



System z 10 Strategy Leveraging technology for new workloads

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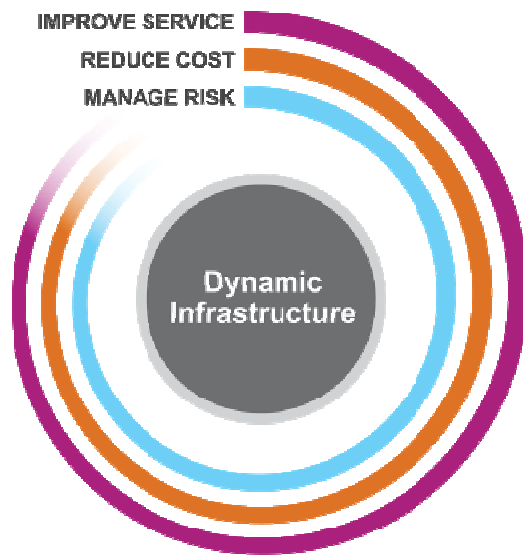
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Discussion Topics

- **The Dynamic Infrastructure® for a smarter planet**
- **The role of IBM System z® in the Dynamic Infrastructure**
- **State of the System z business**
- **What's ahead for System z**



IBM's smarter planet vision



let's build a smarter planet

The world has become flatter and smaller. Now it must become smarter.

Four major IBM initiatives

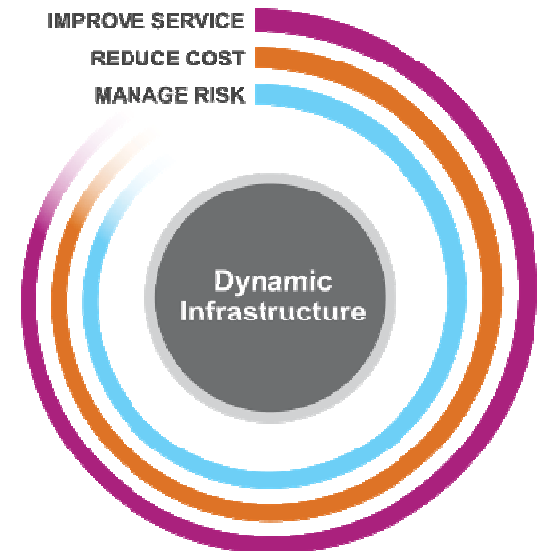
Dynamic Infrastructure

New Intelligence

Green & Beyond

Smart Work

Dynamic Infrastructure

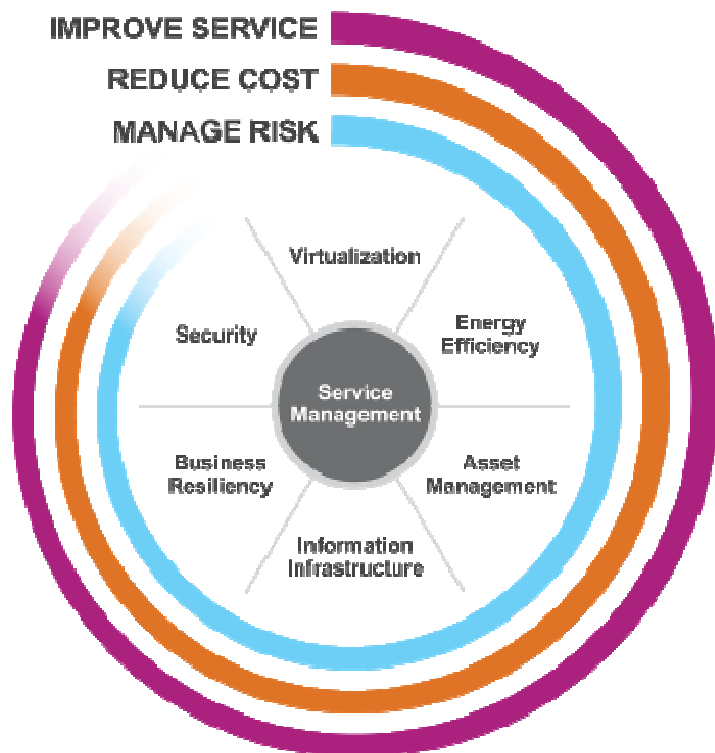


delivers superior business and IT services with agility and speed

System z innovations for a dynamic infrastructure

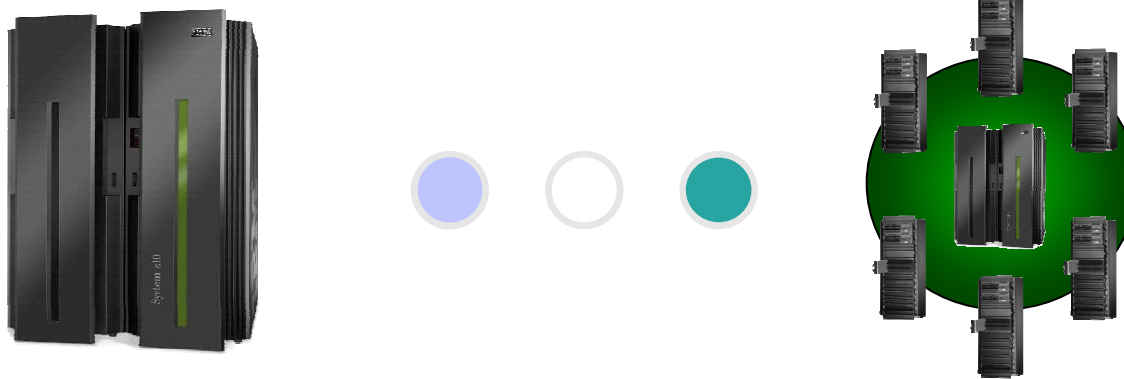
... System z delivers extreme business value through industry leading security, availability, scalability, virtualization and management capabilities

IBM System z



- **IMPROVE SERVICE**
 - Dynamic, policy based, and automated SOA infrastructure
 - Adapt and respond quickly to changing business imperatives
- **REDUCE COST**
 - Industry-leading virtualization, energy efficiency, and scale
- **MANAGE RISK**
 - Secures your business, reduces risk, builds trust and confidence
 - Superior qualities of service allows clients to run their businesses reliably

System z: leadership capabilities for a dynamic infrastructure Now... and in the future



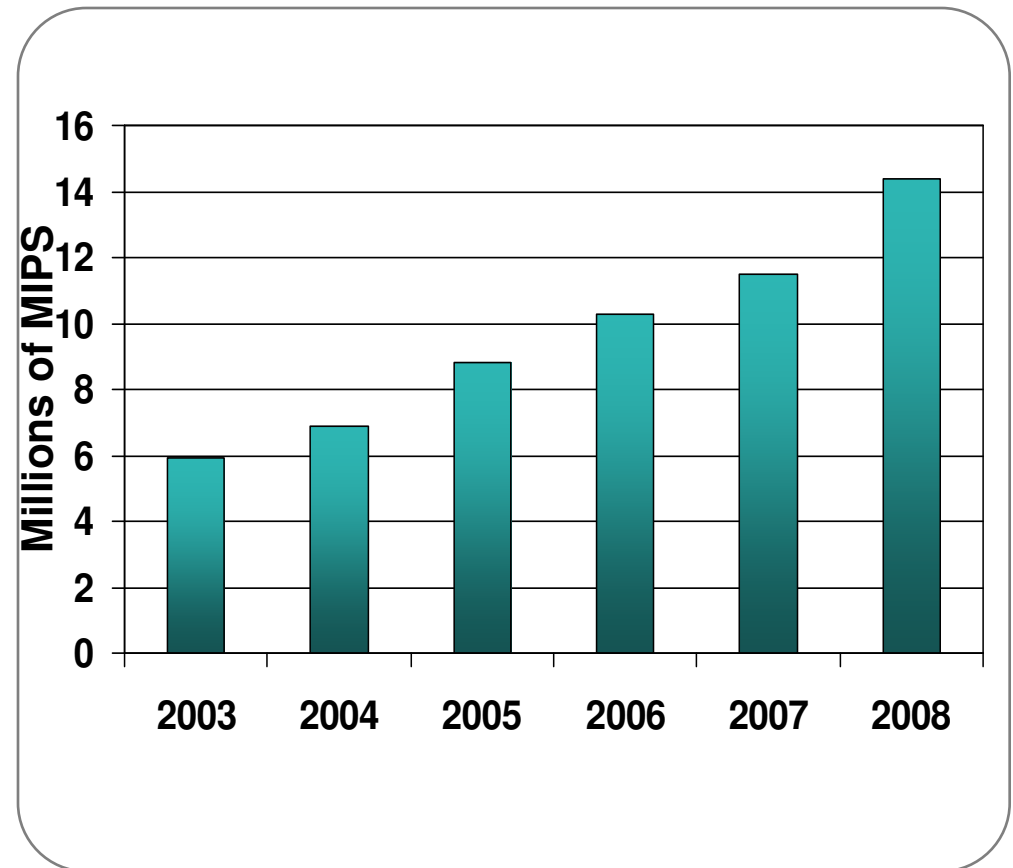
- Highly secure and resilient enterprise data hub
- Industry leading large scale OLTP server
- Highly cost and energy efficient consolidation platform
- Highly utilized enterprise server for mission critical workloads

