Implementing a Dynamic Infrastructure
The Value of IBM System z and the Road Ahead
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CICS*	IMS	S/390*	z/OS*
DataPower*	InfoSphere	System x*	z/VM*
DB2*	Multiprise*	System z*	z/VSE
DFSMS	Parallel Sysplex*	System z9*	zSeries
Dynamic Infrastructure*	Power Systems*	System z10	
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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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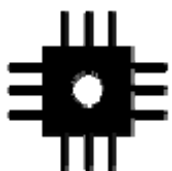
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Discussion Topics

- **The Dynamic Infrastructure® for a smarter planet**

- **The role of IBM System z® in the Dynamic Infrastructure**

- **What's new from System z**

- **What's ahead for System z in the future**
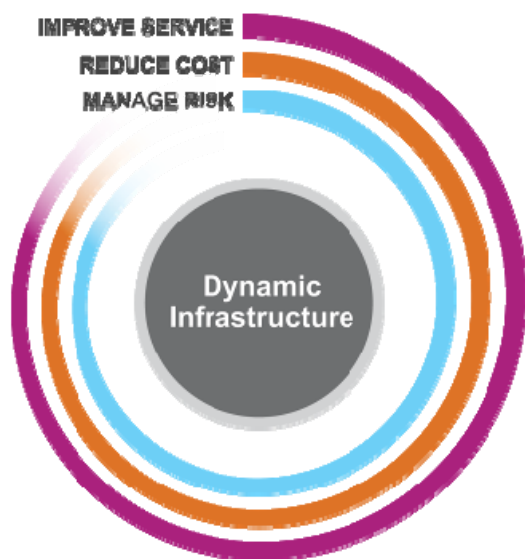
Consider how our world is changing:

Our world is becoming more…

INSTRUMENTED

- **30 billion** embedded RFID tags by 2010
- **1/2 of all sensors** in transportation, facilities and production equipment are smart sensors

INTERCONNECTED

- **1/3 of the world's population** on the Web by 2011
- **4B mobile subscribers** globally at the end of 2008
- **37K cyber attacks** in the US in 2007; 158% increase since 2006

INTELLIGENT

- **15 petabytes of new information** generated every day (8x more than the information in all U.S. libraries)
- **64B** credit card transactions/annum; **up 35%**

To create a smarter planet, we must tackle these interrelated imperatives…
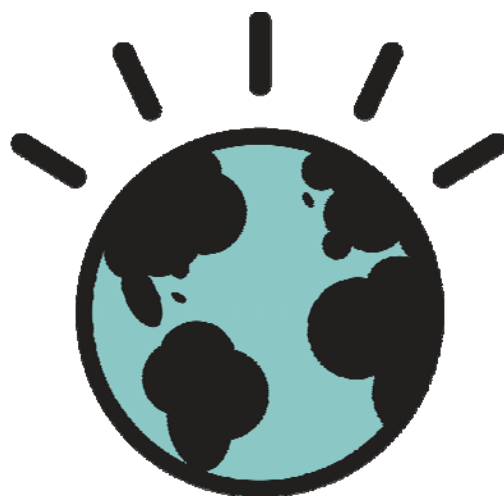
NEW INTELLIGENCE

Data exploding
and in silos
I need insight…

SMART WORK

New business and
process demands
I need to work smart…

GREEN AND BEYOND

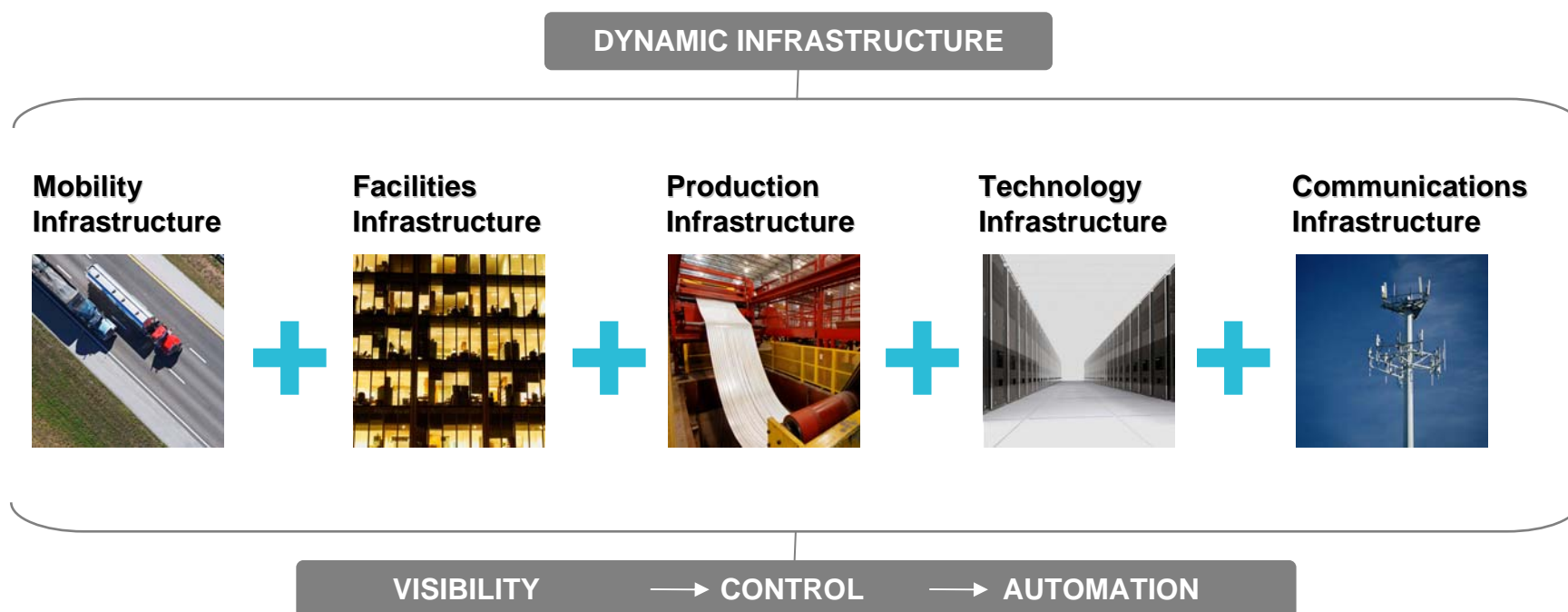Limited resources
I need efficiency…

DYNAMIC INFRASTRUCTURE

Costly and inflexible
infrastructure
I need to respond faster…

A Dynamic Infrastructure…
enables visibility, control, and automation across all business and IT assets

DYNAMIC INFRASTRUCTURE

Mobility Infrastructure

+

Facilities Infrastructure

+

Production Infrastructure

+

Technology Infrastructure

+

Communications Infrastructure

VISIBILITY → CONTROL → AUTOMATION

....converged management to deliver smarter business outcomes

System z Innovations for a Dynamic Infrastructure

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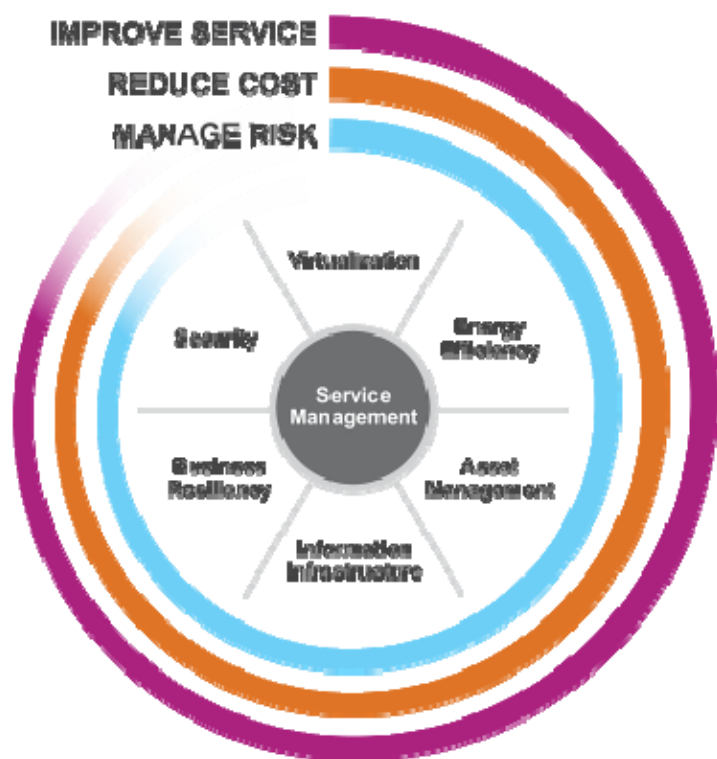
IBM System z

