IBM System z
The Transforming Role of the Mainframe

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Senior VP and Group Executive
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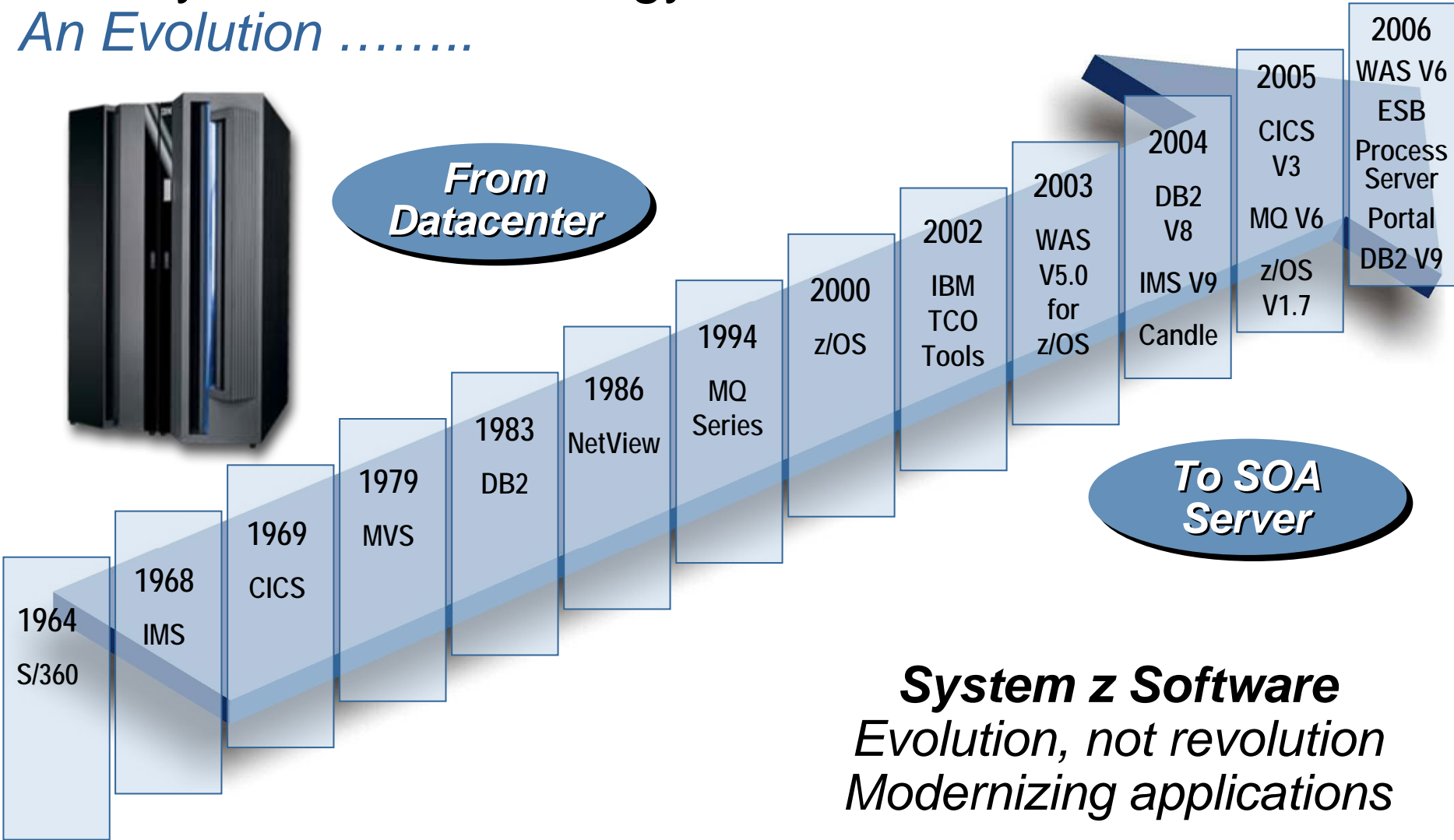
IBM System z Technology
An Evolution ……..

From Datacenter

To SOA Server

- **1964** S/360
- **1968** IMS
- **1969** CICS
- **1979** MVS
- **1983** DB2
- **1986** NetView
- **1994** MQ Series
- **2000** z/OS
- **2002** IBM TCO Tools
- **2003** WAS V5.0 for z/OS
- **2004** DB2 V8 / IMS V9 / Candle
- **2005** CICS V3 / MQ V6 / z/OS V1.7
- **2006** WAS V6 / ESB / Process Server / Portal / DB2 V9

System z Software
Evolution, not revolution
*Modernizing applications*

How Do You Define "Mainframe"?

- It depends on your perspective:
  - **Wikipedia** says: "Mainframes (often colloquially referred to as *big iron*) are *large* and "expensive" computers used mainly by government institutions and large companies for *mission critical* applications, typically bulk data processing such as censuses, industry/consumer statistics, ERP, and financial transaction processing."

  - **searchDataCenter.com** says: "Mainframe is an industry term for a *large* computer, typically manufactured by a large company such as IBM for the commercial applications of Fortune 1000 businesses and other *large-scale computing* purposes. Historically, a mainframe is associated with *centralized* rather than distributed computing. Today, IBM refers to its larger processors as large servers and emphasizes that they can be used to serve distributed users and smaller servers in a computing network"

  - **Mainframes.com** says: ""A mainframe is a continually evolving *general purpose* computing platform incorporating in it architectural definition the essential functionality required by its target applications."

  - **Answers.com** says: "A *state-of-the-art* computer for *mission critical* tasks. In the "ancient" mid-1960s, all computers were mainframes, since the term referred to the main CPU cabinet. Today, it refers to a class of *ultra-reliable* medium and *large-scale* servers designed for *enterprise-class* and carrier-class operations.

