IBM System z Technology Summit

zEnterprise – The First System Of Systems

Deploying Web Applications

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zEnterprise Offers A Choice Of Platforms For Deploying Web Applications

WebSphere on x86 blade in zBX

WebSphere on Power blades in zBX

Groups of Applications With Different Requirements

WebSphere for Linux on z

WebSphere for z/OS

Power and x86 Blades
- ■ Access to back-end data and transactions via secure, private network
- ■ Blades managed by Unified Resource Manager

Linux on z
- ■ Optimized access to z/OS via hipersockets
- ■ Resource management via z/VM
- ■ Uses IFLs for lower costs

WebSphere for z/OS
- ■ Best integration with local back-end data access
- ■ Advanced workload management
- ■ Highest security
- ■ Large scale clustering, high availability, and disaster recovery

Let's consider three kinds of applications to compare deployment tradeoffs

1. Low cost application with basic Quality of Service (QoS) requirements

2. A transactional application with higher quality of service requirements

3. A mission-critical application requiring continuous availability and disaster recovery

Scenario #1: Simple Java Application

A Java application reads and updates a modest database on the same server

- Low cost is a key requirement
- No back-end access is needed
- Basic security and QoS requirements
- Application, Application Server and Database are co-located on the same server in all cases

Java Application

WebSphere

DB2

Server
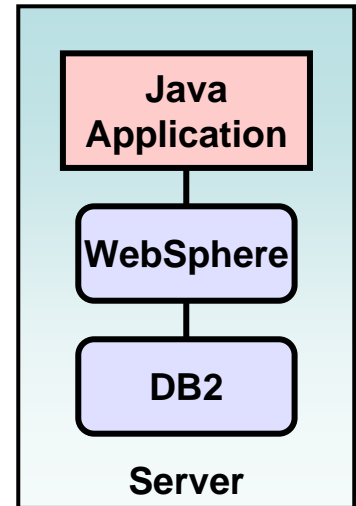
Which is the best zEnterprise deployment option?

Results Of Benchmark And 3 Year Cost Study For Simple Application

WebSphere and DB2 on x86 Blade in zBX

x86 Blade running 4 cores
675 transactions/second
$428 per TPS

WebSphere and DB2 on Power Blade in zBX

PS701 running 4 cores
2,425 transactions/second
$106 per TPS   **Lowest Cost Solution**

Self-contained WebSphere Application with DB2

WebSphere and DB2 for Linux on z

Linux on z running on 4 IFLs
2,275 transactions/second
$317 per TPS

WebSphere and DB2 for z/OS

z/OS running on 2 zAAPs and 2 GP cores
1,005 transactions/second
$763* per TPS

* Price based on 2009 Solution Edition
for WebSphere on System z10. z196
pricing is not available yet.

Which Is The Best Fit For Purpose?

- The application requirements can be satisfied easily with any of the platforms

WebSphere and DB2 on zBX Power blade

- The main requirement is lowest cost, and for this case costs vary widely

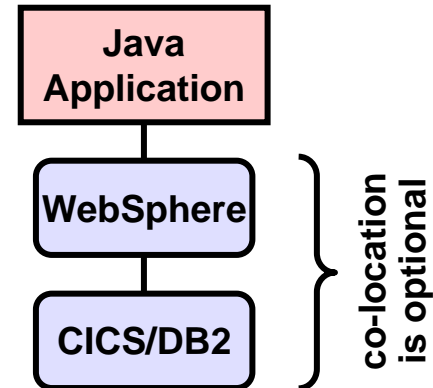⇨ The Power Blade solution offers lowest cost and good Qualities of Service

Scenario #2: Application Interfacing With Mission-Critical Transactions

A Java application provides a Web interface to business data and transactions hosted by DB2 and CICS on a zEnterprise
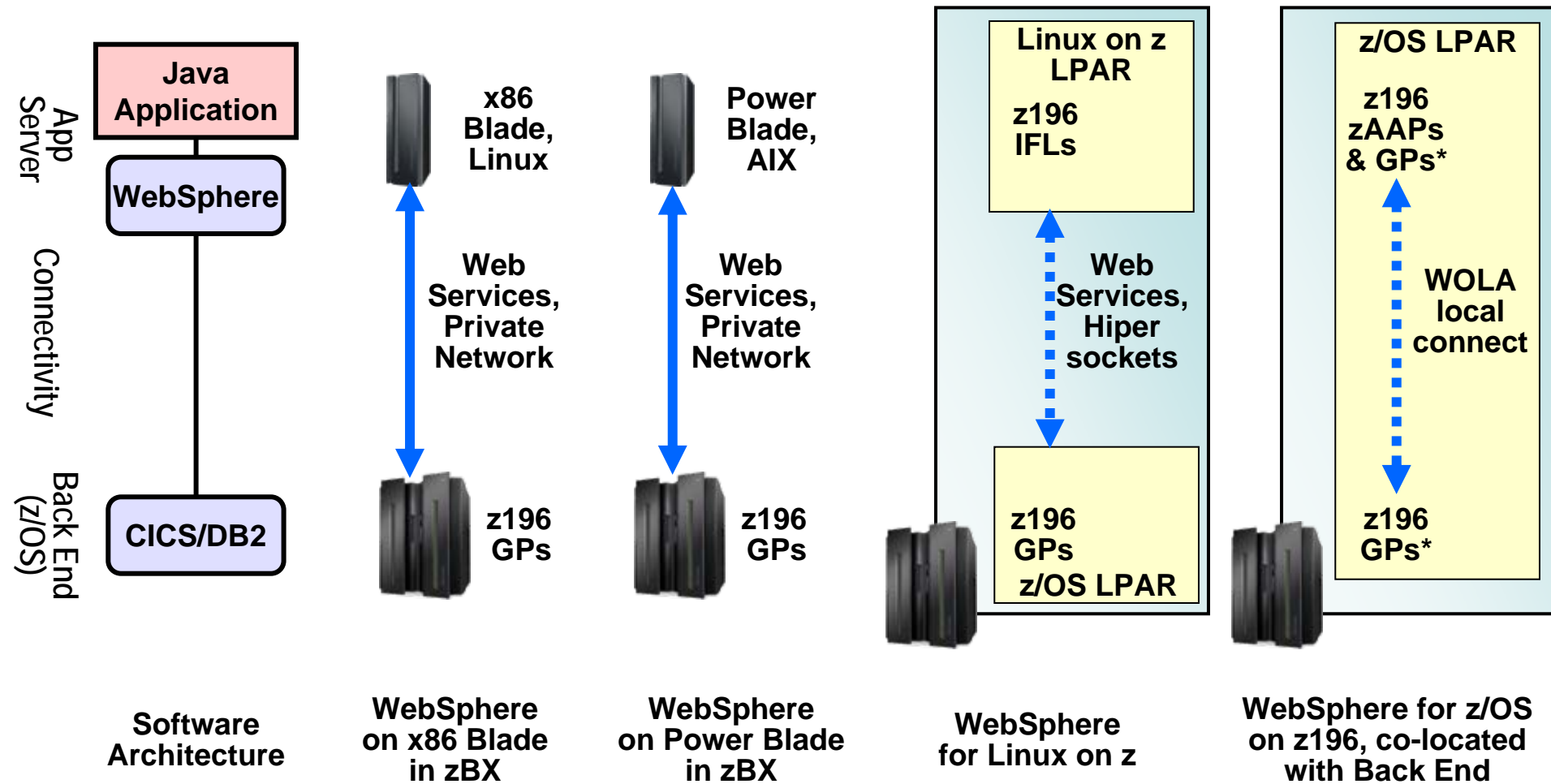
- Higher QoS requirements
    - ▶ Transaction integrity
    - ▶ Typical security requirements
- Solution cost is important, but is second to meeting QoS requirements

```
┌──────────────┐
│     Java     │
│  Application │
└──────────────┘
        │
┌──────────────┐  ┐
│  WebSphere   │  │ co-location
└──────────────┘  │ is optional
        │         │
┌──────────────┐  │
│   CICS/DB2   │  │
└──────────────┘  ┘
```

