# Linux on IBM System z

*Ten years of Enterprise Linux on System z: a simple idea that changed the world*

## Highlights

- Single server simplicity—easy to scale, easy to manage, easy to do more with less

- Highly flexible—outstanding virtualization for advanced resource utilization and dynamic resource allocation

- Efficient workload optimization— superior levels of systems management

- Unmatched qualities of service— rock-solid security and reliability

- An optimized infrastructure that can help reduce costs

## Ten years of Linux on System z

For the last decade, clients around the world have benefited from Linux® on IBM System z®. What officially began in 2000, when IBM announced its investments and support for the Linux environment, has evolved with sustained innovation, continuous refinement and proven technologies, resulting in today's unique advantages of the Linux on IBM System z environment.

Cost pressures, underutilized business and IT assets, increasing operational complexity, and continuous service availability are the forces that continue to drive the need for IT optimization over that period.

Addressing these needs, Linux on System z is an excellent solution. It has gained strong market acceptance with its ability to drive down costs and improve business agility, as indicated by the 21 percent[1] growth of the installed Linux capacity in the last year.

Linux on IBM System z offers a uniquely powerful and comprehensive solution for virtualizing, consolidating, managing and sharing resources with optimum efficiency. The result is an IT infrastructure with advanced scalability, integration capabilities, and rock-solid reliability, which improves virtual server availability, energy efficiency and helps to control costs.

## The better approach

While Linux is Linux, Linux on System z can provide significant advantages over other Linux platforms, which can make a difference for your business.

The integration of people and enterprises around the globe is transforming the way the world works today. The required changes present tremendous challenges for IT organizations, especially with the proliferation of real and virtual servers on x86 or UNIX® systems. These server platforms can make it difficult to fully utilize and effectively manage the IT assets.

Linux on System z is based on the common Linux kernel, giving it the same look and feel as Linux running on any other platform, but the unique combination of Linux, IBM System z server technology, and z/VM® virtualization software provides a uniquely powerful solution that combines the best of all.

IBM System z10™ servers, with their advanced combination of reliability, availability, serviceability, security, scalability, and virtualization, delivers the technology that can help define the infrastructure for the future. With the increased capacity and the number of available processors per server, combined with z/VM virtualization technology, the z10 server virtualization capabilities can support more virtual servers than any of its competitors, hundreds to thousands of virtual servers in a single footprint.

The platform selection for Linux is important – *Linux running on IBM System z offers a better approach*.

## Infrastructure simplification

The Linux on IBM System z solution delivers outstanding value for enterprise infrastructure simplification. The solution empowers IT organizations by delivering advanced virtualization, provisioning and automation capabilities, enabling them to rapidly adjust capacity to their business needs. It offers a comprehensive solution for managing resources efficiently to fulfill environmental responsibilities and achieve sustainability.

## Single server simplicity

Linux running on a single System z10 server together with z/VM virtualization software can do the job of many distributed servers scattered across the enterprise. That means that a single System z server can replace hundreds or even thousands of smaller servers.

As well, IBM System z servers can run at utilization rates as high as 100 percent for extended periods of time.

Furthermore, a single IBM System z server doesn't require external networking to communicate between the virtual Linux servers. All of the Linux servers are in a single box with huge, internal I/O connections.

Even in a single footprint, the System z server is designed to avoid or recover from failures to minimize business disruptions. High availability is realized through component reliability, redundancy, and design features that assist in providing fault avoidance and tolerance, as well as permitting concurrent maintenance and repair.

A major proof point for the "single server simplicity" is IBM's own Enterprise Computing Model transition, also known as Project "Big Green." IBM announced that thousands of distributed x86 and UNIX servers will be migrated to 30 System z servers running virtual Linux servers with z/VM providing the virtualization environment and IBM Tivoli® products providing the systems management.