Reports of the Death of the Mainframe
….. Were Premature

- "I predict that the last mainframe will be unplugged on March 15, 1996."
  - **Stewart Alsop, March, 1991**

- "It's clear that corporate customers still like to have centrally controlled, very predictable, reliable computing systems – exactly the kind of systems that IBM specializes in."
  - **Stewart Alsop, February, 2002**
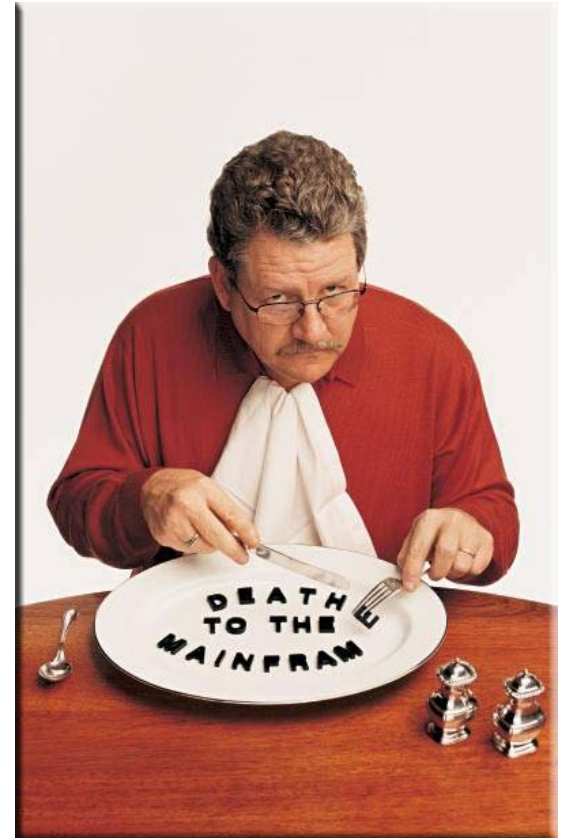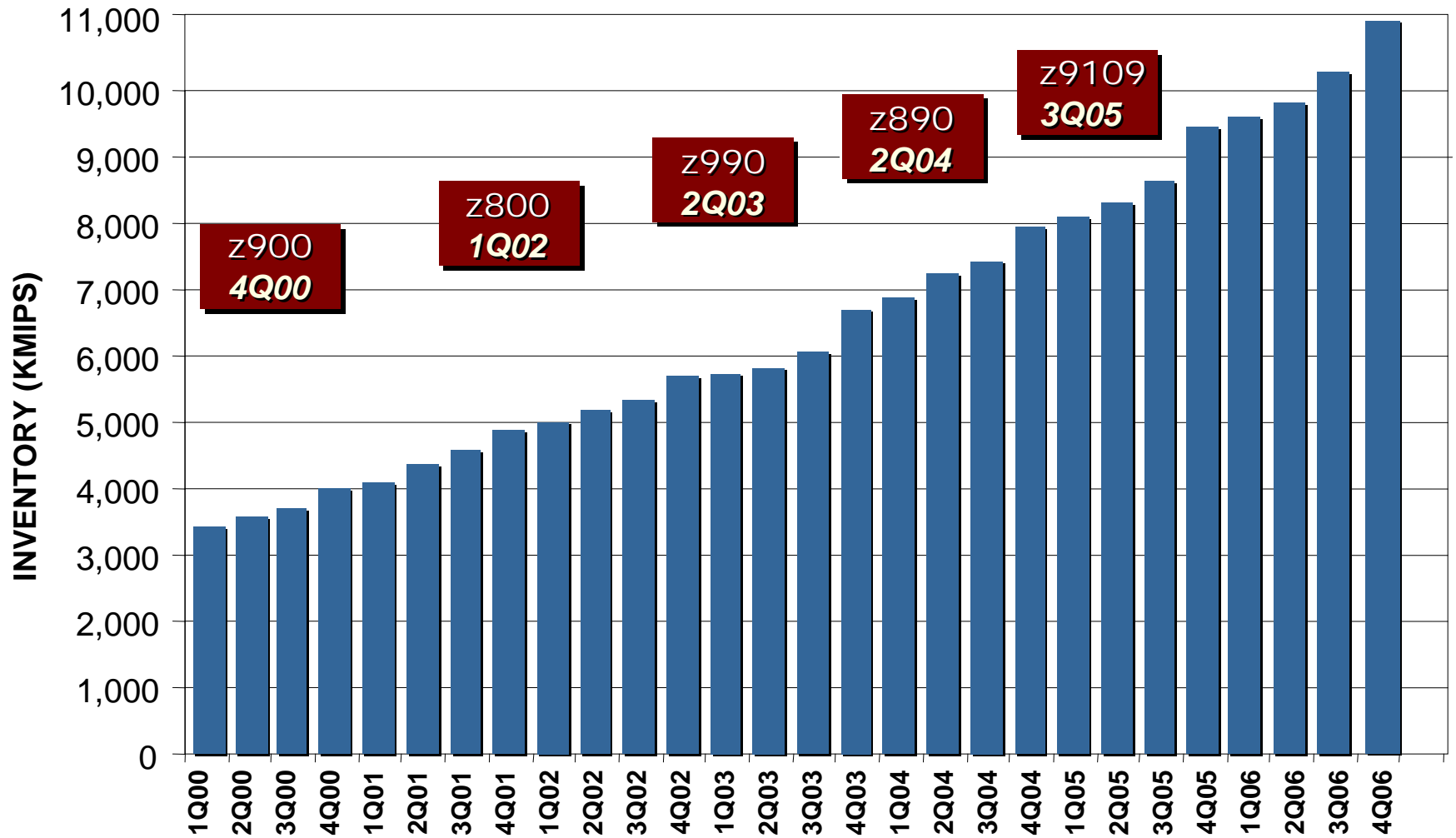

Source: IBM Annual Report, 2001

The Value of Mainframe Computing
Mainframe Computing Delivers Value for Core Commercial Workloads

- **Designed for high availability and responsiveness**

- **Maximum throughout per unit cost**

- **Tight centralized control for**
  - Security
  - Stability / Change Management
  - Backup / Recovery
  - Auditability
  - Resource / Cost Management and Accounting

