IBM System z Trends and Directions

Bryan Foley
Program Director, System z Strategy & Linux for System z Business Line Manager

March 13, 2014

Trademarks

The following are trademarks of the International Business Machines Corporation in the United States and/or other countries.

AIX*	ECKD	HiperSockets	Optim	PR/SM	Smarter Planet*	WebSphere*	z/VM*
BladeCenter*	ESCON*	HyperSwap	Parallel Sysplex*	PureScale*	System i*	z9*	z/VSE*
CIS*	FICON*	IMS	Power*	RACF*	System p*	z10	
Cognos*	FlashCopy*	Lotus*	POWER*	Rational*	System x*	z/Architecture*	
DataPower*	Genelco*	Maximo*	POWER7*	RMF	System z*	zEnterprise*	
DB2*	GDPS*	MQSeries*	PowerHA*	Smarter Analytics	Tivoli*	z/OS*	
DFSMShsm	Guardium*	OMEGAMON*	PowerVM	Smarter Cities*	VMControl	z/Secure*	
DS8000*							

* Registered trademarks of IBM Corporation

The following are trademarks or registered trademarks of other companies.

Adobe, the Adobe logo, PostScript, and the PostScript logo are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, and/or other countries.

Cell Broadband Engine is a trademark of Sony Computer Entertainment, Inc. in the United States, other countries, or both and is used under license therefrom.

Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

IT Infrastructure Library is a registered trademark of the Central Computer and Telecommunications Agency which is now part of the Office of Government Commerce.

ITIL is a registered trademark, and a registered community trademark of the Office of Government Commerce, and is registered in the U.S. Patent and Trademark Office.

Java and all Java based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.

Linear Tape-Open, LTO, the LTO Logo, Ultrium, and the Ultrium logo are trademarks of HP, IBM Corp. and Quantum in the U.S. and

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

OpenStack is a trademark of OpenStack LLC. The OpenStack trademark policy is available on the OpenStack website.

TEALEAF is a registered trademark of Tealeaf, an IBM Company.

Windows Server and the Windows logo are trademarks of the Microsoft group of countries.

Worklight is a trademark or registered trademark of Worklight, an IBM Company.

UNIX is a registered trademark of The Open Group in the United States and other countries.

* Other product and service names might be trademarks of IBM or other companies.

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.

IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

All customer examples cited or described in this presentation are presented as illustrations of the manner in which some customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics will vary depending on individual customer configurations and conditions.

This publication was produced in the United States. IBM may not offer the products, services or features discussed in this document in other countries, and the information may be subject to change without notice. Consult your local IBM business contact for information on the product or services available in your area.

All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Information about non-IBM products is obtained from the manufacturers of those products or their published announcements. IBM has not tested those products and cannot confirm the performance, compatibility, or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Prices subject to change without notice. Contact your IBM representative or Business Partner for the most current pricing in your geography.

This information provides only general descriptions of the types and portions of workloads that are eligible for execution on Specialty Engines (e.g, zIIPs, zAAPs, and IFLs) ("SEs"). IBM authorizes customers to use IBM SE only to execute the processing of Eligible Workloads of specific Programs expressly authorized by IBM as specified in the "Authorized Use Table for IBM Machines" provided at www.ibm.com/systems/support/machine_warranties/machine_code/aut.html ("AUT"). No other workload processing is authorized for execution on an SE. IBM offers SE at a lower price than General Processors/Central Processors because customers are authorized to use SEs only to process certain types and/or amounts of workloads as specified by IBM in the AUT.

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Topics

- Overall Industry Trends
- System z Technical Strategy
- IBM System z®
- The IBM zEnterprise EC12 (zEC12)
- Enterprise Linux
- The zEnterprise BladeCenter® Extension (zBX)
- Analytics
- Mobile
- Cloud
- GDPS Trends and Directions
- Security
- Questions & Discussion

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Overall Industry Trends

Key trends across the global economy that impact spending on Information Technology

- Uncertain macroeconomic indicators in developed economies
- Unstable long-term economic conditions
- Developing economies now contribute more to world economic growth than developed ones
- Success of China's economy becoming more crucial
- Globalization changes the dynamics of commerce
- Four big trends (cloud, social, mobile, analytics)
- Unrelenting march of commoditization
- Demographic shifts continue as people live longer
- Risks are everywhere, resulting in unpredictability
- Long-term risk management requires continued deployment of advanced security technologies

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Eight major trends that will affect the industry in coming years

Growth Markets
By 2015, IDC expects emerging markets to generate over 33% of all IT spending

Big Data
Through 2015, more than 85% of Fortune 500 organizations will fail to effectively exploit big data for competitive advantage

Security
Through 2016, the financial impact of cybercrime will grow 10% per year, due to the continuing discovery of new vulnerabilities

Analytics
Through 2015, more than 90% of business leaders contend information is a strategic asset, yet fewer than 10% will quantify its economic value

Cloud
Economic benefits of cloud will continue to be the #1 driver of adoption through 2016 for most companies.*

Social Business
By 2014, 20% of business users will replace email as the primary interpersonal communications with social networking

Mobile Enterprise
66% of CIOs ranked mobility as a top investment priority in 2012

Smarter Planet
Over $100 billion: Global investment in technology to support smart city development by 2020

*Source: IDC, IDC's CloudTrack 2012 Summer Survey, Part 1: Cost Savings in the Cloud, November 14, 2012

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

IBM System z

Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

zEnterprise:

Integrated IT Infrastructure for Optimized Service Delivery

zEnterprise Unified Resource Manager

- Integrated, dynamic, intelligent resource management
- Workload-Aware Resource Optimization
- Enabled for Infrastructure as a Service

IBM zEnterprise™ EC12 (zEC12)

- Optimized to host large scale database, transaction, and mission critical applications
- The Most efficient platform for Large-scale Linux consolidation

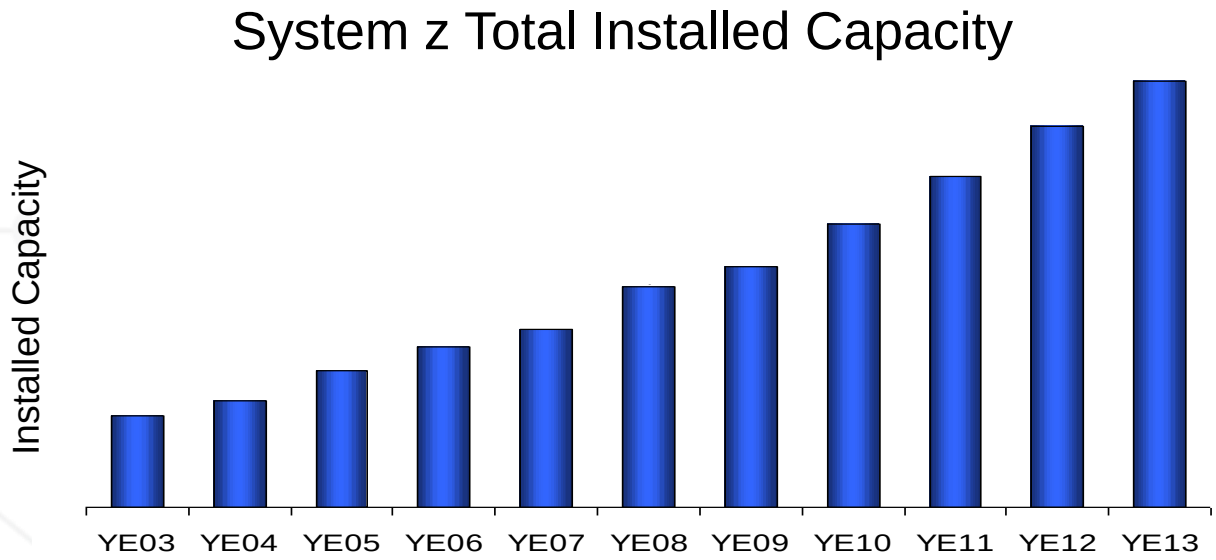
IBM DB2 Analytics Accelerator (IDAA)

- Unprecedented response times to enable 'train of thought' analyses
- Deep transparent integration with DB2
- Queries are executed in the most efficient location

zEnterprise BladeCenter Extension (zBX)

- Selected IBM POWER7™ blades and IBM System x® Blades* for AIX® , Linux, and Windows applications
- High performance optimizers and appliances to accelerate time to insight and reduce cost
- Integrated high performance private network

IBM zEnterprise System:
New clients, new workloads, new applications



260+

new accounts since 3Q10 zEnterprise launch, with 40% in growth markets

320+

hybrid computing units shipped since 3Q10

31%

growth in installed IFL MIPS

7,500+

ISV apps run on IBM System z; 90 new ISVs added in 3Q13

[IFL = Linux-on-z Only Engine]
As of 4Q13

System z Technical Strategic Priorities

Data Server of Choice for Transactions & Analytics

Business Analytics

- Integrated Stack
- Workload-optimized
- OLTP -> HyTAP
- Generate business insights with Big Data style queries

Data-Serving

- Deliver more data … faster
- Support new/popular data formats & Enhance cross platform data access

Stack Performance

- Get workload done faster
- Scale capacity with workload
- Co-optimize hardware & software

Most Secure & Reliable

Security

- Auditable protection of data
- Simplify management & compliance
- Security Analytics
- Cloud security as a service

System Availability

- IT analytics for monitoring & resiliency of the datacenter

Sysplex Availabiity

- Enhanced GDPS
- Active-active solutions
- Asynchronous data replication
- Simplification and autonomics

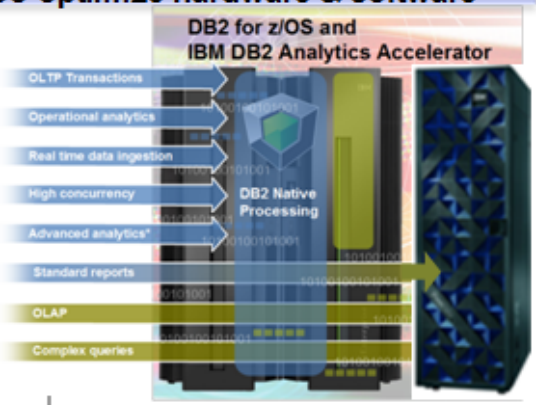
Enterprise Cloud Leadership

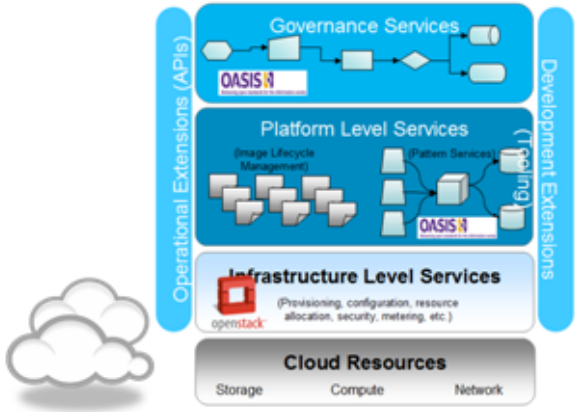
Enterprise Cloud

- Enable cloud-based delivery
- Dynamic shared infrastructure
- Common Cloud Stack
- Isolation for multi-tenancy
- SW defined environment leveraging virtualization
- Streamline deployment/delivery (DevOps, Patterns)
- Develop partnerships with MSP's

Heterogeneous & Mobile Workloads

- Linux consolidation
- Integrate mobile workloads
- Industry Solutions
- Extend platform management
- Cross-platform integration





zEnterprise:

Integrated IT Infrastructure for Optimized Service Delivery

zEnterprise Unified Resource Manager

- Integrated, dynamic, intelligent resource management
- Workload-Aware Resource Optimization
- Enabled for Infrastructure as a Service

IBM zEnterprise™ EC12 (zEC12)

- Optimized to host large scale database, transaction, and mission critical applications
- The Most efficient platform for Large-scale Linux consolidation

IBM DB2 Analytics Accelerator (IDAA)

