

**IBM System z9**  
**Technology Update & Trends**  
**A System z9 for Everyone**



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**LSU 2006**, October-November, 2006  
 25 years of I/T education and positioning

IBM Systems

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**Notable quotable...**

**“I predict that the last mainframe will be unplugged on March 15, 1996”**

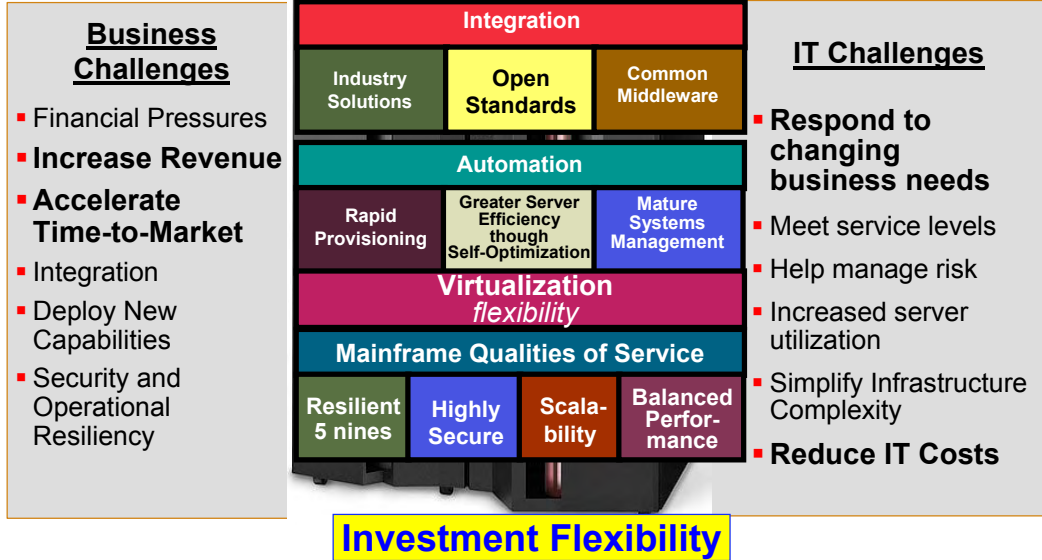
*Stewart Alsop, former InfoWorld columnist (now at Fortune Magazine), March, 1991*



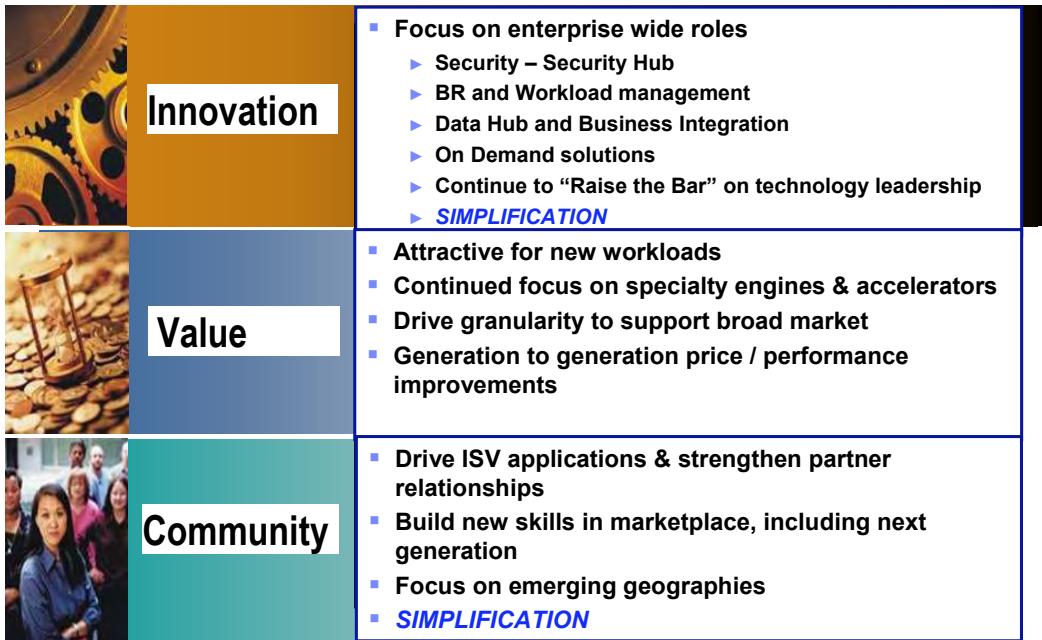
- Annual growth in MIPS of over 30% since 1992
- More than \$20B in mainframe revenue since 1996 (when the last one was to have been unplugged...)
- But there have been many changes in the mainframe since 1991!
- 10 million MIPS installed base

# System z Core Values - 40 years investments...

*still and increasingly at work  
uniquely positioned for the on demand challenge*



## The Mainframe Charter – investing in the future



# System z9 delivers price / performance and investment flexibility for on demand computing

Generation to generation price / performance improvements:	z9 BC	z9 EC
Reduction in chargeable MSUs versus z890 / z990	10%	10%
Reduction in chargeable MSUs versus z800 / z900	19%	19%
Reduction in maintenance costs (*) (up to)	20%	20%
Hardware performance improvement for IFL (Linux), zIIP (DB2, etc.), zAAP (Java) and Internal coupling facilities (ICF) (*) up to	37%	35%
Typical charge for MES upgrades for IFLs and zAAPs	0	0
Technology-driven value	z9 BC	z9 EC
Number of capacity settings	73	78
Specialty engines (IFL, zAAP) and the new System z9 Integrated Information Processors (zIIPs) which can help reduce the cost of certain DB2® Data Serving Workloads (**)	\$95k	\$125k
IBM SW charges for zAAP & zIIP capacity	0	0

**Plus**

- IBM MLC SW Cost per MIP is reduced with a factor 2 since 2001
- Significant price reductions for memory etc..
- On/Off Capacity on Demand (On/Off CoD) enhancements to better manage volatile business requirements

(\*) – comparisons shown are z9 BC vs. z890 and z9 EC vs. z990  
 (\*\*) Prices may vary by country

**The Mainframe Charter**

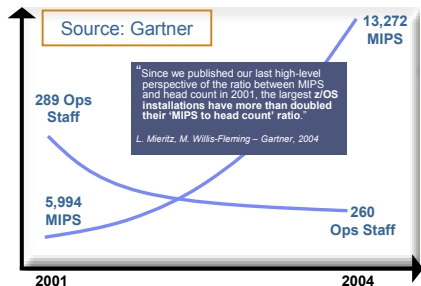
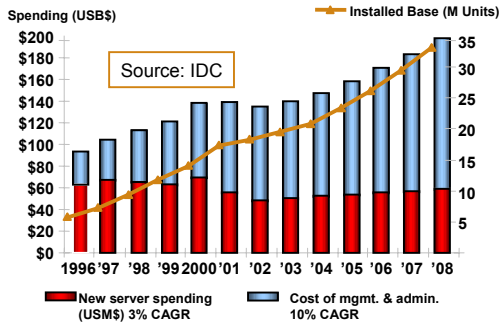
*Investing in the future*

**Innovation**

**Value**

**Community**

# Cost of Complexity – System z is unique in managing growth and cost



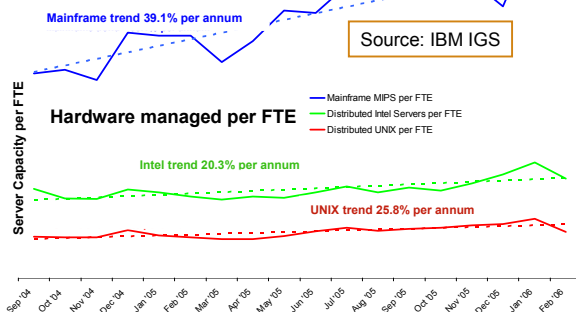
**IBM IGS Observation**

**Total HW/SW/Operational cost / MIP has been reduced by a factor 2 over the last 4 years**

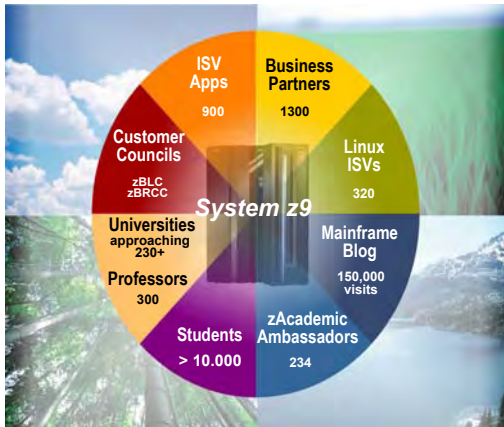
**Predicted average cost per end user in 2010:**

- Mainframes \$6,250
- Unix Minis \$19,000
- PC Servers \$24,000

**5yr costs for hardware, software and maintenance**  
 Arcati Research 2005 – The Dinosaur Myth 2004 Update



# Mainframe Community Ecosystem



## Customer councils

### IBM Academic Initiative

- **GOAL - 20,000 new skills by 2010**  
 ✓ more than 10,000 so far
- **230+ colleges and universities**  
 ✓ with 50% outside US
- **300 professors registered**
- **200+ IBM ambassadors**
- **12 Enterprise systems courses**
- **New e-learning courses developed**

### Partners – heavy investents

- **300+ mainframe Linux ISVs**
- **1,300 mainframe partners**
- **training, loaner program, discounts**
- **24/7 HW/SW/support**

### Mainframe blog

- <http://mainframe.typepad.com>

Meet the Community™ via the mainframe community portal

<http://www.ibm.com/servers/eserver/zseries/about/charter/community.htm>

# z Solution and Technology Rollouts

heavy application focus

	3Q06	4Q06	1Q07	2Q07	3Q07	4Q07
<b>Marketing Theme</b>	<ul style="list-style-type: none"> <li>▪ Information Management</li> <li>▪ Enterprise Security</li> <li>▪ Data Serving</li> </ul>	<ul style="list-style-type: none"> <li>▪ Virtualization</li> <li>▪ Consolidation</li> <li>▪ SOA</li> </ul>	<ul style="list-style-type: none"> <li>▪ Virtualization</li> <li>▪ Consolidation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Data Serving</li> <li>▪ Platform Competitiveness</li> <li>▪ Performance</li> </ul>	<ul style="list-style-type: none"> <li>▪ SOA</li> <li>▪ Enterprise Security</li> </ul>	<ul style="list-style-type: none"> <li>▪ Platform Competitiveness</li> <li>▪ Application Enablement</li> </ul>
<b>Solutions</b>	<ul style="list-style-type: none"> <li>▪ System z Advantage for SAP</li> <li>▪ Oracle DB on Linux consolidation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Electronics</li> <li>▪ Payments with ACI and eFunds</li> </ul>	<ul style="list-style-type: none"> <li>▪ Oracle App Server on Linux for System z</li> </ul>	<ul style="list-style-type: none"> <li>▪ Back end Retail with SAP</li> </ul>	<ul style="list-style-type: none"> <li>▪ SOA Solution for Insurance</li> </ul>	<ul style="list-style-type: none"> <li>▪ Data Warehousing / Business Intelligence</li> </ul>
<b>Technology</b>	<ul style="list-style-type: none"> <li>▪ Security</li> <li>▪ Tape Encryption</li> <li>▪ Data Warehousing (SWG)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Data Hub DB2 V9</li> </ul>	<ul style="list-style-type: none"> <li>▪ Linux virtualization</li> </ul>	<ul style="list-style-type: none"> <li>▪ Data Hub</li> <li>▪ Performance</li> <li>▪ SOA (SWG)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Security</li> </ul>	<ul style="list-style-type: none"> <li>▪ Application Enablement</li> </ul>
<b>Industry Focus</b>	<ul style="list-style-type: none"> <li>▪ Industrial, Govt &amp; Financial</li> </ul>	<ul style="list-style-type: none"> <li>▪ Banking &amp; Financial Markets</li> </ul>	<ul style="list-style-type: none"> <li>▪ Cross-industry and FSS</li> </ul>	<ul style="list-style-type: none"> <li>▪ Retail</li> </ul>	<ul style="list-style-type: none"> <li>▪ Insurance, Govt, &amp; Financial</li> </ul>	<ul style="list-style-type: none"> <li>▪ Industrial</li> </ul>

## The mainframe as a platform for people integration

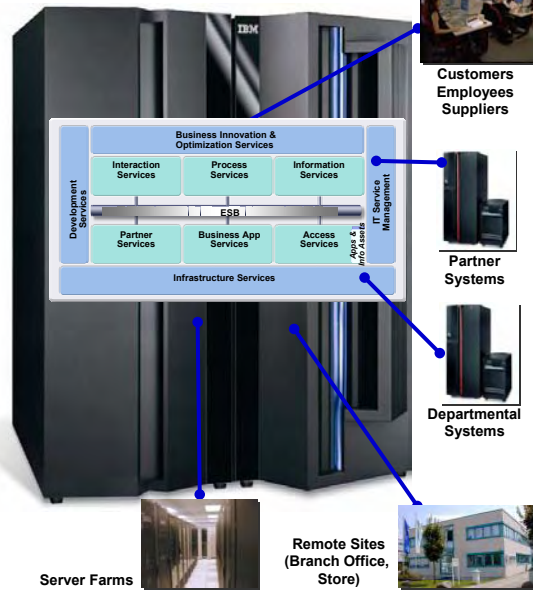
*Delivers all the essential SOA qualities*