- **Simplified and low cost operations and administration**
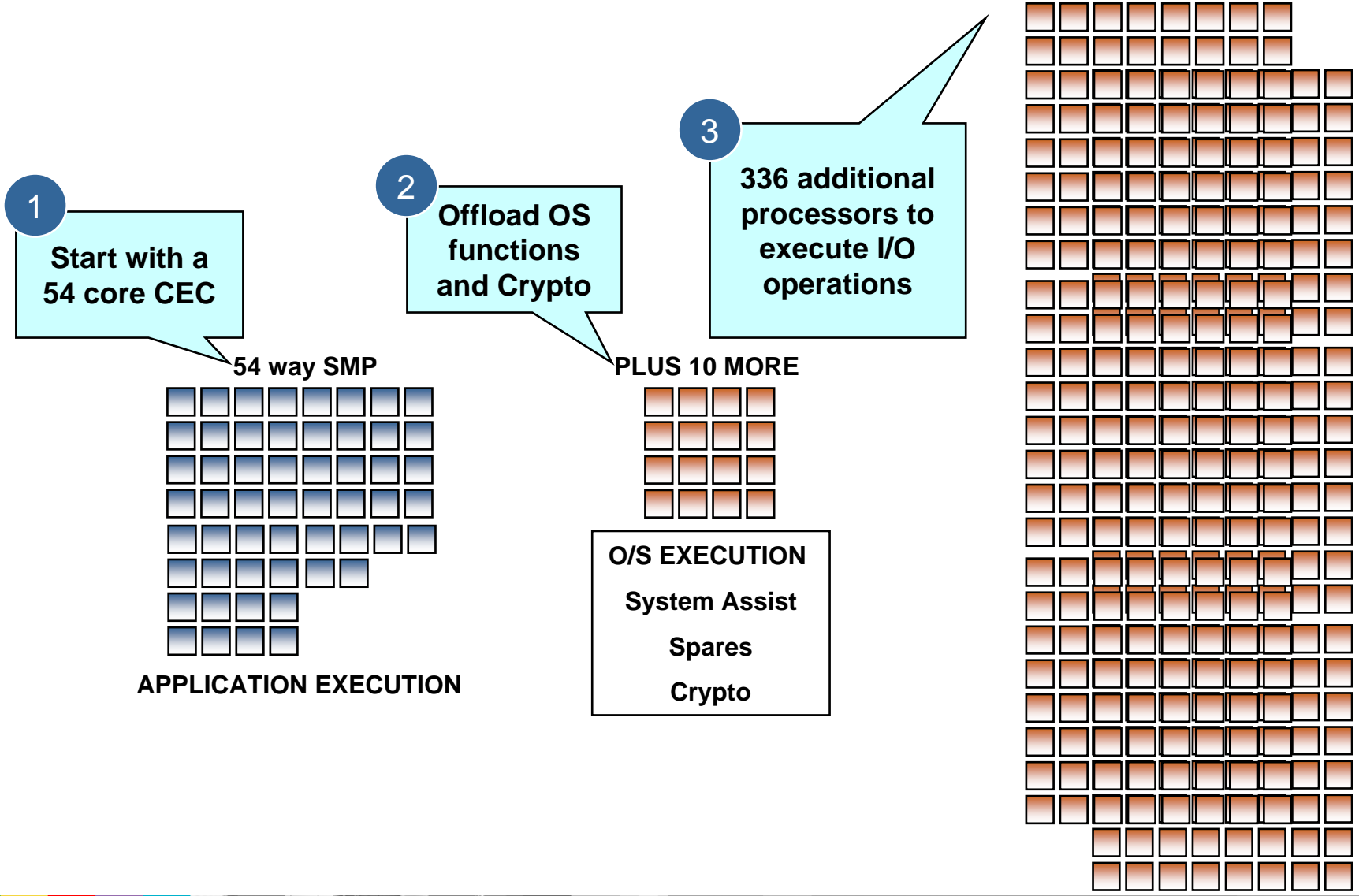
Customers Continue to Add Capacity

Bar chart titled INVENTORY (KMIPS) vs quarters from 1Q00 to 4Q06. Callout labels: **z900 4Q00**, **z800 1Q02**, **z990 2Q03**, **z890 2Q04**, **z9109 3Q05**.

Source: IBM STG Finance

System z
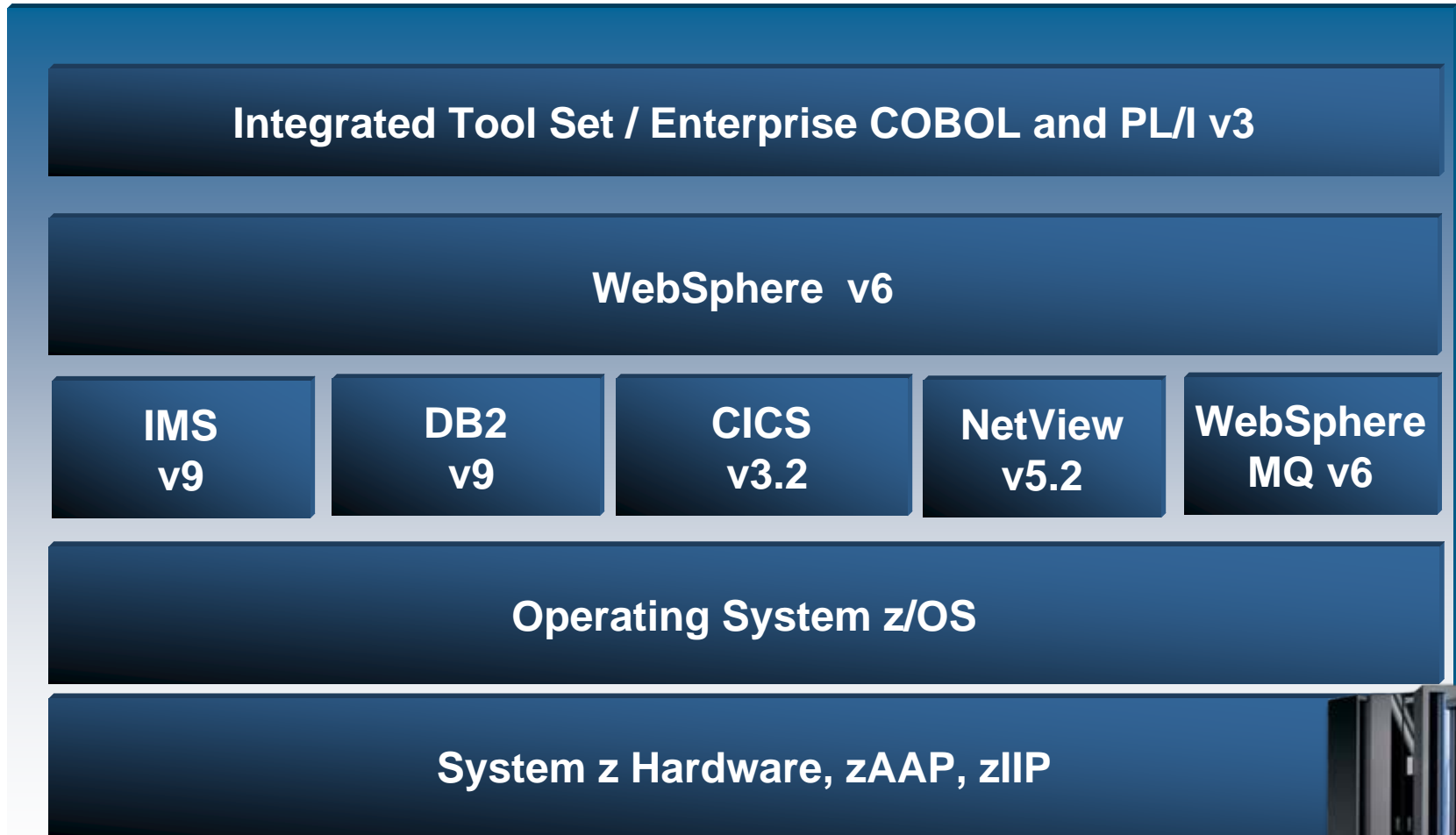*The Mainframe for Mixed Commercial Workloads*

