



# Linux on IBM Z

Linux® is Linux, and IBM Z® provides a superior Linux platform. Using IBM Z for key workloads today, allows for easy extension to Linux.

One platform for entire business processes with all-encompassing security and disaster recovery capabilities. Relying on proven technology accelerates deployment and reduces risk.

<h3>Consider the alternative</h3>	<ul style="list-style-type: none"> <li>✓ Security and Pervasive Encryption</li> <li>✓ Operational Efficiency</li> <li>✓ Co-location inside the server</li> <li>✓ Openness and Compatibility</li> <li>✓ Quality of Service</li> <li>✓ Economic Advantages</li> </ul>	
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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 z14™ (z14) hardware accelerated encryption on every core with CPACF designed to provide fast encryption
- Crypto Express6S 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 will allow ‘protected key’ encryption for data at-rest
- Linux will allow Galois Counter Mode (GCM) encryption for minimum latency and operation overhead of Java workloads
- z/VM® v6.4 provide the prerequisite z14 encryption support to enable the exploitation by Linux guests
- Designed for EAL 5+ hardware security certification

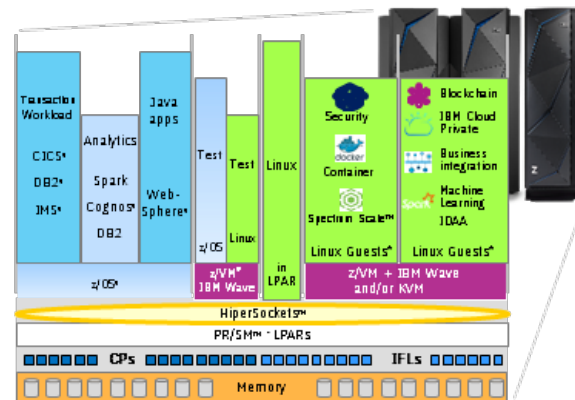
## Operational IT Efficiency

Linux on Z stands in contrast to the ‘add another server approach’. IBM Z servers can **grow ‘on-demand’**, as you need it.

IBM Z supports massive 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, a virtual **‘network-in-one-box’**.

z/VM + IBM Wave for z/VM offer **simple administration** of the virtual environment, and z/VM is a supported environment using **IBM Dynamic Partition Manager** for Linux-only systems.

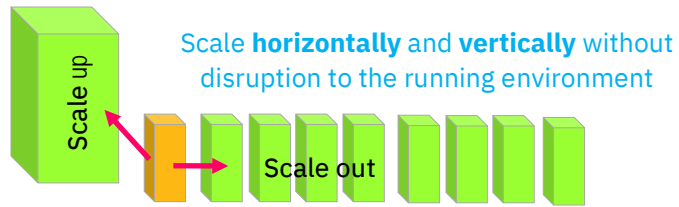


\* workload examples; z/VSE® and z/TPF can also be co-located with Linux





## IBM Z has multi-dimensional growth and scalability options



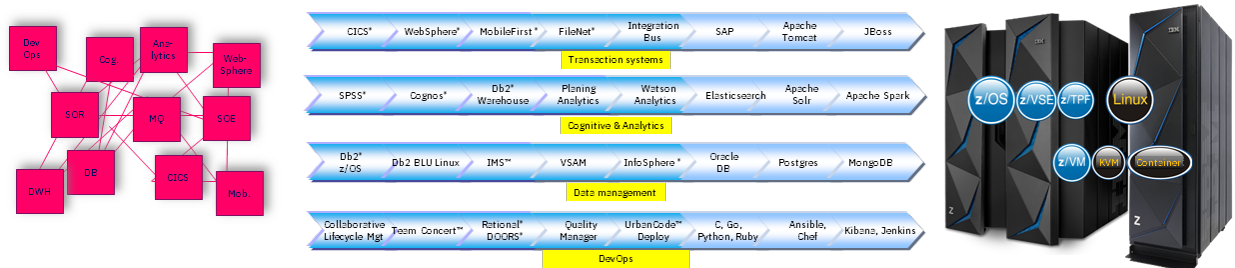
Dynamically add cores, memory, I/O adapters, devices and network cards or clone more Linux guests with a high degree of resource sharing.

