Effective IT Optimization with IBM System z

Consolidation, Cloud, Analytics

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Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

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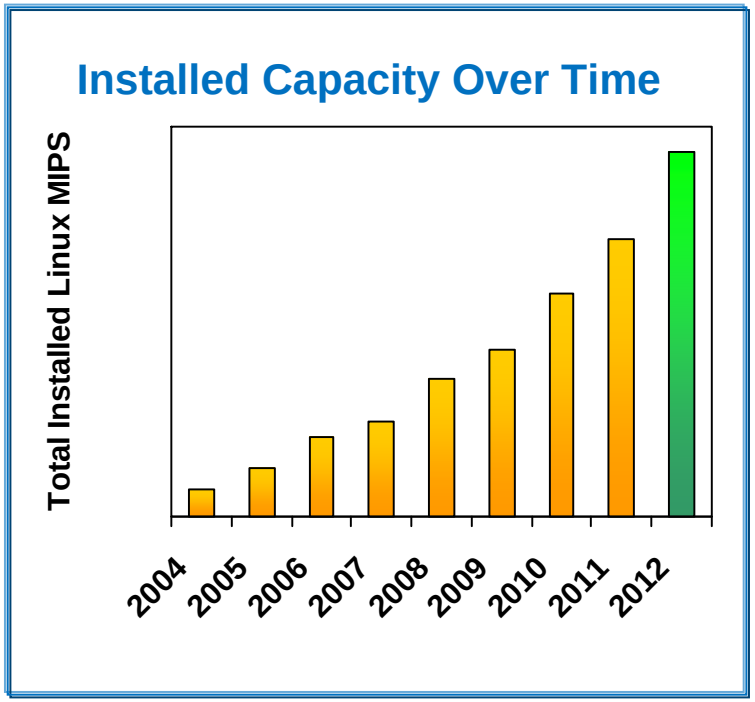
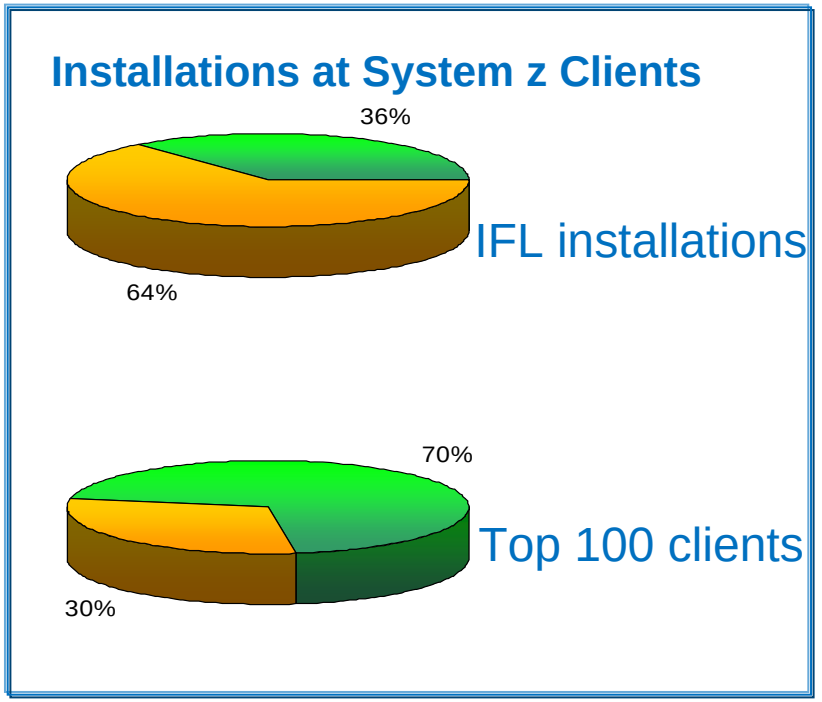
Linux on IBM System z at Year-End-2012