The expected benefits of IBM's transition are significant. Substantial savings are expected, with an 80 percent decrease in energy consumption, an 85 percent decrease in floor space, reduced software and system support costs, along with an improved inventory control, dramatically faster provisioning, improved security and reliability, higher quality due to reduced complexity, and increased stability and availability.

The IBM System z virtualization capabilities can help to support hundreds or thousands of virtual Linux servers in a single 2.83 square meters footprint, and you may be able to deploy new servers in minutes—on demand, expediting your response to business demands.

The replacement of many servers and networks with one server improves cost efficiency and reduces power consumption. IBM System z10 Enterprise Class (z10 EC) and z/VM virtualization together can help reduce power and cooling costs by up to 80 percent or more, through virtualization and consolidation.[3]

A single server with the size of a refrigerator versus a full room of servers—*the better approach*.

## Higher flexibility

The z/VM virtualization software, IBM's premier hypervisor[2] technology, and the System z logical partitioning (LPAR) technology provide leadership virtualization capabilities for the Linux on System z environment.

z/VM offers the highest levels of resource sharing—including the sharing of Linux program executables, over-commitment capabilities for processors and memory, cooperative memory management, I/O bandwidth, and system availability, resulting in nearly 100 percent utilization of the system resources nearly 100 percent of the time.

z/VM offers several data-in-memory techniques that further enhance the scalability and performance of memory-intensive workloads. z/VM support for System z dynamic reconfiguration features allows the nondisruptive dynamic configuration of processors, channels, network adapters, and memory to individual Linux servers, helping to increase availability.

With Discontiguous Saved Segment (DCSS) support, users can store Linux program executables in a single z/VM memory location and share the executables with any or all of the hosted Linux systems. In-memory emulated storage, called virtual disks, allows Linux systems to achieve memory-speed data transfers for read and write I/O operations.
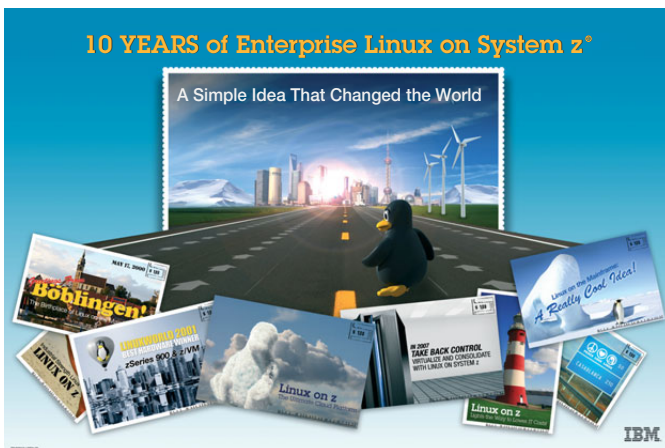
The security certification of z/VM allows you to run production servers side by side on the same machine as test and development servers. This can help to improve resource utilization and offer significant operational benefits as well.

Linux on System z has the support of the outstanding z/VM capabilities included. Leadership virtualization means that you can do more with less—*the better approach*.

## Efficient workload optimization

Linux running on System z can help manage a high number of servers with a small number of IT professionals.

Designed to run multiple and mixed workloads concurrently, System z can share resources and direct them quickly and efficiently between applications, virtually and dynamically, whenever and wherever they are needed. This is done according to user-defined and business-oriented policies.

z/VM systems management capabilities consists of many functions and products or features working together to provide the tools for systems administrators to help keep z/VM and the Linux systems running at the most optimal level and utilizing resources efficiently.

The z/VM Virtual Machine Resource Manager (VMRM) can used to define a set of virtual Linux systems to be part of a workload group, which can then be managed to meet processor and I/O goals. VMRM automatically adjusts performance parameters when there is contention for a resource between virtual Linux systems. VMRM also provides z/VM and Linux systems with the ability to relieve memory constraints.

IBM Systems Director VMControl Image Manager for Linux on System z provides management capabilities for virtual environments across multiple virtualization technologies and physical platforms, to manage and automate the deployment of virtual systems from a centralized location.

