Building a Better Infrastructure With IBM Middleware on IBM Power Systems
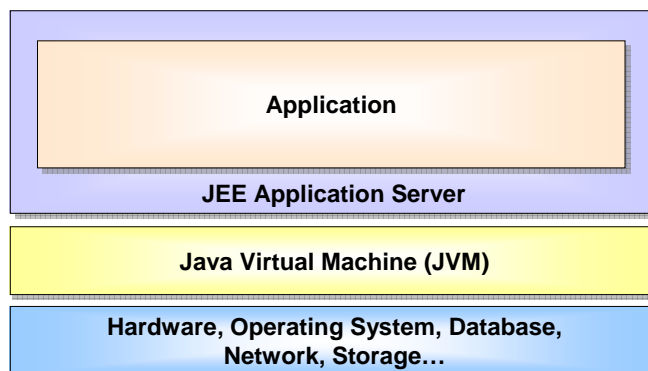
Consolidate Sprawling Web Tiers Onto Scalable WebSphere Servers

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Web Application Servers Need a Foundation

- The Java Virtual Machine (JVM) is the foundation for JEE application servers

Application

JEE Application Server

Java Virtual Machine (JVM)

Hardware, Operating System, Database, Network, Storage…

IBM Java Runtime Provides Superior JVM Performance

- **Class instances can be shared across multiple JVMs**
  - ► Reduces memory requirements
  - ► Speeds startup

- **Garbage Collection (GC) process is more efficient**
  - ► Unused application memory is freed and collected for reuse
  - ► Improved object tracking reduces fragmentation and memory footprint
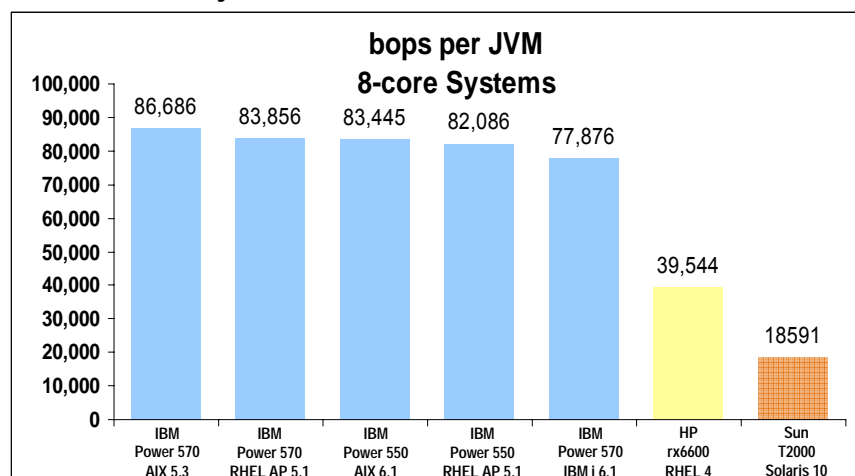 - ► Parallel compaction threads increases speed of GC cycles

- **Just in Time (JIT) compiler increases execution speed**
  - ► Compiles Java byte-code to native machine instructions at runtime to improve performance
  - ► Supports dedicated, asynchronous threads for JIT compilation
  - ► Intelligently applies optimizations for greater performance improvement
    - − Applies highest level of optimizations to most-executed methods
    - − Helps offset cost of compilation
  - ► Dynamically re-compiles methods to adjust to runtime profile changes

Industry Leading Java Performance with IBM Power Systems* and the IBM JVM

SPECjbb2005 Java Business Benchmark

bops per JVM
8-core Systems

System	bops
IBM Power 570 AIX 5.3	86,686
IBM Power 570 RHEL AP 5.1	83,856
IBM Power 550 AIX 6.1	83,445
IBM Power 550 RHEL AP 5.1	82,086
IBM Power 570 IBM i 6.1	77,876
HP rx6600 RHEL 4	39,544
Sun T2000 Solaris 10	18591

*The top 5 systems are all IBM POWER6 processor based systems.