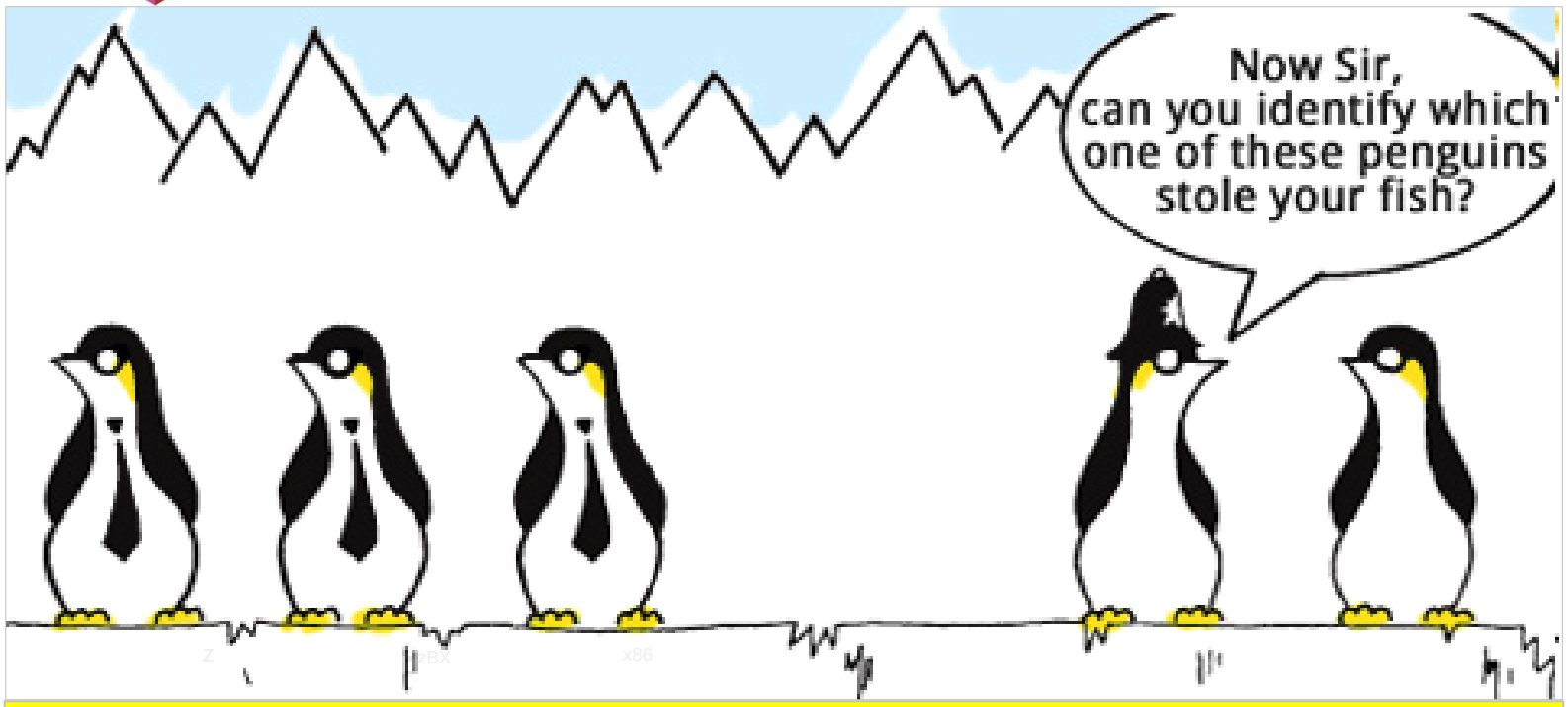




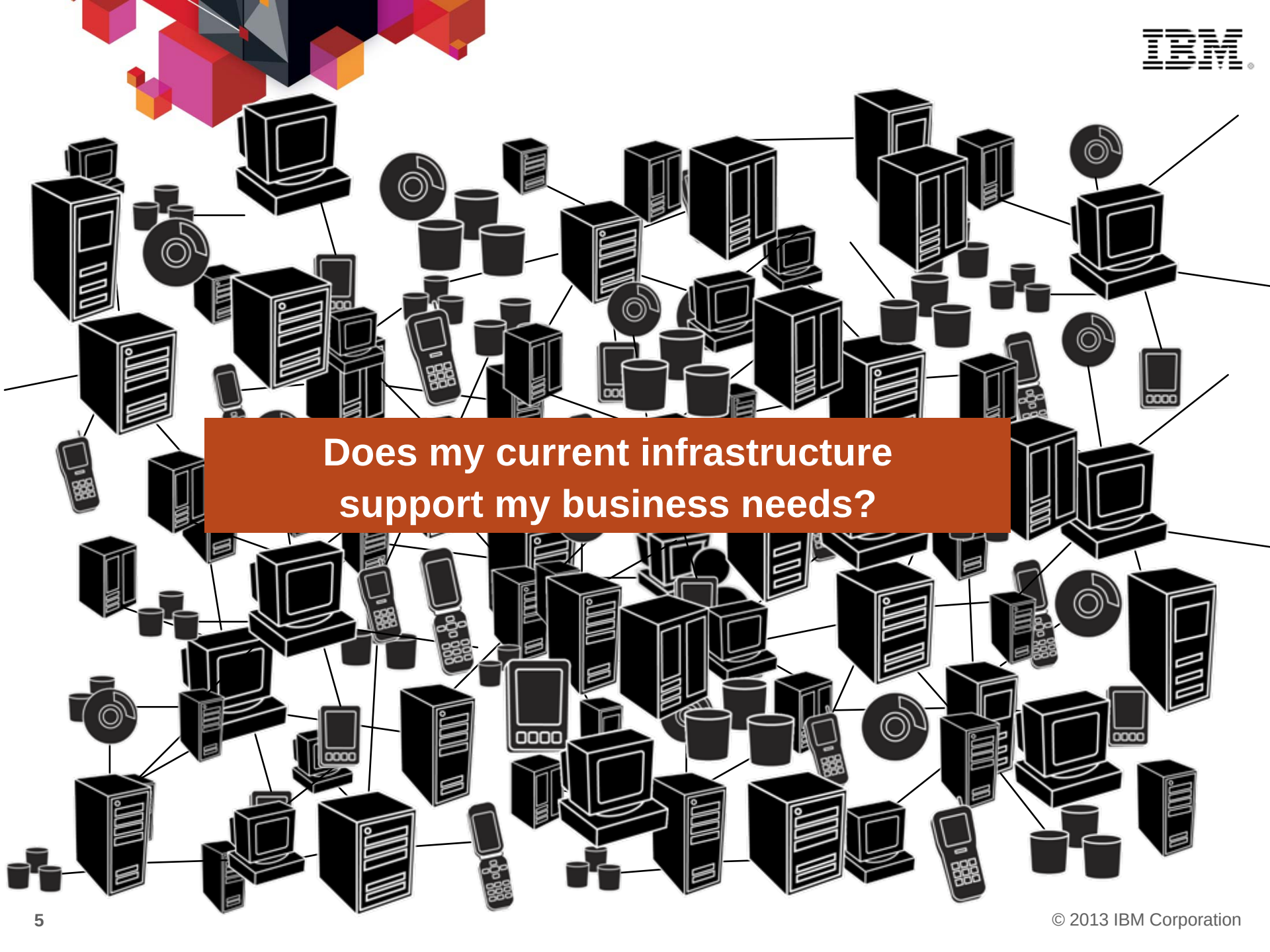
- **22,8% of Total installed IBM System z® MIPS run Linux®**
- **Installed IFL MIPS increased 32% from 4Q11 to 4Q12**

- **36% of System z Clients have IFL's installed**
- **70 of the Top 100 System z Clients are running Linux on System z***

*Top 100 is based on Total Installed MIPS



The **Linux's all look the same** (on different architectures)
and have the same Linux kernel source**.**
But they have **different personalities**, **qualities**, **features** and **options** derived from the architectures.



Smarter Computing: What's Next. Ready Now.

The IBM System z platform delivers capabilities for Smarter Computing

Cloud Ready

- An efficient, scalable infrastructure
- Improved speed and flexibility
- Business innovation

Data Ready

- Shared access to trustworthy information
- Actionable insight on operational data
- Maximum availability of business insight

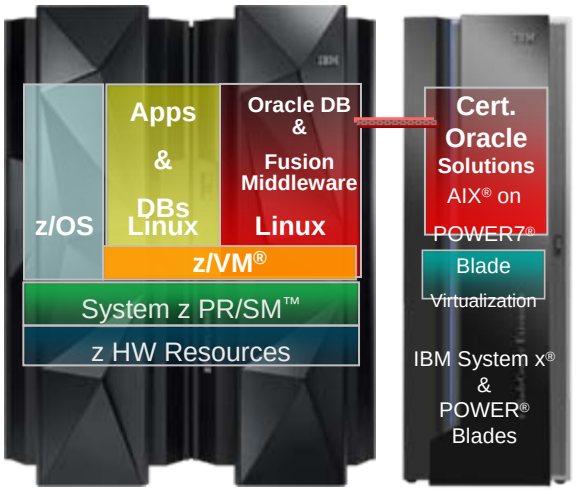
Security Ready

- Data security and integrity
- Trusted identity and access
- Minimal overhead to meet compliance requirements

Consolidate and Deploy Software to the "Best Fit" Technology

Run up to hundreds of distributed server workloads on a single server

- **Extreme consolidation of servers and networking**
- **Fewer components and reduced complexity**
- **Excellent price performance from a software licensing perspective:**
  - One System z processor = One x86/RISC core
- **Industry-best virtual I/O bandwidth and reliability**
- **Superior levels of virtual server provisioning, monitoring and workload management**
- **System z qualities of dynamic resource management and capacity-on-demand**
- **Seamless integration with z/OS® backup and disaster recovery solutions**



Linux Consolidation on System z offers a Powerful Solution to Transform your IT Economics

Dundee City Council delivers value through new technologies

Solution:

For several years, the council has run all its core IT systems (mostly Oracle databases and applications) on SUSE Linux Enterprise Server, running on IBM System z servers.

"Running Linux on the System z platform is a cost-efficient approach, especially for software like Oracle, which is licensed on a per-processor basis," explains Tim Simpson, IT Support Manager at Dundee City Council.

"We can run 60 virtual machines on just four System z processors – whereas an equivalent x86-based architecture might require several processors for each server! So the savings can be considerable."

Read full story

Baldor Electric Company consolidated hundreds of servers and cuts IT and energy cost

Solution:

Baldor runs its core SAP landscape on IBM zEnterprise® 196 and IBM System z10® Enterprise Class servers. Its IBM DB2® 10 for z/OS databases run in IBM z/OS partitions, while 70 virtual servers under z/VM® provide Linux environments that act as SAP application servers. The company uses twelve Central Processors for general-purpose workload, as well as six System z Integrated Information Processors (zIIPs) and 32 Integrated Facility for Linux (IFL) processors.

