

Considerations for making System z your ESB deployment platform

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Introduction

Nearly the entire industry is talking about service oriented architecture (SOA). Service Oriented Architecture is an architectural paradigm and discipline that may be used to build infrastructures enabling those with needs (consumers) and those with capabilities (providers) to interact via services across disparate domains of technology and ownership. Services act as the core facilitator of electronic data interchanges yet require additional mechanisms in order to function. Several new trends in the computer industry rely upon SOA as the enabling foundation. These include the automation of Business Process Management (BPM), composite applications (applications that aggregate multiple services

to function), and the multitude of new architecture and design patterns generally referred to as Web 2.0 (Reference: http://www.adobe.com/enterprise/pdfs/Services_Oriented_Architecture_from_Adobe.pdf)

The widespread acceptance of this architecture is driven by several key factors. First, it vastly simplifies the interaction between multiple, potentially disparate, systems collaborating to support business operations. Second, early adopters have experienced immediate results. They have quickly validated that simplification is enabling them to deliver capabilities faster and helps reduce cost. Third, SOA is setting the stage for a new class of application that is more proactive in meeting the goals of the business.

Recent reports suggest that SOA is now accepted as the defacto approach for infrastructure. Even when businesses do not look to implement SOA across their organization, they will instead implement projects that are likely to reflect SOA practices and behaviors. Many businesses are now doing second generation SOA projects having learned from their initial efforts and are seeing reuse benefits as additional projects rollout.

SOA is about interconnecting application silos—silos that are present on different platforms and perhaps even on systems owned by different businesses. The result can be the breaking down of the silos, leading to better synergy across the business. As a result, it can be challenging to ensure that each platform and project is working to meet the collective service objective for the user who may be in any part of the business. In the past, when applications ran under a single operating system, this task was simpler because there was a single point of control, and the operating system had immediate visibility to all of the parts—applications, data and systems. This end-to-end visibility, in part, is what is making consolidation so appealing, especially as format and protocol differences can be

taken care of by a well architected SOA. However, it is impractical to think that everything can be consolidated onto a single platform. Different parts of the solution might benefit from specific platforms and certainly there will be a significant level of investment in existing systems. You need to tie these systems together so that you can make the most of their individual strengths while managing their interaction to meet service-level commitments.

This white paper explores connectivity as fundamental in implementing SOA, with the enterprise service bus (ESB) at the heart of a successful SOA implementation. It looks at the choice of deployment platform as one of the factors that alleviates a number of concerns that you might have regarding your ESB reliability and performance. And it discusses cost, overall solution maturity and the ability to efficiently connect all your systems, applications and services.

Indeed, for many organizations, the ability to continue deriving extra value from existing IBM System z® assets by reusing enterprise data, applications and skills in an SOA is one of the key considerations. Mainframes contain significant core assets in business data, applications and experienced resources, with an estimated applications-replacement cost of US\$20 trillion.¹ Organizations rely on IBM CICS® Transaction Server to handle transactions valued at more than US\$1 trillion per week,² and IBM IMS™ systems to handle more than 50 billion transaction per day. The opportunity to use this valuable asset base by employing an SOA is compelling. Furthermore, the unique characteristics of the System z platform make it an attractive, if not essential, element of an enterprise-wide SOA.

What is the value of your current System z assets to your organization? As you decide which System z assets need to be exposed as SOA services to continue deriving value, and as you review your key implementation requirements, such as reliability and performance, and choose your connectivity solution,

you have to answer the fundamental question: which deployment platform do I choose? Especially for the ESB, which is widely regarded as a key element of an SOA implementation.

System z might be the right platform for your ESB, because it:

- Enables cost-effective reuse of System z assets.
- Provides exceptional security, compliance, business resiliency and availability for the most-critical core element of your SOA infrastructure—the ESB.
- Minimizes the business risk inherent in unpredictable ESB workloads.
- Provides the computing power, versatility and management centralization to support your datacenter consolidation.
- Offers significantly improved ESB execution characteristics (such as performance) with proximity to data.

Using the System z platform as an ESB can enable you to:

- Create more value from your most-precious investments—System z assets, applications, data and skills.
- Achieve total cost of ownership savings.
- Deliver nondisruptive growth and low incremental cost.
- Match your IT infrastructure to your business requirements.

This white paper can help you decide what kind of deployment really matters for your SOA infrastructure and how System z can be the right platform for your connectivity solution.

