**Siegfried Langer**

**Business Development Manager z/VSE and Linux on System z**

**IBM Germany Research & Development**

IBM

# ISY0457
# IT Optimization
# with the Enterprise Linux Server

2015
IBM z Systems
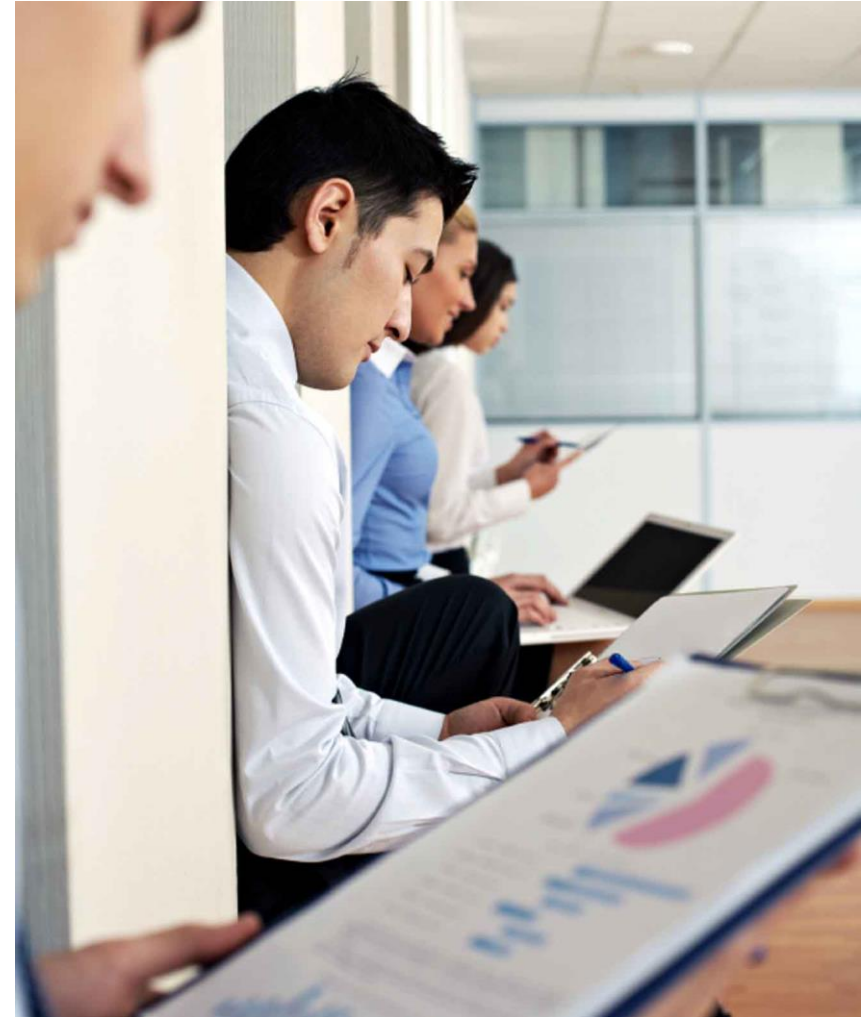Technical University

18-22 May | Dublin, Ireland
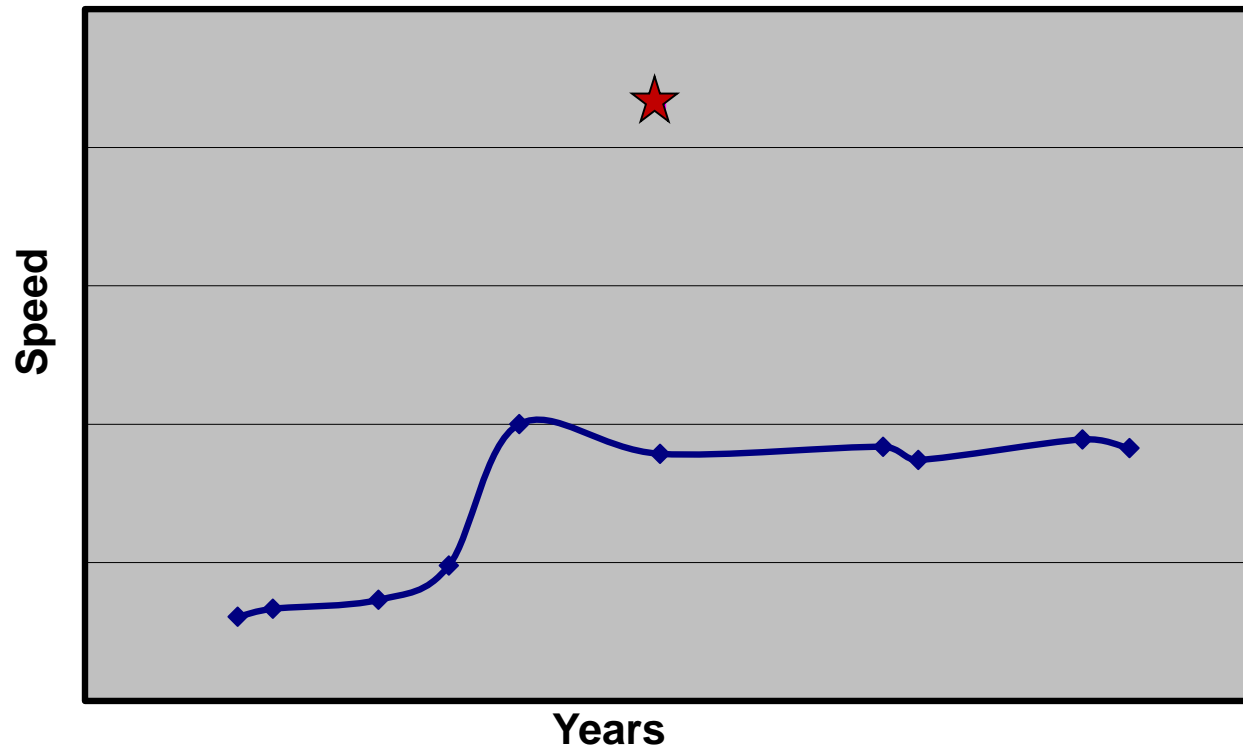
9.0

# Agenda

- **Infrastructure optimization**

  - ➢ *Cost and business value*

- **Linux on z Systems is Linux**

  - ➢ *What makes it different*

- **Application examples**

  - ➢ *Typical workloads*

## Commercial Aircraft Cruise Speed



**Improvements:**
- Capacity
- Efficiency
- Safety
- Environment
- Comfort
- …
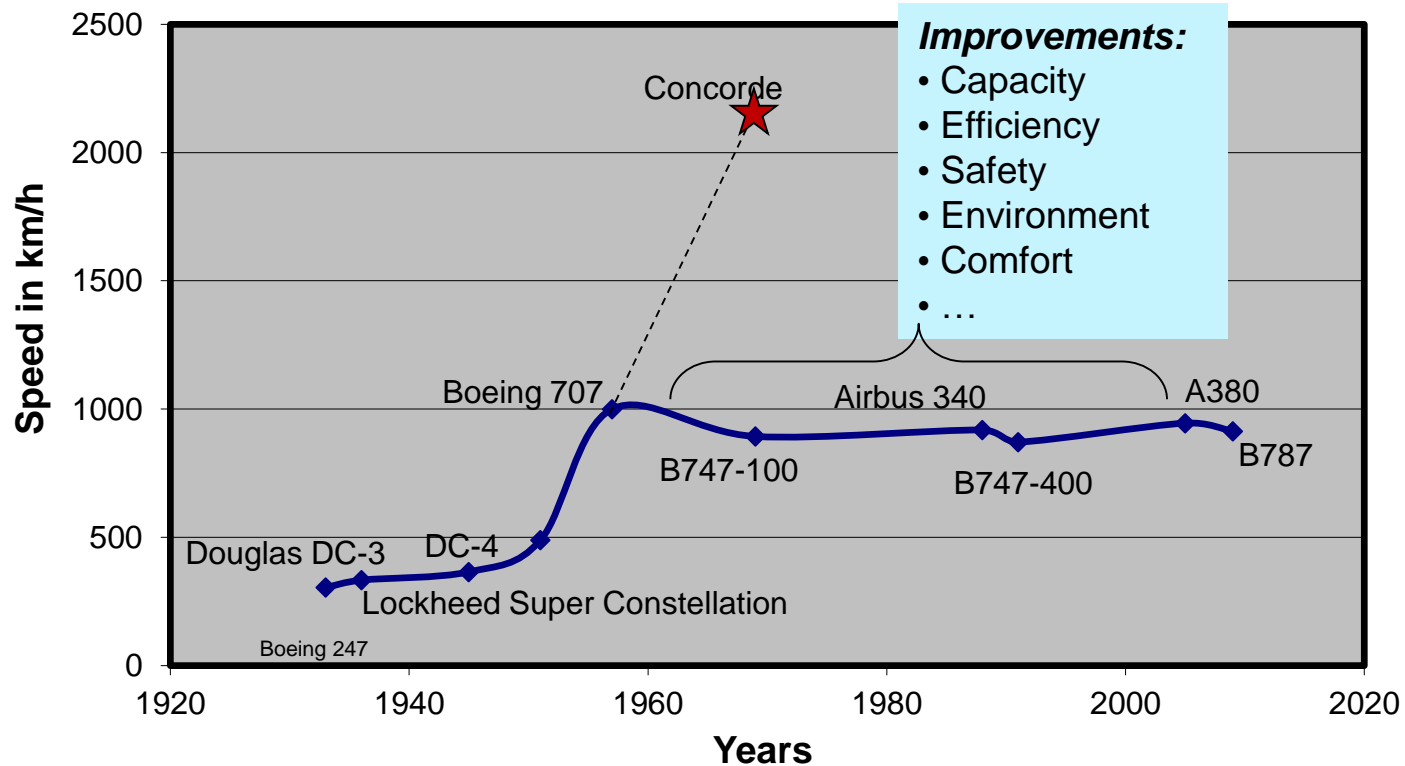
# Fit for Purpose



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*

# Enterprise Linux Server (ELS)

alias

- **Large highly-scalable enterprise class server** running Linux

- Linux on z Systems server

- Solution Edition for Linux on z Systems

- zEnterprise and Linux on z Systems

- Linux on a highly virtualized server based on z Systems architecture

- Linux on the mainframe
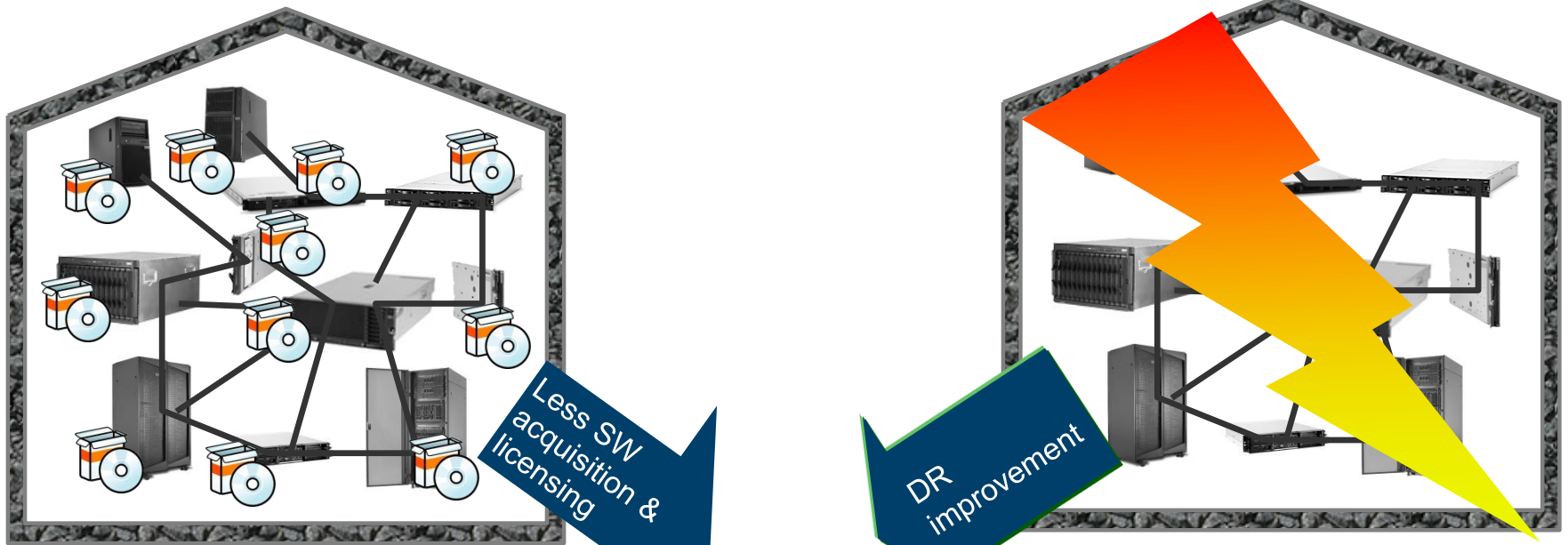
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- 

**z13**

**zBC 12**

# The Difference of Deployment on System z

*Examples: Software Costs and Disaster Recovery*

Less SW acquisition & licensing

DR improvement

**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 | | | |
|---|---|---|---|
| **Availability**<br><br>• High availability<br>• Hours of operation | **Additional development and implementation**<br><br>• Investment for one platform – reproduction for others | **Security**<br><br>• Authentication and authorization<br>• User administration<br>• Data security<br>• Server and OS security<br>• RACF versus other solutions | **Controlling and accounting**<br><br>• System analysis<br>• Cost |