● 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

Reduce cost through industry-leading virtualization

- **Run 10s or 100s of application instances on a single System z server**

- **Drive hardware utilization rates near continuously at 85%+**

- **Dynamically optimize resources according to business priorities**

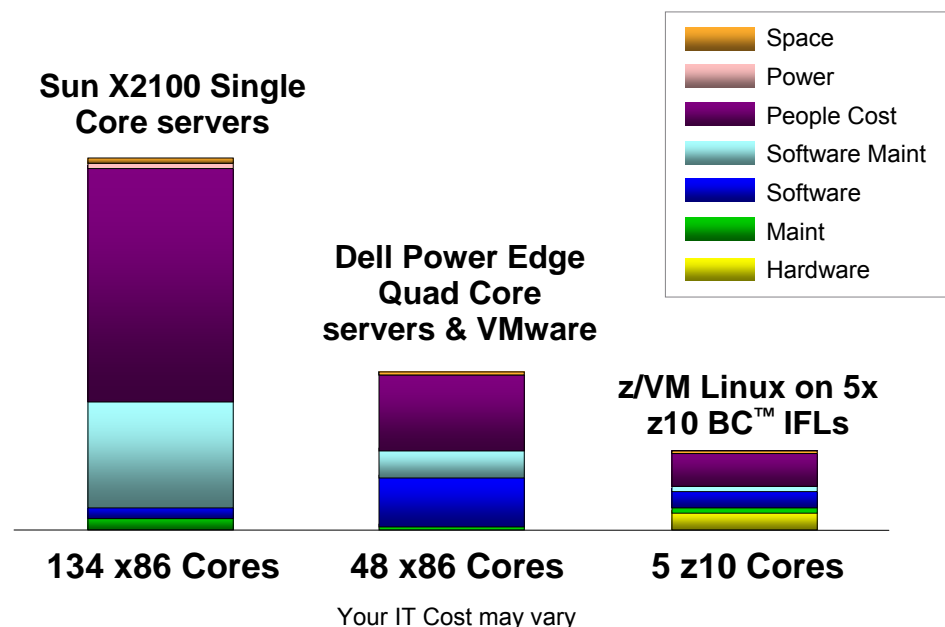- **Deliver extra capacity for Linux virtual servers typically at very little cost with z10™ specialty engines**

… System z delivers large scale consolidation capabilities for savings of up to 80% in total cost of ownership compared to distributed platforms

Reduce cost through consolidation on System z

Consolidating 134 Linux servers to 5 IFLs
Can save up to 50% over x86 w/ VMware

3-Year Total IT Cost

Legend:
- Space (orange)
- Power (pink)
- People Cost (purple)
- Software Maint (teal)
- Software (blue)
- Maint (green)
- Hardware (yellow)

Sun X2100 Single Core servers

Dell Power Edge Quad Core servers & VMware

z/VM Linux on 5x z10 BC™ IFLs

| 134 x86 Cores | 48 x86 Cores | 5 z10 Cores |

Your IT Cost may vary

Here's a cool example:

IBM will consolidate 3,900 servers to about 20 System z10 servers with expected reductions in energy consumption of over 80%

Consolidation:

Save up to 50% over x86 virtualization

All performance information was determined in a controlled environment. Actual results may vary.

Reduce cost through energy efficiency

- **Do the workload of up to hundreds of distributed servers in a single energy efficient System z10**

- **z10 technology delivers improved performance per KWh**

- **Active Energy Manager and Mainframe gas gauge to help manage energy consumption**

"The IBM System z platform can be configured to require 1/12th the electricity as a distributed server farm with equivalent processor capability."[1]

1 IBM System z: Platform Star for Linux and Open Source Software, Ptak, Noel & Associates.

Manage risk with System z security
Leadership technologies for peace of mind

- **Comprehensive protection:**

  - User authorization and access control

  - Encryption to secure data

  - Protection from viruses and malware

- **Industry leadership capabilities and certification - (EAL5)**

- **Dedicated cryptographic processors**

✓ *Mitigating the risk of security breaches*

✓ *Helping to protect your organization's brand image – and bottom line*

✓ *Helping to address compliance needs*

Manage risk with System z resiliency
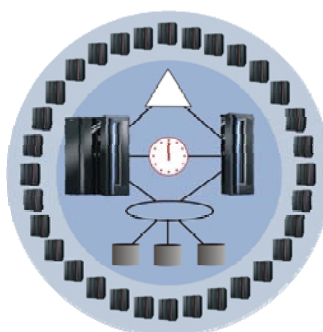## *Availability built in across the system*

Designed to deliver availability at the *application level*

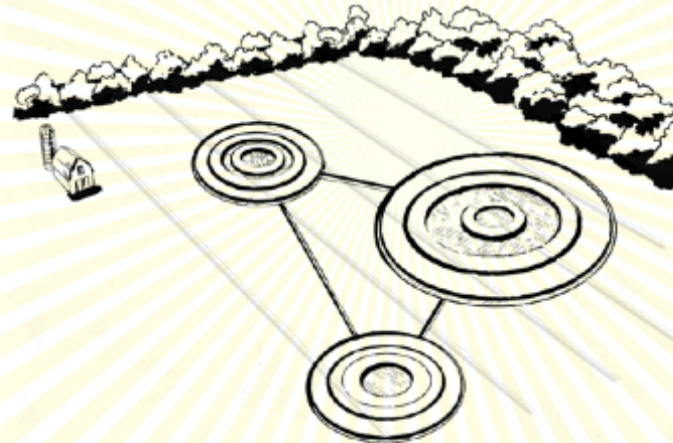| **Single System z**	**Multiple System z**	**Multiple Data Centers**
		Site 1 Site 2
Where mean time between failure is measured in decades	**Designed for *application* availability of 99.999%**	**Industry-leading solution for disaster recovery**
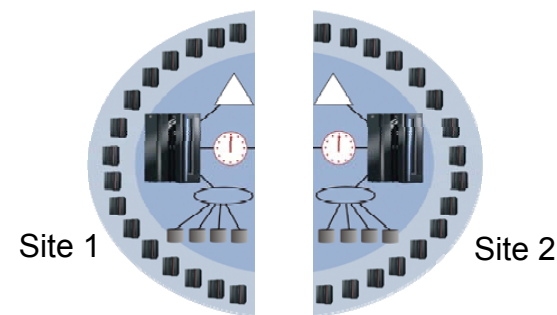
✓ *Avoiding the cost of downtime*

✓ *Ensuring access to critical applications*

✓ *Maintaining productivity of users*

✓ *Open to clients 24/7*

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New from IBM…. innovations for System z

The modern mainframe for small and medium enterprises
The mainframe made over – Smart, Cool, Affordable

IBM System z10™ Business Class (z10 BC™)

Machine Type: 2098

1 Model: E10

Single Frame

Non-raised floor option

Processor Cores:

- **Enterprise Quad Core technology – 3.5 GHz**
- **Enhanced capacity 5-way model with up to 5 zAAPs/zIIPs**
- **Up to a 10-way IFL or Coupling Facility**
- **Core sparing technology**
- **2 SAPs standard per system**
- **Configurable PUs allow you to design the system to meet your needs (e.g. CPs, IFLs, ICFs, zAAPs, zIIPs, SAPs)**

Memory:

- **Lower 4 GB entry point**
- **8 GB HSA separately managed and not included in customer purchased memory**
- **Customer maximum 248 GB**
  - 120 GB- Oct. 08
  - 248 GB – June 09

I/O:

- **New I/O drawer (RAS)**
- **6 GBps InfiniBand® host buses for I/O**
- **High Performance FICON® for System z**
- **FICON/FCP Serviceability Enhancements**
- **OSA-Express3 GbE, 10 GbE, 1000BASE-T**
- **InfiniBand Coupling Links**
- **Continued lower capacity / priced I/O cards**

New levels of application performance
Designed for an expanded set of workloads

- The z10™ BC can deliver up to 50% more performance for general purpose workloads than an IBM System z9® Business Class (z9™ BC)*
- The uniprocessor can deliver up to 40% more performance than z9 BC uniprocessor**
- Up to 1.9x performance improvements for CPU intensive jobs or tasks
- Up to 10X improvement in decimal floating point instructions
- Up to 10 IFLs for large scale consolidation

Customer Engines

z10 BC

IFL
Crypto

z9 BC

zIIP

3.5 GHz processor chip
Hardware Decimal Floating Point

zAAP

z800

z890
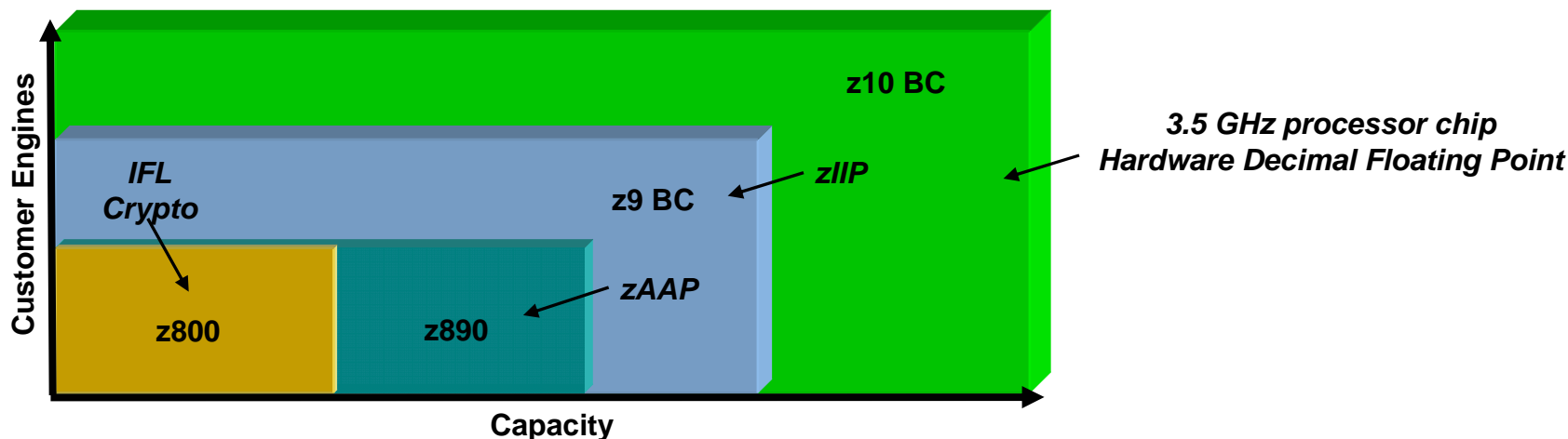
Capacity

More capacity and engines for traditional growth and consolidation

All performance information was determined in a controlled environment.
* LSPR mixed workload average running z/OS® 1.9 - z10 BC z05 versus z9 BC z04   ** LSPR mixed workload average running z/OS 1.9 - z10 BC z01 versus z9 BC z01

Faster → Slower (vertical axis)

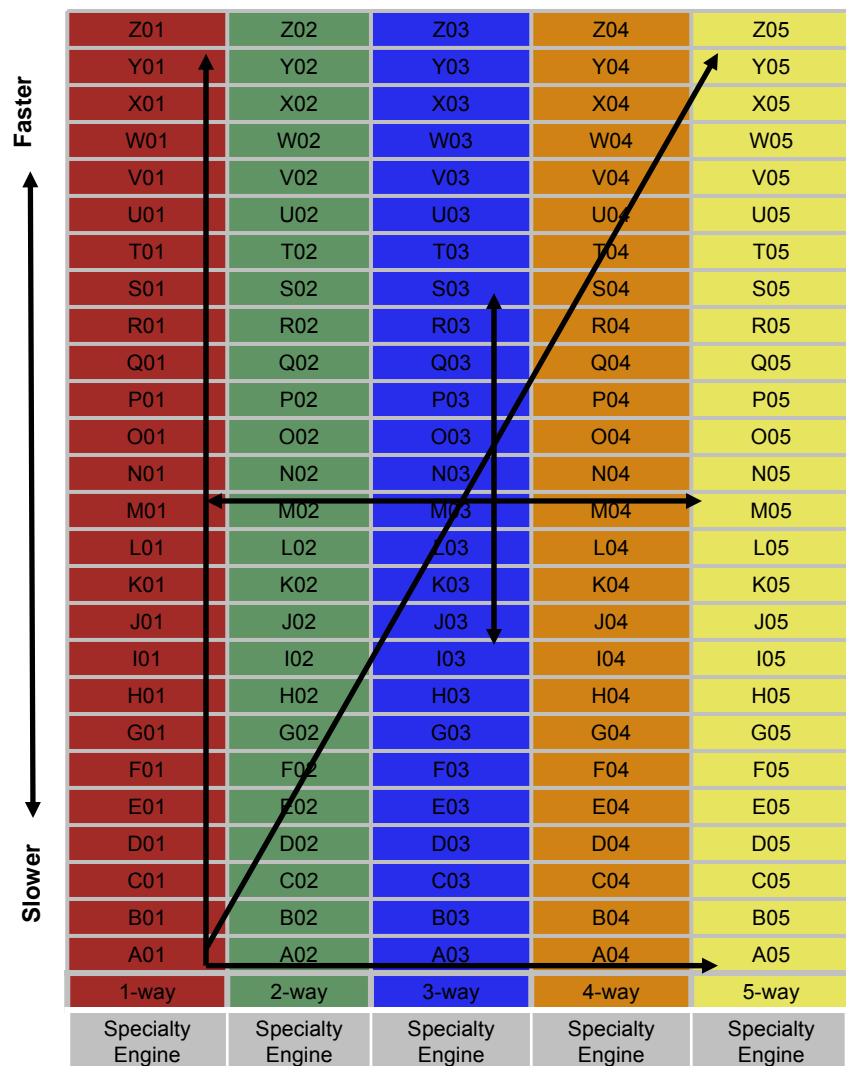|				
Z01	Z02	Z03	Z04	Z05
Y01	Y02	Y03	Y04	Y05
X01	X02	X03	X04	X05
W01	W02	W03	W04	W05
V01	V02	V03	V04	V05
U01	U02	U03	U04	U05
T01	T02	T03	T04	T05
S01	S02	S03	S04	S05
R01	R02	R03	R04	R05
Q01	Q02	Q03	Q04	Q05
P01	P02	P03	P04	P05
O01	O02	O03	O04	O05
N01	N02	N03	N04	N05
M01	M02	M03	M04	M05
L01	L02	L03	L04	L05
K01	K02	K03	K04	K05
J01	J02	J03	J04	J05
I01	I02	I03	I04	I05
H01	H02	H03	H04	H05
G01	G02	G03	G04	G05
F01	F02	F03	F04	F05
E01	E02	E03	E04	E05
D01	D02	D03	D04	D05
C01	C02	C03	C04	C05
B01	B02	B03	B04	B05
A01	A02	A03	A04	A05
1-way	2-way	3-way	4-way	5-way

Specialty Engine (×10)

z10 BC Model E10 with 130 capacity settings

► Granularity designed for flexibility and growth

► Any to any capacity upgradeability within the Model

► All IBM System z10 Enterprise Class (z10 EC™) temporary capacity offerings are available on z10 BC

► CBU capability from smallest to largest capacities

► Increased number of specialty engines than z9 BC

► All specialty engines run at full capacity

► Linux only IFL and ICF only servers (A00)

CP	IFL	zAAP	zIIP	ICF	Additional SAPs	Spares
0-5	0-10	0-5	0-5	0-10	0-2	0 when fully configured