- Extend System z QoS and management to heterogeneous platforms
- Extending reach across the application layer
- A hub for data intensive business processes and business intelligence
- Optimize cost efficiencies and risk across broader enterprise workloads

System z Business Update, Strategy, and Future Directions

IBM z installed capacity continue to grow at double digit rates

- **System z total installed MIPS¹ has grown 20% CAGR since 2003**
 - Specialty engine capacity growing at an astonishing 93% rate
 - Since IBM launched the z900 in 4Q 2000, System z has *nearly doubled its share*, from 17% to 33% in the enterprise server segment²
- **Since the introduction of the z10 in February 2008, System z has grown revenue by 10% and increased market share**



¹ IBM internal MIPS inventory numbers, Sept 08; HP wins based on internal IBM Sales tracking data

² IDC server tracker, Nov 08, , \$250K+ servers

IBM System z: The renaissance continues...

System z Highlights	Full Year 2008
Hardware Revenue	11% YTY @ CC
MIPS Growth	+25% YTY
Specialty Engine MIPS	+68%
New Accounts	54
University Program	130 New Universities
ISVs	>150 New ISVs, >1000 apps

Milestones

- ✓ 5 years – IBM Academic Initiative, System z
- ✓ 537 schools, over 50,000 students worldwide educated
- ✓ 13 Student Contests in 13 countries with 14,672 students from 1,956 schools
- ✓ Resume database and Entry Level Mastery Test
- ✓ Community involvement (roundtables, partnerships, hiring)
- ✓ More educators and students are embrace IBM Enterprise Systems
- ✓ Students are getting jobs

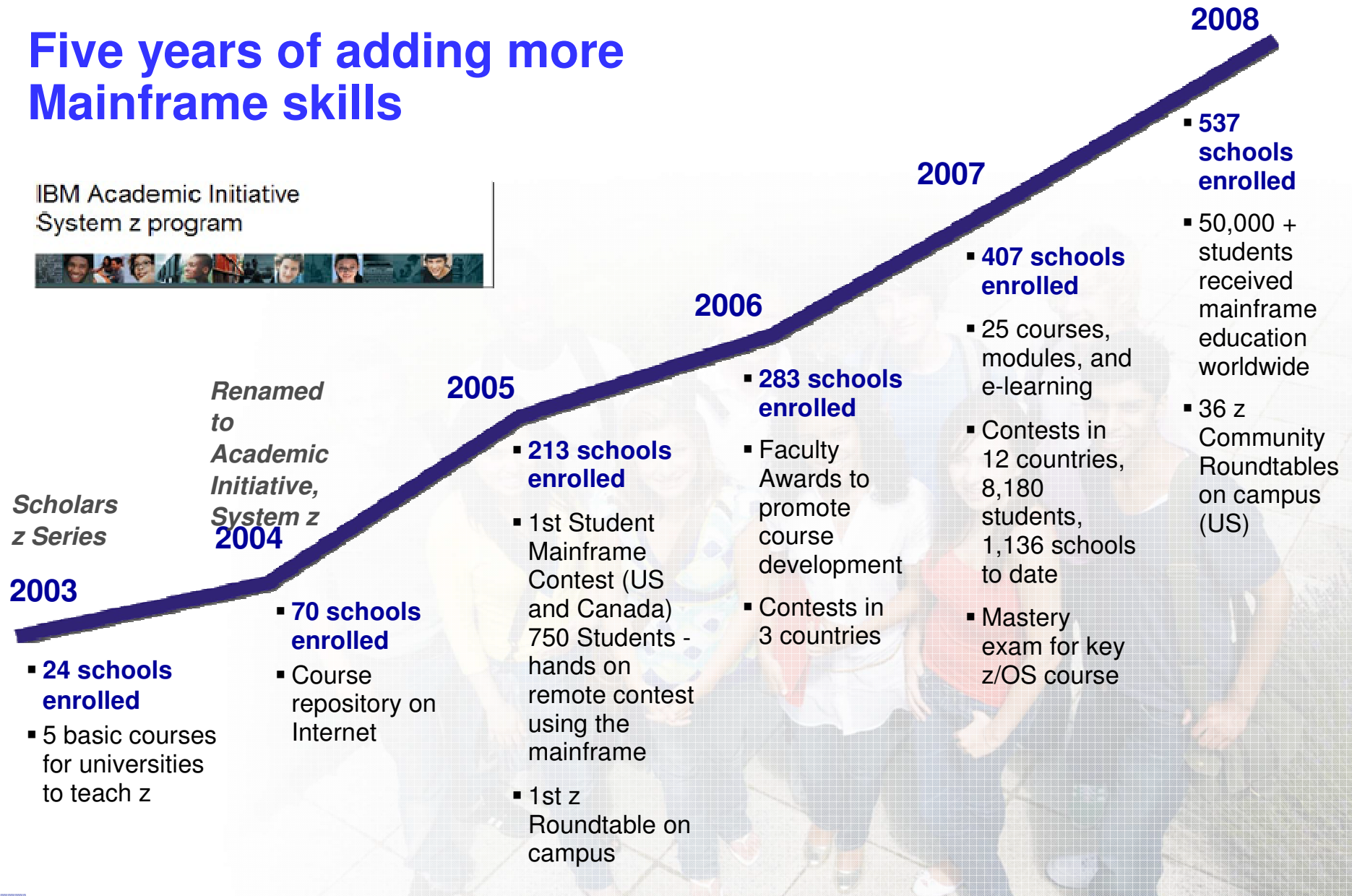


“Master the Mainframe Contest’ helped me get a job at Bank of Montreal.”

Elizabeth Bell, Georgian College

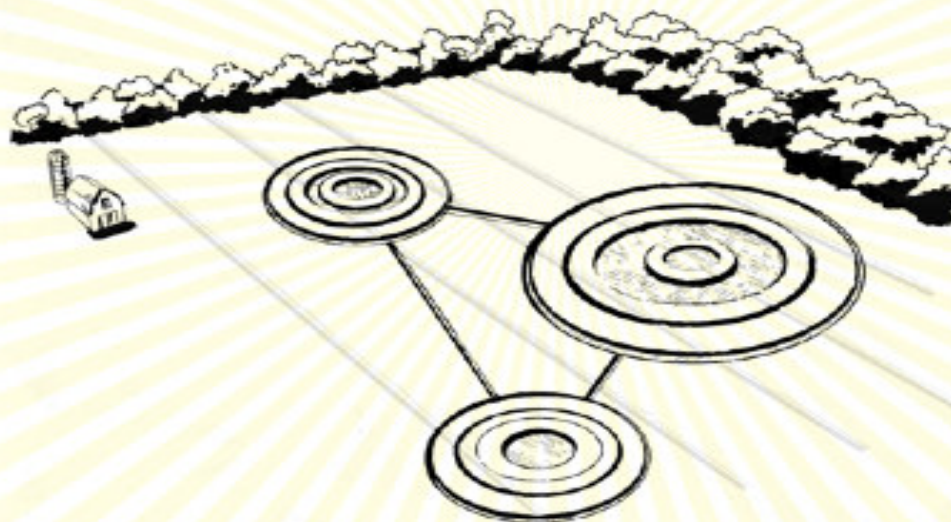
Five years of adding more Mainframe skills

IBM Academic Initiative
System z program



If you believe what our competitors have been saying, here's another myth for you:

The mainframe is responsible for the worldwide crop circle phenomenon.



