

Three Steps Toward Zero Downtime

Guide

www.suse.com/zerodowntime

Solution Guide

Server

Introduction

Service uptime is a top priority for many business operations. From global enterprises to small and medium businesses, increased market competition requires more and more companies to service customers, partners and their own employees around the clock.

Mission-critical workloads, such as SAP, Enterprise Resource Planning (ERP), enterprise databases and highly dense virtualization hosts, often need to reside on operating systems that can exploit underlying reliable hardware and are designed with service availability in mind.

Several products and services from SUSE can help you minimize server downtime by fully exploiting reliable hardware, utilizing redundancy to provide high availability and reducing operational mistakes. This paper is designed to provide an overview of many functions and benefits available in SUSE® Linux Enterprise and related services.

A Closer Look at Downtime

Downtime occurs in two ways: there is planned downtime and unplanned downtime.

Planned downtime is the result of scheduled system maintenance work, such as replacing aged hardware or upgrading a system, which from time to time requires you to reboot a machine. Planned downtime, scheduled in service windows to have minimal impact on business, is still hard to avoid. What's more, with the trends of globalization and mobile computing, large enterprises are facing

constant workflow demand on servers, so it's becoming harder to minimize the impact of planned downtime.

In contrast, unplanned downtime is beyond the control of the organization. Examples are infrastructure failures, human mistakes or even geographical catastrophes. Unplanned downtime is unforeseeable and, therefore, has more impact on your business. According to a recent study by Ponemon Institute¹, a single minute of unplanned downtime costs US\$5,000. In some cases, such as the 30-minute downtime of Amazon.com in 2013, it may have cost the company as much as US\$4.9 million in deferred revenue.

Steps You Should Consider

SUSE is committed to helping you to minimize your downtime and maintain your service level agreements (SLAs). SUSE designs products and services with service uptime in mind and offers many unique features and benefits that keep your service available. Here are the steps you need to consider to move toward zero downtime with SUSE:

¹ Ponemon Institute, "Calculating the Cost of Data Center Outages," May 2011.

Step 1: Prevent Hardware Downtime

Just as in building a house, preventing downtime fundamentally depends on choosing the best foundation for your IT. So the right hardware and operating platform are critical components for preventing downtime. SUSE Linux Enterprise fills this need. It is built on a common code base, offering consistent performance on a wide range of hardware architectures, from Intel64 to IBM mainframes. By providing extra stability and availability features across these different platforms, SUSE offers you a software solution that gives you flexibility.

If you choose IBM System z, which is designed for 99.999 per cent availability (about five minutes of downtime per year), SUSE offers the most commonly used Linux on this platform. We offer technologies that are specially designed for System z such as a two-stage dump framework and robust disk mirroring and tools such as the High Availability Extension on SUSE Linux Enterprise Server for System z. This includes a geo-clustering option that gives you extra dimensions of availability. If you choose the x86_64 platform, SUSE also gives you UNIX-level reliability and availability features. For example, based on the partnership between SUSE and Intel, the kernel of SUSE Linux Enterprise can handle the Machine Check Exception (MCE), which is notified by the Machine Check Architecture (MCA) in the Intel Xeon Processor E7 Family, improving the error-handling capability of your system.

Step 2: Maximize Service Availability

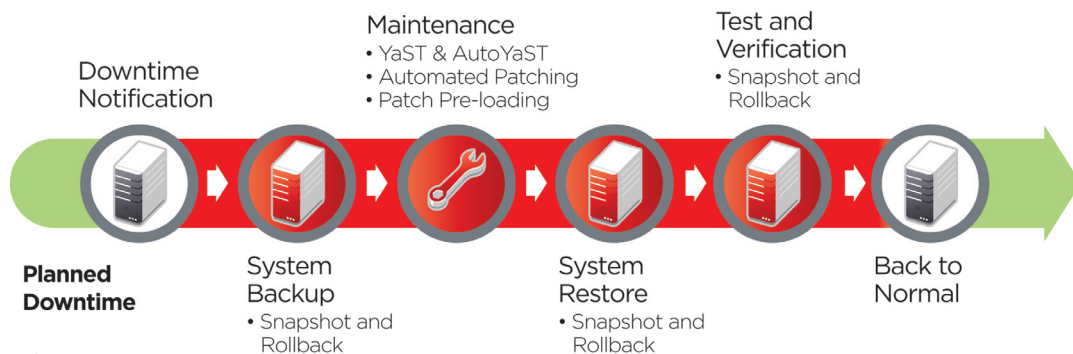
Your ultimate goal is to maximize service and workload availability. Clustering technologies are commonly used today to improve

