying hardware that provides those resources. The abstraction layer allows multiple, isolated execution environments to share a single hardware platform. vSphere accelerates the shift to cloud computing for existing data centers. It also supports compatible public cloud offerings and forms the foundation for the industry’s only hybrid cloud model.

When used with SAP HANA, vSphere advanced features help businesses achieve operational performance and availability. Benefits of using vSphere include:

- **Consolidation.** vSphere allows the consolidation of multiple applications on one physical server, with little or no decrease in overall performance. This consolidation minimizes or eliminates underutilized server hardware, software and infrastructure.
- **Manageability.** vSphere Storage vMotion® and vMotion allow the live migration of virtual machines from server to server and the migration of associated storage with no downtime.
• Availability. vSphere High Availability reduces unplanned downtime and provides higher service levels for applications. In the event of an unplanned hardware failure, affected virtual machines automatically restart on another host in the vSphere cluster.

• Automation. VMware’s automated load balancing takes advantage of vMotion and Storage vMotion to migrate virtual machines among a set of VMware ESXi™ hosts. VMware vSphere Storage DRS and DRS allow automatic resource relocation and optimization for virtual machines and related storage.

• Provisioning. VMware virtualization encapsulates an application into an image that can be duplicated or moved, which greatly reduces the cost of application provisioning and deployment.

Figure 3. VMware vSphere virtual infrastructure

SAP HANA for Production with VMware vSphere

Businesses that power SAP HANA for production with vSphere 5.5 receive SAP support and an optimal environment for achieving a unique, cost-effective solution. This deployment architecture delivers agility, high availability, cost savings, and fast and easy provisioning.
vSphere 5.5 can support SAP HANA databases in scale-up mode up to 64 vCPUs and 1TB of memory – the maximum size of a virtual machine. A 1TB SAP HANA database comprises approximately 512GB of compressed data. The remaining RAM is utilized for temporary tables, intermediate calculations and other SAP HANA database structures. This is the same as the physical requirements for sizing SAP HANA on vSphere. While 1TB is the maximum available size if all of the data needs to reside in RAM, cold data can reside on disk for virtualized SAP HANA databases greater than 1TB when it uses the SAP Advanced Business Application Programming (ABAP) sizing tool.

The new vSphere 6.0 allows for larger virtual machines (up to 4 TB of memory and 128 vCPUs) and physical hosts, making it possible to virtualize larger SAP HANA systems. VMware and Hitachi are reducing customer deployment risk by testing vSphere 6.0 with SAP HANA on a Hitachi platform architecture.

SAP HANA supports a single virtual machine on a dedicated SAP HANA certified server. SAP HANA multi-node scale-out deployment configurations are not yet supported. SAP HANA supports 2- to 4-socket SAP HANA certified Intel E7 Westmere EX or Intel E7 v2 Ivy Bridge EX processor-based configurations in single-node scale-up configurations only. Two-socket Intel E5 v2 and v3 Ivy Bridge EP processor-based configurations in single-node, scale-up configurations are supported as well. Eight-socket SAP HANA certified hardware configurations are not yet supported in production.

Currently, multiple SAP HANA virtual machines on a single server are supported in non-production environments and under Controlled Availability for production environments. See http://scn.sap.com/docs/DOC-60470 for further details. SAP and VMware are continuing to work together to expand production-level support.

The following exceptions to the above conditions apply to SAP non-production environments:

- In addition to 2- and 4-socket certified configurations, businesses can use verified hardware configurations for an 8-socket, single-node SAP HANA appliance or SAP HANA TDI model. The Time Stamp Counter (TSC) must be synchronized between all sockets and cores.
- Multiple virtual machines may be deployed on a single SAP HANA server, and each virtual SAP HANA instance must be sized the same as in a bare metal SAP HANA deployment.

**Hitachi Unified Compute Platform**

Hitachi Unified Compute Platform family of converged infrastructure solutions offers high levels of data center efficiency, agility and resilience to ensure fast and cost-effective service delivery. UCP combines enterprise-class compute blades, storage systems and networking components in a customized and pretested bundle. It also adds software for IT management, automation and orchestration.

To efficiently handle IT workloads, UCP manages compute, network and storage as a shared pool of resources. UCP system integration speeds time to production by simplifying deployment and ensuring predictable results. IT experiences immediate, worry-free implementation without the delays of designing, configuring, optimizing, testing and managing separate components.