Remember the IBM Processor Capacity Reference (zPCR) is a free tool available for download that can be used to size your System z processors.

http://www-03.**ibm.com**/support/techdocs/atsmastr.nsf/WebIndex/PRS1381

IBM z10 BC continues the CMOS Mainframe heritage
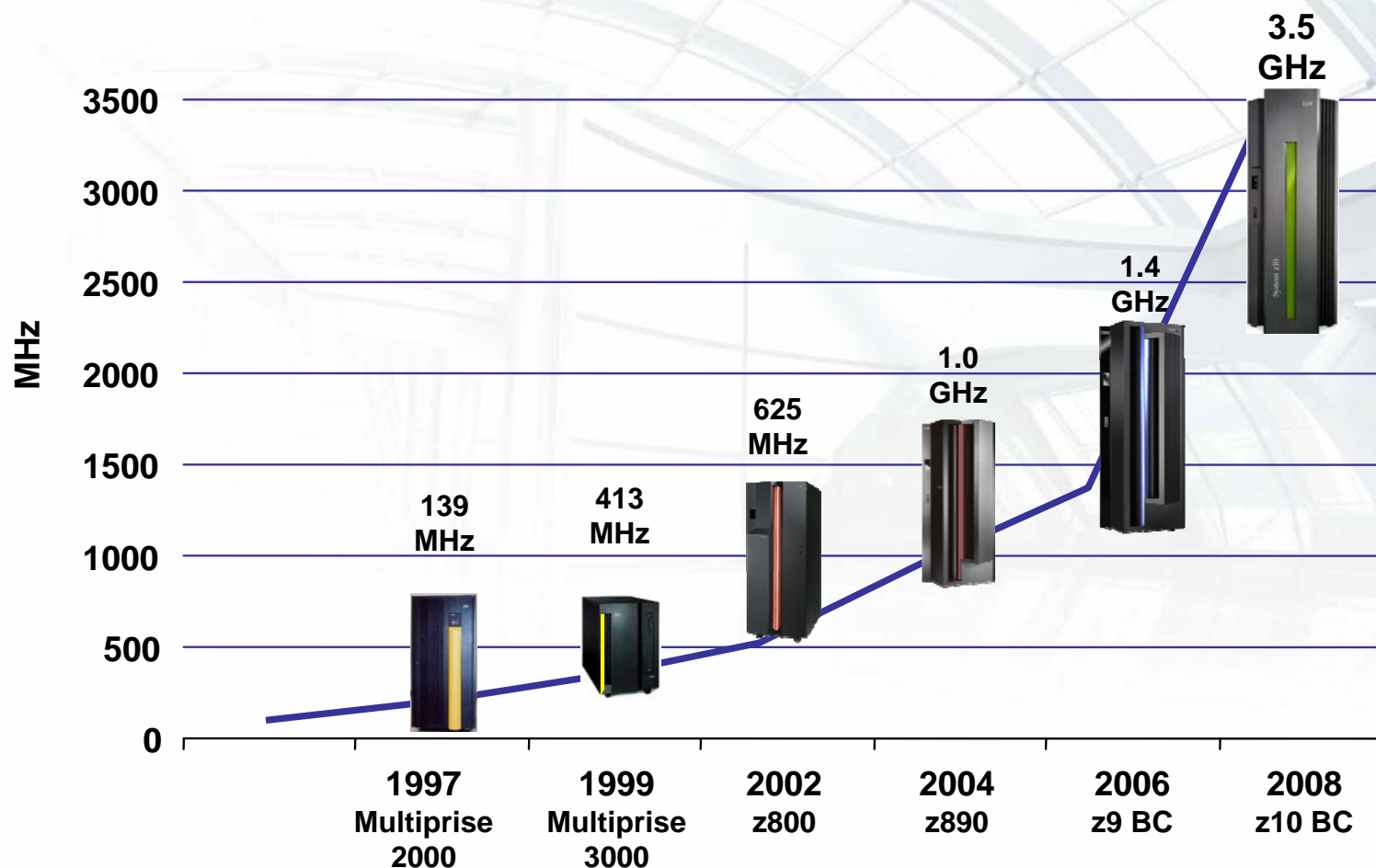
- **Multiprise® 2000 – 1st full-custom CMOS S/390®**
- **Multiprise 3000 – Internal disk, IFL introduced on midrange**

- **IBM eServer™ zSeries® 800 (z800) – Full 64-bit z/Architecture®**
- **IBM eServer zSeries 890 (z890) – Superscalar CISC pipeline**
- **z9 BC – System level scaling**

- **z10 BC – Architectural extensions**
- **Higher frequency CPU**

Making high performance a reality
Designed for the next evolution of Enterprise applications

- **New Enterprise Quad Core z10 processor chip**
  - 3.5 GHz – additional throughput means improved price/performance
  - Cache rich environment optimized for data serving
  - 50+ instructions added to improve compiled code efficiency
  - Support for 1 MB page frames

- **Hardware accelerators on the chip**
  - Hardware data compression
  - Cryptographic functions
  - Hardware Decimal Floating point

Enterprise Quad Core z10 processor chip

- **CPU intensive workloads get performance improvements from new core pipeline design**
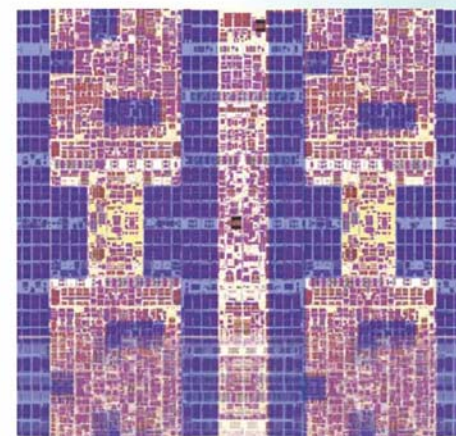
Focused performance boost
Hardware Decimal Floating Point

Up to 10X improvement in decimal floating point instructions*

- **Decimal arithmetic widely used in commercial and financial applications**

- **Computations often handled in software**

- **First delivered in millicode on the System z9 – brought improved precision and function**
  - Avoids rounding and other problems with binary/decimal conversions

- **Integrated on every z10 core to deliver a performance boost to execution of decimal arithmetic**

- **Growing industry support for hardware decimal floating point standardization**
  - Java BigDecimal, C#, XML, C/C++, GCC, DB2® V9, Enterprise PL/1, Assembler
  - Open standard definition led by IBM

Delivering the benefits of System z
to a new set of workloads

* All performance information was determined in a controlled environment.

Evolution of System z Specialty Engines
Big on service, low on cost

Building on a strong track record of technology innovation with specialty engines – DB Compression, Encryption, Vector Facility

IBM System z Integrated Information Processor (zIIP) 2008

Eligible for zIIP:
- DB2 remote access and BI/DW
- ISVs
- IPSec encryption
- z/OS XML
- z/OS Global Mirror
- New HiperSockets™ for large messages
- New IBM GBS Scalable Architecture for Financial Reporting™

System z Application Assist Processor (zAAP) 2004

Eligible for zAAP:
- Java execution environment
- z/OS XML

Integrated Facility for Linux (IFL) 2000

Internal Coupling Facility (ICF) 1997

In z/VM® 5.4, IBM fulfilled plans to support the new System z10 capability to allow any combination of CP, zIIP, zAAP, IFL, and ICF processor-types to reside in the same z/VM LPAR

Harness the Unique Value of Specialty Engines

- **Specialty engine Prices have remained constant yet deliver more capacity**
  - Up to 40% more capacity from z9 BC!!!
  - New lower Prices on z10 BC, now $47.5k USD[1,3]

- **Specialty engine MES upgrades to z10 BC typically move with NO charge**
  (exception for all IFL server and short path upgrades)

- **New lower memory costs for specialty engine enabled workloads, now $2250 per GB[1,2,3]**

- **Distributed Server model over same time:**
  - 3 Technology Refreshes (New Hardware)
  - 3 System migrations