Additionally, Linux and System z offer a broad set of management products, from the rich management tools portfolio of the IBM Tivoli brand that work together to help drive greater IT efficiencies and quality.

Automated workload optimization—*the better approach*.

## Unmatched qualities of service

Availability and protection of the IT infrastructure continues to be important.

The IBM System z is a highly reliable and available server. Since its inception, all of the server elements have always had an internal redundancy, and all of these redundant elements can be switched automatically in the event of a failure. As a result of this redundancy, it is possible to make fixes or changes to any element that is down without stopping the machine from working and interrupting access by the customers.

The IBM System z environment has highly integrated security features. Its capability to run multiple Linux systems concurrently on the same server requires the ability to isolate and protect each Linux environment. IBM System z servers are the world's only servers with the highest level of hardware security certification, Common Criteria Evaluation Assurance Level 5 (EAL5).

The IBM System z servers can implement controlled access, allowing users to access only the applications and data that they need, not those that they are not authorized to use. Server components deliver support for encryption and decryption of data, and for enhancing the security throughput of the system.

z/VM can virtualize System z cryptographic devices so they can be shared by many Linux systems. z/VM can balance the workload across multiple cryptographic devices, and should one device fail or be brought offline, z/VM can transparently shift Linux systems using that device to use an alternate cryptographic device without user intervention. As well, z/VM is certified at Common Criteria EAL4+ for its ability to isolate and protect each Linux system.

Linux is evolving to a higher level of quality by benefiting from the System z qualities of service—*the better approach*.

## Cost-attractive consolidation model

Cost savings can result from an infrastructure simplification that reduces IT complexity.

Linux on System z provides a uniquely powerful infrastructure, based on the outstanding virtualization capabilities and the enormous capacity of the System z server, which can allow you to consolidate hundreds of Linux servers onto a single server.

Possible savings can result from reduced licensing costs for the software. This is due to the fact that a single IBM System z server can run multiple Linux applications on a single processor, and that Linux software is usually priced on a per-processor basis.

Possible savings can result from reduced labor requirements for system management and maintenance. The centralized system management and autonomic computing capabilities of

Linux on IBM System z can also help reduce the errors and minimize workload-balancing tasks that otherwise can consume countless IT staff hours.

Possible savings can result from reduced energy consumption. Fewer servers and networks can mean savings in physical space and heating, air conditioning and electricity costs.

Possible savings can result from increased business continuity. With a suite of built-in features, IBM System z servers can rapidly respond to, or even anticipate, threats to system health, helping to prevent costly system downtime.

Beside cost-attractive consolidation, clients leverage the advantages of the Linux on System z environment to deploy new business models, such as cloud computing, as well as growing workloads, such as business intelligence and collaboration.

The application portfolio is still growing constantly, today, over 3,150 applications are available you can select from, allowing you to choose the best applications for your business needs.

A few hundred products are offered from the IBM software brands—DB2® Information Management, Lotus®, Rational®, Tivoli and WebSphere®—enabling to you optimize the software layer of your IT infrastructure.

Linux on System z can provide the IT infrastructure that helps you achieve a quick return on investment without sacrificing enterprise-class qualities of service, focusing on improving:

- Simplicity
- Efficiency
- Flexibility
- Security and reliability.

*The better approach.*

## For more information

To learn more about Linux on IBM System z, please contact your IBM representative or IBM Business Partner, or visit:
**ibm.com**/systems/z/linux

[1] Source: IBM internal MIPS inventory numbers comparing YE2008 installed capacity vs.YE2009 installed capacity.

[2] A hypervisor, also called a virtual machine manager, is a program that allows multiple operating systems to share a single hardware host.

[3] Comparison is versus 760 Sun X2100 2.8GHz x86 servers without virtualization, reflecting a current-day consolidation on z10 EC IFLs with z/VM Virtualization.

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