Which is the best zEnterprise deployment option?

Let's Compare Four Deployment Options

App Server

Connectivity

Back End (z/OS)

Java Application

WebSphere

CICS/DB2

Software Architecture

x86 Blade, Linux

Web Services, Private Network

z196 GPs

WebSphere on x86 Blade in zBX

Power Blade, AIX

Web Services, Private Network

z196 GPs

WebSphere on Power Blade in zBX

Linux on z LPAR

z196 IFLs

Web Services, Hiper sockets

z196 GPs

z/OS LPAR

WebSphere for Linux on z

z/OS LPAR

z196 zAAPs & GPs*

WOLA local connect

z196 GPs*

WebSphere for z/OS on z196, co-located with Back End

* Shared GP processor pool

Results Of Benchmark And 3 Year Cost Study For Bank Transaction Application

Banking transaction application on WebSphere with CICS/DB2

WebSphere on x86 Blade in zBX

WAS on 5 cores on x86 Blade in zBX
Incremental CICS on 2 added GPs
1,950 transactions per second
$3,346 per TPS **Low Cost Solution**

WebSphere on Power Blade in zBX

WAS on 5 Power cores on PS701 blade in zBX
Incremental CICS on 2 added GPs
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WebSphere for Linux on z

WAS on 4 Added IFLs, Solution Edition Pricing
Incremental CICS on 2 added GPs
2,035 transactions per second
$3,498 per TPS **Low Cost Solution**

WebSphere for z/OS

WAS z/OS and CICS on 12 cores (4 GPs, 8 zAAPs*)
2,480 transactions/second, IWP and GSSP pricing
$3,885 per TPS ←**1.17x Power Blade cost**

* Existing workload (435 MSUs) uses 4 GPs, allowing 8 zAAPs total.

Similar costs invite other considerations

Considerations Of The Power Blade/zBX Solution

- Lowest cost

- Unified Resource Manager provides centralized system monitoring and management

WebSphere on zBX Power blade

- Connect to z196 using a high-speed private network

  ▶ Software security between the Power blade and the z196 is not required

Advantages Of The x86 Blade/zBX Solution

- Low cost

- Unified Resource Manager provides centralized system monitoring and management

WebSphere on zBX x86 Blade

- Connect to z196 using a high-speed private network

  ▶ Software security between the x86 blade and the z196 is not required

Linux On System z Is Great For Consolidation

- **Low cost**

- **Linux on z leverages System z reliability**

- **Both WebSphere and commercial applications work well on Linux on z**

- **Very good security**

  ▶ Virtual network cannot be hacked like a real network

**WebSphere
for Linux on z**

Quality Of Service Advantages From WebSphere For z/OS May Be Worth The Extra Cost