| **Backup/restore/site recovery**<br><br>• Backup<br>• Disaster scenario<br>• Restore<br>• Effort for complete site recovery<br>• Storage area network (SAN) effort | **Operations**<br><br>• Monitoring and operating<br>• Problem determination<br>• Server management tools<br>• Enterprise-wide integrated server management | **Operating concept**<br><br>• Development of an operating procedure<br>• Feasibility of the developed operating procedure<br>• Automation | **Integration**<br><br>• Integrated functionality versus functionality to be implemented (possibly with third-party tools)<br>• Balanced system<br>• Integration of and into standards |
| **Infrastructure**<br><br>• Space<br>• Power<br>• Network infrastructure<br>• Storage infrastructure<br>• Initial hardware costs<br>• Software costs<br>• Maintenance costs | **Resource utilization and performance**<br><br>• Mixed workload/batch<br>• Resource sharing: shared nothing versus shared everything<br>• Parallel Sysplex versus other concepts<br>• Response time<br>• Performance management<br>• Peak handling and scalability<br><br>**Skills and resources**<br><br>• Personnel education<br>• Availability of resources | **Deployment and support**<br><br>• System programming<br>  o Consistent OS and software levels<br>  o Database effort<br>• Middleware<br>  o Software maintenance<br>  o Software distribution across firewalls<br>• Application<br>  o Technology upgrade<br>  o System release change without interrupts | **Further availability aspects**<br><br>• Planned outages<br>• Unplanned outages<br>• Automated takeover<br>• Uninterrupted takeover (especially for databases)<br>• Workload management across physical borders<br>• Business continuity<br>• Availability effects for other applications or projects<br>• End user service<br>• End user productivity<br>• Virtualization |