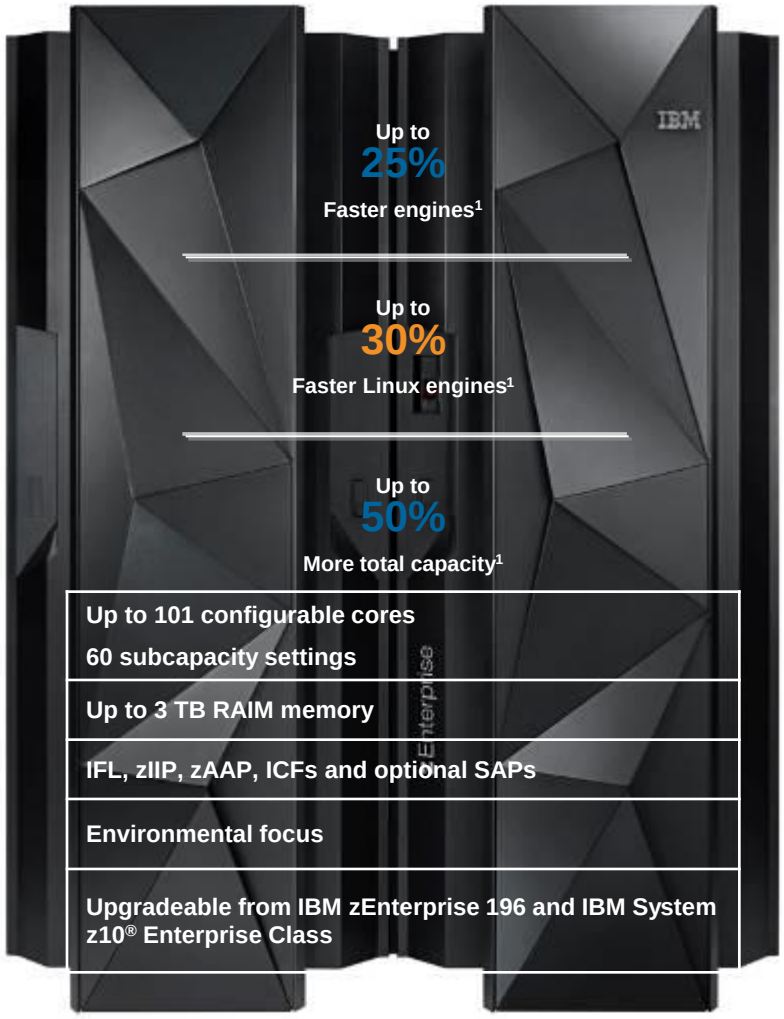
- Unprecedented response times to enable 'train of thought' analyses
- Deep transparent integration with DB2
- Queries are executed in the most efficient location

zEnterprise BladeCenter Extension (zBX)

- Selected IBM POWER7™ blades and IBM System x® Blades* for AIX® , Linux, and Windows applications
- High performance optimizers and appliances to accelerate time to insight and reduce cost
- Integrated high performance private network

zEnterprise EC12 satisfies the most robust enterprise requirements

Announced August 28, 2012



zEC12

Machine Type: 2827

Models: H20, H43, H66, H89, HA1

- **Advanced Technology 5.5 GHz processor chip for performance boost for all workloads**
  - Over ***78,000 MIPS*** for large scale consolidation
- **Processor chip optimized for software performance**
- **Innovation to drive availability to superior levels**
  - ***IBM zAware*** offers snap-shot of the current state of your business
  - ***FLASH Express and pageable large pages*** to drive availability and performance for critical workloads
- **Trusted resilience is a zEnterprise standard**
  - High speed ***cryptography integrated as part of the chip***
  - Enhanced functions with new ***Crypto Express4S***
  - PR/SM **received** ***EAL5+ certification***

[1]Based on preliminary internal measurements and projections against a z196. Official performance data will be available upon announce and can be obtained online at LSPR (Large Systems Performance Reference) website at: https://www.ibm.com/servers/resourcelink/lib03060.nsf/pages/lsprindex. Actual performance results may vary by customer based on individual workload, configuration and software levels.

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

zEnterprise: Enhancing our IBM Mainframe Platform

IBM continues to deliver enhancements that strengthen the role of the mainframe

Support for 50% more I/O devices per FICON channel

Efficiencies provided for shared CF engines

Flash Express exploited by Coupling Facility

LPAR capacity setting update

Unified Resource Manager enhancements

z/VM V6.3 support for 1TB real memory

zEDC Express for data compression

New 10GbE RoCE Express

EP11 and digital signatures - more standards

Simplification and new wizard on TKE 7.3 workstation

New Smart card with stronger encryption

Refresh OSA technology with OSA-Express5S

Crypto as a Service with z/OS V2.1

zEC12: Our Smarter Computing infrastructure that is Cloud Ready, Data Ready, and Security Ready, enabling a Smarter Planet® for today and tomorrow

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

New and additional function/features added since zEC12 availability

IBM zAware and Flash Express were first introduced with the zEC12

- **zBC12 and zEC12 GA2 1 of 2**
- **I/O Enhancements**
  - IBM zEnterprise Data Compression (zEDC) capability for z/OS V2.1 using zEDC Express – Designed to reduce CPU consumption, optimize performance of compression related tasks, and enable more efficient use of storage resources providing a lower cost of computing
  - RDMA (Remote Direct Memory Access) support for z/OS over 10GbE RoCE Express (RDMA over Converged Ethernet) through the use of the new SMC-R (Shared Memory Communications - Remote) protocol - High speed inter communication facilitating data movement between zBC12/zEC12 Systems with z/OS using SMC-R. Improves network latency and throughput, reducing CPU overhead, z/OS network congestion, and cost related to remote off stack data movement.
  - OSA-Express5S – Technology refresh with hot-pluggable transceivers: Exclusive to zBC12/zEC12
- **Security Enhancements**
  - Crypto EP11 enhancements - Extending EP11 support by providing additional cryptographic algorithms in the hardware

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

New and additional function/features added since zEC12 availability

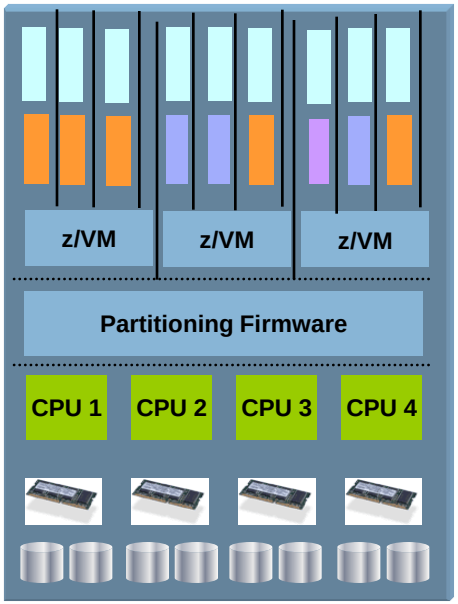
IBM zAware and Flash Express were first introduced with the zEC12

- **zBC12 and zEC12 GA2 – 2 of 2**
- **Coupling Enhancements**
  - CFCC Flash Express Exploitation (SoD)* - The coupling facility will exploit Flash Express memory for the purpose of migrating objects out to flash memory when the number of objects exceeds a calculated threshold and fetching them back into main CF storage when requested. With this support the CF itself will now recognize when MQ shared queues are filling up and utilize Flash Express memory as a storage device if it is present.
  - Coupling Thin Interrupts support - Provides new scheme which enhances exploitation of shared CF engines. Designed to improve z/OS performance on asynchronous operations and Sysplex efficiencies.
- **Unified Resource Manager Enhancements**
  - CPU management for x Blades support - Enables Unified Resource Manager to dynamically manage processors for x86 blades in the zBX. Allows customers to monitor availability of workload resources to satisfy a defined workload service level policy by using cgroups (control groups) which is a function in the KVM hypervisor that allows for management of the processor. cgroup exploitation by Unified Resource Manager/PPM will be to assign cgroup to virtual servers and to dynamically manage CPU share of a virtual server based on policy goals
  - Ensemble Availability Manager (EAM) - Introduction of basic availability services for the ensemble as part of Unified Resource Manager (System p, System x, PR/SM) allows customers to monitor for errors, including conditions affecting the availability of resources and complete error analysis. Allows customers to manage CPU to satisfy a defined workload policy for x86 blades in zBX. Consistency in zBX offering across blade types.

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

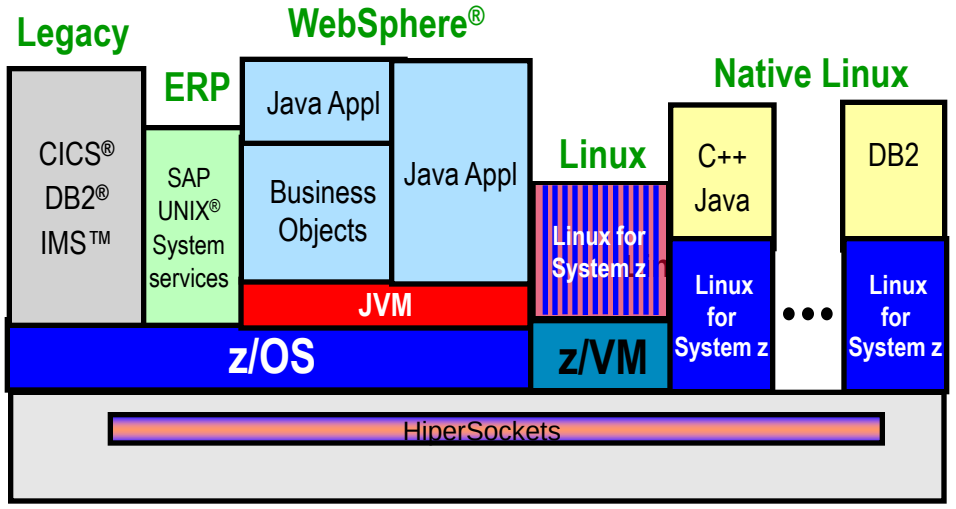
The Ultimate Virtualized System

IBM Mainframe

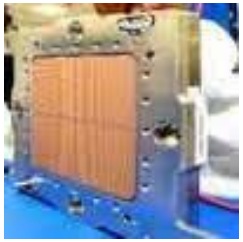


- **Utilization often > 80%**
- Handles **peak workload utilization of up to 100%** without service degradation for high priority workloads

- Massive, robust consolidation platform
- 60 logical partitions, 100's to 1000's of virtual servers under z/VM
- Virtualization is built in, not added on (Processor and I/O)
- HiperSockets for memory-speed communication, as well as Virtual Hipersockets via Guest LANs in z/VM
- Most efficient hypervisor function available
- Sysplex (Single System Image Clustering)
- Intelligent and autonomic management of diverse workloads and system resources based on business policies and workload performance objectives:



Leveraging the Breadth of IBM Technology



AIX

Linux

z/OS

z/TPF

z/VM

z/VSE

Java

Rational.

WebSphere

Information Management

Tivoli

Lotus.

Cognos.

Semiconductor Technology

Microprocessor Design

Systems Design

Virtualization & Operating Systems

Compilers & Java Virtual Machine

Optimized Middleware

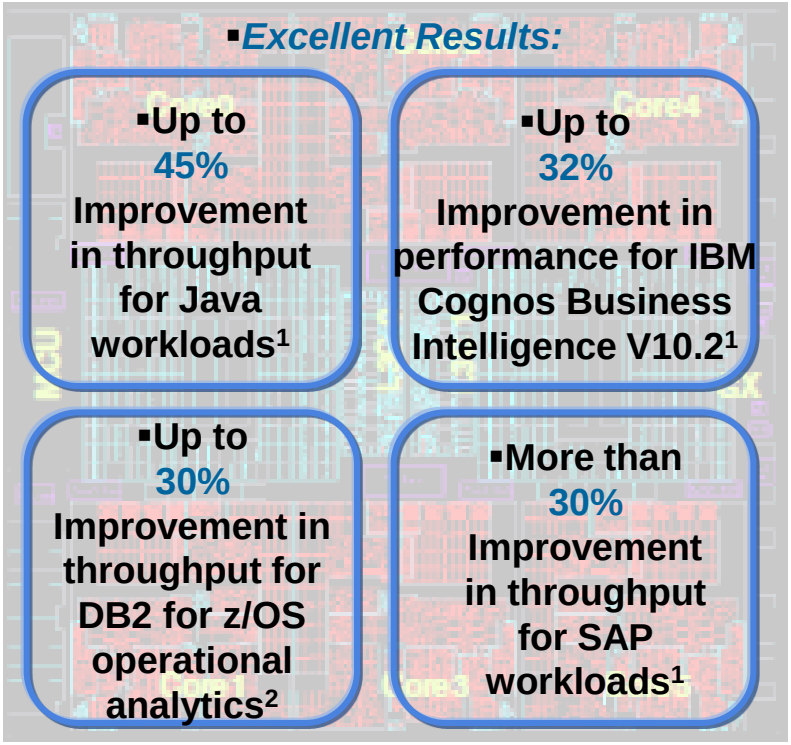
IBM Investment in System z spans the platform stack

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Processor chip optimized for software performance

