Discover the Linux on IBM zEnterprise Effect

The Server that Never Sleeps so You Can

Speaker Name and Title

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The Server that Never Sleeps so You Can

- **In the past, we had an infrastructure that involved many, many servers.**

- Due to technical limitations, the servers didn't allow us really high availability.

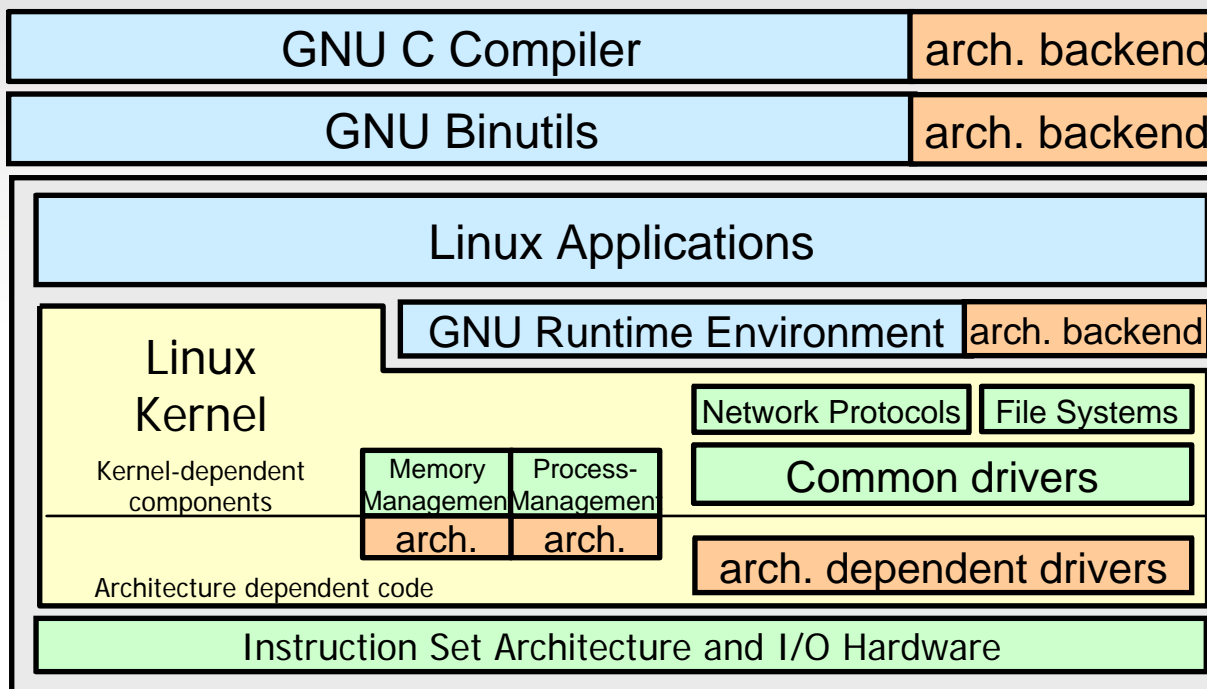- My phone rang all the time. I had to sleep with my phone next to me.

Marcos Vinicius
Manager, Technology Infrastructure
Sicoob

We have a pretty interesting story that actually involves my wife.

- **The mainframe arrived. We transferred the processing to the mainframe.**

- And out of nowhere my wife ask me, „What happened? The phone doesn't ring in the middle of the night anymore. What happened?"

- So I explained the technological changes, the architectual changes.

- My wife give me a big smile and said „I want to meet this mainframe. I love the mainframe."

Marcos Vinicius

Manager Technology Infrastructure at Siccob

Structure of Linux on System z

GNU C Compiler	arch. backend
GNU Binutils	arch. backend

Linux Applications

GNU Runtime Environment — arch. backend

Linux Kernel

Kernel-dependent components

| Network Protocols | File Systems |

Memory Management	Process-Management
arch.	arch.

Common drivers

arch. dependent drivers

Architecture dependent code

Instruction Set Architecture and I/O Hardware

While 🐧 looks the same on different platforms,

every 🐧 shows **different** personalities, **qualities**, **features** and **options** derived from the platform architectures.