The Web Application Server is the Next Layer

■ Provides a common environment and programming model for web applications

▶ **Insulates** applications from hardware, operating system, network, …

▶ **Write once, run anywhere** (JEE)

▶ Provides a scalable **transaction** engine for your enterprise

▶ Platform for developing and deploying **Web Services**

Application
JEE Application Server

Java Virtual Machine (JVM)

Hardware, Operating System, Database, Network, Storage…
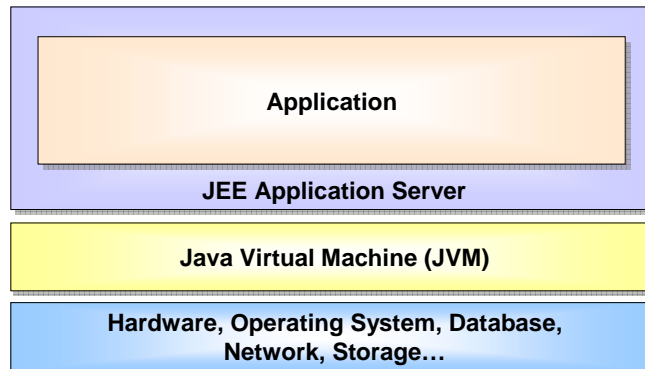
Why IBM WebSphere Software?

Nobody has the same breadth and depth

- Broad portfolio relied on by over 87,000 customers
- #1 market share
- Extensive ecosystem – more than 4,000 partners and 3,150 active ISV solutions
- Over 90% of the top Standard & Poor's 100 accounts rely on WebSphere Application Servers to run their business

Nobody invests more

- IBM investing over $1B a year to deliver SOA and Web services capabilities
- Over 6,700 IBM developers
- Over 10,750 IGS technical practitioners trained on WebSphere

Award winning SOA products

intelligent *enterprise*   ***IBM tops elite vendor list***   *-Intelligent Enterprise Editors' Choice Awards (April 2005)*

IBM Overall Winner in Application Integration Middleware
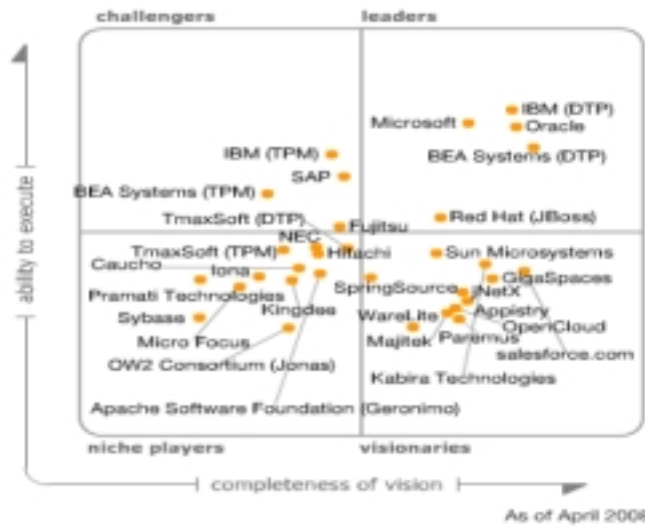   *-CRN Channel Champions Award (March 2005)*

Computing WebSphere tops Network Computing App Server Reviews   ***WebSphere: "impressive management options, support for Web services and general ease of use…"***   *– Network Computing (February 2005)*

IBM WebSphere Application Server Shows Leadership Among Enterprise Application Servers

challengers   leaders

- IBM (DTP)
- Oracle

Microsoft
- IBM (TPM)
- SAP
- BEA Systems (DTP)
- BEA Systems (TPM)
- TmaxSoft (DTP)
- Fujitsu
- Red Hat (JBoss)
- NEC
- TmaxSoft (TPM)
- Hitachi
- Sun Microsystems
- Caucho
- Iona
- GigaSpaces
- Pramati Technologies
- SpringSource
- NetX
- Sybase
- WareLite
- Appistry
- Kingdee
- OpenCloud
- Micro Focus
- Majitek
- Paremus
- salesforce.com
- OW2 Consortium (Jonas)
- Kabira Technologies
- Apache Software Foundation (Geronimo)

ability to execute

niche players   visionaries

|— completeness of vision —|

As of April 2008

Source: Magic Quadrant for Enterprise Application Servers, 2Q08; Gartner Group, April 24, 2008.