Read full story

Accelerate the journey to smarter computing with multi-system virtualization and virtual server mobility

Features:

- Multisystem virtualization allows up to four z/VM instances to be clustered, serviced, and administered as a single system image
- Live guest relocation moves running Linux virtual servers without disruption to the business
- Provides a set of shared resources for the z/VM systems and their hosted virtual machines
- Scales up to four systems horizontally, each with up to 32 CPUs and 256 GB memory
- High server consolidation ratio with support for more virtual servers than any other platform in a single footprint

Benefits:

- Relief from the challenges associated with virtual machine sprawl on competitive systems
- Helps clients avoid planned outages for virtual servers when performing maintenance
- Provides a more manageable infrastructure for cloud computing
- Improved systems management to help manage the life cycle of the z/VM hypervisors and the virtual servers
- Enhanced workload balancing with the added ability to move work to available resource in addition to long standing capability to move system resources to work

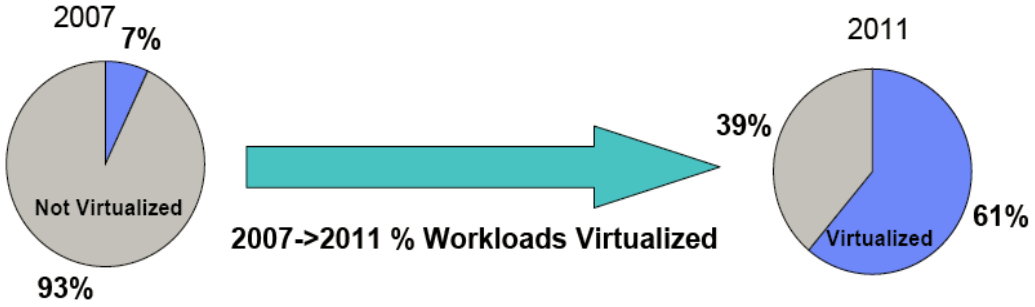
Virtualization is evolving from being a way to reduce costs to being a change agent that enables new and more flexible infrastructures

Cloud Computing
- Elastic scaling
- Shared resources
- Delivered as-a-service
- Private, Hybrid, and Public

Flexible Infrastructure
- Pools of heterogeneous resources
- Policy-based management automation

Availability
- Move running workloads
- Improve maintenance window
- Support old application environments

Test & Server Consolidation
- Better hardware utilization
- Lower power consumption



IBM System z Cloud Blueprint

Integrate	Automate	Orchestrate
"Take out cost" Consolidate and Virtualize	*"Simplify" Automate and Manage Better*	*"Orchestrate" Service Lifecycle Management*
Differentiation	***Standardization***	***Service Management***
• Rapid deployment of Linux virtual servers for less than one dollar a day • Industry leading "gold standard" security for tenant isolation • Elastic scaling achieved by dynamically adjustable capacity at sustained performance • Multisystem virtualization simplifies management by clustering shared resources	• Automated provisioning and de-provisioning • Pool standardized virtualized building blocks • Plug-and-play capacity across hardware generations • Capture and catalog virtual images in the data center • Automated methods for faster delivery of services with higher levels of control	• Integrated virtualization management with IT service delivery processes • Self-service provisioning • Automated service lifecycle management including dynamic instantiation of cloud services • Pay for use • Optimize IT resources to reinvent business processes
• **z/VM** • **Linux on IBM System z**	• **Tivoli® Provisioning Manager *Available now*** • **SmartCloud Provisioning *Available now*** • **SmartCloud Entry *(Coming)***	• **Tivoli Service Automation Manager *Available now*** • **SmartCloud Orchestrator *(Coming)***

IBM System z Newest Technology to Support Your Cloud Journey

Infrastructure Management		**zEnterprise Starter Edition for Cloud**
Infrastructure Operation		**Cloud Ready for Linux on System z**
Private Cloud Management		**IBM System z Solution Edition for Cloud Computing**
Private Cloud SAP Management		**IBM Service Automation Cloud for SAP on zEnterprise**

Supporting Cloud Implementation Stages

- Infrastructure Virtualization
- Infrastructure Management Solutions
- Private Cloud Management Solutions

Enterprise Cloud Computing

A secure cloud for data enables enterprises to improve service to their customers

The University of Bari fosters innovation in the cloud

Solution:

The University leveraged the IBM System z Solution Edition for Cloud Computing — a virtualized infrastructure that uses IBM System z, IBM System Storage®, SUSE Linux Enterprise Server for IBM System z and IBM Tivoli Service Automation Manager to enable intelligent management of Linux virtual machines.

The System z cloud has enabled the development of innovative applications for the local fishing, wine-making and logistics industries, as well as the University itself.

Read full story

Nationwide cuts costs in the cloud

Solution:

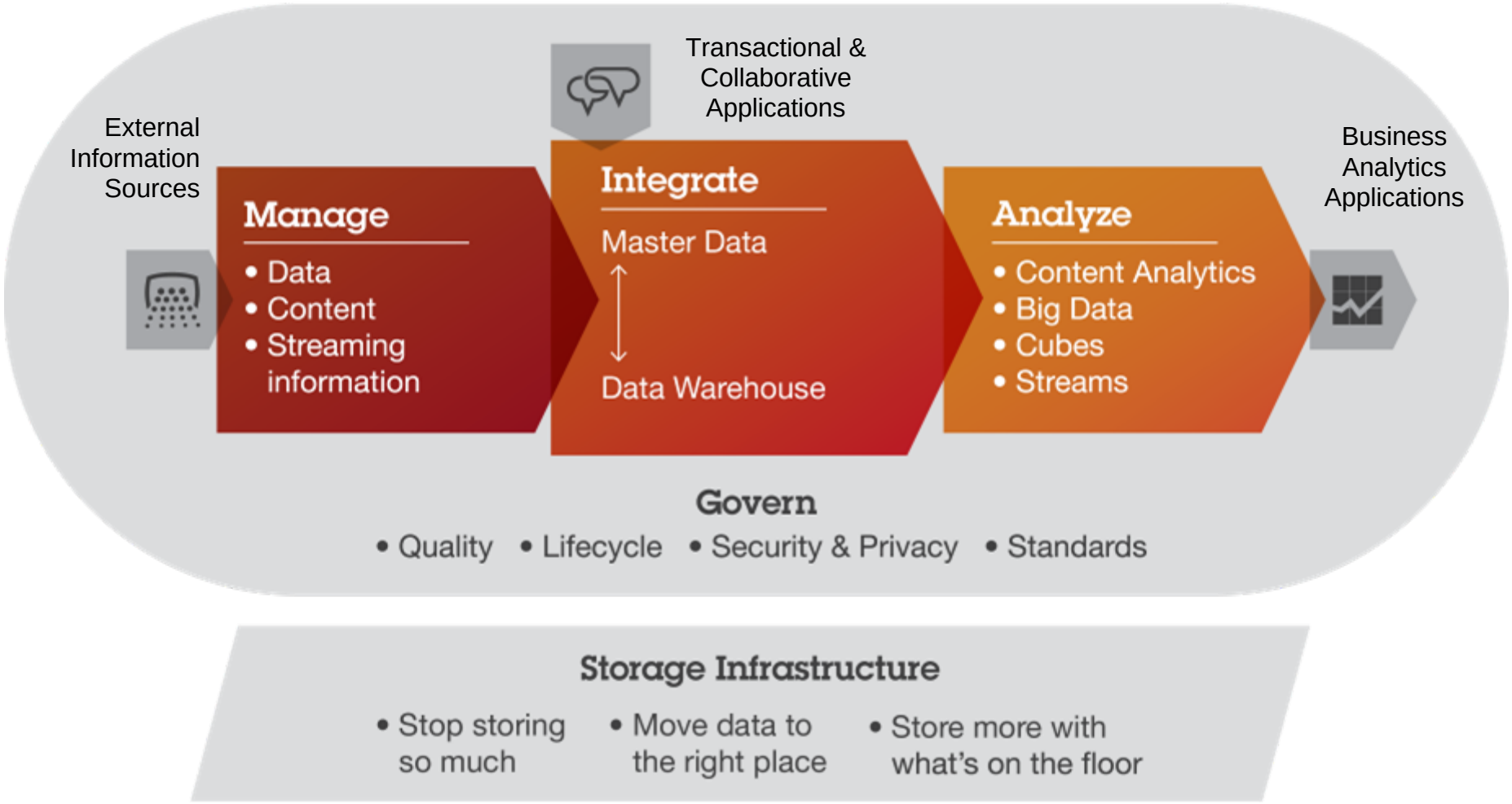
Smart workload consolidation from IBM.

Nationwide consolidated its distributed server landscape to Linux virtual servers running on IBM System z mainframes, creating a multi-platform private cloud optimized for all its different workloads.