Business requirements for your ESB implementation

One of the key aspects of an SOA is the ability to expose applications as reusable, componentized services whereby the underlying implementation is opaque to the service requestor. This is key to separate the application interface from the implementation. A Java service is invoked the same way that a

COBOL service is invoked, enabling CICS developers, for instance, to adapt their implementation to take advantage of new features of CICS programs without affecting the users of that service. The details of the CICS program are hidden from the user of the service, helping to simplify development while enabling the end-point providers, the CICS program in this example, to evolve. After each core business operation is exposed as a service, new SOA applications can be composed from a collection of assets, each developed in the best language for the task. This approach is especially advantageous for System z assets because the decades of refinement can be used in new innovative ways.

This flexibility is achieved through loose coupling of services where the requestor does not directly call the service provider, because all aspects of connectivity logic are completely decoupled from the business application logic. This ensures the business application developer can focus only on the needs of the business rather than the details of the implementation infrastructure. As a result, there is an increasing need to ensure that connectivity does not become an inhibitor to a widely deployed SOA. When you need to connect all your systems, applications and services, the connectivity challenge can be huge. An ESB is regarded as the solution that meets these connectivity requirements. It can simplify the interconnection of interfaces and provide the flexibility to route requests to the optimal provider. It can also dynamically introduce new providers, circumvent provider outages and manage the introduction of new versions of a service.

The ESB performs a number of tasks to enable organizations to meet their SOA connectivity needs. It identifies and routes communication between simple and aggregate services. It bridges the different transport protocols. It transforms dissimilar data formats and schemas, and it publishes business events to and from disparate sources. These tasks are achieved

through the clear separation between the applications that run the business (including business services and business processes) and the ESB (the infrastructure for connecting service requestors (systems and people) and service providers). This decoupling of connectivity helps ensure that interfaces within applications become far less complex, enabling reuse and easier integration of existing assets with new assets as well as being able to derive additional insights and value from these assets as they move across the enterprise.

When considering the integration your SOA needs to provide, you need to be absolutely sure that your ESB is accessible from all of your systems and environments. You want to access and move data—any data—from anywhere to anywhere. You also need to make sure that other components of SOA, such as process management and governance, are supported by the ESB.

So, for a successful SOA implementation, you need an ESB that:

- Provides connectivity and integration between your existing and future environments without additional complexity.
- Helps ensure quality of service to support your service-level commitments.
- Handles complex transactions across multiple resource types and rolls back distributed transactions when problems occur.
- Supports effective end-to-end monitoring and measurements.
- Provides Business Process Management capabilities.
- Meets security and regulatory requirements.
- Increases business flexibility through faster IT response to changes and extend asset lifetime and value to grow business controls and scope.

When considering the ability of your ESB to fulfill these requirements, you might quickly realize that the choice of the deployment platform can affect the degree to which these requirements are met. For example, mainframes were traditionally designed to run multiple, heterogeneous workloads simultaneously and to handle unpredictability. The distributed servers are designed to do only one thing at a time—unlike the mainframe. As a result, an SOA deployment to distributed servers necessitates a farm of servers with resources dedicated to each individual application or task. The net result is that the most-effective solutions for individual projects might result in an overly complex and costly infrastructure for the enterprise as a whole. In a recent study, it was found that on

average, a typical distributed server had a CPU utilization of only five percent. A customer recently consolidated 1,500 server images onto one IFL z/Linux system. (Impact 2010 Creating Agile Dynamic and Cost Effective Business with System z, Tom Rosamilia (http://w3.ibm.com/articles/downloads/other/2914_must_z_popUp.html))

Where do you start to choose which deployment is right for you? (See Figure 1.) Your business needs might dictate a mixed environment; however, there are a number of circumstances where Systems z can be the perfect ESB hub for your SOA solution.