Exploited by Java, PL/I, compilers, DB2, more

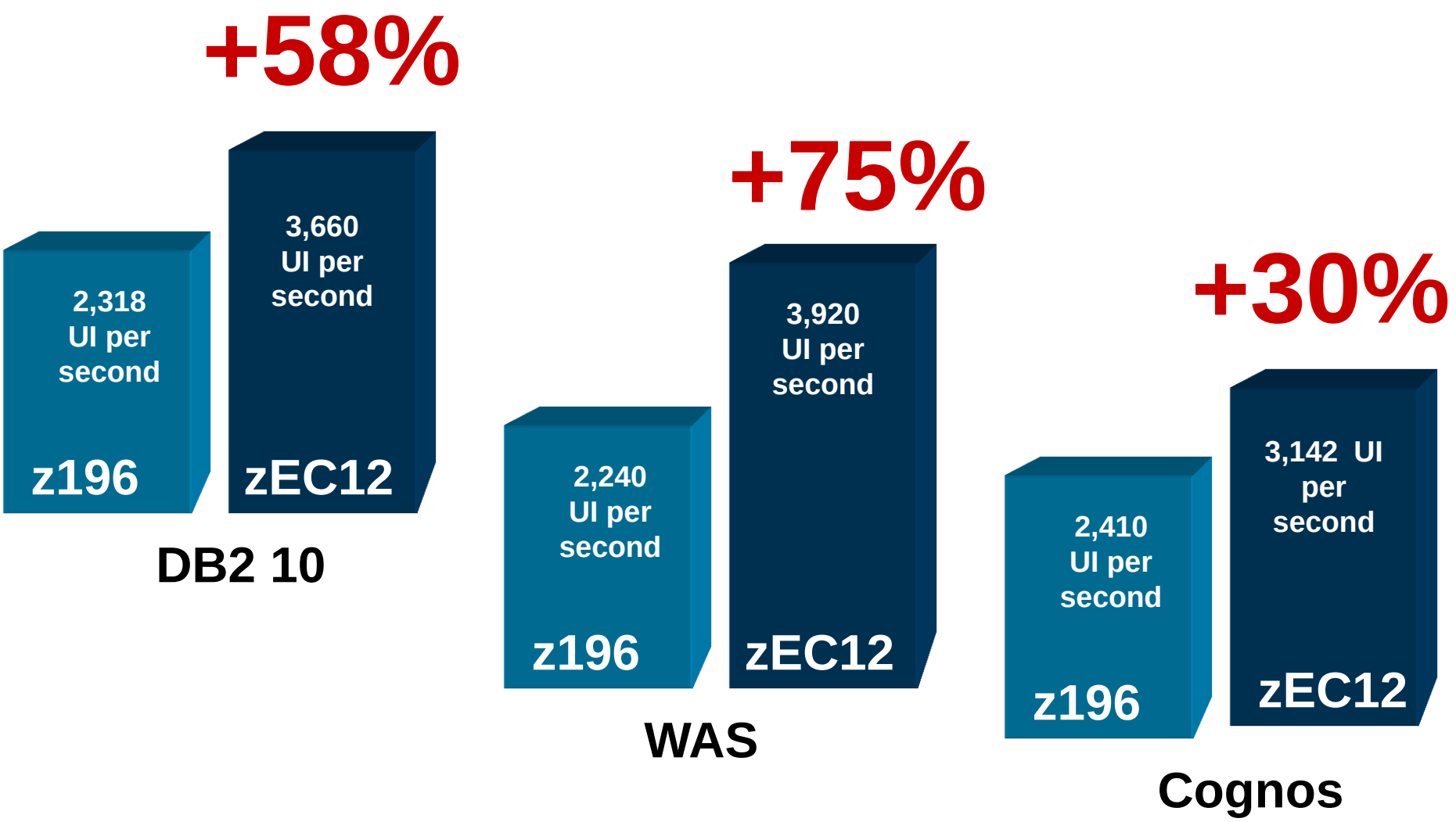
- **Our leadership in microprocessor design supports a boost in performance for all workloads**
  - Second generation out of order execution design
  - Multi-level branch prediction supports complex workloads
- **Larger caches to optimize data serving environments**
  - Almost 2x on chip and 2x additional on book
- **New hardware functions optimized for software performance**
  - ***Transactional Execution Facility*** for parallelism and scale
  - ***Runtime Instrumentation Facility*** is intended to help reduce Java overhead
  - ***2 GB page frames*** are intended to offer performance Improvements for DB2 buffer pools and Java heaps
  - New IBM Enterprise PL/I compiler is planned to exploit and get a performance boost from ***decimal format conversions facility***
  - Up to ***30% improvement in IMS™ throughput*** due to faster CPU, cache and compliers[1]
  - Workloads leveraging ***Flash Express*** with ***Pageable Large Pages*** can see up to a ***8% price performance improvement***[3] over the z196



- [1] Based on preliminary internal measurements and projections
- [2] As measured by the IBM 9700 Solution Integration Center. The measured operational BI workload consists of 56 concurrent users executing a fixed set of 160,860 Cognos reports . Compared DB2 v10 workload running on IBM's z196 w/10 processors to an zEC12 w/10 processors
- [3] based on average 5% discount for zEC12 workloads under the AWLC pricing plus up to 3% more performance per MSU with Flash Express.

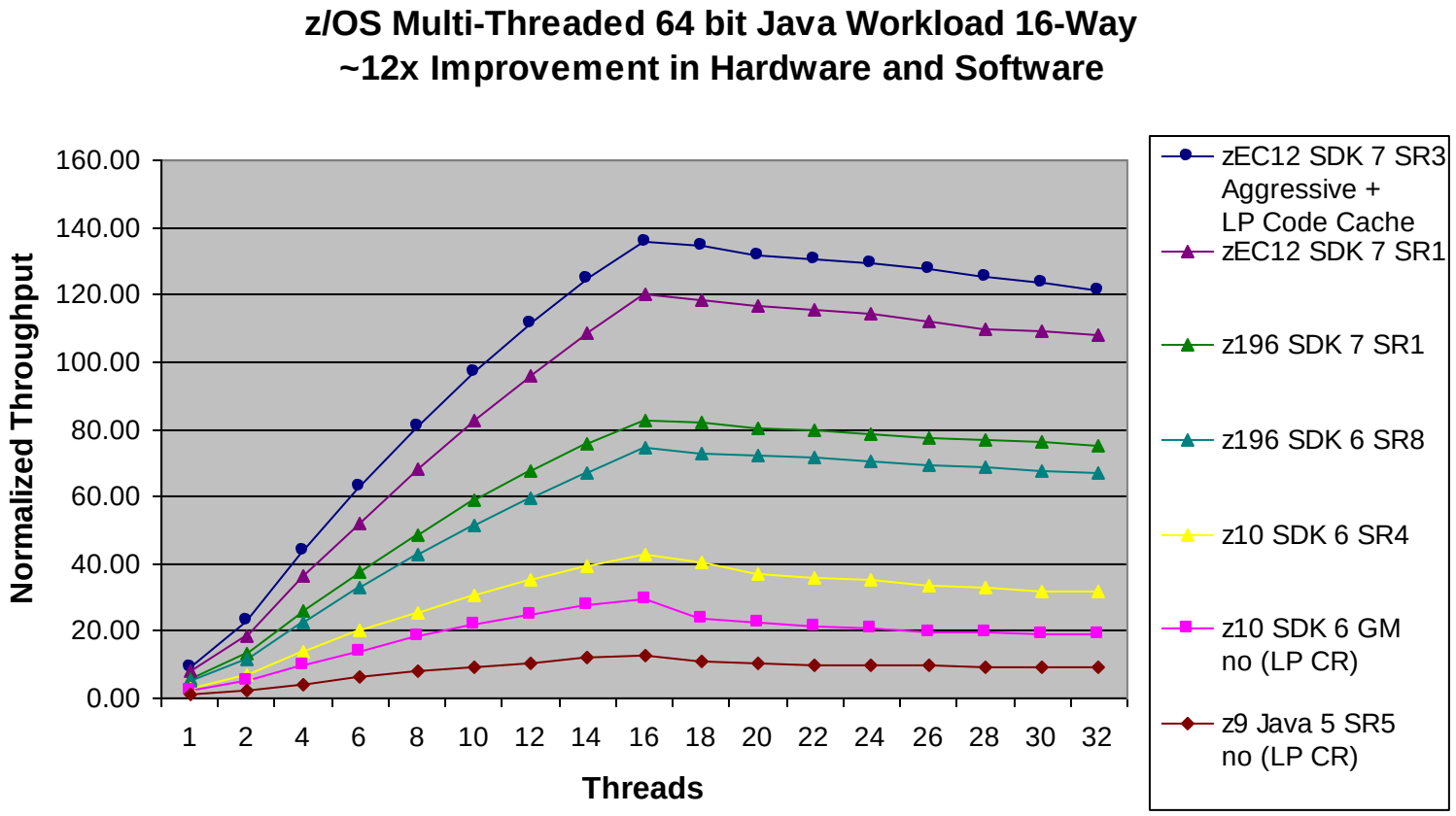
* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Optimized for critical data workloads



z/OS Java SDK 7: 16-Way Performance

Aggregate HW and SDK Improvement z9 Java 5 SR5 to zEC12 Java 7SR3



~12x aggregate hardware and software improvement comparing Java5SR5 on z9 to Java7SR3 on zEC12

LP=Large Pages for Java heap CR= Java compressed references

Java7SR3 using -Xaggressive + Flash Express pageable 1Meg large pages

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

zEC12 – More Hardware for Java

Continued aggressive investment in Java on System z

Significant set of new hardware features tailored and co-designed with Java

Hardware Transaction Memory (HTM)

Better concurrency for multi-threaded applications
e.g., ~2X improvement to juc.ConcurrentLinkedQueue

Run-time Instrumentation (RI)

Innovative new hardware facility designed for managed runtimes
Enables new expanse of JRE optimizations

2GB page frames

Improved performance targeting 64-bit heaps

Pageable 1MB large pages using flash

Better versatility of managing memory, less overhead

New software hints/directives

Data usage intent improves cache management
Branch preload improves branch prediction

New trap instructions

Reduce overhead of implicit bounds/null checks

New 5.5 GHz 6-Core Processor Chip

Large caches to optimize data serving

Second generation OOO design

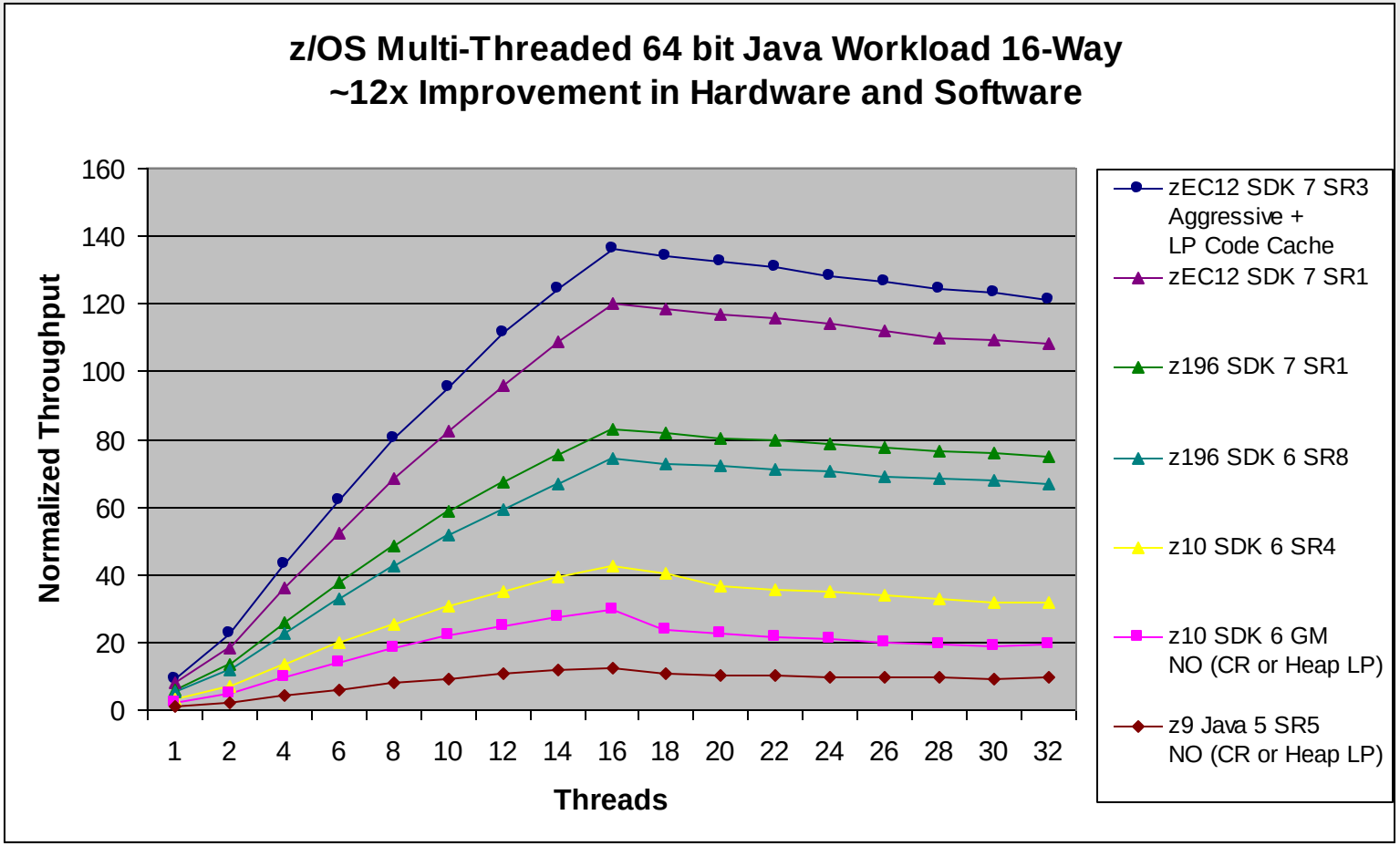
*Up-to **60%** improvement in throughput amongst Java workloads measured with zEC12 and Java7SR3*

Engineered Together—IBM Java and zEC12 Boost Workload Performance
http://www.ibmsystemsmag.com/mainframe/trends/whatsnew/java_compiler/

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

z/OS Java SDK 7: 16-Way Performance

Aggregate HW and SDK Improvement z9 Java 5 SR5 to zEC12 Java 7SR3



~12x aggregate hardware and software improvement comparing Java5SR5 on z9 to Java7SR3 on zEC12

LP=Large Pages for Java heap CR= Java compressed references

Java7SR3 using -Xaggressive + Flash Express pageable 1Meg large pages

(Controlled measurement environment, results may vary)

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Do a Proof of Concept today!!!