Converged platforms from Hitachi Data Systems include certified SAP HANA solutions running on VMware vSphere. These solutions offer:

- Reliability of a private cloud platform that aligns with business service levels.
- Reduced management cost and complexity with coordinated, comprehensive provisioning and administration of virtualized private cloud environments.
- Simplified deployment and management of physical and virtual resources, and simplified ordering and procurement process.
- Increased operational efficiency and resource allocation by aligning business processes to IT execution.
Hitachi Unified Compute Platform for the SAP HANA Platform

Hitachi Data Systems and SAP build upon a 20-year strategic partnership to deliver high-speed analytics and high-performance transaction processing solutions for the enterprise. Unified Compute Platform for SAP HANA provides a comprehensive SAP HANA deployment environment within a single enclosure. Two architectures are available for UCP for SAP HANA: scale-up and scale-out. At this time, VMware supports only SAP HANA scale-up solutions.

Scale-up offerings are ideal for running SAP Business Suite on SAP HANA, proofs of concept, and test and development environments. Several appliance configurations based on Hitachi Unified Storage VM (HUS VM) are available for the backend. Hitachi Compute Blade servers provide the server tier (Hitachi CB520X blades in 2-, 4- or 8-socket configurations). Hitachi symmetric multiprocessing (SMP) technology can link two or four blades to create one large system. Brocade technologies underlie the network layer.

UCP for SAP HANA solutions deliver:

• **Unique scalability:** Blade-based architecture, SMP capability and HUS VM storage infrastructure ensure organic growth without rip and replace.

• **Mission-critical readiness:** Enterprise-class HUS VM performance, engineering excellence built into the compute layer and robust data protection solutions ensure availability and consistency.

Hitachi Unified Compute Platform for VMware vSphere

Unified Compute Platform for VMware vSphere is a fully integrated solution that includes hardware, vSphere and Hitachi Unified Compute Platform Director. This solution forms a strong basis for a private cloud platform.

UCP Director automates and integrates management, server, networking and storage components. It integrates with VMware vCenter™ and VMware vRealize Operations Manager. This integration allows VMware administrators to extend the tools they already use to tasks such as server provisioning, LUN creation and physical network configuration.
This integrated architecture allows the management of physical and virtual resources with the same set of tools for big reductions in mean time to resolution (MTTR). It also enables a faster time-to-service with less opportunity for manual errors, because administrators don’t have to jump between multiple tools to deploy a service.
Both UCP for SAP HANA and UCP for VMware vSphere take advantage of Hitachi storage and server technologies, and Brocade or Cisco networking components. Moreover, Hitachi bundles vSphere 5.5 and additional VMware solutions to provide complete solution support. Note that UCP for VMware vSphere with UCP Director supports both virtualized and physical servers.

Agile and Highly Reliable SAP HANA Deployments with VMware and Hitachi

Reference architectures from Hitachi Data Systems act as building blocks for SAP HANA deployments. All solutions use Hitachi enterprise-class components and VMware virtual machine templates for SAP HANA.

Hitachi Unified Compute Platform for the SAP HANA Platform TDI Reference Architecture and Appliance Solutions with VMware vSphere

Hitachi Data Systems built and tested a reference architecture that combines the pre-existing UCP for SAP HANA 1TB scale-up solution with VMware vSphere. The solution meets required SAP HANA KPIs. Tests confirmed that multiple virtual machines running in parallel (up to eight without overcommitting resources) met the requirements.

Note: Running multiple SAP HANA production virtual machines on the same node is only supported in Controlled Availability by SAP.
Deliver Agile and Highly Reliable SAP HANA Deployments on VMware vSphere and Hitachi Unified Compute Platform

Table 1: SAP HANA on VMware TDI reference architecture for appliance solutions

<table>
<thead>
<tr>
<th>Feature / Component</th>
<th>Version / Requirements</th>
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<tbody>
<tr>
<td>SAP HANA</td>
<td>SP09</td>
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<tr>
<td>VMware vSphere</td>
<td>5.5</td>
</tr>
<tr>
<td>Operating system</td>
<td>SUSE Linux for SAP Applications 11SP3</td>
</tr>
</tbody>
</table>
| CPU and memory              | Intel Xeon processor E7-8880 V2:  
• 4 sockets, 60 cores  
• 1,024KB memory |
| Server architecture         | 2 Hitachi Compute Blade CB520X servers, connected with SMP to form one system |
| Chassis                     | Hitachi Compute Blade 500 |
| Storage                     | 1 Hitachi Unified Storage VM:  
• 4 SAP HANA log volumes at 300GB each  
• 3 SAP HANA data volumes at 3TB each  
• 1 SAP shared  
• 1 SLES operating system storage  
• 1 ESXi operating system |

