

# IT Optimization with Linux on z Systems



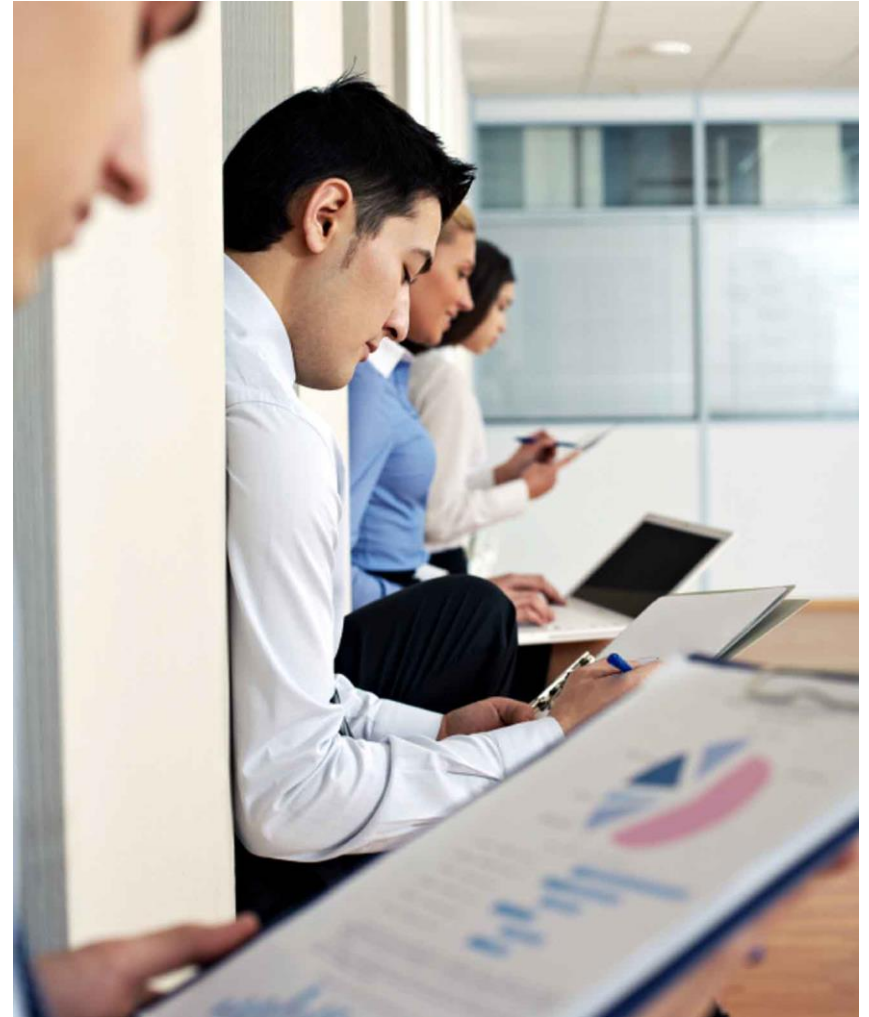
*[VMworkshop.org](http://VMworkshop.org)*



# Agenda

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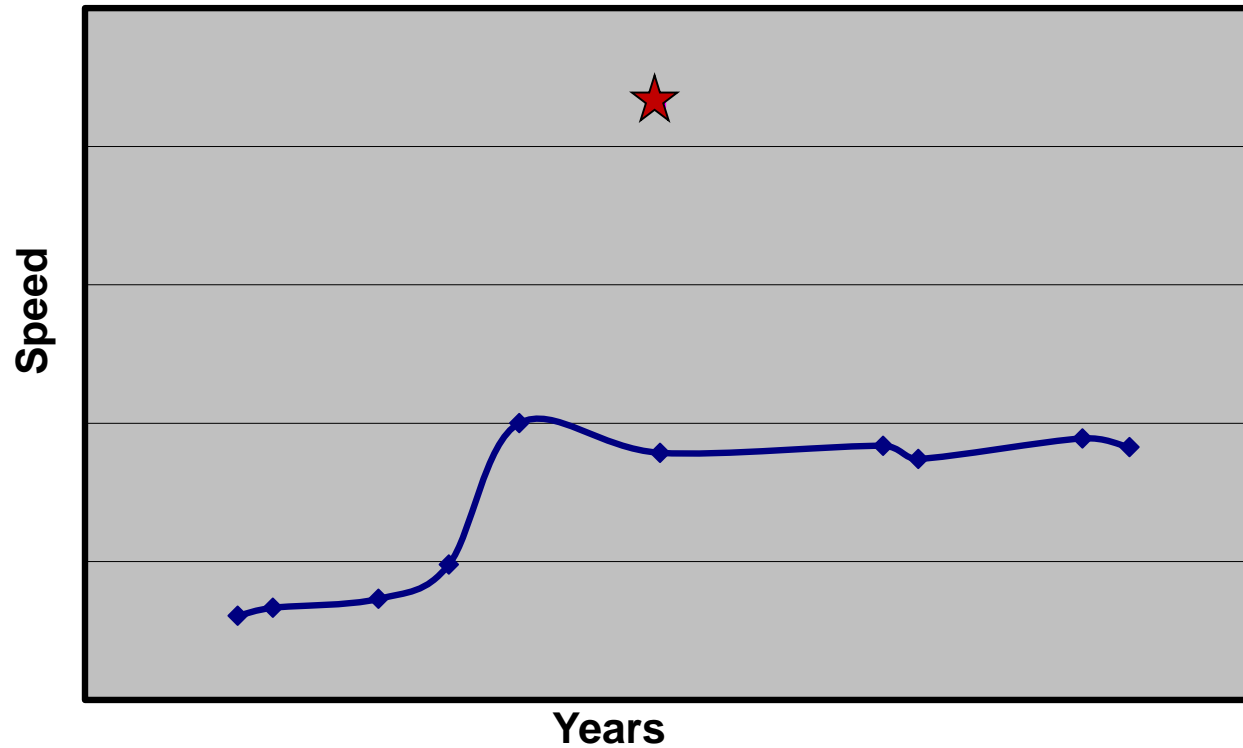
- **Infrastructure optimization**
  - *Cost and business value*
- **Linux on z Systems is Linux**
  - *What makes it different*
- **Application examples**
  - *Typical workloads*



## Industry trend

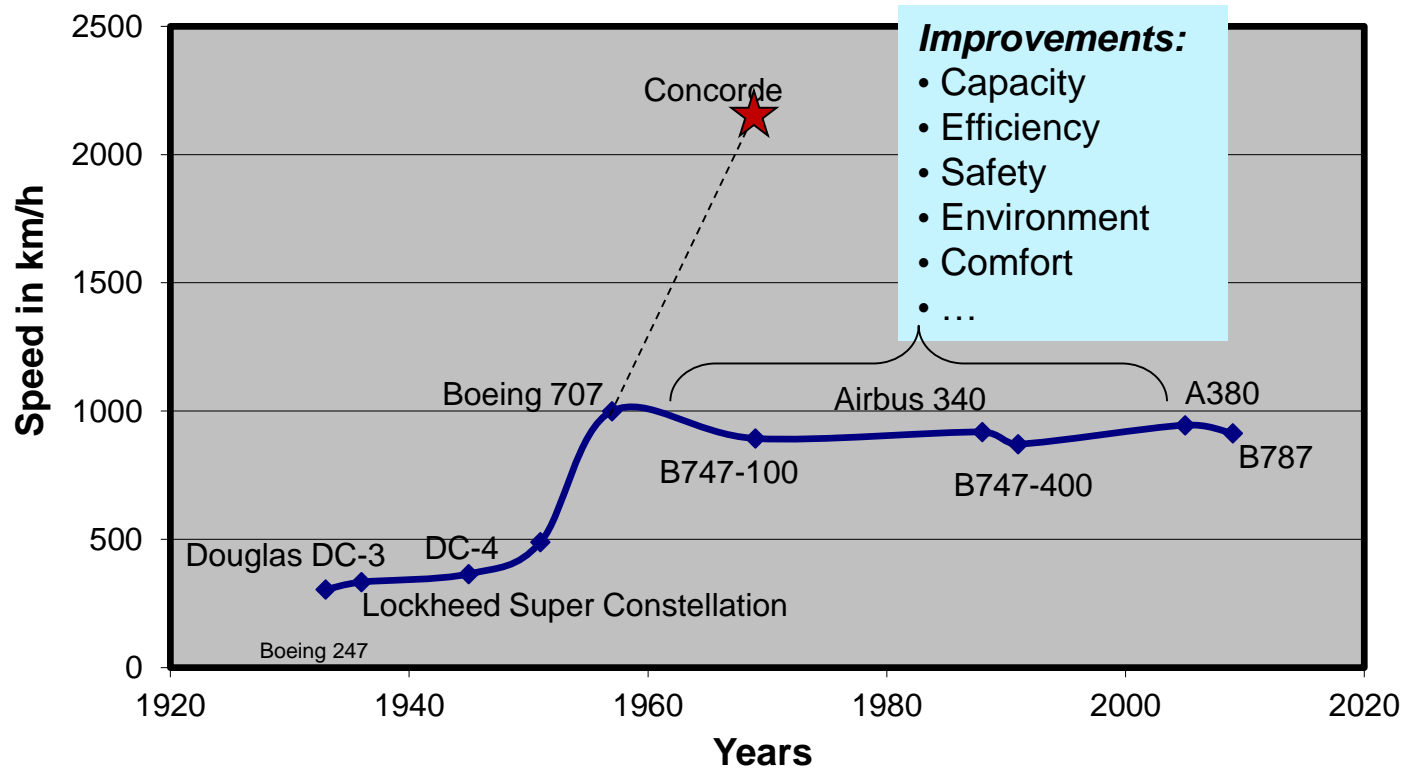
– which industry product trend is depicted here?