Truth is, IBM System z® runs circles around our competitors' non-mainframe solutions. With System z virtualization and up to 100% utilization for sustained periods, you can also significantly reduce your TCO.*



Separate myth from truth. ibm.com/software/truez

IBM

If you believe what our competitors have been saying, here's another myth for you:

The mainframe is responsible for alien abductions.



Our competition will say just about anything to snatch you away.
Truth is, IBM System z® can lower your TCO, requiring as little as 30% of the
power of a distributed server farm running equivalent workloads.*



Separate myth from truth. ibm.com/software/truez

System z strategy

1. *Innovate to address the IT infrastructure challenges of today and the future*

- Further simplify, consolidate and reduce the costs of an IT infrastructure
- Integrate, virtualize and coherently manage the multiple and varied elements of business applications
- Scale up and leverage System z strengths in data serving

2. *Extend strengths of System z*

- Invest for continued leadership in System z: performance, virtualization, enterprise security, enterprise business continuity
- Extend System z best of breed capabilities to a broader set of workloads
- Deploy optimized technologies for specific applications or components

3. *Expand the ecosystem and support core applications that our clients want*

- Recruit new solutions and solution providers and integrators
- Expand skills and capabilities across the globe



The IBM System z10™ Enterprise Class... a marriage of evolution and revolution

Evolution

- Scalability and virtualization to reduce cost and complexity
- Improved efficiency to further reduce energy consumption
- Improved security and resiliency to reduce risk
- New heights in storage scalability and data protection

Revolution

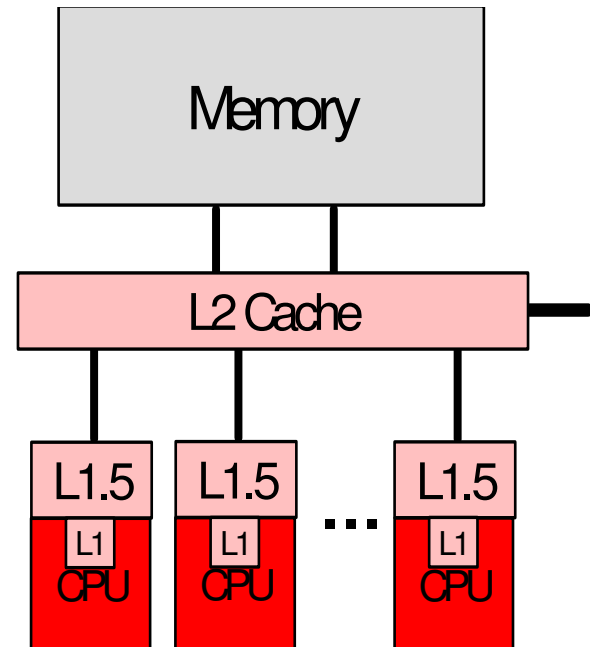
- 4.4 GHz chip to deliver improved performance for CPU intensive workloads
- ‘Just in time’ deployment of capacity resources
- Vision to expand System z capabilities with appliance technology



Enhanced attributes of System z10

- Java and new application performance focus

- **Processor core**
 - 4.4 Ghz and new pipeline
 - larger on-chip cache (L1.5)
- **L2 Cache**
 - Size increased
 - cache sharing enhanced with “Star” topology interconnect
- **ISA (Instruction Set Architecture) extensions**
 - over 50 new instructions including ...
 - storage immediate, compare and relative instructions
 - compare and branch, compare and trap
 - prefetch or “touch” instructions
 - improved code efficiency for Java and C++ code
- **DFP (Decimal Floating Point) instructions in HW**
 - improved performance and precision for decimal calculations
- **Large Page (1 MB) support**
 - improved TLB effectiveness
- **Exploitation of the above comes in various flavors**
 - JIT automatically uses many of these items beginning with the JVM running Java 6 SR1
 - additional JVM exploitation in Java6 SR2 and later releases
 - C,C++ compile time options targeting z10
 - application development



System z10 Java 6 Performance

- **Exploits z10 out of the box**
- **New features**
 - Faster thread performance (~1.5x MIPS)
 - Large page support
 - zOS only provides authorized support in R1.9
 - Extensions to the ISA
 - 20+ new instructions are exploited
 - Decimal Floating Point for BigDecimal objects
- **Average improvement across 8 single threaded benchmark cases shows 2.1X improvement vs z9**
- **Multi-threaded case shows 1.7x improvement vs z9**
- **XML parsing results average 1.9X improvement vs z9**

Extending System z management and QoS to non-z technologies

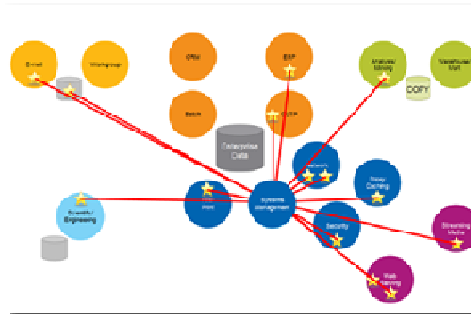
- A single management and policy framework across web serving, transaction, and database to lower the cost of enterprise computing
- Mainframe QoS characteristics will be extended to acceleration appliances and application servers to manage risk
- The dynamic resource management of the mainframe is extended to all devices within a multi-tier architecture to improve service

