

# SAP Solutions—High Availability on SUSE® Linux Enterprise Server for SAP Applications

All best practices have been developed jointly between Hewlett-Packard and SUSE, as well as with the following hardware and software providers:



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# Executive Summary

**SAP Business Suite is a sophisticated application platform for large enterprises and mid-size companies. Many critical business environments require the highest possible SAP application availability. SUSE® Linux Enterprise High Availability Extension, running on the modern x86-64 hardware platform, satisfies this requirement.**

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Modern SAP systems, running critical workloads, have to meet the highest standards for availability of their SAP services. SAP already comes with some basic redundancy mechanisms out of the box. However, for a full high availability, SAP relies on third-party, high availability cluster solutions, that are designed to cover all components in the SAP solution stack that could fail and cause an interruption of the SAP services. The protected components include for example the SAP NetWeaver software, SAP databases, the network, server hardware and the underlying storage systems.

The goal of most businesses is to reach an availability of up to 99.999 percent. This is less than five minutes of service outage per year. This goal is attainable only when all single points of failure are eliminated and when takeover procedures happen reliably, smoothly and very fast in the event of an outage.

HP and SUSE offer the right hardware and software technologies to run fully redundant, high available SAP systems for critical SAP workloads.

HP delivers SAP-certified, enterprise-class hardware such as the HP ProLiant blade servers and HP EVA storage arrays. Together with various management technologies, the SUSE delivers the SAP-recommended Linux operating system, SUSE Linux Enterprise Server 11. It is fully validated and certified by SAP for almost all SAP products. Together with the High Availability Extension, SUSE offers a complete Software stack to make SAP systems high available. Third-party high availability cluster solutions are no longer needed. SUSE Linux Enterprise Server for SAP Applications, which was developed specifically for SAP workloads, includes the operating system and the high availability extension with the required SAP resource agents. No additional software is needed.

Once they have these hardware and software technologies, cluster architects need additional resources. High availability SAP systems tend to be very complex, and individual requirements for storage replication, network connectivity and soon result in an enormous number of architecture possibilities for just one SAP cluster. Extensive resources would be needed to design, implement and test a cluster that fulfills all individual requirements.

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To minimize the planning, implementation and testing required, HP, SUSE and several other hardware and software partners have developed a set of best practices that describe the most common SAP high-availability scenarios at a detailed technical level. Cluster architects can use these best practices as implementation guides and combine them as needed to setup their individual SAP high-availability clusters.

Each best-practice has been professionally designed, planned and tested by an inter-disciplinary team of high-availability cluster and SAP experts. Each best-practice document focuses on a dedicated technical topic. Combined, these make up a powerful documentation collection that covers almost all high-availability requirements.

This white paper provides an overview of the best practices. For more details on each scenario please refer to the document collection at: [www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html](http://www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html)

## Introduction

### SAP on Linux

SUSE and SAP have a strong partnership and cooperate on a wide range of technologies and solutions. Besides the Linux operating system layer, SUSE and SAP work closely together to integrate identity and security management solutions from SUSE with the SAP NetWeaver platform and business software applications.

SUSE has multiple dedicated resources working at the SAP headquarters and the SAP Linux Lab to ensure maximum interoperability between our products and services.

SAP established the SAP Linux Lab back in 1999, to support SAP software on Linux. The Linux Lab assists other SAP departments with software development on the Linux platform, processes Linux-specific support problems and acts as an information hub to all SAP partners in the Linux ecosystem.

Linux enables customers to reduce their total cost of ownership (TCO). Linux distributors do not charge a license fee for Linux because it is open source, so customers need to pay only for

support and services. Because Linux is supported on a very wide range of server hardware, customers now have the possibility to escape from vendor lock-in. In terms of administration, SAP customers see little difference between Linux and proprietary UNIX-like operating systems. Linux is well accepted in all areas of data center computing. Through open interfaces and a wide range of supported applications, Linux is capable of providing all required services for standalone SAP workloads and integration in existing SAP environments.