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# Industry trend: commercial aircraft industry

## Commercial Aircraft Cruise Speed



## Fit for Purpose



All of these “tools” can very quickly move a person from one place to another.

But, which one is the right tool to move one person?

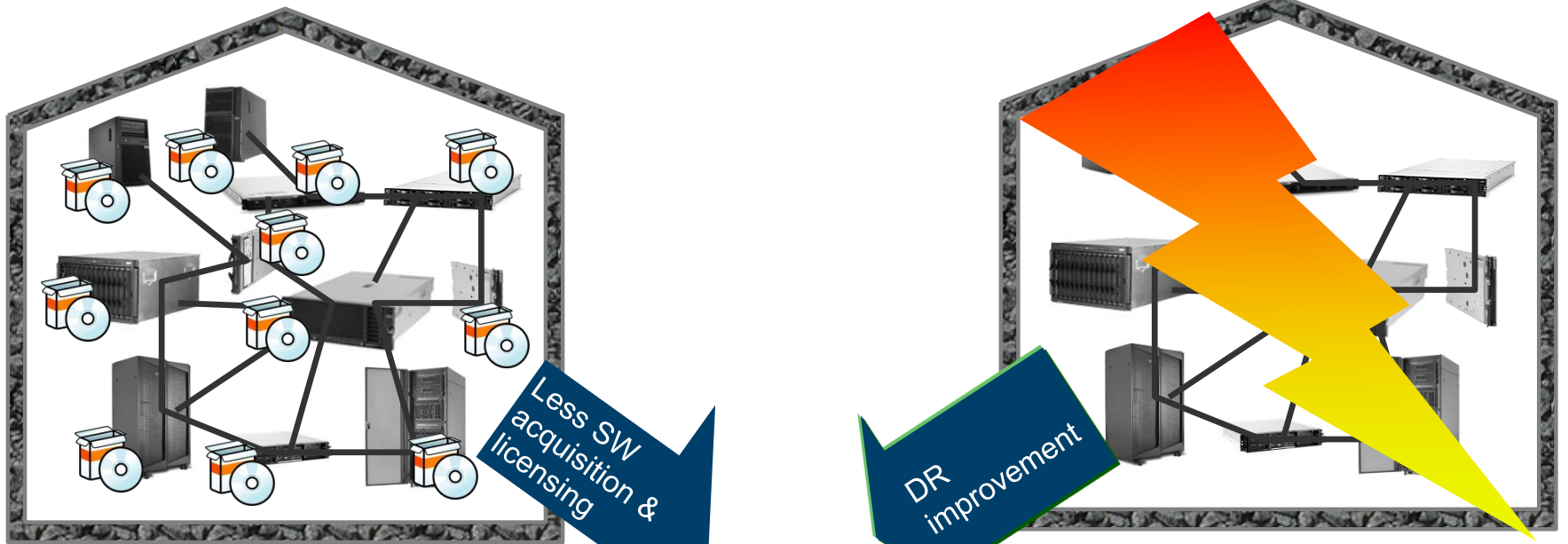
Fifty people? Five hundred people?

***Platform Selection Is All about Using the Right Tool for the Right Job***



# The Difference of Deployment on System z

Examples: Software Costs and Disaster Recovery



**Distributed software is often priced by the number of processor cores.**

**On System z, one IFL is equivalent to one core!**



**Coordinated near-continuous availability and DR solution for critical data on Linux**

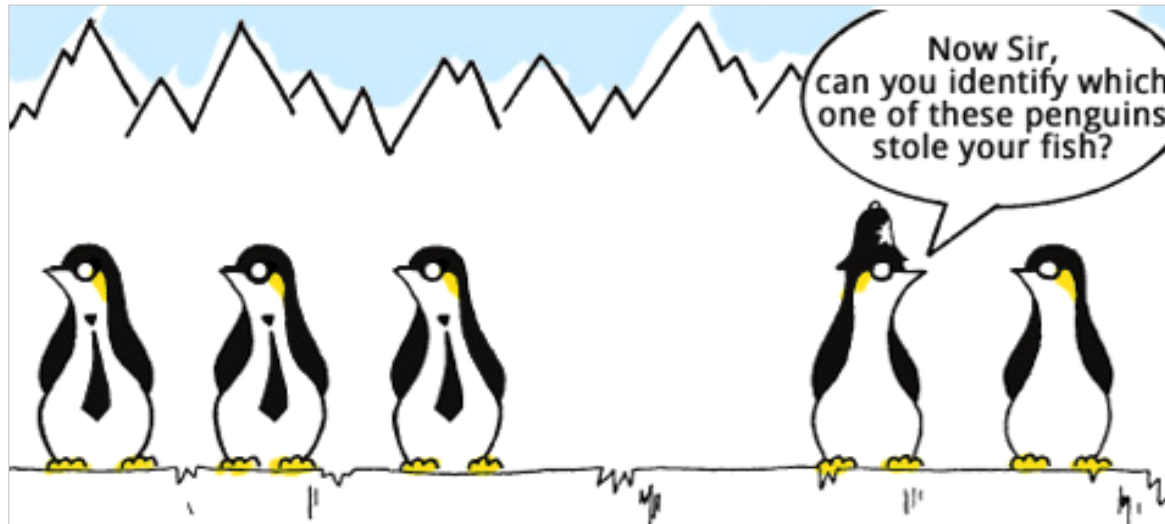
# Complete Range of IT Cost Factors

Cost factors highlighted in yellow are the only ones that organizations routinely assess.