IFL Value Increase

Legend:
- IFL Capacity
- % Increased Value

Model	% Increased Value
G5	
G6	38%
z800	56%
z890	198%
z9 BC	372%
z10 BC	447%
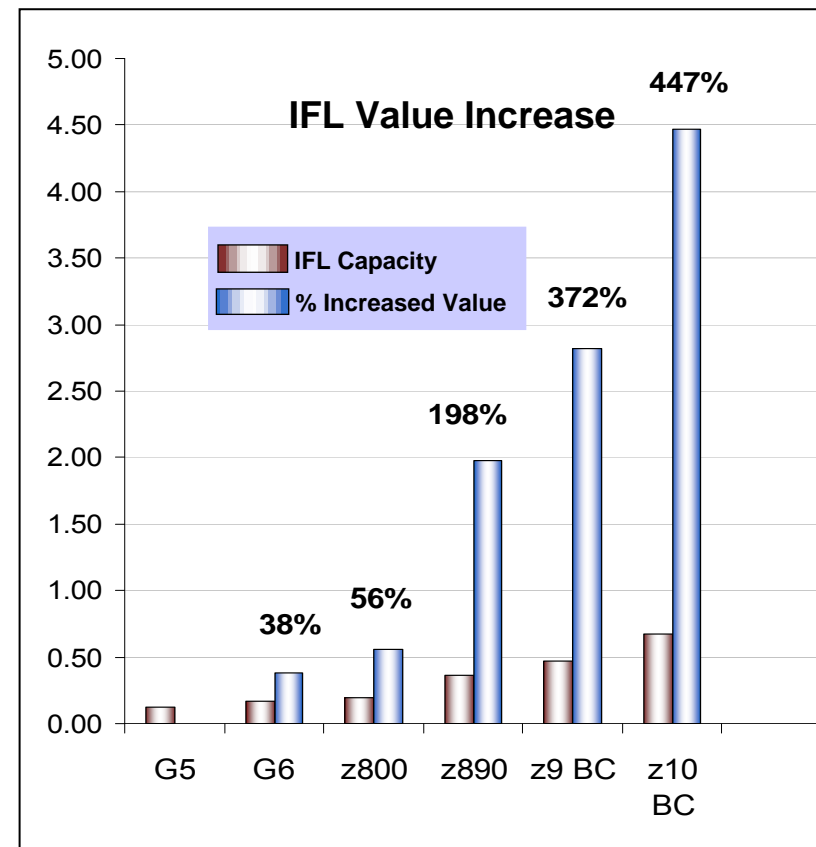
Specialty Engines:

The investments that continues to deliver value generation to generation

1 - Prices in USD, may vary by country, 2 – Limited to 16GB per engine, 3 – Does not include Internal Coupling Facilities (ICFs)

IBM System z family

IBM System z9 EC (2094)

- **Announced 7/05 - Superscalar Server with up to 64 cores**
- **5 models – Up to 54-way**
- **Granular Offerings for up to 8 CPs**
- **PU (Engine) Characterization**
  - **CP, SAP, IFL, ICF, zAAP, zIIP**
- **On Demand Capabilities**
  - **CUoD, CIU, CBU, On/Off CoD**
- **Memory – up to 512 GB**
- **Channels**
  - **Four LCSSs**
  - **Multiple Subchannel Sets**
  - **MIDAW facility**
  - **63.75 subchannels**
  - **Up to 1024 ESCON channels**
  - **Up to 336 FICON channels**
  - **FICON Express2 and 4**
  - **OSA 10 GbE, GbE, 1000BASE-T**
  - **Coupling Links**
- **Configurable Crypto Express2**
- **Parallel Sysplex® clustering**
- **HiperSockets – up to 16**
- **Up to 60 logical partitions**
- **Enhanced Availability**
- **Operating Systems**
  - **z/OS, z/VM, z/VSE, TPF, z/TPF, Linux on System z**

IBM System z9 BC (2096)

- **Announced 4/06 - Superscalar Server with 8 cores**
- **2 models – Up to 4-way**
- **High levels of Granularity available**
  - **73 Capacity Indicators**
- **PU (Engine) Characterization**
  - **CP, SAP, IFL, ICF, zAAP, zIIP**
- **On Demand Capabilities**
  - **CUoD, CIU, CBU, On/Off CoD**
- **Memory – up to 64 GB**
- **Channels**
  - **Two LCSSs**
  - **Multiple Subchannel Sets**
  - **MIDAW facility**
  - **63.75 subchannels**
  - **Up to 420 ESCON channels**
  - **Up to 112 FICON channels**
  - **FICON Express2 and 4 Gbps**
  - **OSA 10 GbE, GbE, 1000BASE-T**
  - **Coupling Links**
- **Configurable Crypto Express2**
- **Parallel Sysplex clustering**
- **HiperSockets – up to 16**
- **Up to 30 logical partitions**
- **Enhanced Availability**
- **Operating Systems**
  - **z/OS, z/OS.e, z/VM, z/VSE, TPF, z/TPF, Linux on System z**

IBM System z10 EC (2097)

- **Announce 2/08 - Server with up to 77 cores**
- **5 models – Up to 64-way**
- **Granular Offerings for up to 12 CPs**
- **PU (Engine) Characterization**
  - **CP, SAP, IFL, ICF, zAAP, zIIP**
- **On Demand Capabilities**
  - **CoD, CIU, CBU, On/Off CoD, CPE**
- **Memory – up to 1.5 TB for Server and up to 1 TB per LPAR**
- **Channels**
  - **Four LCSSs**
  - **Multiple Subchannel Sets**
  - **MIDAW facility**
  - **63.75 subchannels**
  - **Up to 1024 ESCON channels**
  - **Up to 336 FICON channels**
  - **FICON Express2 and 4**
  - **OSA 10 GbE, GbE, 1000Base-T**
  - **InfiniBand Coupling Links**
- **Configurable Crypto Express2**
- **Parallel Sysplex clustering**
- **HiperSockets – up to 16**
- **Up to 60 logical partitions**
- **Enhanced Availability**
- **Operating Systems**
  - **z/OS, z/VM, z/VSE, TPF, z/TPF, Linux on System z**

IBM System z10 BC (2098)

- **Announced 10/08 – Server with 12 cores**
- **Single model – Up to 5-way**
- **High levels of Granularity available**
  - **130 Capacity Indicators**
- **PU (Engine) Characterization**
  - **CP, SAP, IFL, ICF, zAAP, zIIP**
- **On Demand Capabilities**
  - **CoD, CIU, CBU, On/Off CoD. CPE**
- **Memory – up to 120 GB**
- **Channels**
  - **Two LCSSs**
  - **Multiple Subchannel Sets**
  - **MIDAW facility**
  - **63.75 subchannels**
  - **Up to 480 ESCON channels**
  - **Up to 128 FICON channels**
  - **FICON Express2 and 4 Gbps**
  - **OSA 10 GbE, GbE, 1000BASE-T**
  - **InfiniBand Coupling Links**
- **Configurable Crypto Express2**
- **Parallel Sysplex clustering**
- **HiperSockets – up to 16**
- **Up to 30 logical partitions**
- **Enhanced Availability**
- **Operating Systems**
  - **z/OS, z/OS.e, z/VM, z/VSE, TPF, z/TPF, Linux on System z**

