



WHITE PAPER

SUSE Linux Enterprise as a Mission-Critical Enterprise Server

Sponsored by: SUSE

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EXECUTIVE SUMMARY

Mission-critical computing was once the domain of large systems that offered scale and availability and came with an associated cost premium. And workloads that once were the sole domain of large systems, including enterprise resource planning (ERP), customer relationship management (CRM), and decision support, are now commonly deployed aboard x86 servers running Linux operating systems (OSs). Thanks to competitive market conditions and changing user preferences, large systems have evolved as well, and today they are available in more cost-effective configurations with attractive support and maintenance options. More importantly, large systems no longer run only proprietary operating systems. Linux has become the common denominator that encouraged and facilitated these changes.

This is not just a "hardware growing up" or a "hardware opening up" story: The emergence, evolution, and maturation of open source software – at all layers of the software stack – have helped make these transitions possible. This IDC white paper tells the story of not only open source software that has established broad credibility for producing reliable, safe, cost-effective technologies but also open source communities that have established themselves as a place where innovative ideas can be cultivated and brought to market. After Linux established itself as a successful project, the floodgates opened and open source communities ushered in a new leadership role that introduced technologies to the industry, including Xen, KVM, OpenStack, Hadoop, container technology including Docker, and a wide variety of new application development and deployment frameworks and languages.

Yet another key transition is taking place as public cloud infrastructure is being built using Linux as a key building block for what ultimately is a heavily open source-dominated solution stack. A look at most hyperscale cloud solution providers reveals that Linux is a key component being used.

IDC finds that organizations of all sizes now embrace Linux for mission-critical computing tasks, taking advantage of capabilities such as high availability, geo clustering, live patching, and full system rollbacks. One interesting example specific to large organizations is the use of SAP applications, including the popular SAP HANA in-memory solution, on a foundation such as SUSE Linux Enterprise Server. Thanks to a close working relationship forged between SUSE and SAP, which focused on creating a hardened, optimized solution for business environments, the two companies now offer a prescriptive deployment architecture, which results in good deployment experiences, successful implementations, and early returns on investments because of the relatively turnkey nature of the product integration.

Linux is seen as a well-regarded choice for mission-critical workloads, whether the workload is a migration from Unix environments, a new deployment, or an expansion of an existing Linux investment.

IN THIS WHITE PAPER

This IDC white paper reviews how x86 servers running the Linux operating system have evolved into mission-critical solutions that meet the demanding application needs of enterprise customers. The paper focuses on helping IT professionals gain a better understanding of the use of and value delivered by SUSE Linux Enterprise as part of a mission-critical application deployment. A user case study that discusses how Linux is being leveraged as an enterprise platform is also included.

SITUATION OVERVIEW

Mission-Critical Workloads Remain Essential

The industry has shifted its view on the concept of "mission critical" workloads. A mission-critical workload once was intrinsically a deployment on a large server with a long history of reliability, scalability, and stability, leading to the concept of a mission-critical server. This notion has extended to include solutions based on an x86 platform, an environment that may use multiple software layers to establish or extend the reliability and scalability of the combined software/hardware solution.

Today most enterprise customers use virtualization software on their mission-critical x86 servers, as they have on their large systems for many years. On x86 servers in particular, virtualization helps extend the scalability and reliability of all the applications in use. As scalability needs increase, virtualization facilitates the easy relocation of other workloads via live migration to alternate host systems. Or should a given system not have enough capacity to support the scale needed by the primary critical application, it becomes practical to migrate that application to a larger server with more basic capacity.

Understanding the Larger Linux Solution Spectrum

Linux on IBM Mainframes

IBM stunned the industry when it revealed an effort to port Linux to the z Systems in the early 2000s. Initially seen as something of a curiosity, Linux has grown to become a key component of IBM's z strategy, and Linux support is offered either natively or through IFL options on virtually every product in IBM's high-end portfolio. There are Linux-only machines such as those in the newly announced LinuxONE family, which is optimized for Linux workloads and offers SUSE Linux Enterprise Server as its primary distribution. IBM's overall strategy for its high-end Linux servers is focused on a top-to-bottom open source strategy and has embraced all the key technologies one would expect, including KVM, OpenStack, Docker, MongoDB, MariaDB, Chef, Puppet, and Salt, as well as a long list of application solutions including Go, Java, PHP, Python, Node.js, and Ruby.