Full Range of IT Cost Factors			
<b>Availability</b> <ul style="list-style-type: none"> <li>High availability</li> <li>Hours of operation</li> </ul>	<b>Additional development and implementation</b> <ul style="list-style-type: none"> <li>Investment for one platform – reproduction for others</li> </ul>	<b>Security</b> <ul style="list-style-type: none"> <li>Authentication and authorization</li> <li>User administration</li> <li>Data security</li> <li>Server and OS security</li> <li>RACF versus other solutions</li> </ul>	<b>Controlling and accounting</b> <ul style="list-style-type: none"> <li>System analysis</li> <li>Cost</li> </ul>
<b>Backup/restore/site recovery</b> <ul style="list-style-type: none"> <li>Backup</li> <li>Disaster scenario</li> <li>Restore</li> <li>Effort for complete site recovery</li> <li>Storage area network (SAN) effort</li> </ul>	<b>Operations</b> <ul style="list-style-type: none"> <li>Monitoring and operating</li> <li>Problem determination</li> <li>Server management tools</li> <li>Enterprise-wide integrated server management</li> </ul>	<b>Operating concept</b> <ul style="list-style-type: none"> <li>Development of an operating procedure</li> <li>Feasibility of the developed operating procedure</li> <li>Automation</li> </ul>	<b>Integration</b> <ul style="list-style-type: none"> <li>Integrated functionality versus functionality to be implemented (possibly with third-party tools)</li> <li>Balanced system</li> <li>Integration of and into standards</li> </ul>
<b>Infrastructure</b> <ul style="list-style-type: none"> <li>Space</li> <li>Power</li> <li>Network infrastructure</li> <li>Storage infrastructure</li> <li>Initial hardware costs</li> <li>Software costs</li> <li>Maintenance costs</li> </ul>	<b>Resource utilization and performance</b> <ul style="list-style-type: none"> <li>Mixed workload/batch</li> <li>Resource sharing: shared nothing versus shared everything</li> <li>Parallel Sysplex versus other concepts</li> <li>Response time</li> <li>Performance management</li> <li>Peak handling and scalability</li> </ul> <b>Skills and resources</b> <ul style="list-style-type: none"> <li>Personnel education</li> <li>Availability of resources</li> </ul>	<b>Deployment and support</b> <ul style="list-style-type: none"> <li>System programming                             <ul style="list-style-type: none"> <li>Consistent OS and software levels</li> <li>Database effort</li> </ul> </li> <li>Middleware                             <ul style="list-style-type: none"> <li>Software maintenance</li> <li>Software distribution across firewalls</li> </ul> </li> <li>Application                             <ul style="list-style-type: none"> <li>Technology upgrade</li> <li>System release change without interrupts</li> </ul> </li> </ul>	<b>Further availability aspects</b> <ul style="list-style-type: none"> <li>Planned outages</li> <li>Unplanned outages</li> <li>Automated takeover</li> <li>Uninterrupted takeover (especially for databases)</li> <li>Workload management across physical borders</li> <li>Business continuity</li> <li>Availability effects for other applications or projects</li> <li>End user service</li> <li>End user productivity</li> <li>Virtualization</li> </ul>

Linux is Linux,

but are all Linux infrastructure solutions identical?



**No**

, while Linux is Linux, the underlying infrastructure (hardware and infrastructure software) directly affects the Linux workloads.



# Why Linux on z Systems

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- **Higher utilization**

- ✓ Up to 100% (typically 80%+) → lower software license cost

- **Scalability**

- ✓ Resources can be added transparently → incremental growth as needed

- **Faster processor**

- ✓ Lower number of cores (IFLs) → lower software license cost

- **Capacity on Demand (CoD) and Capacity Backup (CBU)**

- ✓ Flexibility to react to peaks or disaster → being prepared at lower cost

- **Highest reliability**

- ✓ Better availability → higher quality of service

- **Integration and virtualization**

- ✓ Two levels of virtualization (LPAR and z/VM) → security, flexibility, consolidation of conflicting workloads on single physical server

- ✓ DR advantages → lower complexity and integration with z/OS or z/VSE systems

- ✓ Easier systems management → lower management cost

# Optimized Computing: Nationwide's Linux on System z Virtualization

## ***Reduces TCO and Time to Deploy***

Nationwide was already experiencing serious technology pain points from the continuous growth of its business. Among these were:

- *Too many distributed physical servers with low utilization*
- *A lengthy provisioning process that delayed the implementation of new applications for headquarters and agencies, and for new customers for Nationwide's human resources outsourcing business*
- *Limitations in data center power and floor space*
- *High Total Cost of Ownership (TCO)*
- *Difficulty allocating processing power for a dynamic environment.*

## **TCO results that Nationwide has experienced:**

- Monthly Web hosting fees have gone down by 50 percent.
- Hardware and operating system **support needs have decremented by 50 percent.**
- CPU utilization is up an average of 70 percent, with the elimination of many physical servers with below average utilization.
- **Middleware licensing costs for WebSphere, Oracle, and UDB have dramatically fallen.**
- **There has been an 80 percent reduction in data center floor space needs, and power consumption is down.**
- **The net of the effort is a \$15 million savings for Nationwide IT over the past three years.**



**Nationwide**<sup>®</sup>  
Insurance

*“Our goal was server optimization and our approach was virtualization.”*

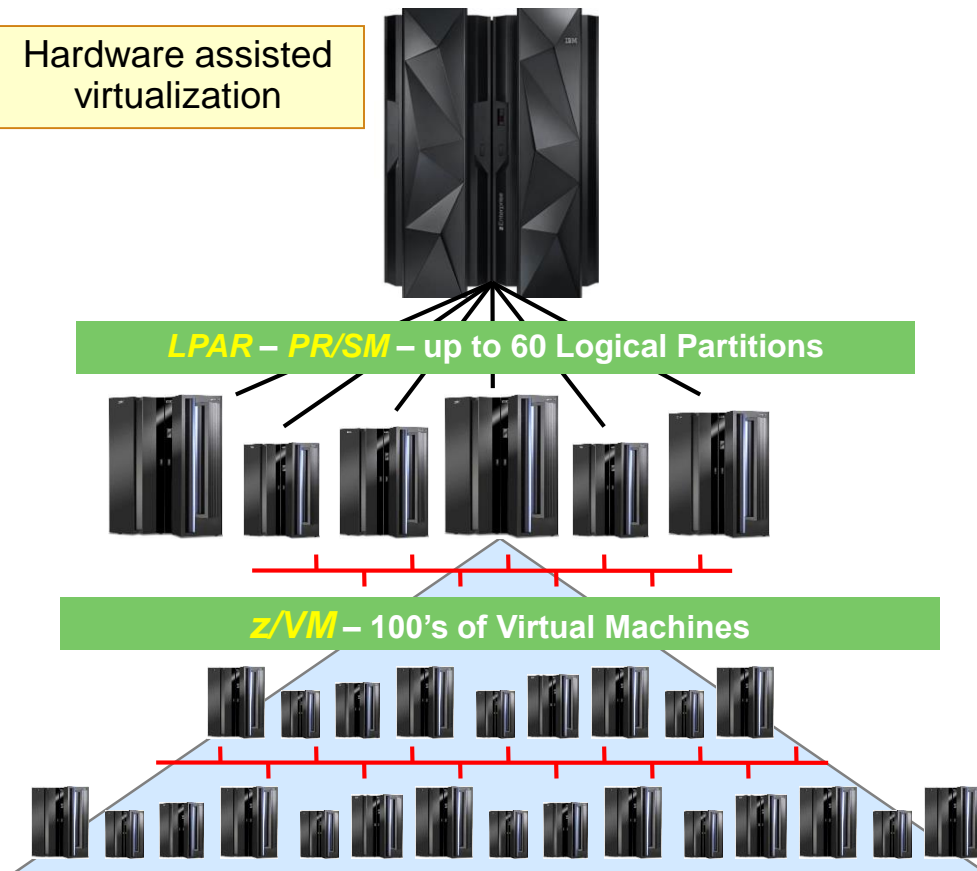
— Guru Vasudeva, Nationwide vice president and CTO

[enterprisesystemsmedia.com/article/optimized-computing-nationwides-linux-on-system-z-virtualization-reduces-tc](http://enterprisesystemsmedia.com/article/optimized-computing-nationwides-linux-on-system-z-virtualization-reduces-tc)