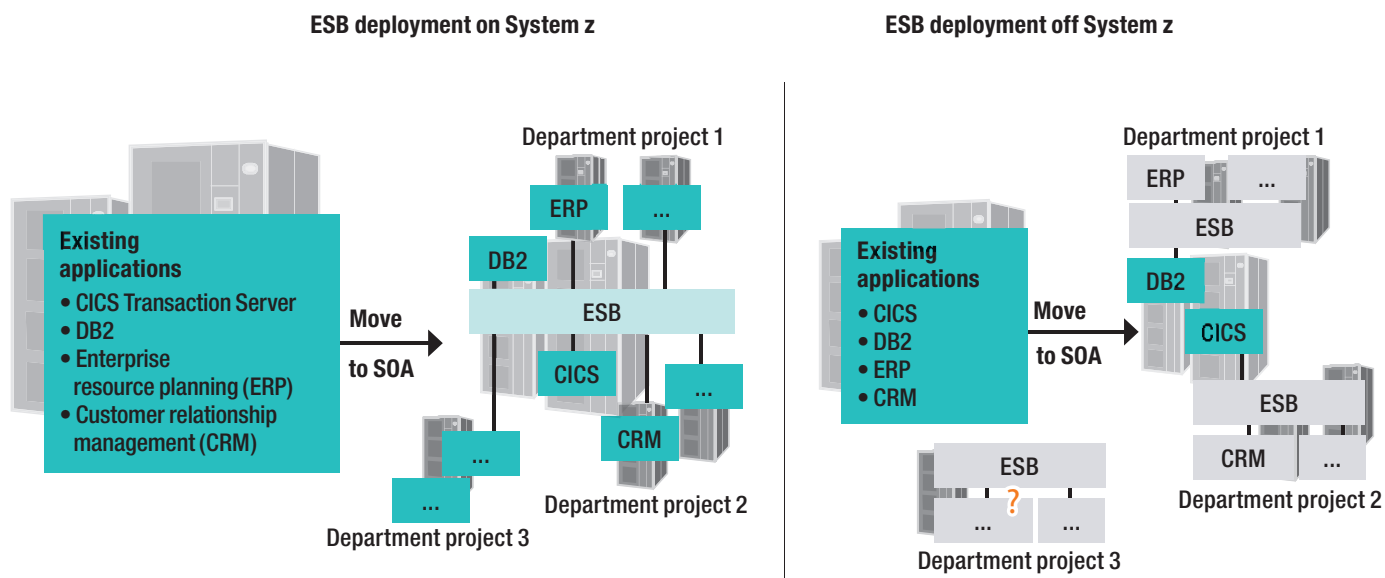


Figure 1: Where do you start to choose which deployment is right for you?

Things to consider when choosing a platform to meet your requirements

So, what questions should you ask yourself when making the ESB deployment decision to help avoid having an overly complex infrastructure that consumes your resources and holds your business back?

Reuse and integration

To address reuse and integration needs, consider the following questions:

- Where do your critical workloads and data reside today?
- What is the value of your existing investment?
- How can you make the most of your existing infrastructure and skills?
- What kind of integration with other applications do you require?
- Where do these applications reside?
- Does your integration include the data held in files?
- How complex are the business transactions that the ESB will be handling?

Business criticality

Questions to consider regarding critical service capabilities include:

- What are your most-critical services?
- How will the ESB downtime affect your ability to run these services, and ultimately, your business results? Lost revenue and repeat business?
- Do you have visibility to which services are running, whether you know about them, whether they are running successfully, and whether they are meeting business and service level expectations?
- What are your service-level commitments and requirements to availability, reliability, scalability and disaster recovery?
- What is your platform's growth capability vs. need? For scalability? For ever-expanding industry features?
- What about security?

Performance

To evaluate the effect on performance, consider these questions:

- Where does most of your data reside?
- Do you know the extent of the performance improvements achieved by colocating your data and business logic?
- Do you know how the execution and performance characteristics will be affected by distributing the data and business logic?

Growth

To address growth concerns, you should ask yourself the following questions:

- What are your future growth requirements? Speed of adding new capacity? Tolerable levels of disruption to the user?
- How well does each of the platforms you are considering support these requirements?
- How do the usage levels of different platforms compare and what are the cost implications?
- How does horizontal scaling affect your datacenter infrastructure capabilities?
- Do the usage levels of different platforms compare and what are the cost implications?

Total cost of ownership

When considering total cost, you should ask yourself if you are concerned with total cost of ownership, including the cost of people, power and cooling, space, ease of growth and cost per application, rather than simply the total cost of acquisition (TCA). Does the total cost of ownership span the changes needed over years to come? When trying to ensure the best use of resources to improve the total cost of ownership then the effective use of an ESB can ensure that assets across all resources, both System z and other environments can be connected to maximize productivity.

Flexibility

With regard to flexibility, consider whether the proposed ESB solution, along with the deployment platform, enables you to take an evolutionary approach.