Linux on IBM System z in 3Q2013
*Installed Linux Compute Power at 49% CAGR**

- 25.8% of Total installed compute power on System z runs Linux

- Installed Linux compute power increased 44% from 3Q12 to 3Q13

- 38% of System z Customers have Linux cores installed

- 81 of the top 100 System z customers are running Linux on System z**

- 58% of new System z Accounts run Linux

Installed Linux Compute Power Over Time

Bar chart x-axis labels: YE04 YE05 YE06 YE07 YE08 YE09 YE10 YE11 YE12 3Q13
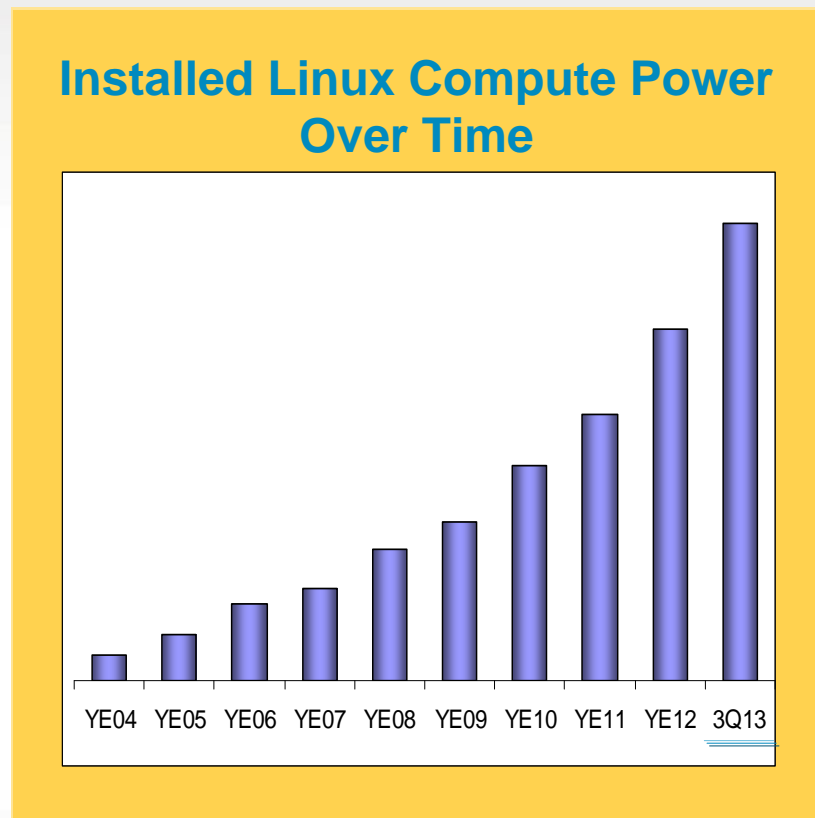
* Based on YE 2003 to 3Q2013
**Top 100 is based on total installed compute power

Success based on Client Values
IT challenges addressed with IT Optimization on System z

IT Challenges

- IT budget

- Take care on expected growth

- Security and availability - 24x7 operations

- Automation and monitoring

- Flexible deployment for software

- Virtualization of everything

- Social and environmental responsibilities

- IT capabilities to deliver on the business strategy

Reliability, Availability, Security, Scalability, Supportability, Serviceability & Standardization

What is Different About System z
Collocation of data and applications and Disaster Recovery

Distributed IT environment

Collocation of data and applications

Disaster Recovery improvement

Distributed IT environment

Improved Performance and Efficiency.

Collocation reduces **operational complexity,** allowing for the **reuse of skills and infrastructure** in the form of **processes, tools, and procedures.**

Coordinated availability and DR solution for applications and databases.

What is Different About System z
Security & Operational Efficiency and Inside-Growth

Distributed IT environment

Improved Security and Operational Efficiency

Inside-Growth Horizontal & vertical scalability

Distributed IT environment

Less servers, cables, switches result in less operational effort and less intrusion points.

System z virtualization capabilities provide mature and sophisticated technologies.

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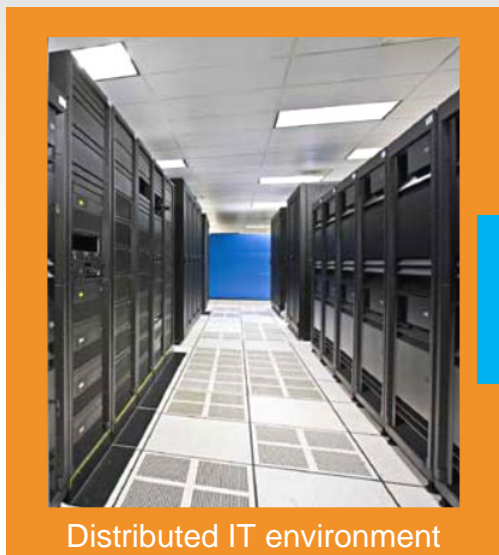# CSL-WAVE Virtualization Management
Intelligent Visualization – Simplified Monitoring –
Unified Management

- **Monitors and manages virtual servers and resources** from a single graphical interface

- **Simplifies and Automates** tasks

- **Provisions virtual resources** (Guests, Network, Storage)

- **Supports advanced z/VM capabilities** such as Single System Image and Live Guest Relocation

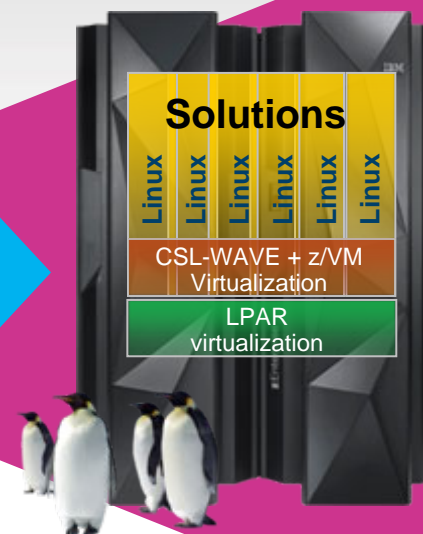- **Allows delegation of administrative capabilities** to the appropriate teams

Drives simplicity into managing highly virtualized environments while taking the first critical steps toward cloud.