System z Future

System z Mainframe



Integrated Systems Management Firmware

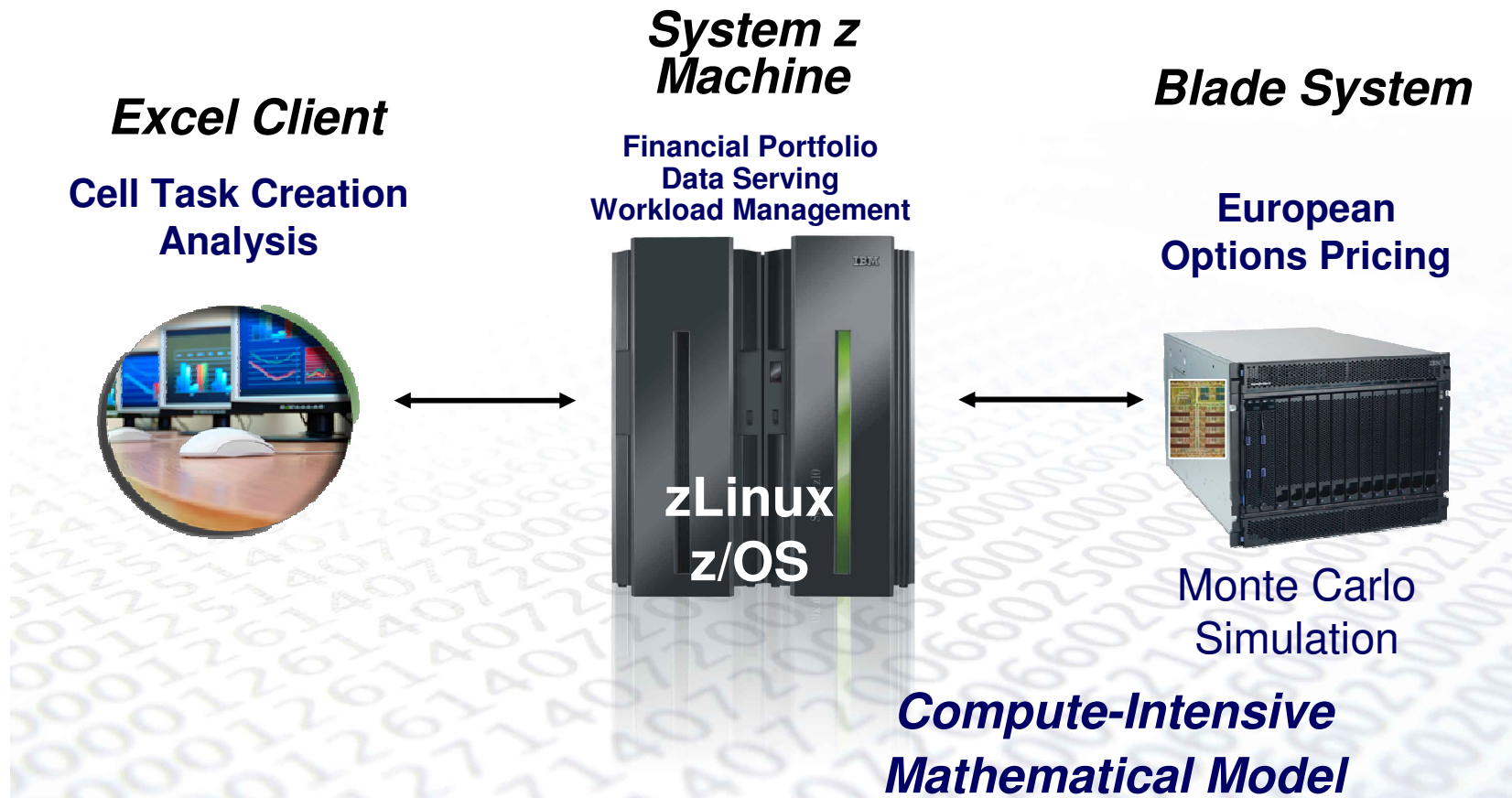


Accelerators and Application Serving Blades



Exploiting System z for New Workloads

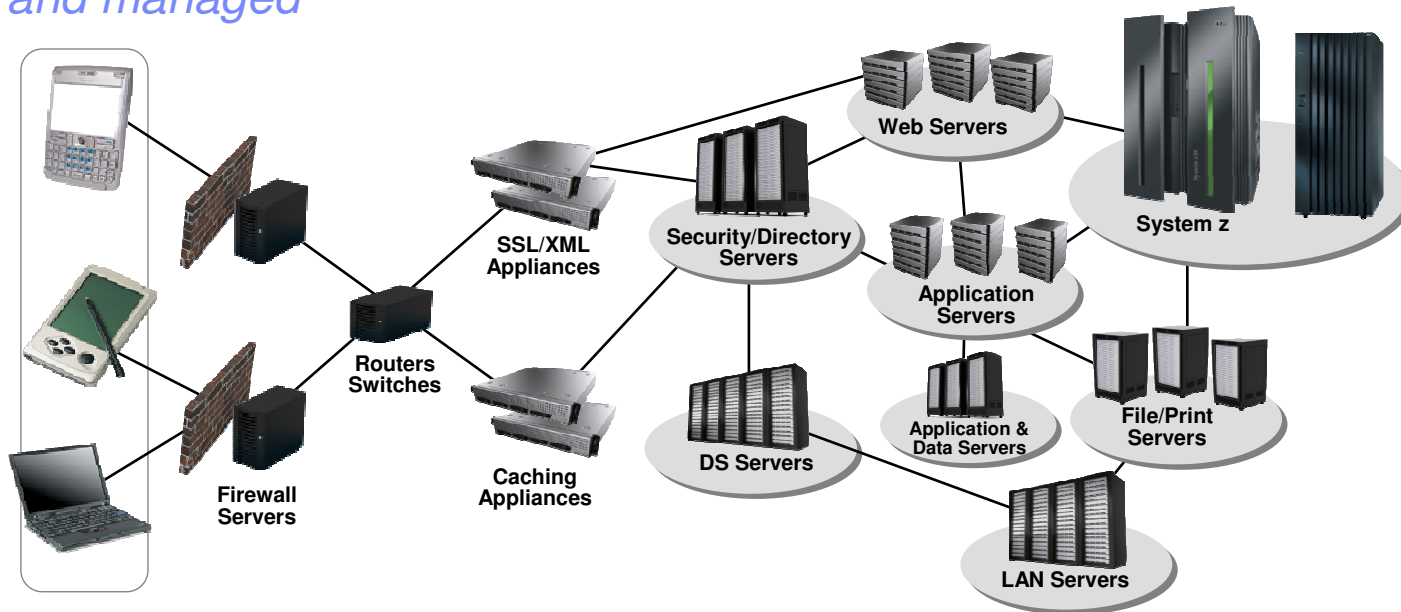
- Financial analytics - POC



Technical Trends and Directions for System z

The following charts cover IBM's future direction and intent and are subject to change or withdrawal without notice, and represent goals and objectives only.

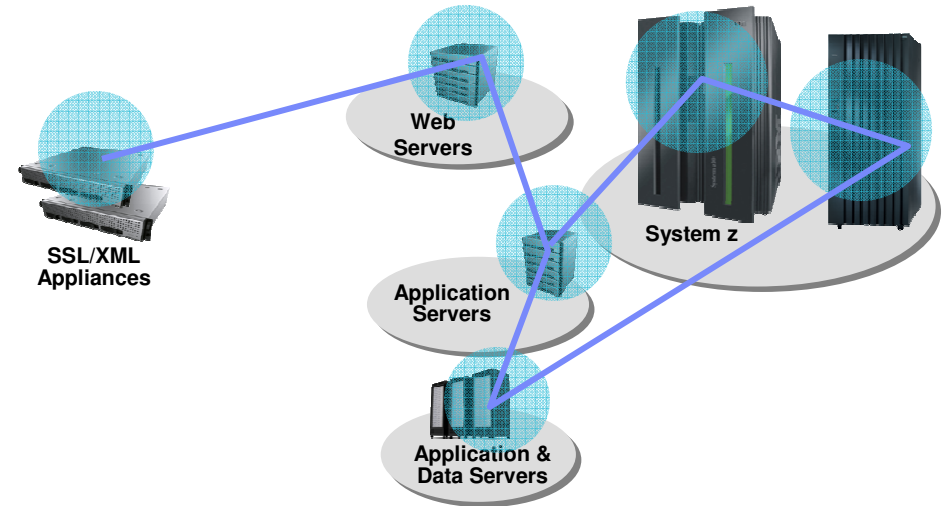
The IT model is shifting ... real-time event-driven workloads, richer content, and modular technologies alter the composition of *systems and how systems are deployed and managed*



- **Application software and middleware is becoming more platform agnostic**
- **Data availability, security, scalability requirements growing**
- **Real-time, event-driven processing is driving the opportunity for specialized acceleration & offload engines**
- **Multi-core/thread designs are becoming key drivers for system performance**
- *Platform Virtualization Capabilities are improving the efficiency of single purpose workload images*
- *Platform management software for Virtualization is emerging aimed at reducing cost and complexity and providing transparent quality of service to software hosted in the virtual image of today's compute-intensive applications*

The composition of today's data center introduces challenges in managing the delivery of critical business services to intended cost and service objectives

- **Complexity and fragility**
- **Increased management (labor) costs**
- **Increased power/cooling costs**
- **Reduced flexibility and responsiveness**
- **Quality of service issues**
- **Under-utilized capacity**
- **Inability to relate the management IT resources to business objectives**