# z Systems – Extreme Virtualisation

## *Build-in and Shared Everything Architecture*

Hardware assisted virtualization



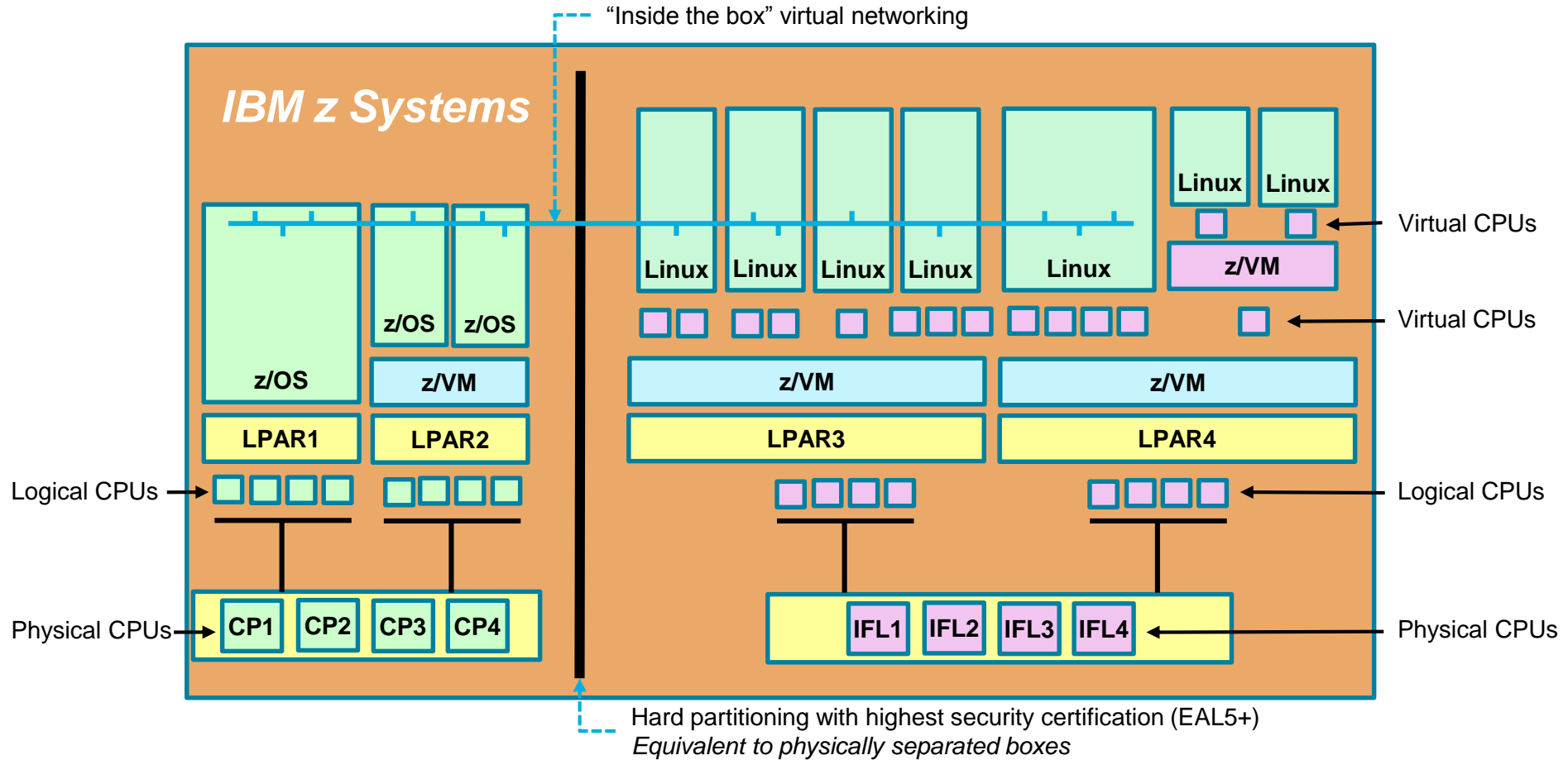
## **z Systems**

- Provisioning of virtual servers in seconds
- High granularity of resource sharing (<1%)
- Upgrade of physical resources without taking the system down
- Scalability of up to 1000's of virtual servers
- More with less: more virtual servers per core, sharing of physical resources
- Extensive life-cycle management
- HW-supported isolation, highly secure (EAL5+ or EAL4+ certified)

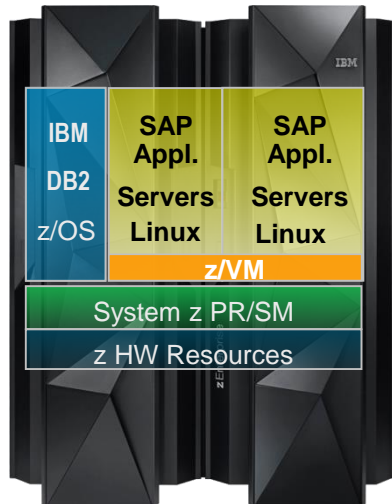
## **Distributed platforms**

- Limited virtual server scalability per core
- Scaling requires additional physical servers
- Operational complexity increases with growth of virtual server images
- Single level of virtualization (no VM on VM)

# IBM z Systems Virtualization Options



# SAP Application Server Deployment and Consolidation on System z



## Business Continuity

- DB on z/OS
- Data Sharing in Parallel Sysplex®
- HA with Tivoli System Automation

## Server Consolidation

- Internal near memory-speed communication
- Scale-up and scale-out capabilities
- Fabulous performance throughout

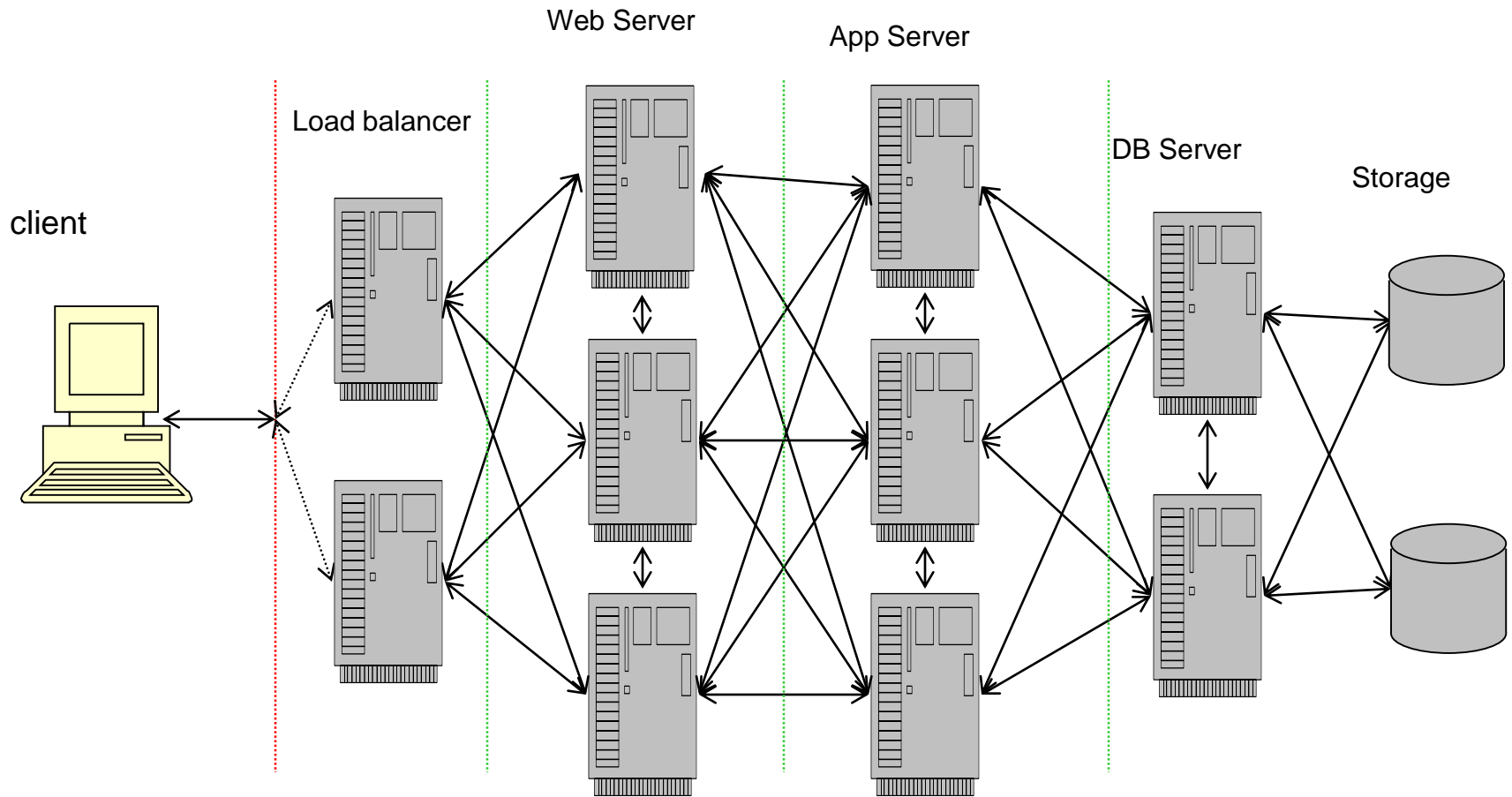
## Embasa - Brazil

- **Manages one of the largest water treatment services**
- **Needed a high-performance, cost-effective way to introduce SAP software while continuing with the tried and trusted database solution**
- **Commercially attractive “Solution Edition” gave confidence to go ahead**