IT Optimization with System z

Distributed IT environment

Improved efficiency and economics

Solutions

Linux Linux Linux Linux Linux Linux

CSL-WAVE + z/VM Virtualization

LPAR virtualization

- **Operational and management reduction**
- **Software licensing cost reduction**
- **Network reduction**
- **Improving security**
- **Collocation of data and applications**
- **Floor-space and energy reduction**
- **Growth inside a server**
- **Maximized hardware utilization**
- **Disaster recovery cost reduction and simplicity**

IBM CIO zEnterprise Landscape

- eMail >365K users
- w3.ibm.com
- Blue Harmony
- >50% top Critical apps on z/OS 15% on Linux on z
- IBM Connections
- Cognos Cloud
- Software / Redbook Downloads
- ~50 System z Machines
- >400 z/OS Instances >200 VM Instances
- >2200 Linux guests on System z
- IDAA for DB2 Crypto for SSL
- YE 2014 100% on z196/zEC12
- IFL's for Linux zIIPs for DB2 ICF's for CF

…supporting the Globally Integrated Enterprise

IBM System z is open for all Solutions
Capitalize from transformative technologies

- **Data services**
- **Business applications**
- **Mobile applications**
- **Security & Infrastructure services**
- **Email & collaboration services**
- **Business Process Management**
- **Enterprise Content Management**
- **Development & test**
- **Industry Solutions**
- **All managed in a Cloud**

Cloud ready

Data ready
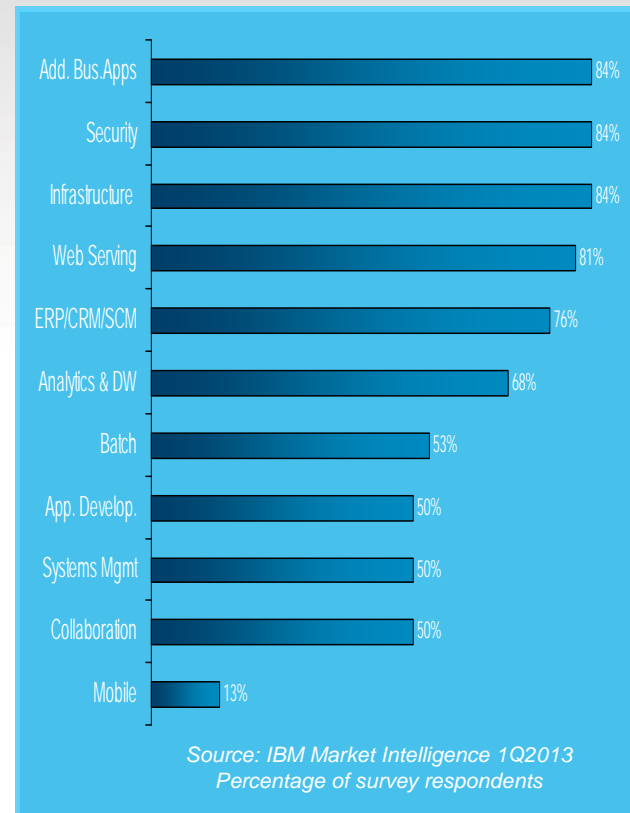
Mobile ready

Security ready
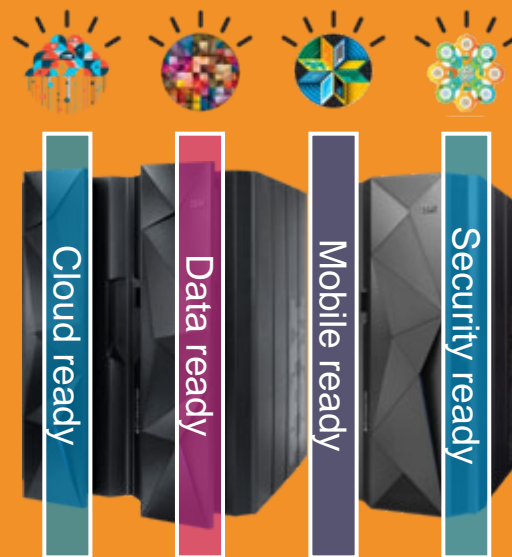
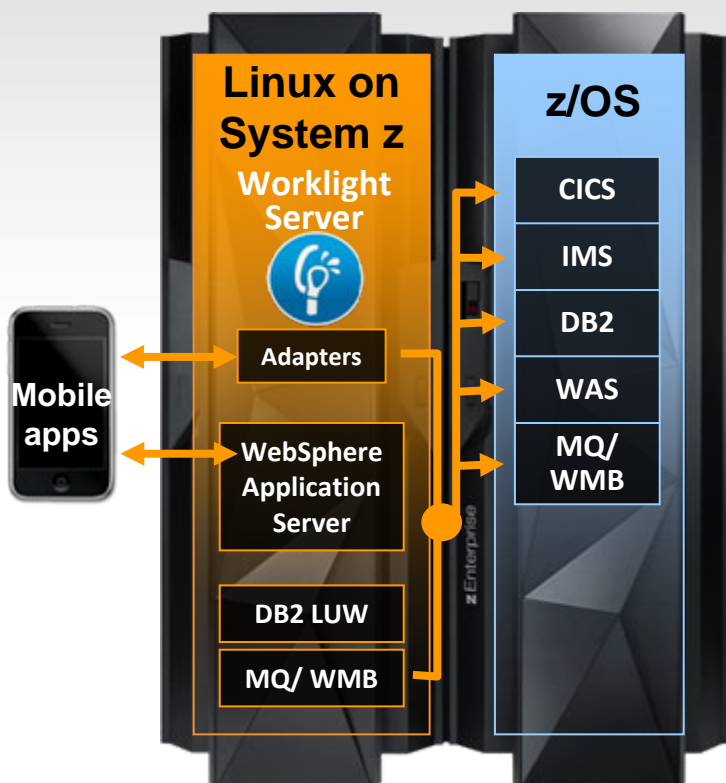**Linux on IBM zEnterprise®**
and
IBM Enterprise Linux Server