# Linux is Linux,

but are all Linux infrastructure solutions identical?
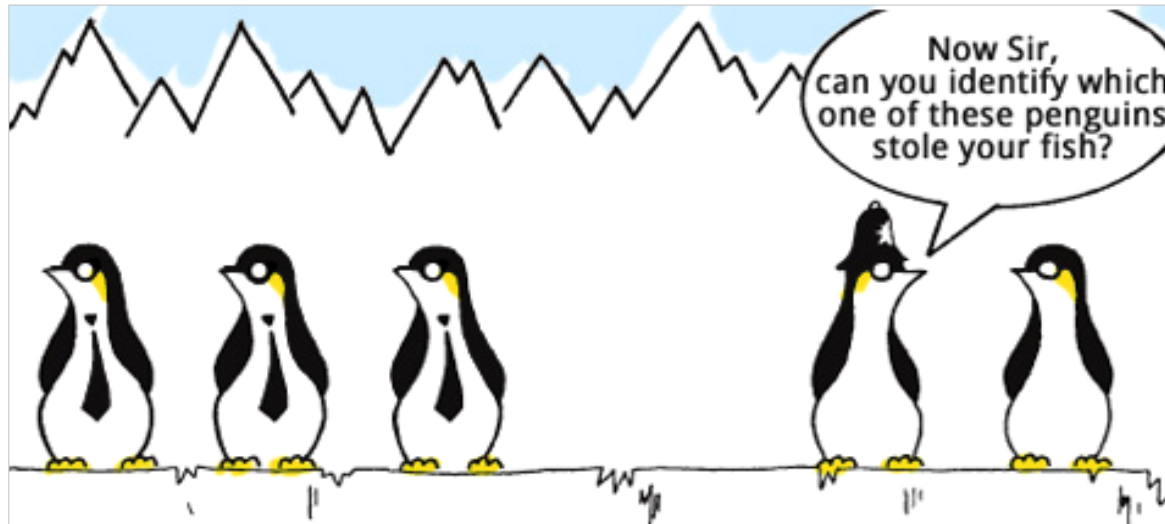


**No**, while Linux is Linux, the underlying infrastructure (hardware and infrastructure software) directly affects the Linux workloads.

# Enterprise grade Linux solution

While „Linux is Linux", the underlying platform is providing differentiation of the Linux solutions.

An "enterprise grade Linux" solution, in our understanding, has defined characteristics:

- **IT simplicity, allowing to run up to hundreds of different workloads in parallel on one server**

- **Easy workload integration of new and existing data and applications**

- **Flexible server provisioning, simple to manage**

- **High productivity, based on efficient systems and life cycle management**

- **Highest resource utilization levels**

- **High levels of quality of service – security, availability, reliability**

"*Enterprise-grade isn't just about specific features, rather it is about delivering a strategy that enables a consistent architectural model with the support and service necessary for [the] … complex environment that organizations find themselves in.*" - Ben Kepes, contributor to Forbes
www.forbes.com/sites/benkepes/2013/12/18/what-does-enterprise-grade-really-mean

# Why Linux on System z

- **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**.

enterprisesystemsmedia.com/article/optimized-computing-nationwides-linux-on-system-z-virtualization-reduces-tc

*"Our goal was server optimization and our approach was virtualization."*

— Guru Vasudeva, Nationwide vice president and CTO

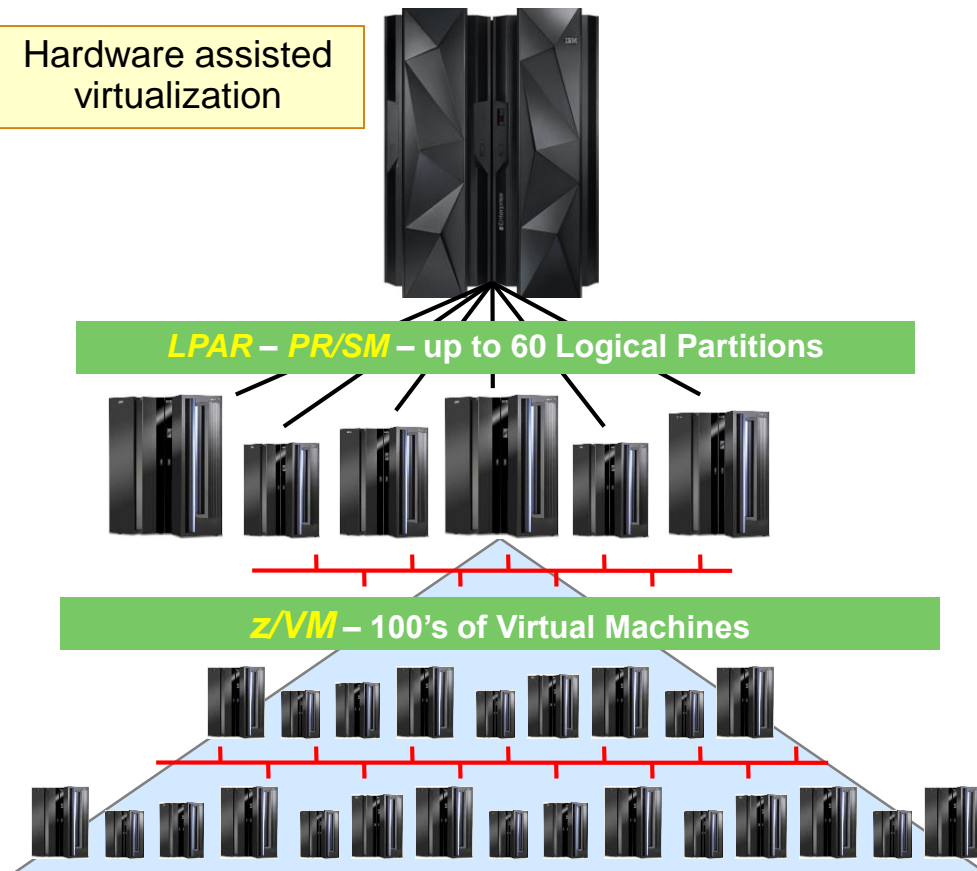# z Systems – Extreme Virtualisation
## *Build-in and Shared Everything Architecture*