With IBM z/VM, the virtualized servers are able to use the fast I/O of the mainframe and share its resources, while simultaneously taking advantage of the traditional mainframe strengths of reliability and high availability.

Read full story

All Information can be Incorporated into an Enterprise Information System on IBM System z



IBM business analytics and data warehousing solutions on System z

Designed to cost effectively exploit information for optimized business performance

Miami-Dade County builds a highly scalable private cloud analytics platform

Solution:

"We realized that Linux on System z was an extremely cost-effective platform for certain types of applications, especially if they need the rock-solid reliability and availability that the mainframe can offer," comments Jose Eskert, Senior System Programmer at Miami-Dade County.

Rosario Fiallos, Enterprise Business Intelligence Architect, adds: "We had a situation where there were a few different Cognos® systems that were being used by different departments—some running on small Wintel servers, or even on desktop PCs, and others on UNIX® servers. But we had big ambitions for Cognos to become a true enterprise system, which meant we needed a much more powerful and scalable infrastructure. Moving to Linux on System z was the perfect option."

Read full story

Bankia gains innovative insights to boost competitiveness

Solution:

"An ETL solution like InfoSphere™ DataStage® was vital for our business, as we wanted to make sure that data from each of the seven joint-venture banks could be gathered and analyzed by a single central system, instead of having our analytics function scattered across several different tools and data sources. A reliable method of collecting, cleaning and standardizing data was critical to ensure consistent, accurate group-wide analysis, which would help us manage the business as effectively as possible."

Bankia chose to run the IBM InfoSphere software on Linux on System z, which combines the open standards of Linux with the power and resilience of the IBM System z mainframe.

Read full story

IBM Enterprise Linux Server

An ideal platform for optimized workload deployment

The Enterprise Linux Server (ELS) alias
The "Linux-only" System z server

- **Combines the modern System z server and virtualization technologies with Linux**
- **Provides high scalability, flexibility and security**
- **Allows for an IT infrastructure inside a single, physical server**
- **Allows for processor-based pricing for most IBM Linux software and most vendor software products**
- Does not require any other operating system skill, beside virtualization and Linux skills
- Does not increase any IBM software charges for traditional System z operating systems and middleware

ELS with up ro 101 cores running at 5.5 GHz

ELS with up to 80 cores running at 5.2 GHz

ELS with up to 10 cores running at 3.8 GHz

Improve IT Economics and Drive Greater Performance

IBM Enterprise Linux Server can do more for less

EFiS EDI Finance Service AG boosts business flexibility and efficiency

Solution:

EFiS implemented an IBM System z Solution Edition for Enterprise Linux based a new IBM zEnterprise 114 server. It also uses IBM WebSphere® software to manage its application environment.

In 2008, this strategy led the company to replace approximately 200 x86-architecture servers, including a number of Sun Solaris systems, that were not fully meeting its performance or scalability requirements. EFiS migrated key applications from its existing servers to an IBM System z Solution Edition for Enterprise Linux based on a single IBM System z9® Business Class server.

Read full story

Transzap fuels a competitive edge with increased application uptime from IBM System z

Solution:

Transzap knew that they wanted to implement virtualization to improve their scalability and business flexibility, and started investigating IBM System z offerings. They were particularly excited to discover the Linux on System z platform, as they had previous experience running their business applications on Linux operating systems.

Being able to virtualize Oracle and other applications with z/VM on System z and having Linux as the operating system foundation have provided Transzap with significant advantages. For example, they are now able to create new database instances over a period of two or three days.

Read full story

IBM Software Products

~300 IBM Software products available for Linux on System z

Software products by brand

- AIM (WebSphere) ~90
- Enterprise Content Mgmt. ~8
- Information Management ~58
  - thereof: InfoSphere ~29
- Lotus® ~6
- Rational® ~17
- Tivoli ~101
  - thereof: Maximo® ~26
- Other ~20

IBM Software Workload Focus

- Application Infrastructure
- People Productivity with Portal
- Connectivity and Integration
- Business Process Management
- Content Management
- Business Intelligence
- Cloud Computing
- Service and Security Management
- Service Management and Process Automation

Status of 01/24/2013

zEnterprise Industry Solutions for a Smarter Planet

Smarter Planet® – Industry Solutions

Banking

- IBM Financial Transaction Manager on zEnterprise
- SAP Bank Analyzer on zEnterprise
- IBM Core Banking Solution on zEnterprise
- FSS Business Intelligence and Data Analytics Solution
- IBM Smarter Analytics™ Anti-Fraud Infrastructure for zEnterprise

Insurance

- IBM Smarter Analytics: Anti-Fraud, Waste and Abuse Solution for Insurance
- IBM Genelco® Insurance Administration Solution
- IBM zEnterprise Insurance Integration Hub

Government / Smarter Cities®

- IBM zEnterprise Starter Edition for Cloud for Government
- IBM Intelligent Operations Center for Smarter Cities
- IBM Smarter Infrastructure for Social Services - Curam on zEnterprise
- IBM Enterprise Asset Management (Maximo) for Government

Healthcare / Life Sciences

- IBM Smarter Analytics Signature Solution: Anti-Fraud, Waste and Abuse
- IBM Health Plan Integration Hub

Retail

- IBM zEnterprise Smarter Analytics for Retail

New solutions | Linux-based solutions

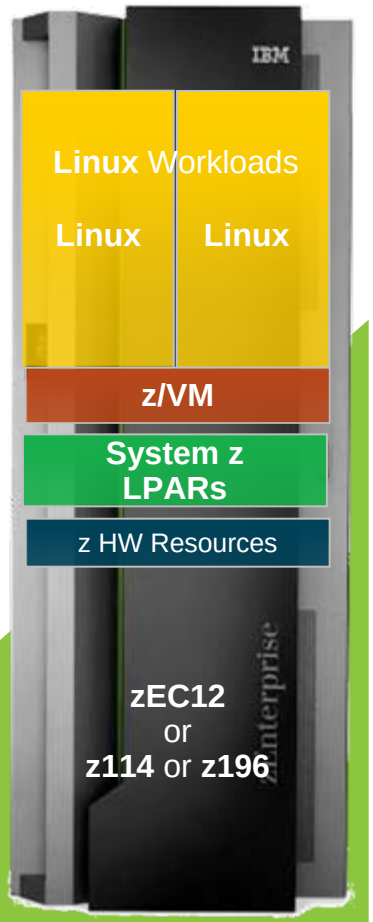
More than 1400 New and Upgraded Applications added for z/OS and Linux

Added over 90 New ISV Partners in 2012

- **z/OS**
  - Over 1,080 New or Upgraded applications
  - More than 4,400 total z/OS applications
- **Linux**
  - **Over 400 New or Upgraded applications**
  - **More than 3,000 total Linux applications**

Built-in Security for Linux Workloads

- Industry's top-rated EAL5+ security classification* for hardware Logical Partitions (LPARs)
- EAL4+ security classification on z/VM offering unmatched levels of secure virtualization and consolidation
- Security-rich holistic design to help protect system from malware, viruses, and insider threats
- Granular access controls integrated across the platform
- Centralized audit collection available for an enterprise view
- Network security features to help address outside threats
- Encryption solutions to help secure data from theft or compromise while in flight or at rest