the general availability of the system through redundancy. SUSE has more than 15 years of experience in open source clustering technology. SUSE Linux Enterprise High Availability Extension is designed to combine several redundant servers into one cluster, achieving higher availability than is possible with a single server. It has an up-to-date stack, allowing you to flexibly set up clusters among physical nodes or virtual guests. And it gives you easy-to-use tools to manage your cluster. SUSE Linux Enterprise High Availability Extension is available as an extension to SUSE Linux Enterprise Server and is an integrated part of the SUSE solution for SAP, System z and private cloud. In other words, you have maximum choice to secure critical services.

Constantly monitoring the nodes and their services for availability and performance allows the cluster to initiate fault isolation and service recovery—containing failures swiftly and ensuring timely restoration of service in case of failures. Support for rolling upgrades—migrating services away from one node in the cluster after another as each of them enters its maintenance window—even reduces the impact of planned downtime as nodes and services are updated. For fully virtualized services, this can completely eliminate outages due to planned hardware downtime through live migration.

For stateless workloads such as web servers, which respond to each client request as an isolated transaction, SUSE Linux Enterprise High Availability Extension includes IPv4 and IPv6 load balancing, allowing you to handle node and service failures and redirect requests to other nodes to maintain the availability and performance of the service.

Figure 1. Timeline of Planned Downtime



Red = service downtime
Green = service uptime

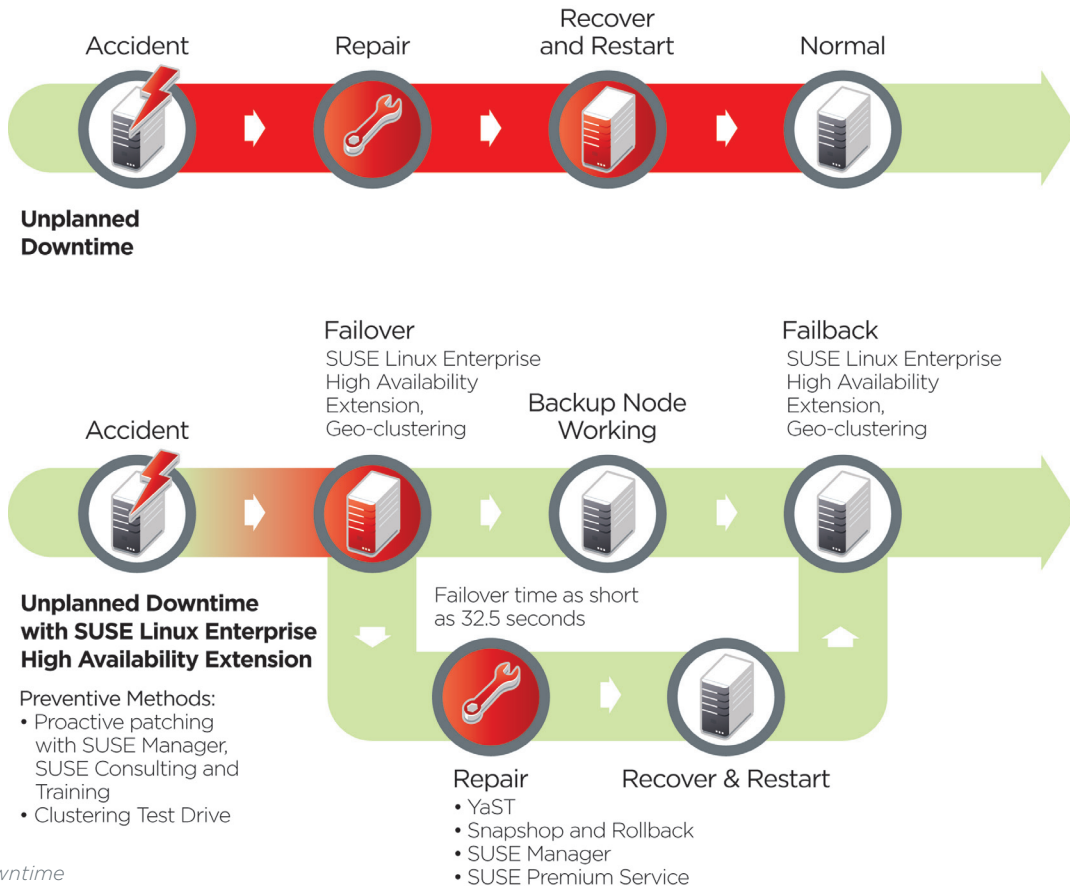
SUSE Linux Enterprise High Availability Extension supports metro-area clustering that includes nodes up to 25 kilometers distant from one another. This helps improve business continuity when regional accidents such as building power outages happen. What's more, Geo Clustering for SUSE Linux Enterprise High Availability Extension supports bridging clusters across unlimited, global distances, further enhancing your business continuity and service availability.