- Advanced Workload Management
  - ▶ On other platforms, you need WebSphere Virtual Enterprise at extra cost
- Co-location benefits: running WebSphere in the same LPAR with back-end systems
  - ▶ WOLA communications between WebSphere and CICS significantly reduces CICS MSU cost compared to hybrid and distributed solutions using Web services
  - ▶ Local JDBC Type 2 and WOLA communications give faster response time compared to hybrid and distributed solutions
  - ▶ Robust, high-speed two-phase commit between WAS and CICS
- Leverages System z High Availability and security features to provide the most secure, robust and reliable solution
  - ▶ Disaster Recovery options are also available
- These and other advantages come at extra cost
  - ▶ In the previous study, the cost was **1.17x** the lowest-cost solution
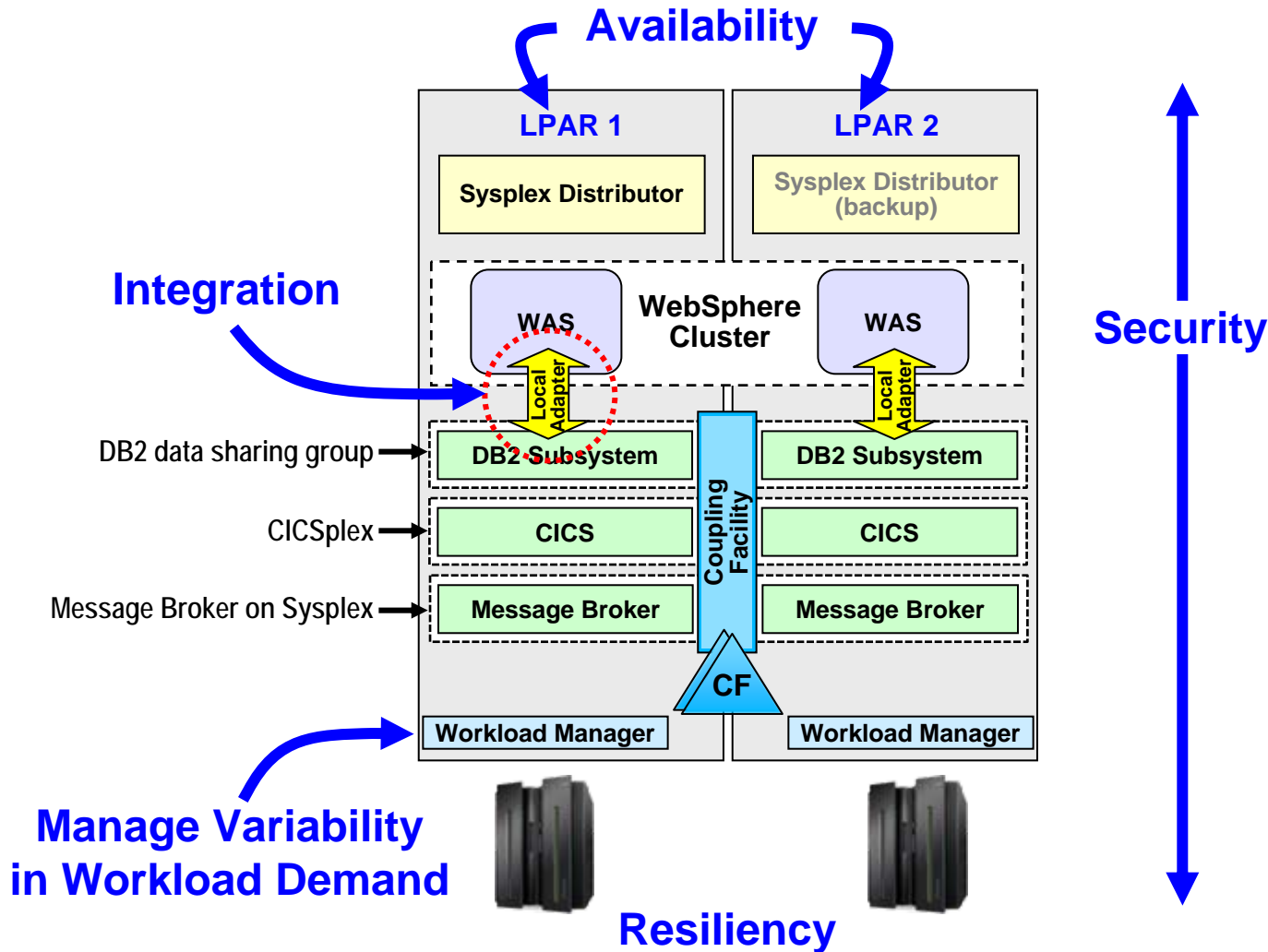
WebSphere for z/OS

Scenario 3: Multi-tier Application – Connect To Backend Systems, HA With DR

- **Requirement: Mission-critical Java applications with back-end support for**

  - ▶ Database read/update from one or more databases

  - ▶ Invoke back-end transactions

- **Substantial QoS requirements:**

  - ▶ Transaction Integrity and Security

  - ▶ High Availability and Disaster Recovery

  - ▶ Workload Management to ensure Service Level Agreements are met

- **Solution cost is important, but second to QoS requirements**

Java Application

application server   application server

co-location is optional

Backend systems
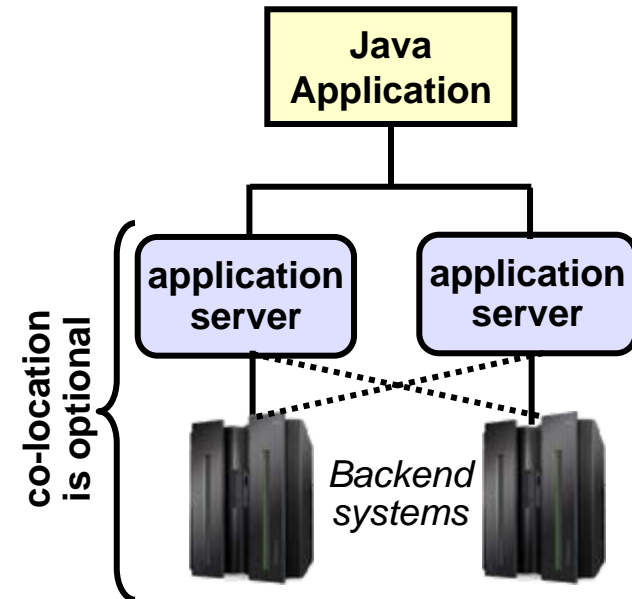
WebSphere For z/OS Can Be Deployed In A Parallel Sysplex Configuration

Availability

Integration

Security

LPAR 1	LPAR 2
Sysplex Distributor	Sysplex Distributor (backup)

WebSphere Cluster

WAS — Local Adapter

WAS — Local Adapter

Coupling Facility

DB2 data sharing group → DB2 Subsystem | DB2 Subsystem

CICSplex → CICS | CICS

Message Broker on Sysplex → Message Broker | Message Broker

CF

Workload Manager | Workload Manager

Manage Variability in Workload Demand

Resiliency

Let's see how WAS for z/OS provides these capabilities

Parallel Sysplex Is The Key Enabler For High Availability

- **Parallel Sysplex** links two or more cooperating hosts in an Active/Active configuration

- **Coupling Facility** provides memory shared between hosts for
  - Locks
  - Cache
  - Data lists

- **Clusters** group cooperating middleware instances across the Sysplex
  - If one instance fails, another takes the load
  - Incoming transactions intelligently distributed to WAS instances in the cluster for load balancing
  - DB2 clusters implement data sharing
  - CICSplex shares customer workload
  - MQ uses Sysplex to provide high availability for message-driven applications