The efficient and economic infrastruture for consolidation and solution deployment

Recommended Workloads for Linux on System z

✓ **Data services**: DB2, Cognos, SPSS, InfoSphere™, Informix, Oracle Database, Builders WebFOCUS, …

✓ **Business applications**: WebSphere Application Server, WebSphere Process Server, WebSphere Commerce, SAP apps, Oracle apps, Java™, …

✓ **Mobile application hosting**: WebSphere Portal, IBM Worklight®, …

✓ **Security & Infrastructure services**: WebSphere MQSeries®, WebSphere Message Broker, WebSphere Enterprise Service Bus, DB2 Connect™, …

✓ **Email & collaboration**: Lotus Domino®, Lotus Collaboration: Sametime, Connections, Quickr™, Forms, …

✓ **Business Process Management**: Business Process Manager, WebSphere Business Monitor, FileNet® Business Process Manager, WebSphere Operational Decision Management, …

✓ **Enterprise Content Management**: FileNet Content Manager, Content Manager, Content Manager On Demand

✓ **Development & test**: e.g. of WebSphere/Java applications – Rational® Asset Manager, Build Forge®, ClearCase®, Quality Manager, UrbanCode

(Bar chart)

Category	Percentage
Add. Bus.Apps	84%
Security	84%
Infrastructure	84%
Web Serving	81%
ERP/CRM/SCM	76%
Analytics & DW	68%
Batch	53%
App. Develop.	50%
Systems Mgmt	50%
Collaboration	50%
Mobile	13%

Source: IBM Market Intelligence 1Q2013
Percentage of survey respondents

✓ **Industry Solutions**: Intelligent Operations Center for Smarter Cities®, Smarter Infrastructure for Social Services - Curam on zEnterprise, Enterprise Asset Management (Maximo®) for Government, Smarter Analytics™ Anti-Fraud Infrastructure for zEnterprise, zEnterprise Smarter Analytics for Retail

➔ **All workloads managed in a Cloud**: Tivoli® Provisioning Manager (TPM), Tivoli System Automation Manager (TSAM), SmartCloud Provisioning (SCP), CSL-Wave, xCat, …

Connecting Mobile Apps on the zEnterprise

Linux on System z

Worklight Server

Adapters

WebSphere Application Server

DB2 LUW

MQ/ WMB

z/OS

CICS

IMS

DB2

WAS

MQ/ WMB

Mobile apps

zEnterprise

- ✓ System z is leader in transaction processing with the ability to handle volumes of critical data

- ✓ System z secures the data for mobile processing from mainframe to mobile device

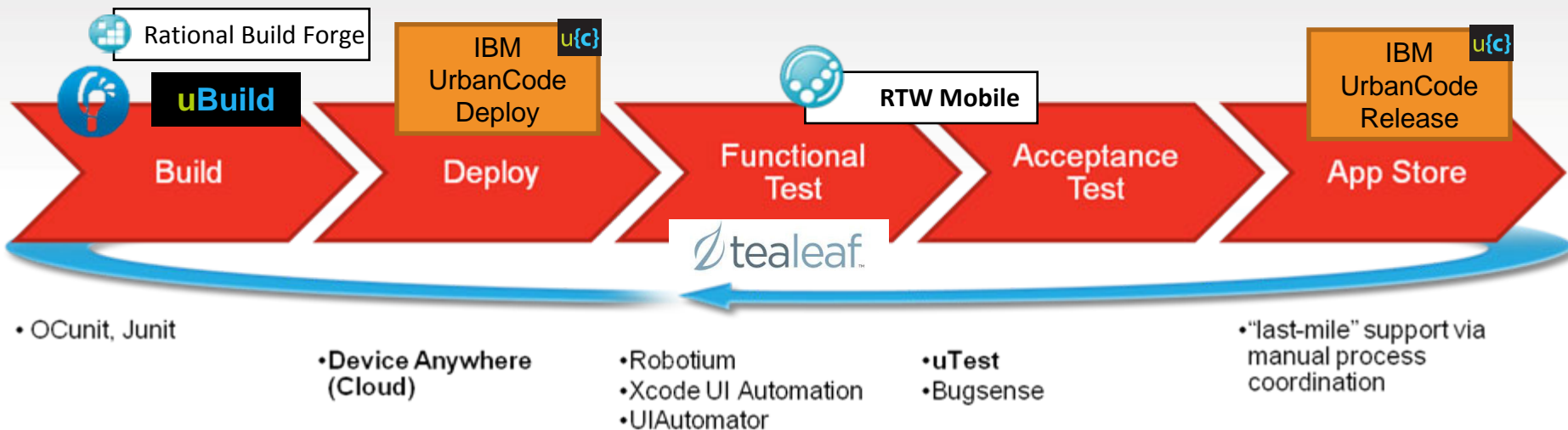- ✓ System z is the perfect environment for developing a mobile, cloud, and analytics integrated solution