### SUSE Linux Enterprise Server for SAP Applications

SAP recommends SUSE Linux Enterprise Server as a preferred Linux platform. Since the very beginning of SAP involvement with Linux, SUSE has been the number one Linux platform for SAP. SUSE Linux Enterprise Server has become the reference platform for SAP software development. SAP now actively suggests SUSE Linux Enterprise Server when customers want to run SAP workloads on Linux. Recently, SAP chose SUSE Linux Enterprise Server as the operating system for the fast-start program of its Business All-in-One solutions.

SUSE Linux Enterprise Server for SAP Applications is optimized to provide the best Linux platform for SAP software.

YaST®, the SUSE Linux Enterprise Server main installation and administration tool, provides an SAP software pattern that installs the prerequisites needed for running SAP software. Also, some system parameters are fine-tuned in preparation for the SAP workload.

### Support and Certification

For SAP customers, SUSE offers a priority support service that provides customers with a single point of contact for support, from the operating system through the application. This offering is valid in combination with SUSE Linux Enterprise Server or SUSE Linux Enterprise Server for SAP Applications.

SAP and SUSE are working together to ensure that SUSE Linux Enterprise Server service packs always match the certification of the respective product. In fact, SAP recommends always using the latest available service pack.

SUSE provides at least five years of general support for platform and operating system products, including its revisions, starting at the date of a product's general availability. When general support ends, SUSE offers extended support for a minimum of two years. This gives SAP customers long product life, ensuring a low total cost of ownership.

### **SUSE Linux Enterprise High Availability Extension**

Your data is the most valuable asset that you have. It is what your business depends on. Robust, scalable and manageable storage is a top priority for your IT department. High availability storage, applications and services are critical for your business to be competitive. But even as data grows, you can lower storage management costs and still benefit from an easy-to-manage, high availability storage foundation that scales as needed.

The SUSE Linux Enterprise High Availability Extension, a featured addition for SUSE Linux Enterprise Server 11, satisfies these needs.

It includes high availability service and application clustering, file systems and clustered file systems, network attached storage (NAS), network file systems, volume managers, storage area network (SAN) and drivers, and the means to manage of all these components working together. The SUSE Linux Enterprise High Availability Extension 11 is included in the SUSE Linux Enterprise Server for SAP Applications product from SUSE.

Unlike proprietary solutions, SUSE Linux Enterprise High Availability Extension keeps costs low by integrating open source, enterprise-class components. The key components of the extension are:

- *OpenAIS, a high availability cluster manager that supports multi-node failover Resource agents to monitor availability of resources, including SAP instances and SAP databases*
- *Oracle Cluster File System 2 (OCFS2), a parallel cluster file system that offers scalability*
- *Cluster Logical Volume Manager (cLVM2), a logical volume manager for the Linux kernel, which provides a method of allocating space on mass storage devices that is more flexible than conventional partitioning schemes*

- *Distributed replicated block devices (DRBD8), which provide fast data resynchronization capabilities over a LAN and replicated SAN semantics, allowing customers to use cluster-aware file systems without additional SANs*
- *High-availability GUI and various command-line tools*

Availability is a result of the interaction of cluster software with application services on the front side and the operating system and hardware resources on the other side.

Following this basic idea, cluster software like OpenAIS could not increase the availability on its own. It needs a lot of modules, such as services, resource agents, a messaging layer, network and file system availability, and a stable Linux kernel designed and configured for productive server systems in data centers.

SUSE Linux Enterprise High Availability Extension integrates these open source technologies and enables you to support line-of-business workloads traditionally reserved for UNIX and mainframe systems.

### **SAP Resource Agents**

The SAP Instance Resource Agent is responsible for starting, stopping and monitoring the services in an SAP instance. The resource agent monitors the following services: disp+work, msg\_server, ensERVER, enrepserver, jcontrol and jstart.

The SAP Instance Resource Agent can be used to manage the following SAP instances:

- *SAP WebAS ABAP Release 6.20–7.30*
- *SAP WebAS Java Release 6.40–7.30*
- *(For 6.40 please also read SAP note 995116.) SAP WebAS ABAP + Java Add-In Release*
- *6.20–7.30 (Java is not monitored by the cluster.)*

The purpose of the SAP database resource agent is to start, stop and monitor the database instance of an SAP system. Together with the relational database management systems (RDBMS) it will also control the related network service for the database.