Architecturally compatible:

- SOA Reference Architecture
- Architectural services
- Communications and integration
- Process control
- Reuse of core assets
- Helps address industry standards

Operationally superior:

- End-to-end **security** features in the enterprise
- **24/7 availability**
- **Massive scalability**
- **Automated recoverability**
- **Centralized operations**



## System z9 - today

**Unlimited Scalability - High Flexibility**  
**Resilience - Security**  
**Integration**

**Continued effective price reduction**  
**HW and SW**

# IBM Announces the System z9

## Investment:

- 3 years
- \$1.2 billion
- 5,000 tech professionals

## System z - today

Scalability - High Flexibility  
 Resilience - Security  
 Integration

Continued effective price reduction  
 HW and SW

### z9 EC Enterprise Class

Up to 64 engines (cores)  
 Multiple Capacity levels  
 zAAP, zIIP, IFL engines  
 Investment protection  
 Upgrade from z900, z990, z9-BC



### z9 BC Business Class

Up to 8 engines (cores)  
 1-3 way + speciality engines  
 0-4 way + speciality engines  
 Multiple Capacity Levels  
 zAAP, zIIP, IFL engines  
 Investment protection  
 Upgrade from z800-4, z890



26 to 17500++ MIPS  
 Corresponds to:  
 3000 to more than 2 million TPC-C

# System z9 - Scalability and Upgrade strategy

## Each new range has delivered:

- New function
- Improved performance
- Improved availability and serviceability
- Better price/performance
- Field Upgrades to protect investments

4 Advanced z9 BC MCM's (Book's)  
 Concurrent Install / Upgrade / Repair  
 Concurrent upgrade of microcode

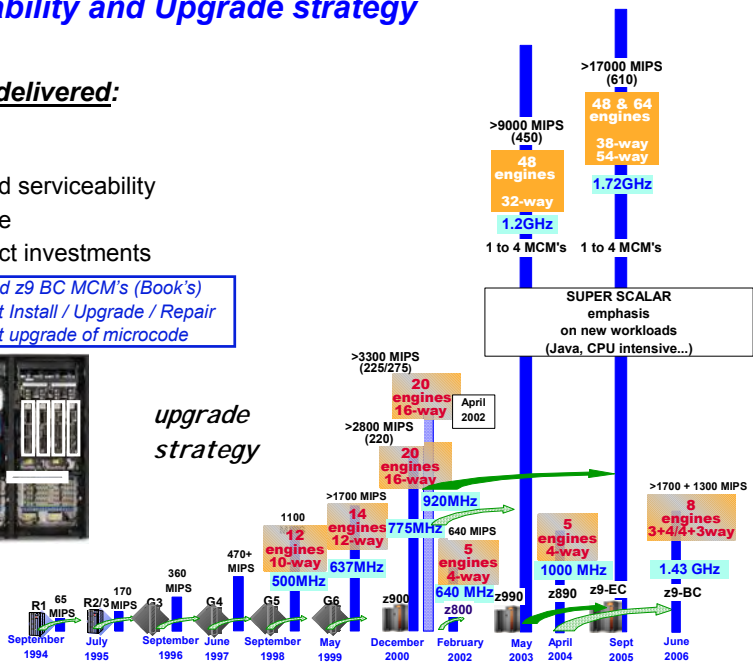


### System z9 EC MCM

95x95mm  
 16 chipsites, 217 capacitors  
 3.9 billion transistors  
 104 layer of glass ceramic  
 476 meters of wire  
 more than 4000 MIPS  
 more than 400000+ TPC-C



upgrade  
strategy



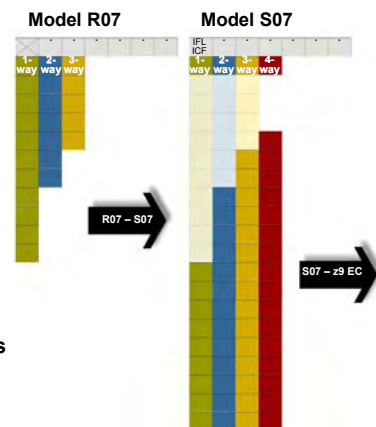
# IBM System z9 Business Class (BC) systems



**ENABLING BUSINESS.  
A THROUGH Z.**

## z9 BC - The modern mainframe for the small to medium enterprises *Low entry point and more choices*

- **Designed for flexibility in 2 new models - R07 and S07**
  - ▶ Entry model (R07) with 1 to 3 standard engines
  - ▶ 1 to 4 way (S07) model
  - ▶ **Granularity options – same entry size as z890 (26 MIPS)**
  - ▶ Up to 7 way with speciality engines
- **More speciality engines for more workloads (480 MIPS)**
  - ▶ Integrated Facility for Linux (IFL), Internal Coupling Facility (ICF)
  - ▶ System z™ Application Assist Processor (ZAAP)
  - ▶ **System z Integrated Information Processor (zIIP)**
- **On demand upgrade capability**
  - ▶ Any-to-Any upgradeability including upgrade to z9 EC
  - ▶ On/Off Capacity on Demand (On/Off CoD) functions available
  - ▶ Sub-capacity CBU options
- **Double Memory (64GB) compared to z890**
- **Enhanced networking and connectivity options**
- **Built with System z9's Cryptographic & Encryption functions**
  - ▶ ATM/POS Remote Key Load
- **EWLC and Tiered EWLC Software Pricing Structure**
- **Operating system support - similar to z9 EC**
  - ▶ z/OS.e continues to be supported



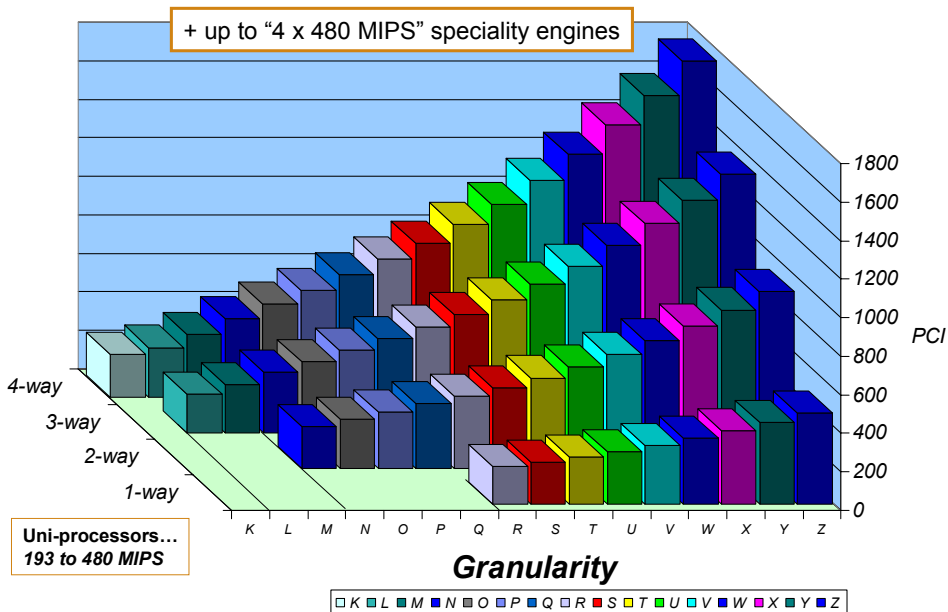
**+38% Engine Size**  
**0.7 ns Cycle Time**  
**+ 37% Capacity**

**Based on System z9 technology**  
Availability enhancements  
More FICON channels  
MIDAW (FICON performance)  
10 Gb Ethernet  
Multiple Subchannel Sets (MSS)





## Processor Granularity z9 BC S07 – 193 to 1782 MIPS



## z9 BC – HSA considerations

### ■ HSA Estimator on Resource Link

- ▶ Previously only available on a machine Support Element
  - Estimates relative to the machine family of the Support Element

### ■ HSA significantly larger than pre-z890 processors

### ■ HSA larger than that experienced on z800 or z890 processors

- ▶ Probable values in the 1.5 - 3 GB range depending on configuration
  - Dependent on number of LPARs, Multiple Channel Subsets, etc.
  - Some incremental growth for a 2086 to 2096 upgrade with no major changes to configuration

## Standalone z9 BC Software Pricing

**For Sub-Capacity Eligible Products \***  
Entry Workload License Charges (EWLC)

**For non Sub-Capacity Eligible Products**  
EWLC Tiered Price Structure

### EWLC Price Structure

Base	3 MSUs
Level 1	4 - 17 MSUs
Level 2	18 - 30 MSUs
Level 3	31 - 45 MSUs
Level 4	46 - 87 MSUs
Level 5	88 - 175 MSUs
Level 6	176 - 260 MSUs
Level 7	261+ MSUs

cumulative monthly pricing

### EWLC Tiered Price Structure

Tier A	1-11 MSUs
Tier B	12-15 MSUs
Tier C	16-40 MSUs
Tier D	41 - 75 MSUs
Tier E	76 - 1500 MSUs
Tier F	1501+ MSUs



Flat monthly pricing.  
Select the tier based on the  
MSU rating of your server

\* Note: The z9 BC Model A01 is priced using zSeries Entry License Charges (zELC).

## Protecting your investment in System z technology

- Full upgrades within the z9 (R07 to S07 to z9 EC)
- Any to any upgrade from the z890
- Upgrade from the z800 model 004\*
- No charge MES upgrades on IFLs and zAAPs
- Capability of the System z9 servers to nondisruptively increase computing resources within the server
  - ▶ Can enable dynamic and flexible capacity growth for mainframe servers
  - ▶ Temporary capacity upgrade available through On/Off Capacity on Demand
  - ▶ Temporary, nondisruptive addition of CP processors/capacity, IFLs, ICFs, zAAPs or zIIPs
  - ▶ New options for changing On/Off CoD configurations
  - ▶ Sub-capacity CBU engines



## IBM System z9 Enterprise Class (EC) systems



ENABLING BUSINESS.  
A THROUGH Z.

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### IBM System z9 EC overview

- **Machine Type**  
**2094**
- **5 Models**  
**S08, S18, S28, S38, S54\***
- **Processor Units (PUs)**  
48way & 64way  
580 to 17500+ MIPS  
0.58 ns cycle time  
12 PUs/book for S08/18/28/38  
16 PUs/book for S54  
2 SAPs per book, standard  
2 spare PUs per server  
1-38 or 1-54 PUs available...
  - CPs, IFLs, ICFs, zAAPs
  - optional SAPs
- **Compared to z990**  
+35% more UNI-capacity  
+95% more system capacity



- **Memory**  
Minimum of 16 GB  
up to 128 GB/book & 512 GB/system  
in 16 GB increments
- **Bandwidth for I/O cage**  
up to 16 STIs per book
  - ▶ 2.7 GB/s for each I/O
  - ▶ 2.0 GB/s for ICBs
- **Total system I/O bandwidth capability of 170+ GB/sec**
- **New generation of FICON/FCP**
- **Improved FICON performance with the MIDAW facility**  
(Modified Indirect Data Address Word)
- **Multiple subchannel sets**
- **4 Channel Subsystems**
- **60 Logical Partitions**
- **Concurrent ucode upgrade**
- **Concurrent book upgrade/repair**
- **Upgradeability**  
Upgrade paths from z900 & z990  
Disruptive upgrade from zSeries and from other z9-BC models to model S54

Models	MCMs	Available PUs	Standard SAPs	Standard Spares	CP/ICF/IFL's and zAAP	Max Memory	Max** Channels
S08*	1	12	2	2	8	128 GB	960***
S18*	2	24	4	2	18	256 GB	1024
S28*	3	36	6	2	28	384 GB	1024
S38*	4	48	8	2	38	512 GB	1024
S54*	4	64	8	2	54	512 GB	1024

**The name of the product is 'IBM System z9 109'**

The SW Model Capacity Indicator field will read 700-754 depending on the number of active CPs on the machine.

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## z9 EC – Delivering increased capacity and performance

### Delivering new levels of scalability

- ▶ Built on modular book design – one to four books
- ▶ Five models with one machine type
  - 1 to 38-way high performance server (four models)
  - Up to 54-way enhanced model for high performance and maximum capacity
- ▶ The z9 EC full capacity uniprocessor is expected to deliver 35% more capacity than the z990 uniprocessor \*
- ▶ The S54 offers 95% more server capacity than z990 \*\*
- ▶ Two spare processor units per server
- ▶ Increased memory – up to 512 GB per server
- ▶ Multiple Subchannel Sets (MSS) for an increased number of logical volumes
- ▶ Up to 60 logical partitions (2X improvement)

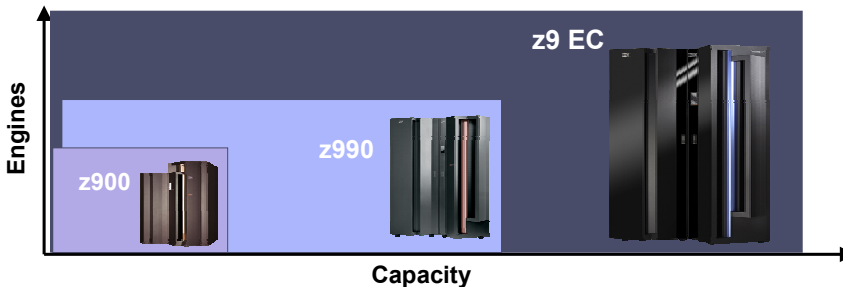
### Improved I/O Performance

- ▶ Up to 80%\*\*\* more bandwidth than the IBM eServer zSeries 990 (z990)
- ▶ Can improve FICON performance with Modified Indirect Data Address Word (MIDAW) facility
- ▶ New generation of FICON/FCP

\* LSPR mixed workload average. z9 EC-701 Vs z990-301

\*\* This is a comparison of the z9 EC 54-way and the z990 D32 and is based on LSPR mixed workload average.