LPAR 1	LPAR 2
Sysplex Distributor	**Sysplex Distributor (backup)**

WebSphere Cluster

WAS   WAS

DB2 Subsystem	DB2 Subsystem
CICS	CICS
Message Broker	Message Broker

Coupling Facility

CF

| Workload Manager | Workload Manager |
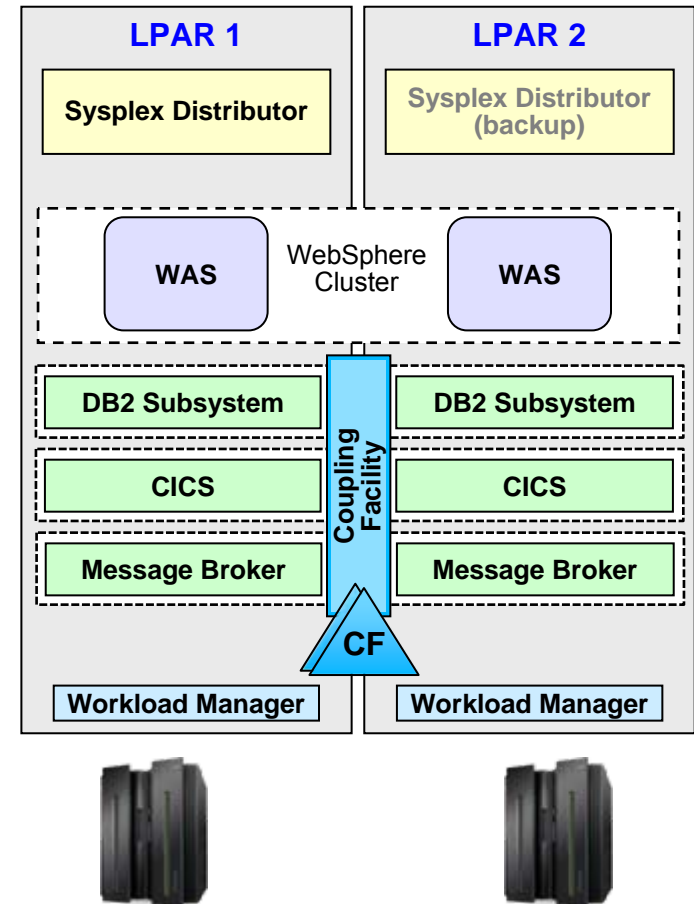
Sysplex Distributor Sends Incoming Requests To Best Available Server

- Sysplex Distributor is an intelligent router
  - ▶ Receives incoming requests
  - ▶ Determines which potential target LPAR is the best
  - ▶ Redirects the request to that LPAR

- It uses current load information from Workload Manager to support dynamic load balancing among WebSphere instances

- In the event of a failure in the LPAR or TCP stack, Sysplex Distributor functions **automatically** move to a backup TCP/IP stack

- All of this is transparent to the user and the applications

Incoming Requests

Sysplex Distributor

Sysplex Distributor (backup)