Linux is a key element of IBM's strategy for high-end servers. The reality is that few new applications are deployed today on z/OS. New workloads that are deployed on z Systems are almost universally deployed on a Linux foundation. If Linux needed an endorsement as a high-end solution, IBM has given it just that with the z Systems and LinuxONE platforms.

Traditional Midrange Servers

Once again, IBM has chosen Linux as the foundation for its RISC platform. With the POWER8 technology wave, the company has introduced little endian byte ordering, which has a major impact on Linux application compatibility between x86 and POWER architectures. As with the z Systems initiatives, IBM has come up with a long list of open source products that support POWER8 servers, including the open source virtualization engine PowerKVM. SUSE is a key partner of IBM in supporting customers that wish to deploy workloads where absolute scalability and data throughput are prerequisites.

x86 Servers

At the volume end of the business, x86 servers account for the vast majority of the unit volume being deployed. According to IDC's Worldwide Quarterly Server Tracker, x86 servers account for 99% of all servers shipped and close to 100% of the servers shipped that primarily run a Linux operating system. Linux has grown in market share and currently accounts for over 29% of commercial (paid) server operating systems in use. When combined with nonpaid Linux versions, Linux collectively accounts for over 39% of server operating systems in use as the primary OS on servers. With growth in public cloud infrastructure (which heavily leverages Linux and other open source software products), and in the future, as a base infrastructure layer for Internet of Things (IoT) intelligent gateways (and for the "things" as well), the Linux server operating environment is likely to continue to increase in share.

In the past, it was challenging for x86 servers to establish credibility as a mission-critical solution. Vendors of alternative products that support mission-critical deployments have marketed aggressively against x86 servers and have worked to raise concerns about the reliability and scalability of x86 servers. In response, Intel and its OEM partner community have invested significantly to boost the raw capabilities of x86 servers. For example, in the most recent wave of Xeon processor releases, Intel focused on boosting cache and memory capability, both of which extend the ability to support large databases and in-memory database applications. The longer-term focus over the past decade has been to continuously improve the x86 processor's ability to run large transactional workloads, so related technologies such as I/O bandwidth and core speed increases accompany specifics such as memory improvements.

Intel's OEM partners have also built a robust set of platform form factors suitable for service providers and hyperscale datacenters (density-optimized form factors), enterprise datacenters (blades and racks), and distributed offices and small businesses (tower form factors). These same OEM partners have worked with distribution providers such as SUSE to qualify and cross-certify their hardware for SUSE Linux Enterprise Server.

In addition, SUSE has a long history of working with key virtualization software providers including VMware and Microsoft. SUSE's goal has been to provide a Linux distribution that is able to run open source hypervisors, namely Xen and KVM (included with the Linux operating system distribution), balanced by a consistent effort to also optimize the SUSE distribution for deployment on independent hypervisors from VMware or Microsoft should a customer have an existing commitment to one or both of those technologies.

The Value of Availability Extensions

SUSE has invested in extensions to the Linux operating system specifically to expand the resilience of a SUSE Linux solution in the context of single-system environments, multiple-system environments, and geographically dispersed deployments. These extensions generally are independent of virtualization solutions and can include technologies such as high-availability extensions, clustering software, and live patching solutions that allow for updates to be made without a reboot. They also add the ability to do a full system rollback should a problem occur.

Live Patching

SUSE offers a kernel live patching solution called SUSE Linux Enterprise Live Patching. This product is based on an open source project and makes it possible for customers to use a zero-interruption live patching process that allows software fixes to be applied to a live kernel – while it is running – and updated code to be grafted in. This ensures that applications that cannot be easily halted, such as databases, online transaction processing engines, and other critical and long-running applications, can be updated for security or compliance reasons without needing a stop or reboot.