Hardware assisted virtualization

**LPAR** – **PR/SM** – up to 60 Logical Partitions
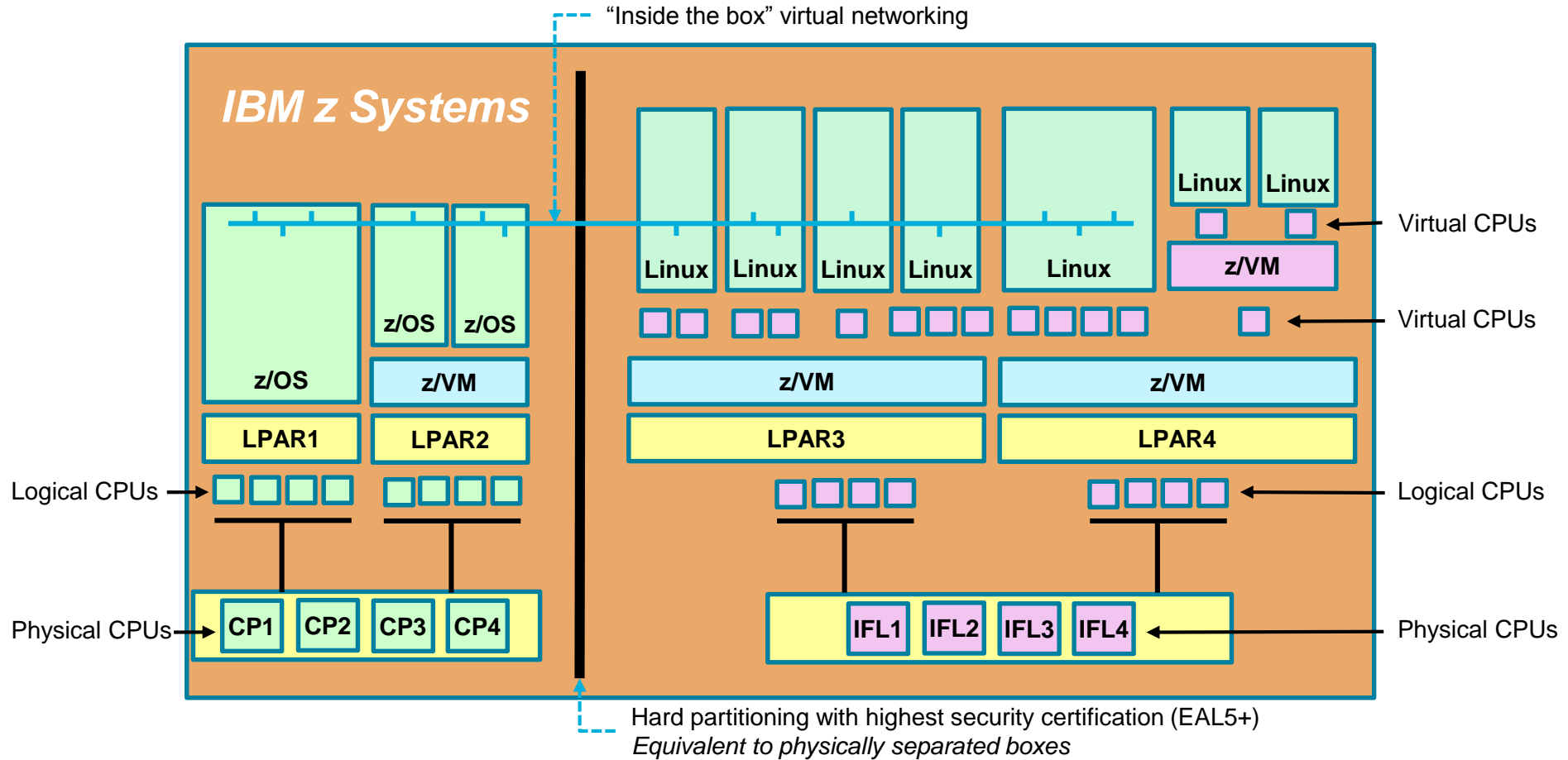
**z/VM** – 100's of Virtual Machines

## 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)
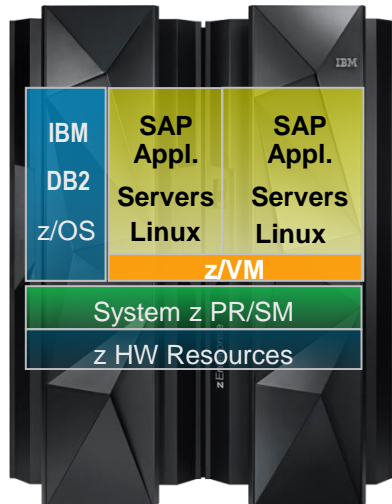
## Distributed platforms

- 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



"Inside the box" virtual networking

IBM z Systems

Linux   Linux

Virtual CPUs

Linux   Linux   Linux   Linux   Linux        z/VM

z/OS    z/OS

Virtual CPUs

z/OS     z/VM                z/VM              z/VM

LPAR1    LPAR2              LPAR3            LPAR4

Logical CPUs                                              Logical CPUs

Physical CPUs    CP1  CP2  CP3  CP4        IFL1  IFL2  IFL3  IFL4    Physical CPUs

Hard partitioning with highest security certification (EAL5+)
*Equivalent to physically separated boxes*

# 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
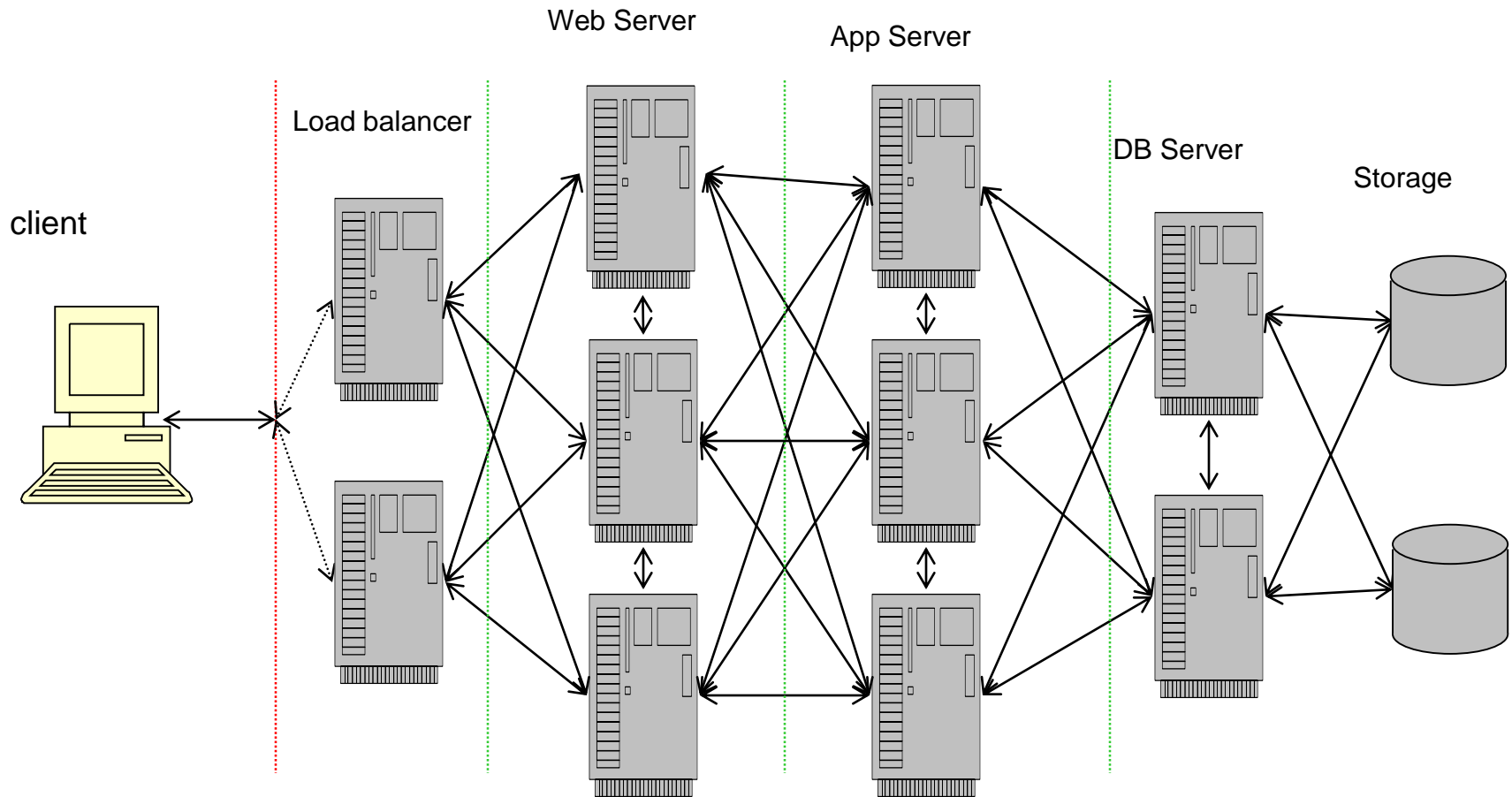- Scale-up and scale-out capabilities
- Fabulous performance throughout

| Embasa - Brazil | Endress+Hauser – Germany |
|---|---|
| • **Manages one of the largest water treatment services** | • **Specialist in measurement technology; 89 companies across 42 countries** |
| • **Needed a high-performance, cost-effective way to introduce SAP software while continuing with the tried and trusted database solution** | • **Detailed cost-benefit analysis compared Linux on System z to Power/x86 servers. z/OS, z/VM and a total of 80 IFLs** |
| • **Commercially attractive "Solution Edition" gave confidence to go ahead** | • **Simple and intuitive user management tools make it possible for just 1.5 FTEs to administer the entire Linux landscape** |