The reference architecture shown in Figure 7, which is also available as a pre-configured appliance, helps customers in two ways when building an SAP HANA TDI infrastructure:

• For single-node systems.
• For systems with multiple compute nodes that share the same Hitachi Unified Storage VM (HUS VM) storage system. In this case, the compute part is derived from the reference architecture but the storage setup is generalized to support multiple compute nodes. With this approach each SAP HANA VM must have its own suitably sized set of storage RAID groups.

SAP HANA TDI on Hitachi Unified Compute Platform for VMware vSphere with UCP Director

Hitachi Data Systems has released an SAP HANA TDI reference architecture that uses UCP for VMware vSphere with UCP Director. This solution uses the orchestration and monitoring features of UCP Director. It also provides a convenient way to consolidate SAP HANA and a traditional SAP landscape on one platform.

Table 2: Hitachi SAP HANA on VMware TDI reference architecture with UCP Director

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<tr>
<th>Feature / Component</th>
<th>Version / Requirements</th>
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<tbody>
<tr>
<td>SAP HANA</td>
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<tr>
<td>Operating system</td>
<td>SUSE Linux for SAP applications 11SP3</td>
</tr>
<tr>
<td>SAP HANA</td>
<td>SP09</td>
</tr>
</tbody>
</table>
| CPU and memory              | Intel Xeon processor E5-8880 V2:  
• 2 sockets, 24 cores  
• 512 GB RAM |
| Server architecture         | 1 Hitachi Compute Blade CB520X server |
| Chassis                     | Hitachi CB500 |
| Storage                     | 1 Hitachi Unified Storage VM (HUS VM):  
• 4 SAP HANA log volumes at 300 GB each  
• 3 SAP HANA data volumes at 3 TB each  
• 1 SAP shared  
• 1 SLES operating system storage  
• 1 ESXi operating system |
This reference architecture provides easy installation and management. It allows the converged Hitachi Unified Compute Platform for VMware vSphere to host a flexible and uncomplicated SAP HANA scale-up solution. This reference architecture is an excellent choice for consolidating SAP HANA with SAP application servers and traditional SAP databases. However, it limits SAP HANA systems to 500GB. (Note that this reference architecture deployed SAP HANA on physical blades, but deployment on VMware vSphere is supported as well.)

**Sample Deployment Architectures and Roll-out Models**

Following is an example of one way a business might use SAP HANA TDI architectures with Hitachi and VMware components. In this example, a business wants to deploy two SAP systems on SAP HANA, SAP ECC and SAP CRM. Both the production and Q&A systems require approximately 800GB of memory. Other nonproductive systems, such as sandbox, test and development, consume about 300GB each. The business selects SAP HANA System Replication. Other options businesses often use for backup and disaster recovery include Hitachi Universal Replicator or Hitachi TrueCopy.

![Diagram](image)

Figure 8: Hitachi Unified Compute Platform for the SAP HANA Platform on VMware deployment architecture with disaster recovery

This reference architecture involves deploying one or more SAP HANA virtual machines that use 1TB, 2-blade SAP HANA compute nodes with vSphere and vMotion capability between the nodes in the primary data center. Benefits of this deployment architecture include:

- **Flexible SAP HANA rollout:** Takes full advantage of advanced VMware virtualization features such as vMotion.
- **Reduced downtime:** Uses vMotion and High Availability for nonproductive test, development and sandbox systems.
- **Mission-critical readiness:** Enterprise-class Hitachi components.
- **Easy scalability:** Storage and compute scaling features.
- **Cost efficiency:** Storage sharing and meaningful consolidation.
It’s a common perception that SAP HANA TDI architectures add substantially to on-site work. It’s true that the base architecture setup for the SAP HANA TDI model adds additional, but manageable, on-site effort. Depending on the architecture and the type of requested services, on-site effort can vary greatly. However, businesses that combine SAP HANA TDI flexibility, a single platform vendor across servers and storage, and implementation by Hitachi Data Systems Global Services Solutions typically enjoy a very successful outcome. On a high level, Hitachi follows the steps presented in the following workflow.