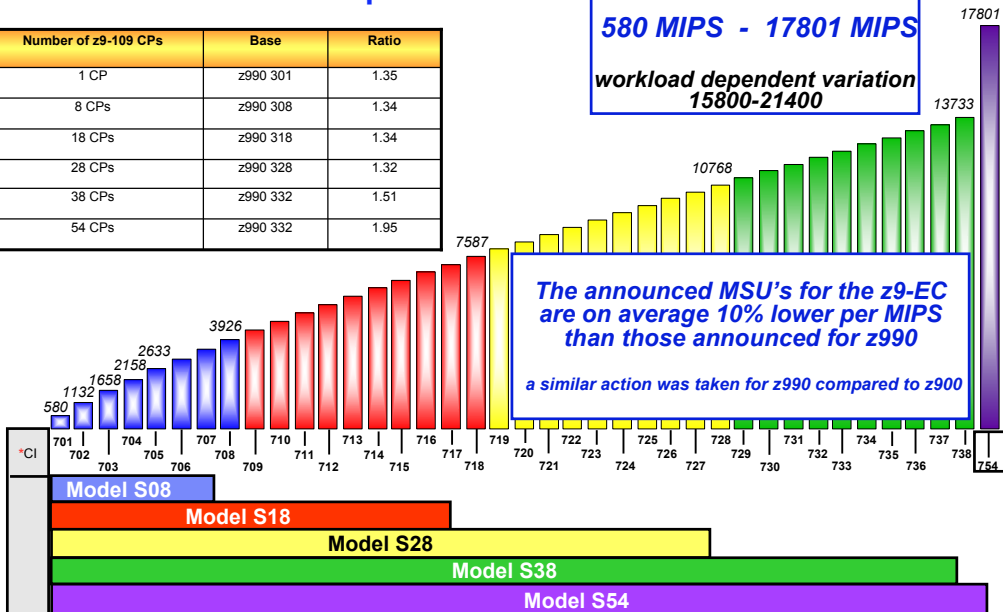
\*\*\* When comparing a z990 Model A08 with a z9 EC Model S08



## z9-EC Performance Comparison

Number of z9-109 CPs	Base	Ratio
1 CP	z990 301	1.35
8 CPs	z990 308	1.34
18 CPs	z990 318	1.34
28 CPs	z990 328	1.32
38 CPs	z990 332	1.51
54 CPs	z990 332	1.95

**580 MIPS - 17801 MIPS**  
workload dependent variation  
15800-21400

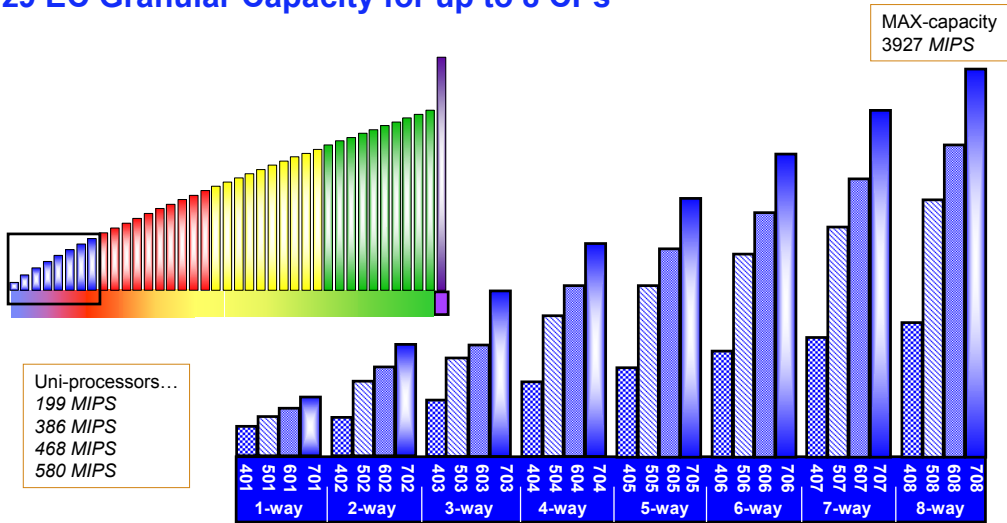


**The announced MSU's for the z9-EC are on average 10% lower per MIPS than those announced for z990**  
a similar action was taken for z990 compared to z900

Note: For MSU values, refer to:  
[www-1.ibm.com/servers/eserver/zseries/library/swpriceinfo/](http://www-1.ibm.com/servers/eserver/zseries/library/swpriceinfo/)  
For ITRs refer to: [www-1.ibm.com/servers/eserver/zseries/lsp/zSeriesZOS.html](http://www-1.ibm.com/servers/eserver/zseries/lsp/zSeriesZOS.html)

- CI = Capacity Indicator and refers to number of installed CPs.
- CI Reported by STSI instruction.
- Model 700 does not have any CPs.

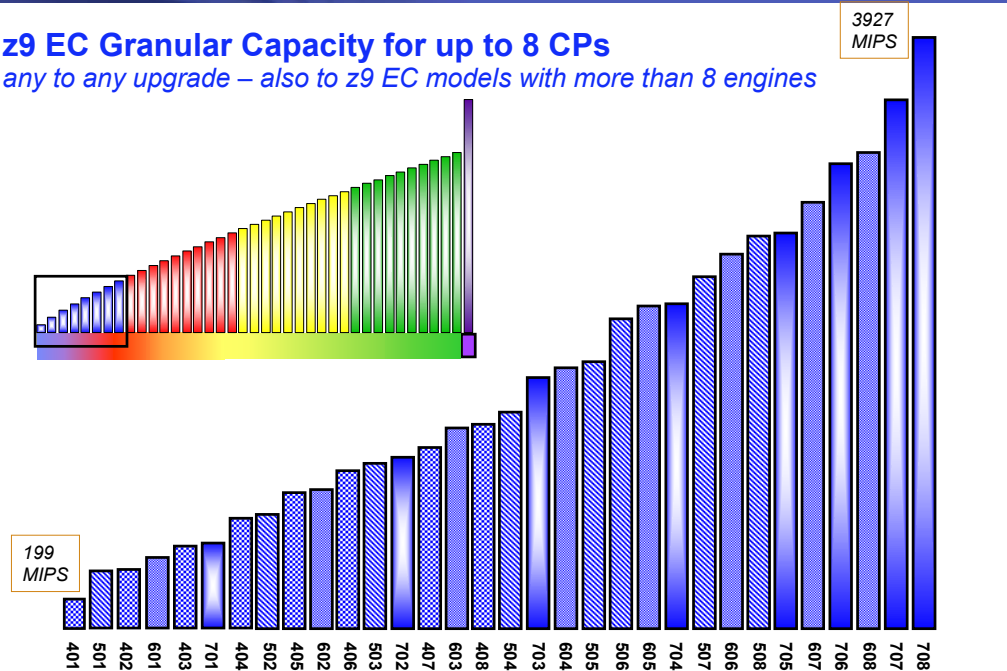
## z9 EC Granular Capacity for up to 8 CPs



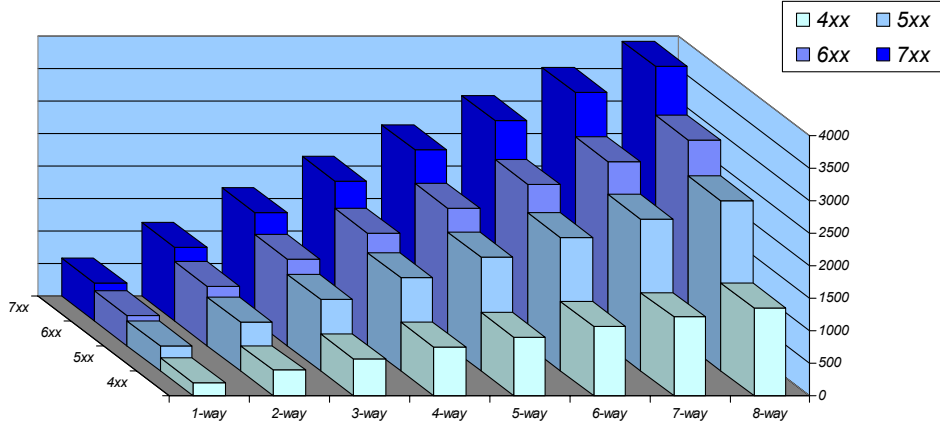
- The z9 EC now has 24 additional capacity settings at the low end of the processor (any-to-any upgrade)
- **Entry point is approximately 34% the capacity of the 701**
- All CPs must be the same capacity within one z9 EC
- **Combined zAAPs and/or zIIPs can not be more than 2x the number of CPs**
- Only 8 CPs can have granular capacity, other PUs must be CBU or characterized as specialty engines

## z9 EC Granular Capacity for up to 8 CPs

any to any upgrade – also to z9 EC models with more than 8 engines

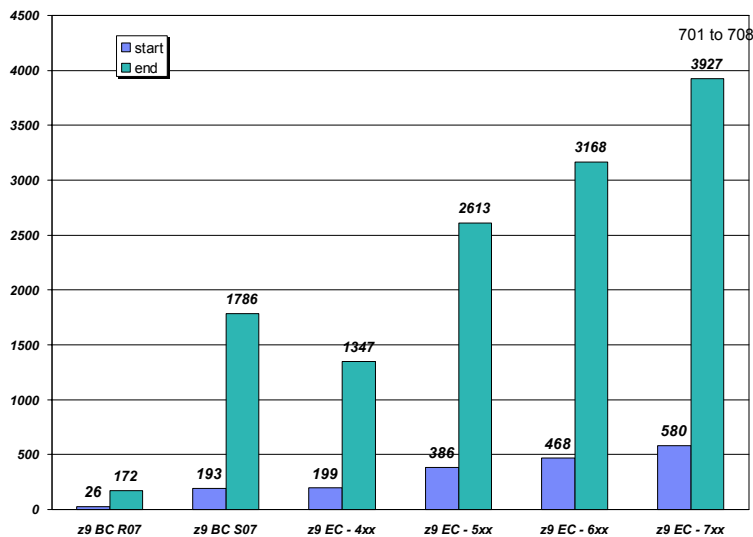


## Processor Granularity z9 EC S08



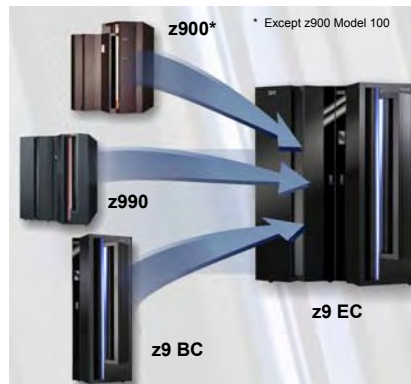
1-way	2-way	3-way	4-way	5-ways	6-ways	7-ways	8-ways	SW Model
199	388	569	740	903	1058	1206	1347	4xx
386	753	1104	1436	1752	2053	2339	2613	5xx
468	913	1338	1741	2124	2489	2836	3168	6xx
580	1131	1659	2158	2633	3086	3515	3927	7xx

## Capacity Overlapping



## Protecting Your Investment in System z Technology *Enhanced flexibility for upgradeability*

- **Full upgrades within the z9 EC**
  - ▶ Including any to any upgradeability in the 32 sub-capacity matrix
- **Any to any upgrade from the IBM eServer zSeries 990 (z990), IBM eServer zSeries 900 (z900) - except Model 100, or IBM System z9 BC Model S07**
- **Capability of the System z9 servers to nondisruptively increase computing resources within the server such as processors, memory and I/O\***
  - ▶ Can enable dynamic and flexible capacity growth for mainframe servers
  - ▶ Temporary capacity upgrade available through On/Off Capacity on Demand of CP processors, IFLs, ICFs, zAAPs or zIIPs
  - ▶ New options for reconfiguring specialty engines if the business demands it
  - ▶ New options for changing On/Off CoD configurations
  - ▶ Sub-capacity CBU engines



\* When properly configured. Also, upgrading to an S54 from other z9 EC models will require a planned outage

## What's new in the LSPR for the z9-BC

- **Business As Usual changes**
  - ▶ uplevel z/OS V1R6, subsystem and compilers
- **Improve customer representativeness of workload mix**
  - ▶ drop CB-S (very short batch) workload
  - ▶ add CB-J (java-based) batch workload
  - ▶ new Mixed workload scales closer to LoIO-mix
- **Improve customer representativeness of LPAR environment**
  - ▶ 95% of z990s are configured with more than one z/OS image
  - ▶ provide two LSPR tables
    - single-image (SI) table
      - one z/OS image equal in size to Nway of model (z/OS V1R6 limit to 32way)
    - multi-image (MI) table
      - average complex LPAR configuration for each model based on customer profile
      - most representative for vast majority of customers
      - basis for single-number metrics