The System z platform—designed for integration

As was established earlier, a lot of value is in your existing System z assets, which need to be reused and exposed as services. Your ESB needs to be able to perform these tasks efficiently and reliably, in a simple and manageable way. If you already have your core applications and data in subsystems such as CICS, IMS, ADABAS or IBM DB2®, the good news is, you are in a great position to take advantage of state-of-the-art System z virtualization capabilities and optimize for integration. System z, always at the forefront of virtualization, makes an excellent platform for integration and consolidation. There is more to virtualization than simply providing support for multiple application-based servers on a single platform. That's why System z virtualization is designed and engineered for virtualization from the silicon up. IBM has just announced zEnterprise™ (announcement/information). This is a new approach to computing for system virtualization and management. As a result, customers can integrate the management of zEnterprise System resources as a single system and extend mainframe qualities, such as governance and manageability, to workloads running on select IBM POWER7® and System x® blade servers. With the ability to manage workloads across systems as one, the zEnterprise System can drive up to 40 percent lower acquisition costs and reduce cost of ownership by 55 percent.

Everything is shared and virtualized. This multidimensional virtualization is fundamental to quality of service and usage because it:

- Supports the total hardware and software redundancy that gives System z its amazing availability.
- Enables hardware and software to be maintained and enhanced while in production.

- Contributes to the 100 percent application isolation that gives System z its security characteristics.
- Virtualizes everything, including the network, helping to minimize network delays and network hardware costs.
- Enables servers to run at close to 100 percent capacity while meeting demanding interactive response-time targets for tens of thousands of users.
- Provides virtualization and system management for workloads running across System z, and select POWER7 and System x servers.
- Allows a data center to respond to huge variations in workload demand from moment to moment, autonomically, without manual intervention.

The result? Consistent, extremely high resource utilization. Consolidation and simplification on a massive scale. And workload management for business agility and flexibility.

What does this mean for your ESB implementation?

Virtualization support enables multiple ESB instances to share the underlying system resources while preserving the isolation characteristics of distinct physical systems. The workload manager assures that the resources are assigned based on business priority, preventing a new test ESB, for example, from affecting a production ESB. By activating virtual ESB instances rather than configuring new hardware instances, you can improve responsiveness and avoid unnecessary expenses. Virtualization on the z System and provide you the capability to stand up LPAR images in less time. You can manage your ESBs from a single point of control across the enterprise. Workload isolation and security can meet your requirements. And of course, virtualization capabilities contribute to System z advantages in the other areas of consideration described in this white paper. Workload manager capabilities allow for automatic management of virtualized resources across the enterprise.



(Source: <http://mainframe-watch-belgium.blogspot.com/2010/07/ibm-zenterprise-system-new-dimension-in.html>)

Business criticality: How System z meets your ESB quality-of-service requirements

One of the key ideas behind SOA is business responsiveness—helping to ensure that your business can be more flexible and better able to respond to the needs of your customers and the changing needs of the business without adding to the complexity or cost of updating and maintaining assets. Addressing these challenges requires highly adaptable qualities of service to meet the needs of different customers, as well as the different levels of service required across the business. Performance that fluctuates with demand, or services that are available to only some parts of the business due to hardware selection by either requestor or provider, can result in industry fines and lost customers. When shared services and the service bus become critical business resources, the potential cost of a failure increases. Compare a service representing a personal-productivity task with a service related to handling your core business data (see Figure 2).

