



Linux on IBM Z

Linux® on IBM Z® is the same Linux as on other architectures, however, it is optimized to leverage the strengths and capabilities of the outstanding IBM Z technology.

Relying on proven technology accelerates deployment and reduces risk.

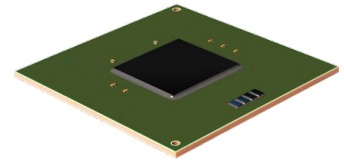
<p>Consider the alternative</p>	<ul style="list-style-type: none"> ✓ Efficient and economically ✓ Resilient and trustworthy ✓ Scalable and flexible ✓ Secure and open 	
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‘Built-in’ Security for Pervasive Encryption

Security capabilities
▪ Data encryption
▪ Security integrated across the stack and lifecycle
▪ Secured isolation
▪ Clear Key, Secure Key, Protected Key and Public Key Infrastructure (PKI)
▪ Auditing
▪ Network Security

- IBM® z15™ (z15) hardware accelerated encryption on every core with CPACF designed to provide fast encryption
- Crypto Express7S card adds additional capabilities
- Designed to meet FIPS, ANSI, PKI and DK standards
- Linux allows for ‘clear key’ encryption for data in-flight/at-rest, and ‘protected key’ encryption for data at-rest
- Galois Counter Mode (GCM) encryption for minimum latency and operation overhead of Java™ workloads
- IBM Data Privacy Passports¹, in conjunction with z15, extending data protection throughout the enterprise
- IBM z/VM® v7.1 and v6.4 provide the prerequisite z15 encryption support to enable the exploitation by Linux guests
- Designed for EAL 5+ hardware security certification

State-of-the-art semiconductor technology – IBM z15 chips



14 nm SOI	<ul style="list-style-type: none"> ▪ On-chip cryptography acceleration ▪ On-chip compression acceleration ▪ Single Instruction Multiple Data (SIMD) ▪ Out-of-order execution ▪ Hardware transactional memory (HTM) ▪ Separate cores for I/O processing 	9.2 billion transistors
Type 8561: 5.2 GHz, up to 12 cores per chip		L1 / L2 cache on core
2 threads per core, enhanced SMT		L3 cache on chip, L4 cache on System Controller chip

¹ Available via a z15 only IBM software product



Operational Efficiency

IBM Z supports high density of workloads with thousands of users in parallel and up to thousands of Linux servers in one box.

Workloads on IBM Z can communicate via fast internal connections, and with Shared Memory Communication even faster performance can be achieved while saving compute power.

z/VM + IBM Wave for z/VM offer simple administration of the virtual environment.

KVM virtualization enables the use of Linux administration skills on IBM Z. z/VM and KVM are supported environments of the IBM Dynamic Partition Manager for Linux-only systems.

With Linux on IBM Z you can transform IBM Z and Linux environments into a secure, private on-premise cloud environment. Integrating DevOps capabilities with cloud optimized software, allows to take advantage of IBM software via containers and microservices.

Containers can be deployed via IBM Cloud Paks™, IBM Private Cloud, Docker, and other container technologies.

Co-locating workloads on IBM Z can benefit from great performance and operational efficiency.



IBM Z has multi-dimensional growth and scalability options



Scale **horizontally** and **vertically**
without disruption
to the running environment

- Provision for peak utilization - dynamically add cores, memory, I/O adapters, devices and network cards - unused resources automatically reallocated after peak
- z/VM offers high levels of resource sharing, data-in-memory techniques and outstanding I/O
- KVM is included in Linux distributions for IBM Z, and optimized to benefit from IBM Z capabilities
- Temporary activation of resources through 'On/Off Capacity on Demand' at a per-day per-core charge, permanent activation through 'Capacity on Demand'

Flexible Resource/Workload Management and High configuration flexibility

- Resources can be assigned dynamically and efficiently between workloads, whenever and wherever they are needed
- Live virtual server migration capabilities provided with z/VM Single System Image feature and KVM
- Goal-oriented approach for performance management of a hypervisor



Co-location inside IBM Z

IBM Z enables business integration and co-location to reduce complexities, extend services and deploy next generation apps very fast. Co-locating applications and data on IBM Z—running on Linux, IBM z/OS®, IBM z/VSE® or IBM z/TPF—provide not only the unique opportunity to tightly connect ‘systems of records’ and ‘systems of interaction’, it also allows to build and integrate cloud native applications with existing applications.

