

# Workloads for SUSE® Linux Enterprise Server for System z

# Why SUSE® Linux Enterprise Server for System z?

**Baldor Electric has replaced more than 100 physical machines with one System z server and reduced its floor space from 6,000 square feet to 900 square feet. The company runs manufacturing, sales, distribution, HR, financials, business warehousing and several other workloads on SUSE Linux Enterprise Server for System z.**

Many customers are migrating their mission-critical workloads to SUSE® Linux Enterprise Server on System z\* servers to reduce data center costs. An important aspect of this server consolidation process is determining which workloads are appropriate to run on SUSE Linux Enterprise Server for System z. Server consolidation, enabled by virtualization software technology, involves moving workloads from several physical servers onto a single physical server that hosts multiple virtual machines.

In this paper, we focus on the types of workloads that are good candidates to migrate to this platform. We will also look at some of the important workloads, such as Oracle, IBM middleware and SAP, which are successfully running on SUSE Linux Enterprise Server for System z.

## Novell and IBM Develop Linux for System z

Novell began working with IBM in 2000 to deploy a Linux\* distribution on mainframes (System z servers). During this timeframe, IBM developed the Integrated Facility for Linux (IFL) to make running Linux virtual machines on System z servers economical. System z servers have many inherent capabilities that make consolidation appealing. These include rock-solid reliability, scalability, security and high utilization rates.

Today, a large percentage of enterprise workloads, such as business intelligence, data warehousing and daily business transactions, reside on System z servers. System z servers can be found in every industry, including

financial institutions, insurance companies and hospitals. In traditional distributed environments, front-end application servers often access enterprise data stored on a System z server over a network. When these front-end applications are migrated to the System z server, they experience greater input/output (I/O) rates between the application and back-end data because the applications and the data are on the same machine. System z servers can run multiple workloads of various types; they provide highly reliable and secure environments; and they have the ability to run at high utilization rates over long periods of time.

The newer IBM\* System z servers allow a single z/VM operating system instance to scale up to 32 processors. You can allocate more CPUs, memory and I/O capacity to a group of Linux virtual machines, allowing you to add more Linux instances to meet a wide range of business demands. System z servers typically run with utilization rates in the 70 to 80 percent range, and customers such as Nationwide Insurance say that it is not uncommon for a System z server to run for several hours with a 95 percent or higher utilization rate.

Most users deploy SUSE Linux Enterprise Server for System z on an existing System z server with extra capacity, making server consolidation on a System z server very cost-effective. In other cases, experienced System z users purchase dedicated System z servers on which they run only Linux workloads. Nationwide and other Novell and IBM customers have purchased Linux-only System z servers for server consolidation uses.

## Why Run Workloads on SUSE Linux Enterprise Server for System z?

Customers who are considering moving workloads to SUSE Linux Enterprise Server for System z should take into consideration the following benefits of System z:

### **Low Total Cost of Ownership (TCO)**

In today's enterprise computing environment, the cost of ownership includes the cost of servers; infrastructure components such as cables, racks and switches; software licenses; floor space; electricity for power and cooling; and system administration. In many data centers, server sprawl is increasing operational costs and administrative complexity. System z servers generally require approximately 20 percent of the floor space and power of equivalent capacity x86 servers. Nationwide Insurance<sup>1</sup>, a Novell® customer running SUSE Linux Enterprise Server for System z, has forecast savings of US\$15 million over three years in floor space, cooling and hardware costs.

IBM lowered the cost of using System z servers to run SUSE Linux Enterprise Server by introducing the IFL specialty processor. IFLs allow you to purchase a single software license and share it across many Linux virtual machines. You are charged only for a single processor license, resulting in potentially huge software license savings.

### **Reduced Data Center Complexity**

Data centers typically have multiple types of operating systems and architectures in use at any given time, and these systems are typically acquired from many different vendors. This generally means that several hardware and software licensing agreements must be maintained. To maintain these various

software and hardware systems, you must hire system administrators with varying backgrounds. These issues lead to data center complexity. But with SUSE Linux Enterprise Server for System z, you can consolidate many workloads onto a single System z server, reducing the number of hardware vendors and software licenses that you must maintain. Consolidation greatly simplifies many tasks such as backing up, updating and patching systems. In addition, consolidating workloads makes software license management simpler and more cost-effective.

### **Increased Flexibility**

Data center directors often have to respond to changing business demands and changes in market requirements. To maintain a competitive edge, they must make these changes quickly. One common example of responding to business plans is provisioning new servers with new workloads. The time it takes to provision new workloads is often the leading issue in maintaining business agility and flexibility.

Using z/VM, customers can provision new virtual Linux servers in minutes with the security and reliability inherent in System z servers. The z/VM hypervisor pools, emulates, and distributes system resources so that Linux virtual machines can all share the same resources. z/VM provides sophisticated workload and resource management capabilities that allow a wide variety of workloads to be scheduled and run without user intervention.