New innovations available on zBC12 and zEC12

Compress your data 4X	*Network latency reduced up to 80% to improve service levels*	*10x faster response time and 37% increase in throughput vs disk*	*Difficult or unusual problems can be found in 2 clicks not hours*	*84% Lower TCA with fit for purpose cloud architectures*
NEW	NEW	ENHANCED	ENHANCED	NEW
Data Compression Acceleration	**High Speed Communication Fabric**	**Flash Technology Exploitation**	**Proactive Systems Health Analytics**	**Hybrid Computing Enhancements**
Reduce CP consumption, free up storage & speed cross platform data exchange	Optimize server to server networking with reduced latency and lower CPU overhead	Improve availability and performance during critical workload transitions, now with dynamic reconfiguration; CF exploitation (SOD)	Increase availability by detecting unusual application or system behaviors for faster problem resolution before they disrupt business	x86 blade resource optimization; New alert & notification for blade virtual servers; Latest x86 OS support; Expanding future roadmap
zEDC Express	*10GbE RoCE Express*	*IBM Flash Express*	*IBM zAware*	*zBX Mod 003; zManager; Ensemble Availability Manager; DataPower Virtual appliance (SoD)*

ENHANCED **zIIP & zAAP Specialty Engines:** 100% increase in allowable zIIP/zAAP capacity per CP to improve new workload economics – moving from 1:1 to 2:1 ratio

NEW **zEnterprise compilers (COBOL, PL/I, C/C++)** provide an optimized application infrastructure for increased software performance

System Z Compression for the CIO

- Cut DASD storage costs for compressed data in half saving your organization $millions with at low CPU overload enabling a new generation of data intense applications.
- Improve the effectiveness and lower the cost of DASD replication technology by cutting data transfers in half for compressed data.
- Improve Batch Processing times by higher effective I/O transfer rates and improved I/O buffering. Where deployed, compression can remove I/O related bottleneck from I/O limited workloads such as the creation of audit logs including IBM's SMF log.
- Reduce CPU consumption and shorten execution times for Java workloads that use Java deflate services.

System z Compression *is a critical building block for high performance data serving that allows lower cost, higher performance data storage.* ***System z Compression*** *transforms existing compression users by increasing compression rates tenfold with lower CPU consumption and enables new middleware compression exploitation.*

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Technology drivers

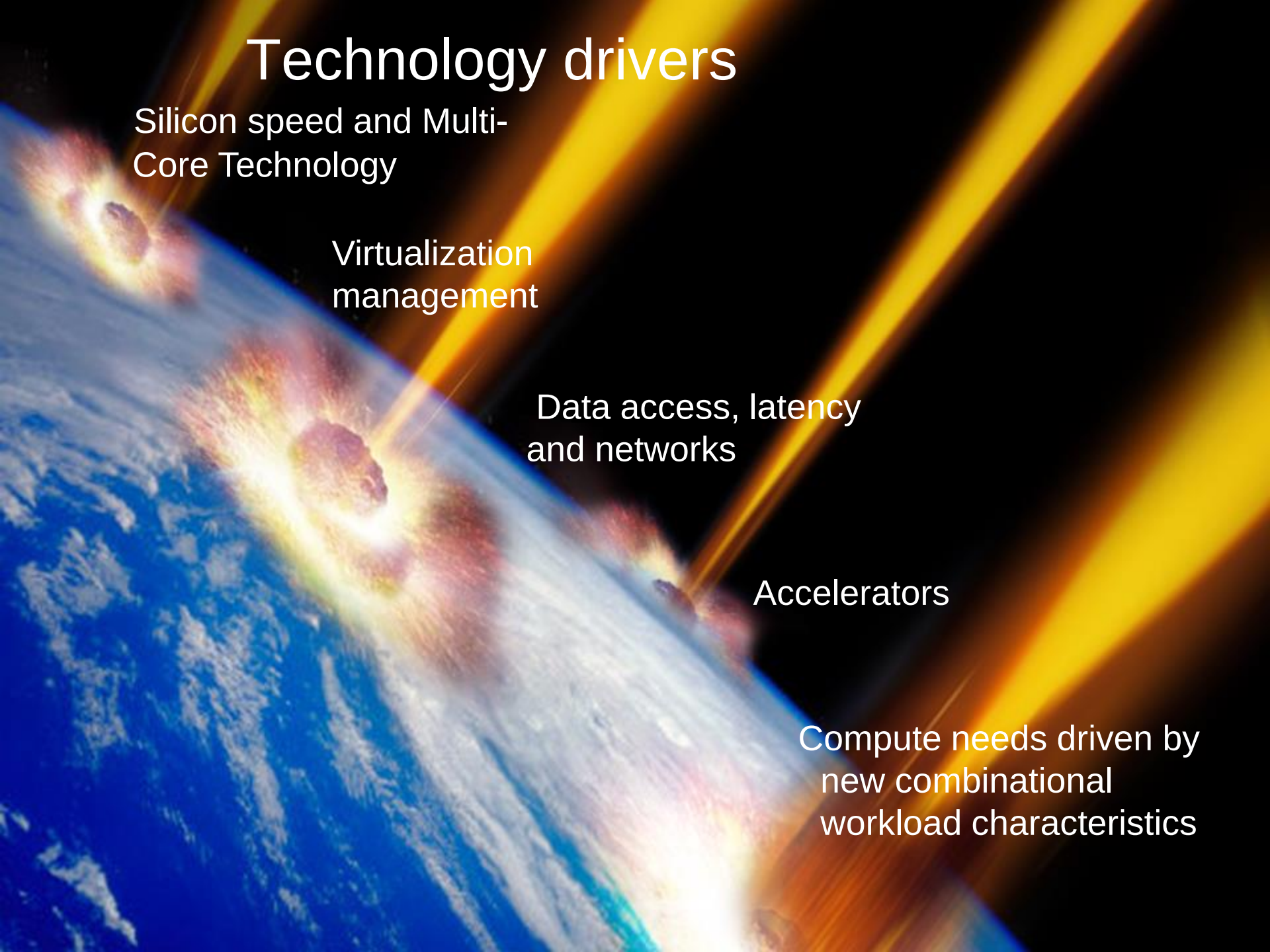
Silicon speed and Multi-Core Technology

Virtualization management

Data access, latency and networks

Accelerators

Compute needs driven by new combinational workload characteristics



IBM Enterprise Linux Server

including IBM Wave for z/VM

Master IT complexity

The real alternative to compete versus x86 sprawl !

Multidimensional Virtualization

Very large Shared Resource Space

Allows for consolidation and tight integration of Large Server Farms

into

VIRTUAL "BLADES"

VIRTUAL "RACKS"

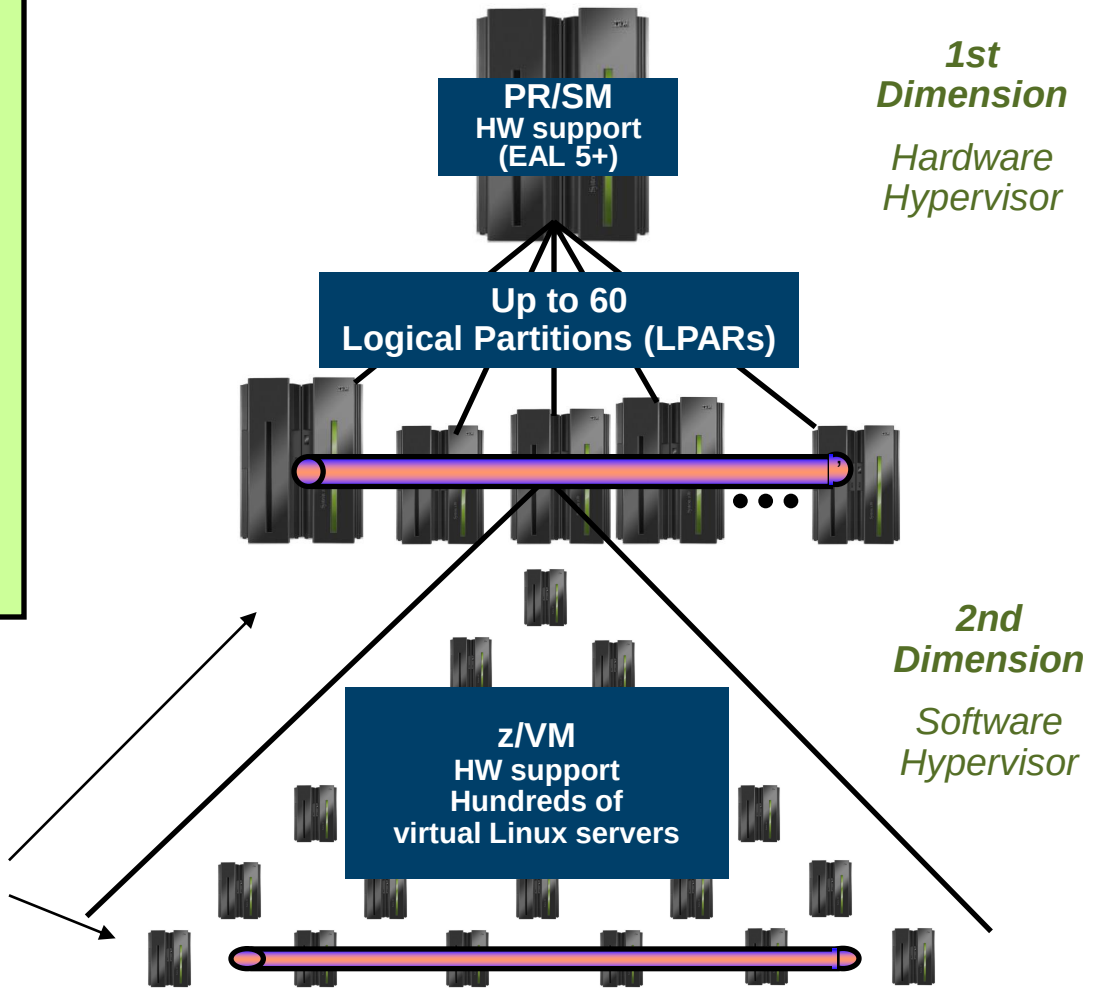
VITUAL NETWORKS

on the same footprint with managed performance, QoS and HW enforced security isolation

High speed (multiple GB/sec) and low latency interconnect

For integration with full integrity/isolation

The power of many
The simplicity of one



Virtualization is transparent for OS/Application execution
HW Enforced Isolation

IT Simplicity with Enterprise Linux

IBM Enterprise Linux Server

Facts		Values
Deploy up to 40 virtual servers per core		As low as $1.^{00}$/day per virtual server[1]
Up to 520 virtual servers in a single ELS footprint	**Linux Server Solution** including hardware, virtualization and support	Save up to 55% on TCO over 5 years[2]
Intelligent visualization – Simplified monitoring – Unified management		More than 3,000 ISVs apps supported
Secure isolation of logical partitions with highest level of security certification		Starting as low as $75K USD[3]
Support for Red Hat, SUSE and OpenStack® Cloud		

[1] IBM calculations of zEnterprise limits across maximum zBC12 configuration. Results may vary. 3-Year cost for hardware, hardware maintenance, and z/VM.
[2] Based on preliminary measurements and projections comparing Oracle DB on x86 2 chip 8 core 2.13GHz blades vs. zBC12 and ELS solution edition pricing. Subject to change and results may vary based on numerous factors.
[3] Based on US market and will vary by country.