- Provision for peak utilization, unused resources automatically reallocated after peak
- z/VM offers high levels of resource sharing, data-in-memory techniques and outstanding I/O bandwidth
- Temporary activation of additional resources through 'On/Off Capacity on Demand' at a per-day per-core charge, permanent activation through 'Capacity on Demand'
- FICON Express16S+ is designed for a boost in I/O rates and a reduction in single stream latency

## 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
- Goal-oriented approach for performance management of a hypervisor

## Co-location inside IBM Z



- 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
  - Reduced risk by eliminating exposure of network data to threats
- Centralized management of co-located workloads
  - Optimized resource utilization based on high levels of resource sharing,
  - Same arrangements for administration of security, process monitoring, backup and disaster recovery, etc.

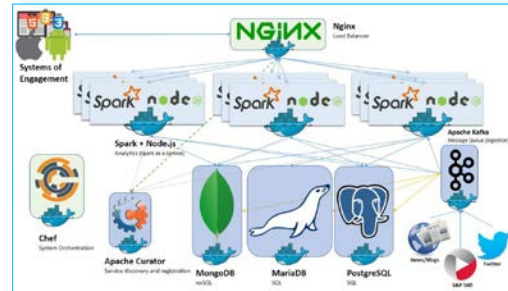


## Openness and Compatibility

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

### IBM Z is committed to open standards

- APIs and microservices open up IBM Z capabilities to mobile apps and hybrid environments
- IBM Z provides Linux enterprise platform for open innovation comprising the best of Linux and open technology
- KVM on IBM Z is offered by Linux distribution partners,
- Docker and other container technologies available,
- Linux on IBM Z run all kind of open source software: Ansible, Chef, Erlang, Go, Fluentd, Jenkins, Kibana, Kubernetes, MongoDB, Node.js, Hyperleger Fabric, PostgreSQL, Puppet, Python, Ruby, Salt, Spark, SWIFT - plus many others



Financial Trading Demo Architecture

## 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 zero unplanned downtime due to hardware failures
- IBM GDPS® for near-continuous availability
  - Recover from outages in seconds
- IBM zAware function for anomaly detection
  - Detect issues before they become critical

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



## State-of-the-art semiconductor technology – IBM z14 chips

14 nm SOI	<ul style="list-style-type: none"> <li>Single Instruction Multiple Data (SIMD)</li> <li>Out-of-order execution</li> <li>On-chip cryptography acceleration</li> <li>Hardware transactional memory (HTM)</li> </ul>	6.1 billion transistors
<ul style="list-style-type: none"> <li>Type 3906: 5.2 GHz, up to 10 cores per chip</li> <li>Type 3907: 4.5 GHz, up to 9 cores per chip</li> </ul>		L1 / L2 cache on core
2 threads per core, enhanced SMT	<ul style="list-style-type: none"> <li>Separate cores for I/O processing</li> </ul>	L3 cache on chip, L4 cache on CPC drawer

## Economic Advantages

IBM Z technology allows for:

- Hardware accelerated encryption on every core
  - Consumable data protection
- SMT, SIMD, cache design, co-location, ...
  - High performance and throughput
- Specific processors for I/O and RAS
  - Reduced CPU footprint
  - Improved resiliency / business continuity
- Highly reliable memory (RAIM)
- High resource utilization minimizes idle resources
  - Can save software costs
  - Allows for low cost per workload

Total Cost of Ownership advantages can be achieved in

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

IBM Z provides		
<b>Performance</b>	Cores, memory Multi-tier cache I/O	High High High
<b>Reliability</b>	Spare cores Reliable memory Concurrent upgrades/replacement	High High High
<b>Scalability</b>	Secure partitions Capacity on demand Multiple workloads/VMs on system	High High High
<b>Security (for workloads/data/VMs)</b>		High

IBM z14 Models M01 – M05, type: 3906

IBM z14 Model ZR1, type: 3907

Adding IFLs onto an existing IBM Z server means low incremental costs while making the system more profitable

To learn more: [ibm.com/it-infrastructure/z/os/linux](http://ibm.com/it-infrastructure/z/os/linux)

\* IBM is working with the open source community and with the Linux distribution partners to get the functionality included in their Linux

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