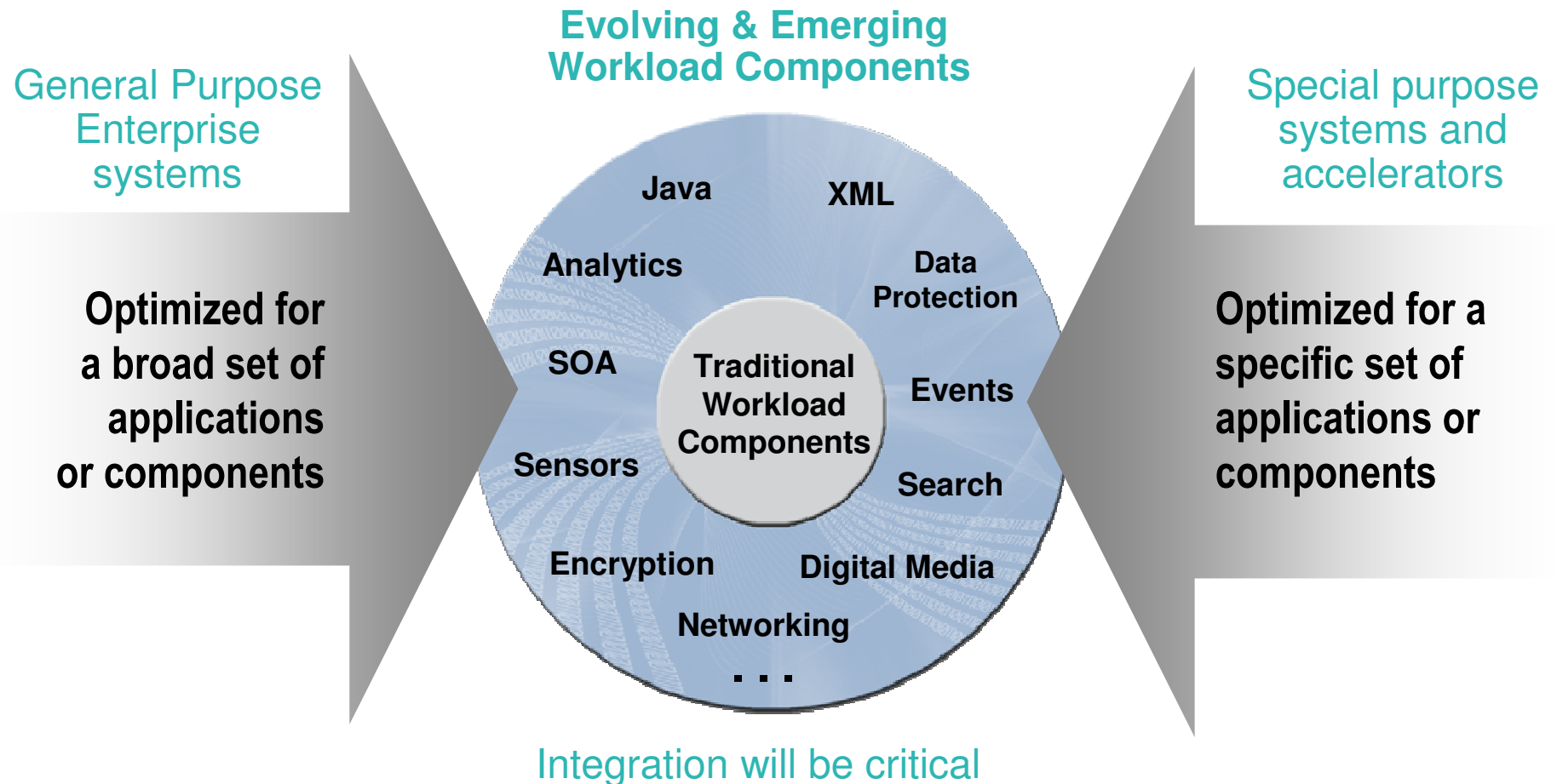


Opportunity

- IBM System z and its evolution to a well managed, integrated, hybrid platform provides an opportunity to deliver enhanced function, and to further simplify, consolidate and reduce the costs of managing IT infrastructure
- The ability to integrate, virtualize and coherently manage the multiple and varied processing elements of a deployed business service, in accordance with stated business objectives, is the focus of this set of extensions to the System z platform.

Emerging applications . . . with hybrid transactions

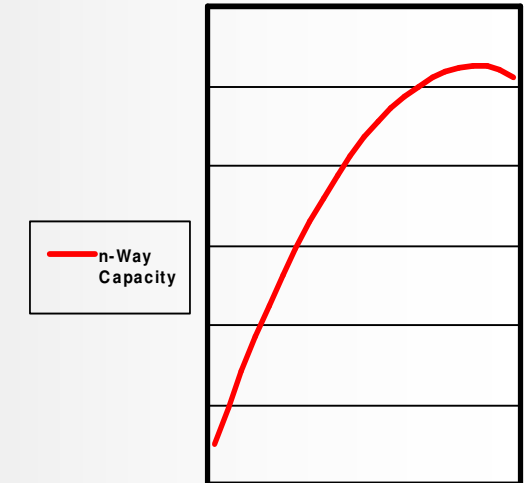
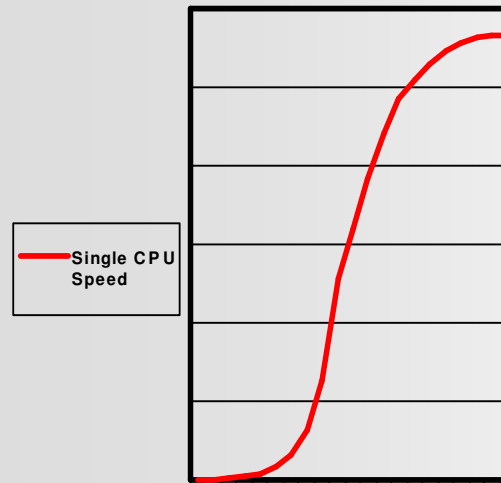
Future objectives include complete application integration in an optimal fashion



Both General and Special Purpose capabilities needed because of increasing transaction variability

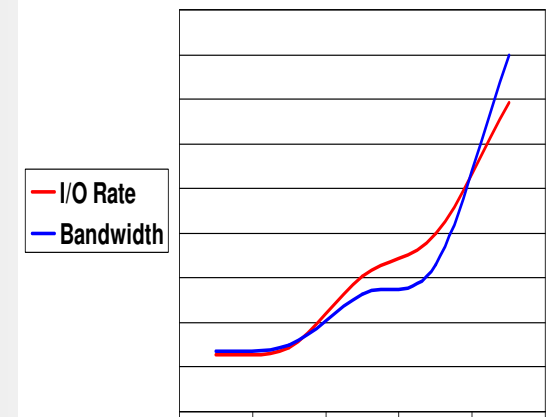
Next: Coping with physical limits

- **The industry is hitting fundamental physical limits:**
 - Size
 - Speed of electromagnetic propagation
 - Heat transfer rates
- **Large CPU speed increases are a thing of the past, across the industry**
- **Capacity increases will increasingly come from higher n-way, more multithreading, and NUMA optimization**
- **Demand for lower latency will drive co-location of hybrid transaction processing elements**



“In terms of size [of transistor] you can see that we're approaching the size of atoms which is a fundamental barrier,”