Current Load Info

WAS **WebSphere Cluster** WAS

Workload Manager   **Workload Manager**
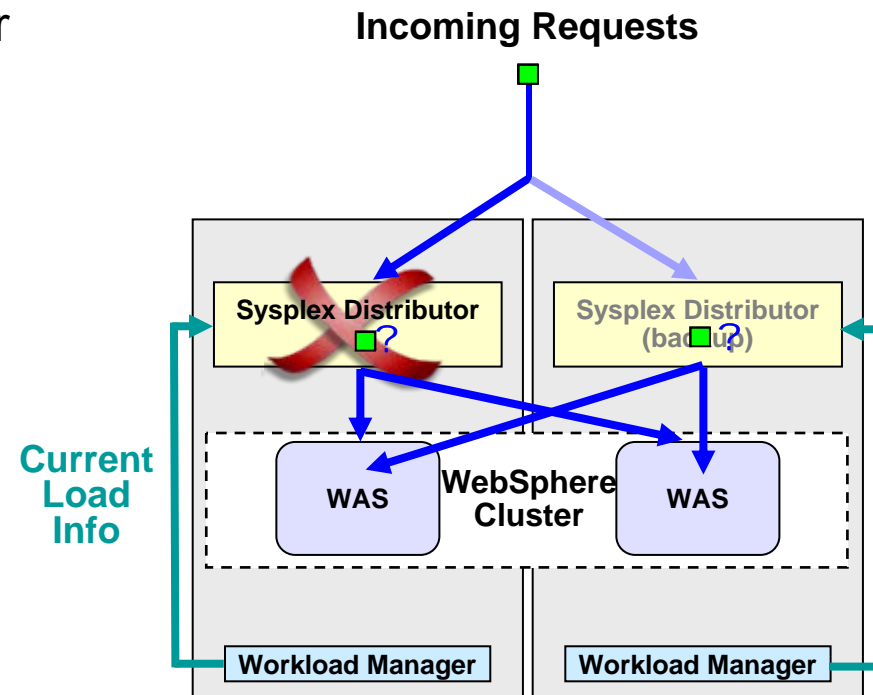
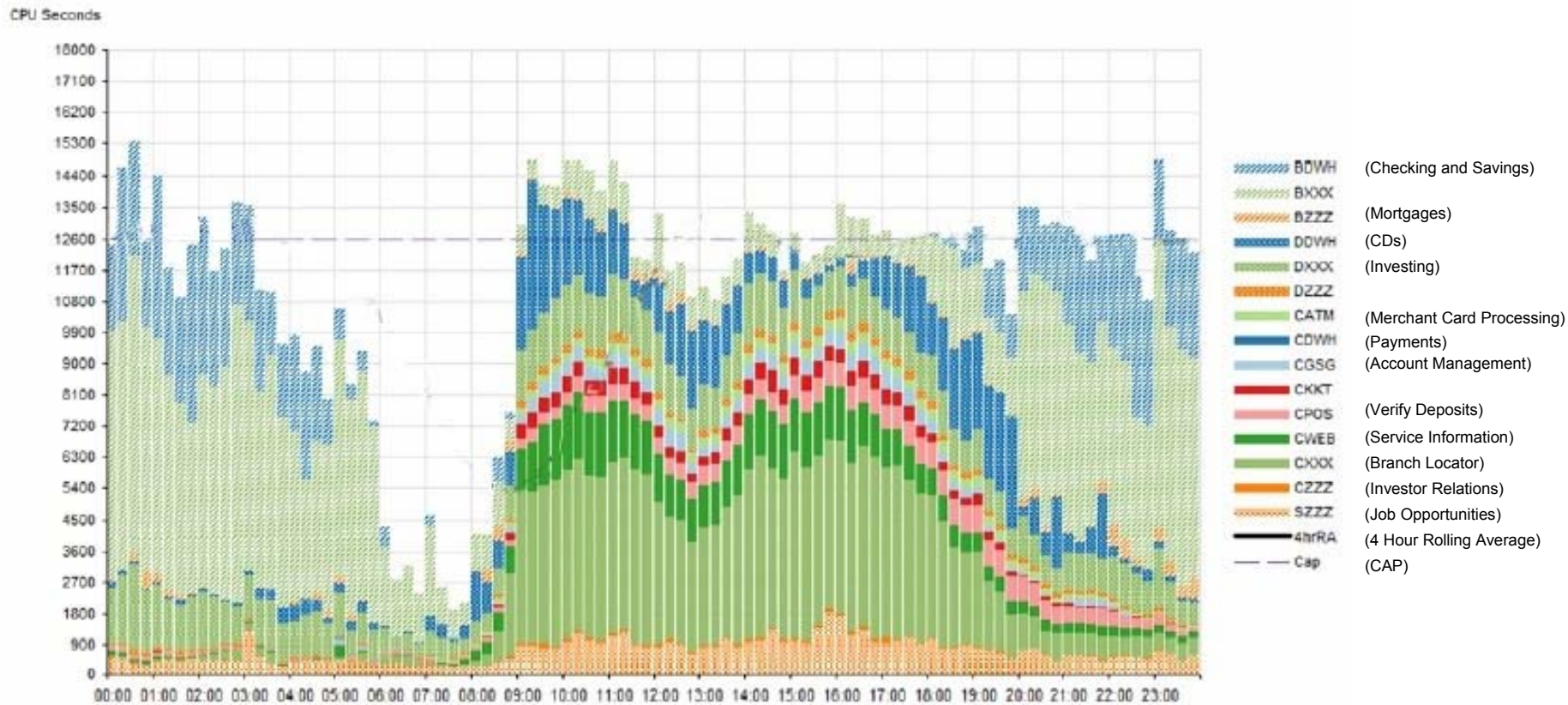# Mixed Workloads Share Pooled Processing Resources
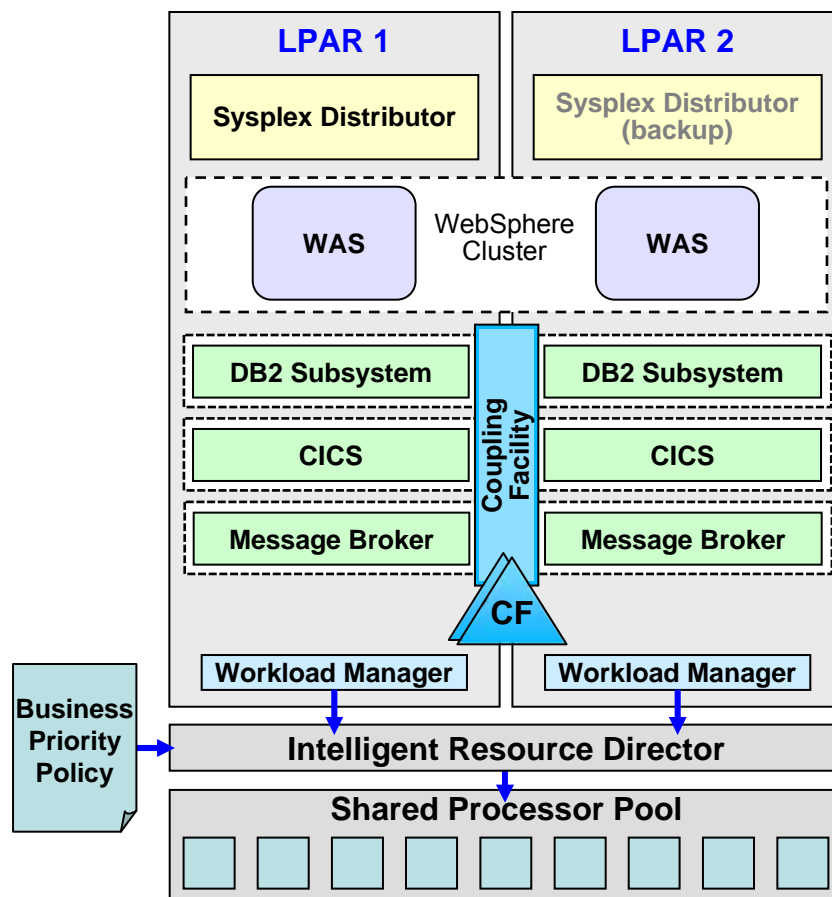
Workloads with light, medium, and heavy variation
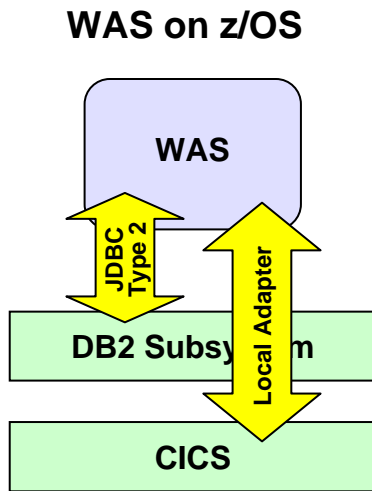share the same pool of processors