15

# 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**

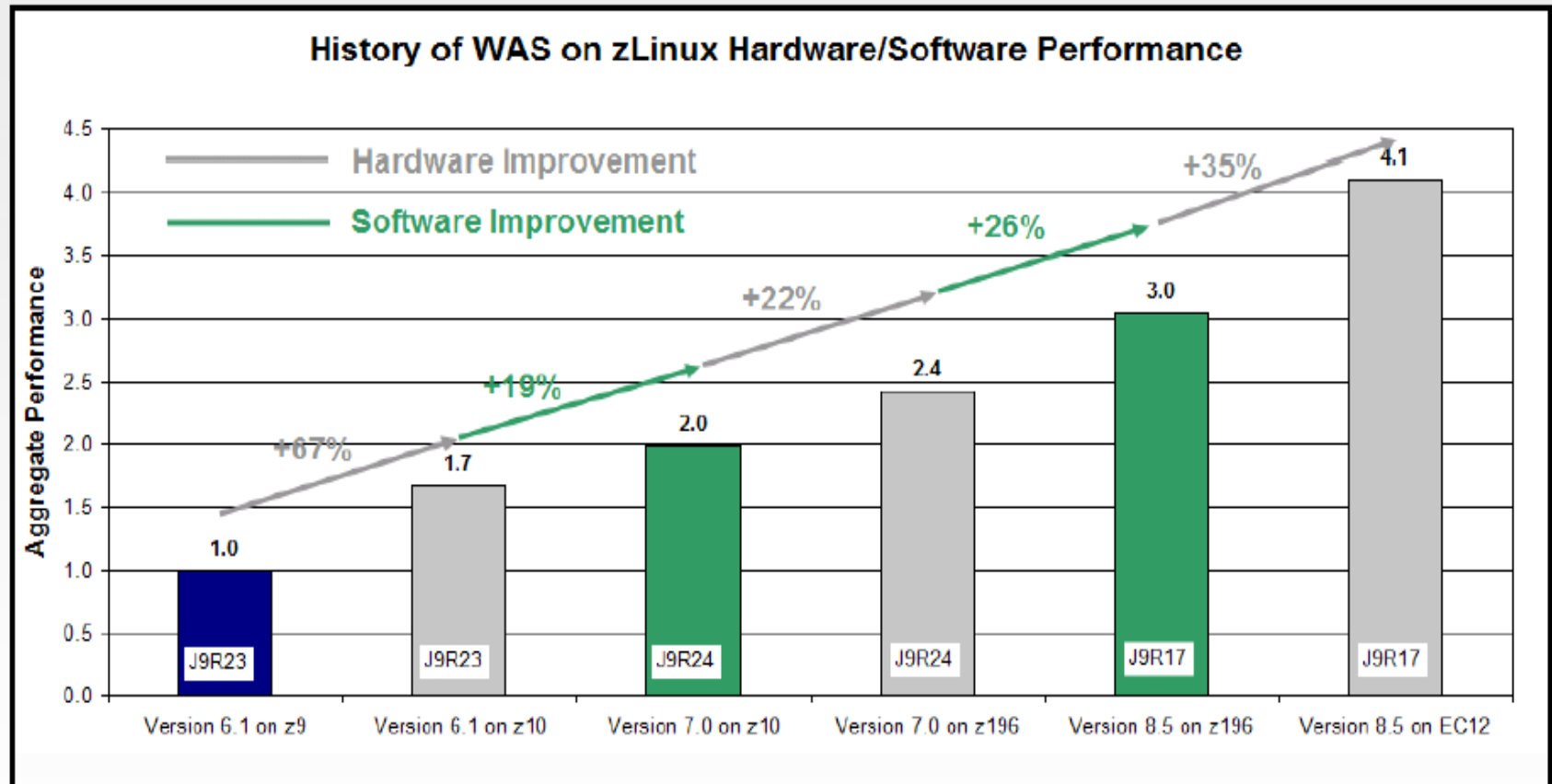Backbone

**Just 10 Cables!**
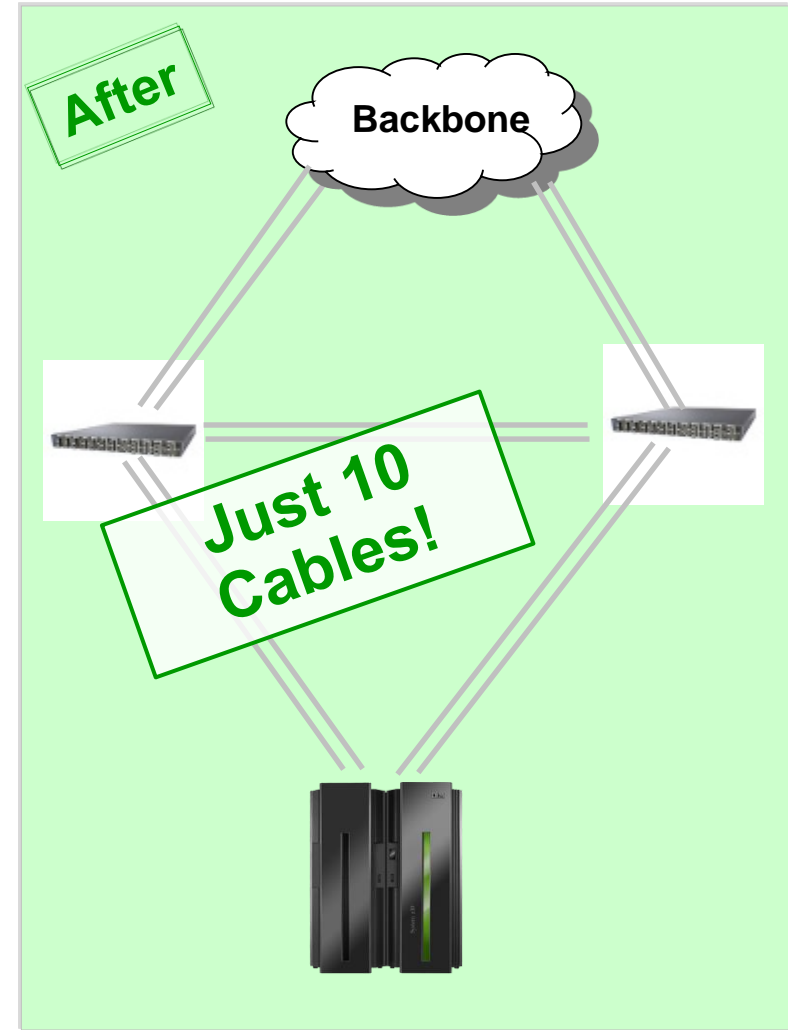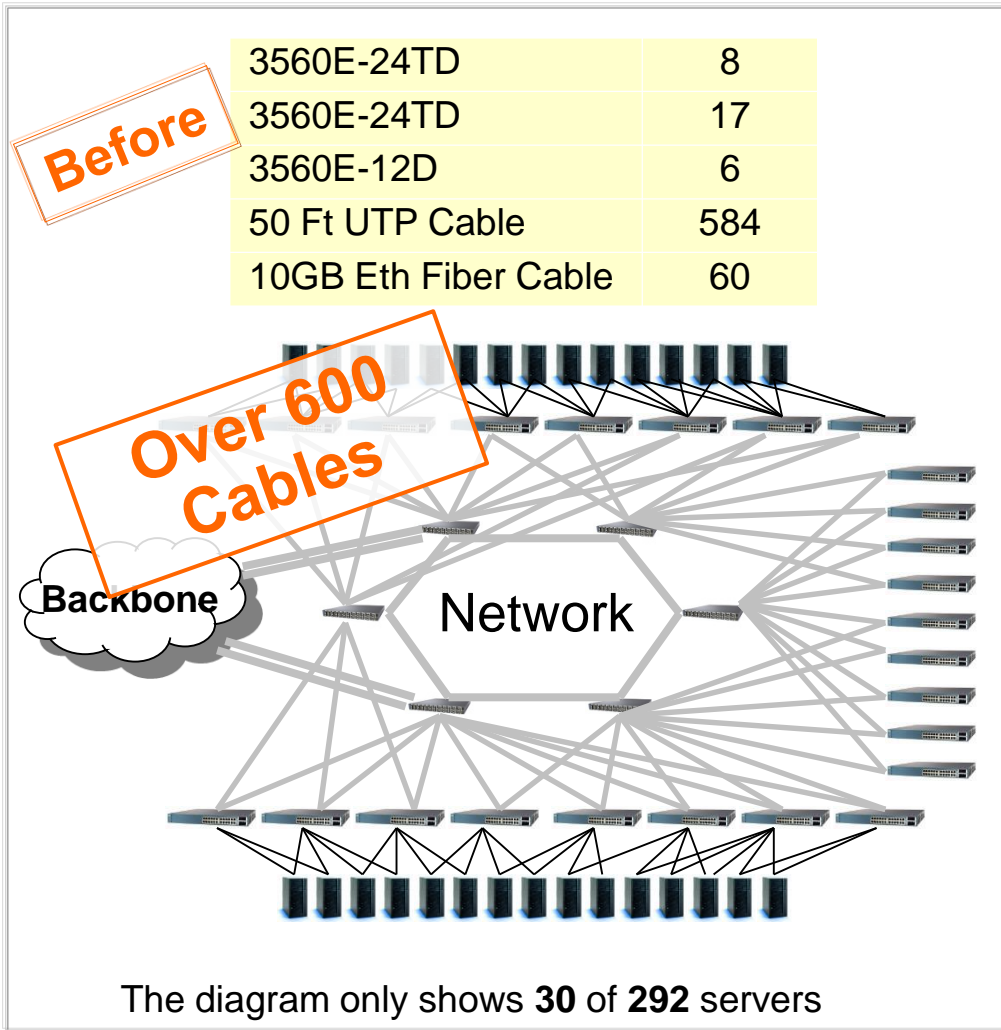
# WebSphere Application Server (WAS) on Linux on z Systems