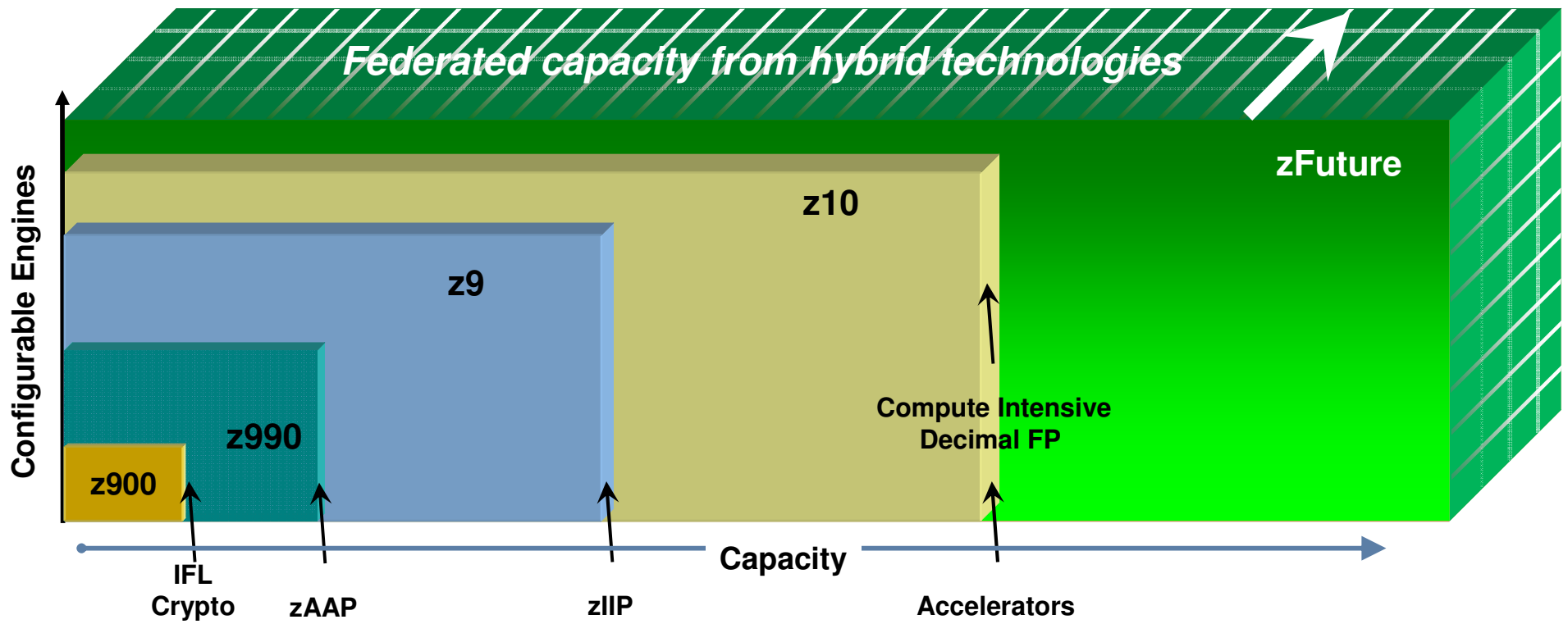
Gordon Moore, April 2005*



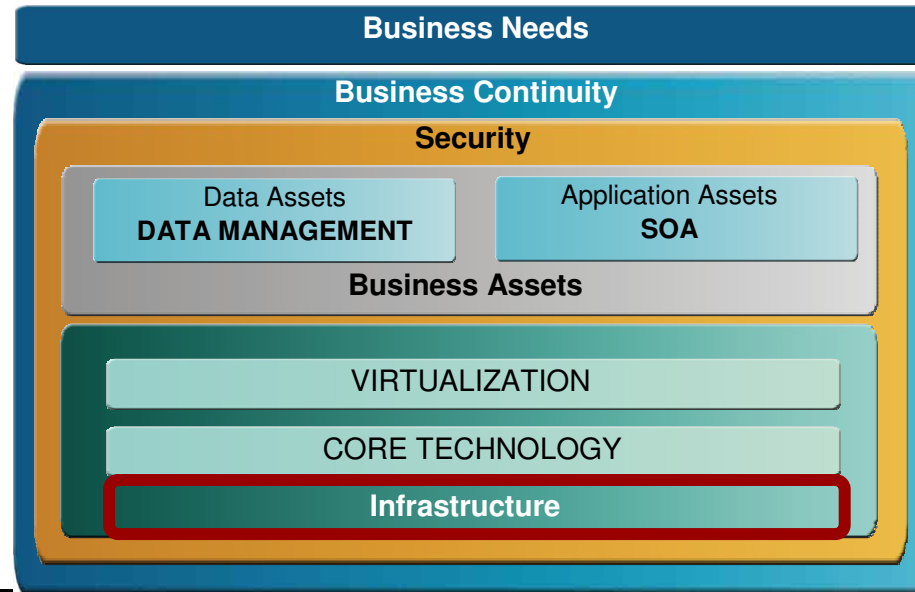
Processor performance and future scalability

The business capabilities from leveraging the “z” dimension

- Performance increase with enhanced engine capacity
 - Specialty Engines technology dividend
- z/OS image size will grow with Hardware
- Performance objectives for equivalent n-way configurations:
 - Traditional workload = 1.3x predecessor
 - New workload = 1.7x predecessor



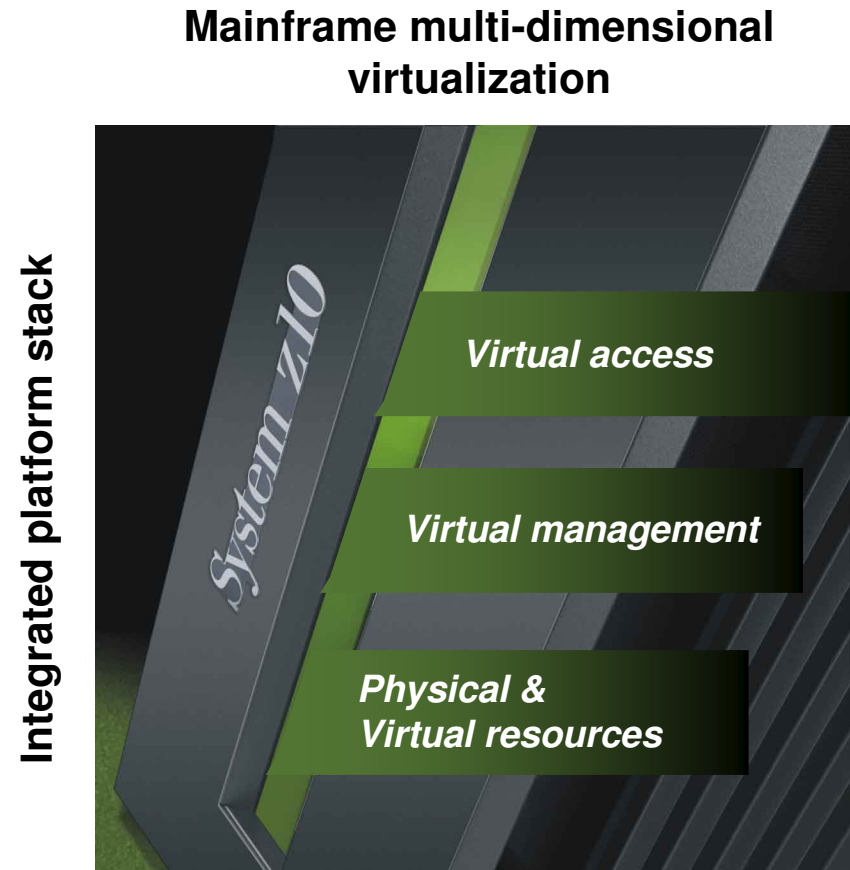
System z Technical strategy: Core technology



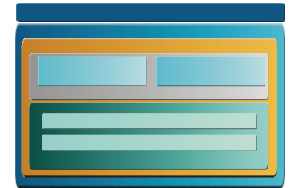
<i>Availability and Enterprise Resiliency</i>	<ul style="list-style-type: none"> Auto-IPL * Basic Hyperswap* Sysplex Availability and Mean Time To Recovery* 	<ul style="list-style-type: none"> Concurrent software maintenance* Predictive software failure analysis**
<i>Simplification</i>	<ul style="list-style-type: none"> Health and Migration Checks* z/OS I/O Auto-Configuration** PD Workbench** 	
<i>Economics</i>	<ul style="list-style-type: none"> XML, IPsec, SDM, offload to zIIP and/or zAAP, zIIP-assisted HiperSockets, ISV zIIP exploitation 60 LPAR support Policy-based capacity provisioning 	<ul style="list-style-type: none"> Release-to-Release z/OS performance improvements* Industry-standard I/O attachment* zHybrid technologies** Chilled water cooling option**
<i>Scale and Performance</i>	<ul style="list-style-type: none"> 64-way single image zFuture multithreading and single-system image* growth, with HiperDispatch improvements* Larger EAVs, support for all data types* 64-bit programming extensions* 	<ul style="list-style-type: none"> Latency Reduction* Accelerators* Support for significantly larger real memory per LPAR**

Mainframe paradigm

- **Mainframe original design point:**
 - *Share everything*
 - *Support of mixed workloads*
 - *Highly available & secure*
- **Virtualization helps enable:**
 - *Simplification*
 - *High utilization*
 - *Intelligent management*
- **This creates a foundation to:**
 - *Help customers build cost effective & efficient infrastructures*
 - *Highly Available & Secure*