WebSphere Application Server Editions

WebSphere Application Server for zOS

WebSphere Extended Deployment

- **Virtual Enterprise**
- **Compute Grid**
- **eXtreme Scale**

Runs on Power Systems

WebSphere Application Server Network Deployment — **Cluster**

WebSphere Application Server — **Basic**

WebSphere Application Server Express — **SMB**

WebSphere Application Server Community Edition — **FREE!**

Built on a common codebase

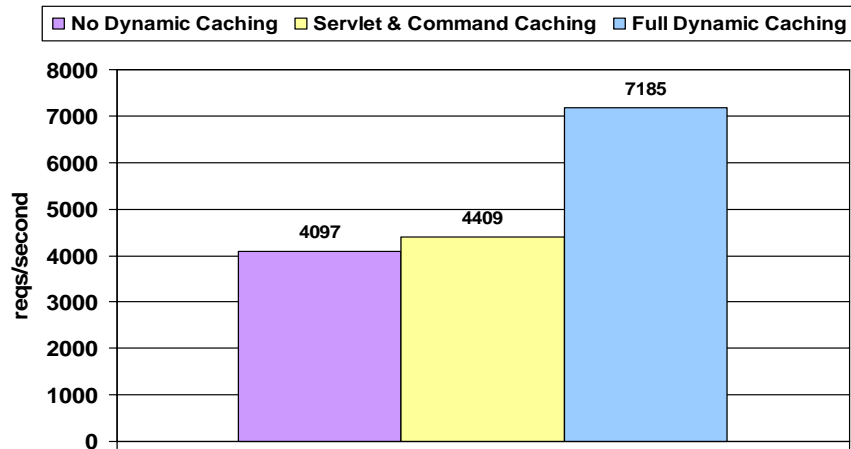*Built on open source technology*
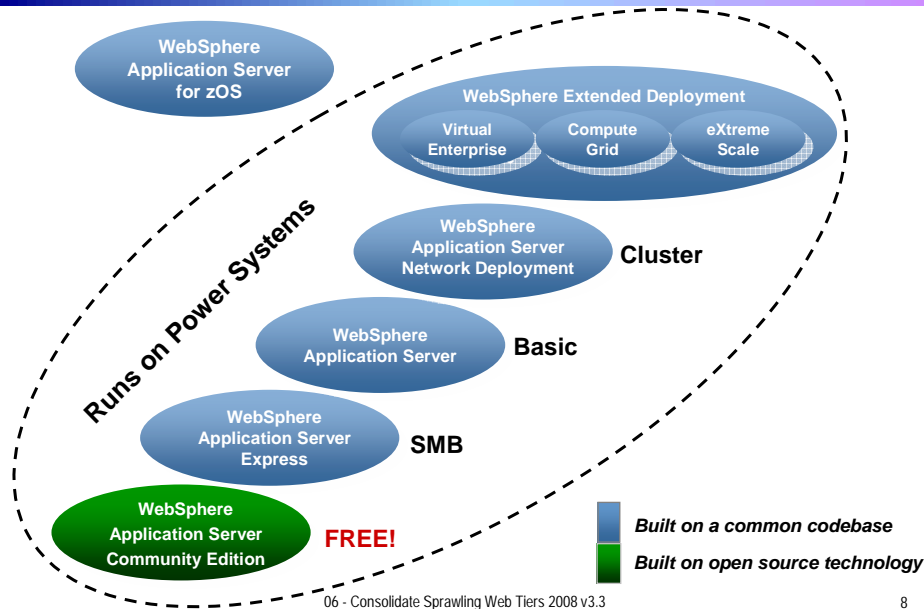
WebSphere Application Server 6.1 Exploits Power Systems Hardware

- Supports 64-bit AIX and Linux on Power Systems
  - ▶ Leverages large memory
    - − caching large amounts of data in memory
    - − avoiding slower access resources like databases or disks
    - − BLOB's (binary large objects) is a good case, in 32-bit, sometimes not able to cache the entire object in the Java heap

  - ▶ Java heaps can be configured much larger than the ~2-3GB limitations of the 32-bit platforms to enhance performance

  - ▶ Double precision 64-bit mathematical computations are better for
    - − computational intense applications
    - − statistical applications, simulation and modeling applications
    - − apps that use security and encryption

WebSphere Application Server Caching Improves Performance

- WebSphere Application Server supports caching of static content
  - ▶ HTML pages
  - ▶ Graphic files (e.g., JPG)
  - ▶ Java class libraries