- **Server side software components and adapters for channeling System z to mobile devices** with IBM Worklight Server

- **Mobile application support** with WebSphere Application Server on System z

- **Mobile protocol connectivity with core System z applications** including CICS, IMS, TPF, MQ, WMB and DB2

DevOps for Mobile
## Accelerate Delivery focusing on quality and user experience

Rational Build Forge

uBuild

IBM UrbanCode Deploy

RTW Mobile

IBM UrbanCode Release

Build — **Deploy** — **Functional Test** — **Acceptance Test** — **App Store**

tealeaf

- OCunit, Junit

- Device Anywhere (Cloud)

- Robotium
- Xcode UI Automation
- UIAutomator

- uTest
- Bugsense

- "last-mile" support via manual process coordination

One-star ratings kill companies. A **fickle user base with many competing options** makes reacting to feedback essential. **Continuous Feedback and Optimization** using **Tealeaf** helps monitor user sentiment and usage, letting teams react to poor feedback before it spirals

THE WALL STREET JOURNAL.

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FileNet as the foundation for ECM solutions

- Ideal candidate for deployment in a virtualized environment

- Gains benefits from the flexibility for resource configurations and virtual network features

- Local memory provides high communication requirements (no hardware requirements)
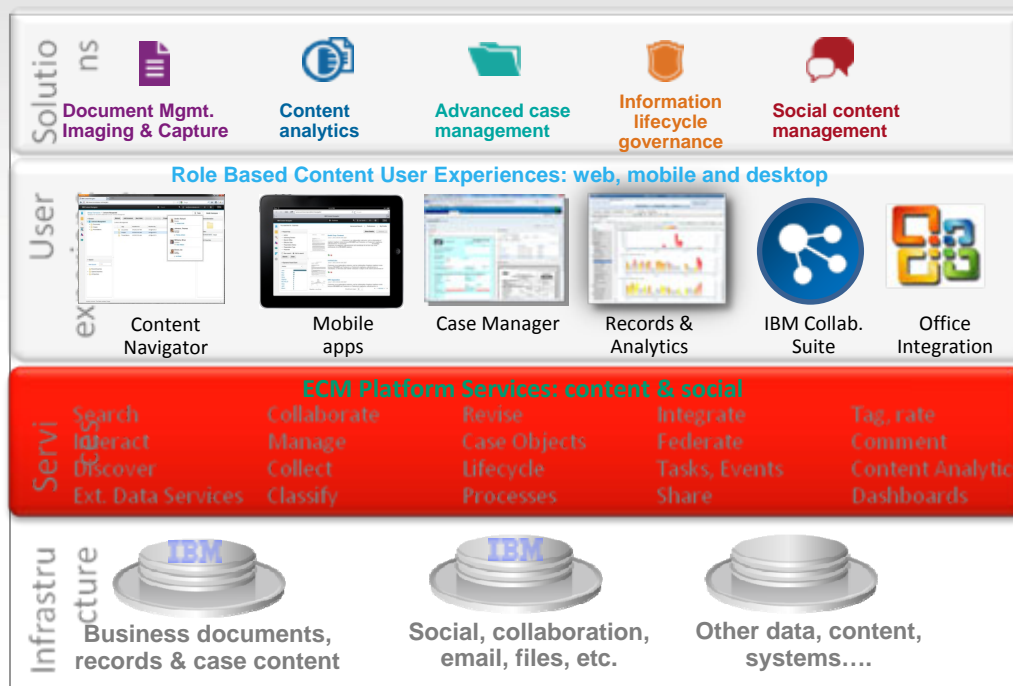
The System z virtualization environment provides significant advantages for all multi-server environments, such as FileNet P8.

- Fast communication with short latencies between multiple components
- High disk I/O bandwidth

Why consider Linux on System z?

Datacenter Simplicity

- Less is more – simplicity through advanced and tightly integrated virtualization technology, automation features and highly-scalable server capacities

Trusted Operations

- Designed to avoid or recover from failures for extremely high levels of business availability

- Impressive horizontal and vertical scalability – Advanced resource utilization – Flexible resource allocation

Unrivaled Economics

- Software licensing costs can be reduced by up to 70%
- Maintenance and operations cost go hand in hand with simplicity of IT
- Fewer servers use less energy and consume less space

- Unique simple design can dramatically reduce overall IT costs compared to distributed IT environments and even public cloud providers.