z10 BC to z9 BC Functional Comparison

Processor / Memory	▪ Uniprocessor Performance	▪ Up to 1.40 performance improvement over z9 BC uniprocessor*
	▪ System Capacity	▪ Up to 1.50 times system capacity performance improvement over z9 BC**
	▪ Processor Design	▪ 3.5 GHz processor chip for z10 BC vs. 1.4 GHz for z9 BC
	▪ Models	▪ z10 BC has 1 and z9 BC has 2 models
	▪ Processing Units (PUs)	▪ z10 BC has up to 10 cores to configure, up to 7 on z9 BC
	▪ Granular Capacity	▪ z10 BC has up to 130 Capacity settings vs. 73 on the z9 BC
	▪ Memory	▪ z10 BC has up to 256 GB vs. up to 64 GB on z9 BC
	▪ Fixed HSA	▪ z10 BC has fixed 8 GB HSA, z9 BC had HSA from purchased memory
Virtualization	▪ LPARs	▪ z10 BC has up to 5 logical processors in an LPAR vs. 4 on z9 BC
	▪ HiperDispatch	▪ z10 BC has HiperDispatch for improved synergy with z/OS Operating System to deliver scalability and performance
Connectivity	▪ HiperSockets	▪ z10 BC New HiperSockets Layer 2 and Multiple Write Facility
	▪ FICON for SANs	▪ Up to 128 FICON channels on z10 BC vs. 112 on z9 BC
	▪ Total channels	▪ z10 BC can support up to 480 vs. 420 for z9 BC
	▪ Internal I/O Bandwidth	▪ z10 BC has industry standard 6 GBps InfiniBand supports high speed connectivity and high bandwidth vs. z9 BC using 2.7 GBps Self Time Interconnects (STIs)
	▪ Enhanced I/O structure	▪ New I/O Drawer
	▪ Coupling	▪ Coupling with InfiniBand[1] – improved distance and potential cost savings
	▪ Cryptography	▪ Improved AES 192 and 256, stronger hash algorithm with Secure Hash Algorithm (SHA-512) and support for longer Personal Account Numbers up to 19
	▪ LAN Connectivity	▪ New family of OSA-Express3 features for z10
On Demand / RAS	▪ Capacity Provisioning Mgr	▪ z10 & z/OS (1.9) for policy based advice and automation
	▪ RAS Focus	▪ z10 can help eliminate preplanning required to avoid scheduled outages
	▪ Just in Time deployment of Capacity	▪ Capacity on Demand offerings CBU and On/Off CoD plus new Capacity for Planned Events are resident on z10
	▪ Enhanced I/O structure	▪ z10 BC has 'hot-pluggable' I/O drawers
Environmentals	▪ Monitoring	▪ z10 displays energy efficiency on SAD screens
		▪ Utilizes IBM Systems Director Active Energy Manager for Linux on System z for trend calculations and management of other servers that participate

* LSPR mixed workload average running z/OS 1.9 - z10 BC Z01 versus z9 BC Z01
** This is a comparison of the z10 BC 10-way and the z9 BC 7-way and is based on LSPR mixed workload average running z/OS 1.9

Consolidation with Linux gets a "green light"

System z servers may help customers become more energy efficient:

- Deploy energy efficient technologies – reduce energy consumption and save floor space

Economics of IFLs and z/VM help to drive down the cost of IT

- IFLs attractively priced, have no impact on z/OS license fees, and z/VM and Linux software priced at real engine capacity
- New 50% price reduction on IFLs for System z10 BC, now $47,500*
- Plus 62% price reduction on System z10 memory prices for new workloads when purchased with Specialty Engines*, now $2250 per GB **
- And typically MES upgrades when moving to new technology are priced at no charge

Over 2450 LINUX applications are supported on System z, 15% growth in 2008

Integrated Facility for Linux – IFL

* Prices are stated in US currency and may vary by country.
Specialty engines do not include Internal Coupling Facilities (ICFs)
** Limited to 16 GB per engine

The right level of business continuity protection for your business – *GDPS family of offerings*

NEW!

***Geographically Dispersed Parallel Sysplex™ GDPS® V3.6 Preview:* an end-to-end disaster recovery solution to enable:**

- Automated recovery removes people as Single Point of Failure
- A single point of control for heterogeneous data across enterprise

Continuous Availability of Data Within a Data Center	*Continuous Availability / Disaster Recovery Metropolitan Region*	*Disaster Recovery at Extended Distance*	*Continuous Availability Regionally and Disaster Recovery Extended Distance*
Single Data Center Applications remain active	**Two Data Centers Systems remain active**	**Two Data Centers**	**Three Data Centers**
Near-continuous availability to data	**Automated D/R across site or storage failure No data loss**	**Automated Disaster Recovery "seconds" of Data Loss**	**Data availability No data loss Extended distances**
GDPS/PPRC HyperSwap™ Manager	**GDPS/ PPRC HyperSwap Manager GDPS/PPRC**	**GDPS/GM GDPS/XRC**	**GDPS/MGM GDPS/MzGM**

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

IBM.

System z Business Update, Strategy, and Future Directions

Industry perspectives

Growth and Innovation

*"…IBM has reinvented the mainframe. The **pursuit of new workloads** has been a critical aspect of the resurgence, while at the same time protecting and nurturing the installed base. The introduction of **specialty engines** has been a catalyst to the growth but represents only the first step toward a significant change in architecture during the next five years."*
Source: Gartner Data Center Conference, Dec. 2008 (Gartner The IBM Mainframe Platform Ongoing Challenges, New Opportunities)

*"Enterprises seeking to build the industry's **most cost effective service-oriented datacenters** need to look closely at IBM's hardware platforms, software products, and professional services offerings in particular – and IBM's z10 in specific. -- serves as the ideal platform for service-oriented data centers of the future".*
Joe Clabby, Clabby Analytics, Feb 2008

Cost Effective and Modern

Simplifying IT

*"For those IT organizations that have seen the light and are moving their emphasis from the never-ending challenge of trying to optimize their IT infrastructure to the more important **optimizing of the delivery of IT services, nothing beats the mainframe**,"*
Mike Kahn, The Clipper Group, February 2008

System z remains a growing product line *for IBM because, during the past decade, it has morphed historical strengths into new forms aligned with today's languages, operating environments, and computing standards. And, in fact, **System z strengths such as mitigating business risk** in many forms have once again shoved their way to the fore of many IT departments' priorities. This includes protecting against hardware and site failures, managing a company's security policies and credentials, acting as a focal point for integrating the myriad applications that make up a business process, and being able to adapt to sharp spikes in load.*
Gordon Haff, Illuminata, January 2009

Manage Risk

IBM System z installed capacity continue to grow at double digit rates

- **System z total installed MIPS[1] has grown 20% CAGR since 2003**

    – Specialty engine capacity growing at an astonishing 93% rate

    – Since IBM launched the IBM eServer™ zSeries® 900 (z900) in 4Q 2000, System z has *nearly doubled its share*, from 17% to 33% in the enterprise server segment[2]

- **Since the introduction of the z10 in February 2008, System z has grown revenue by 10% and increased market share**
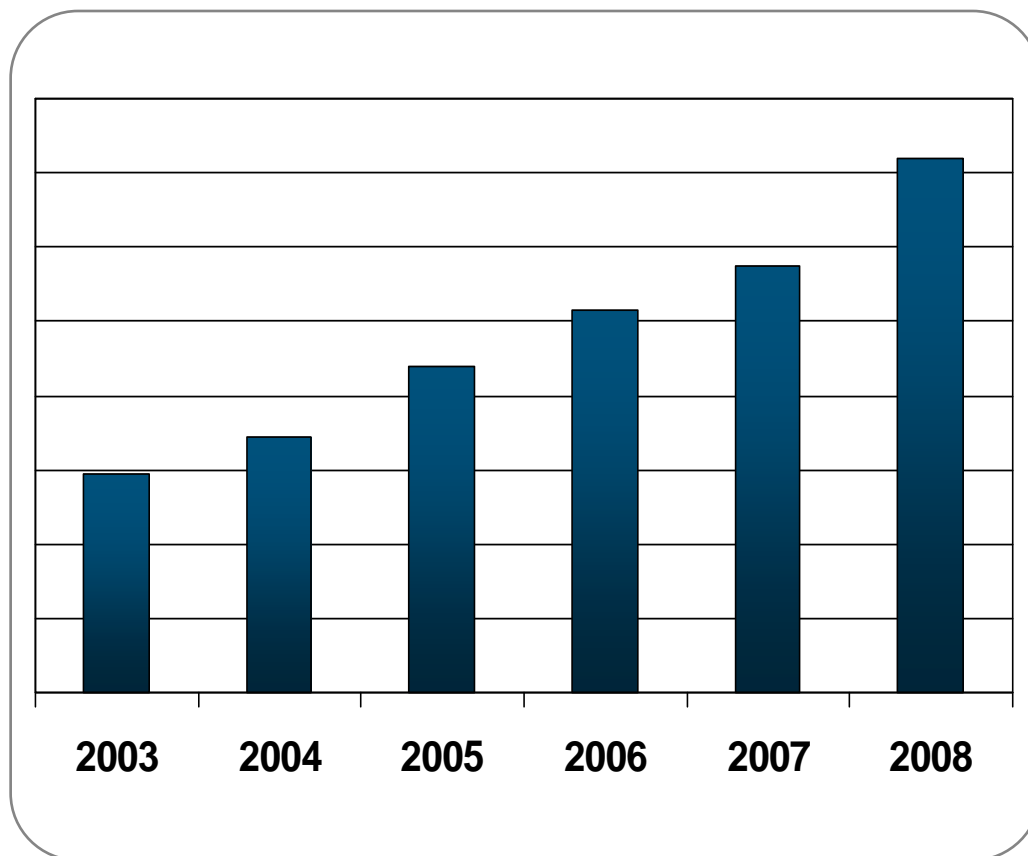
[1] IBM internal MIPS inventory numbers, Sept 08; HP wins based on internal IBM Sales tracking data
[2] IDC server tracker, Nov 08, , $250K+ servers