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As with Oracle Listener and the xserver of MaxDB, the resource agent expects a standard SAP installation and therefore needs fewer parameters to be configured. The monitor operation of the resource agent can test the availability of the database by using SAP tools such as R3trans or jdbccconnect. This ensures that the database is accessible for the SAP system.

The SAP database resource agent supports the following databases in an SAP installation:

- *Oracle 10gR2 and 11gR2*
- *DB2 UDB for Windows and UNIX 9.x*
- *SAP-DB / MaxDB 7.7*

The resource agents are part of the SUSE Linux Enterprise High Availability Extension.

## HP Hardware

### HP ProLiant Systems

HP ProLiant systems offer simplicity, manageability and flexibility to ideally position them for SAP Business Suite environments. The broad range of SAP applications cover the full range of business solutions, including a middleware stack. HP ProLiant servers meet such sometimes complex IT infrastructures by offering the industry's broadest range of infrastructure solutions. The ProLiant server range comprises the ML, DL and BL blade series, which offer customers the possibility to deploy either two-, four- or eight-CPU rack-mounted or standalone machines. The DL series is density optimized for flexibility and manageability and ideal for multi-server SAP deployments, while the ML series is suitable for standalone systems that require maximum internal storage capacity. HP BladeSystem infrastructures offer a highly flexible and scalable environment that enables enterprises to embrace change while dramatically reducing their total cost of ownership. HP also offers a set of software tools called ProLiant Essentials that extends server functionality for dynamic resource optimization, automated and intelligent management, and continuous, secure operations. HP BladeSystems and some ProLiant Essentials modules make up the infrastructure that supports both the SAP Adaptive Computing concept and the HP Virtual Infrastructure Solution for SAP Business Suite.

### HP StorageWorks 6400/8400 Enterprise Virtual Array (EVA)

The HP StorageWorks 6400/8400 Enterprise Virtual Array (EVA) family is an enterprise-class storage array system designed to aggregate and automate array management tasks to manage more storage capacity with fewer resources. The EVA family is designed specifically for customers in the business-critical, enterprise marketplace and is a scalable, highly available and highly reliable virtual-array storage solution. The EVA 6400/8400 saves time, space and costs compared to traditionally architected storage. It is supported by a powerfully simple suite of management software, making it easy for users to provision storage and to achieve the highest level of productivity. The HP StorageWorks 6400/8400 Enterprise Virtual Array family is designed for the data center where improved storage utilization and scalability are critical needs. The EVA meets application-specific demands for transaction I/O performance for midrange and enterprise customers. It provides easy capacity expansion, instantaneous replication and simplified storage administration. EVA products combined with HP StorageWorks Command View EVA software provides a comprehensive solution designed to simplify management and maximize performance.

## Find the Right Best Practices for Your Requirements

Following is a set of best practices that we developed to cover as many of the most- common scenarios as possible. We do not expect one best practice to fit all customer needs. While each best practice focuses on a specific scenario, most of these best practices can be combined to fit your more complex situation.

Depending on the scenario you want to implement, you can select one or more of these best practices from SUSE. To help you decide which best practice matches your preferred architecture and system management principles, we describe each of the best practices in a short top-level view. This will help you implement the optimal infrastructure for running SAP NetWeaver on SUSE Linux Enterprise Server 11 with the SUSE Linux Enterprise High Availability Extension.

The following best-practices have been developed together with customers, partners and our consulting experts:

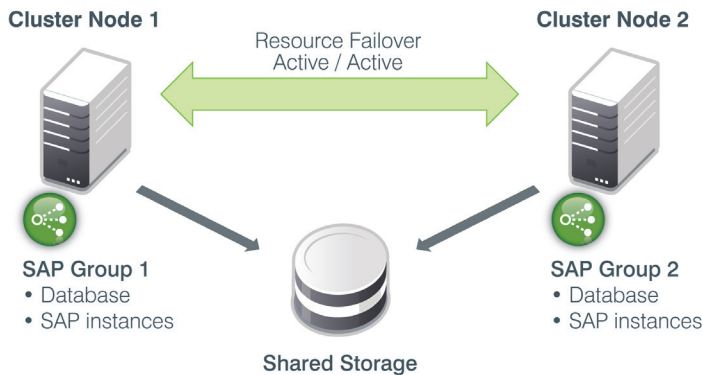
- Simple stack high availability with two SAP systems active/active
- Enqueue replication high availability active/active
- DRBD data replication high availability active/active