### **Reduced Downtime**

Your business suffers when workloads are not consistently available, which means your data center must recover quickly from all downtime, whether planned or unplanned. However, if your business can't recover quickly from downtime, you'll potentially face losses from tens of thousands to millions of dollars per

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<sup>1</sup> Case Study: Nationwide Uses Linux and High-Power Virtualization for Web Presence, Gartner, June 2007, G00148213.

System z servers have many inherent capabilities that make consolidation appealing. These include rock-solid reliability, scalability, security and high utilization rates.

- *Disaster recovery characteristics*
- *Security*
- *Server consolidation resulting in co-location of applications and reduction in network traffic*
- *Data exchange using shared memory or fast interconnects such as HiperSockets*

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2 *System z9 Linux solutions, Len Santalucia, IBM, [www.sinenomine.net/system/files/zLinuxMarketStatsAndAppsBestFit.pdf](http://www.sinenomine.net/system/files/zLinuxMarketStatsAndAppsBestFit.pdf)*

hour. No other computing platform has integrated availability-enhancing features throughout its architecture as thoroughly as IBM System z. System z servers are designed with redundancy in mind. If a failure occurs, the built-in redundancy capabilities shift the work from the failing component to a functioning component, preventing workloads and services from being interrupted. Failed components may be removed and replaced while workloads are active and continue to run—eliminating downtime.

### Which Workloads Should Run on SUSE Linux Enterprise Server for System z?

If you are contemplating migrating workloads to a SUSE Linux Enterprise Server for System z virtual environment, you need to be aware that not all workloads run better on System z servers. For example, workloads with high CPU requirements generally run better on x86 or Power architectures. Below we provide some guidance on which workloads run well on SUSE Linux Enterprise Server for System z. The three workload categories are:<sup>2</sup>

1. Best fit applications
2. Good fit applications
3. Challenging applications

#### **Best Fit Applications**

Best fit applications are those that leverage the classic strengths of System z servers:

- *High availability*
- *High I/O bandwidth capabilities*
- *Capability to run diverse sets of workloads concurrently*

Applications that interface directly with System z server applications are very good candidates to move to SUSE Linux Enterprise Server for System z—especially if the System z server applications and the databases that they communicate with are on the same System z server the external applications are being migrated to. The benefits are improved throughput, higher performance, network simplification and improved security.

Examples of best fit applications include:

- *WebSphere\* MQSeries*
- *Oracle\* Database 10g*
- *SAP*
- *IBI WebFOCUS*
- *DB2\* Connect*
- *CICS Transaction Gateway*
- *IMS Connect for Java\**
- *WebLogic/WebSphere and Java applications development*
- *Applications requiring top end disaster recovery*
- *Domino\**
- *Backup solutions such as Tivoli\* Storage Manager*

#### **Good Fit Applications**

What makes a good fit application? A good fit application is an application that is optimized for SUSE Linux Enterprise Server for System z, but also runs well on other architectures, such as x86 and POWER\*. For this category of applications, there are several variables that should be evaluated, in addition to your business requirements, to determine which architecture(s) are best for these applications:

- TCO
- Application availability on Linux
- Politics within the organization

Examples of good fit applications include:

- DB2
- Informix
- WebSphere Application Server
- Apache Web Server
- Samba
- Network infrastructure, FTP, NFS, file and print serving, etc.
- E-mail solutions

### Challenging Applications

Challenging applications are those that run on Linux for System z, but present business or technical concerns that may prompt businesses to examine the workload further and seriously consider another architectural solution. This type of application includes:

- *ISV and IBM applications that have not yet been ported to SUSE Linux Enterprise Server for System z. When the application is not available on SUSE Linux Enterprise Server for System z and the ISV has indicated that there is little interest in porting it to System z, it is unlikely that the application is a good candidate for SUSE Linux Enterprise Server for System z.*
- *Applications that, by design, run at very high sustained utilization (greater than 95 percent). These applications are best run on distributed systems that optimize throughput.*
- *Standalone single applications with no requirements for improving server utilization. System z is not a good target if you have only a few standalone applications with no plans to increase the number of standalone servers running the applications.*
- *Applications that are too internally sensitive to move. The organizational structure of the company and IT department, along with resistance to migration, may be too much to overcome.*

IBM's work with its RACE (Rehosting Applications from Competitive Environments), an internal tool that IBM uses in sales engagements, provides additional information with respect to which workloads run best on SUSE Linux Enterprise Server for System z.<sup>3</sup> RACE partitions workloads into 10 categories that range from data intensive to compute intensive. These categories were created through hundreds of hours of working with customers to determine whether or not to consolidate applications onto Linux for System z servers or onto another architecture. Establishing the categories of applications that might be involved in the server consolidation process is extremely important for determining which alternative produces the lowest TCO while meeting customer business needs.