4x aggregate HW, SDK and WAS improvement:
    WAS 6.1 (Java 5) on z9 to WAS 8.5 (Java 7) on zEC12



### History of WAS on zLinux Hardware/Software Performance

WAS 8.5.5.5 with SSL (clear key)
z/OS - 1 CP and 4 zIIPs
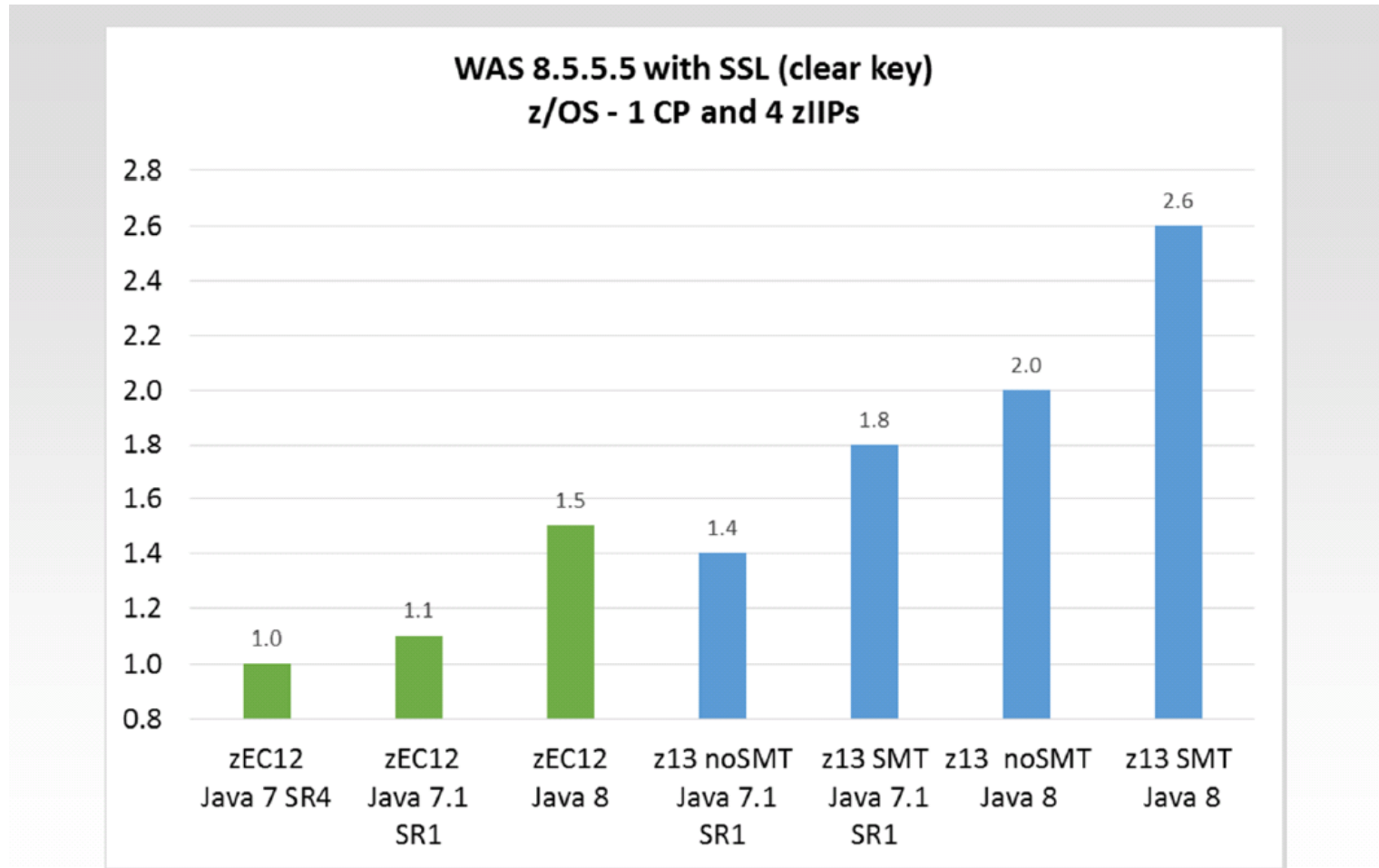
**2.6x improvement in throughput with IBM Java 8 and IBM z13**

(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."*

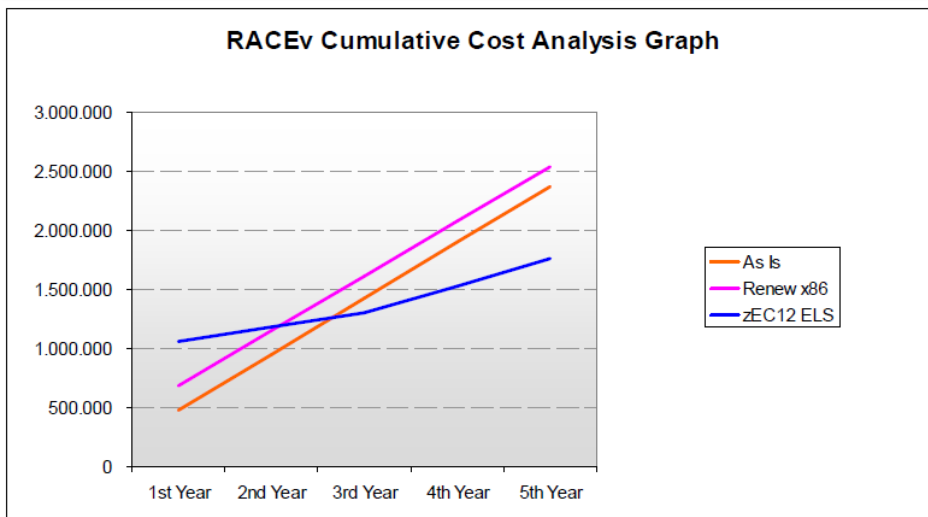*—Paulo Nassar, IT Processing and Storage Infrastructure Manager, Sicoob*