- WebSphere Application Server also supports caching of dynamic content produced by
  - ▶ Java servlets
  - ▶ JavaServer Pages (JSP)
  - ▶ WebSphere command objects
  - ▶ Web services objects
  - ▶ Java objects

- What was the name given to IBM's patented dynamic caching technology?
  - ▶ "DynaCache"

WebSphere Dynamic Caching Increases Overall Throughput

■ No Dynamic Caching **☐ Servlet & Command Caching** **■ Full Dynamic Caching**

Bar chart: reqs/second (y-axis, 0 to 8000)
- No Dynamic Caching: 4097
- Servlet & Command Caching: 4409
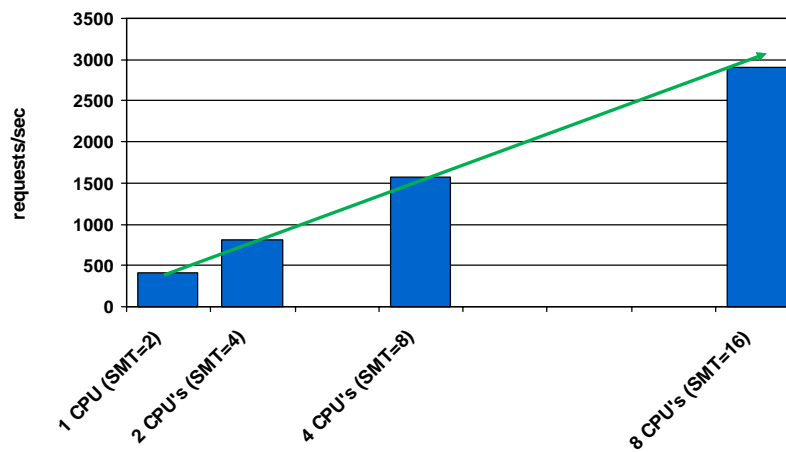- Full Dynamic Caching: 7185

WebSphere Application Server V6.1

IBM Power Systems p5-550, (4) 64-bit 1.65GHz POWER5+ processors (SMT Enabled), 4GB RAM, AIX 5.3 ML3 (64 bit)

Throughput increases with dynamic caching in all scenarios

WebSphere Application Server on Power Systems SMP Achieves Near-Linear Scalability

WAS Performance Scaling on AIX on Power Systems

Bar chart: requests/sec (y-axis, 0 to 3500)
- 1 CPU (SMT=2): ~400
- 2 CPU's (SMT=4): ~800
- 4 CPU's (SMT=8): ~1550
- 8 CPU's (SMT=16): ~2900

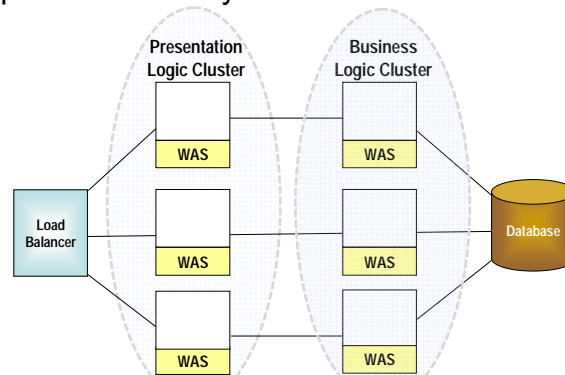IBM Power Systems p5-570, 16 x 1.9 GHz, 32GB RAM, AIX 5.3 SP2, 64 bit

Web Application Servers Are Often Clustered

- **Why?**
  - ▶ To increase workload capacity
  - ▶ To improve availability

- **How?**
  - ▶ In multi-tier deployments
  - ▶ Cluster members connected through LAN