The best-practices described in this whitepaper are available at: [www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html](http://www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html)

## Best Practices Explained in Detail

### Simple Stack High Availability with Two SAP Systems Active/Active

This best practice defines an entire SAP system, including the database and all cluster-controlled instances, on a single cluster node running within a single resource group. The cluster uses shared storage devices such as SAN devices to provide the data to all cluster nodes. However, to minimize cluster complexity, the file systems are mounted by one cluster node at a time. This gives you the free choice of using any supported Linux standard file system such as ext3, reiserfs and xfs.



**Figure 1.** Simple Stack High Availability with Two SAP Systems Active/Active

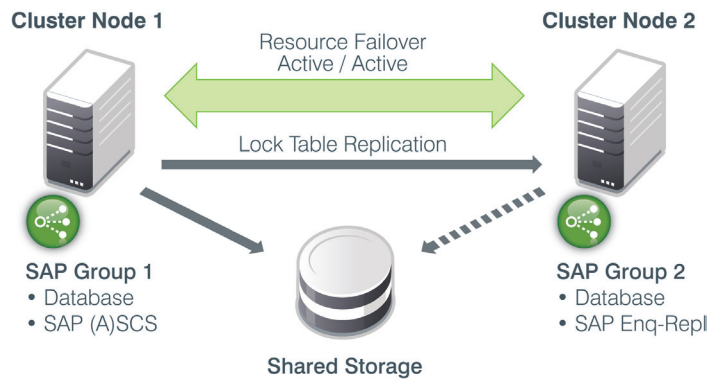
The advantages of this cluster model include:

- Less complex cluster design
- Easy to expand with additional SAP systems
- Avoids domino effects, if running a single SAP system in the cluster

To learn more about the architecture, technical details and how to implement this high availability scenario, please read our document *SAP on SUSE Linux Enterprise—Best Practices for Running SAP NetWeaver on SUSE Linux Enterprise Server 11 with High Availability Simple Stack* at: [www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html](http://www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html)

### Enqueue Replication High Availability Active/Active

The best practice Enqueue Replication High Availability supports running an entire SAP system balanced on both cluster nodes. The master/slave mechanism of the SAP instance resource agent for the SCS/ASCS instances allows it to run the enqueue replication server. This increases the availability of the SCS/ASCS instances by providing a replication of the central locking table. In the case of a cluster failover, the SCS/ASCS instances are able to take over the replicated locking table. This mechanism improves the availability of the SAP system.



**Figure 2.** This best practice runs an entire SAP system balanced on both cluster nodes.

The advantages of this cluster model are:

- Locking table replication using the enqueue replication server improves availability of the SAP system
- Load balancing (database/instances) over both cluster nodes
- You can also run the database on a separate cluster if you want to spread the workload

To learn more about the architecture, technical details of this solution and how to implement this high availability scenario, please read our document *SAP on SUSE Linux Enterprise—Best Practices for Running SAP NetWeaver on SUSE Linux Enterprise Server 11 with High Availability—Enqueue Replication High Availability Active/Active* at: [www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html](http://www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html)

### DRBD Data Replication High Availability Active/Active

The best practice DRBD Data Replication High Availability Active/Active supports two separated data centers and host-based storage replication from one data center to the other. One of the key cluster techniques is the distributed replicated block device (DRBD). This technique is included in the product SUSE Linux Enterprise Server for SAP Applications 11 SP1 and SUSE Linux Enterprise High Availability Extension 11.