A recent innovation from SUSE, SUSE Linux Enterprise Live Patching (formerly code named kGraft), addresses service availability problems from another angle. It can do live kernel

patching without requiring you to reboot the machine. This is especially important because many machines need a long time to come into full service mode. With this new technology, you can have urgent kernel patches without waiting until the next service window, reducing the need for planned downtime. The unique advantages of SUSE Linux Enterprise Live Patching are:

- It integrates smoothly into existing package and patch management solutions because it uses the Enterprise Linux RPM package standard.
- While patching, there is no need to hold the Linux kernel for a short time as is necessary in other technologies.

Figure 2. Timeline of Unplanned Downtime



Step 3: Minimize Human Mistakes

According to Forrester, about 13 percent of downtime incidents are caused by human mistakes². By using proper tools and automation you can reduce the risk of error in repetitive or complicated tasks. SUSE provides a wide range of easy-to-use tools to reduce these operational mistakes.

Since 2009, a snapshot and rollback feature has been included in SUSE Linux Enterprise Server. It is based on Snapper, an efficient snapshot tool, and btrfs, a Copy-on-Write Linux file system focusing on fault-tolerance, repair and easy administration. With recent updates in this feature, system administrators can take snapshots of the full system, including kernel files, and roll back to a well-known state with one click if necessary.

For single-system management, SUSE Linux Enterprise Server includes YaST®, the most powerful and extensive Linux framework for installation, configuration and administration. By offering pre-selected packages for specific use cases (e.g., file server, print server and web server etc.), it will help administrators reduce errors. Moreover, YaST provides a consistent UI in both graphic and text modes, which is helpful when downtime happens.

Automated Linux server management with SUSE Manager reduces administrator effort, increases productivity and produces fewer outages. SUSE Manager helps IT professionals perform management and provisioning tasks faster and with fewer errors, which improves IT staff productivity while reducing server downtime. Administrators can also identify server performance issues earlier, reducing disruption to services and limiting business impact. Pre-loading patches to your system prior to applying them also reduces the downtime caused by patching. Another important feature is package lock. If you lock your packages, they can't be overwritten by newer or older packages. This maintains the status of mission-critical applications and protects them from unwanted changes.

SUSE Manager delivers complete lifecycle management for Linux servers that helps administrators automate the processes required to manage their data center. It eliminates manual and time-consuming tasks related to asset management, initial provisioning, patching, configuration management and redeployment. In addition, SUSE Manager provides compliance and security frameworks for reporting and management of industry and regulatory compliance standards.

What's More: Services

It's always good to have dedicated support when downtime happens. Premium Services from SUSE give you a dedicated resource, ensuring the highest level of availability and productivity. And since every organization has different needs, you can tailor our service to meet the unique requirements of your business. SUSE also offers consulting and training services for best practices and technical know-how. All these services help you adopt and manage your SUSE solution with complete confidence.