▪ Near-linear scalability	up to 900,000+ concurrent users
▪ "Mean Time Between Failure"	measured in decades vs. months
▪ ¼ network equipment costs	virtual versus physical
▪ 1/25th floor space	400 sq. ft. versus 10,000 sq. ft
▪ 1/20 energy requirement	$32/day versus $600/day
▪ 1/5 the administration	< 5 people versus > 25 people
▪ Highest average resource utilization	> 70% versus < 15%
▪ Highest concurrent workload	hundreds of applications versus few

IBM System z9

1 Start with a 54 core CEC

2 Offload OS functions and Crypto

3 336 additional processors to execute I/O operations

54 way SMP

APPLICATION EXECUTION

PLUS 10 MORE

O/S EXECUTION

System Assist

Spares

Crypto

IBM System z Platform Coherence

Integrated Tool Set / Enterprise COBOL and PL/I v3

WebSphere v6

IMS v9	**DB2 v9**	**CICS v3.2**	**NetView v5.2**	**WebSphere MQ v6**

Operating System z/OS

System z Hardware, zAAP, zIIP

Transaction Management
The System z Application "Sweet Spot"

- **Transaction monitor – *manages a transaction***
  - A program or subsystem that manages or oversees the sequence of events that are part of a transaction
  - Makes sure the ACID properties of a transaction are maintained
  - Includes functions such as interfacing to databases and networks and transaction commit/rollback coordination
  - Provides an API so applications can exploit the services of the transaction monitor

- **IBM's z/OS-based transaction monitors:**
  - **IMS - Information Management System**
  - **CICS - Customer Information Control System**
  - **WebSphere Application Server for z/OS**

- A key strength of the z/OS platform is support for high-volume, high-performance transaction management using transaction monitors

IMS
Information Management System

"IMS Runs the World" since 1968

the world depends on it

- **Most Corporate data is managed by IMS**
  - Over 95% of Fortune 1000 Companies use IMS
  - IMS manages over 15 billion GBs of production data
  - $2 trillion/day transferred through IMS by one customer

- **Over 50 billion transactions a day run through IMS**
  - IMS serves close to 200 million users per day
  - Over 79 million IMS trans/day handled by one customer on a single production Sysplex, 30 million trans/day on a single CEC
  - 120 million IMS trans/day, 7 million/hour handled by one customer
  - 4,000 trans/second (250 million/day) across TCP/IP to a single IMS
  - Over 3,000 days without an outage at one large customer
  - 21,000 trans/second on a single z990, with 4 IMS servers

CICS
Customer Information Control System

- CICS provides an execution environment for concurrent program execution for multiple end users, who have access to multiple data types

- CICS will manage the operating environment to provide performance, scalability, security, and integrity

  - 30+ years of applications
  - >30B transactions per day
  - 5,000 packages, 2,000 ISVs
  - 30M CICS users
  - 50K CICS/390 licenses, 16K customers
  - 950,000 CICS application programmers
  - 490 of IBM's top 500 customers

CICS

IBM System z and DB2
Where You Put Your Data Matters

- **Integrity**

- **High availability**

- **Security**

- **Systems and database management**

DB2. Information Management Software

> - **DB2 for Z in:**
>   - 25 of the top 25 worldwide banks*
>   - 23 of the top 25 US retailers**
>   - 9 of the top 10 global life / health insurance providers***

Top companies as identified in:
* WW Banks from The Banker.com: http://www.thebanker.com/news/fullstory.php/aid/1699/Tio_1000_World_Banks.html
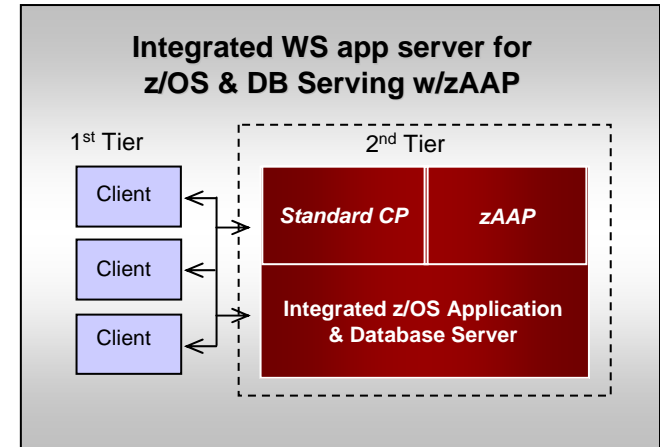***US Retailers from National Retail Federation July 2005: http://www.stores.org/pdf/TOP100printwithad.pdf*
***Insurance - 2005 Ward's 50 Benchmark Group: www.memic.com/news/Wards50.asp

WebSphere Application Server for z/OS
The Java Transaction Manager

- **Architected on SOA infrastructure & principles**
  - Fully J2EE 1.4 platform certified
  - Leading Web Services support
  - WebSphere Rapid Development & Deployment

- **zAAP enabled (z9-109, z990, z890)**
  - Run Java applications next to mission critical data
  - Lower the cost of computing for WebSphere Application Server
    (and all z/OS based Java applications)

- **Common code infrastructure**
  - Administration skills shared between platforms
  - Develop anywhere, run on WebSphere Application Server for z/OS

- **Native OS support – leverages the z/OS platform**

- **Optimization** features designed to provide security and data interaction, including support for the traditional mainframe SW – CICS, IMS, DB2

- **Enhanced QoS** within the product, complementary to QoS of the platform

Integrated WS app server for z/OS & DB Serving w/zAAP

1st Tier | 2nd Tier

Client

| Standard CP | zAAP |

Integrated z/OS Application & Database Server

Client

Client

Virtualization

Mainframes – The Innovator and Leader in Virtualization Function

- **Share processor, memory, I/O, and network among multiple operating environments**
 - Isolate workloads with EAL5 level security
  - Share resources among workloads
  - Enable communication for workloads internally with an in-memory TCP/IP network

- **35+ year history of virtualization, innovation and refinement**
  - Hardware and software based for optimum performance and flexibility
  - Robust suite of function for creating, provisioning, deploying, and managing virtual servers