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

System z Linux: The Fastest Growing Server Platform.
2008 New Linux Capacity on System z = ~40-60,000 x/86 cores

- **77% increase in System z Linux MIPS:**

- **22 of 54 new New System z Clients installed Linux**

- **Approximately 1,300 System z customers are now using Linux on System z**

- **Linux is ~15% of the customer System z install base (MIPS)**

■ # Linux Engines Sold per Year

2000

1500

1000

500

0

2002   2004   2006   2008
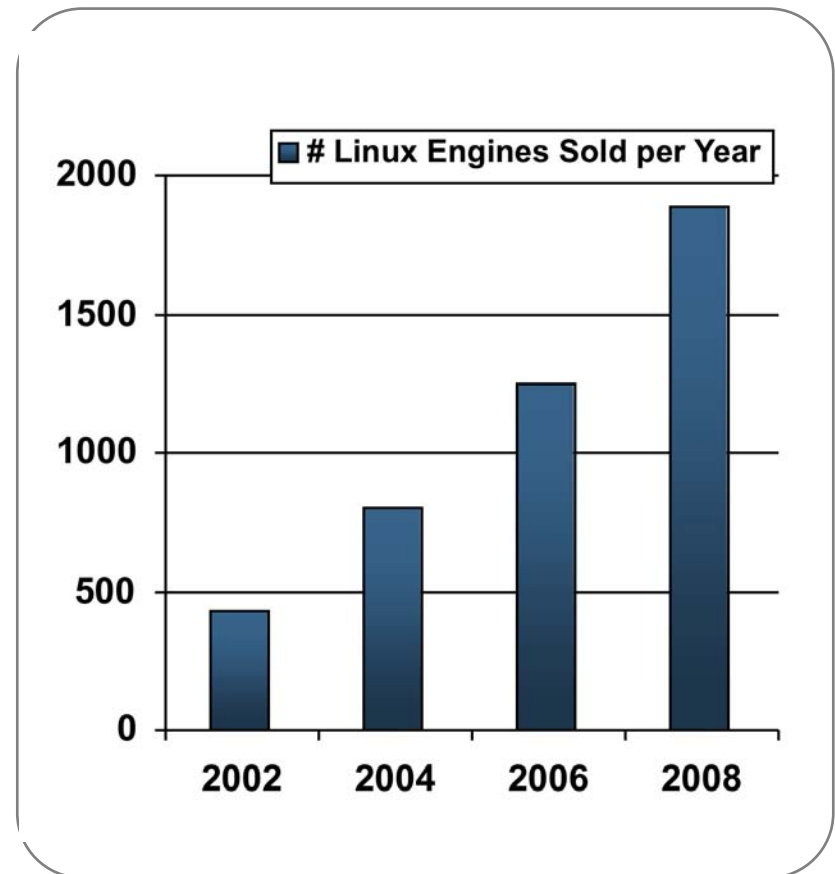
System z: The right technology…
45 years of market leadership

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

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

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 road ahead for Dynamic Infrastructure with System z

Our goal is to extend mainframe qualities to <u>heterogeneous</u> platforms within a Dynamic Infrastructure to Support Critical Applications

- End-to-End Systems Management

- Policy based Automation Across the Applications Stack

- Mainframe Security

- Application Resiliency

- Consolidated Disaster Recovery

- Improved Economies of Scale and Efficiency

Extending System z management and QOS to non-System 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

System z: leadership capabilities for a Dynamic Infrastructure
Now…

Role of System z today:

- Secure and resilient enterprise data hub

- Enterprise server for mission critical applications requiring high levels of availability and security (eg, OLTP)

- Highly efficient consolidation platform for exceptional cost savings
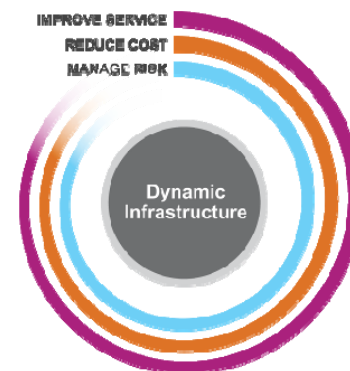
Mainframe Qualities:

- High application-level availability, not just Hardware or OS

- Iron-clad security (EAL-5)

- Extreme scalability

- Integrated capabilities for workload management, provisioning, etc.

- Extensive monitoring and audit capabilities

System z: leadership capabilities for a Dynamic Infrastructure … and in the future

Role of System z today:

- Secure and resilient enterprise data hub

- Enterprise server for mission critical applications requiring high levels of availability and security (eg, OLTP)

- Highly efficient consolidation platform for exceptional cost savings

Role of System z tomorrow

- An extremely Cost-efficient platform across broader enterprise workloads

- Multi-tier business application host for a wider range of critical applications

- System z QoS (RAS) and management extended to heterogeneous platforms and applications

Service Levels to Match Your Business Needs
Increased flexibility for your multi-tier, multi-architecture strategy

Low TCO

Low TCA

Lower | *Scalability, Security, Dynamic Workload Management* | **Higher**

Distributed Systems
- ✓ Silo managed islands of computing
- ✓ Less dynamic
- ✓ Minimal resource sharing

Application Serving Blades
- ✓ Expanded ISV support for enterprise applications
- ✓ Targeted for applications that interact with mainframe data and transactions
- ✓ Provisioned and managed by System z

Linux-on-z/VM
- ✓ Extreme consolidation of servers and networking
- ✓ Superior levels of virtual server provisioning, monitoring and workload management
- ✓ Industry-best virtual I/O bandwidth and reliability
- ✓ Fewer components and reduced complexity
- ✓ System z qualities of dynamic resource management and capacity-on-demand
- ✓ Seamless integration with z/OS backup and disaster recovery solutions

z/OS
- ✓ Extreme scalability and performance for transaction processing and data serving
- ✓ High availability and cross-system scalability with Parallel Sysplex® and GDPS
- ✓ Leading policy-based capacity provisioning and workload management
- ✓ Pervasive, high-performance security support