Backup

What is Different About System z

What System z Hardware Does

- **System z hardware is designed to run multiple workloads concurrently**
  - More cache and memory to support shared workloads
  - Dedicated I/O subsystem delivers high bandwidth and achieves high density for workloads with heavy I/O
  - High Performance FICON (zHPF) improves I/O rates and I/O service time
  - Physical I/O adapters and channel are virtualized and shared by workloads
  - Dynamic channel path management (DCM) dynamically adjust the channel configuration in response to shifting workload patterns

- **System z hardware has unique workload management capabilities**
  - Workload managers efficiently manages dynamically computing resources
  - Workload manager takes processing resources from "donor" workloads when needed
  - Workload management handles workload peaks with maximum core efficiency
  - LPAR isolation/virtualization permits most effective use of resources
  - Sharing resources efficiently with isolation allows multiple environments to co-exist

- **System z hardware qualities of service are rated at 99.999% availability**
  - Comprehensive, multi-layered strategy for reliability and serviceability
  - Concurrent operations with hardware repair and upgrade protects against outages
  - Highest availability and lowest downtime
  - Capacity on Demand provides elasticity to handle unexpected peaks
  - Highest standard for Disaster Recovery
  - Ultimate security – EAL5, virtual machine cannot circumvent workload isolation, HiperSockets™ provide secure memory-speed communication

What is Different About System z

Virtualization

- **Do more with less**
  - Deploy more servers, more networks, more applications, and more data
  - Achieve nearly 100% utilization of system resources nearly 100% of the time
  - Enjoy the highest levels of resource sharing, I/O bandwidth, and system availability
- **Reduce costs on a bigger scale**
  - Save on software license fees
  - Consume less power and floor space
  - Minimize hardware needed for business continuance and disaster recovery
- **Manage growth and complexity**
  - Exploit extensive facilities for life cycle management: provisioning, monitoring, security, workload mgmt, capacity planning, charge back, patching, backup, recovery, etc.
  - Add hardware resources to an already-running system without disruption
  - Workload deployment on a "scale up" machine means fewer cables, fewer components to impede growth
- **More flexibility, minimize lead time for new projects**
  - Workload deployment to a single System z server offers significant advantages in terms of flexibility
  - Rapid provisioning reduces lead time for new IT projects, helping to increase business agility

What is Different About System z

Maximizing Resource Utilization

- **Software Hypervisor integrated in hardware**
  - Sharing of CPU, memory and I/O resources
  - Virtual network – virtual switches/routers
  - Virtual I/O (mini-disks, virtual cache, …)
- **Shared everything infrastructure through hardware allows for maximum utilization of resources**
  - Processors, Memory, Network, Adapters, Cryptography, Devices
- **Designed to support diverse mixed workloads – not just more of the same**
  - Intelligent and autonomic management of diverse workloads and system resources based on business policies and workload performance objectives
  - Allows deployment while maintaining one virtual server per application
  - Complete workload isolation
  - High speed inter-server connectivity
- **Handles peak workload utilization of 100% without service level degradation**
 - Utilization often (usually) exceeds 90%

Why consider Linux on System z?

- **Single server simplicity**
  - Fewer components lead to a simpler and less complex IT environment which requires less administration efforts

- **Efficiency at scale - high flexibility, scalability & resource utilization**
  - All system resources can be shared and directed dynamically between applications, virtually, whenever and wherever they are needed

- **High server capacity with up to 101 cores running at 5.3 GHz[1]**
  - Host up to hundreds of virtual Linux servers in a single footprint

- **Non-disruptive growth within one physical server**
  - Computing capacity can be added on the fly[2]

- **Ultimate security**
  - EAL5 certification and high-speed cryptography integrated as part of the chip

- **Economics**
  - Saving opportunities in software, maintenance, energy & floor space, disaster recovery

[1] ELS based on zEC12 server, ELS based on zBC12 server provides 13 cores running at 4.2 GHz

[2] Processors, memory, I/O connectivity can be added without disruption.

Deploy Oracle Software to the "Best Fit" Technology
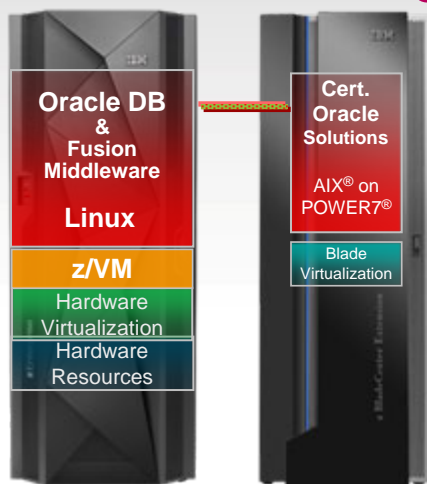
Oracle software deployments (incl. consolidations) with the Enterprise Linux Server provides an excellent price performance.

- From an Oracle licensing perspective 1 IFL = 1core

- Less operational efforts

- High levels of security and availability

Business Connexion – South Africa	**Met Office** – UK
• ICT services to the financial sector, government, … and more • Approximately 50 virtual Linux servers; flexible environment for hosted services; high performance for Oracle databases • Enabled competitive pricing for client services	• 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

Business Intelligence and Predictive Analytics
IBM DB2, IBM InfoSphere, IBM Cognos BI and SPSS

SPSS
Cognos
InfoSphere Warehouse
DB2 LUW
DB2 for z/OS
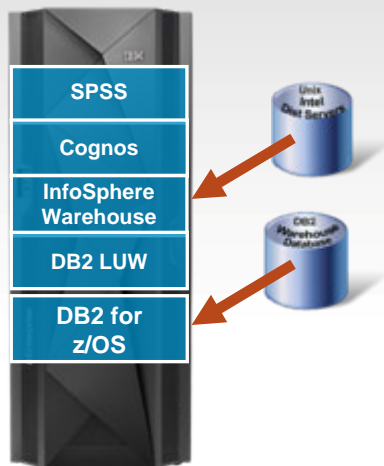
Integrated Stack creates compelling value for the Business Users