## Endress+Hauser – Germany

- **Specialist in measurement technology; 89 companies across 42 countries**
- **Detailed cost-benefit analysis compared Linux on System z to Power/x86 servers. z/OS, z/VM and a total of 80 IFLs**
- **Simple and intuitive user management tools make it possible for just 1.5 FTEs to administer the entire Linux landscape**

# HA with Independent Tiered Execution Streams



# Insurance Company Consolidated 292 Servers to a z10

**Before**

3560E-24TD	8
3560E-24TD	17
3560E-12D	6
50 Ft UTP Cable	584
10GB Eth Fiber Cable	60

**Over 600 Cables**

Backbone

Network

The diagram only shows **30** of **292** servers

**After**

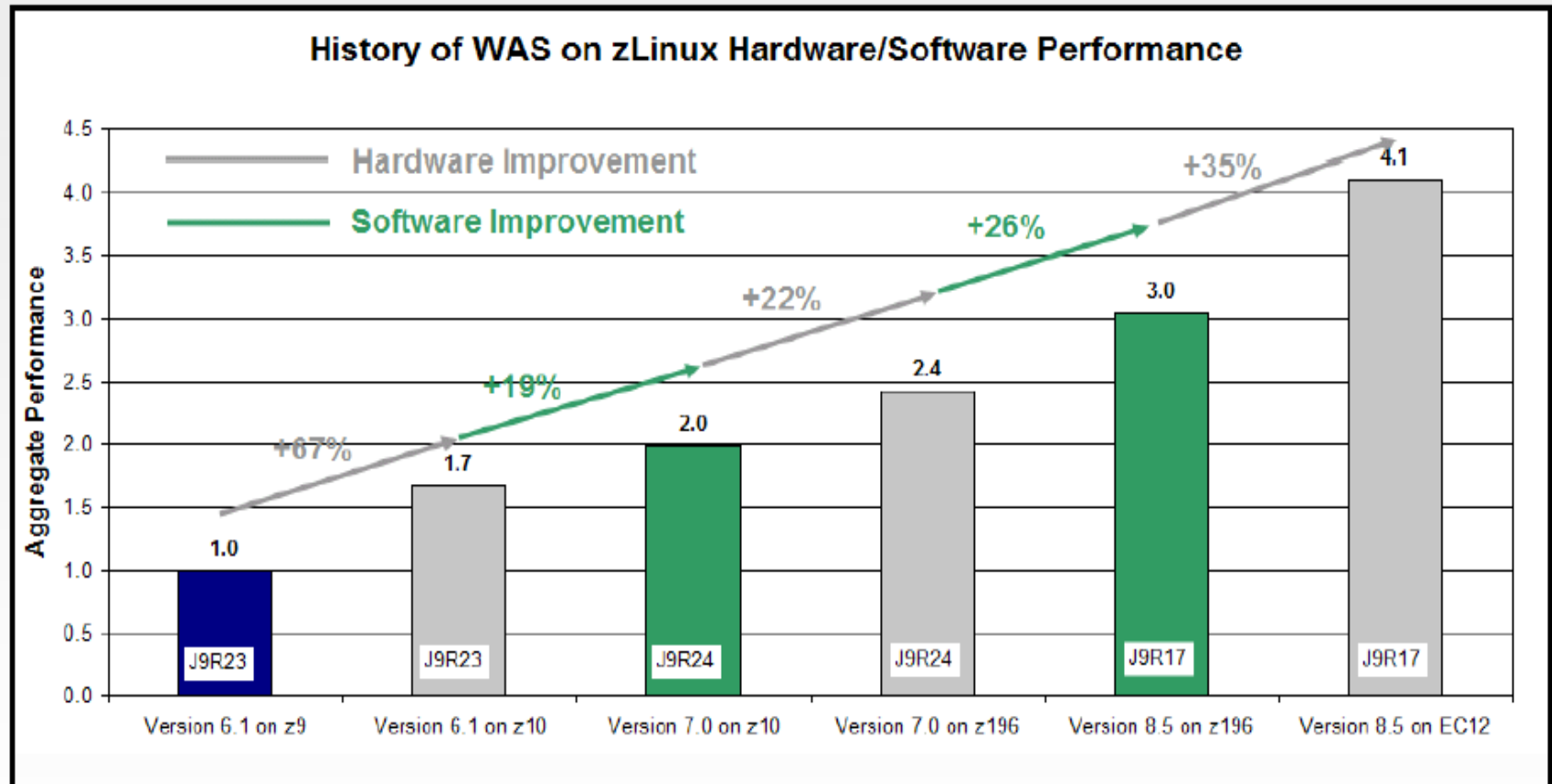
Backbone

**Just 10 Cables!**

# WebSphere Application Server (WAS) on Linux on z Systems

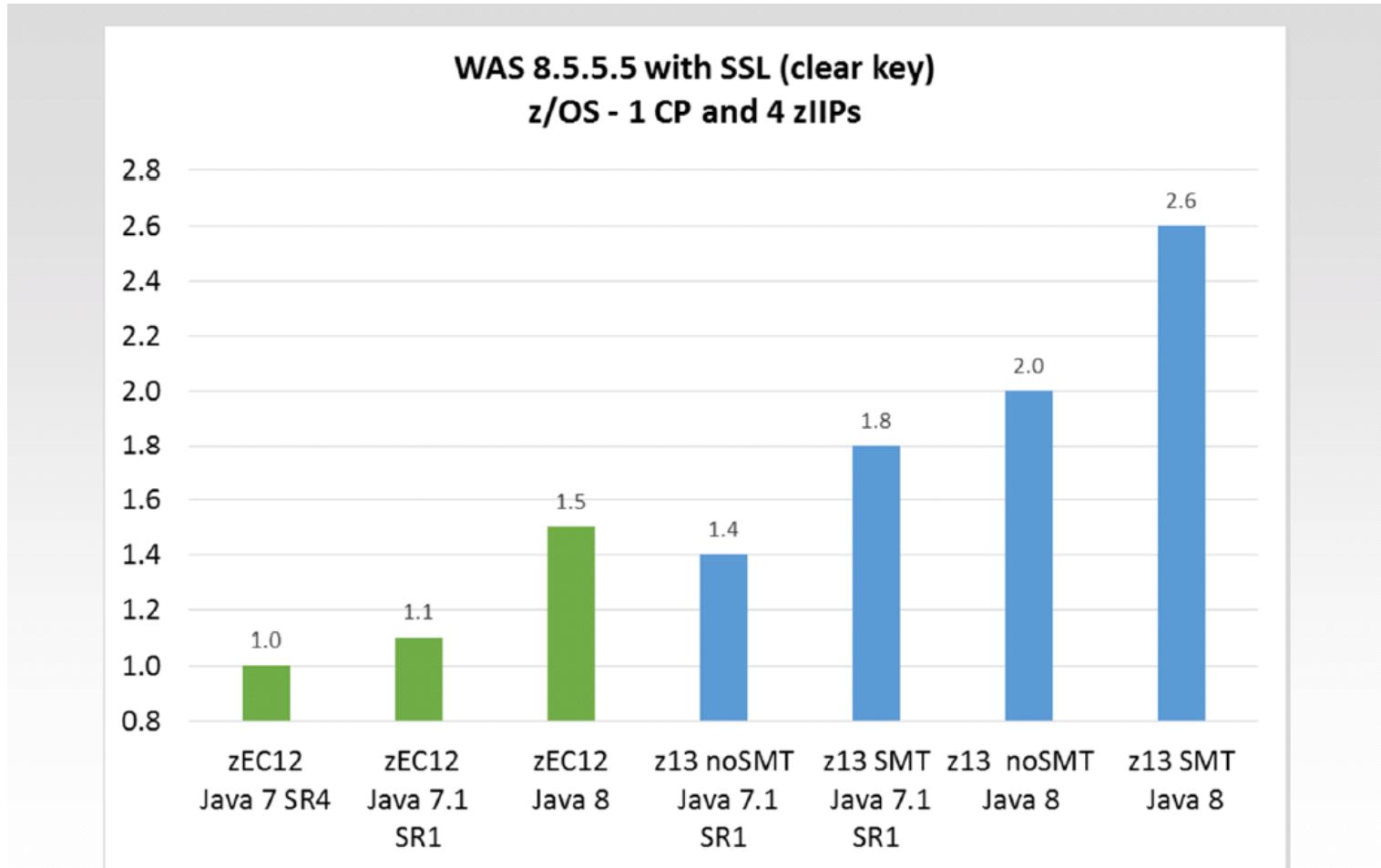
4x aggregate HW, SDK and WAS improvement:

WAS 6.1 (Java 5) on z9 to WAS 8.5 (Java 7) on zEC12





## z/OS WAS 8.5.5.5 – SSL-Enabled DayTrader 3.0



**2.6x improvement in throughput with IBM Java 8 and IBM z13**

(Controlled measurement environment, results may vary)

# Sicoob

## Supporting rapid business growth

### The need:

To meet its strategic objective of being the primary provider of financial services to its members, Brazilian credit union system Sicoob needs to ensure that it can meet members' **needs for 24/7 service and mobile access to information**. The existing distributed infrastructure could not scale to provide the necessary performance and availability, or to enable the data consolidation required for analytics.