## Average LPAR Configuration Profiles for the Multi-image Table

- Total number of z/OS images
  - ▶ 5 images at low-end models to 9 images at high-end
- Number of major images (>10% weight each)
  - ▶ 2 images across full range of models
- Size of images
  - ▶ low- to mid-range models have at least one image close to Nway of model
  - ▶ high-end models generally have largest image well below Nway of model
    - these models tend to be used for consolidation
- Logical to physical CP ratio
  - ▶ low-end near 5-1
  - ▶ most of the range 2-1
  - ▶ high-end near 1.5-1

## IBM System z9 Capacity on Demand





## System z9 Concurrent Upgrade – CUoD

### standard functions

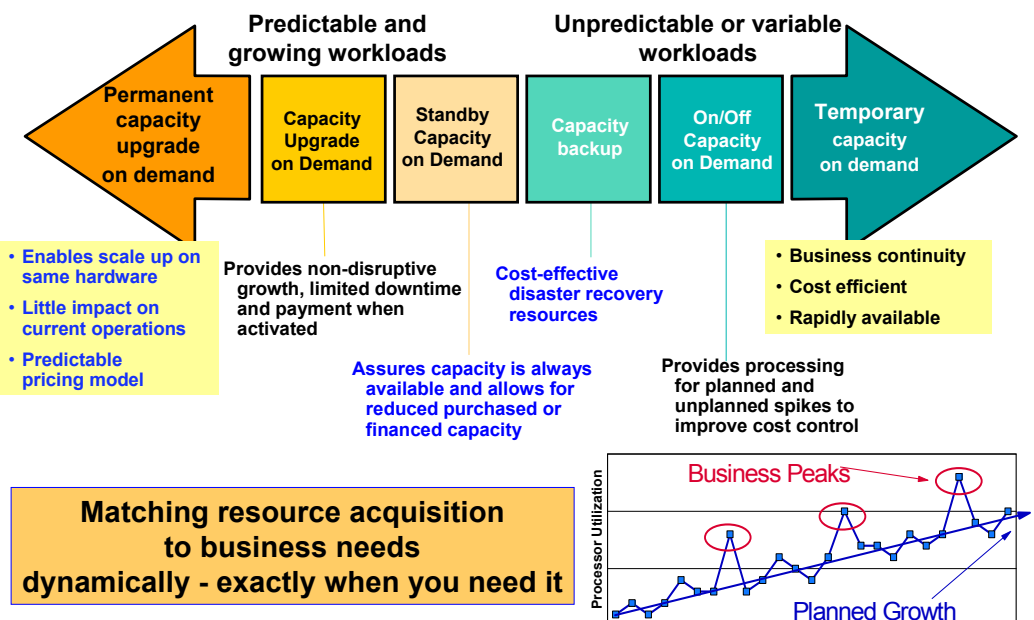
- Non-disruptive addition of CPs ('model capacity' upgrade), ICFs, IFLs, zAAPs, zIIPs
- Some administrative improvements
- LIC enable additional memory increments
- Concurrent model upgrade (capacity setting) to add active PUs, PU capacity and memory
- Downgrades are non-disruptive
- Note: I/O feature adds and removes are also non-disruptive
- **CBU – CP's, zAAPs, IFL's & ICF's**

#### Notes:

1. CUoD is built on a base of concurrent "hot-plug" maintenance
2. I/O feature adds and removes are also non-disruptive
3. Customer planning and operator action are required to take full advantage of CUoD. To avoid a planned outage, it may be necessary to predefine LPAR profiles with "reserved" resource specified. It may also be necessary to use z/OS or z/VM dynamic I/O capabilities. In some cases, disruption of certain LPARs is required following a concurrent hardware change.

## Capacity on Demand

a must in a consolidated and simplified on demand infrastructure



## IBM System z9

### Availability

Concurrent MES upgrade

Redundant I/O Interconnect  
Concurrent Book Upgrade/Replace

Concurrent Oscillator Switch

other items...



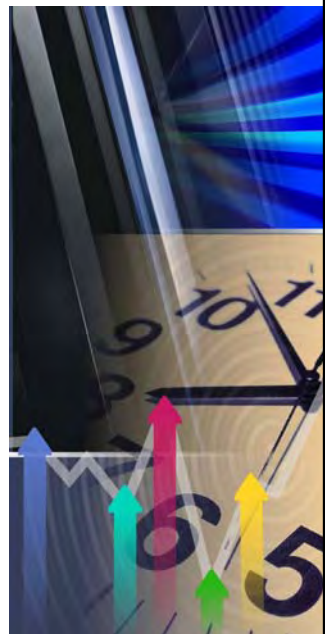
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## z9 – Providing new levels of availability

- **Improving the application of HW driver maintenance:\***
  - ▶ Concurrent microcode level upgrade (at synch points)
  - ▶ reducing planned outages using enhanced driver maintenance
- **New enhanced book availability (EC models only)**
  - ▶ Enhancing recovery of resources
  - ▶ Improving ability to nondisruptively add/repair memory resources
- **Redundant I/O Interconnect (RII)**
  - ▶ Allows for dynamic book replacement without I/O loss (EC models)
  - ▶ Allows for MBA replacement without I/O loss
- **Extending capability for Capacity Backup (CBU) to include specialty engines**
  - ▶ Sub-capacity CBU's are supported
- **Improving memory availability with flexible memory offering (EC models only)**
- **Dynamic Oscillator switchover**

\* Customer pre-planning is required and may require purchasing additional hardware resources

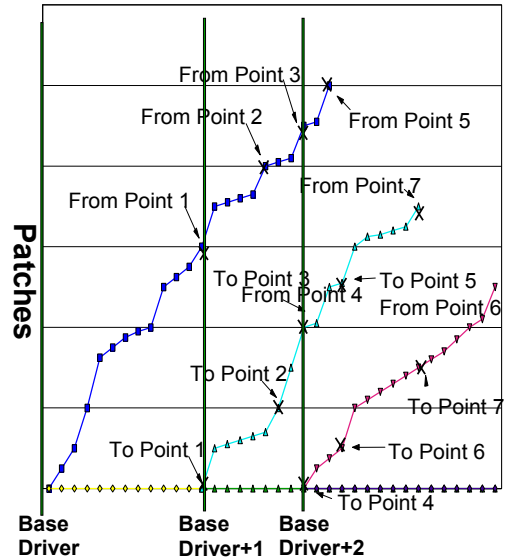


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## Enhanced Driver Maintenance

- The ability to concurrently move from one patch point on major driver N, to a patch point on major driver N+1
- Cannot move any to any, must move from a specific "from" patch bundle to a specific "to" patch bundle
- A Limited number of specific cross-over bundles will be defined for each driver.
- Crossover bundles (target dates) will be communicated (via resource link) in advance for planning.
- Disruptive driver upgrades are permitted at any time
- Concurrent cross-over from driver N to driver N+1, to driver N+2 must be done serially. No composite moves.
- No concurrent back off possible. Must move forward to driver N+1 once CDU is initiated. Catastrophic errors during CDU may dictate a disruptive outage



## IBM System z9 Channel and I/O System Connectivity considerations



## IBM System z9 Channel and I/O System - Connectivity considerations

up to 4 Logical Channel Subsystems  
Multiple Subchannel Sets (63.75K + 64K)  
1024 channels - 336 FICON

FCP Sharing (zVM & zLinux)

MIDAW Architecture  
FICON Express / Express 2 (2Gbps) / Express 4 (4Gbps)

OSA Express 2 - up to 10Gb Ethernet  
Hipersockets

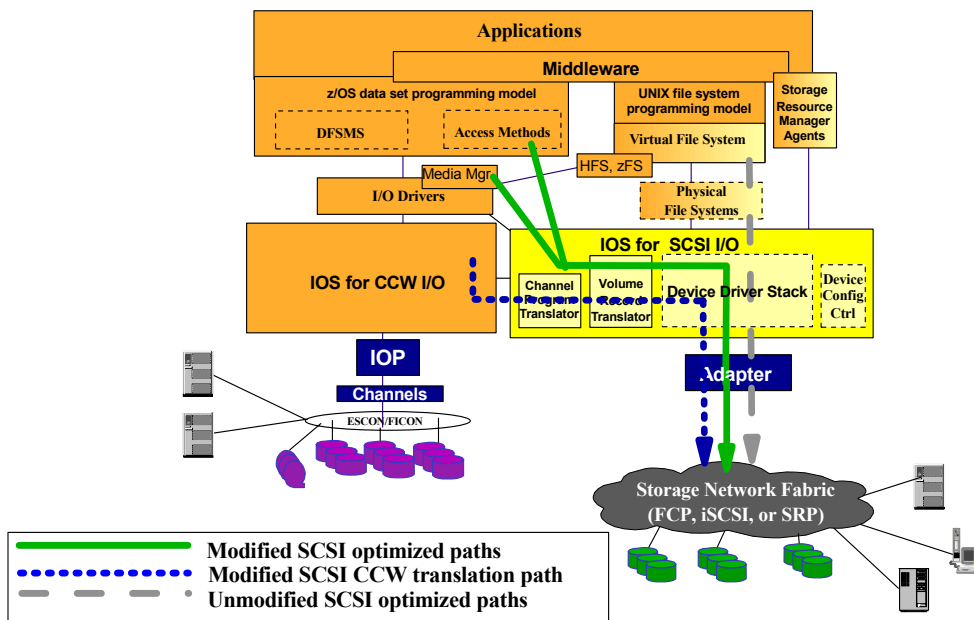
Enhanced CP Assist  
new Crypto Express 2 Adapter with combined SSL Accelerator & Coprocessor

Peer mode Coupling links only – ICB4

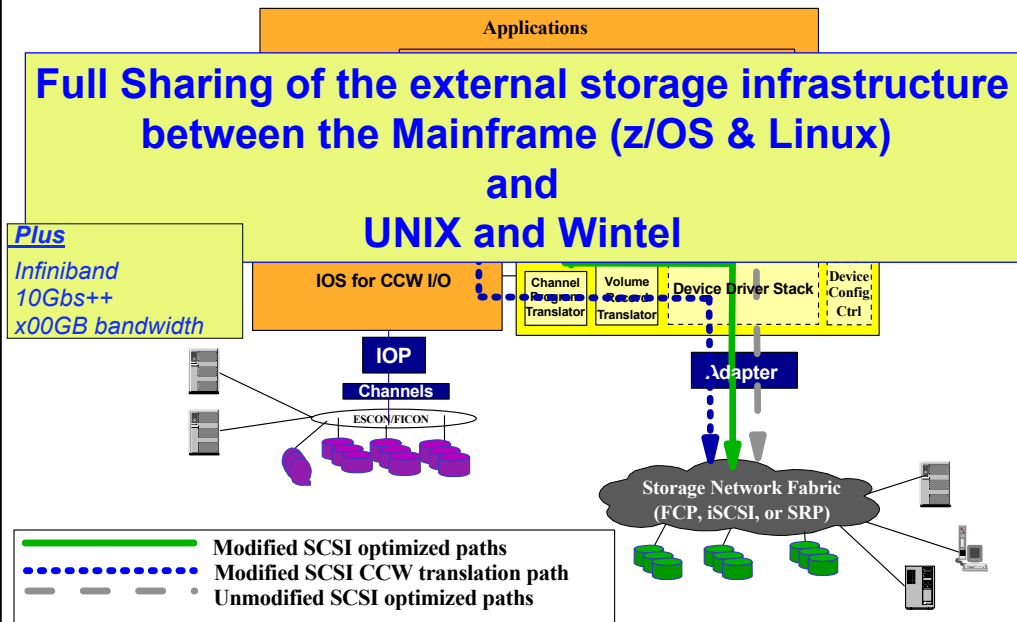
### Future options or possibilities

higher bandwidth and Bus speed - Faster I/O exceeding 10Gbs  
Exploitation of Infiniband - internal and external  
FCP support within z/OS – sharing of I/O with Unix/Wintel

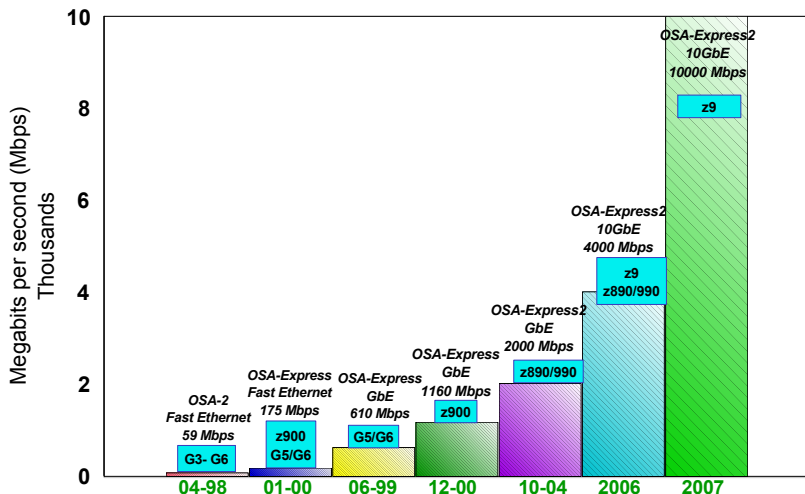
## System z - potential future I/O structure