High Availability

For some customers, the key requirement may not be true nonstop availability; rather, it may be to have resiliency that can quickly restore services in the event of a hardware, software, or application failure. In a virtualized environment, solutions exist to script an automatic failover and make it possible to restart an application to another server in an existing datacenter or to a remote datacenter should an outage occur. In addition, the SUSE Linux Enterprise High Availability Extension product enables customers to configure an environment that can fail over to other nodes in a cluster should there be an outage on the primary node.

SUSE Linux Enterprise High Availability Extension 12 is offered as an n-node local and geo-capable cluster solution built from open source software and uses the modern OpenAIS (Application Interface Specification) for cluster messaging and membership. SUSE Linux Enterprise High Availability Extension allows for greater continuity and uptime, which leads to better and more consistent data integrity. The product enables customers to configure a multimode cluster configuration, with agents offered to monitor the health of a list of common open source products including KVM, Xen, Apache, and Tomcat and agents for common third-party applications such as VMware, SAP application instances and databases, Oracle, IBM DB2, IBM WebSphere, and IBM Informix.

Geo Clustering

SUSE expanded its High Availability Extension technology to function in a geographically dispersed environment. This capability allows customers to configure failover alternatives at regional datacenters or even into cloud providers, such as Amazon Web Services. Geo clustering resources are intended for scenarios where a widespread outage, such as a power grid failure due to a natural disaster, makes regional datacenters unavailable. In this case, SUSE Linux Enterprise High Availability Extension 12 could fail over to another cluster located in a different geographic area. Of particular note is that the failover can be configured to take place automatically, or manually, depending upon industry regulatory compliance or internal rules that may make automatic failover problematic.

Full System Rollback

In the event an installation needs to be restored to an earlier snapshot due to a failed application upgrade, or to remove patches that proved problematic, SUSE Linux offers a full system rollback option through the open source SUSE solution "Snapper." The Snapper tool takes advantage of the integral file system, btrfs, to create system images at a specific moment in time and use that snapshot as the basis for a restoration that would reverse a change that proved problematic in some way. For most customers, the use of Snapper would be beneficial prior to major operating system or application portfolio upgrades. This product is complementary to SUSE's other availability solutions. For many applications, a full rollback would become necessary only after a substantial installation or operational problem.

FUTURE OUTLOOK

The Power of the Larger Open Source Ecosystem

Linux has established itself as a key solution for the broader industry. Although commercial products started to grow quickly only in the early 2000s, today Linux is widely seen as a key component of current solutions and is even better positioned for future cloud-based deployments. Indeed, most hyperscale cloud solution providers have settled on Linux as one of the key components of their software stack. This is partly because of the open source nature of Linux, but it is more related to the larger open source ecosystem that surrounds Linux.

That larger ecosystem includes base infrastructure layers such as KVM and Xen, which are lowest-level virtualization solutions that power a modern cloud environment. Above the hypervisor, OpenStack has emerged as a key interface layer that helps organize and orchestrate the compute layer. Because OpenStack includes projects associated with storage (Swift, Cinder), networking (Neutron), and management/orchestration (Heat), this technology becomes a central coordinating layer for open source-based private cloud deployments. Most Linux distributions, including SUSE's distribution, include commercially packaged and supported implementations of OpenStack, making adoption easier and safer for commercial entities.

Beyond OpenStack, numerous other open source projects tend to have close integration with the Linux operating system. Examples of open source projects include OpenDaylight (designed to help drive software-defined networking); Ceph (object, block, file storage); database projects including Hadoop, MariaDB, and PostgreSQL; and application container and deployment frameworks including Docker, Rocket, Node.js, Python, Ruby, and Cloud Foundry. The takeaway is that industry development has converged around Linux as a foundation layer. Even Microsoft has begun to take its lead from the open source community and has embraced the runtime application frameworks that are used in the Linux world. Microsoft even embraced Docker and will support Docker Containers in the next release of Windows.

Ultimately, IDC sees Linux as a key component of next-generation deployments, and as the industry moves increasingly to a cloud-based deployment model, we expect to see Linux use grow.

CHALLENGES/OPPORTUNITIES

Supporting mission-critical application workloads using a SUSE Linux Enterprise platform offers customers broad opportunity aboard multiple hardware architectures. Of course, there are some challenges that must be overcome.