- **z/VM Virtualization to simplify your IT infrastructure**
  - Support up to hundreds of concurrent applications with z/VM
    - Share applications, data, as well as hardware among large numbers of servers
  - Management tools for operation, maintenance, and accounting
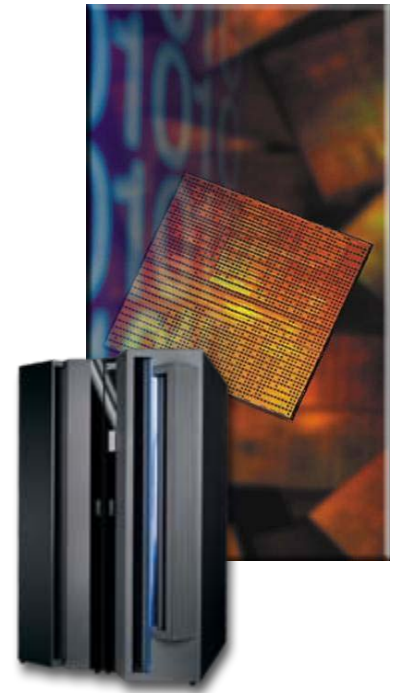
z/OS Security

- **Security Server for z/OS**
  - **RACF – Resource Access Control Facility**
 - LDAP
  - Firewall

- **Encryption**
  - On-board cryptographic hardware in System z9 servers
  - **Integrated Cryptographic Service Facility (ICSF)** in z/OS
    - Callable APIs to perform crypto functions from software

- **Public Key Infrastructure (PKI) Services**
  - Enables a PKI on z/OS
  - Operates a Certificate Authority
  - Provides administration application, end-user interface, integration with z/OS LDAP, ICSF, and HTTP server
  - Certified "Identrus Compliant" in 2005

Driving Value *Up* and Cost *Down*
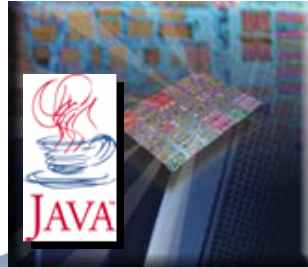## *Evolution of Specialty Engines*
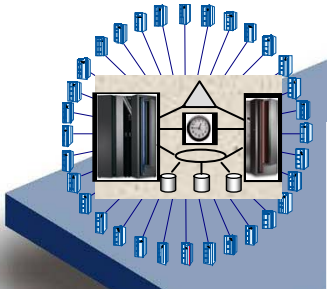
Internal Coupling Facility (ICF) 1997

- Centralized data sharing across mainframes

Integrated Facility for Linux (IFL) 2001

- Support for new workloads and open standards

System z9 Application Assist Processor (zAAP) 2004

- Designed to help improve resource optimization for z/OS Java technology-based workloads

WebSphere DataPower SOA Appliances 2005

- Easy-to-deploy network devices that simplify, help secure, and accelerate XML and Web services deployments
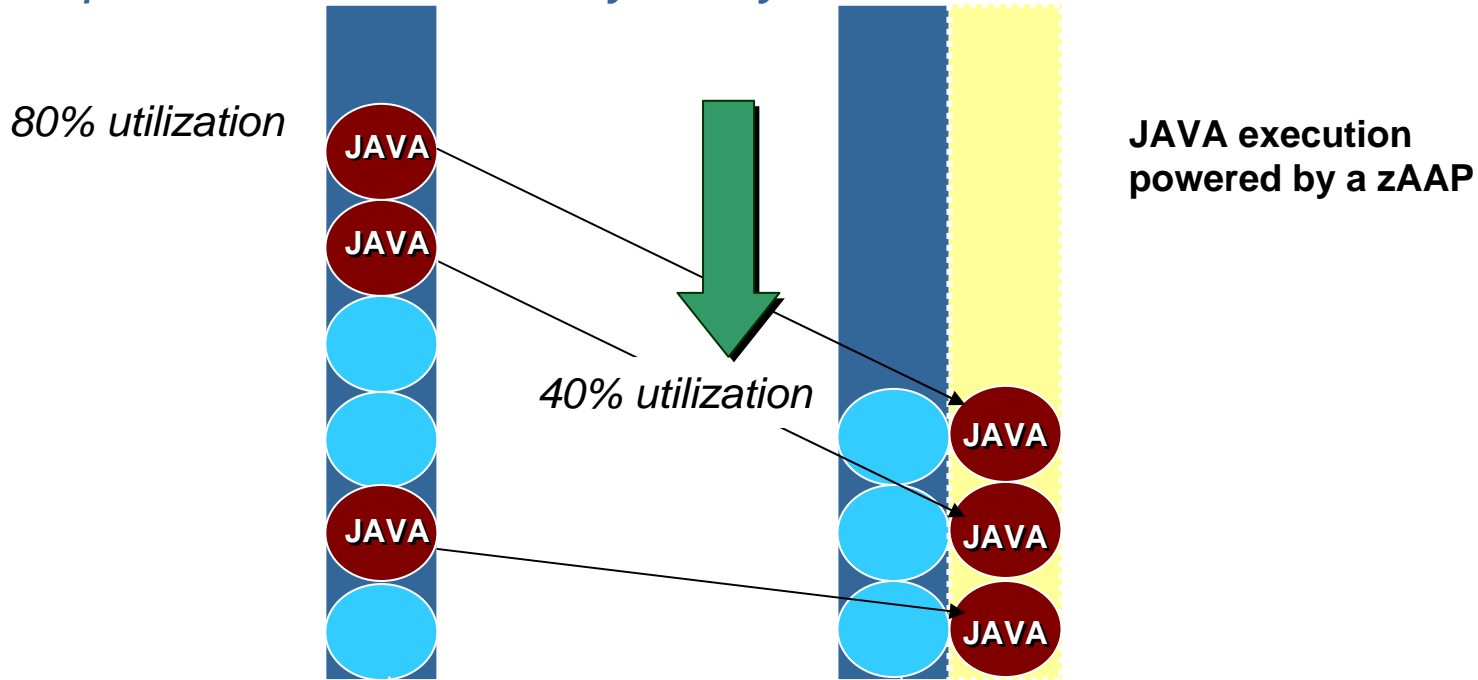
IBM System z9 Integrated Information Processor (zIIP) 2006

- Designed to help improve resource optimization for eligible data workloads within the enterprise

zAAP – System z9 Application Assist Processor

Consider a WebSphere Application that is transactional in nature and requires 1000 MIPS today on System z