- Predictive Analytics, Business Intelligence, Data Warehousing on highly scalable, secure and available IBM System z

- Low cost, easy to manage

- Simplified and faster access to the transactional data

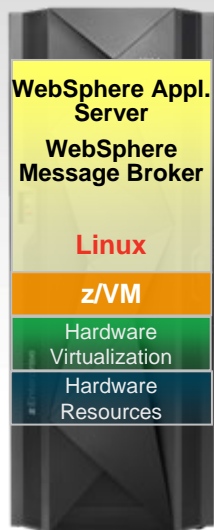| **Siccob** - Brazil	**White Cube** - UK
• Supporting rapid business growth with robust, secure and efficient System z technology	• Moved from an x86 based environment to an Enterprise Linux Server
• Created a virtualized Linux landscape running more than 300 production environments, and deployed DB2, InfoSphere DataStage and Cognos	• Migration from x86 to System z was a seamless experience
• Enabled growth in mobile, internet and branch transactions; avoiding $1.5 million in electricity costs annually	• Reduced maintainance and deployment times
	• Leverages IBM Cognos analytics software on System z
	• Together, hardware and software, enables White Cube to make informed decisions, based on real time

Benefits of Webhosting on Linux for System z
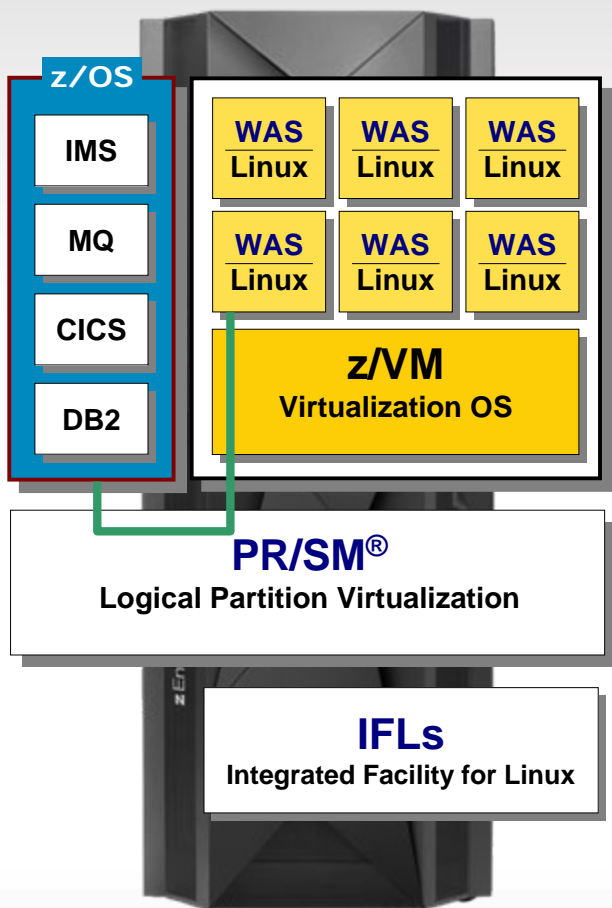
The benefits relate to how multiple Linux instances can be efficiently hosted on System z:

- Ability to consolidate many Linux and WAS instances to a single server footprint

- Better disaster recovery (DR) capabilities since all artifacts grouped by System z

- Ability to create new instances of Linux and WAS very quickly

- Ability to access z/OS data across HiperSockets

Web Application Hosting and SOA Infrastructure

WebSphere Appl. Server

WebSphere Message Broker

Linux

z/VM

Hardware Virtualization

Hardware Resources

- Ability to consolidate many Linux and WebSphere Application Server (WAS) instances to a single server footprint

- Better disaster recovery capabilities since all artifacts grouped

- Ability to shared WAS binaries across multiple Linux instances hosted by z/VM virtualization

- Ability to create new instances of WAS very quickly

- Ability to communicate and access data across HiperSockets

Traxpay - Germany	**Bank of Tokyo-Mitsubishi UFJ (BTMU)** - Japan
• Traxpay looked to redesign the B2B payment process to offer an innovative financial transactions platform, enabled 24/7 • Banking connections are implemented in Java using WebSphere Application Server. Highly secure point-to-point communication links are established with IBM WebSphere MQ • ELS and WebSphere allows to deliver the utmost in online performance, reliability, and security for our customers	• BTMU developed a Service Oriented Architecture (SOA) platform to realize this "cloud-banking" concept • It does „*not only enables service linkage on Linux and other systems, but also scalability*" • SOA platform, leveraging WebSphere Message Broker, has accelerated the ability to build services in response to business issues • 18% increase of re-utilization rate of services* * as of March 2012

Much more workloads that benefit

Reliable and Scalable Business Collaboration	IBM Enterprise Content Management (ECM) Solutions	IBM Maximo Asset Management
Lotus Domino + TREND MICRO **Lotus Sametime** **Lotus Quickr** **Lotus Connections**	IBM ECM portfolio includes approximately forty different software products such as **FileNet** and **IBM Content Manager**	**Maximo Asset Management** unifies comprehensive asset life cycle and maintenance management on a single platform.
Gruppo API – Italy	**Large Healthcare Insurer** – USA	**City and Country of Honolulu** – USA
The migration of Lotus Domino, the corporate email system, worked extremely well. Over a two week period, 1,200 user email boxes were moved to ELS without interruption of service to users.	FileNet and Content Manager On Demand are used with DB2, InfoSphere and Cognos to support the business processes for the Integrated Health Management. The solution enables to analyze a large collection of data while also achieving real-time claims adjudication and offering a robust member portal.	Maximo software is used as a single point of management for every aspect of a wide range of public services. Using the solution, the city can also improve the perception of the city by performing more preventive and corrective maintenance.