With microservices and standard APIs, existing assets can be used in new ways, delivering into next generation application services. Standard APIs ease the creation and microservices offer the architectural style to create independently deployable units for agility and scalability.

- High performance and efficiency
 - Optimized for data serving, quick response times and less application waits through optimized cache structure and large cache sizes
 - High I/O bandwidth due to dedicated I/O processors and memory buffer cache
- Cross-memory data and local network transfer advantages
 - High throughput and low latency by less hops
 - Less network equipment (routes, switches) – network is inside the server
- Centralized management of co-located workloads
 - Optimized resource utilization based on high levels of resource sharing,
 - Same arrangements for security, process monitoring, backup and disaster recovery, etc.

Quality of Service - Resiliency and Security



- Spare cores for transparent failover
- RAIM subsystem to eliminate failures
- Built-in bottom to top security



Not available on x86 servers

- Expect unplanned downtime due to hardware failures
- Live Guest Relocation via z/VM SSI and KVM
- IBM GDPS® for near-continuous availability
- IBM Spectrum Scale™ for advance clustering technology

Error Prevention	<ul style="list-style-type: none"> ▪ Hardware and firmware designed to protect against outages ▪ Built-in redundancy eliminates single points of failure ▪ Extensive testing and failure analysis at every level
Error Detection and Correction	<ul style="list-style-type: none"> ▪ Error detection embedded in components ▪ Built-in automated diagnostics; problem determination and isolation ▪ Non-disruptive installation, upgrades and maintenance avoids outages
Error Recovery	<ul style="list-style-type: none"> ▪ Automated failover to speed recovery and minimize system impact ▪ Business continuity and disaster recovery solutions – IBM GDPS, z/VM SSI, IBM Spectrum Scale, HiperDispatch, Call Home, etc.



Openness and Compatibility

IBM Z servers are fully supported for open source components, ranging from the Linux operating system, KVM hypervisor offered by Linux distribution partners, container technologies, next-generation app development, through application runtime layers.

Containers can be deployed via IBM Cloud Pak for Applications, IBM Private Cloud, Docker, and other container technologies. IBM announced plans² to bring Red Hat OpenShift and IBM Cloud Paks to IBM Z. IBM’s goal for Red Hat OpenShift for IBM Z will be to help clients enable greater agility and portability through integrated tooling and a feature-rich ecosystem for cloud-native development.

- Linux on IBM Z is Linux run all kind of open source software

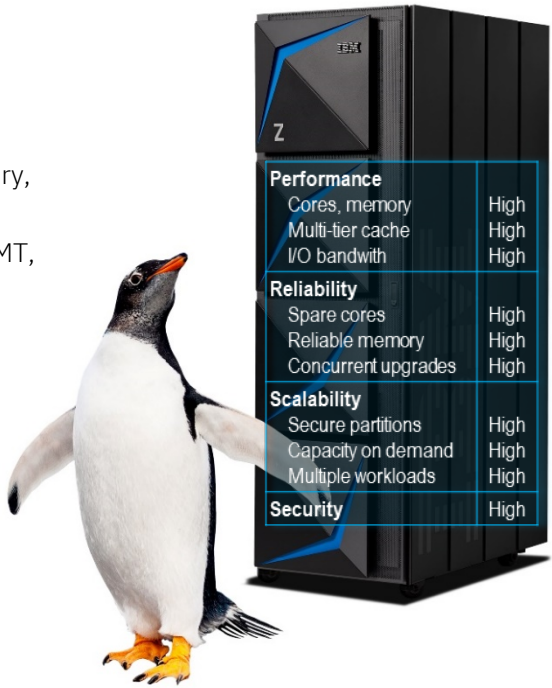
Economic Advantages

IBM Z technology allows for

- On-core hardware accelerated encryption
- On-core hardware accelerated compression
- High resilience with error prevention–detection–recovery, specific processors for RAS, and reliable memory
- High performance and throughput with large caches, SMT, SIMD, HiperSockets™, Shared Memory Communication, specific processors for I/O
- Immense capacity, up to 190 cores with 5.2 GHz and up to 40 TB memory for high workload density
- High resource utilization helps to save cost per workload

Cost advantages can be achieved in

- Operational management
- Security and business continuity
- Software acquisition and licenses
- Flexibility of configuration
- Floor space and energy
- Maintenance effort



Adding IFLs to an IBM Z means low incremental costs, while making the system more profitable.

Using IBM Z for key workloads today, allows for easy extension to Linux.

To learn more: ibm.com/it-infrastructure/z/linux

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² Please see: ibm.co/2OAtVko