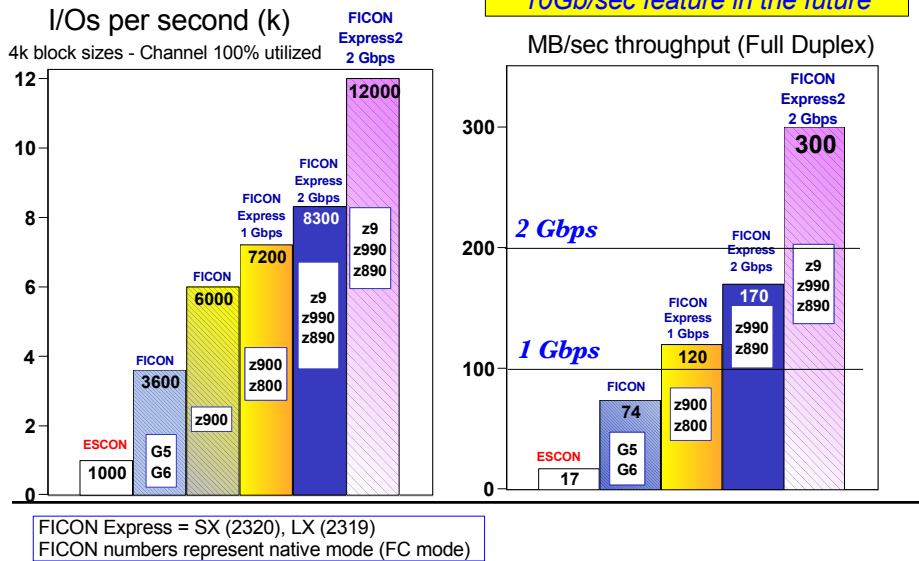
## System z - potential future I/O structure



## System z Network I/O Performance objectives



## FICON Express2 - Potential Performance increase



## Introducing FICON Express4 for System z9

- **Designed to improve capacity and performance with next generation 4 Gbps FICON/FCP**
  - ▶ Up to 25% improvement in FICON channel throughput when processing a mix of read and write data transfers<sup>1</sup>
  - ▶ Up to 65% improvement in FICON channel throughput when processing all read or all write data transfers<sup>1</sup>
  - ▶ 220% cumulative MB/sec throughput improvement in DB2 table scan tests for extended format data sets with FICON Express4 on z9 EC with the MIDAW facility compared to FICON Express2 with the IDAW facility on z9-109<sup>2</sup>.
    - 46% without the MIDAW facility on z9EC
- **Benefits**
  - ▶ Helps to support reduced cost of storage operations and shorter backup windows with faster channel link data rates
  - ▶ Enables migration to higher performance with 1/2/4 Gbps auto-negotiating links
- **FCP channel performance improvements for z/VM and Linux environments<sup>1</sup>**
  - ▶ Up to 50% in FCP channel throughput when processing a mix of read & write large data transfers
  - ▶ Up to 100% in FCP channel throughput when processing all read or all write large data transfers
- **2-port/4-port cards for z9 BC and 4-port for z9 EC**

1. Large sequential data transfers on z9 EC with FICON Express4 operating at 4 Gbps (running z/OS V1.7) when compared to FICON Express2 on z9-109 (running z/OS V1.6)  
2. Results of internal DB2 table scan tests with the z9 EC, the MIDAW facility, FICON Express4 operating at 4 Gbps (running z/OS V1.7), and the DS8000 compared to z9-109, and FICON Express2 operating at 2 Gbps (running z/OS V1.6)

**Next generation 4 Gbps FICON/FCP ... helping to improve capacity and performance**

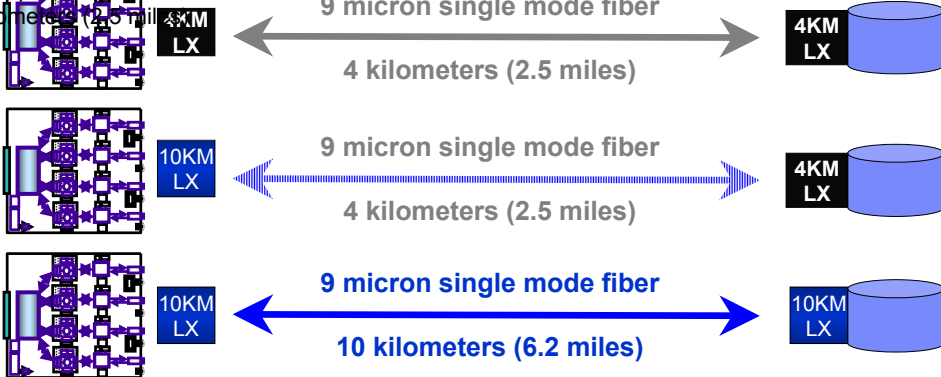
## System z9 FICON Express4 Unrepeated Distances

### IBM System z9 4Gb FICON/FCP connectivity:

The ANSI Fibre Channel Physical Interface (FC-PI-2) standard 10 kilometer (km) and 4 kilometer transceivers when using 9 micron single mode fiber optic cabling

IBM supports FC-PI-2 variants

IBM supports interoperability of 10 km transceivers with 4 km transceivers provided the unrepeated distance between a 10 km transceiver and a 4 km transceiver does not exceed 4 kilometers (2.5 miles)



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## IBM Storage Ready for System z9 and FICON Express4

### IBM System z9 and IBM storage 4 Gb FICON/FCP connectivity may help to:

- Support faster link speeds and shorter backup windows
- Enable channel and link consolidation to help simplify management and reduce the cost of the storage infrastructure
- Support easier migration to 4 Gbps bandwidth with auto-sensing links



*IBM has a full range of  
Disk, SAN, Tape, Software,  
& Services for System z9*

<b>Disk</b>	DS8000 – 4 Gbps FICON/FCP Planned 2Q06 DS6000 – 2 Gbps FICON/FCP
<b>SAN</b>	IBM SAN256B and SAN32B-2 FICON/FCP IBM SAN256M (Planned for 2006) and SAN32M, and SAN140M 4 Gbps FICON/FCP Cisco MDS 9500 and 9216 4Gbps FICON/FCP Planned 2006
<b>Virtualization</b>	IBM SVC 4 Gb FCP for Linux on System z Planned 2Q06 VTS 2 Gbps FICON/FCP TS7510 Virtualization Engine™ – 2 Gbps FCP for Linux on System z Planned 2Q06
<b>Tape</b>	IBM TS1120 4 Gbps FCP Tape Drive IBM TS1120 Tape Controller 4 Gbps FICON Planned 2Q06 IBM LTO Gen 3 – 4 Gbps FCP for Linux on System z Planned 2006 IBM 3494 and 3584 Tape Libraries IBM TS3310 Tape Library – 4 Gbps FCP for Linux on System z Planned 2Q06

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## System z9 MIDAW

*Designed to enhance performance for FICON Express 2 and 4*

- **Can improve FICON performance for**
  - Extended Format (EF) data sets – including DB2 and VSAM
- **Can improve channel utilization and can significantly improve I/O response times**
  - Internal IBM DB2 Table Scan tests(\*) with the z9 EC, FICON Express2 and the IBM TotalStorage® DS8000 control unit comparing MIDAW facility configurations to pre-MIDAW configurations showed:
    - 36% to 58% reduction in response times
    - 35% to 56% reduction in channel busy
    - 56% to 126% improvement in I/O throughput
- **Supported on z/OS 1.6 and above and corresponding supporting devices**

## System z9 Multiple Subchannel Sets

- **Description**
  - ▶ Only one set of 63K subchannels are available with z990, z890, z900, z800
  - ▶ For System z9, two subchannel sets are now available per LCSS, enabling a total of 63.75K subchannels in set-0 and adding 64K-1 subchannels in set-1
  - ▶ Multiple subchannel sets provides growth for I/O device configuration
- **Operating System Requirements**
  - ▶ z/OS 1.7 and later
  - ▶ z/OS will only allow Parallel Access Volume Alias (PAV-alias) devices in the second subchannel set.
  - ▶ Subchannels for any other devices not allowed in subchannel Set-1



## IBM System z9 109 Parallel Sysplex

### Additional Information:

Parallel Sysplex Web Site:  
[www.ibm.com/servers/eserver/zseries/psa](http://www.ibm.com/servers/eserver/zseries/psa)

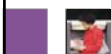


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A THROUGH Z.**

## Coupling Facility Control Code (CFCC) for System z9

- **Structure size (and CF storage) increase when moving from**
  - ▶ CF Level 11 to CF Level 14 (or 12/13)
  - ▶ CF Level 12 or CF Level 13 to CF Level 14
  
- **CFCC level 14 does not change on a System z9**
  
- **Recommendations have not changed for System z9 for CP designations**
  - ▶ Still Workload volume dependent
  - ▶ Recommendation still to use dedicated CPs for production CF/ICFs

## IBM System z9 Security & Cryptography



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### System z9 EC Security Summary

- **z9 EC PR/SM – Common Criteria EAL5 Certification, March 2006**

- **Crypto Express2 feature**

- ▶ Support high levels of security for demanding applications – fully programmable
- ▶ Designed to meet FIPS 140-2 level 4 certification
- ▶ Offers high-scale performance for SSL transactions
- ▶ Integration using ICSF

- **Trusted Key Entry optional smart card reader**

- ▶ Smart Cards – Certified to meet FIPS 140-2 Level 2

- **Common Criteria (ISO/IEC 15408) Evaluation Assurance Levels Reference: <http://niap.nist.gov/cc-scheme/>**

- ▶ z/OS V1.7 – Controlled Access Protection Profile (CAPP) EAL4+ and Labeled Security Protection Profile (LSPP) EAL4+, February 2006
- ▶ z/VM V5.1 with RACF® for z/VM – Controlled Access Protection Profile (CAPP) EAL3+ and the Labeled Security Protection Profile (LSPP) EAL3+, October 2005
- ▶ Novell SUSE SLES 9 and Red Hat RHEL 4 – Controlled Access Protection Profile (CAPP) EAL4+



**EAL5: Evaluation Level 5**  
**CAPP: Controlled Access Protection Profile (CAPP)**  
**LSPPS: Labeled Security Protection Profile (LSPP)**

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## System z Cryptographic Technology

- Continue to provide flexible Secure Sockets Layer (SSL) acceleration
- Continue to provide competitive symmetric performance in a security-rich environment
- Provides integration of Crypto features via ICSF
- Focus on required certifications and open standards
- Continue to improve performance
  - ▶ Each Crypto Express2 feature on a System z9, with both adapters configured as accelerators, is designed to provide up to 6000\* SSL handshakes per second

**z900/z800** – Dec. 2000/ May 2002  
2 Chips on CEC Board - CMOS7s+ PCICC/PCICA (10/01)

**G6** – June 1999  
2 Chips on Processor MCM - CMOS5x + PCICC (6/99)



**G5** – Sept. 1998  
2 Chips on Processor MCM - CMOS5x + PCICC (6/99)



**G4** – Sept. 1997  
SCMs on Planar Board - CMOS5x



**G3** – June, 1997  
SCMs on Planar Board - CMOS5x



**z9 BC** – May, 2006  
Crypto Express2

**z9 EC** – September, 2005  
Crypto Express2

**z990/z890** – January 2005  
Crypto Express2

**z890** – May 2004  
PCIXCC/PCICA

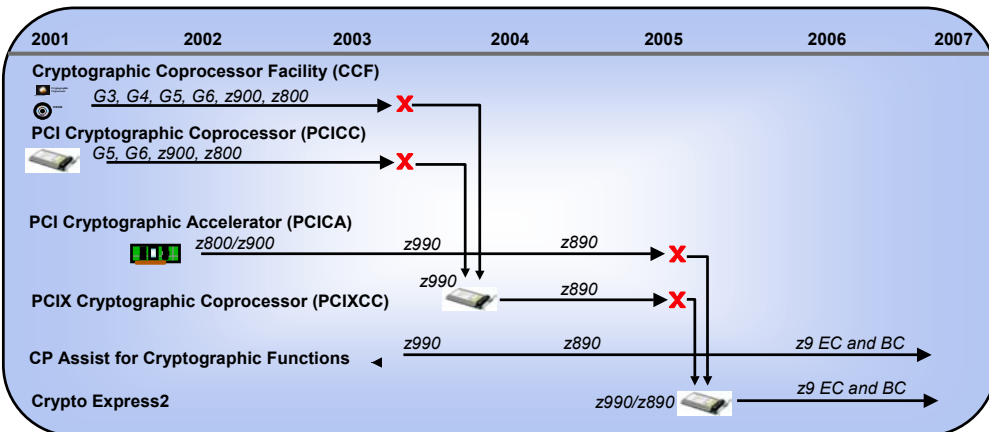
**z990** – September 2003  
PCIXCC

**z990** – June 2003  
CPACF/PCICA

**z900/z800** – Dec. 2000/ May 2002  
2 Chips on CEC Board - CMOS7s+ PCICC/PCICA (10/01)

\*These measurements are examples of the maximum handshakes per second achieved in a laboratory environment with no other processing occurring and do not represent actual field measurements. Details are available upon request.