IT Simplicity with Enterprise Linux

IBM Enterprise Linux Server – based on IBM zEnterprise® EC12 (zEC12)

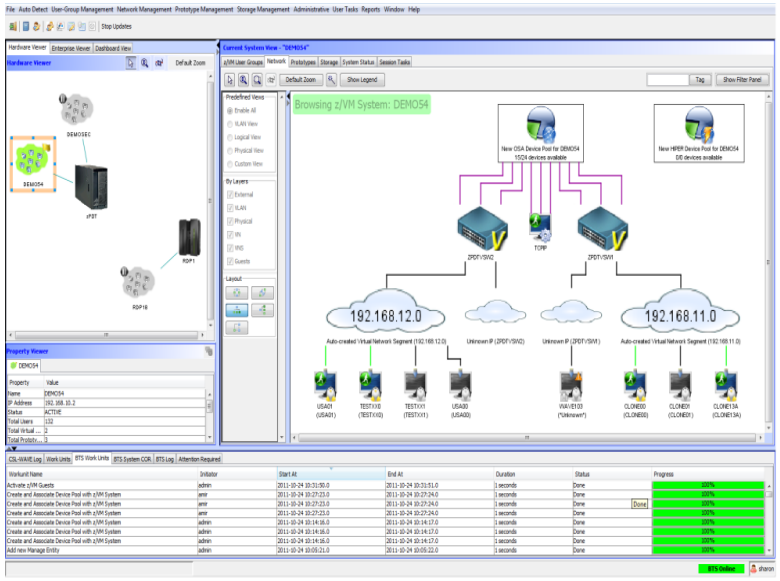
Facts		Values
Deploy up to 60 virtual servers per core		As low as 70 cents/day per virtual server[1]
Up to >6000 virtual servers in a single ELS footprint	**Linux Server Solution** including hardware, virtualization and support	Save up to 68% on TCO over 5 years[2]
Intelligent visualization – Simplified monitoring – Unified management		More than 3,000 ISVs apps supported
Secure isolation of logical partitions with highest level of security certification		Starting as low as $75K USD[3]
Support for Red Hat, SUSE and OpenStack® Cloud		

[1] IBM calculations of zEnterprise limits across maximum zEC12 configuration. Results may vary. 3-Year cost for hardware, hardware maintenance, and z/VM.
[2] IBM calculation based on a 20:1 consolidation ration and ELS solution edition pricing. 5-Year total IT cost. Subject to change and results may vary based on numerous factors.
[3] Based on US market and will vary by country.

IBM Wave for z/VM (IBM Wave) Overview

IBM Wave simplifies and helps automate management and administration of z/VM and Linux virtual servers, jumpstarting the initial steps needed to get to cloud. By using a new user interface it extends the reach of your administrative 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



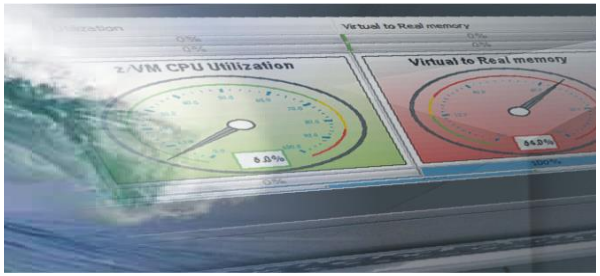
A simple, intuitive graphical management, provisioning, and automation tool to help you fully leverage the power of System z virtualization on z/VM.

Extend the Reach of Skills with IBM Wave for z/VM

Intelligent Visualization

- Shorten the learning curve needed to manage complex environments
- Organize and simplify management of z/VM and virtual Linux servers
- View servers and storage utilization graphically; understand the status of system resources with Intelligent icons
- Reduce unnecessary steps using highly customizable views
- Graphical or tabular displays with layered drill down
- Make existing staff more self-sufficient

Simplified Monitoring



- Monitor the status of z/VM systems through an innovative interface
- Monitor performance of CPU, paging devices, spool disks and more;
- Use agentless discovery to detect an accurate view of your environment
- Use advanced filters, tagging, layout and layer selection to make monitoring and management more meaningful
- Complements IBM OMEGAMON® XE used for in-depth performance monitoring

Unified Management

- Manage your system from a single point of control
- Assign and delegate administrative access with role based assignments
- Provision, clone, and activate virtual resources . Define and control virtual network and storage devices
- Perform management tasks such as live guest relocation
- Annotate resources for additional policy based management
- Execute complex scripts with a single mouse click

Fewer Cores result in Less Software Costs

Software Pricing:

One x86 core is equivalent to one ELS core[1]

Much fewer cores

	204 cores	*Example:* **Software cost per core:** ▪ OTC = **$40K** ▪ Support per year = **$10K**	17 IFLs (cores)	
1. Year	OTC: **$8,160K** Support: **$2,040K**		OTC: **$680K** Support: **$170K**	1. Year
2. Year	Support: **$2,040K**		Support: **$170K**	2. Year
3. Year	Support: **$2,040K**		Support: **$170K**	3. Year
Total	**$14,280K**	$13,090K less = **91,6% less**	**$1,190K**	**Total**

Linux Software is usually priced on the number of cores

[1] PVU rating is not taken into account

Comparing IT costs and value

- Enormous pressure on IT budgets
- Many aspects of IT costs are obvious
  - Hardware
  - Software licensing and support
  - Skills
  - Environmentals and floor space
- Some are much less obvious:
  - Telecommunications
  - Fiber
  - Operational complexity
  - Backup and recovery
  - Business cost of an outage

IBM can help you compare!

- RACE studies
- Eagle studies
- Scorpion studies (fee-based)

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

zEnterprise:

Integrated IT Infrastructure for Optimized Service Delivery

IBM zEnterprise™ EC12 (zEC12)

- Optimized to host large scale database, transaction, and mission critical applications
- The Most efficient platform for Large-scale Linux consolidation

IBM DB2 Analytics Accelerator (IDAA)

- Unprecedented response times to enable 'train of thought' analyses
- Deep transparent integration with DB2
- Queries are executed in the most efficient location

zEnterprise Unified Resource Manager

- Integrated, dynamic, intelligent resource management
- Workload-Aware Resource Optimization
- Enabled for Infrastructure as a Service

zEnterprise BladeCenter Extension (zBX)

- Selected IBM POWER7™ blades and IBM System x® Blades* for AIX® , Linux, and Windows applications
- High performance optimizers and appliances to accelerate time to insight and reduce cost
- Integrated high performance private network

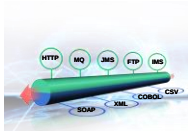
Evolution of hybrid computing with IBM System z

July 2010
z196
First ever multiplatform computer – mainframe and distributed with single management

Nov 2010

Availability of zBX with POWER7 blades and IBM Smart Analytics Optimizer

Mar 2011
DataPower XI50z within the zBX



Jul 2011

Announce zEnterprise 114

Sep 2011
Availability of Linux on System x on HX5 blades in the zBX

Oct 2011

IBM DB2 Analytics Accelerator – evolution of IBM Smart Analytics Optimizer – coming out of the zBX and into Netezza® technology

Dec 2011
Availability of Microsoft Windows on System x blades in zBX and APIs

Aug 2012

zEC12 Next generation of hybrid computing

Oct 2012
Announced zEnterprise Analytics System 9700 and IBM DB2 Analytics Accelerator V3

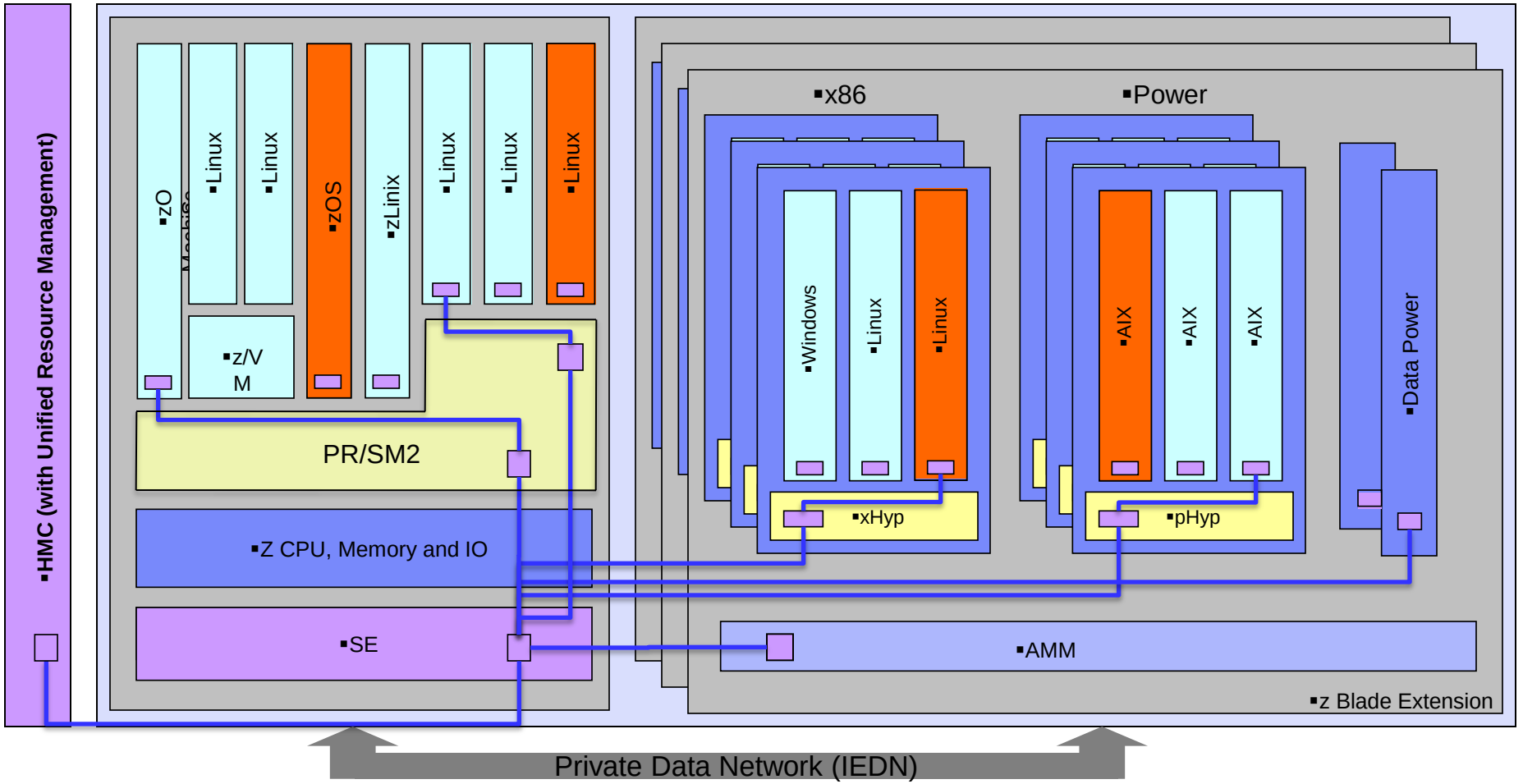
Jul 2013

Announce zBC12

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

zEnterprise: Simplified virtualization and management

Workload Resource Groups: SLA Mgmt and Reporting (Deployment, Performance, Availability, Security, Energy)