Sharing Processors Eliminates Wasted Resources Of Distributed Servers
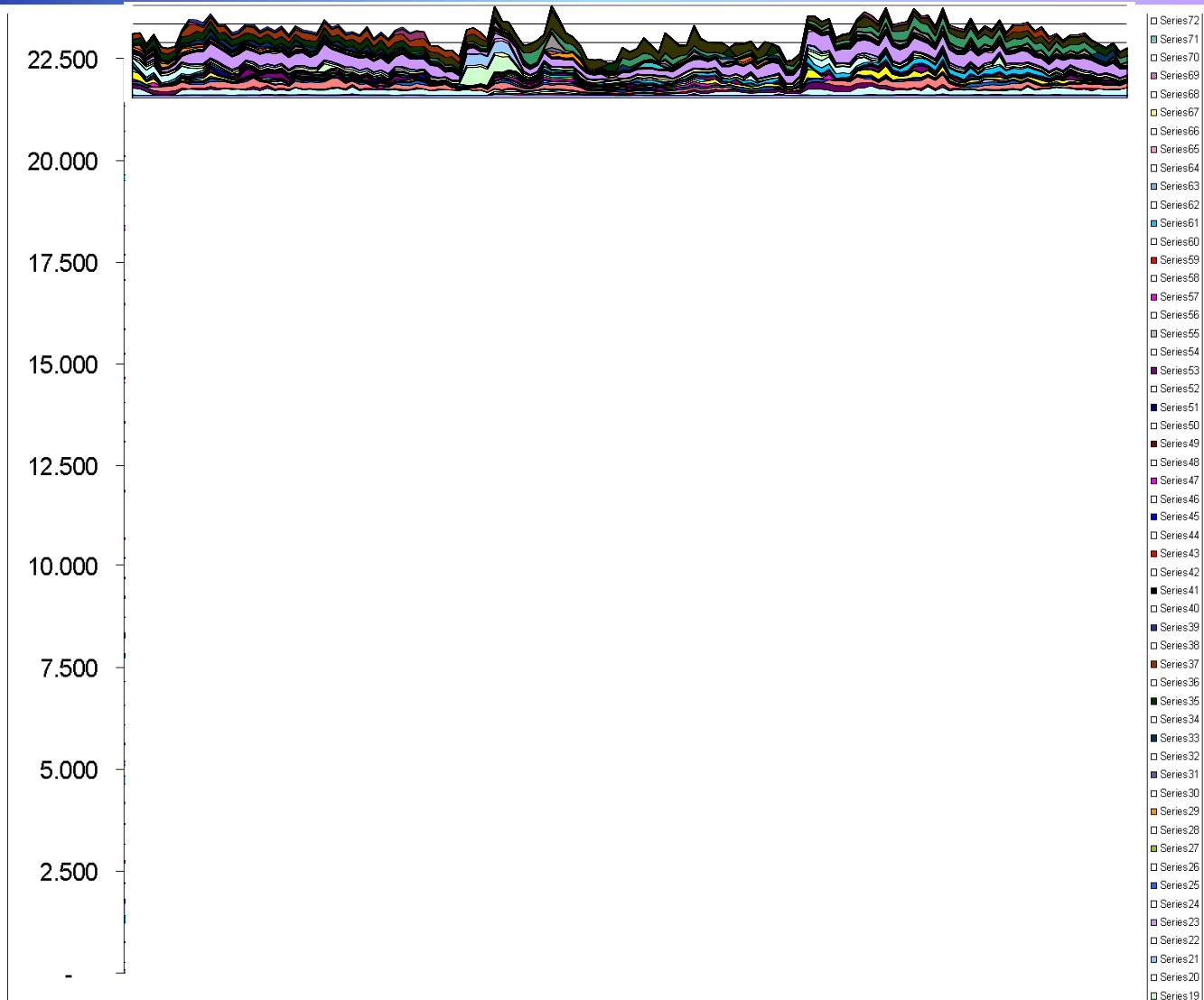
zEnterprise Shared Processors Achieve Competitive Costs Per Workload

Webplex Co-locates Applications With Backend Systems For Efficiency And Security

WAS on z/OS

Hybrid Design

- Data can be shared in memory between WAS, DB2, and CICS by co-locating in same LPAR
  - ▶ Local adapters provide direct, cross-memory access
  - ▶ Optimal performance, faster response time
  - ▶ Security - data stays in same physical host
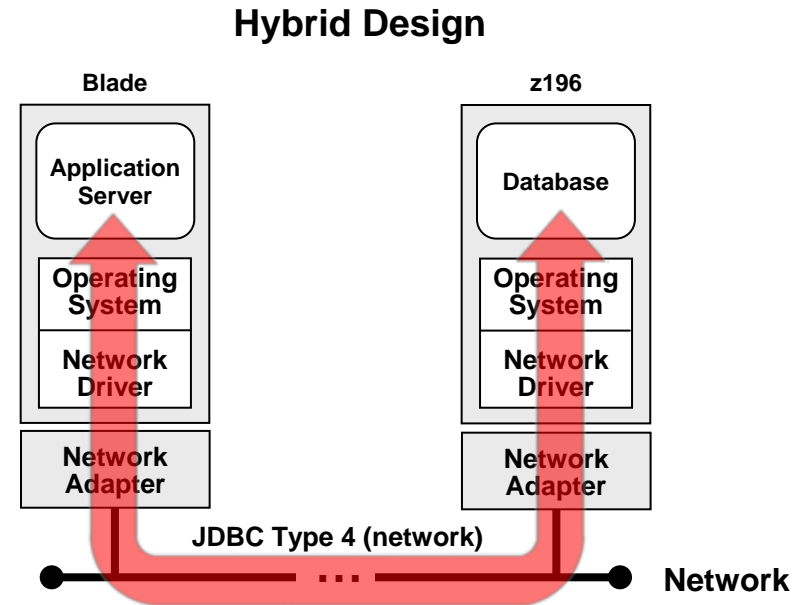
- Hybrid design separates applications from data and transactions
  - ▶ Accumulates network latency
  - ▶ Web services overhead – XML Parsing, serializing and deserializing Java objects, etc