# Virtualization and Cloud Portfolio

Virtualization Infrastructure & Virtualization Management	Entry Level Cloud Standardization & Automation	Advanced Cloud Orchestration & Optimization
zEnterprise: zEC12, zBC12 • Massively scalable • Characterized by great economics / efficiencies • Highly secure / available **z/VM 6.3** • Support more virtual servers than any other platform in one footprint • Integrated OpenStack® support **Linux on System z** • Enterprise Linux Server **CSL-WAVE** • Drives simplicity into managing virtualized environments while taking the first steps toward cloud	**xCAT** • Shipped with z/VM 6.3 • Allows customers to set up a rudimentary cloud environment, without acquiring any additional product • Based on open source code • No upgrade path to SmartCloud suite **SmartCloud Entry *** • A simple, entry level cloud management stack • Based on OpenStack • First tier in the SmartCloud suite of cloud management products	**Cloud Ready for System z** • Image-based cloud service delivery with integrated provisioning, monitoring, service catalog & service desk, storage management, and HA **SmartCloud Provisioning** • Builds on functionality of SmartCloud Entry and adds middleware pattern support for workload deployment **SmartCloud Orchestrator *** • Builds on functionality of SmartCloud Provisioning and adds runbook automation
Differentiation	*Standardization*	*Service Lifecycle Management*

* System z support currently in development

Solution scale and lifespan significantly impact the cost equation

- **Acquisition costs:**
  - Hardware, systems software, maintenance

- **Operating costs:**
  - Application license, labor, energy, floor space

Typically, the larger the scale or the longer the lifespan of the solution, operating costs become relatively more important
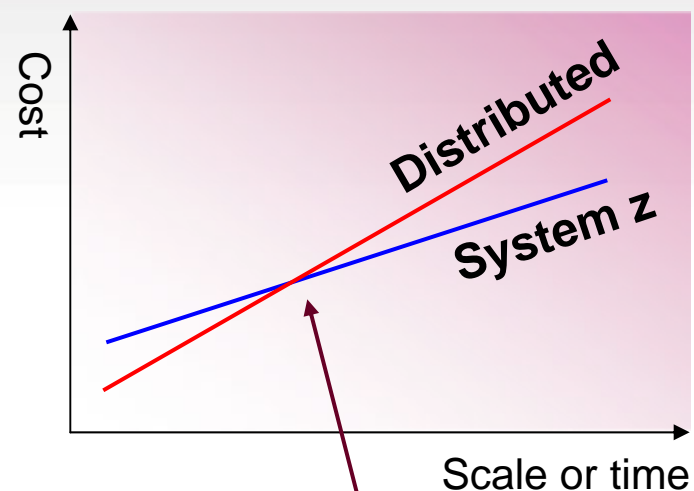
Scale, lifespan and individual workload characteristics all impact the position of the cross over point

Application Performance Characteristics – what fits?

Workload performance varies by application and can be best served by different platforms or the right mix of multiple platforms.

10. **CPU Intensive** – e.g. numerically intensive, etc.

9. **Protocol Serving** – e.g. static HTTP, firewall, etc.

8. **Skewless OTLP** – e.g. simple and predictable transaction processing

7. **Java Heavy** – e.g. CPU intensive Java applications

6. **Java Light** – e.g. data intensive Java applications

5. **Database** – e.g. Oracle DBMS or dynamic HTTP server

4. **Mixed High** – e.g. multiple, CPU-intense simple applications

3. **Mixed Low** – e.g. multiple, data-intense applications or skewed OLTP, MQ

2. **I/O Bound** – e.g. high I/O content applications

1. **Data Intensive** – large working set and/or high I/O content applications

Optimal for System z

Optimal for other platforms

World-Class Server Virtualization:
System z LPAR and z/VM

Helping clients reduce costs and improve control of their IT infrastructure

✓ *Virtualization*　　✓ *Consolidation*　　✓ *Workload management*　　✓ *Automation*

- *Logical Partitioning (LPAR) and z/VM are complementary technologies*

  - Both employ great hardware and firmware (PR/SM) innovations developed over the years

  - Virtualization is a part of the *basic componentry* of the System z platform

Together, System z LPAR and z/VM technology provide:

  - High performance "on the metal" virtual servers for larger, performance-critical workloads

  - The ability to provision 1000s of additional virtual servers flexibly and on demand

- *LPAR*

  - Host a relatively small number of very high-performance virtual servers

  - Very low overhead, hardware-based virtualization through partitioning

- *z/VM*

  - Host large numbers of high-performance virtual servers

  - Low overhead, hardware-based, true virtualization with extreme levels of software augmentation