### Solution components:

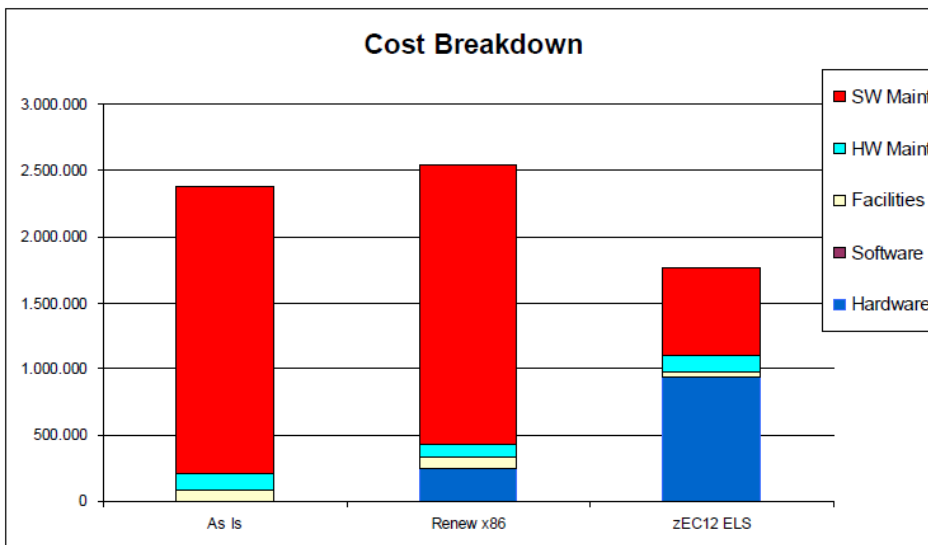- IBM® DB2® for Linux on System z®
- IBM Cognos® for Linux on System z

**SICOOB**

ZSP03735-USEN-00

# Database consolidation example



RACEv Cumulative Cost Analysis Graph

Legend: As Is, Renew x86, zEC12 ELS



Cost Breakdown

Legend: SW Maint, HW Maint, Facilities, Software, Hardware

Categories: As Is, Renew x86, zEC12 ELS

**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

**New z13 ELS (Enterprise Linux Server) with**
- 6 IFLs
- z/VM hypervisor
- 50 Linux servers
- Oracle DB Enterprise Edition

*...plus further savings on system admin, floor space, network, etc.*

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

Sizing information based on IBM internal RACEv tool and US prices. Actual results may vary.

# 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*
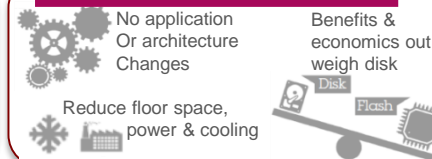
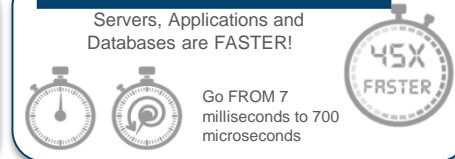## Why IBM FlashSystem for Linux on System z?

### Extreme Performance
**Cut IO** Wait Time **80%+**
Latency Under 100 Microseconds
**3X increase** IOPS

### Enterprise Reliability
Highest Reliability levels
Storage
Purposed-built, Enterprise Architecture

### Macro Efficiency
No application Or architecture Changes
Benefits & economics out weigh disk
Reduce floor space, power & cooling
Disk
Flash

### IBM MicroLatency™
Servers, Applications and Databases are FASTER!
45X FASTER
Go FROM 7 milliseconds to 700 microseconds

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

# Oracle HA with System z

## Oracle RAC



z/VM LPAR 1

**Linux**

**Node 1**

**Linux**

**Node 2**

z/VM LPAR 2

IPC*

**Application Server(s)**

**Oracle DB**

*IPC – IPC is a HiperSockets connection

*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.)

- 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

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

| Virtualization | Entry Level Cloud | Advanced Cloud |
| --- | --- | --- |
| **Infrastructure & Virtualization Management** | **Standardization & Automation** | **Orchestration & Optimization** |

## 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*

---

openstack™

## 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*

---

openstack™

## 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*

## Continued Evolution
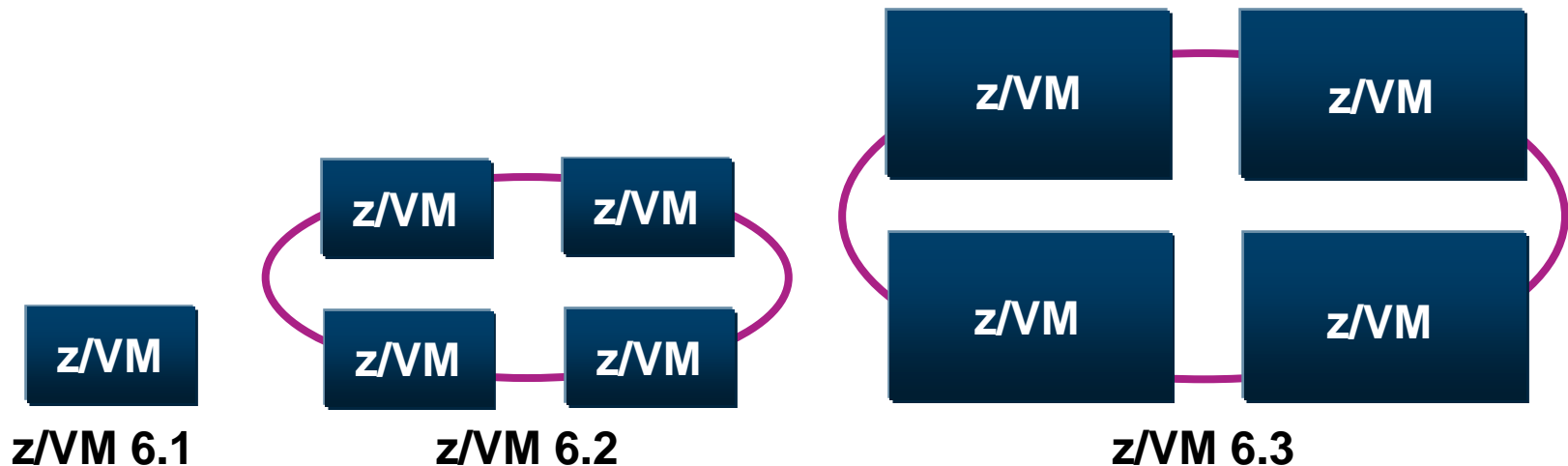
- Improved TCO
- Scaling and efficiency improvements
- Ease of usability