### The solution:

Virtualized its distributed servers on SUSE Linux Enterprise Server for IBM® System z®—making this its strategic platform for all new servers. Initially, the bank ran **more than 300 virtual servers on two IBM zEnterprise® 196 servers**. The solution includes IBM DB2® software supporting 50 major databases, IBM InfoSphere® DataStage® software for data transformation, and IBM Cognos® software for business analytics.

### The benefits:

- Enabled 600 percent growth in mobile solutions and 200 percent growth in internet banking
- Supported 60 percent increase in in-branch transactions, while avoiding R\$ 3 million [USD 1.5 million] a year in electricity costs
- Transformed the speed, reliability and efficiency of service delivery to members, with rapid deployment of new resources

*“Compared with databases on our previous distributed landscape, DB2 running on Linux on the IBM System z platform offers more reliability and performance, and better integration with our backup, monitoring and ETL tools.”*

*—Paulo Nassar, IT Processing and Storage Infrastructure Manager, Sicoob*

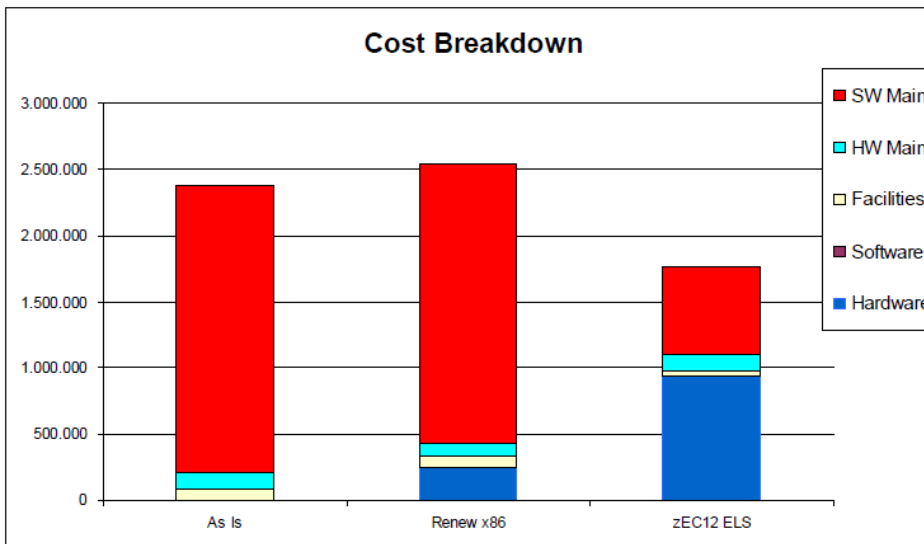
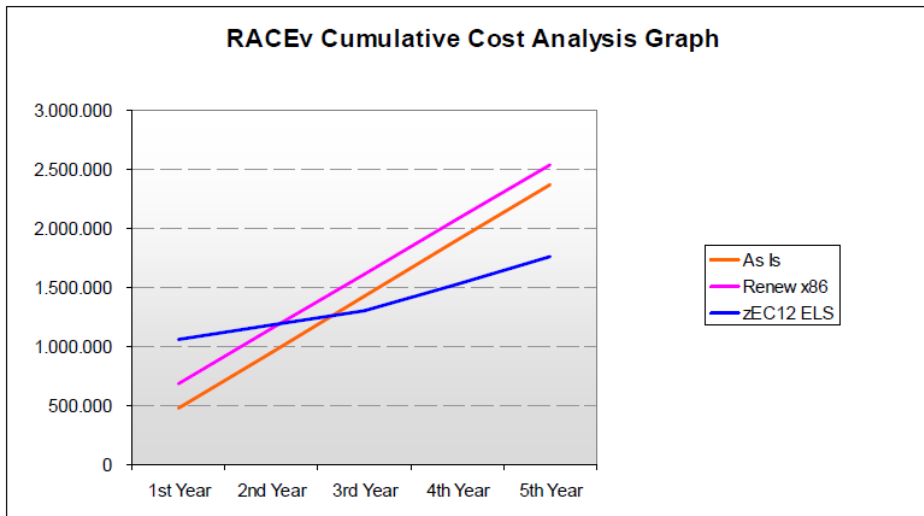
### Solution components:

- IBM® DB2® for Linux on System z®
- IBM Cognos® for Linux on System z



ZSP03735-USEN-00

# Database consolidation example



- ProLiant BL260c G5 Xeon E5430**  
 Quad Core 2.66GHz (1ch/4co)
- 50 physical Linux servers
    - 10 servers @ 25% utilization
    - 20 servers @ 15% utilization
    - 20 servers @ 10% utilization
  - Oracle DB Standard Edition



Renewal: ProLiant BL280c G6 Xeon X5672 Quad Core 3.2GHz (1ch/4co)

# The Met Office forecasts a bright outlook for Linux on z Systems

## ***Saving software licensing and hardware lifecycle costs by consolidating applications and systems***

### **The need**

The Met Office uses post-processing systems to tailor its weather forecasts for specific clients' needs. Running these systems on a distributed Linux infrastructure was becoming complex and expensive.

### **The solution**

Following a comprehensive evaluation and benchmarking process, the Met Office decided to migrate suitable candidates from its distributed Linux landscape onto a pair of IBM® zEnterprise® 196 servers.

- Oracle licensing costs cut by a factor of 12
- I/O-intensive workloads perform considerably better on zEnterprise than on commodity servers
- Fewer physical servers means a more manageable Linux landscape and lower hardware lifecycle costs

“*By consolidating distributed commodity servers you can save a great deal of money. When we looked at all of the parameters, it just made sense to move the workload to the mainframe.*”

— Martyn Catlow, portfolio lead for centralised IT infrastructure, the Met Office

# IBM FlashSystem & Linux on z Systems

## *Highest Reliability, Maximum Performance*

### Now you can leverage the “Economies of Scale” of Flash

- Accelerate Application Performance
- Gain Greater System Utilization
- Lower Software & Hardware Cost
- Save Power / Cooling / Floor Space
- Drive Value Out of Big Data



IBM FlashSystem is certified ([see SSIC](#)) to attach to Linux on z to meet your business objectives

### Performance of Linux on z with FlashSystem

I/O bound relational databases, like Oracle, can benefit from IBM FlashSystem over spinning disks.