80% utilization

JAVA
JAVA

40% utilization

JAVA

JAVA execution powered by a zAAP

JAVA
JAVA
JAVA

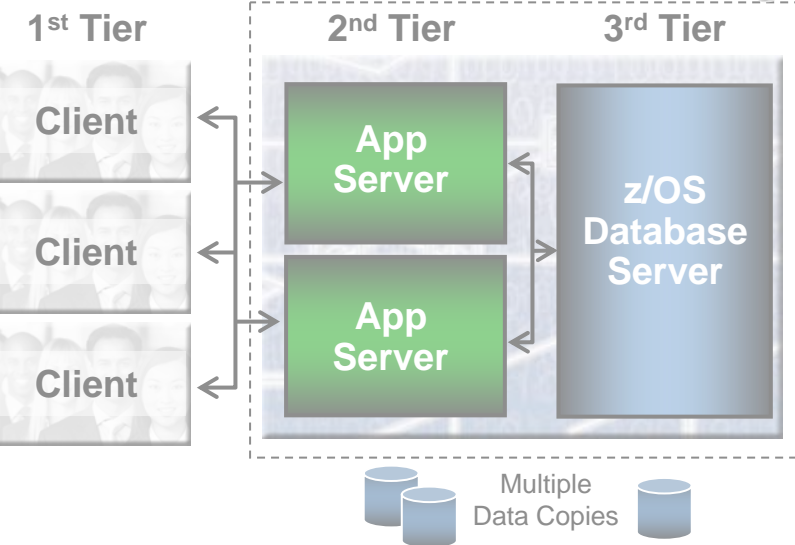| 1000 MIPS for WebSphere App	500 MIPS for WebSphere App + 500 MIPS now available for additional workloads

In this example, with zAAP, we can reduce the standard CP capacity requirement for the Application to 500 MIPS or a 50% reduction.*
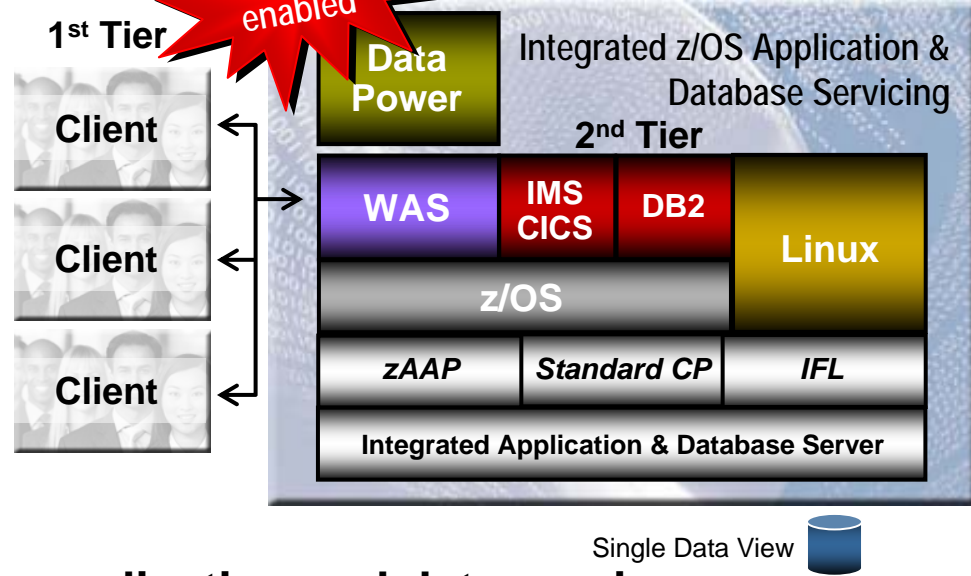
*For illustrative purposes only

System z: *Enterprise Hub for Data and SOA*

BEFORE
Networked Web Serving

1st Tier	2nd Tier	3rd Tier
Client	App Server	z/OS Database Server
Client	App Server	
Client		

Multiple Data Copies

zAAP & IFL enabled

AFTER

1st Tier

Client
Client
Client

Data Power

Integrated z/OS Application & Database Servicing

2nd Tier

WAS	IMS CICS	DB2	
			Linux

z/OS

| zAAP | Standard CP | IFL |

Integrated Application & Database Server

Single Data View

Potential advantages of consolidating application and data serving

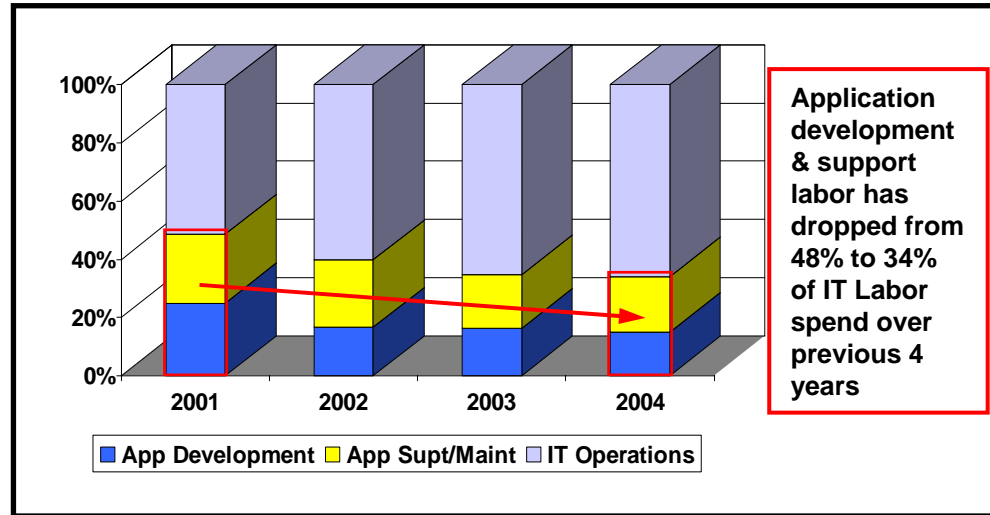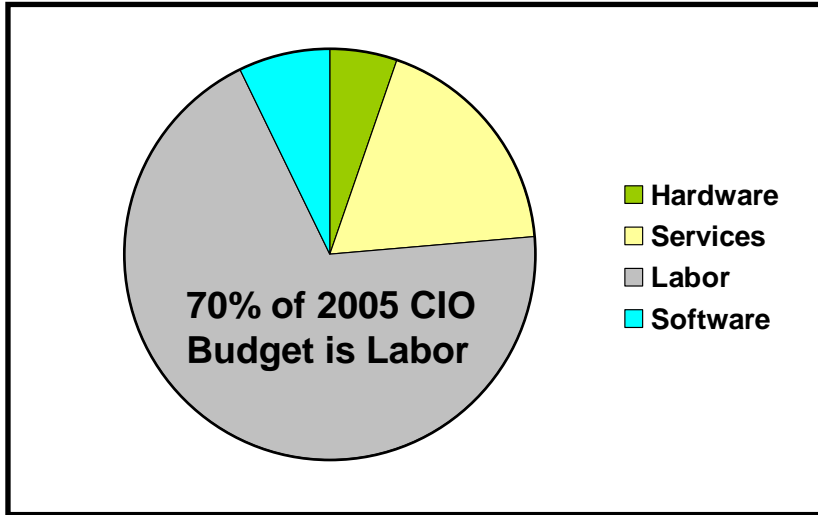|	
▪ **Security**	**Fewer points of intrusion**
▪ **Resilience**	**Fewer Points of Failure**
▪ **Performance**	**Avoid Network Latency**
▪ **Operations**	**Fewer parts to manage**
▪ **Environmentals**	**Less Hardware**
▪ **Utilization**	**Efficient use of resources**
▪ **Scalability**	**Batch and Transaction Processing**
▪ **Auditability**	**Consistent identity**
▪ **Simplification**	**Problem Determination/diagnosis**
▪ **Transaction Integrity**	**Automatic recovery/rollback**