See http://www.vm.**ibm.com**/zvm630/

| 2013 | 2014 | |
|------|------|---|

**z/VM 6.1**    **z/VM 6.2**    **z/VM 6.3**

# 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
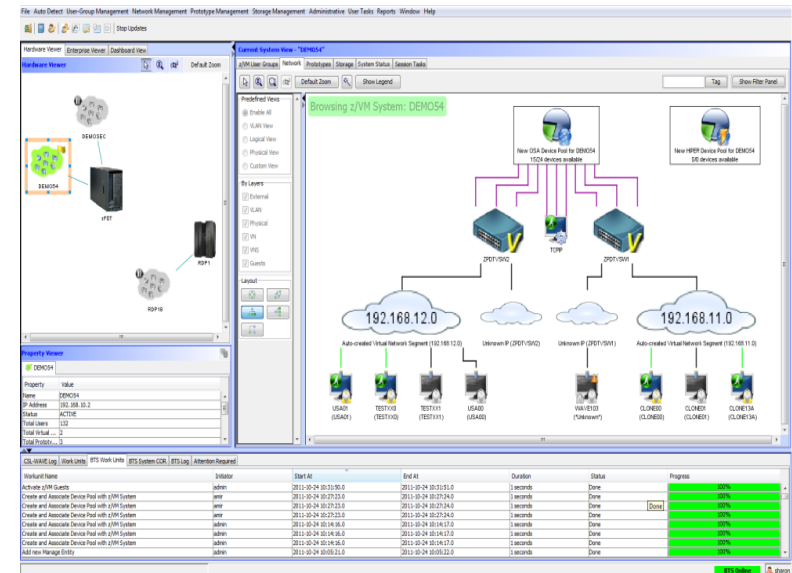


*A simple, intuitive graphical management, provisioning, and automation tool to help you fully leverage the power of System z virtualization on z/VM.*
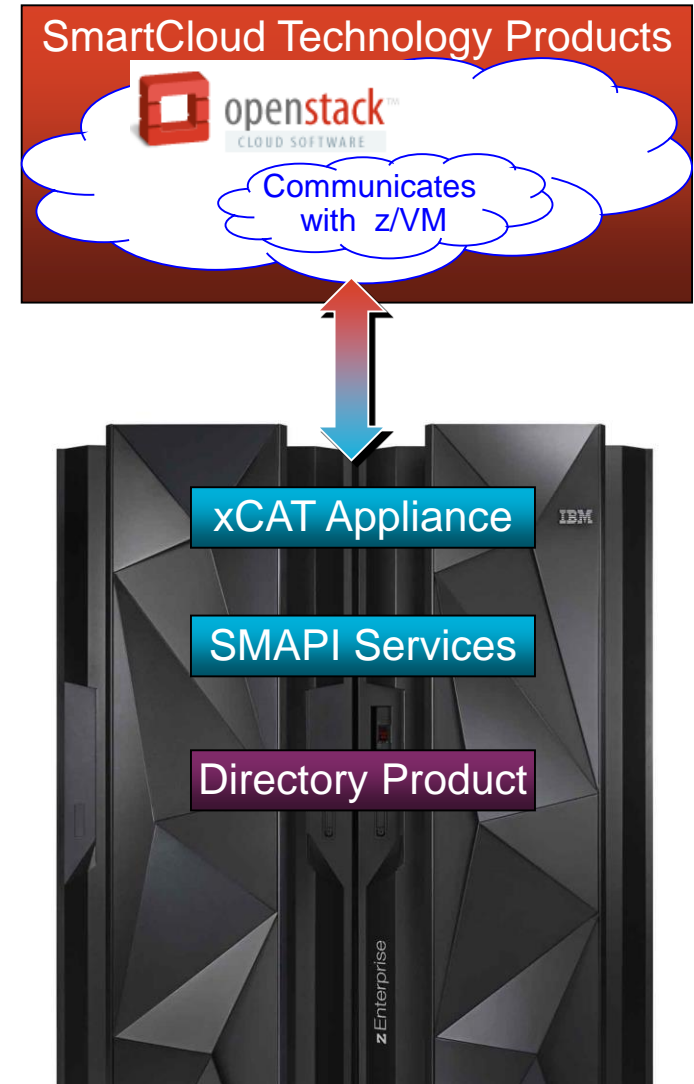
# IBM Cloud Manager with OpenStack

**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*

SmartCloud Technology Products

openstack
CLOUD SOFTWARE

Communicates with z/VM

xCAT Appliance

SMAPI Services

Directory Product

# IBM Enterprise Cloud System
## Trusted Cloud. Simply Delivered.

**Open Linux Environment**
- *Red Hat/SUSE*
- *3000+ Applications*

**Fully Automated Cloud Orchestration & Monitoring**

openstack™

**Hypervisor and Virtualization Management**

IBM Storage

**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
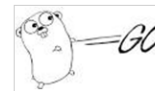
**Databases-Messaging**

**Dev Languages-Environments**

**Cloud Infrastructure**

PostgreSQL  mongoDB

apache CouchDB relax

RabbitMQ  MariaDB

**GEMFIRE**

Cloudant

node.js

Ruby  OCaml Interpreter  Erlang

GCCGO  python

OCaml Compiler

R  GO

php

**Cluster Computing**

Spark

docker  openstack CLOUD SOFTWARE

CHEF
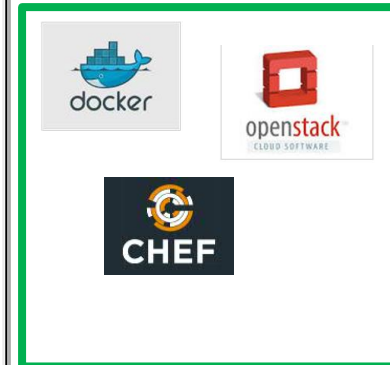
puppet labs

CLOUD FOUNDRY

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

→ *Session lIM2734 - Thursday 13:45 – 14:45, Munster:*
Linux on z Systems and Its Participation in the Open Source Ecosystem

# IT Optimization with z Systems
## *Improved Effectiveness and Efficiency*
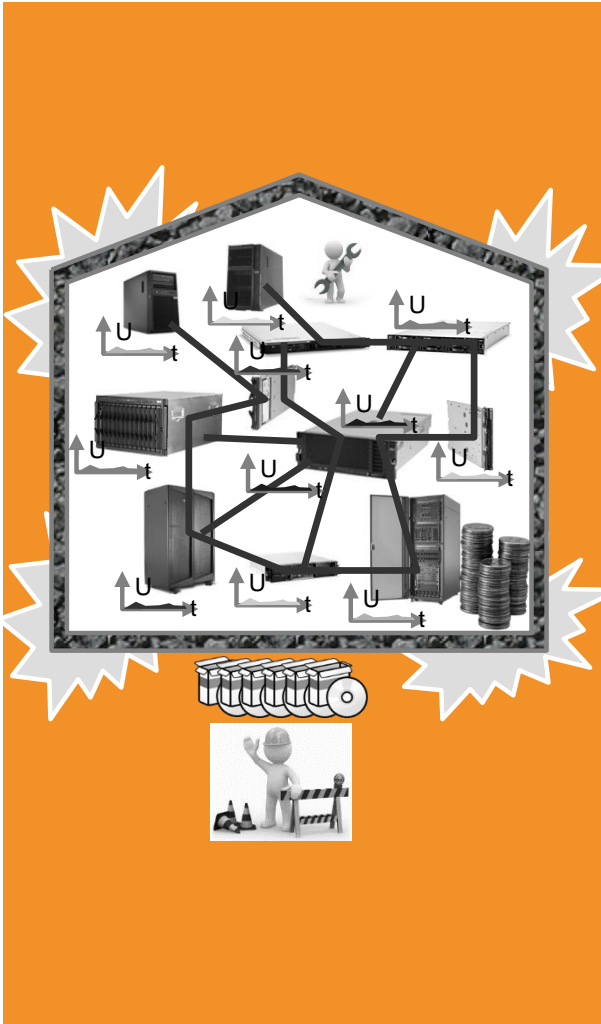


- ✓ **Operational and management reduction**

- ✓ **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**

**Siegfried Langer**
*Business Development Manager*
*z/VSE & Linux on System z*

**IBM**

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*& Development GmbH*
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*Phone:  +49 7031 - 16 4228*

*Siegfried.Langer@de.ibm.com*

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  - Use IBM Training Search to locate public training classes near to you with our five Global Training Providers
  - Private training is also available with our Global Training Providers

- Demanding a high standard of quality – **view the paths to success**
  - Browse Training Paths and Certifications to find the course that is right for you

- If you can't find the **training that is right for you** with our Global Training Providers, we can help.
  - Contact IBM Training at dpmc@us.ibm.com

**Global Skills Initiative**