- **21x** reduction in response times\*
- **9x** improvement in IO wait times\*
- **2x** improvement in CPU utilization\*

*New FlashSystem 900 and z Systems FiconExpress16s I/O cards can provide an even higher throughput*

## Why IBM FlashSystem for Linux on System z?

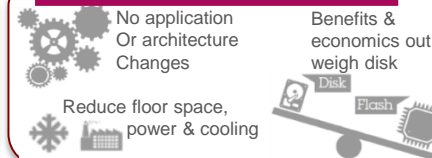
### Extreme Performance



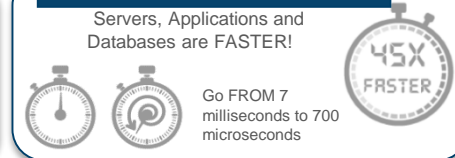
### Enterprise Reliability



### Macro Efficiency



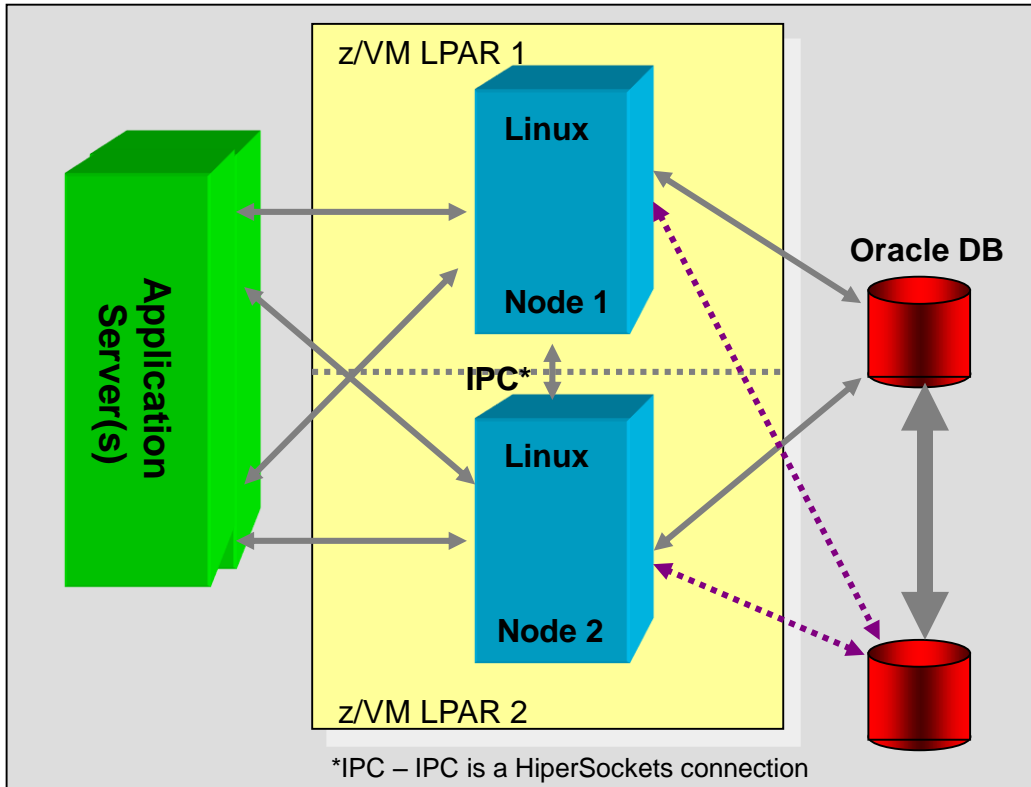
### IBM MicroLatency™



\* IBM internal test results with IBM FlashSystem 820 and FiconExpress4s

# Oracle HA with System z

## Oracle RAC



- Guards against Linux failure, LPAR failure, z/VM failure, Oracle instance failure, LPAR maintenance
- Can be: Active/active, active/passive
- Not limited to two nodes

### Server provided HA

Oracle

- RAC
- Data Guard
- Flashback
- CRS
- Grid Control

### Operating system HA

Linux

- Linux Clustering

z/VM

- Mature Hypervisor
- Hardware assist
- z/VM SSI/LGR

### Hardware provided HA

System z

- Spare CPUs
- N+1 power supplies
- Chip sparring in memory
- Concurrent maintenance
- 50 years MTBF (system fail.)

# Virtualization and Cloud Portfolio for Linux on z Systems and z/VM

## Virtualization

Infrastructure &  
Virtualization Management

### IBM z/VM 6.3

- Support more virtual servers than any other platform in a single footprint
- Integrated OpenStack support



### IBM Wave for z/VM

- A graphical interface tool that simplifies the management and administration of z/VM and Linux environments

*Differentiation*

## Entry Level Cloud

Standardization & Automation



### IBM Cloud Manager with OpenStack

- A simple, entry level cloud management stack
- Based on OpenStack
- Supports System z environments
- Formerly known as SmartCloud Entry

*Standardization*

## Advanced Cloud

Orchestration & Optimization



### IBM Cloud Orchestrator

- Builds on functionality of **IBM Cloud Manager with OpenStack** and adds runbook automation and middleware pattern support for workload deployment
- Based on OpenStack
- System z support as “managed-to”
- Formerly known as SmartCloud Orchestrator

*Service Lifecycle  
Management*

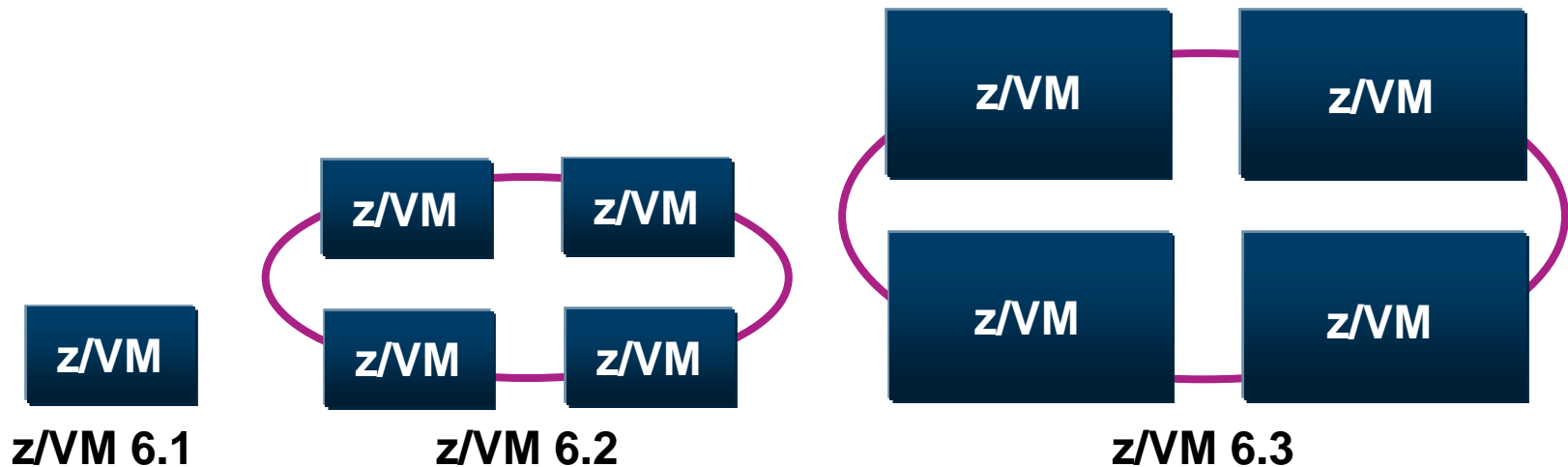
# z/VM Version 6 Release 3

## *Making Room to Grow Your Business*

### Continued Evolution

- Improved TCO
- Scaling and efficiency improvements
- Ease of usability

See <http://www.vm.ibm.com/zvm630/>

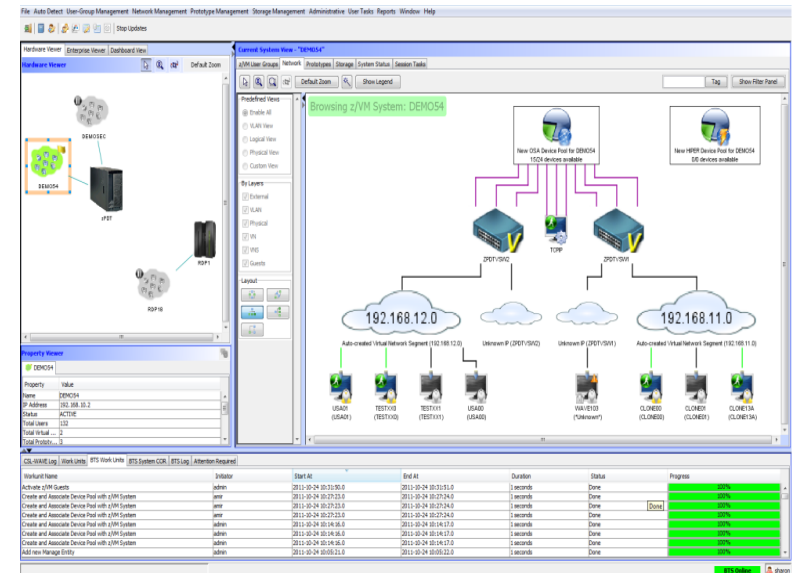




# IBM Wave for z/VM (IBM Wave)

**IBM Wave simplifies and helps automate management and administration of z/VM and Linux virtual servers, jumpstarting the steps needed to get to cloud. With its content rich interface IBM Wave extends the reach of your staff and lets you manage z/VM and Linux intuitively and cost effectively, reducing reliance on deep expert skills.**