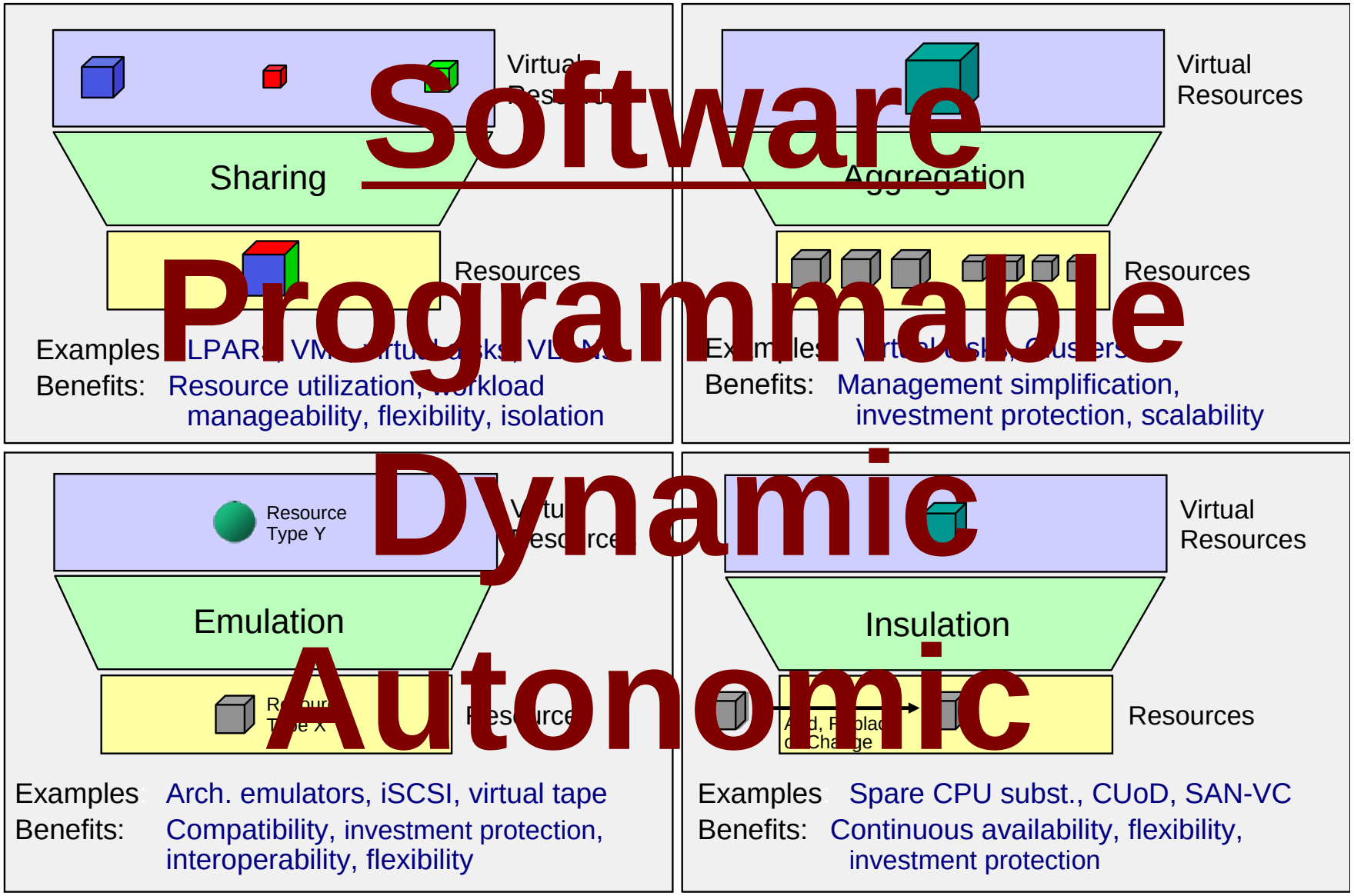
* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Virtualization Trends and Observations

- Rigidity of traditional IT environments and organizational boundaries can be a significant impediment to rapid development and deployment of applications and services
- Workload resource requirements are becoming more diverse, more dynamic, and less predictable
- The value of virtualization is expanding beyond resource sharing and improved utilization to providing IT deployment agility, optimization, and operational efficiency
- A virtualized IT Infrastructure allows the resources to be expressed as “software” which enables advanced levels of management automation and promotes new levels of agility, efficiency, and alignment with service level objectives
- Virtualization is becoming the foundation for Agile IT Infrastructure Deployment, Operational Management, and Control

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Infrastructure Virtualization Benefits



* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

zEnterprise:

Integrated IT Infrastructure for Optimized Service Delivery

zEnterprise Unified Resource Manager

- Integrated, dynamic, intelligent resource management
- Workload-Aware Resource Optimization
- Enabled for Infrastructure as a Service

IBM zEnterprise™ EC12 (zEC12)

- Optimized to host large scale database, transaction, and mission critical applications
- The Most efficient platform for Large-scale Linux consolidation

IBM DB2 Analytics Accelerator (IDAA)

- Unprecedented response times to enable 'train of thought' analyses
- Deep transparent integration with DB2
- Queries are executed in the most efficient location

zEnterprise BladeCenter Extension (zBX)

- Selected IBM POWER7™ blades and IBM System x® Blades* for AIX® , Linux, and Windows applications
- High performance optimizers and appliances to accelerate time to insight and reduce cost
- Integrated high performance private network

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

IBM DB2 Analytics Accelerator

Accelerating decisions to the speed of business

▪*Blending System z and Netezza technologies to deliver unparalleled, mixed workload performance for complex analytic business needs.*

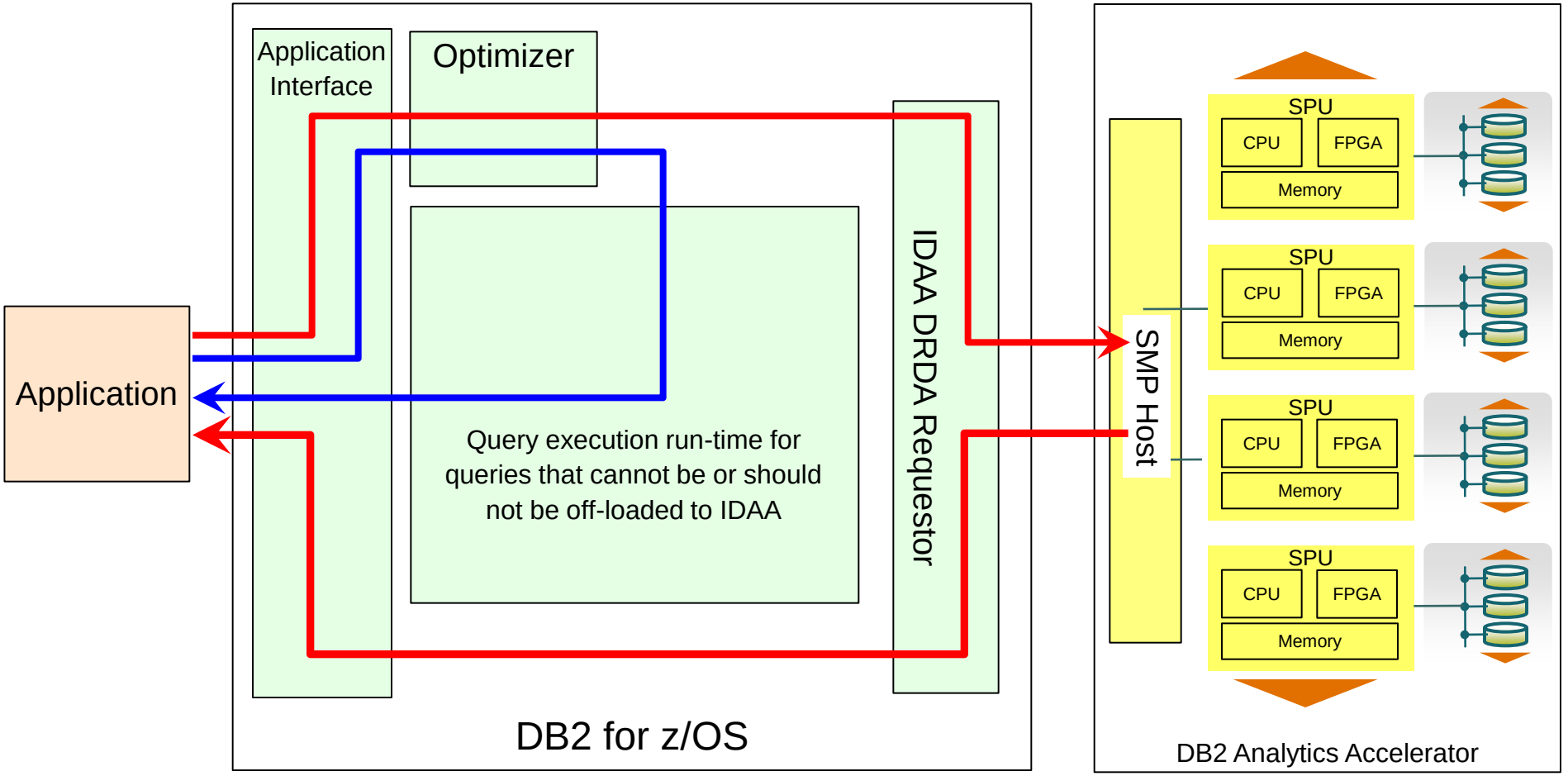
Get more insight from your data

- Fast, predictable response times for “right-time” analysis
- Accelerate analytic query response times
- Improve price/performance for analytic workloads
- Minimize the need to create data marts for performance
- Highly secure environment for sensitive data analysis
- Transparent to the application

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

▪*Low Latency, High Capacity Update*

Query Execution Process Flow



Queries executed without DB2 Analytics Accelerator

Queries executed with DB2 Analytics Accelerator

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Performance & Savings

			DB2 Only		DB2 with IDAA		Times Faster
Query	Total Rows Reviewed	Total Rows Returned	Hours	Sec(s)	Hours	Sec(s)	
Query 1	2,813,571	853,320	2:39	9,540	0.0	5	1,908
Query 2	2,813,571	585,780	2:16	8,220	0.0	5	1,644
Query 3	8,260,214	274	1:16	4,560	0.0	6	760
Query 4	2,813,571	601,197	1:08	4,080	0.0	5	816
Query 5	3,422,765	508	0:57	4,080	0.0	70	58
Query 6	4,290,648	165	0:53	3,180	0.0	6	530
Query 7	361,521	58,236	0:51	3,120	0.0	4	780
Query 8	3,425.29	724	0:44	2,640	0.0	2	1,320
Query 9	4,130,107	137	0:42	2,520	0.1	193	13

- Queries run faster
- Save CPU resources
- People time
- Business opportunities

Actual customer results, October 2011

DB2 Analytics Accelerator: "we had this up and running in days with queries that ran over 1000 times faster"

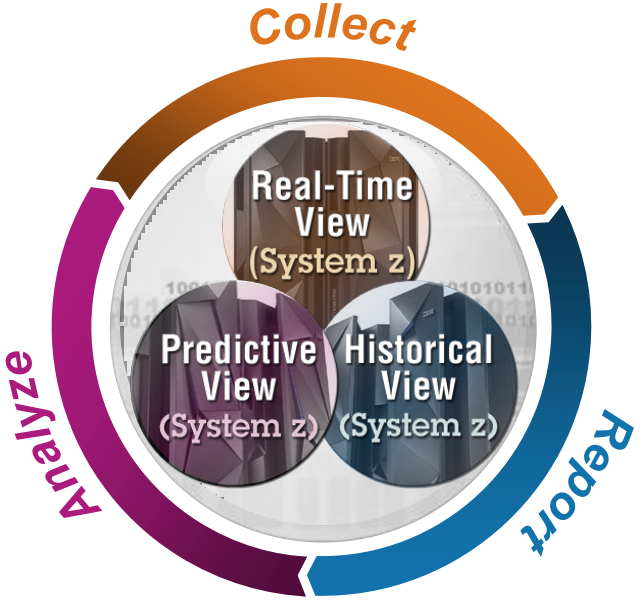
DB2 Analytics Accelerator: "we expect ROI in less than 4 months"

- Advance to 32 minute mark for DB2 Analytics Accelerator section of keynote

- *Accelerating decisions to the speed of business*

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

When organizations shift from information silos to a “single view of the truth” they gain numerous advantages



Problems:

Significant effort spent copying and moving data – resulting in veracity/security issues

Business does not have access to the most current view

Complicated, bifurcated infrastructure requiring multiple skill types

No single point of management

Business continuity concerns

Advantages:

Less movement of data, resulting in higher quality and less risk of loss

Integration with core systems delivers most accurate view to the business

Integrated architecture leveraging existing environment

Single view simplifies management

Business continuity inherited from core systems

The System z strategy integrates transactional and analytics processing into one streamlined, end-to-end data lifecycle