With IFL

With zAAP

zIIP – System z9 Integrated Information Processor

- A breakthrough that strengthens mainframe position as the world's premier database serving platform

- Frees-up computing capacity

- Business Intelligence and transaction processing:
  - Reduce security risks
 - Improve resource optimization
  - Lower costs

IT Infrastructure Trends – Cost
Decrease in Efficiency as IT Spending Shifts to Operations Labor

70% of 2005 CIO Budget is Labor

- Hardware
- Services
- Labor
- Software

Application development & support labor has dropped from 48% to 34% of IT Labor spend over previous 4 years

■ App Development ■ App Supt/Maint □ IT Operations
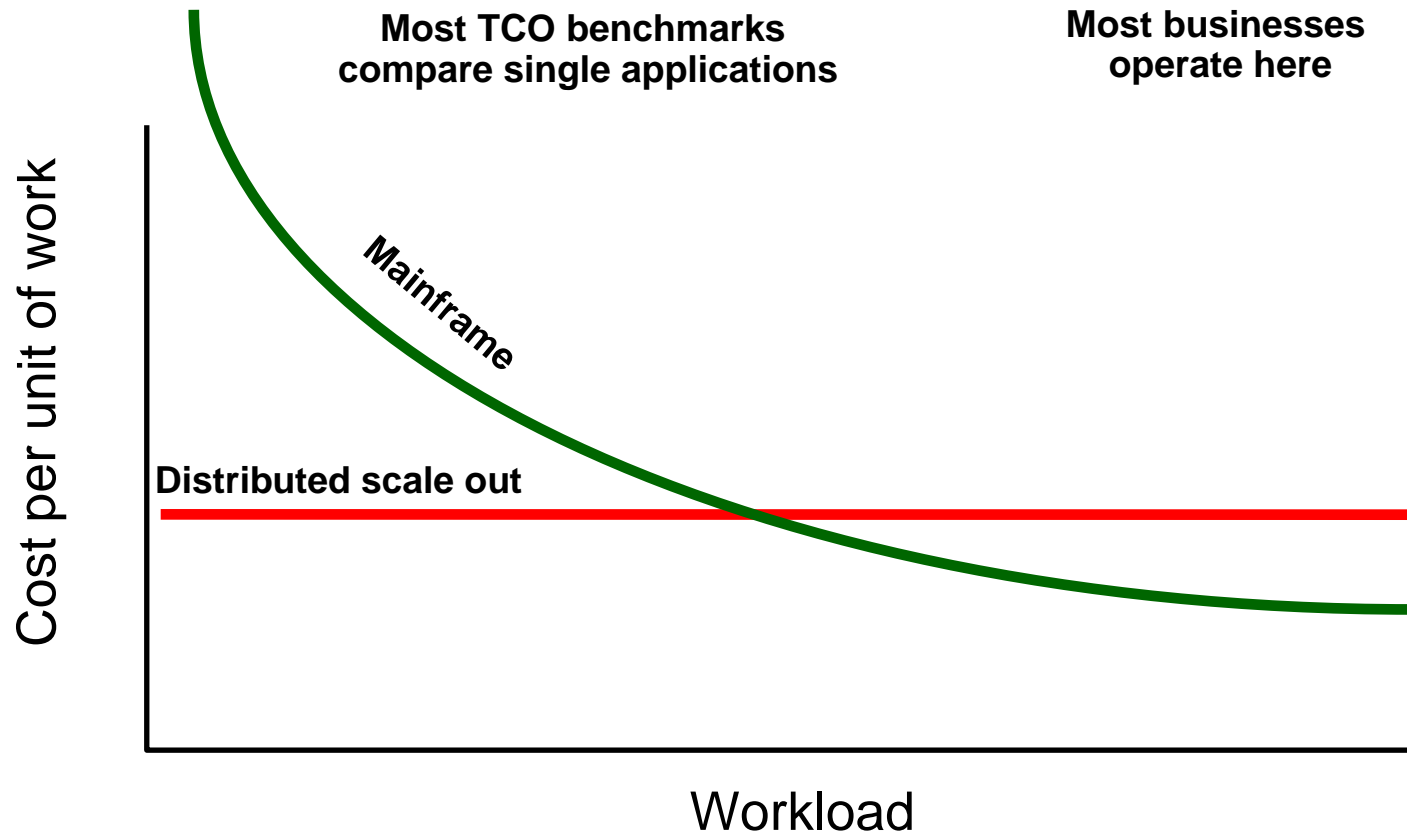
- 70% of CIO budget is labor

- Operations labor will be 73% of CIO labor budgets by 2008

- $325B in operations labor by 2008

- Administration
- Development
- Operations
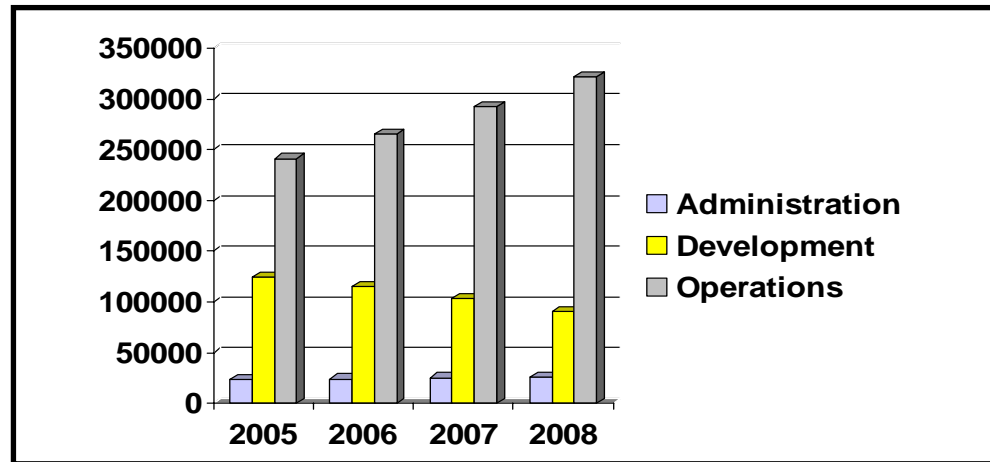
Source: Tivoli Commissioned Study 1Q05