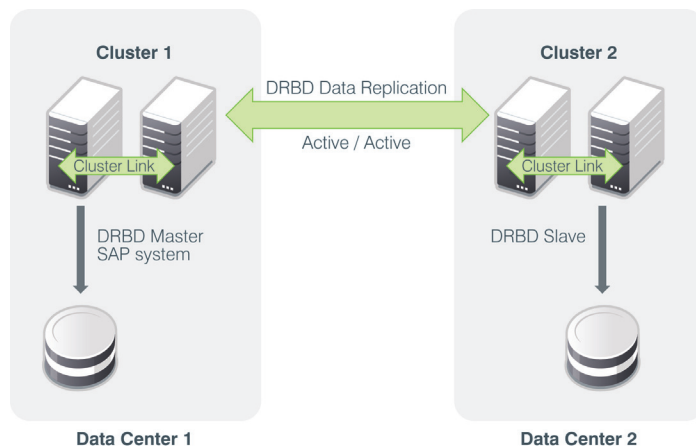
DRBD allows you to transparently mirror data from one node to another via the network. DRBD can be understood as network-based RAID 1.

The example configuration described in the best practice below comprises four SAP nodes spread across two distinct sites, with two nodes per site. The nodes in each site form an OpenAIS/Pacemaker high availability cluster. This architecture assumes that both sites provide a local SAN with fully meshed fibre channel connectivity. In the example, the cluster nodes are assigned to two SCSI logical units (LUNs) spread across two different shared storage devices. Each cluster node has access to both LUNs with redundant, multipath connectivity and uses Linux software RAID (MD) for host-based mirroring.

For replication between sites, a DRBD device is layered on top of the RAID mirror. Thus, asynchronous storage replication between sites requires no SAN connectivity—simple IP connectivity is sufficient.

The advantages of this cluster model are:

- *Data replication from one data center to another*
- *Supports a wide area cluster*
- *The solution could also be extended scenarios where the data centers run different SAP systems*



**Figure 3.** DRBD Data Replication High-availability Active/Active.

To learn more about the architecture, technical details of this solution and how to implement this high availability scenario, please read our document *SAP on SUSE Linux Enterprise—Best Practices for Running SAP NetWeaver on SUSE Linux Enterprise Server 11 with High Availability—Storage Mirror with DRBD* at: [www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html](http://www.suse.com/products/sles-for-sap/resource-library/sap-best-practices.html)

### Conclusion

HP and SUSE provide all the required hardware and software components to successfully set up and run high availability SAP workloads in physical and in virtual environments.

HP provides with the ProLiant server and blade solutions a powerful platform for SAP workloads of all sizes. HP EVA storage arrays provide the optimal SAN back end to safely store critical SAP business data. Combined with the CLX extension for HP EVA storage systems, HP significantly improves the redundancy of and thus the availability of SAP data stored in the SAN.

SUSE provides SUSE Linux Enterprise Server for SAP Applications, the most interoperable platform for mission-critical computing.

SUSE Linux Enterprise Server for SAP Applications enhances SUSE Linux Enterprise Server with additional functions and services, such as the SUSE Linux Enterprise High Availability Extension, which are tailored for SAP in the data center. They come with all necessary components to run the SAP Business Suite applications as well as SAP certified databases in high availability clusters. SUSE Linux Enterprise Server 11 is certified for almost all SAP products.

Using SUSE Linux Enterprise Server for SAP Applications together with our comprehensive set of best practices, IT architects get a powerful tool box to design and implement even very complex and customized high availability SAP clusters that fit individual business and IT infrastructure requirements.

SUSE and HP worked together with several hardware and software partners, as well as with customers, to develop solutions that reflect real-world SAP scenarios rather than just theoretical setups. All described topics have been carefully chosen based on specific customer demands. The developed best practices have been planned, implemented and tested on the same hardware that is commonly used in data centers running critical SAP systems.

## Credits

All best practices have been developed jointly between HP and SUSE, as well as with the following hardware and software partners:



To address the demands of our customers and to develop customer-proven solutions, we worked closely together with the following customers:

- BASF IT Services
- HP Hosting Services

We would like to thank our partners and customers for their committed engagement. We would especially like to thank our team members from seven different companies for their hard and successful work. We believe that brilliant solutions have their origin in the minds of brilliant people.



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