What Are WebSphere Optimized Local Adapters (WOLA)?
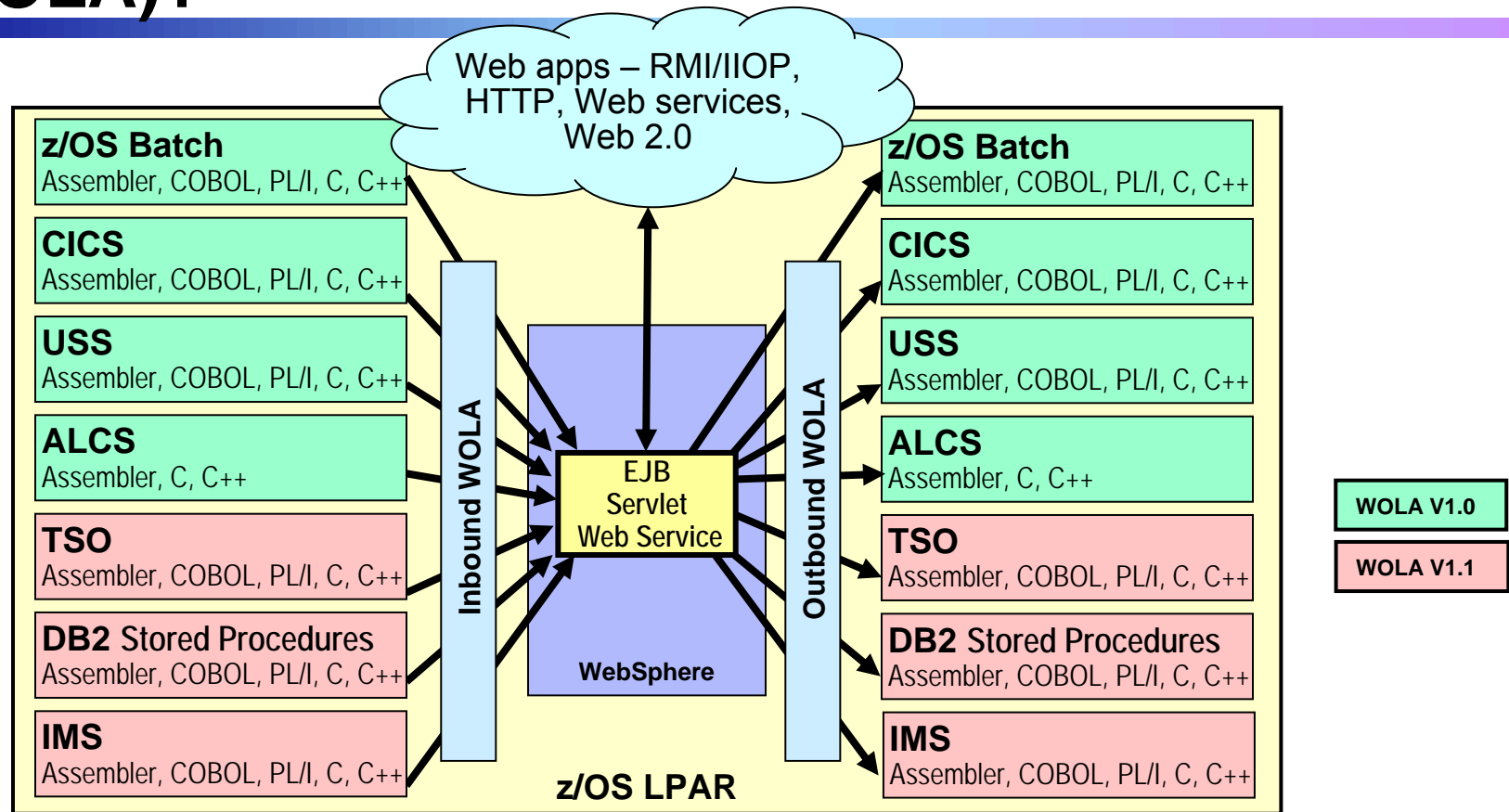
WOLA supports fast, **bi-directional,** local calls between z/OS native apps and WebSphere apps for

- Global transactions, security propagation, WLM context passing
- 1-phase and 2-phase commit from WAS to CICS
- WOLA v2 improves CICS Transactions support

A Secure Foundation

- **zEnterprise has the highest commercial common criteria ratings**
  - ▶ PR/SM rated at EAL 5
- **Workload Isolation**
  - ▶ zEnterprise Hypervisor maintains strict isolation between workloads
  - ▶ Hardware coded storage protect keys protects system and user workloads
  - ▶ Architecture design makes typical buffer overflows and virus payloads inoperable
- **Integrated access control throughout the stack**
  - ▶ RACF enforces access control and logs security events
- **Secure cryptographic encoding**
  - ▶ On-chip crypto hardware assist
  - ▶ Optional high speed cryptographic processors
  - ▶ Support for Advanced Encryption Standard (AES) 192 and 256, SHA-384 and SHA-512

z/OS Provides Essential Network Security For Applications

- Communication Server for z/OS ensures that
    1. The partner is who it claims to be (endpoint authentication)
    2. Data came from the intended partner (data origin authentication)
    3. Data was not changed since it was sent via digital signatures (data integrity)
    4. Only the intended receiver can understand the data via encryption (data confidentiality)

- Data integrity and confidentiality are accelerated by zEnterprise cryptographic hardware

z/OS Provides Advanced Network Security

- Communications Server for z/OS provides the first line of defense against **network attacks**
    - ▶ Intrusion detection services
    - ▶ Dynamic defensive filtering protect from denial of service attacks
    - ▶ IPSec can encrypt data end-to-end, or across any portion, as controlled by a policy document
    - ▶ IPSec VPN offers system-to-system security, transparently to applications
    - ▶ SSL/TLS provides application-to-application security
- Communications Server for z/OS supports **memory-to-memory hipersocket connections** for internal communications
- z/OS HTTPS conforms 100% to the standard, but adds:
    - ▶ Ability to store keys in SAF (RACF) <u>or</u> file stores
    - ▶ Use of crypto hardware accelerator to speed up the encryption and decryption processes

WebSphere Application Server For z/OS Is The Ideal Web Infrastructure

- **WebSphere Application Server (WAS) for z/OS is also the foundation for**

  - ▶ WebSphere Process Server for z/OS

  - ▶ WebSphere Enterprise Service Bus for z/OS

  - ▶ WebSphere Portal for z/OS
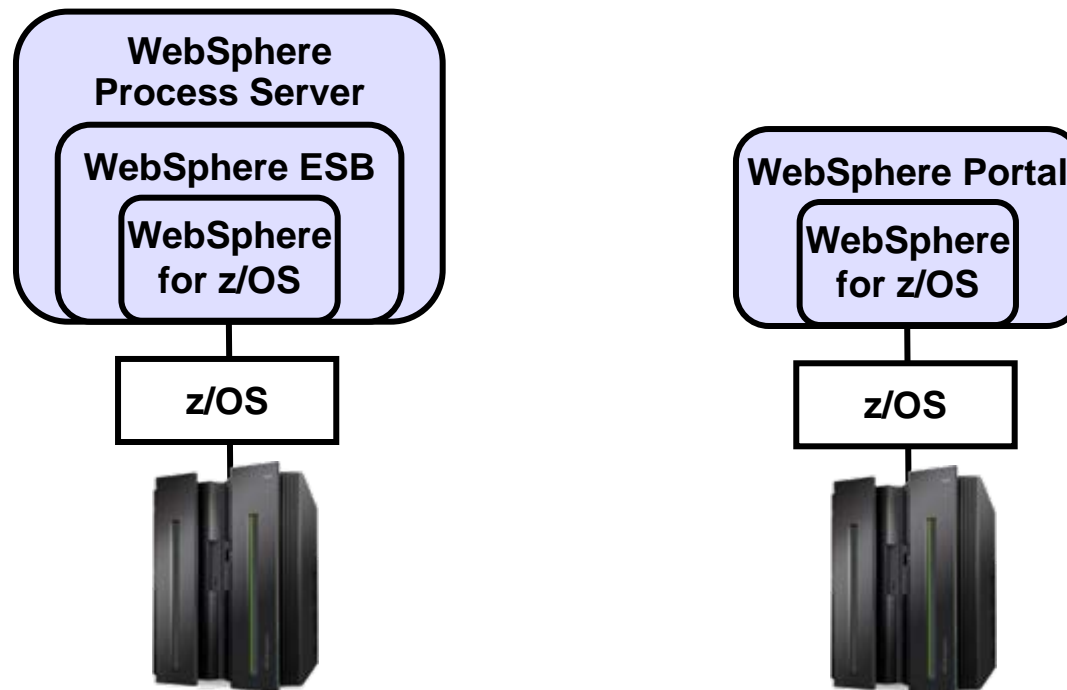
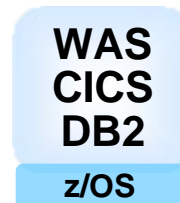# Getting Started Subcapacity Pricing (GSSP) for WebSphere for z/OS