Mainframe Cost Per Unit of Work Goes Down
…. As Workload Increases

**Most TCO benchmarks
compare single applications**

**Most businesses
operate here**

Cost per unit of work

Mainframe

Distributed scale out

Workload

People Cost is the Driver of TCO

- In a recent typical study, a customer thought they only had 24 UNIX servers
  - But these were just the <u>PRODUCTION</u> servers
  - In addition they had 49 servers for Development, Test and Disaster Recovery
- They needed <u>44 people</u> to support these servers and $7M software
  - Running at only 20% utilization
- A comparable System z implementation would have required just 20 servers
  - Requiring <u>16 people</u> to support
  - Using $6M software
- They thought the Solaris environment was 1/5th of the cost of the mainframe ….. *but in fact the System z TCO was 37% less*
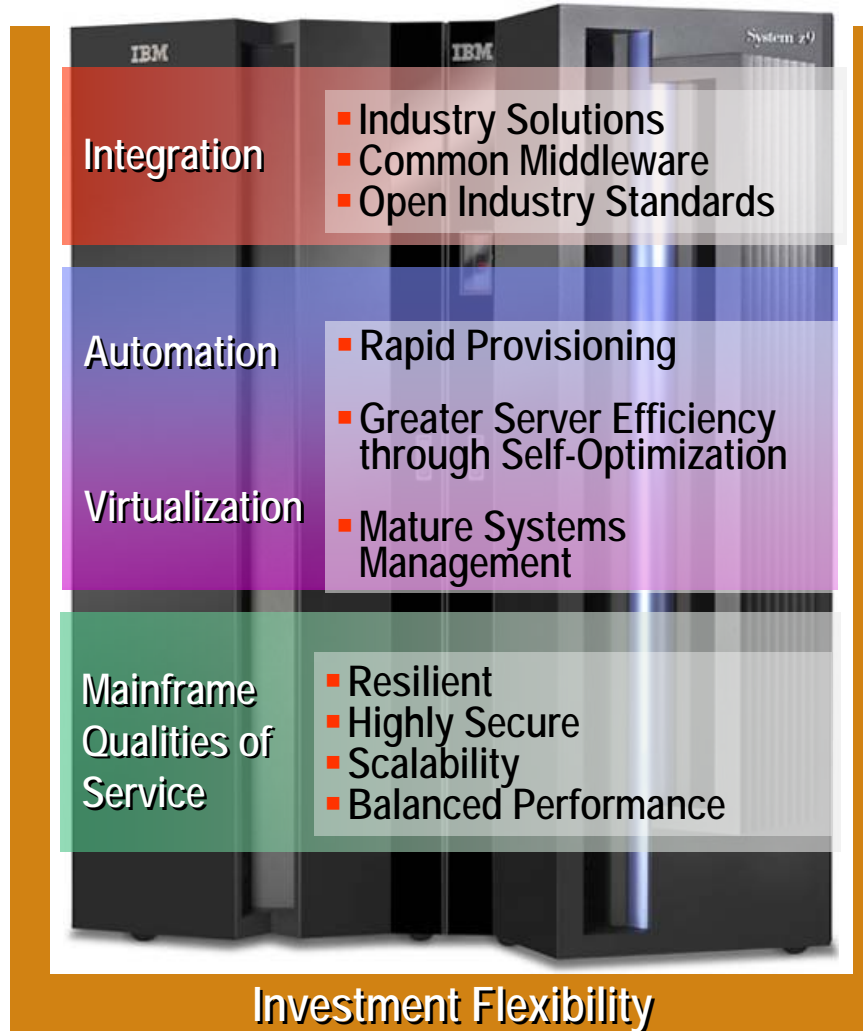
3 Year Cost of Ownership

Bar chart (Thousands):
- Current Sun: $15,025
- Mainframe: $13,500
- MF w/ zAAPs: $9,425

Legend: Other (green), People (yellow), Software (blue), Hardware (red)
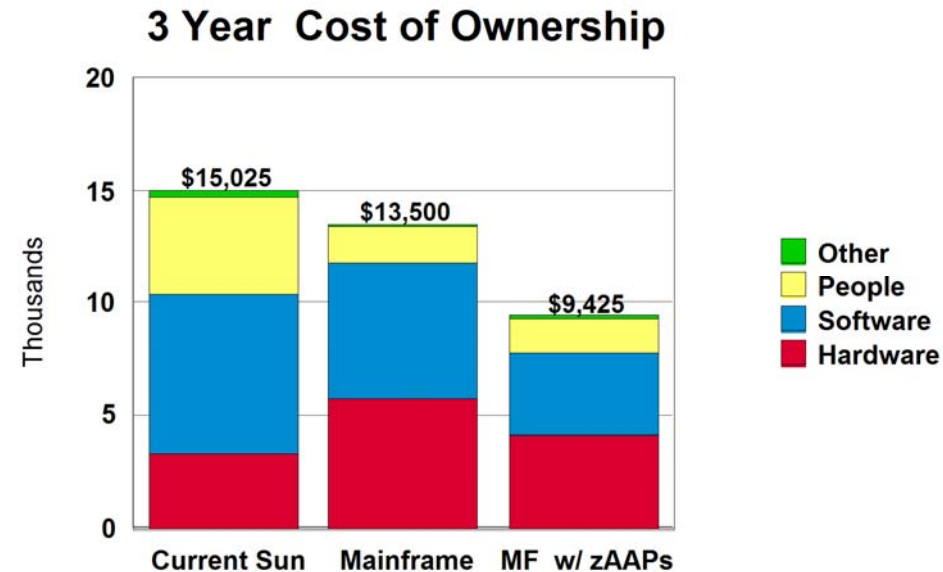
System z Core Values
Built Upon a 40 Year Heritage …. and Still Relevant

Business Challenges

- **Financial Pressures**
- **Security and Operational Resiliency**
- **Simplify Infrastructure Complexity**
- **Accelerate Time-to-Market**
- **Increase Revenues**
- **Deploy New Capabilities**

Integration
- Industry Solutions
- Common Middleware
- Open Industry Standards

Automation
- Rapid Provisioning

Virtualization
- Greater Server Efficiency through Self-Optimization
- Mature Systems Management

Mainframe Qualities of Service
- Resilient
- Highly Secure
- Scalability
- Balanced Performance

Investment Flexibility

IT Challenges

- **Be responsive to changing business needs**
- **Meet service level agreements**
- **Increase server and IT resource utilization**
- **Help reduce IT Costs**
- **Develop new applications while mitigating risk**

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