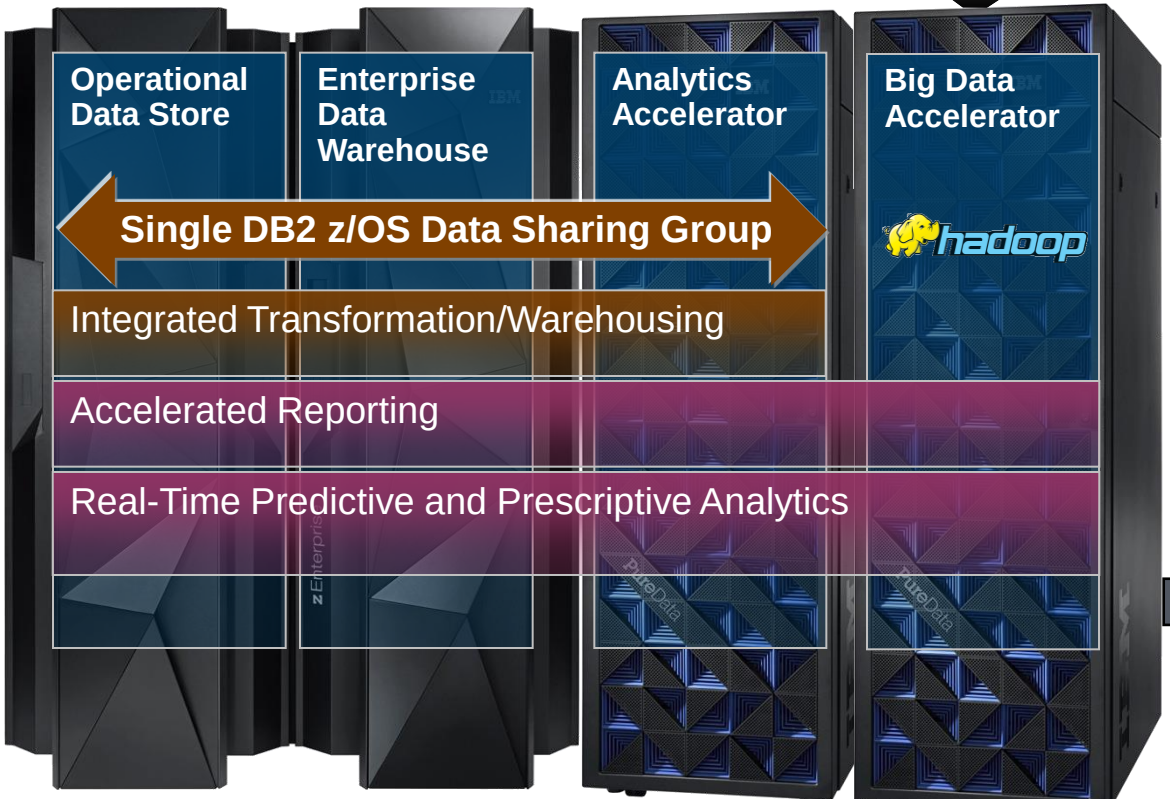
Better business response,
Reduced data movement, reduced complexity, reduced configuration resources,
More accurate, more secure, more available

System z Hybrid Transaction and Analytic Processing:

Everything is online – analytics in the right place

Customer Interaction Data In

- OLTP Transactions
- Operational analytics
- Real time data ingestion
- High concurrency
- Advanced analytics
- Standard reports
- OLAP
- Complex queries
- Historical queries



Business Insight Out

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Bridging Systems of Record and Systems of Engagement to enable the mobile enterprise

Mobile Interfaces

OS device variety

Screen size variety

Various smartphones

Tablets

Systems of Engagement

Web application server

Mobile application runtime server

Security components

Back-end access services

Caching to back-end services

Systems of Record

Databases and data sources

Enterprise applications & transactional services

Client Tier Devices

Middle Tier Server

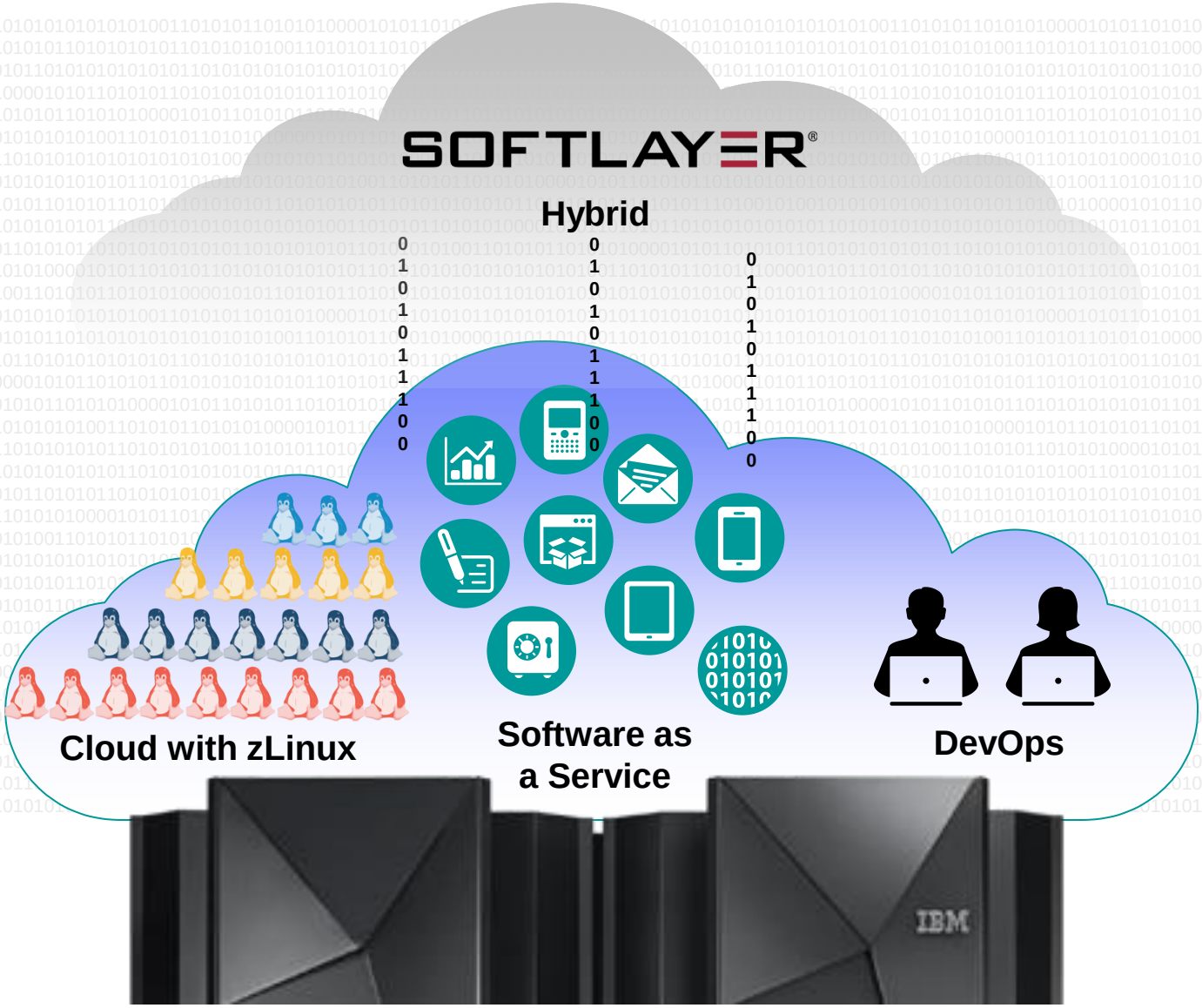
Back-end Data & Services

Systems of Engagement are cloud-based, decentralized, support rapid app development

Systems of Record are well integrated, trusted repositories

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

System z: The Multidimensional Cloud



App Dev cloud
Maximize efficiency by tapping unutilized resources

z/OS cloud
Core business operations enabled as cloud services

Hybrid cloud
Maximum flexibility through use of on- and off-premise resources

Linux on z cloud
Highly efficient fully virtualized infrastructure

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

A Full Spectrum of GDPS Solutions

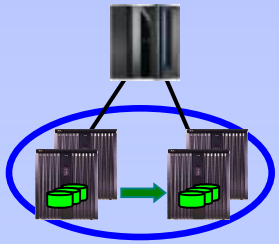
GDPS/PPRC HM

Continuous Availability of Data within a Data Center

Single Data Center

Applications remain active

Continuous access to data in the event of a storage subsystem outage



RPO=0 & RTO=0

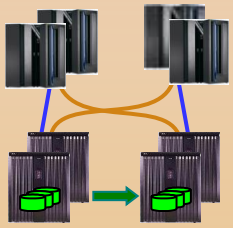
GDPS/PPRC

Continuous Availability / Disaster Recovery within a Metropolitan Region

Two Data Centers

Systems remain active

Multi-site workloads can withstand site and/or storage failures



A/S RPO=0 & RTO<1 hr or

A/A RPO=0 & RTO mins

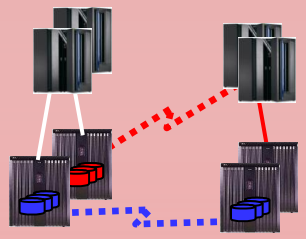
GDPS/GM & GDPS/XRC

Disaster Recovery at Extended Distance

Two Data Centers

Rapid Systems Disaster Recovery with "seconds" of Data Loss

Disaster recovery for out of region interruptions



RPO secs & RTO <1 hr

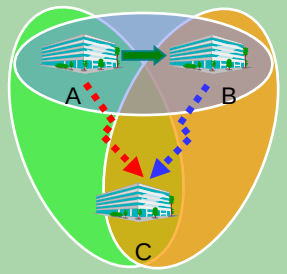
GDPS/MGM & GDPS/MzGM

Continuous Availability Regionally and Disaster Recovery Extended Distance

Three Data Centers

High availability for site disasters

Disaster recovery for regional disasters



A/S RPO=0 & RTO<1 hr or

A/A RPO=0 & RTO mins

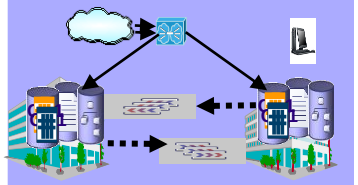
and RPO secs & RTO <1 hr

GDPS/Active-Active*

Continuous Availability, Disaster Recovery, and Cross-site Workload Balancing at Extended Distance

Two or More Data Centers

All sites active



RPO secs & RTO secs

RPO – recovery point objective
RTO – recovery time objective

Synch replication
Asynch replication

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Security

Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

What if you could create the ultimate security environment for piece of mind?

The average corporate IT infrastructure is cyber attacked nearly 60,000 times every day.

IBM Managed Security Services, 2010. Based on IBM X-FORCE Data and Analysis

Even the perception of insecure/mishandled data will **damage a company's brand**

Source: Forrester – white paper for IBM

The global **cost of cyber crime is nearly $400 billion a year**, and there are more than one million victims of cyber crime every day

Source: http://www.fbi.gov/news/speeches/responding-to-the-cyber-threat (2011 Norton Cybercrime Report) http://now-static.norton.com/now/en/pu/images/Promotions/2012/cybercrimeReport/2012_Norton_Cybercrime_Report_Master_FINAL_050912.pdf

The average **cost of a data breach incident is US$5.5 million**

Source: 2011 Cost of Data Breach Study: United States, Ponemon Institute LLC, March 2012.

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Executives from all lines of business understand the importance of security to their customers

CTO
Technology

Over 55% of executives believe that above all else data must be secure beyond the reach of malicious use[1]

CFO
Financial

In general, the role of information security will be moving away from specific risks to global risks. The role will be much larger than it used to be. – Finance Director, Insurance[2]

CMO
Marketing

An IBM study on social media revealed that fear of both privacy breaches and receiving spam are the top reasons customers are reluctant to engage with businesses via social media[3]

CRO
Risk

By 2014, 80% of risk leaders will need to report on risk compliance and security postures to the board of directors, not just the CEO[4]

CISO
Security

98% of security leaders cited mobile as their greatest near-term technology worry[5]

Sources:
(1)Forrester Study on Data Analytics, (2) ftp://submit.boulder.ibm.com/sales/ssi/ecm/en/cie03117usen/CIE03117USEN.PDF
(3) http://public.dhe.ibm.com/common/ssi/ecm/en/gbe03416usen/GBE03416USEN.PDF (4) http://www.scmagazineuk.com/gartner-security-summit-be-agile-to-challenges-to-survive-and-thrive/article/259681/ (5) / http://www.economist.com/blogs/dailychart/2011/10/personal-technology

As a result, the Security market is shifting

	Traditional Focus ***Governance and Compliance***	Emerging Focus ***Risk Management***
Security strategy	**React when breached**	**Continual management**
Speed to react	**Weeks/months**	**Realtime**
Executive reporting	**None**	**Operational KPIs**
Data tracking	**Thousands of events**	**Millions of events**
Network monitoring	**Server**	**All devices**
Employee devices	**Company issued**	**Bring your own**
Desktop environment	**Standard build**	**Virtualization**
Security enforcement	**Policy**	**Audit**
Endpoint devices	**Annual physical inventory**	**Automatically managed**
Security technology	**Point products**	**Integrated**
Security operations	**Cost Center**	**Value Driver**