- **Problem:** You add WebSphere to existing LPAR for optimal communication with CICS or DB2, its initial utilization is low, but it's charged as if it was heavily used

- **Solution:**
  - ▶ If GP utilization for WebSphere is less than 50% of the new LPAR size, then the WebSphere GSSP price is based on twice the WebSphere GP MSUs instead of the new LPAR size

- **Example:**

CICS DB2

z/OS
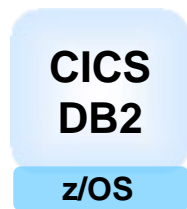
Existing LPAR
Size: 435 MSUs

Add new application:
+ 145 MSUs WAS*
+ 137 MSUs CICS
+ 18 MSUs DB2
+ 60 MSUs other

WAS CICS DB2

z/OS

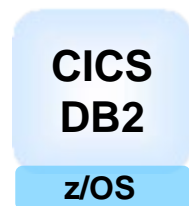**New LPAR**
Size: 795 MSUs

WebSphere for z/OS, 3-year TCA:
- BAU Price: $832K
- GSSP Price: $410K

51% WAS discount with GSSP!

* Total new WAS workload: 965 MSUs
  zAAP-eligible portion: 820 MSUs (85% offloaded – no software charge)
  WAS GP portion: 145 MSUs
  WAS BAU cost basis: 795 MSUs
  WAS GSSP cost basis: 290 MSUs

Integrated Workload Pricing (IWP)
# For WebSphere with CICS, IMS, Or COBOL

- **Problem:** You add WebSphere to existing LPAR for optimal communication with CICS or DB2, but this increases the price for CICS for your existing applications

- **Solution:**
  - ▶ CICS and/or IMSis priced at the new LPAR size <u>excluding</u> the WebSphere GP MSUs
  - ▶ Other software (DB2, z/OS, etc) are priced at new LPAR size, as usual

- **Example:**

CICS DB2

z/OS

Existing LPAR Size: 435 MSUs

Add new application:
- + 145 MSUs WS
- + 137 MSUs CICS
- + 18 MSUs DB2
- + 60 MSUs other

WS CICS DB2

z/OS
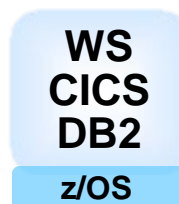
New LPAR Size: 795 MSUs

CICS, 3-year MLC charges:
- ▪ BAU, based on 795 MSUs: $886K
- ▪ IWP, based on 650 MSUs: $570K

36% CICS discount with IWP!

GSSP And IWP Can Be Used Together To Save You Money

WebSphere on x86 Blade in zBX

WAS on 5 cores on x86 Blade in zBX
Incremental CICS on 2 added GPs
1,950 transactions per second
$3,346 per TPS

WebSphere on Power Blade in zBX

WAS on 5 Power cores on PS701 blade in zBX
Incremental CICS on 2 added GPs
1,975 transactions per second
$3,330 per TPS

WebSphere for Linux on z

WAS on 4 Added IFLs, Solution Edition Pricing
Incremental CICS on 2 added GPs
2,035 transactions per second
$3,498 per TPS

Banking transaction application on WebSphere with CICS/DB2

WebSphere for z/OS

WAS z/OS and CICS on 12 cores (4 GPs, 8 zAAPs)
2,480 transactions/second

$4,183 per TPS using Business as Usual Pricing   **$3,885** per TPS IWP and GSSP pricing

Development Manager — "We are building SOA and use XML, but we use **many** other data formats – from COBOL copybook to industry-specific formats"

IBM — "DataPower appliances provide any-to-any data transformations – with full integration with System z!"

DataPower XI50B Advanced Data Integration Appliance Reduces Mainframe Processing

- An SOA appliance in a blade form
  - **Any-to-Any data transformation at wire speed**
    - between XML, COBOL copybooks,
      text, industry standards, or custom formats
  - Built-in **XML parsing** and **transformation**
    - Convert between XML schemas
  - **Content-based routing**
  - Creates **bridges between messaging protocols**
    - MQ, WebSphere JMS, third-party JMS, FTP, HTTP
  - **Direct-to-database access** for DB2, Oracle, and Sybase
    - Use XML to directly insert, modify, query, and retrieve database info
  - **Advanced security capabilities** based on industry standards
  - Data validation,
  - Field-level security
  - Web services management
  - Access control

WebSphere DataPower XI50B

System z With WebSphere DataPower XI50B Is A Powerful Synergy

- Higher performance with DataPower hardware acceleration, reduces CPU usage

- Enables Web services for z backend systems

  - ▶ IMS, COBOL via copybook, DB2 (and other databases), CICS

- z/OS Sysplex Distributor performs load distribution to multiple DataPower blades

- XI50B Complementary High Availability features
  - ▶ Dual power supplies
  - ▶ Active/passive failover support
  - ▶ No spinning media
  - ▶ Self-healing capability

- Remote SAF/RACF and Crypto security integration

In the first half of 2011, IBM intends to offer a WebSphere DataPower appliance for IBM zEnterprise System on zBX model 002

Summary: Deployment Options For WebSphere on zEnterprise

- Power and x86 blades in a zBX offer the lowest-cost solution for simple Web applications, while benefiting from Unified Resource Management

- WebSphere for z/OS provides the most secure and reliable deployment platform, with the best Qualities of Service available and automated Disaster Recovery

- WebSphere DataPower offloads data transformation and message routing, provides security, and will soon be available for zEnterprise

The Best Fit for Purpose depends on application requirements – zEnterprise gives you four choices for optimal WebSphere deployment!