Presentation Logic Cluster

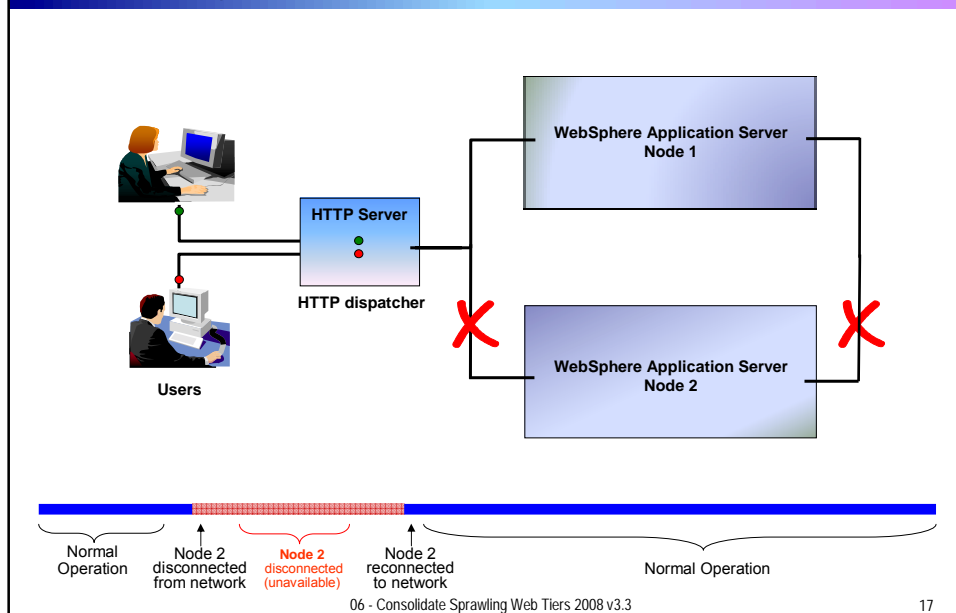**Business Logic Cluster**

WAS

WAS

Load Balancer

WAS

WAS

Database

WAS

WAS

WebSphere Network Deployment (ND) Provides Clustering Capability

- Built-in clustering capability eliminates single points of failure and also provides
  - ▶ Capacity to handle workloads greater than one server
  - ▶ Workload management to balance client requests across application servers
  - ▶ Server failover capability to automatically redirect requests to a redundant server

- Enables isolation of application servers, each application server
  - ▶ Loads from local file system
  - ▶ Runs its own services (JNDI, security)
  - ▶ Logs distributed transactions

- Built-in High Availability Manager reduces the amount of time it takes to recover

WAS ND Cluster Test: Perfect Failover and Recovery Behavior

| Normal Operation | Node 2 disconnected from network | **Node 2 disconnected (unavailable)** | Node 2 reconnected to network | Normal Operation |

WebSphere Virtual Enterprise Provides Continuous Operations – Even During Maintenance

- Application Edition Management
  - ▶ WebSphere Virtual Enterprise supports managing multiple editions of an application in a WebSphere cluster
    - − Explicit control over application editions (creation/activation/deletion)

- Interruption-free rollout of application updates
  - ▶ Explicit orchestration between routing agent and application servers during updates
  - ▶ Ability to "roll back" to a previous application version

- **Eliminate the need for planned web site outages!**

DEMO: WebSphere Virtual Enterprise Application Update Rollout

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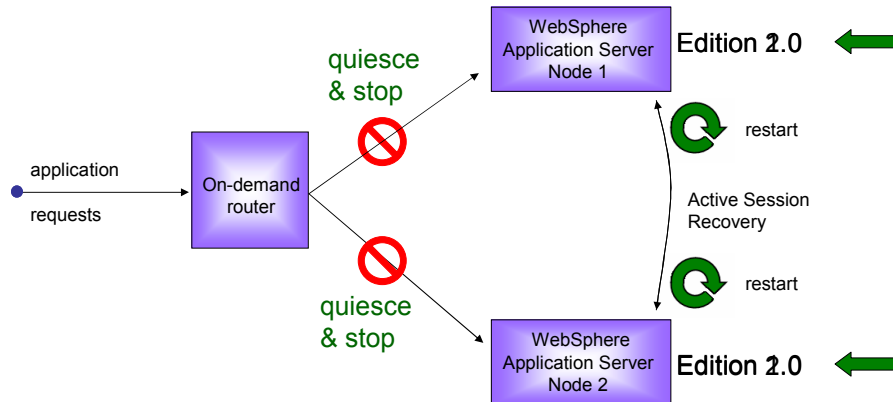
WebSphere XD Is Designed for the Data Center with More Complex Requirements

- WebSphere Virtual Enterprise
  - ▶ Eliminates planned outages
  - ▶ Quickly provisions application workloads using dynamic clusters
  - ▶ Ensures defined service levels are met by intelligently routing application service requests