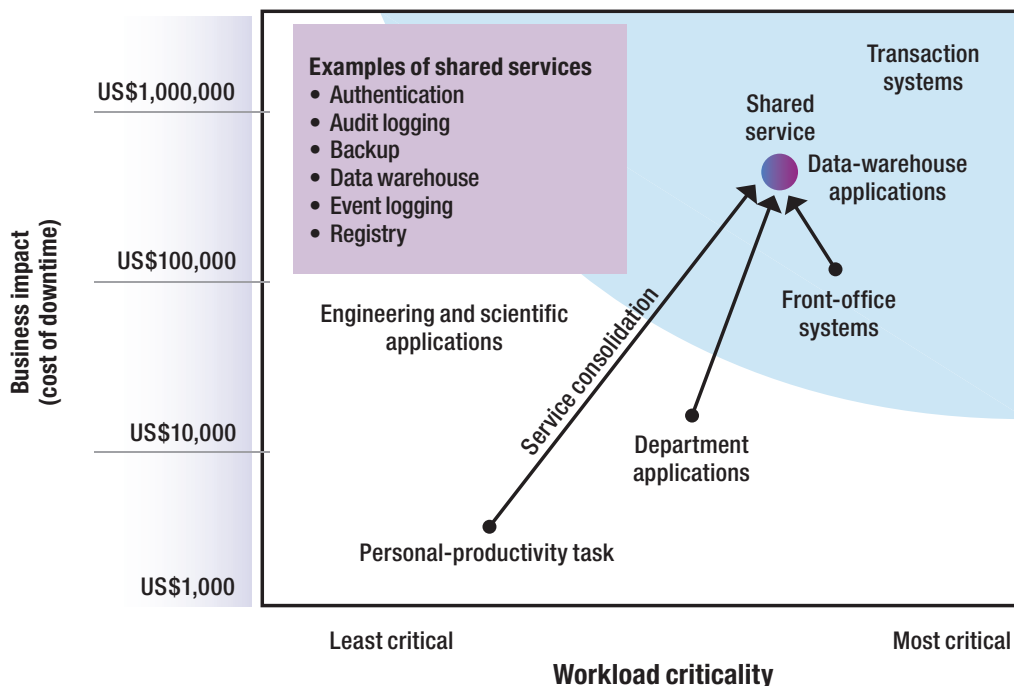


Figure 2: Business criticality: ESB is a critical application.

On the graph in Figure 2, as the services go up the stack and to the right, the business impact goes up. So when you externalize common functions as SOA services, you have to consider how critical these services are to your business and how moving from a dedicated service to a shared service might impact the performance of the service itself. If a shared service used by a multitude of applications is not working, the scope of the impact is widespread. Quality of service is now a critical and high-priority factor, and the cost of downtime of this service multiplies by the number of applications using it. This circumstance forces you to re-examine what an “application” means when you are considering industry data related to applications, as illustrated by the example in Table 1.

A mere minute of downtime can bring big losses^d

Business application	Estimated outage cost per minute
Supply-chain management	US\$11,000
E-commerce	US\$10,000
Customer service	US\$3700
ATM/POS/EFT	US\$3500
Financial management	US\$1500
Human-capital management	US\$1000
Messaging	US\$1000
Infrastructure	US\$700

Table 1: Profit-draining potential related to service downtime

How can your choice of deployment platform affect your ability to keep up with the changing workload? System z is uniquely capable of helping to ensure that your ESB is highly available:

- Up to 99.999 percent availability in an IBM Parallel Sysplex® environment to avoid planned and unplanned outages
- Change management and rolling maintenance to help reduce planned outages

- IBM Geographically Dispersed Parallel Sysplex™ (GDPS®) to enable the recovery of whole systems across vast distances in split-second time
- Component-level recovery for both hardware and software
- Automated recovery response to failures including restart and isolation, as appropriate
- Dynamic workload balancing across systems and logical partitions for 24×7 operations

The next section explores these aspects of System z quality of service in more detail.

The System z platform is based on a zero-downtime design point. Redundancy is built into the system, supporting dynamic replacement of failed processors, memory and input/output (I/O) adapters. A failed component is replaced dynamically without disrupting applications. System z self monitors all components and provides escalation of hardware alert events to IBM z System support.

The system supports concurrent hardware upgrade and nondisruptive capacity upgrade as needed to accommodate growth and help reduce planned outages. The autonomic self-tuning technology built into the IBM z/OS® operating system enables critical infrastructure, such as the ESB, to readily take advantage of newly introduced capacity. As alluded to before, System z Workload Management can maximize resources by targeting unused resources where they are needed the most.

Multiple System z instances are frequently interconnected into a Parallel Sysplex clustered environment, providing the benefits of a multisystem environment with the management of a single system. Sysplex-wide security, workload management and data- and queue-sharing policies help ensure that workloads across multiple systems run securely and efficiently. The Sysplex Distributor, part of the z/OS kernel, exposes a single virtual Internet Protocol (IP) address that is intelligently load-balanced across IP resources on different physical

systems or logical partitions (LPARs). This function enables nondisruptive redirection around a failed service and intelligent request distribution, helping to optimize load balancing across a multiple-system environment.