## System z9 and zSeries Crypto Roadmap



- Cryptographic Coprocessor Facility – Supports “Secure key” cryptographic processing
- PCICC Feature – Supports “Secure key” cryptographic processing
- PCICA Feature – Supports “Clear key” SSL acceleration
- PCIXCC Feature – Supports “Secure key” cryptographic processing
- CP Assist for Cryptographic Function allows “Clear key” crypto functions from any CP/IFL
- Crypto Express2 – Combines function and performance of PCICA and PCICC

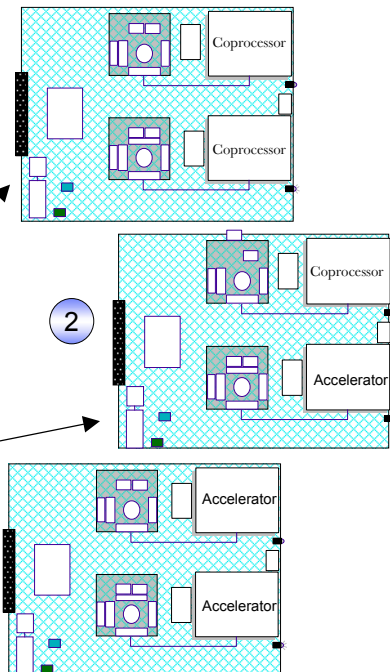
## z9 BC/EC – Enhancing security

- **Integrated cryptography features offer more security options on z9 EC**
  - ▶ Advanced Encryption Standard (AES) support in z9 EC hardware
  - ▶ Stronger hash algorithm with SHA-256
  - ▶ Pseudo Random Number Generator
  - ▶ ATM/POS remote key loading support
- **Crypto Express2 improved flexibility and speed**
  - ▶ Configurability options, two coprocessors, two accelerators or one of each
  - ▶ With both adapters configured as accelerators each Crypto Express2 card is designed to provide up to 6000 SSL handshakes per second \*
- **Secure encryption facility for z/OS to help protect data shared with partners, suppliers, and customers**
  - ▶ Designed to leverage z/OS key management and high performance hardware encryption
- **Can help to achieve higher levels of certifications and compliance**
- **Virtualized cryptographic capabilities for card sharing by Linux virtual servers**
- **Complementary IBM technology and vendors' advanced security solutions**
  - ▶ Can enable a cross-platform model that can extend RACF® capabilities to the enterprise
  - ▶ Expansion of ISV community ensures application availability



## System z9 Cryptographic Support Summary

- **CP Assist for Cryptographic Function (CPACF) 1**
  - ▶ Standard on every CP and IFL
  - ▶ Supports DES, TDES and SHA-1
  - ▶ New to z9 EC
    - Advanced Encryption Standard (AES)
    - Secure Hash Algorithm – 256 (SHA-256)
    - Pseudo Random Number Generation (PRNG)
- **Crypto Express2**
  - ▶ Two configuration modes
    - Coprocessor (default)
      - Designed for Federal Information Processing Standard (FIPS) 140-2 Level 4 certification
    - Accelerator (configured from the HMC)
  - ▶ Three configuration options
    - Default set to Coprocessor
- **TKE workstation with 5.0 level of LIC**
  - ▶ Supports configurable Crypto Express2 feature
  - ▶ New Graphical User Interface (GUI)
  - ▶ Smart Card Reader



## Secure Enterprise Data - Solutions for a Heterogeneous Environment

Helping to reduce risk end-to-end across your value chain



**zSeries is becoming the HUB for enterprise security**

Leverage zSeries Encryption Facilities – Integrated/Crypto Express2  
Leverage z/OS key management capabilities across the enterprise



**Protect Data Leaving Your Enterprise**

**Protect Archived Data**

*Businesses are proactively focusing on securing customer and business data*

- Increasing regulatory requirements driving need for security of data for audit compliance
- Recent events highlight impacts caused by loss/theft of removable data
- Requirements for tighter security driving need for encryption of data

**Enterprise-wide Key Management**



**Protect Enterprise-wide Data**

**IBM future directions\***

- Encryption for IBM TotalStorage
- Continued enhancements of mainframe key mgmt services

- Encryption with key management for removable media
- Provide highly secure data transfer with partners, suppliers, and customers
- Enable high volume encryption of data for remote site archival
- Can create trusted exchange with heterogeneous systems with support for open standards for IP encryption

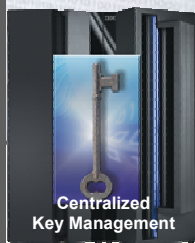
## Tape Encryption with Key Management on System z

**Why z/OS centralized key management?**

- Can help to protect and manage keys
  - Highly secure and available key data store
  - Long term key management
  - Disaster recovery capabilities
- Single point of control
- Over a decade of production use

*Encryption Facility for z/OS, V1.1*

*Data Encryption in the Server*



**Protected Encryption Keys**

**Data Encryption in TS1120\***



*Plans for encryption in IBM System Storage™ (\*)*



**Enterprise scope**

- Flexible options for business partner exchange
- Partners can encrypt and decrypt using no-charge Java client
- Supports public key or password based exchange
- Plans to support OpenPGP standard\*

- Highly secure tape library
- High performance archive encryption
- Transparent to existing processes and applications
- Can help provide audit compliance

## Server Time Protocol

*Time Synchronization – The Next Generation*



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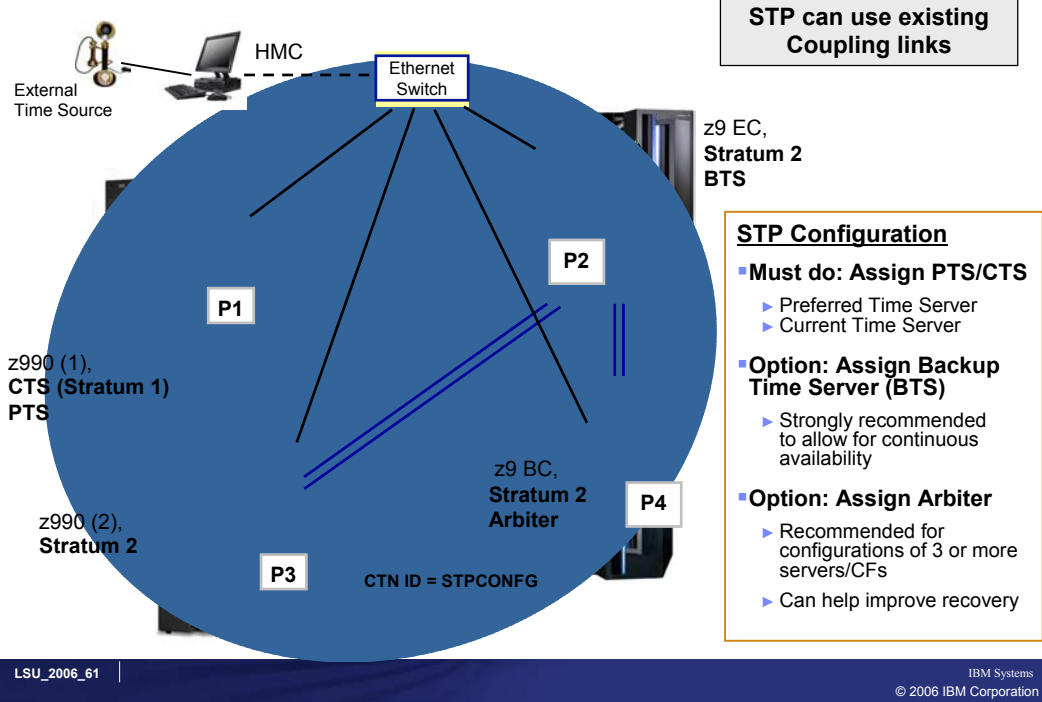
## What is Server Time Protocol ?

- **Designed to provide the capability for multiple servers to maintain time synchronization with each other and form a Coordinated Timing Network (CTN)**
  - ▶ CTN: a collection of servers that are time synchronized to a time value called Coordinated Server Time (CST)
- **IBM Server-wide facility implemented in IBM System z9™, IBM eServer™ zSeries® 990 (z990), zSeries 890 (z890) Licensed Internal Code (LIC)**
  - ▶ FC1021 on each server and/or Coupling Facility
  - ▶ Single view of "time" to PR/SM™
  - ▶ PR/SM can virtualize this view of time to the individual logical partitions (LPARs)
  - ▶ STP is not available on z900, z800 or 9672 Gx servers
- **Message based time synchronization protocol**
  - ▶ Similar to Network Time Protocol (NTP) – an industry standard
  - ▶ Timekeeping info transmitted over Coupling Links (*ISC-3 links in Peer mode, ICB-3 and ICB-4*)
  - ▶ **NOT** standard NTP (*see SOD*)
- **Designed to support a multi-site Sysplex of up to 100 km (62 miles) with repeaters**
- **Allows use of dial-out time services to set time to international time standard (UTC) to within +/- 100 ms as well as adjust to UTC on a periodic basis**

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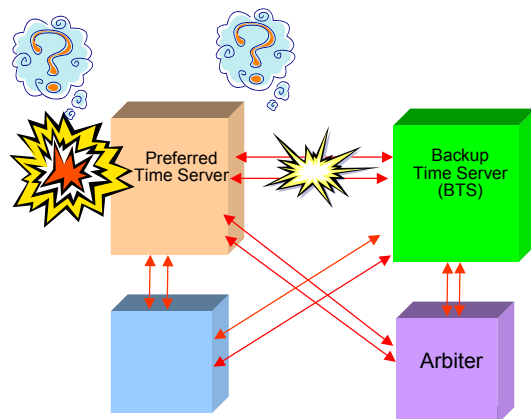
## Example of STP-only CTN



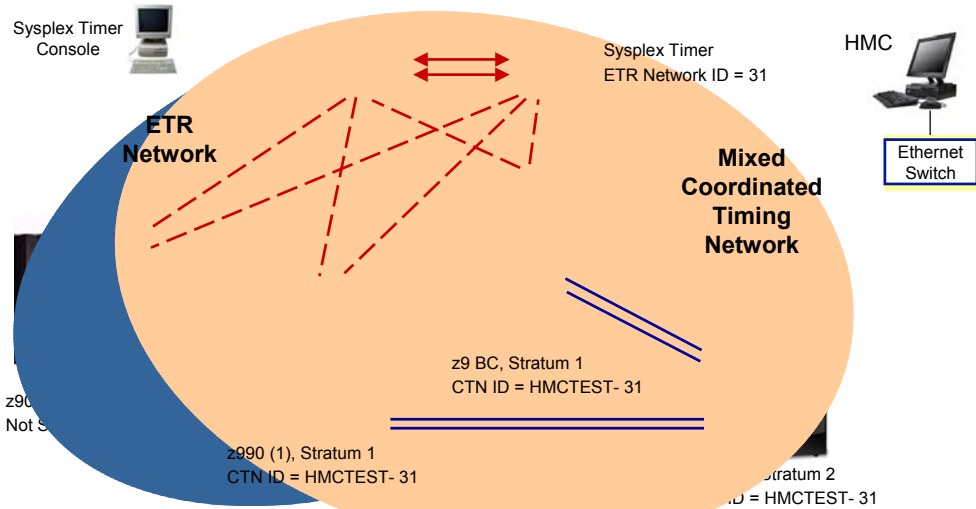
## Example of Backup Time Server / Arbiter

**If the Backup Time Server loses communication with PTS on all established paths, what does it do ?**

- It asks the Arbiter for its status
- If Arbiter still getting signals (just links are lost), BTS becomes Stratum 3 (get signals from a level 2 Stratum)
- If Arbiter also lost communication, (assume PTS failed), BTS takes over as CTS (Stratum 1)

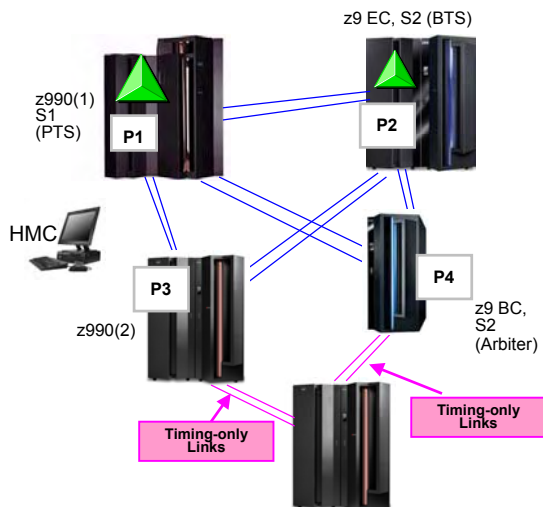


# Mixed Coordinated Timing Network



- z9 BC, z990(1), z900 synchronized to Sysplex Timer
- z9 BC, z990(1) are Stratum 1 servers
  - ▶ Two Stratum 1 servers recommended to help avoid single point of failure
- z990(2) synchronized to either z9 BC or z990(1) via STP is a Stratum 2 server
  - ▶ z990(2) does not need ETR link connections
  - ▶ z990(2) can be located up to 100 km away from z9 BC, 990(1)

# Timing-only Links – what is it...?



- Coupling links that allow 2 servers to be synchronized when a CF does not exist at either end of link
- These timing-only links are used to transmit STP messages only
- Typically required when synchronization needed in a Non-Parallel Sysplex configuration *(for example XRC)*
- HCD enhanced to define Timing-only links
- Can be defined in either Mixed CTN or STP-only CTN



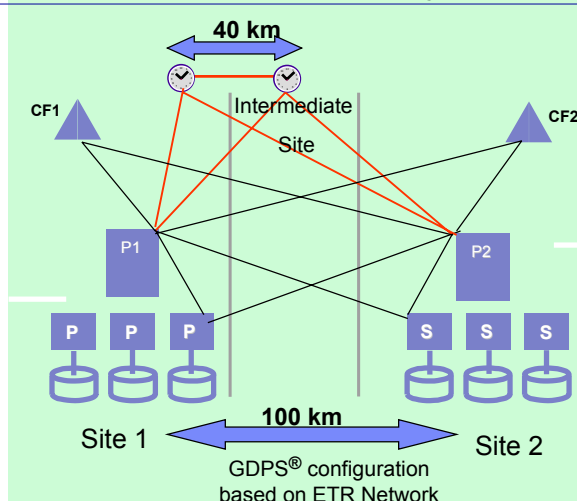
## STP – key attributes

- Allows Parallel Sysplex distances to extend beyond the current 40 km limit
  - ▶ Limits set by coupling protocol and links
- Can help meet more stringent (precise) time synchronization requirements
- Expected to Scale with technology as processors and messaging technology improve
- Does not require dedicated Timer links
  - ▶ Uses same hardware and protocols as data
  - ▶ Reduced requirements to infrastructure
- Allows concurrent migration from an ETR network with proper planning
- Allows coexistence with ETR network
- Allows time to be set to a dialup service to within 100 ms of UTC