- WebSphere eXtreme Scale
  - ▶ Processes large transaction volumes using in-memory data grid
  - ▶ Scales linearly

- Compute Grid
  - ▶ Enables the "batch-like" Java workloads to run in WebSphere Application Server environment

Wal★Mart Leverages WebSphere Virtual Enterprise for Infrastructure Optimization and Availability

WAL★MART

- **Problem**
  - ▶ Web sites had to be taken offline for updates
  - ▶ Peak demand for individual applications resulting in response time degradation

- **Solution**
  - ▶ Shared infrastructure based on WAS/ND and WebSphere Virtual Enterprise Operations Optimization

- **Key benefits**
  - ▶ Simplified rollouts via WebSphere Virtual Enterprise's application versioning capabilities
  - ▶ Increased system availability and reliability
  - ▶ Improved resource utilization / infrastructure optimization
    - − Reclaim 90 servers while providing capacity for 50 future applications without additional hardware purchase
  - ▶ Reduced support and administration time

Intel-based Web Environments, A Common Source of Server Sprawl

We have too many web application servers.

Let me show you how the **WebSphere Application Server running on Power Systems** can simplify your IT infrastructure.

Service Oriented Finance CIO

IBM

Scale Up From WebSphere Intel Clusters to Power Systems

- Performance advantage on Power Systems enables scale up
  - ▶ Replace Intel Servers with fewer Power Systems servers
  - ▶ Simpler environment means less administration and a reduced footprint

- Can maintain failover capabilities with server virtualization

- Partitions can communicate with each other at memory speed for additional performance advantages
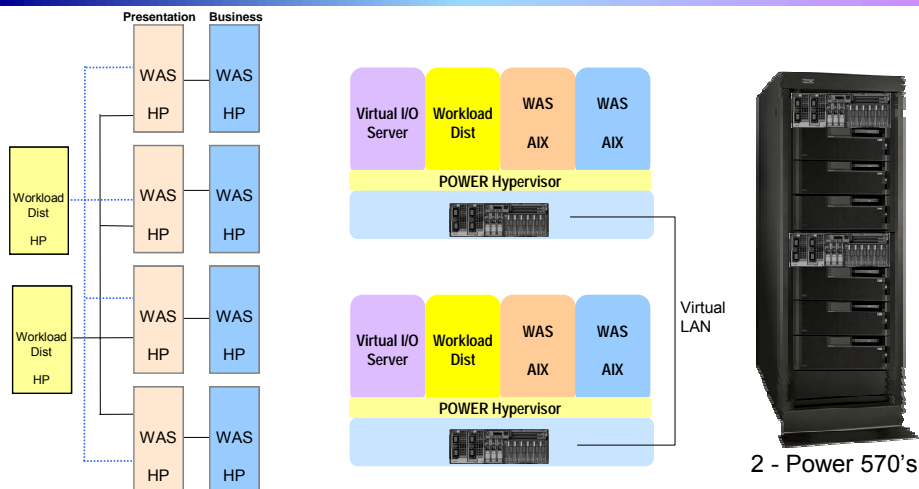
Power Systems

WebSphere Application Server
Cluster of Windows/Intel Servers

Scale-up and Consolidate to Simplify WebSphere Clusters

Presentation   Business

WAS	WAS
HP	HP

Workload Dist HP

WAS	WAS
HP	HP

Workload Dist HP

WAS	WAS
HP	HP

WAS	WAS
HP	HP

Virtual I/O Server	Workload Dist	WAS AIX	WAS AIX
POWER Hypervisor			

Virtual I/O Server	Workload Dist	WAS AIX	WAS AIX
POWER Hypervisor			

Virtual LAN

2 - Power 570's

- Scale-up to leverage performance advantages and server virtualization features
- Consolidate multiple types of workloads to a single Power Systems server
- Preserve advantages of clustering web application servers

How Can I Migrate to a WebSphere Environment on Power Systems?

I want to move to WebSphere and Power Systems to simplify my infrastructure!