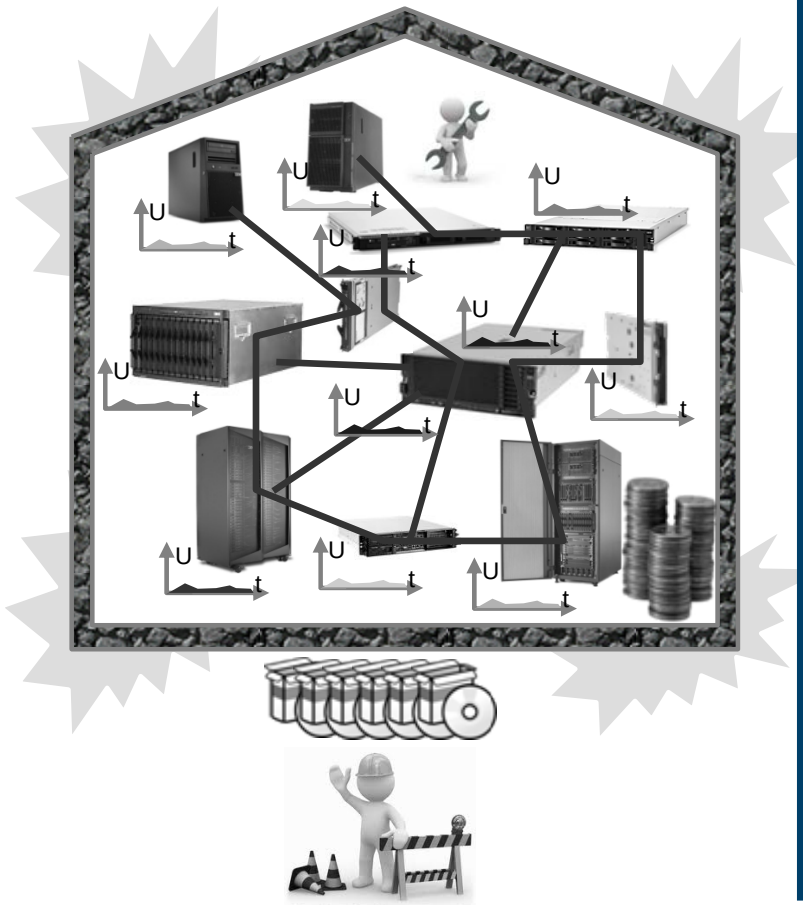
The IBM advantage …only System z can boast the combination of EAL5+, an EAL4+ certified hypervisor, FIPS 140-2 Level 4 and related security certifications

The Gold Standard for Security

* https://www.bsi.bund.de/ContentBSI/EN/Topics/Certification/newcertificates.html

Why IT Optimization with IBM System z

Improved IT Efficiency and Reduced Costs



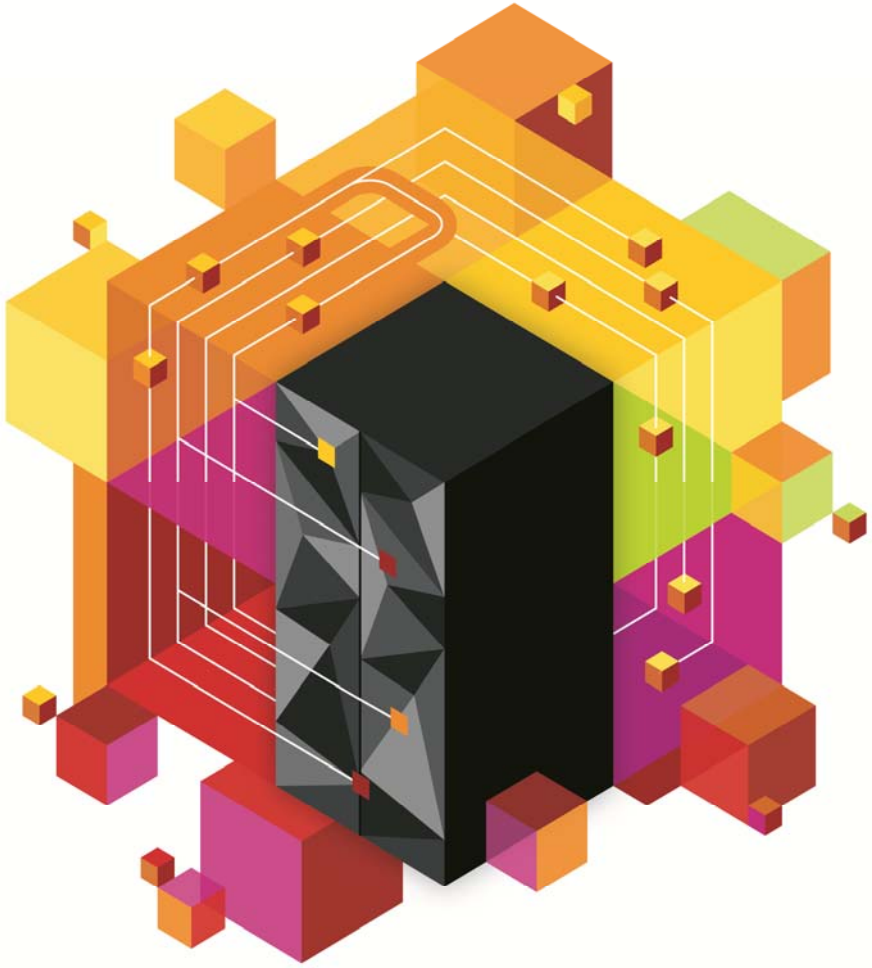
- Software cost reduction
- Operational and management reduction
- Floor-space and energy reduction
- Network reduction
- Maximizing utilization
- Proximity of data and applications
- Technology refresh effort reduction
- Growth inside a server
- Disaster recovery cost reduction
- Improving security

IT Optimization with IBM System z provides

- **Single server simplicity**
- **Efficiency at scale - high flexibility, scalability and resource utilization**
- **High server capacity with up to 101 processors running at 5.5 GHz**
- **Non-disruptive growth within one physical server**
- **Ultimate security**
- **Economics**

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

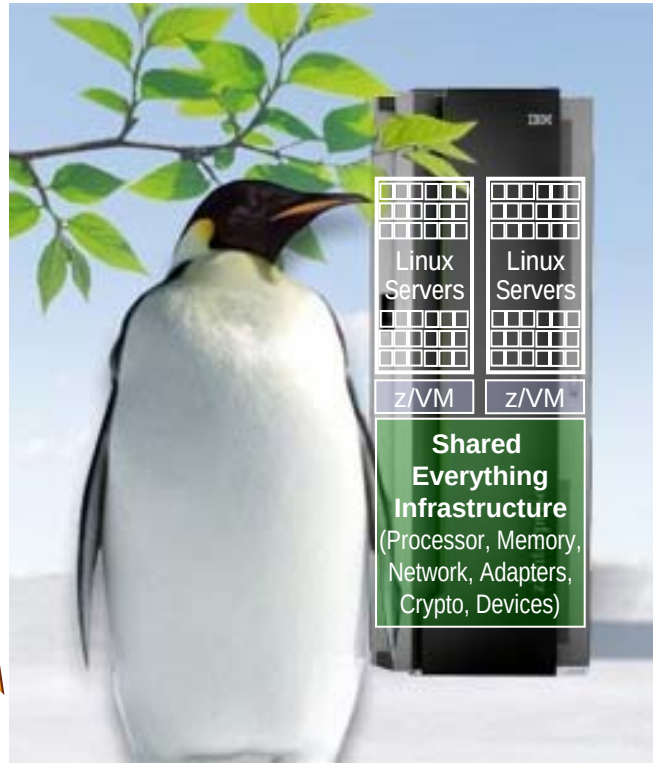
Backup



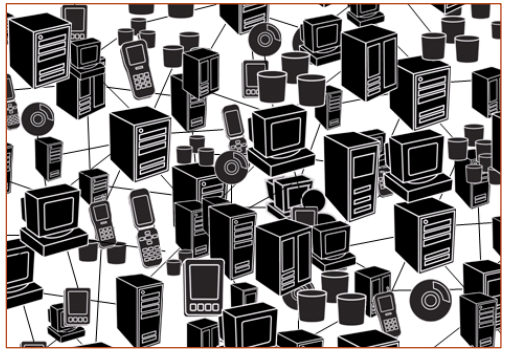
IBM Enterprise Linux Server

Saving Money and Reducing Complexity

- Run more applications/software at less expense
- Manage more virtual servers with fewer people
- Absorb workload spikes more easily
- Consolidate more servers per core
- Spend less on disaster recovery
- Occupy less floor space
- Save on energy



Helping you
"Do More with Less"



A refrigerator size box versus vs. a full room of servers.
The differences are quantum.