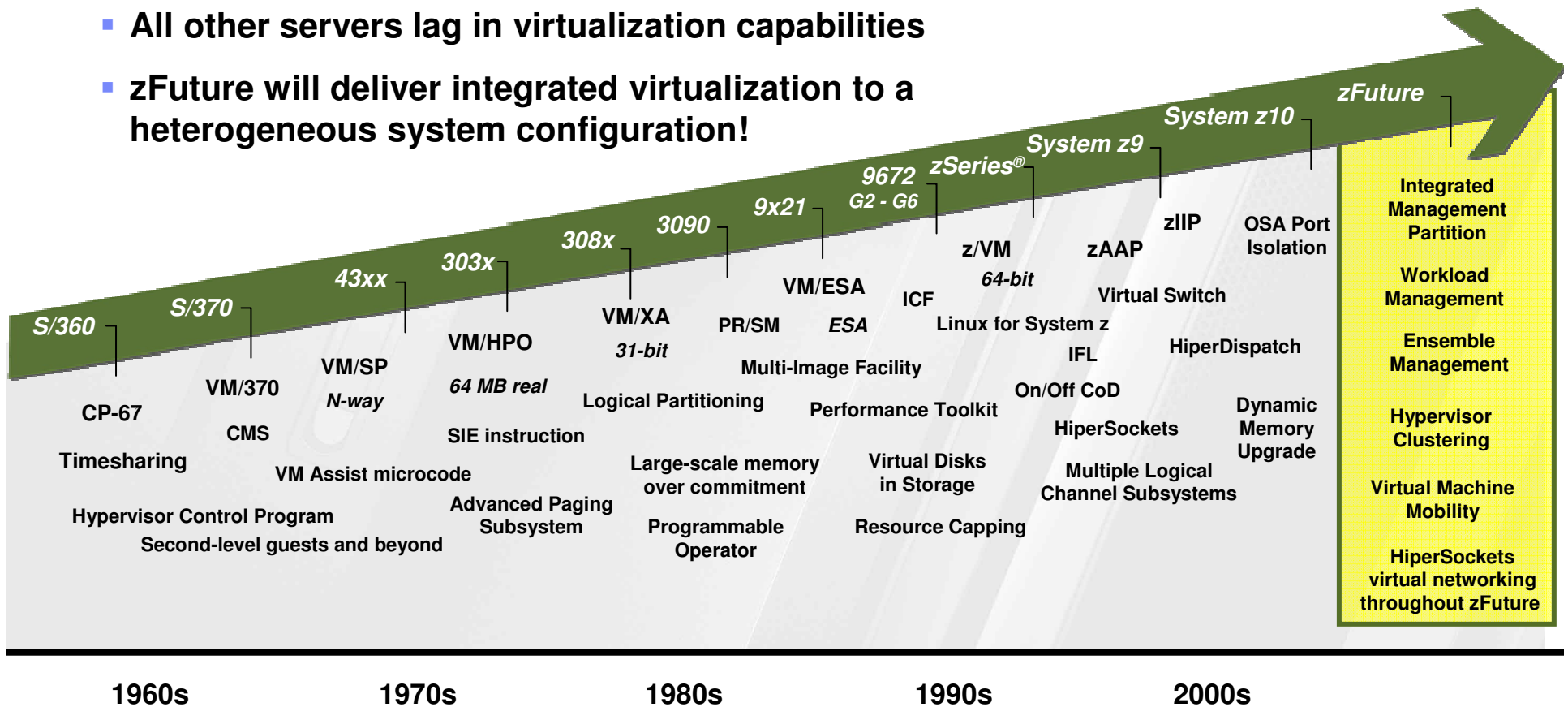


Key virtualization features are designed in, not added on



zFuture: The next leap in virtualization

- Virtualization was pioneered and perfected on IBM mainframes
- System z continues to set the gold standard in virtualization
- All other servers lag in virtualization capabilities
- zFuture will deliver integrated virtualization to a heterogeneous system configuration!



Tooling

Assemble Solution

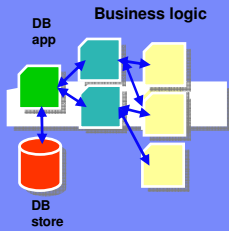


Image Library

Service Lifecycle Management

Deployment Planning

- Service Composition
- Determine required infrastructure resource configuration and capacity

Deployment, Image Mgmt

- Determine the optimal placement of service workloads
- Deployment of composite services, applications, images

Configuration, Security & Policy

- Creation of Service Availability, Performance, Security, Energy Management Policies

Visualize, Monitor

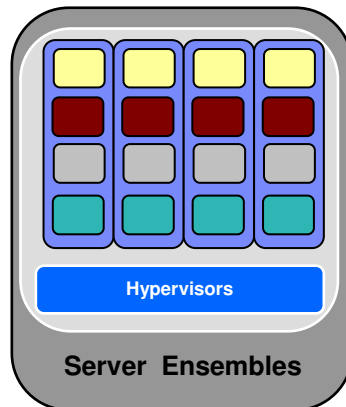
- Business System Dashboards
- Service Monitoring and Reporting

Service Management

Ensemble Management Interfaces

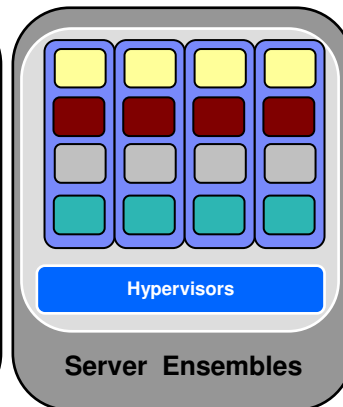
Ensemble Management

System z Ensemble



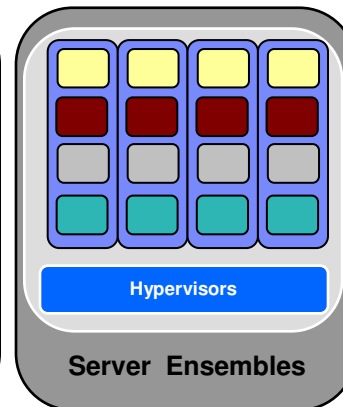
Server Ensembles

Power Systems® Ensemble



Server Ensembles

System x® Ensemble



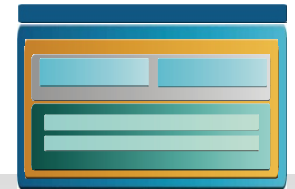
Server Ensembles

Storage Ensemble

Ensemble Management

- Hardware Configuration and Operational Control
- Pooling and virtualization of server, storage, network)
- Platform Task Automation
- Autonomic resource management
- Virtual Image Management
- Energy Management
- Performance Monitoring and Management
- Availability Monitoring and Management
- Accelerator "Firmware" Configuration
- Virtual Network Configuration and Security

System z ensemble

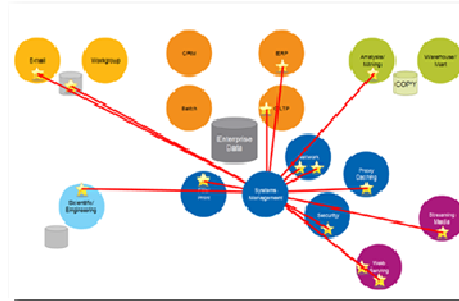


System z Future

System z Mainframe



Integrated Systems Management firmware

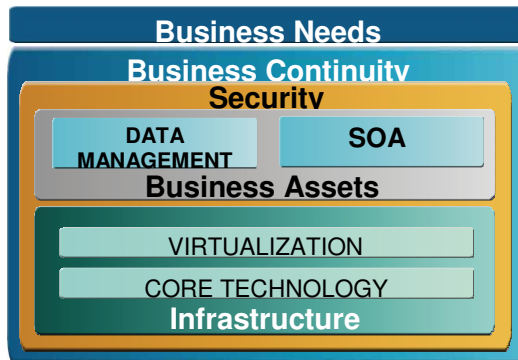


Accelerators

- Extend and accelerate System z workloads
- Lower cost per transaction while improving application response time for CPU intensive applications

Application Serving Blades

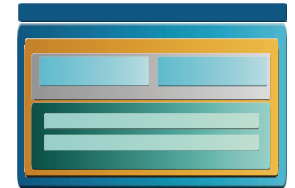
- Logical device integration between System z resources and application serving commodity devices
- Providing competitive price-performance and improved QoS for applications with a close affinity to mainframe data



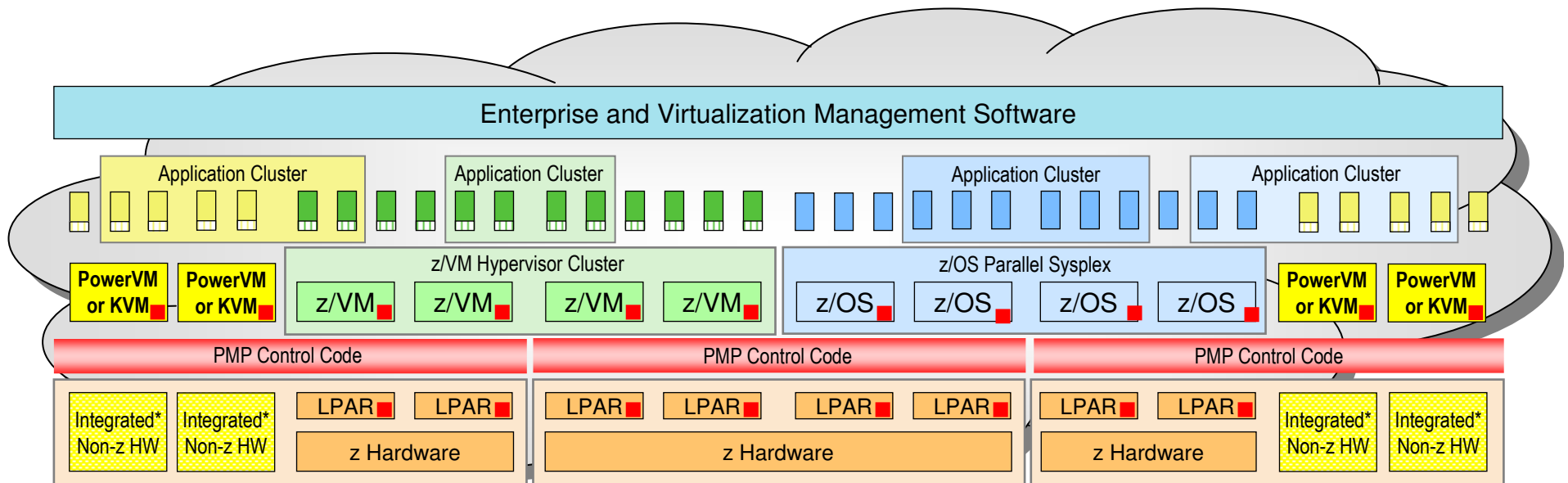
- Integrate, monitor, and manage multi-OS resources as a single, logical virtualized system
- Single WLM, Security, and System Management interface across all resources