JEE applications can be easily migrated from other JEE servers.
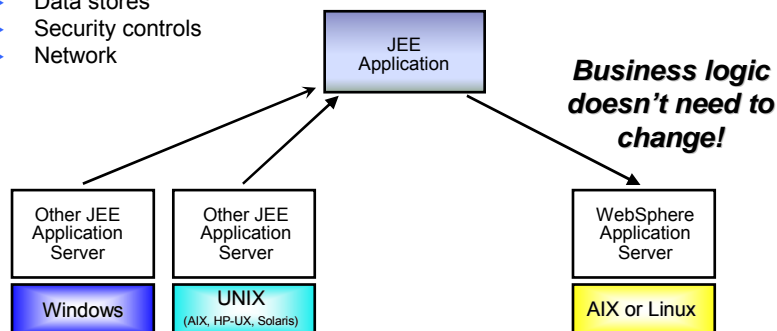
Service Oriented Finance CIO

IBM

Migrate JEE Web Applications to WebSphere on Power Systems

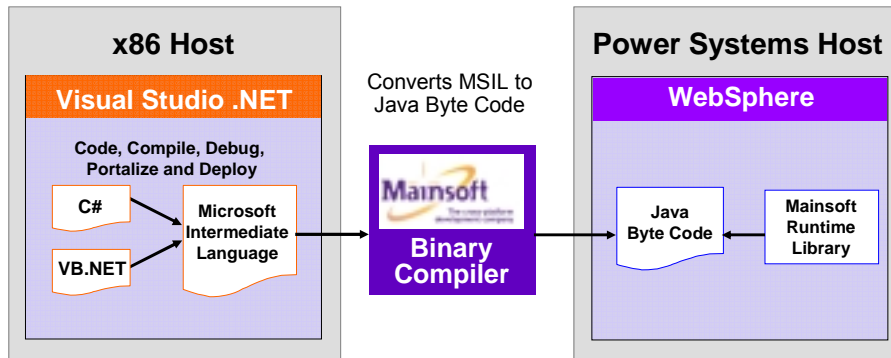**Application portability – one of the key benefits of JEE architecture**

Steps required:

1. Copy Enterprise Archive (EAR) file from other server
2. Install EAR into WebSphere Application Server
3. Specify environment-specific configuration
   - ▶ Data stores
   - ▶ Security controls
   - ▶ Network

JEE Application

Business logic doesn't need to change!

Other JEE Application Server	Other JEE Application Server	WebSphere Application Server
Windows	UNIX (AIX, HP-UX, Solaris)	AIX or Linux

Execute .NET Code on Power Systems

Visual MainWin® for Java EE

x86 Host

Visual Studio .NET

Code, Compile, Debug,
Portalize and Deploy

C# → Microsoft Intermediate Language

VB.NET →

Converts MSIL to Java Byte Code

Mainsoft
The cross platform development company

Binary Compiler

Power Systems Host

WebSphere

Java Byte Code ← Mainsoft Runtime Library

WebSphere Application Server Consolidation Business Case

- Current environment
  - ▶ JEE application on WebSphere Application Server on Red Hat Linux
  - ▶ 30 HP Integrity rx2600 servers
    - − 2 workload distributors
    - − 14 presentation tier nodes
    - − 14 business logic tier nodes
  - ▶ HP servers are used at 27% capacity

Annual Cost Per Unconsolidated Server*

Power and Cooling	$731
Floor Space	$987
Annual Server Maintenance	$829
Annual Connectivity Maintenance	$213
Annual Disk Maintenance	$203
Annual Software Support	$3,263
Annual Enterprise Network	$1,024
Annual System Adminstration	$20,359
Total Annual Costs	$27,609

* Source: IBM internal consolidation project

For 30 unconsolidated servers, annual costs are $828,280

Consolidation Cost Summary and Comparison

Power Systems One Time Charge

Server Acquisition	$ 725,582
Connectivity Acquisition	$ 38,322
Disk Acquisition	$ 98,719
Software Licenses	$ 80,699
Migration Cost	$ 336,993
Total OTC (Cost of migration)	$ 1,280, 314

Price Sources — Power 570 and maintenance, Red Hat Linux and maintenance: IBM Technical Sales; WebSphere Application Server: IBM.com Passport Advantage Express Software Catalog; HP Integrity and maintenance: HP TPC-C benchmark report.