Source: Client Insights 27-Jun-11, *An Evaluation of the Security & Risk Opportunity; Assessing a New Approach to Competitive Differentiation,* Ari Sheinkin

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Defense in depth provides the ultimate secured infrastructure

Protection of …

Core Functions	Encryption, Key Mgmt.	Communications	Identity, Authentication, Directory	Audit	Applications, DB2
▪ Authorized Libraries ▪ Certificate Authority ▪ EAL 5+ ▪ Integrity Assurance ▪ PKI Services ▪ Policy Based Administration ▪ Policy Management ▪ Role Based Access ▪ Secured Flash ▪ Secured IEDN ▪ Workload Isolation ▪ Workload Key Protection	▪ Centralized DB2 controls ▪ Datapower (XML) ▪ Key Management (EKMF) ▪ Tape and Disk Encryption ▪ TKE Workstation ▪ z/OS Encryption Facility	▪ Intrusion Detection & Prevention ▪ Secured Network Communicaitons (SSL, IPSec)	▪ Digital signatures ▪ End to End Authentication ▪ Identity Management ▪ Identity Propagation ▪ Passtickets ▪ Tivoli Directory Services	▪ Compliance and Audit Reporting ▪ zSecure Command Verifier	▪ Cross Site Scripting protection ▪ Database Encryption ▪ DB Labeled security ▪ Optim

System z Security Solutions

System z Security solutions to address specific needs in the marketplace based on areas identified as key investment areas for Security. Solutions consist of HW, SW & Services

- **Auditing:** Focus on compliance logs as granularity of audit logs as compliance regulations become increasingly strict

Enterprise Key Management Pillar - Advanced Crypto Analytics Provider (ACSP)
Leverages z/OS, ICSF, Crypto Express hardware to centralize operational keys on z/OS for distributed applications

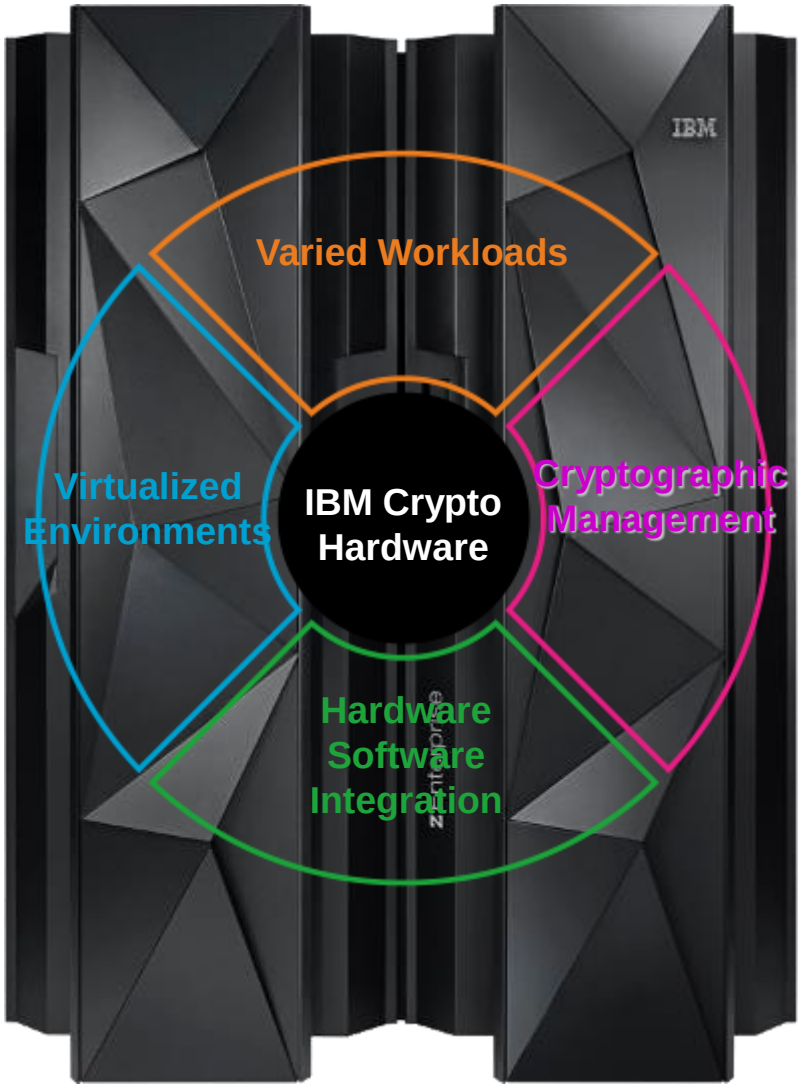
Enterprise Key Management Pillar - Crypto Analytics Tool (CAT)
Builds on EKMF foundation & provides insight on key usage and potential crypto key exposures

- **Key Management:** Focus on management of keys & certificate while meeting compliance standards and audit reviews
  - ***Enterprise Key Management Foundation (EKMF)***
    Provide a centralized key management solution that leverages clients' investments IBM System z Hardware Cryptography for the ultimate protection of sensitive keys and meeting compliance standards
- **Compliance:** Focus on keeping ahead of industry standards for System z – enabling our systems to be compliant to the latest standards and make passing audits easier – e.g. – PCI Compliance
  - ***IBM Payment Card Industry Hardware Collection***
    The IBM Payment Card Industry Compliance collection is the basis in establishing a highly secure management hardware cryptographic model

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

IBM System z Cryptographic Strategy

Capabilities aligned to enterprise workloads



Transaction Workloads

- Leadership encryption and transaction processing
  - Global banking and commerce industries

Trusted Identities

- Public Key Infrastructure / high assurance encryption
  - Provision & process qualified digital certificates
  - ID cards, electronic passports and signatures
    - All backed by the security of HW

Data Security

- Infrastructure to secure high-value enterprise data
- CPACF and CryptoExpress

Enhanced Crypto virtualization *

- Enable virtual domains for cloud environments
- Isolation enhanced through cryptography

Simplified management & Compliance *

- Enterprise Key Management Foundation (EKMF)
- Extend Trusted Key Entry Workstation (TKE)
  - Broader cross platform crypto HW management
  - Integrate Host and TKE workstation components
- Use analytics for insight into use of sensitive keys

Standards

- Enable interoperable management & provisioning

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

System z Technical Strategic Priorities

Data Server of Choice for Transactions & Analytics

Business Analytics

- Integrated Stack
- Workload-optimized
- OLTP -> HyTAP
- Generate business insights with Big Data style queries

Data-Serving

- Deliver more data … faster
- Support new/popular data formats & Enhance cross platform data access

Stack Performance

- Get workload done faster
- Scale capacity with workload
- Co-optimize hardware & software

Most Secure & Reliable

Security

- Auditable protection of data
- Simplify management & compliance
- Security Analytics
- Cloud security as a service

System Availability

- IT analytics for monitoring & resiliency of the datacenter

Sysplex Availabiity

- Enhanced GDPS
- Active-active solutions
- Asynchronous data replication
- Simplification and autonomics

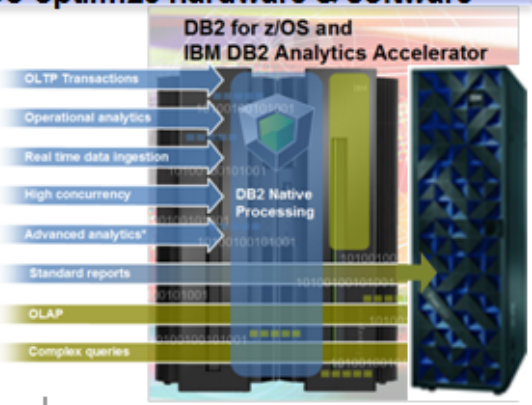
Enterprise Cloud Leadership

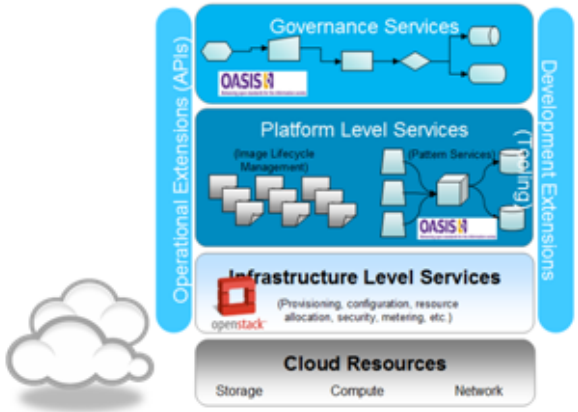
Enterprise Cloud

- Enable cloud-based delivery
- Dynamic shared infrastructure
- Common Cloud Stack
- Isolation for multi-tenancy
- SW defined environment leveraging virtualization
- Streamline deployment/delivery (DevOps, Patterns)
- Develop partnerships with MSP's

Heterogeneous & Mobile Workloads

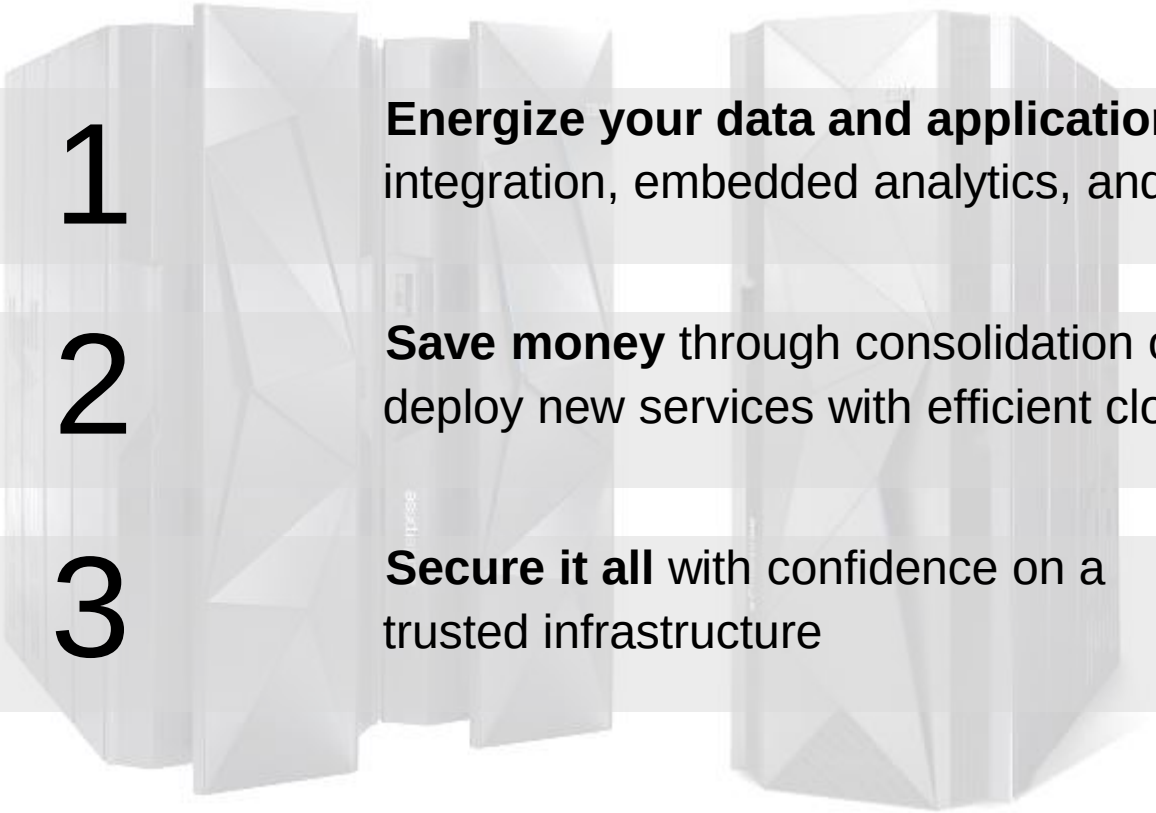
- Linux consolidation
- Integrate mobile workloads
- Industry Solutions
- Extend platform management
- Cross-platform integration





A zEnterprise for Everyone

Freedom to choose the "right sized" mainframe to fit your needs



1. **Energize your data and applications** through hybrid integration, embedded analytics, and mobile optimization
2. **Save money** through consolidation on Linux and quickly deploy new services with efficient cloud foundation
3. **Secure it all** with confidence on a trusted infrastructure

Build a better customer experience with IBM zEnterprise

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

धन्यवाद
Hindi

多謝
Traditional Chinese

ขอบคุณ
Thai

Спасибо
Russian

Bedankt
Nederlands

Thank You
English

شكراً
Arabic

Merci
French

Obrigado
Brazilian Portuguese

Gracias!
Spanish

多谢
Simplified Chinese

Danke
German

நன்றி
Tamil

ありがとうございました
Japanese

감사합니다

* Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.