zFuture
Mainframe QoS extended to multi-tier applications

Processor performance and future scalability

The business capabilities from leveraging the "z" dimension

- Performance increase with enhanced engine capacity
    - Specialty Engines technology dividend
- Sub-capacity engine sizes available for smaller configurations
- 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
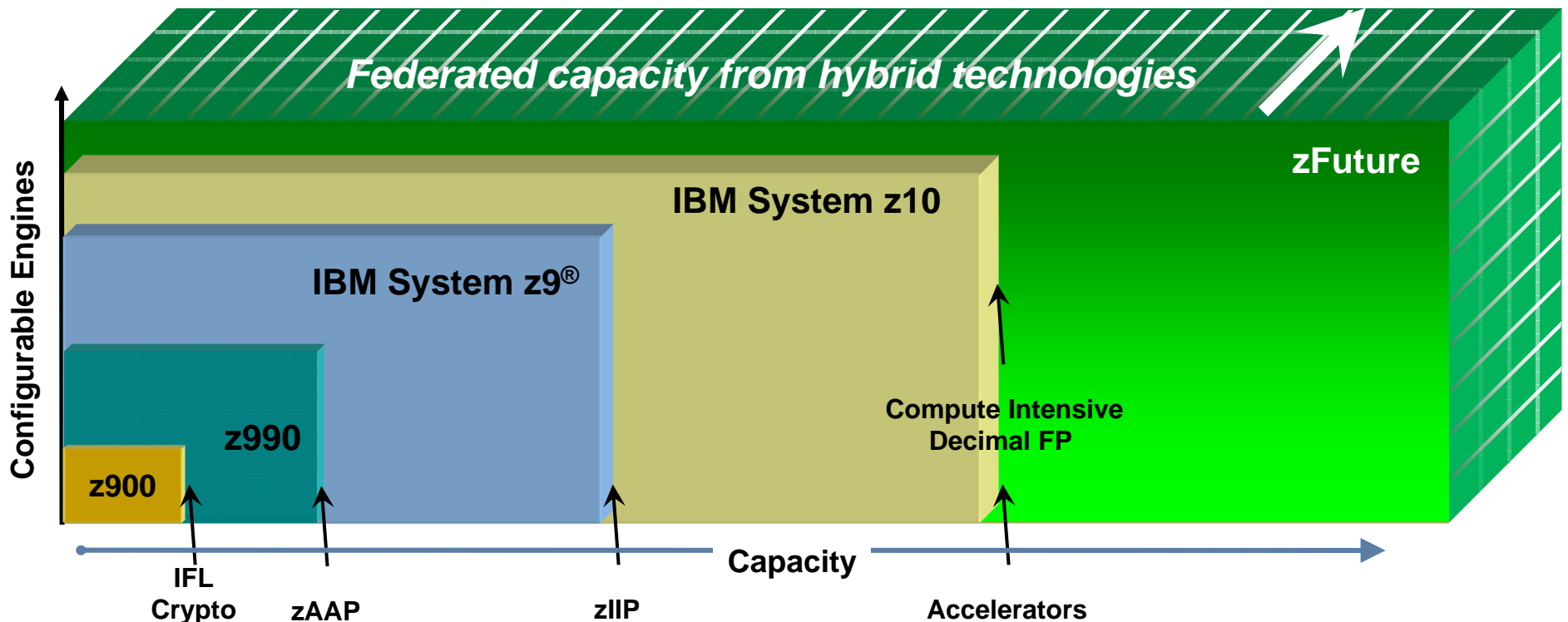
Mainframe Paradigm
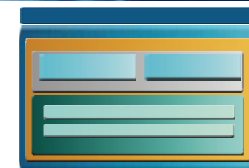
- **Mainframe original design point:**
  - *Share everything*
  - *Support of mixed workloads*
  - *Highly available & secure*

- **Virtualization helps enable:**
  - *Simplification*
  - *High utilization*
  - *Intelligent management*

- **This creates a foundation to:**
  - *Help customers build cost effective & efficient infrastructures*
  - *Highly Available & Secure*

Mainframe multi-dimensional virtualization

Integrated platform stack

System z10

Virtual access

Virtual management

Physical & Virtual resources

Key virtualization features are designed in, not added on

zFuture: The next leap in virtualization
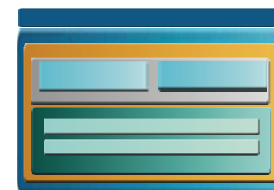
- Virtualization was pioneered and perfected on IBM mainframes

- System z continues to set the gold standard in virtualization
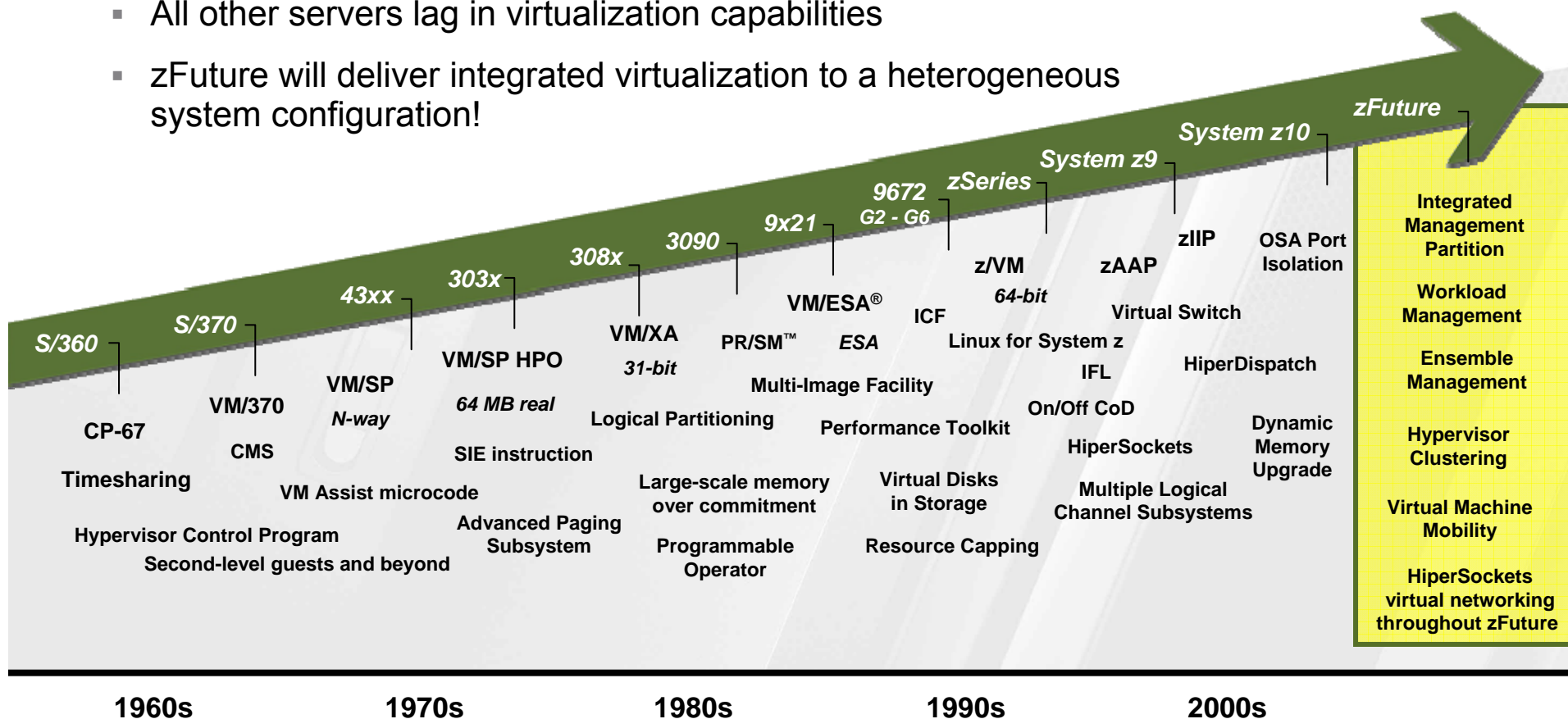
- All other servers lag in virtualization capabilities

- zFuture will deliver integrated virtualization to a heterogeneous system configuration!

zFuture

System z10

System z9

zSeries

9672
G2 - G6

9x21

3090

308x

303x

43xx

S/370

S/360

zIIP

OSA Port
Isolation

z/VM

zAAP

64-bit

Virtual Switch

VM/ESA®

ICF

Linux for System z

VM/XA

PR/SM™ ESA

HiperDispatch

31-bit

Multi-Image Facility

IFL

VM/SP HPO

VM/SP

N-way

64 MB real

Logical Partitioning

Performance Toolkit

On/Off CoD

Dynamic
Memory
Upgrade

VM/370

Large-scale memory
over commitment

Virtual Disks
in Storage

HiperSockets

CMS

SIE instruction

CP-67

VM Assist microcode

Programmable
Operator

Resource Capping

Multiple Logical
Channel Subsystems

Timesharing

Hypervisor Control Program

Advanced Paging
Subsystem

Second-level guests and beyond

**Integrated
Management
Partition**

**Workload
Management**

**Ensemble
Management**

**Hypervisor
Clustering**

**Virtual Machine
Mobility**

**HiperSockets
virtual networking
throughout zFuture**

| 1960s | 1970s | 1980s | 1990s | 2000s |

Thank you