IBM multi-architecture virtualization – Conceptual view

System z multi-system, federated Hypervisor configuration



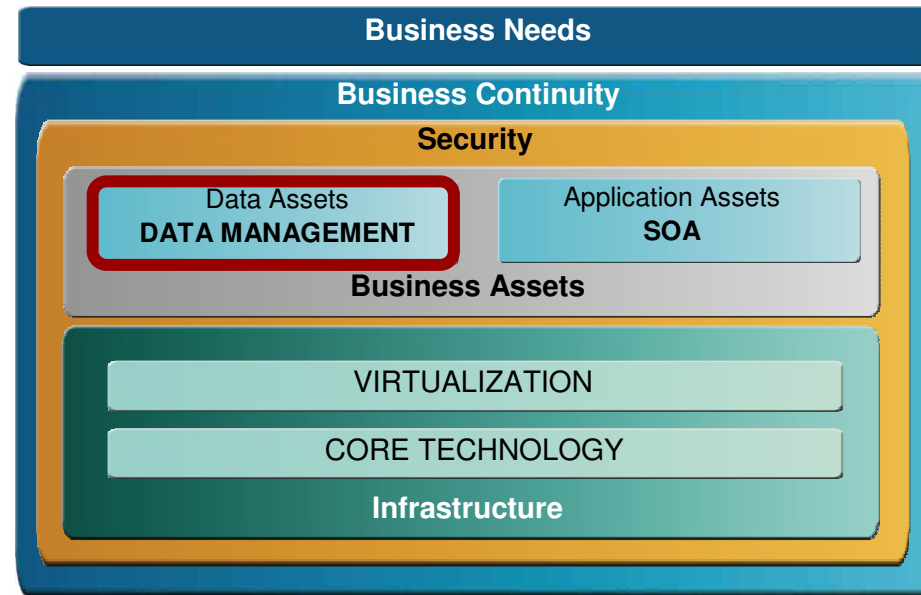
- **The System z Platform Management Partition (PMP) will host a federation of platform management functions, including:**
 - Resource monitoring
 - Workload management
 - Availability management
 - Image management
 - Energy management
- **Integrates with hardware management and virtualization functions**
- **Controls hypervisors and management agents on blades**
- **Open integration to enterprise-level management software**



■ = Code that interfaces with Platform Management Partition (PMP)

* E.g., Cell Broadband Engine, DataPower, Power Blades, x86_64

System z Technical strategy: Data management



Traditional Strengths

- Leader in DB Clustering Technology
- Unparalleled RAS Characteristics
- Database Scalability
- Specialty Engine exploitation
- SOA enablement

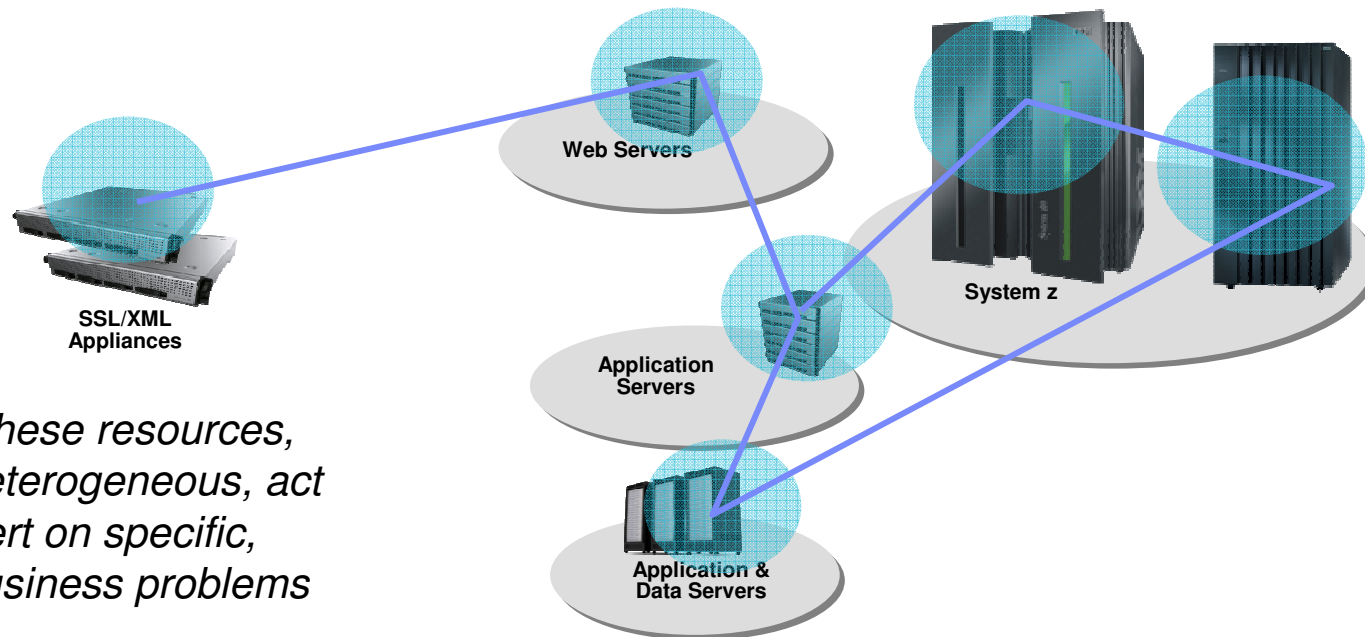
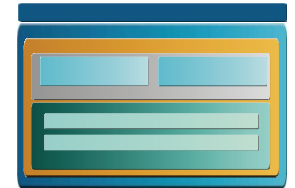
Developments

- Managed Reporting
- New Accelerators
- Pure XML
- Operational Business Intelligence
- DB2 DW enhancements

Future

- Active/Active Near Continuous Availability
- VSCR 64 bit exploitation
- zFuture exploitation
- Analytics on System z
- Data Cloud

Dynamic Infrastructure with System z Ensembles



Some of these resources, although heterogeneous, act in concert on specific, focused business problems

Opportunity

When a subset of enterprise resources act in concert on specific business solutions, a better approach is to manage these resources as a single entity – and plug this single point of control into the enterprise management fabric

System z: The right technology... 45 years of market leadership And a clear roadmap to the future!



IBM System z

The world's most powerful enterprise computing platform

Improved price/performance

100s of Capacity choices for the right size server

Business Resilience

LOW COST OF OWNERSHIP

Leadership capabilities with IBM Systems software

The future runs on System z and the future begins today



Just in Time Capacity

- Permanent capacity for non-disruptive growth
- Temporary capacity for fluctuating workloads
- Interim capacity for continued operation
- Policy based automation capabilities
- Offerings can be replenished dynamically



Secure and Resilient

- Mitigate the risk of security breaches
- Dedicated cryptographic processors
- Industry leadership capabilities and certification
- Where mean time between failure is measured in decades



World-Class Virtualization

- Large scale consolidation for savings of up to 80% in total cost of ownership compared to distributed platforms
- Deploy servers, networks, and solutions fast
- Support for multiple operating systems
- Dynamically optimize resources according to business priorities