Conclusion

Server and operating systems with mature and proven features and functions are playing more and more critical roles in keeping your service available. As the leading enterprise Linux solution provider, SUSE has been helping customers to reduce downtime by further exploiting reliable hardware, enhancing service availability with clustering and minimizing human mistakes with efficient tools. More importantly, SUSE is constantly innovating to expand choices for customers. When downtime isn't an option, the simple choice is SUSE.

² Forrester Research, Inc., "The State Of Business Technology Resiliency," Q2 2014. Based on a survey of 94 global disaster recovery decision-makers and influencers.

Feature and Benefit Overview for Reducing Server Downtime

Functions or Features	Benefits	Product or Service ³
Failover clustering	Meet SLAs by including redundancy for your mission-critical workloads. Set up cluster among physical nodes or virtual guests.	SUSE Linux Enterprise High Availability Extension
IPv4, IPv6 Load-balancing	Automatically distribute stateless server workloads (e.g., web service) to achieve high availability.	SUSE Linux Enterprise High Availability Extension
Cluster test drive	Simulate and validate cluster setup before actual failover happens.	SUSE Linux Enterprise High Availability Extension
Resource Agents	No-extra-charge resource agents for popular open source and third-party applications, such as SAP, to ensure availability for your key workloads.	SUSE Linux Enterprise High Availability Extension, SUSE Linux Enterprise Server for SAP
Cluster rolling update	Ensure service uptime by updating nodes sequentially without full cluster downtime.	SUSE Linux Enterprise High Availability Extension
Live kernel patching	Install critical security patches before the next service window, without rebooting.	SUSE Linux Enterprise Live Patching
YaST and AutoYaST	Efficient single-system systems management framework with consistent and easy-to-use UI, and with multi-machine management automation capability automated systems management for multiple machines.	All SUSE Linux Enterprise products
Snapshot and rollback	Reduce human mistakes by taking snapshots of the system (including kernel files) and allow you to roll back to a well-known state.	SUSE Linux Enterprise Server, SUSE Linux Enterprise Server for System z
Reliability, availability and serviceability (RAS)	Tightly coupled with underlying hardware technologies (e.g., System z or x86_64) to ensure workload service uptime.	SUSE Linux Enterprise Server, SUSE Linux Enterprise Server for System z
Checksums for data and metadata	Higher integrity of the file system (btrfs, partially xfs), errors are detected earlier, less impact on data integrity and data availability.	SUSE Linux Enterprise Server, SUSE Linux Enterprise Server for System z
File system-level deduplication by btrfs	Deduplication helps to reduce storage space, saves costs and increases the efficiency in system maintenance.	SUSE Linux Enterprise Server, SUSE Linux Enterprise Server for System z
Geo-clustering	Bridge clusters of any distance to ensure business continuity.	Geo Clustering for SUSE Linux Enterprise High Availability Extension
Metro-clustering	Combat regional accidents by clustering with nodes up to 25km.	SUSE Linux Enterprise High Availability Extension
Automated patching	Reduce human errors by automated patch management.	SUSE Manager
Patch pre-loading	Pre-load patches to systems prior to applying them, reducing downtime in patching.	SUSE Manager
Package lock	Lock your packages to maintain the status of mission-critical applications and protect them from unwanted changes.	SUSE Manager
Premium Service engineers	Customizable engineering support to avoid downtime.	SUSE Service
Training, consulting	Technical know-how and best practices.	SUSE Service

³ Please see the table on the following page for links to additional information for each of these product/service names.

Products and Services

1. SUSE Linux Enterprise Server, www.suse.com/products/server
2. SUSE Linux Enterprise Server for System z, www.suse.com/products/systemz
3. SUSE Linux Enterprise Server for SAP, www.suse.com/products/sles-for-sap
4. SUSE Linux Enterprise High Availability Extension, www.suse.com/products/highavailability
5. Geo Clustering for SUSE Linux Enterprise High Availability Extension, www.suse.com/products/highavailability/geo-clustering
6. SUSE Linux Enterprise Live Patching, www.suse.com/products/live-patching
7. SUSE Manager, www.suse.com/products/suse-manager
8. SUSE Premium Services, www.suse.com/support/premium
9. SUSE Consulting and SUSE Training, www.suse.com/services/consulting
10. Long Term Service Pack Support, www.suse.com/products/long-term-service-pack-support



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