## STP Enhancements over ETR Network

**STP design can allow longer distances with less complex and less costly infrastructure**

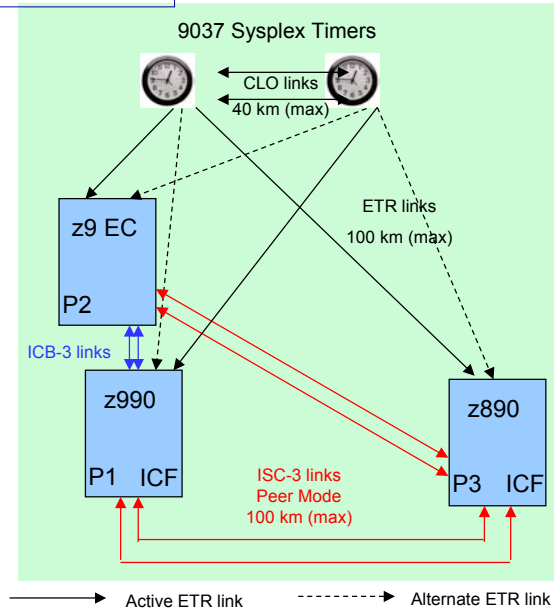
- STP supports a multi-site timing network of up to 100 km without requiring an intermediate site
- Fiber distance between Sysplex Timers cannot exceed 40 km
- Intermediate site to locate second timer recommended to avoid a single point of failure, if data centers more than 40 km apart



## STP Enhancements over ETR Network (cont) ...

### STP design can allow more stringent synchronization

- Time of Day (TOD) clocks of servers must be synchronized within the fastest messaging time between servers
- In this diagram, between IBM System z9 Enterprise Class (z9 EC) and z990 (shortest messaging time in example) compared to between z990 and z890 (longer messaging time in example)
- “Best case” messaging times over ICB links in Parallel Sysplex (8 us approximately) approaching “Worst case” TOD synchronization between CECs stepping to 9037s 40 km apart (4 us approx)



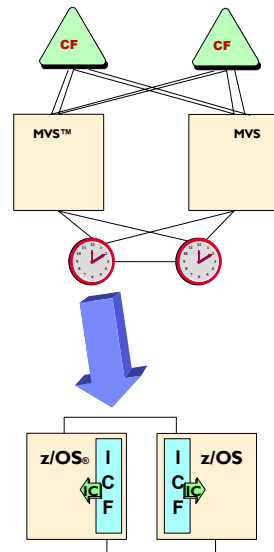
## STP - key attributes (cont) ...

### Allows

- Use of dial-out time services to initialize Coordinated Server Time (CST) to within +/- 100 ms of international time standard (UTC)**
  - ▶ NIST Automated Computer Time Service (ACTS)
  - ▶ NRC Canadian Time Service (CTS)
  - ▶ IEN Telephone Date Code (CTD)
- Scheduling of periodic dial-outs to time services so that CST can be gradually steered to an international time standard (UTC)**
- Setting of local time parameters,
  - ▶ Time zone offset
  - ▶ Daylight Saving Time (DST) offset
  - ▶ Leap Seconds offset
- Automatic updates of DST offset based on time zone algorithm**
- Adjustment of CST up to +/- 60 seconds**

## Other potential STP values

- **Helps Eliminate**
  - ▶ Infrastructure requirements (space, power, etc.) to support Sysplex Timers
  - ▶ Sysplex Timer maintenance costs.
  - ▶ Dark fiber between sites for ETR and CLO links
- **Helps Reduce**
  - ▶ Fiber optic infrastructure requirements for DWDM ports, patch/trunk cables
- **Helps improve System Management**
  - ▶ Allows automatic adjustment of Daylight Saving Time offset based on time zone algorithm
    - With ETR network, you need to schedule DST offsets at least twice a year manually at the Sysplex Timer console
  - ▶ Allows gradual time adjustment of up to +/- 60 seconds
    - Sysplex Timer allows time adjustments of up to +/- 4.999 seconds



## Statements of Direction

- IBM intends to enhance the accuracy of initializing and maintaining Coordinated Server Time to an international time standard such as Coordinated Universal Time (UTC). The then current server is planned to have the capability of attaching to an external time source, such as a Global Positioning System (GPS) receiver.
- Network Time Protocol (NTP) client support: IBM intends to enhance the STP design to provide Network Time Protocol (NTP) client capability, so that Coordinated Server Time may be initialized and maintained to time provided by an NTP server. The purpose of this function is to allow the same time across an enterprise comprised of heterogeneous platforms.



\* All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice. Any reliance on these Statements of General Direction is at the relying party's sole risk and will not create liability or obligation for IBM.

## Publications

- **Redbook™**
  - ▶ Server Time Protocol Planning Guide, SG24-7280 (available now)
  - ▶ Server Time Protocol Implementation Guide, SG24-7281 (available at GA)
  - ▶ S/390 Time Management and IBM 9037 Sysplex Timer, SG24-2070
- **Resource Link**
  - ▶ Introduction to STP Education Module (available at GA)
  - ▶ SAPR Guide, SA06-012 – Confirmation Form required prior to shipment of FC1021
- **STP WEB site** ([www.ibm.com/systems/z/ps0/stp.html](http://www.ibm.com/systems/z/ps0/stp.html))
  
- **Server Installation Planning**
  - ▶ System z9 EC Installation Manual for Physical Planning, GC28-6844
  - ▶ System z9 BC Installation Manual for Physical Planning, GC28-6855
  - ▶ zSeries 990 Installation Manual for Physical Planning, GC28-6824
  - ▶ zSeries 890 Installation Manual for Physical Planning, GC28-6828
- **Hardware Management Console User's Guide**
- **Support Element User's Guide**
- **Server Installation Manual**
- **System Overview manuals**
- **PR/SM Planning Guide**
- **Server Service Guide**
- **Online Help**

## Hardware & Software Planning

- **Servers and Coupling Facilities**
  - ▶ EC Drivers and STP Feature Code
- **Hardware Management Console**
- **Coupling Links and Timing-only Links**
- **Multi-Site**
  - ▶ Dense Wave Division Multiplexer (DWDM)
- **Operating Systems**
  - ▶ OS levels
  - ▶ Preventative Service Planning (PSP)
  - ▶ IPLs
  - ▶ CLOCKxx

## Prerequisites

- **Hardware - System z9, z990 or z890 server**
  - ▶ Concurrent MCLs on Driver 55 (z990, z890) to install STP Licensed Internal Code (LIC)
  - ▶ Concurrent MCL to enable STP
  - ▶ System z9 HMC
    - New HMC
    - Upgrade of existing HMC
- **Software - z/OS 1.7 or higher**
  - ▶ STP code in z/OS 1.7 (default=disabled)
  - ▶ PTFs for STP support
  - ▶ PTF to enable STP
  - ▶ IPL required
- **Toleration PTFs for z/OS 1.4, 1.5, 1.6 in Mixed Timing Network**
  - ▶ Mixed CTN Configurations
  - ▶ Ensures server has Message Time Ordering Facility (MTOF)
  - ▶ Various prerequisite APARs
  - ▶ IPL Required

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

## IBM System z9 Software



## z/OS Support for System z9

### Improved FICON performance

#### Modified Indirect Data Address Word (MIDAW) (z/OS 1.6)

- ▶ New system architecture designed to improve FICON performance for extended format data sets **including:**
  - DB2 queries, utilities and logs
  - VSAM, HFS, zFS, PDSE, IMS Fast Path, SAM-E

### Relief for 64K device limit

#### Multiple Subchannel Sets (z/OS 1.7)

- ▶ Almost two-fold increase in the number of logical volumes for typical z/OS images
- ▶ Each z/OS image can use a second set of subchannels for defining Parallel Access Volumes (PAV) aliases
- ▶ Provide an additional 64K subchannels

### Support for more real memory (z/OS 1.8)

- ▶ z/OS 1.8 limit will be 4 TB (was 128 GB)
- ▶ Up to 512 GB supported on System z9
- ▶ Up to 256 GB supported on IBM z990

### Exploitation of hardware:

#### z/OS 1.6

Up to 32 engines<sup>1</sup> in single image  
 Up to 60 logical partitions  
 Up to 63.75K subchannels  
 Modified Indirect Data Address Word (MIDAWs)  
 HiperSockets support of IPv6  
 OSA large send for IPv4 traffic<sup>2</sup>  
 zAAP<sup>2</sup>, zIIP  
 CPACF enhancements  
 Crypto Express2

#### z/OS 1.7

Multiple subchannel sets  
 z/OS 1.7 is planned to support Server Timer Protocol\*  
 FICON link incident reporting  
 Wild branch diagnosis

#### z/OS 1.8

More real memory  
 WLM enhancements for zAAP  
 Coupling Facility performance enhancements

<sup>1</sup> Also available on z990

<sup>2</sup> Also available on z990 and z890

## Extending Scale and Flexibility

### IMAGES

Up to 60 LPARS on a single server (z/OS 1.7 and IBM System z9™ Enterprise Class (z9 EC), up to 30 LPARS with z/OS 1.7 and System z9 Business Class (z9 BC)

Up to 32 processors per logical partition (z/OS 1.6 with System z9 and IBM eServer™ zSeries® 990 [z990])

Up to 32 z/OS logical partitions can be configured in a single-image Parallel Sysplex® cluster, with shared data (up to 1,024 engines total)

Support for up to 4 TB of real memory on a single z/OS image (z/OS 1.8). (Up to 512 GB on System z9, up to 256 GB on z990)

### I/O CONFIGURATIONS

**MIDAW** - Designed to improve FICON performance (z/OS 1.6, 1.7)

Support for 63K subchannels (z/OS 1.4)

63.75K subchannels (in sub-channel set =0) (z/OS 1.7 and System z9)

Support for multiple subchannel sets – 127.75K subchannels (z/OS 1.7 and System z9)

Support for more than 32K device groups (z/OS 1.8)

Parallel VARY OFFLINE (z/OS 1.7) and VARY ONLINE (z/OS 1.8) processing – vary up to 32 devices in parallel

IBM TotalStorage DS6000 & DS8000 enhancements

### FILES

Support for larger sequential and EXCP data sets (>64K tracks)

Larger JES spool, and DFSMSHsm™ and DFSMSrmm™ journal data sets (z/OS 1.7)

More than 255 extents per VSAM component (z/OS 1.7)

Support for more GRS concurrent ENQs - new maximum is 2,147,483,647 (z/OS 1.8)

Language Environment (C/C++) support for sequential data sets larger than 64K tracks and for VSAM extended addressability data sets (z/OS 1.8)

z/OS UNIX limit on file descriptors per process increased from 128K to 512K

## z/OS Support Summary



		G5/G6 Multiprise® 3000	z900 z800	z990 z890	z9 EC z9 BC	DS8000 DS6000	End of Service	Coexists with z/OS	Planned Ship Date
z/OS	1.2	x	x	x <sup>c</sup>			10/05	1.5	
	1.3	x	x	x <sup>c</sup>			3/05	1.6	
	1.4	x	x	x <sup>1</sup>	x <sup>1</sup>	x	3/07	1.7	
	1.5	x	x	x	x	x	3/07	1.8	
	1.6		x	x	x	x	9/07	1.8*	
	1.7		x	x	x	x	9/08*	1.9*	
	1.8		x	x	x	x	9/09*	1.10*	9/06
	1.9*		x	x	x	x	9/10*	1.11*	9/07*

- z/OS.e supported on z800, z890, and z9 BC only
- z/OS 1.5, z/OS 1.6, and z/OS 1.7 are planned to coexist with z/OS 1.8
- z/OS 1.7 is planned to coexist with z/OS 1.8 and 1.9
- x<sup>c</sup> - Compatibility support only
- x<sup>1</sup> - z990 compatibility or exploitation feature required (orderable until December 2006)
- There is no IBM Bimodal Accommodation Offering available for z/OS 1.5 or higher releases.