What is Different about System z

Maximizing Resource Utilization

- Software hypervisor tightly integrated with hardware
- Shared everything infrastructure through hardware allows for maximum utilization of resources
- Designed to support diverse mixed workloads – not just more of the same
- Handles peak workload utilization of 100% without service level degradation

Linux on System z has a Continuous Focus on Characteristics the Workload Benefits from

Security Capabilities:

- Privacy,
- Regulatory requirements, Identity management, Common Criteria Certification, Image Isolation,
- Cryptographic Acceleration,
- Centralized Authentication,
- Physically secure communications with HiperSockets™ and Guest LANs

Consolidation Capabilities:

- Server, Network, Storage, Staff, Skills, Utilities, Environmental, Applications Hosting of different workloads at the same time

Business Resiliency Capabilities:

- High Availability,
- Disaster Recovery, Serviceability, Reliability,
- Storage failover (HyperSwap™), Data replication (XRC, PPRC)

Operational Simplification Capabilities:

- Virtualization,
- Simulation,
- Single Point of Control,
- Single System Image,
- z/OS Similarities/Synergies,
- Resource Sharing

Flexibility / On demand Capabilities:

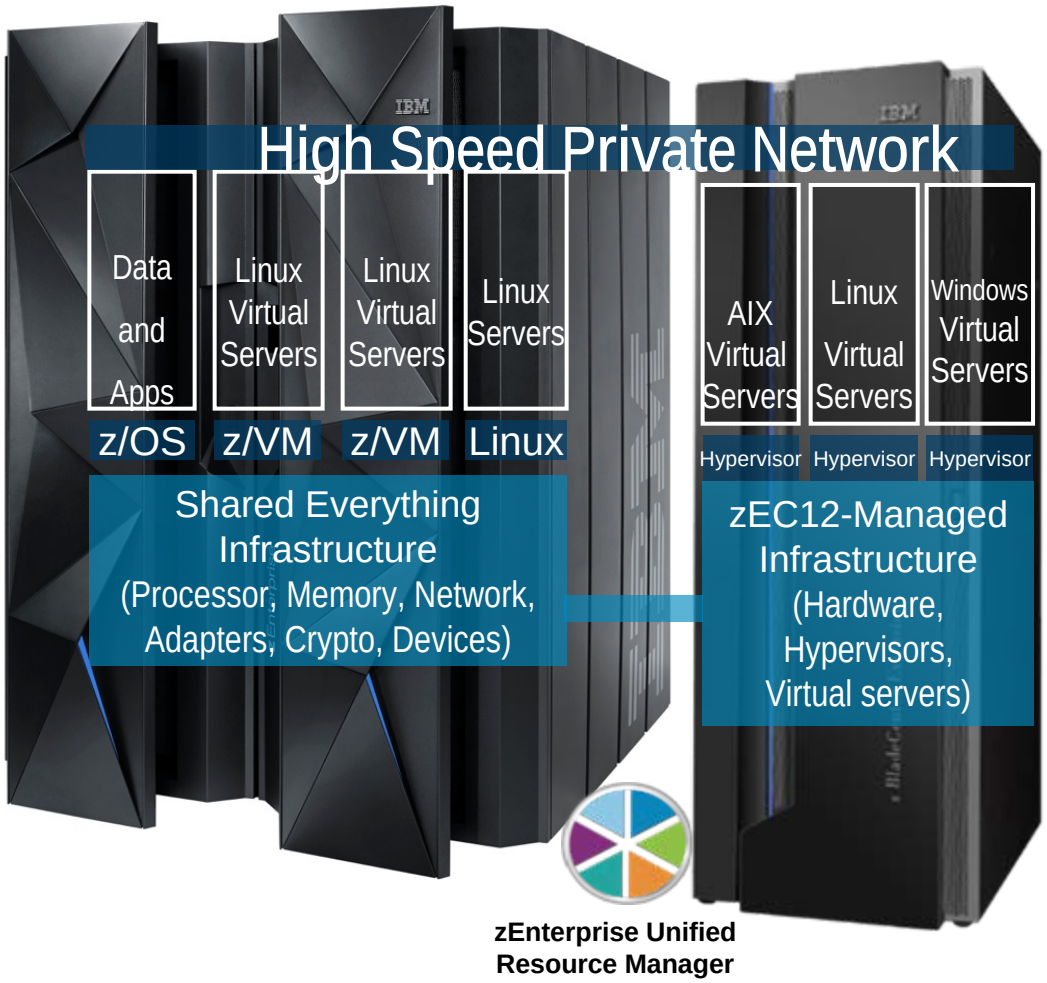
- Mixed Workloads: Scale-up & scale-out,
- Rapid server (de)commissioning,
- Idle Servers don't consume resources

Proximity to z/VSE® & z/OS managed Data:

- Increased transaction throughput, HiperSockets
- Shared data access
- Integrated storage management

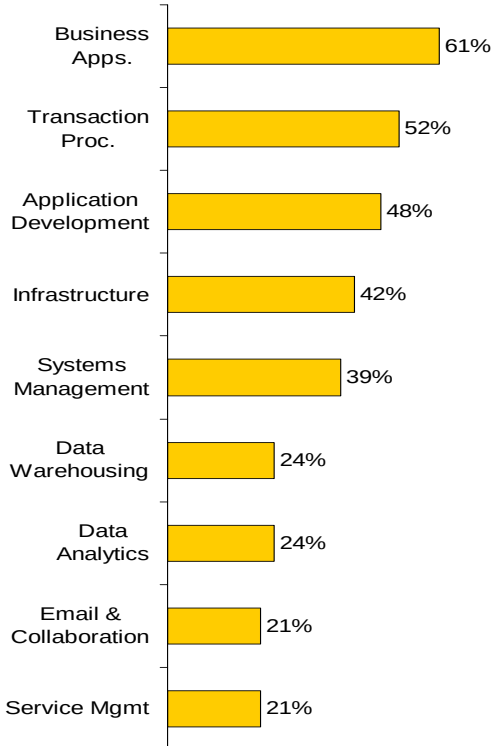
Best Fit Usage Scenarios for IT Optimization with IBM System z

- Virtualization and server management
- Security services for entire enterprise
- Database and warehouse services
- Cloud and cloud management
- Application development and test



Recommended Workloads for Linux on System z

- Data services: Cognos, SPSS, DB2, InfoSphere, Informix®, Oracle Database, Builders WebFOCUS, …
- Business applications: WebSphere Application Server, WebSphere Process Server, WebSphere Commerce, …
- Development & test: e.g. of WebSphere/Java applications – Rational Asset Manager, Build Forge®, ClearCase®, Quality Manager
- Email & collaboration: Lotus® Domino®, Lotus Collaboration (Sametime, Connections, Quickr™, Forms) WebSphere Portal, …
- Enterprise Content Management: FileNet® Content Manager, Content Manager, Content Manager On Demand
- Business Process Management: Business Process Manager, WebSphere Business Monitor, FileNet Business Process Manager, WebSphere Operational Decision Management, …
- Infrastructure services: WebSphere MQSeries®, WebSphere Message Broker, WebSphere Enterprise Service Bus, DB2 Connect™, FTP, NFS, DNS, Firewall, Proxy, …
- Cloud management: Infrastructure (IaaS), Platform (PaaS), Software (SaaS), Business Process as a Service – Tivoli System Automation Manager, Tivoli Provisioning Manager, Integrated Service Management for System z, Maximo®Asset Management, …