Challenges

- **Outdated perceptions.** Most customers have a long history of using x86 servers, including negative experiences with x86 and Windows in the 1990s thanks to Windows NT. They also have negative impressions of complexity and high costs associated with Unix servers and mainframe platforms. Today's dominant server platforms have largely addressed the respective issues, giving customers the ability to choose the platform with the right balance of cost (acquisition, maintenance and support), reliability, performance, and scalability based on the requirements for the workload and how critical it is to business operations.
- **Capturing and/or moving existing applications.** While there has been a broad migration to Linux x86 servers from Unix/RISC, as well as a widespread endorsement to use Linux on IBM z Systems for modern applications, there may still be some resistance to moving the most critical applications to Linux on x86. The less critical, easier-to-move applications migrated to Linux on x86 a long time ago, and what is left to migrate today is a smaller pool of large, scalable, and critically important applications. In some cases, the right move is to migrate those applications to Linux on z Systems or OpenPOWER systems.

Opportunities

- **Benefits from standardization and compatibility.** Linux has become a de facto standard in the industry, and nearly all industrial-strength cloud infrastructure that has been built runs on Linux. Linux is available aboard virtually every major cloud architecture (excluding Microsoft Azure) on the market today, which gives customers considerable flexibility with "rightsizing" application workloads and the infrastructure on which those workloads are deployed. The use of Linux also helps position customers for a future move – if and when they are ready – to public cloud infrastructure.
- **Preparing for cloud computing.** Using Linux on a customer's preferred hardware platform effectively "future proofs" that investment. Virtually all modern application software, including next-generation application frameworks and languages, cloud system software, orchestration software, container software, and anything else that becomes critical, will likely be available on Linux.
- **Value of modernization.** High-value, mission-critical installations benefit from a modernization/migration effort because it ensures that they are relocated onto modern hardware and modern infrastructure software, making maintenance easier and security better thanks to the use of current infrastructure software.

CONCLUSION

Executive Advice

Mission-critical computing was once the domain of large systems that offered scale and availability and came with an associated cost premium. Use of x86 servers with Linux is increasing, and moving to this infrastructure positions customers for future deployment options to emerging solutions, including cloud and IaaS.

Linux on x86 has become a leadership technology, with modern open source development of new and emerging projects such as OpenStack, container technology including Docker, and a wide variety of new application development and deployment frameworks and languages. Public cloud infrastructure is largely being built on a Linux foundation today.

IDC finds that organizations of all sizes now embrace Linux for mission-critical computing tasks. The case study that follows provides one such example. Simply stated, Linux is a well-regarded choice for mission-critical workloads, whether the workload is a migration from Unix environments, a net-new deployment, or an expansion of an existing Linux investment.

CASE STUDY

Leveraging Linux for Standardizing Application Delivery

Service providers know a thing or two about the software they support. Such is the case for Deutsche Telekom subsidiary T-Systems International GmbH, which is an advocate for using Linux as part of its critical infrastructure in its cloud hosting services. T-Systems is a sizable entity, with 47,800 employees staffing operations in 20 countries and global delivery capability. T-Systems reported revenue of €8.6 billion from corporate customer operations in 2014.

As a service provider, T-Systems supports a number of related, but unique business operations. The company provides hosting services, outsourcing services for systems maintenance and application

development, and private, hybrid, and public cloud services. Among other things, T-Systems offers software-as-a-service (SaaS) solutions and hosts other companies' applications as part of the SaaS solutions portfolio. The company also offers infrastructure-as-a-service (IaaS) and platform-as-a-service (PaaS) solutions.

Not surprisingly, the company must have a wide variety of skills to support existing customer environments. When hosting customer environments, T-Systems has little say over the infrastructure software in use and must support customers' operating systems (AIX, Solaris, Windows, and Linux) along with customers' application workloads. But when it comes to T-Systems' own Dynamic SAP offering, T-Systems has made a commitment to SUSE Linux Enterprise Server.