The 10 application categories utilized by RACE are given below. The workloads are ordered from best to worst for running on SUSE Linux Enterprise Server for System z:

1. Data intensive—Large working set and/or high I/O content applications
2. I/O bound—High I/O content applications
3. Mixed low—Multiple, data intensive applications or skewed OLTP, MQ applications
4. Mixed high—Multiple, CPU-intensive simple applications
5. Database—Oracle DBMS or dynamic HTTP server
6. Java light—Data-intensive Java applications
7. Java heavy—CPU-intensive Java applications
8. Skewless OLTP—Simple and predictable transaction processing
9. Protocol serving—Static HTTP, firewall, etc.
10. CPU intensive—High use of the CPU to do numerical calculations

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<sup>3</sup> *The RACE tool provides a relatively quick and easy way to produce a comprehensive financial analysis around various alternatives for server consolidation such as the use of Linux for System z running under the z/VM System z server hypervisor or VMware on x86.*

Nationwide Insurance, a Novell customer running SUSE Linux Enterprise Server for System z, has forecast savings of US\$15 million over three years in floor space, cooling and hardware costs.

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- 4 [www.novell.com/partners/ibm/mainframe/success.html](http://www.novell.com/partners/ibm/mainframe/success.html)  
5 [www.iflexsolutions.com/iflex/solutions/flexcubelandingpage.aspx](http://www.iflexsolutions.com/iflex/solutions/flexcubelandingpage.aspx)

## System z10 Server and Categorizing Workloads

Traditionally, business-intensive applications have performed very well on System z, while CPU-intensive applications have not. The new IBM System z10 server, however, is a better platform for running CPU-intensive applications than previous System z servers. As a result, this may affect the categorization of workloads presented earlier.

The System z10 server is enabling workloads that, in the past, have not been considered good fits for System z servers. The z10 has quad-core, 4.4 GHz CPUs; SMP with up to 64 CPUs; up to 1.5 TB of RAM; InfiniBand interconnect; up to 48 network ports with 10 GB Ethernet; NPIV (N\_Port ID Virtualization) support for SAN; and up to 60 LPARs. For example, the z10 may enable workloads with CPU-intensive processing, large RAM requirements, external InfiniBand connectivity, large 10 GB Ethernet network connectivity, and virtualized SAN with NPIV.

The new CPUs contain integrated accelerators for decimal point computation, cryptography and data compression. The z10 has 70 percent more capacity and three times the available memory of the largest System z9 server. It permits customers to run SAP on Linux together with DB2 on z/OS on one System z server.

The z10 gives customers the opportunity to:

- Consolidate many Linux file/print, infrastructure and Web servers on one platform
- Consolidate many Java Web applications servers on one platform
- Place SAP\* servers on the System z server
- Place high-performance finance applications on the System z server
- Secure network data traffic without additional load for the CPUs

## The Unique Value of SUSE Linux Enterprise Server for System z

SUSE Linux Enterprise Server for System z is used to run some of today's most heavily used workloads:

### Oracle

Oracle licensing costs are much lower on SUSE Linux Enterprise Server for System z than on other platforms. Oracle is licensed by processor count, and only one Oracle license is required per IFL. This license can be shared among many SUSE Linux Enterprise Server for System z virtual machines.

Several customers are using both Oracle 9i and Oracle 10g on SUSE Linux Enterprise Server for System z. State, local and federal governments, utilities, telephone companies and others are running Oracle on SUSE Linux Enterprise Server for System z. For example, Idaho Power<sup>4</sup> has a z900 server with two IFLs. The company moved from HP\* systems to SUSE Linux Enterprise Server for System z. The break-even point for Idaho Power was two Oracle databases moved from Intel servers. Idaho Power currently runs 30 SUSE Linux Enterprise Server for System z virtual machines. It runs a variety of mission-critical applications on SUSE Linux Enterprise Server for System z including payroll, tax and legal applications, as well as the databases for its outage management system.

I-flex's FLEXCUBE<sup>5</sup> for core banking runs on SUSE Linux Enterprise for System z with the Oracle infrastructure stack, including Oracle Database and Oracle Application Server. This solution provides banks with new flexibility for core business applications running on SUSE Linux Enterprise Server for System z.

## IBM Middleware

One of the primary applications for SUSE Linux Enterprise Server for System z is the IBM WebSphere family of products. This family includes WebSphere Application Server, WebSphere Network Deployment, WebSphere Portal and WebSphere MQ. IBM has hundreds of other middleware products that run on SUSE Linux Enterprise Server for System z including products from the DB2, Lotus\*, Rational\* and Tivoli families.