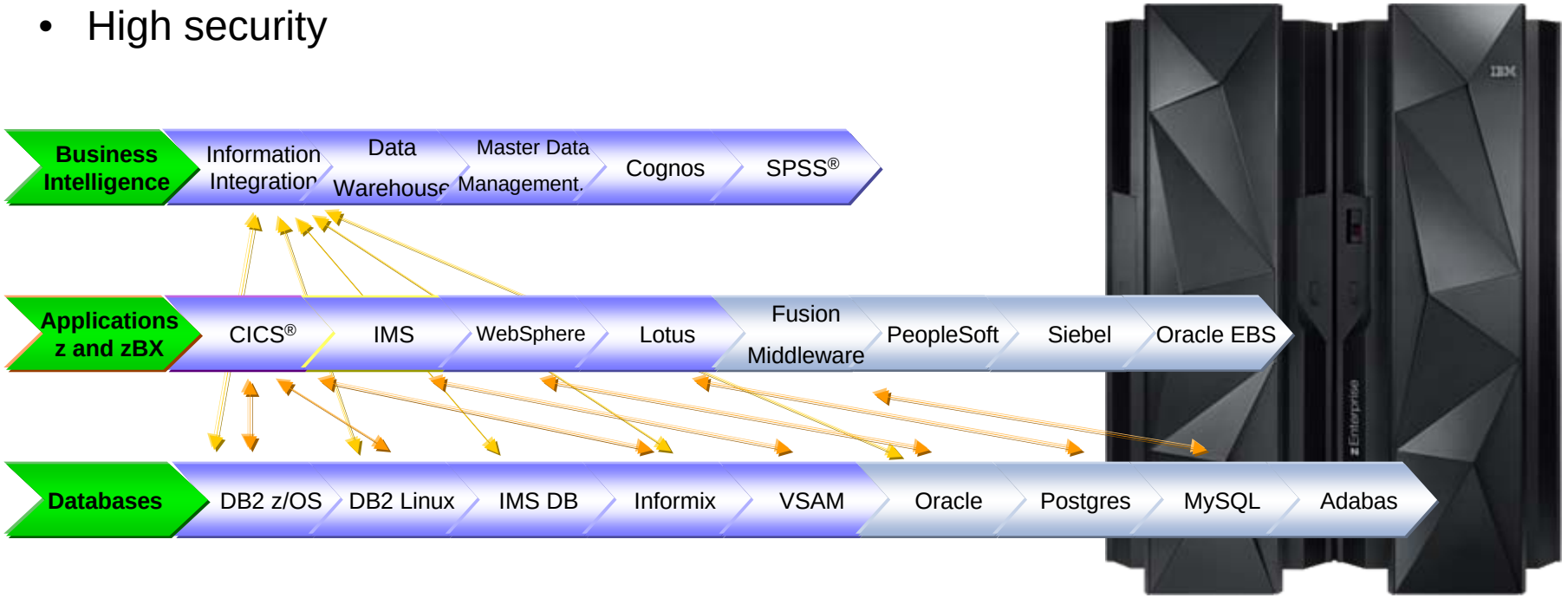
Source: IBM Market Intelligence 2012

Percentage of survey respondents

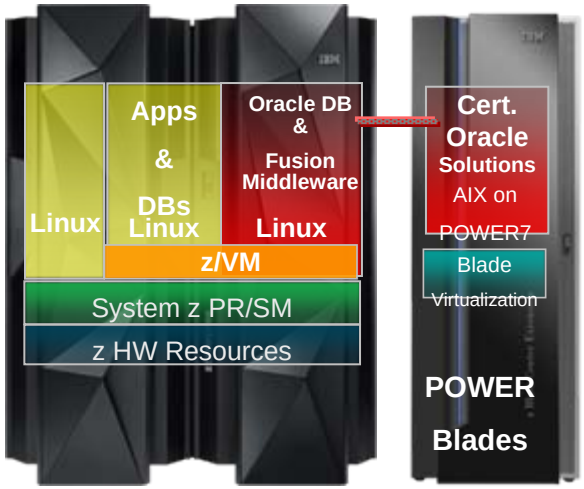
Example: Leverage Proximity of Data and Applications

Proximity of existing and new applications / data on the same physical System z server allows to „Get the Best from Your Investements“

- Access from All applications to All data
- Centralized management
- High performance
- High security



Deploy Oracle Software to the “Best Fit” Technology



Oracle software deployments (incl. consolidations) **with an Enterprise Linux Server (ELS) provides an excellent price performance.**

- From an Oracle licensing perspective 1 ELS core = 1 core from distributed server
- Less operational efforts
- High levels of security and availability

Business Connexion – South Africa

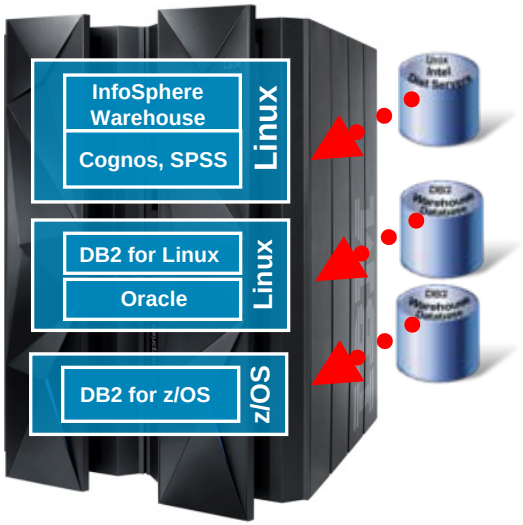
- ICT services to the financial sector, government, … and more
- Approximately 50 virtual Linux servers; flexible environment for hosted services; high performance for Oracle databases
- Enabled competitive pricing for client services

Sparda Datenverarbeitung eG – Germany

- IT provider for approximately 4.2 million customers
- Runs a number of very large Oracle databases, where the virtual Linux server requires 30 GB memory and ~350 GB storage
- Eperienced >99% availability, which proves the Linux reputation

Business Intelligence and Predictive Analytics

IBM Cognos BI and SPSS



Integrated Stack creates compelling value for the Business Users

- Predictive Analytics, BI, DW on highly scalable, secure and available IBM System z
- Low cost, easy to manage
- Simplified and faster access to the transactional data

Commercial Bank – China

- Wanted to transition to a more suitable platform to support new core-banking system
- zEnterprise is best platform for their large data center - a nation-wide consolidation
- Eliminating potential procurement delays

IBM Blue Insight - USA

- IBM's strategic analytics platform, designed to empower IBM employees
- Offers services for data warehousing and analytics, all based on System z; all data is analyzed using Cognos for Linux on System z, which generates reports for distribution
- Delivers $25 million savings over five years; enables further savings

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

Much more Workloads which Benefits from zEC12

Reliable and Scalable Business Collaboration

Lotus Domino

\+ TREND MICRO

Lotus Sametime

Lotus Quickr

Lotus Connections

Gruppo API – Italy

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 System z without interruption of service to users.

IBM Enterprise Content Management Solutions

IBM ECM includes one of more of approx. 40 different software products such as **FileNet** and **IBM Content Manager**

Large Healthcare Insurer – USA

FileNet and Content Manager OnDemand are used with DB2, InfoSphere and Cognos to support the business processes for the Integrated Health Management initiatives.

IBM Maximo Asset Management

Maximo Asset Mgmt. unifies comprehensive asset life cycle and maintenance management on a single platform.

City and County of Honolulu – USA

With Maximo Asset Mgmt. software, the city deployed a new work order system that combined citizen-provided data and data from the city's geographic information system to schedule repairs.

Reliable and Scalable Business Collaboration

Imagine the Possibilities on zEC12

Lotus Domino

Lotus Sametime

Lotus Quickr

Lotus Connections

Lotus offers solutions to deliver:

- Exceptional web experience
- Social Software
- Collaboration
- Messaging

IBM's Smarter Computing Transformation

Highest average TCO savings achieved – $780 per server per month – with migrations from UNIX to Linux on System z.