## z9 EC and z9 BC operating system software

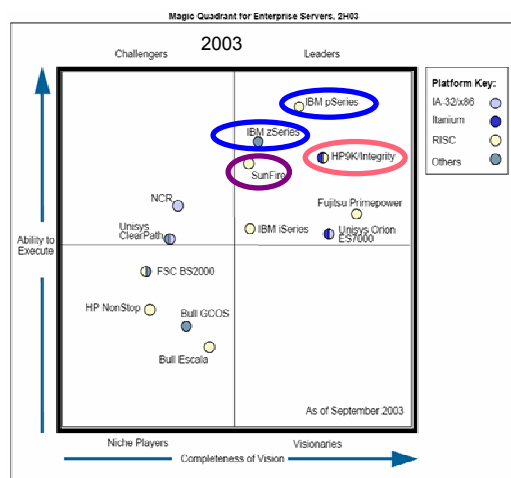
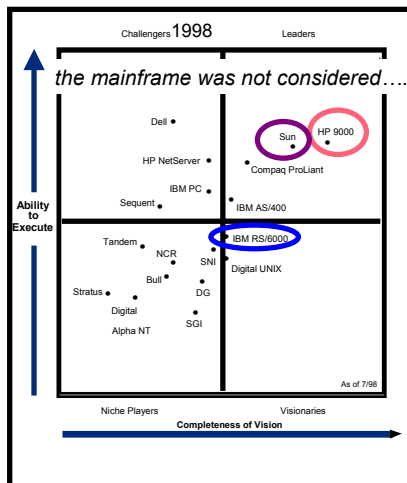
Operating System	ESA/390 (31-bit)	z/Arch (64-bit)
z/OS Version 1 Release 4*, 5*, 6, 7, 8	No	Yes
z/OS.e# Version 1 Release 4*, 5*, 6, 7, 8	No	Yes
Linux, 64-bit distribution	No	Yes
Linux, 31-bit distribution	Yes	No
z/VM® Version 5 Release 1, 2	No	Yes
z/VM Version 4 Release 4 **	Yes	Yes
z/VSE*** 3.1, VSE/ESA™ 2.7 ****	Yes	No
z/VSE V4 ***** (Preview – no GA announced)	No	Yes
z/TPF Version 1	No	Yes
TPF Version 4 Release 1 (ESA mode only)	Yes	No

- # z/OS.e - z800, z890 and z9 BC only
- \* Support for z/OS 1.4 and 1.5 will end on March 31, 2007
- \*\* Support for z/VM V 4.4 will end September 30, 2006
- \*\*\* z/VSE V3 can execute in 31-bit mode only. It does not implement z/Architecture™ and specifically does not implement 64-bit mode capabilities. z/VSE V3 is designed to exploit select features of IBM System z hardware.
- \*\*\*\* Support for VSE 2.7 will end February 28, 2007
- \*\*\*\*\* z/VSE V4 is designed to exploit 64-bit real memory addressing, but will not support 64-bit virtual memory addressing

Note: Please refer to the latest PSP bucket for latest PTFs for new functions/features.

# System z Consultants view

## Gartner's view on Server Vendor positioning – 1998 to 2003



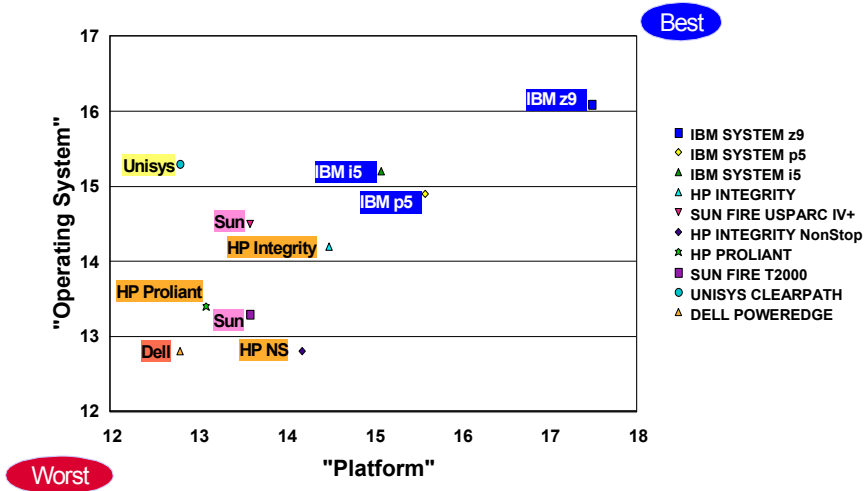
**"Increasing ISV enthusiasm and market demand justifies an increase in ability to execute that now puts pSeries into the overall leading position on the Magic Quadrant, a position that Sun Microsystems has consistently held for more than three years"**  
 Source: Gartner Group 10/02

Source: Gartner's Magic Quadrant reports July 1998, October 2002 and September 2003



## Gartner's platform positioning 2q06

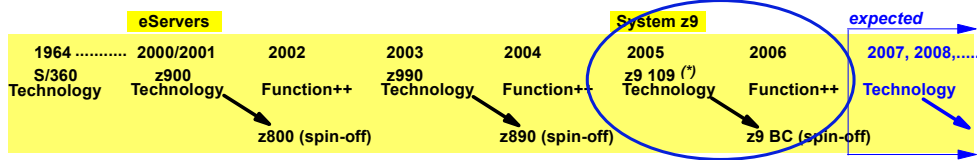
Top 10 Unweighted - Frame and Rack



Source: Gartner, Server Scorecard Evaluation Model version 2, May 2006

## System z Future roadmap

# System z Directions – Development and Delivery roadmap

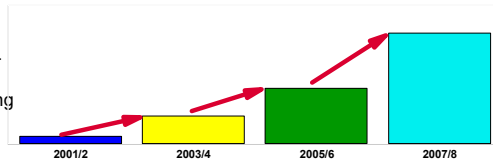


(\*) has been renamed to z9 Enterprise Class (EC)

**eServer Convergence**, - moving mainframe like capabilities to other platforms, - but continued functional differentiation in respect to implementation of all aspects of "quality of service"

### Addressing business requirements

- ▶ Continuous availability without complexity
- ▶ Improved business continuity
- ▶ Enhanced virtualization and resource mgmt.
- ▶ Increased capacity and performance
- ▶ Improved self-configuring and self-optimizing
- ▶ Reduced total cost of ownership
- ▶ Investment protection



**Scalability from smallest system to largest system of refreshed HW = 700 times**  
**Within a System = 30 times**  
**With Clustering = 30 times more capacity than a single system**

# IBM eServer convergence

## to ensure

- building of high quality platform solutions to a very competitive hardware cost
- transfer of mainframe inspired technologies to enhance QoS and Flexibility
- system management convergence - "identical" functional interfaces to "attack" people cost issues
- and increase the ability to integrate end-to-end

## Convergence



<b>Shared Software</b>		
SAP, DB2, Tivoli, Domino, MQ, CICS, Java, Websphere		
<b>LINUX ENABLED PLATFORMS</b>		
<b>Shared Hardware</b>		
Power/Mechanical		
I/O technologies		
System Architecture (LPAR and NUMA)		
Logic & Memory Chip and Packaging technologies		
"Intel"	Power	S/390

## while maintaining

- platform values in...
- support of different needs
- protecting investments



# IBM eServer convergence

## to ensure

- building of high quality platform solutions to a very competitive hardware cost
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- system management convergence - "identical" functional interfaces to "attack" people cost issues
- and increase the ability to integrate end-to-end

## Convergence

- Common platform:
- Differentiated products:
- Serving diverse markets:

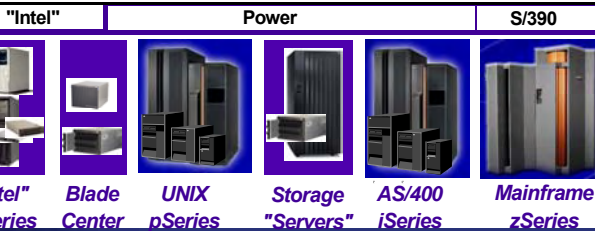


**Value for zSeries**

- Sourced from a VOLUME based technology
- makes is affordable to maintain and further develop THE platform with the MOST unique scalability, reliability, and availability characteristics

**Shared Software**  
SAP, DB2, Tivoli, Domino, MQ, CICS, Java, Websphere

Logic & Memory Chip and Packaging technologies



## while maintaining

- platform values in...
- support of different needs
- protecting investments

# System z9 - Scalability and Upgrade strategy

## Each new range has delivered:

- New function
- Improved performance
- Improved availability and serviceability
- Better price/performance
- Field Upgrades to protect investments

**Solid roadmap**  
2006/7/8 timeframe....  
1.72 Ghz to "x.x GHz"  
More engines per chip

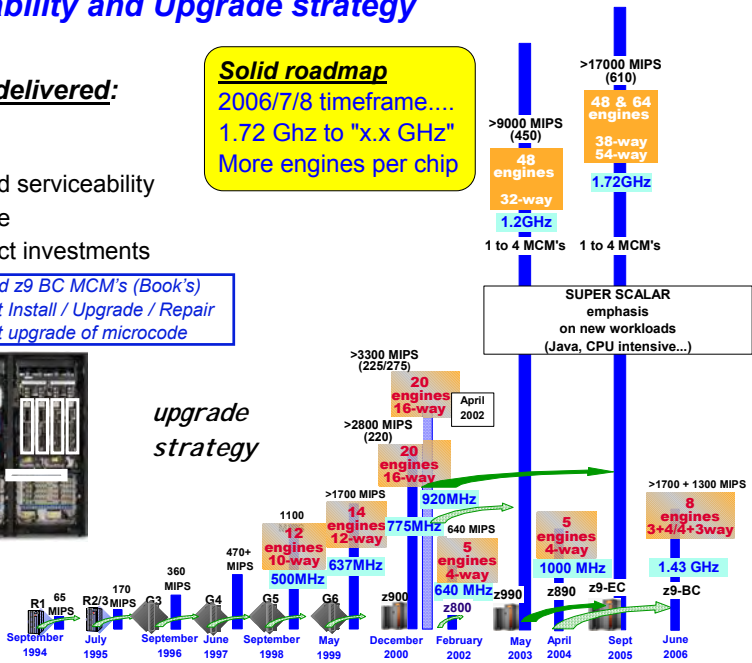
4 Advanced z9 BC MCM's (Book's)  
Concurrent Install / Upgrade / Repair  
Concurrent upgrade of microcode



## System z9 EC MCM

95x95mm  
16 chipsites, 217 capacitors  
3.9 billion transistors  
104 layer of glass ceramic  
476 meters of wire  
more than 4000 MIPS  
more than 400000++ TPC-C

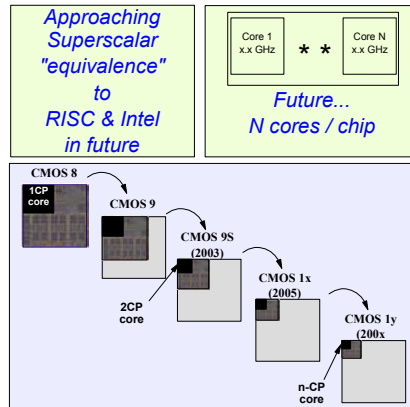
upgrade strategy



# Chip technology evolution

Increasing "area" is available for SoC design  
 More cores (engines per chip) to be followed by  
 more threads per core  
 16way systems on a chip are within reach !!!

- **Superscalar Capabilities**
- Larger caches
- Memory controller functions
- Redundancy (processors, arrays, etc.)
- More concurrent threads
- **Hardware accelerators**
  - more special assist Engines (accelerators/offload)
  - like System Assist Processors = SAPs
  - Crypto assists - special on System z
  - Compression & Translation - special on System z
  - Decimal Floating Instruction Hardware - opportunity
  - ...



Trends	2002	2005	2006/8	->>
transistors	174M	500M	1-1.3B	+3B
Mtr/cm2	65	142	350	863
Core	1-2	1-2	1-4	1 to +1K* Cores
GHz	0.7-2.1	1-3.5	1.2- 6	1.5-10

\* (16w SMP x 64 chips, in 20cm x 20cm package)

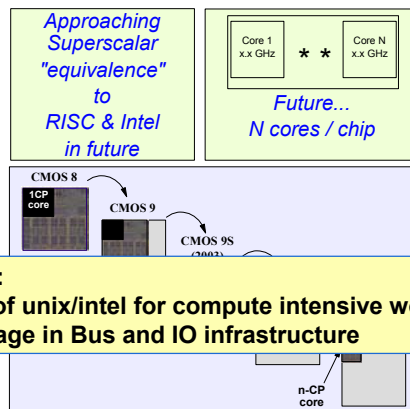
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- **Superscalar Capabilities**
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- Memory controller functions
- Redundancy (processors, arrays, etc.)
- More concurrent threads

**NOTICE:**  
 The cpu speed of z will approach the capacity of unix/intel for compute intensive work  
 ...while System z will maintain its advantage in Bus and IO infrastructure

- Crypto assists - special on System z
- Compression & Translation - special on System z
- Decimal Floating Instruction Hardware - opportunity
- ...



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## IBM System z9 Summary



**ENABLING BUSINESS.  
A THROUGH Z.**

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## System z9 EC and BC – delivering new functions and features



- New IBM zIIP
- Granularity with entry one third the size of the 701
- Up to 54 configurable CPs
- Premier Availability server – with Enhanced Book Availability, RII and Enhanced Driver Maintenance
- MIDAW Facility
- FICON Express4
- Enhanced CPACF and Crypto Express2
- ATM/POS remote key loading
- Administrative On/Off CoD test
- Sub-capacity CBUs



- New low entry model
- New IBM zIIP
- Extreme Granularity
- Up to 7 PUs
- 37% more uni processor, up to 64 GB memory, 170% more bandwidth
- Sub-capacity CBUs and Administrative On/Off CoD Test
- Enhanced Driver Maintenance and RII
- MIDAW Facility and MSS
- NPIV and IPV6 Support for HiperSockets OSA-Express2 OSN (OSA for NCP)
- Enhanced CPACF with AES, PRNG and SHA-256 and Configurable Crypto Express2
- Temporary state changes allowed and new test/training option for On/Off CoD

LSU\_2006\_90

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Now there is a System z9 for everyone . . .



. . . which one is right for you?