EBS Building Society<sup>6</sup> in Dublin, Ireland runs IBM WebSphere on SUSE Linux Enterprise Server for System z to manage communications between customer-facing Web applications (also running on SUSE Linux Enterprise Server for System z) and the back-end CICS transactional systems. The high-speed virtual Ethernet facility of System z enables much faster communications than could be achieved between separate physical systems.

## SAP

Novell has worked with SAP to create an optimized version of SUSE Linux Enterprise Server for System z that brings even more value to SAP and its customers. Customers benefit from reduced complexity of application deployments and lower costs.

Baldor Electric's centralized data center runs SAP Business Suite for all its mission-critical operations on SUSE Linux Enterprise Server for System z using z/VM for virtualization. SUSE Linux Enterprise Server for System z gives Baldor Electric high availability for all of its mission-critical SAP systems.

Baldor Electric<sup>7</sup> also uses SUSE Linux Enterprise Server for System z with Priority Support for SAP so that it can funnel all support requests through Novell. Priority Support

for SAP gives Baldor Electric a single point of contact for its support issues. The company says that SAP runs much better on Linux than any other platform.

Baldor Electric has replaced more than 100 physical machines with one System z server and reduced its floor space from 6,000 square feet to 900 square feet. The company evaluated the competition and selected SUSE Linux Enterprise Server for System z based on the strong partnership between Novell and IBM. Baldor Electric runs manufacturing, sales, distribution, HR, financials, business warehousing and several other workloads on SUSE Linux Enterprise Server for System z.

## Conclusions

SUSE Linux Enterprise Server for System z running in a virtualized environment under z/VM provides a number of benefits for users who are considering server consolidation to reduce costs and increase business agility. An important issue to consider is what types of workloads run best on Linux for System z.

Hundreds of applications, or workloads, are certified for SUSE Linux Enterprise Server for System z. However, by looking at the workload characteristics, you can determine which workloads can be consolidated to run effectively in virtual machines under z/VM in an IFL. Over the past several years, we have found that data-intensive workloads with high I/O are at one end of the continuum. CPU-intensive workloads are at the other end with high I/O workloads being better fit workloads for SUSE Linux Enterprise Server for System z.

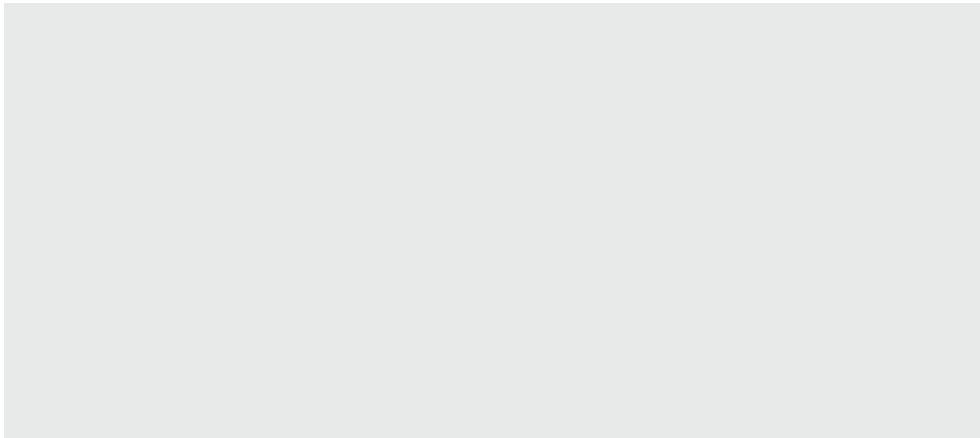
Applications such as WebSphere MQSeries, SAP, Oracle 10g and DB2 Connect are very good fits for SUSE Linux Enterprise Server for

## Why run workloads on SUSE Linux Enterprise Server for System z?

- Low TCO
- Reduced data center complexity
- Increased flexibility
- Reduced downtime

6 [www.novell.com/partners/ibm/mainframe/success.html](http://www.novell.com/partners/ibm/mainframe/success.html)

7 [www-01.ibm.com/software/success/cssdb.nsf/bycustomerVW?OpenView&RestrictToCategory=gjcss67sap\\_BaldorElectricCompany&cty=en\\_us](http://www-01.ibm.com/software/success/cssdb.nsf/bycustomerVW?OpenView&RestrictToCategory=gjcss67sap_BaldorElectricCompany&cty=en_us)



[www.novell.com](http://www.novell.com)

System z. Others that are good fits include DB2, Apache and Samba. Applications that run at very high sustained utilization rates or have very high CPU requirements are not always good fits for SUSE Linux Enterprise Server for System z and are best run on

distributed systems. The advent of the z10 server, however, has made SUSE Linux Enterprise Server for System z a much better platform for running CPU-intensive applications.



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