Gruppo API – Italy

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 System z without interruption of service to users. Article on Mainframezone.com

BG-Phoenics – Germany

Email is still highly important; using Linux makes it cost−effective to run this service on the ultra-reliable z196 server with the efficiencies of virtualization on System z.

IBM case study

IBM Enterprise Content Management Solutions

Enterprise Content Management (ECM) manages unstructured information

– Capture it, index it, store it, and route it electronically through business processes

– Analyzing it and deleting it are new capabilities

IBM ECM includes one of more of approx. 40 different software products

– E.g. FileNet or IBM Content Manager

Most components run on Linux on System z.

IBM is the *only* ECM solution provider who provides an ECM solution for System z.

Russian Hydrometeorological Research Institute - Russia

World Data Center is the world's largest publicly available archive for hydrometeorology monitoring data. The solution enables them to collect, process, store and disseminate information digitally. The client can now consolidate different media types and has a simplified data access.

IBM case study

Large Healthcare Insurer – USA

FileNet and Content Manager OnDemand are used with DB2, InfoSphere and Cognos to support the business processes for the Integrated Health Management initiatives. The solution brings together data from disparate sources and creates an enterprise data warehouse that can be used for data mining and forecasting.

IBM Maximo Asset Management

Key client business issues:

– Cost inefficiencies and operational complexity associated with leveraging the asset infrastructure

– Need to measure and manage the asset availability and risk across *all* strategic assets

Maximo Asset Management unifies comprehensive asset life cycle and maintenance management on a single platform.

Maximo software provides insight for all of enterprise assets, their conditions and work processes, for better planning and control.

City and County of Honolulu – USA

The original offer was for x86 technology with Oracle on System z, but IBM suggested that a Maximo solution that leverages mainframe application and database would be more advantageous to the customer. IBM case study

Technology Solutions Company – Brazil

Maximo software is used as a single point of management for every aspect of a wide range of public services. Using the solution, a city maintains and monitors its public services, assets, water, roads, parks, urban mobility and utilities, thus performing more preventive and corrective maintenance.

IBM Green Data Center – USA

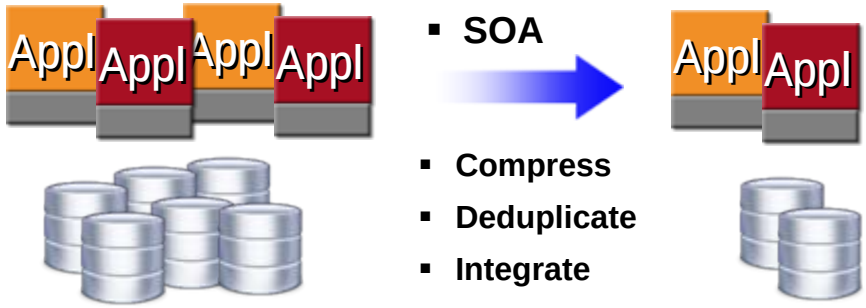
Maximo Asset Management for Energy Optimization transforms data into insights that help staff improve airflow and maximize data center efficiency.

Strategies to Improve Value and Reduce Costs

Optimize the Overall IT Environment

Consolidate Hardware Infrastructure

Consolidate Redundant Software and Data



- **SOA**
- **Compress**
- **Deduplicate**
- **Integrate**
- **Archive**

Improve Service Delivery

Integrated Service Management

Visibility **Control** **Automation**

Cloud Computing

The New Evolution of the IT Infrastructure

LARGE Infrastructure → **SMALL Infrastructure**

Less Space
Less Power
Less Admins
More Efficient

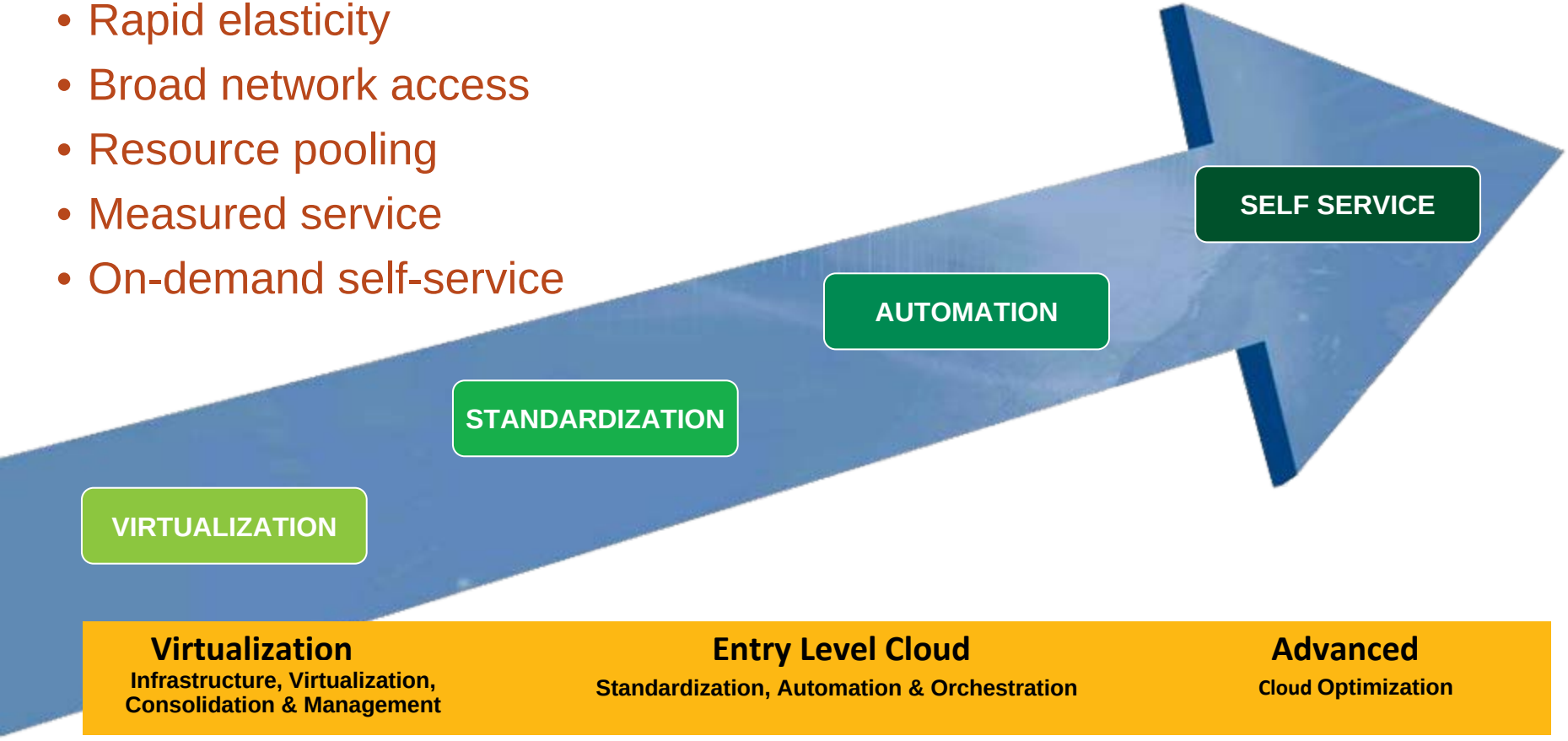
x86 RACK Systems	x86 Blade Center Systems	IBM zEnterprise
15 kw/m²	Energy Use[1]	1.5 kw/m²
20x more Expensive	Software Licenses[2]	95% Less Cost
38%	Executive Satisfaction[3] Survey	90%

[1] Montpellier PSSC Green Data Center Benchmark; [2] Baldor Case Study; [3] Solitaire Interglobal: Comparing Virtualization Alternatives

Cloud Computing - Based on Virtualization and Standardization

Cloud Computing – Characteristics *:

- Rapid elasticity
- Broad network access
- Resource pooling
- Measured service
- On-demand self-service



* Source: National Institute of Standards and Technology (NIST)