- Monitors and manages virtual servers and resources from a single interface
- Simplifies and automates administration and management tasks
- Provisions virtual resources (Guests, Network, Storage)
- Supports advanced z/VM capabilities such as Single System Image and Live Guest Relocation
- Allows delegation of administrative capabilities to the appropriate teams



***A simple, intuitive graphical management, provisioning, and automation tool to help you fully leverage the power of System z virtualization on z/VM.***

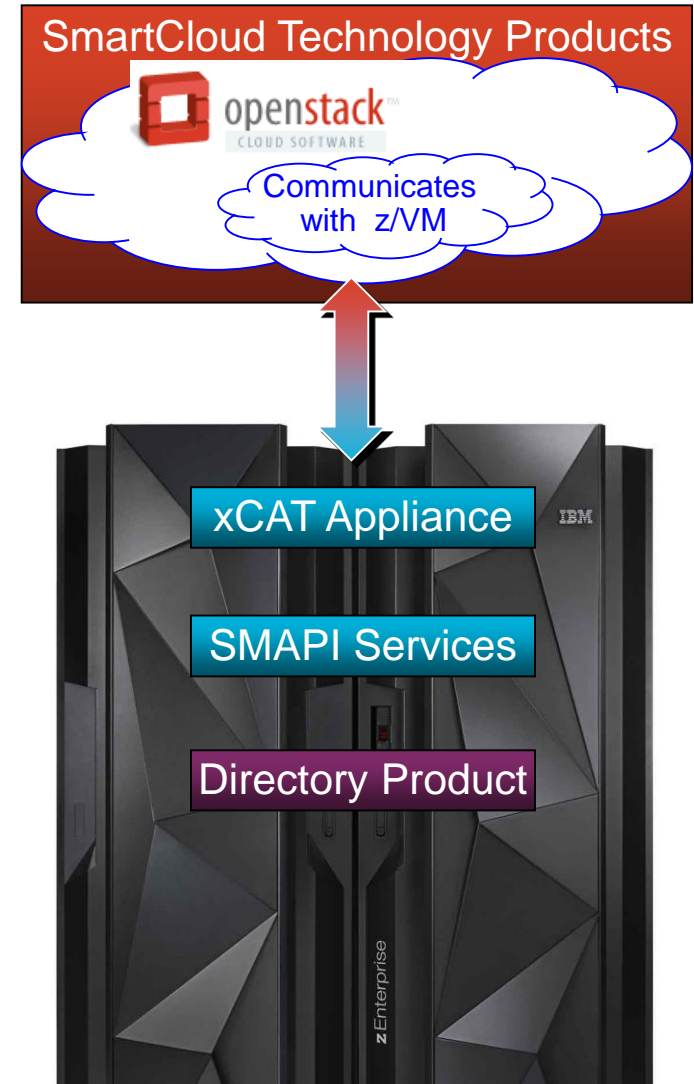
# IBM Cloud Manager with OpenStack

## Benefits:

- Full access to OpenStack APIs, backed with IBM support
- Cloud management solution that is easy to use
- Self service portal for workload provisioning and virtualized image management
- Heterogeneous support for IBM PowerVM®, z/VM, IBM PowerKVM and x86, and more
- Deploy, resize and capture
- Linux server backup and restore

*Requires z/VM 6.3 with appropriate service*

- *The xCAT Appliance utilizes new and existing Systems Management APIs (SMAPI) to interact with the z/VM system*



# IBM Enterprise Cloud System

*Trusted Cloud. Simply Delivered.*



## Open Linux Environment

- Red Hat/SUSE
- 3000+ Applications



## Fully Automated Cloud Orchestration & Monitoring



## Hypervisor and Virtualization Management



## Utility Pricing and MSP Flexible Financing



## Trusted, 24/7 IBM Support



## Award Winning Hardware Design



- Integrated
- Delivered in 30-45 Days
- Production Ready in Hours

- 99.99%+ Availability
- EAL4 Server Security
- Available June 20, 2014

# Open Source Priorities in 2015

## Databases-Messaging



GEMFIRE®



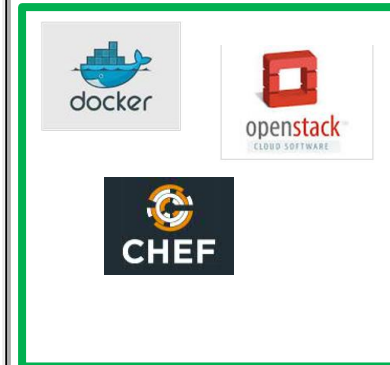
## Cluster Computing



## Dev Languages-Environments



## Cloud Infrastructure

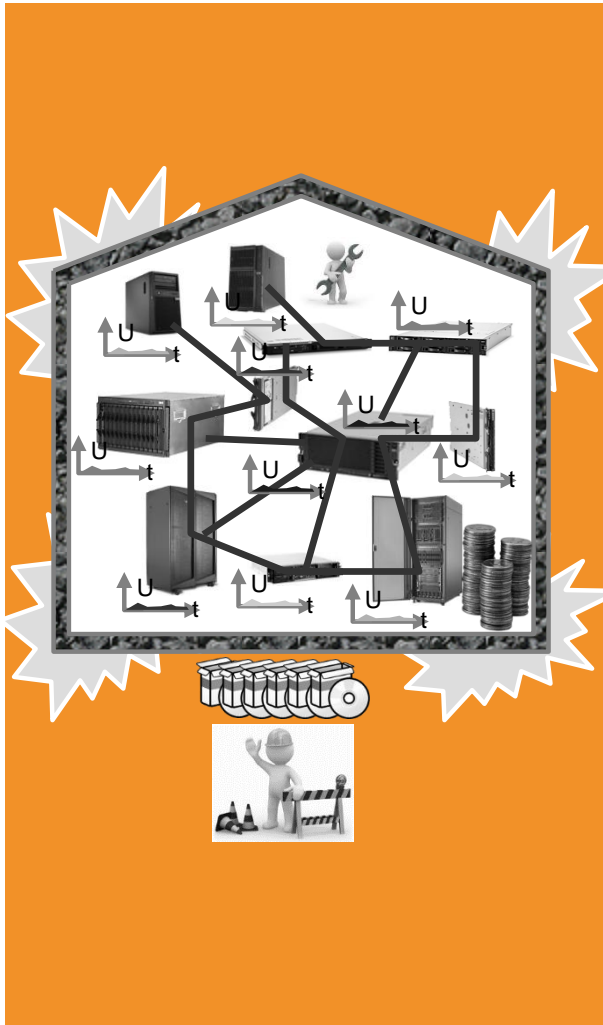


Green port/test done  
open source versions

Looking at various sources of input: e.g. BlueMix, Githubstats, feedback from: IBM client reps, direct client input e.g. zBLC, on going research

# IT Optimization with z Systems

## *Improved Effectiveness and Efficiency*




- ✓ Operational and management reduction
- ✓ Software acquisition and licensing cost reduction
- ✓ Maximizing utilization
- ✓ Network reduction
- ✓ Collocation of data and applications
- ✓ Floor-space and energy reduction
- ✓ Growth inside a server
- ✓ Improving security
- ✓ Disaster recovery cost reduction



# Linux on IBM z Systems

*The real alternative to x86 server sprawl*



A full room of servers **versus** One footprint with the size of a refrigerator

**Unmatched Linux capacity**

**It's easy and cost-effective.**

- Dundee City Council

**Great degree of flexibility and scalability.**

- Halkbank

**Quickly and cost-effectively deploy innovative services.**

- Banca Carige

**Maintenance and support effort reduced by at least 65%.**

- Algar Telecom

**Operates even when resources are at 100% utilization.**

- Bank of Tokyo-Mitsubishi UFJ

**Differentiates in level of service and quality of service.**

- L3C LLP

# Questions



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CICs*	HiperSockets	Parallel Sysplex*	Smarter Cities	z/OS*
ClearCase*	IMS	POWER*	SPSS*	z/VM*
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