81% reduction in energy consumption

97% reduction in floor space costs

Power Systems Annual Cost

	Year 1	Year 2, 3
Power and Cooling	$ 4,214	$ 4,214
Space	$ 1,125	$ 1,125
Annual Server Maintenance	$ 33,564	$ 33,564
Annual Connectivity Maintenance	$ 1,533	$ 1,533
Annual Disk Storage Maintenance	$ 3,949	$ 3,949
Annual SW Support	$ 1,499	$ 17,339
Annual Enterprise Network	$ 13,824	$ 13,824
Annual System Administration	$ 82,889	$ 82,899
Total Annual Costs	$ 142,596	$ 158,436

Unconsolidated Annual Cost

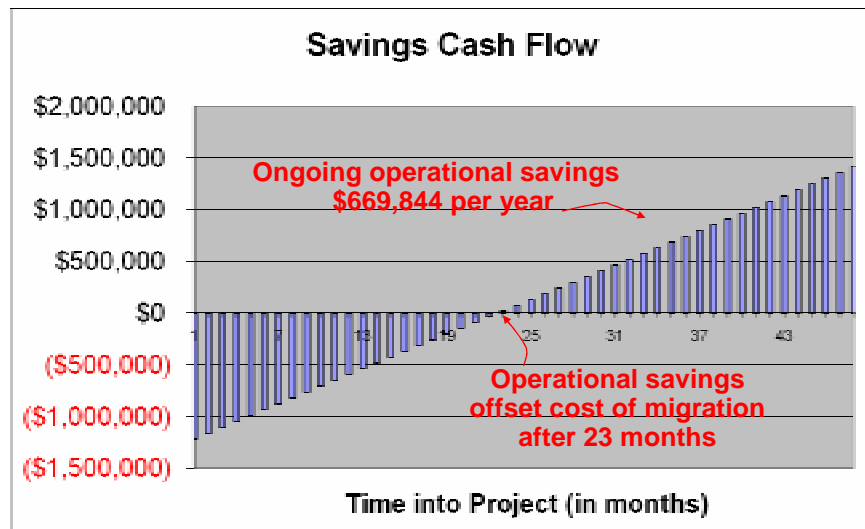|	
Power and Cooling	$ 21,930
Space	$ 29,610
Annual Server Maint	$ 24,880
Annual Connectivity Maintenance	$ 6,390
Annual Disk Storage Maintenance	$ 6,090
Annual SW Support	$ 97,890
Annual Enterprise Network	$ 30,720
Annual System Administration	$ 610,770
Total Annual Costs	$ 828,280

Operational cost savings = $ 669,844 per year, break even in 23 months

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WebSphere Application Server Cash Flow Analysis

Savings Cash Flow When Consolidating 30 HP Servers to 1 Power Systems Server

Savings Cash Flow

Ongoing operational savings $669,844 per year

Operational savings offset cost of migration after 23 months

Time into Project (in months)
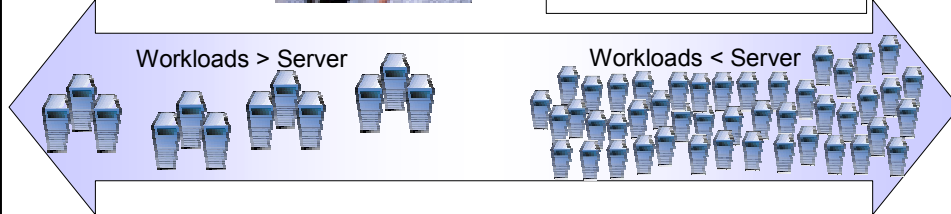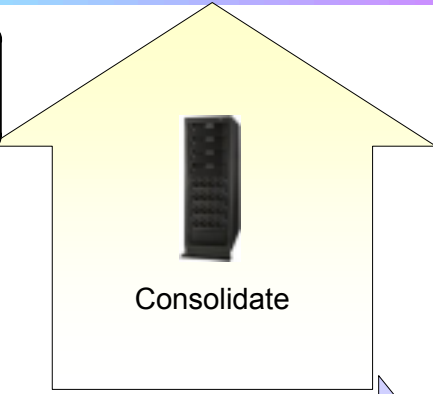
References, Additional Information

- MainSoft contact: Ron Johnsen – VP WW Sales, ronj@mainsoft.com USA 408 200 4023

- WebSphere 64-bit performance whitepaper: ftp://ftp.software.ibm.com/software/webserver/appserv/was/64bitPerf.pdf