When there is flexibility on the part of a customer, T-Systems will help with a migration to standard infrastructure, lowering the operational cost for the customer and for T-Systems. For instance, if an SAP customer contracts with T-Systems to outsource its ERP applications, the T-Systems team will encourage that customer to bring its data to the T-Systems environment but to move to an SAP implementation on SUSE Linux Enterprise Server, T-Systems' standard software stack.

T-Systems' Infrastructure

The infrastructure services team focuses on delivering PaaS and IaaS products and supports approximately 84,000 instances hosted on 37,000 physical servers. Of the 84,000 instances, about one-third are Windows, 10% are commercial Unix versions (primarily AIX and Solaris but also some HP-UX), and about 20% are Linux servers. The other 37% of the servers are described as "ESX servers," which in turn are supporting Windows and Linux operating systems instances.

"When we think about how to invest our money, we try to invest in platforms that we can utilize. We want to get away from small islands, get to large platforms, and offer as much as we can in a common base," explains Andreas Berger, Head of Global Platform Engineering at T-Systems.

T-Systems created an architecture called the Dynamic Cloud Platform (DCP), which it uses as the foundation for a variety of services delivered to corporate customers. DCP allows T-Systems to use the same storage and compute infrastructure and software investments for multiple customers at a lower operational cost. "We invested a lot into DCP so we can offer different shades of customer-facing business," Berger adds.

DCP is built on Cisco network technology and Cisco UCS x86 servers and primarily leverages virtualization technology from VMware, although there is also some Microsoft Hyper-V in use. In addition, in some cases, the hypervisor choice may be something different, as selected by a client. Out of this common foundation, the company can support a variety of disparate workload types.

Berger says that T-Systems developed an ecosystem on top of DCP called Dynamic Computing Services (DCS), which is the company's preferred software stack for commercial workloads. It includes a highly standardized way of dividing the OS from the application and is based on read-only OS images. T-Systems uses SUSE Linux Enterprise Server as the OS of choice on its DCS offering. The company is running Red Hat Enterprise Linux to some extent, but it is not running community-supported Linux. "We are trying to keep the zoo of colorful animals as simple as possible," quips Berger.

Today T-Systems has about 7,000 server instances of SUSE Linux Enterprise Server in use and many instances of Red Hat Enterprise Linux servers in use. Berger notes that the company is in the process of shifting the Red Hat products to Oracle Enterprise Linux support.

New Applications

Not surprisingly, T-Systems sees the mix of new applications moving to favor Linux as the deployment platform. "If you look at [commercial Unix instances], you recognize a lot of them are running legacy applications – applications that are 10 years, 15 years, or 20 years old. When it comes to new application development, we see it trend more toward Linux," says Berger.

While T-Systems has not had bad experiences with other commercial Linux distributions, the company has found the SAP support as a positive for SUSE Linux Enterprise Server. "The integration of SUSE Linux Enterprise Server with SAP is pretty good. It scales in factors that we need. There are some features in the recent SUSE Linux Enterprise Server releases that are optimized for SAP. These are the things we are using," explains Berger. "My colleagues have [found] very good experiences with SUSE Linux Enterprise Server. That is why we rely on SUSE Linux rather than going with another distribution. We are running 55 million SAPS [SAP Application Performance Standards] on about 3,500 SLES machines."

Berger believes that Linux has matured to the point of being very consumable for the organization. "Sometimes it's hard to bring an application into the DCS ecosystem, but once it is there, it runs very stable, with a high degree of optimization. A lot of the things we were asking for have been incorporated into SUSE," he says. Live kernel patching, container technology, and the ability to separate the application from the operating system were features Berger's team wanted and now has. "Looking forward, the OpenStack integration will play a large role in our space," notes Berger.

Advice for Others

According to Berger, the goal is to find a standardized way to install middleware components such as WebSphere, Oracle, Apache, and other products. He says, "What we have seen is the initial integration of new applications into our DCS – this is really hard work. So the first time installing an Apache or an Oracle DB, to really bring it into a fashion that it does not write files somewhere in the OS space but to separate it into different file systems, this was quite hard work; however, we take it as an opportunity to leverage application container techniques in the future."

Given T-Systems' experience in bringing customers' applications into a standardized environment, Berger says that the best plan of attack for customers is simple: "Don't try it on your own. We will host the applications for you."

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