![Workflow Diagram](image)

**Figure 9:** High-level workflow for implementing SAP HANA TDI architectures. Hi-Track refers to the Hi-Track Remote Monitoring system from Hitachi Data Systems.

### Conclusion

VMware and Hitachi Data Systems work together to ensure businesses can confidently and economically operate mission-critical SAP HANA applications in virtualized environments. SAP HANA virtualization from VMware combines with Hitachi converged infrastructure solutions to accelerate the journey of an SAP business to a software-defined data center and ultimately to the cloud.

VMware vSphere allows rapid deployment, non-disruptive migration, dynamic orchestration and easy replication of SAP HANA virtualization instances. Hitachi Unified Compute Platform adds unique scalability across servers, storage, switches and networking devices. Deep integration between UCP Director and VMware vCenter ensure complete system visibility, monitoring and troubleshooting along with efficient resource utilization.

Virtualization of SAP HANA contributes to the future success of the business with new levels of data center efficiency. VMware and Hitachi capabilities contribute to that success by providing:

- **Fast time-to-market.** Deployment of SAP HANA instances on the SAP HANA virtualization infrastructure are quick and easy, thanks to SAP HANA virtual machine templates from VMware or Hitachi. The components of Hitachi converged solutions for SAP HANA are pretested with pre-installed SAP software. Hitachi Data Systems Global Services Solutions doesn’t have to re-architect a solution every time, which makes implementation fast and affordable.

- **Simplicity, efficiency, low total cost of ownership.** The well-known scalability of VMware virtual machines combined with Hitachi storage scalability, SMP technology and single-point management add operational efficiency to the data center.

- **High service levels with excellent performance.** Enterprise-class components from Hitachi Data Systems deliver the required service levels for mission-critical deployments. When applicable, VMware availability features, such as vMotion and High Availability, augment this capability.
Resources

For more information about the SAP HANA, VMware, and Hitachi products discussed in this paper, view the links below.

**Hitachi References for SAP with VMware vSphere**

- SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere:
- Hitachi Unified Compute Platform for the SAP HANA Platform on VMware vSphere in a Medium 1 TB Scale-Up Configuration using Hitachi Compute Blade 500 and Hitachi Unified Storage VM:
- SAP HANA Tailored Datacenter Integration on Hitachi Unified Compute Platform for VMware vSphere with Hitachi Compute Blade 500:

Additional information can be located at:

- Hitachi solutions for SAP (general):
  http://www.hds.com/solutions/alliance/sap
- Hitachi solutions for VMware (general):
  http://www.hds.com/solutions/alliance/vmware

**SAP HANA**

- SAP HANA Platform:
  https://help.sap.com/hana_platform
- SAP HANA Tailored Datacenter Integration (TDI):
  http://www.saphana.com/docs/DOC-4380
- SAP Notes Related to Hitachi / HDS:
  http://scn.sap.com/docs/DOC-57937
- SAP Notes Related to VMware:
  http://scn.sap.com/docs/DOC-27321
- SAP HANA support for VMware vSphere Environments:
  http://Service.sap.com/sap/support/notes/1788665
- SAP HANA on VMware vSphere in production:
  http://Service.sap.com/sap/support/notes/1995460
- SAP HANA System Landscape:
  http://scn.sap.com/docs/DOC-59900

**VMware References**

**VMware vSphere**

- Best Practices and Recommendations for Scale-up Deployments of SAP® HANA® on VMware vSphere:
- VMware vSphere Documentation:
- Performance Best Practices for VMware vSphere 5.5:
  http://www.vmware.com/pdf/Perf_Best_Practices_vSphere5.5.pdf
• VMware Documentation:
  https://www.vmware.com/support/pubs/
• VMware Licensing Help Center:
  http://www.vmware.com/support/licensing/

VMware Community and TV
• VMware Community, VMware Technology Network (VMTN):
  https://communities.vmware.com/community/vmtn
• VMware Community, VMware Best Practices:
  https://communities.vmware.com/community/vmtn/bestpractices
• VMware Community, VMware Knowledge Base:
  http://communities.vmware.com/community/vmtn/resources/knowledgebase
• VMware Support Insider:
  http://blogs.vmware.com/kb/kbtv
• VMware TV:
  http://www.youtube.com/user/vmwaretv
• VMworld TV:
  http://www.youtube.com/user/VMworldTV
• VMware KBTV (external):
  http://www.youtube.com/user/VMwareKB

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