Each zEnterprise System supports upwards of 96 processors, will support up to 114 blades with eight cores and up to Up to 60 LPARs each with 64-bit central memory addressability, Designed for EAL5 certified for the security of its LPARs (PR/SM)isolation for z/OS and Linux® operating environments. A quad-core 5.2 GHz processor chip which is designed to help improve the execution of Java™ and CPU-intensive workloads and up to 3 TB of memory. That's double the memory of the preceding system, the z10, which had a 4.4-GHz quad processor. The security and energy requirements remain and, IBM, for instance, says that its latest mainframe has a 60 percent performance gain without using any more power than the z10. (Source: Computerworld)) The new zEnterprise node can be set up as “ensembles” which can contain 128 zEnterprise configurations supported in an interconnection of geographically dispersed data centers Support for multiple operating environments enables one environment to be taken out of service for upgrade while other environments continue to support the applications. All system hardware resources, including cryptographic features, are shared across all LPARs with high-speed, dynamic provisioning provided by the integrated IBM Intelligent Resource Director. The IBM zEnterprise Unified Resource Manager is key for the “hybridism” of the system and keeps the parts together. It is a new platform management capability which monitors, and governs workloads that are deployed across zEnterprise assets, including Linux virtual machines running on z/VM. Via the Unified Resource Manager, the multioperating system resources running on different architectures function as a single, logical, virtualized system, with shared memory, shared disk, etc. This provides operational convenience when customers want to relocate applications from the zEnterprise to Linux on z/VM as a result of application growth, closer consolidation requirements and/or a need for superior qualities of service. (i.e. zEnterprise Features)

The System z platform supports multiple robust hypervisors which include IBM z/VM® and the addition of PR/SM, to enable hundreds of images to run within a single LPAR. This capability allows you to interconnect virtual images under z/OS and the iServers and xServers (Blade Center Extension) in support of development, test and production work, and enables high-speed, secure interaction through virtual (in-memory) local area networks (LANs). High-speed, cross-memory interaction with applications running on the z/OS platform is provided through integrated support for IBM HiperSockets™ technology.

The System z platform also supports the interconnection of geographically dispersed data centers. This capability enables clusters of System z machines to take over work from each other automatically in case of a catastrophic event. This technology supports both metropolitan and regional disaster scenarios. Both systems can perform productivity work, if desired, and the designated relative importance of each workload will dictate how available resources are used following a takeover. And you can use System z features such as capacity on demand and capacity backup to dynamically activate other resources to meet needs during the crisis period.

Often, this type of configuration has been established to support the existing, critical business transactions and batch jobs. Adding an ESB to a System z environment enables this infrastructure to be used more fully, because the ESB is just another System z task and can fully participate in the dynamic recovery scenarios. Queued messages can be replicated so that the ESB can be dynamically recovered by the backup system.

For enterprises that have already set up this relationship between data centers, you can take advantage of that work by easily incorporating the ESB as an additional z/OS workload. Deploying an ESB as a part of the z/OS environment is ideal for providing the core connectivity needed to access resources in your System z environment, especially where there is a

desire to take advantage of the System z features such as shared queues. When workloads extend to include deployment on z/Linux environments, you can deploy ESBs in these images as well to ensure seamless integration of assets wherever they are running. ESBs from IBM such as WebSphere® Message Broker or WebSphere ESB are available to be deployed on both z/OS and z/Linux systems.

Security

Security needs to be examined more closely. According to the State of Information Security 2005 report from PricewaterhouseCoopers and CIO Magazine, not only are security-related events up 22.4 percent over the previous year's figures, but the number of organizations reporting financial losses as a result of the attacks is also surging. Twenty-two percent of companies said they had been hit financially, compared with last year's seven percent.⁵

For important business work, the ESB needs to be deployed in the most-secure environment available. A breach of the ESB could be dramatic, affecting many applications, and can be difficult to detect until some damage is done.

The industry, in general, views the System z platform as the most-secure platform available. It has been running the most-critical core business applications for most large corporations for decades. In addition, it stores most of the critical business data for enterprises. With its industry-leading security features built into all system layers, it is truly the security hub for the enterprise.

The System z platform supports industry-leading cryptography, including cryptographic accelerators on each of the central processors with support for Tactical Data Encryption System (TDES), Advanced Encryption Standard (AES) and Secure Hash Algorithm (SHA)-256. The cryptographic support provided by the z/OS operating environment includes both clear-key and private-key operations. System z cryptography holds the industry's top hardware rating—FIPS

140-2 Level 4. System z offers amazing integrity—LPARs with EAL5-certified isolation for z/OS and Linux operating environments and HiperSockets technology.

The unique hardware-managed virtual-storage addressing and address-space design with storage-protect keys help ensure isolation of privileged tasks from business tasks. This function enables a more-secure shared memory and shared workload environment. It is virtually impossible for one application to tamper with the storage of another application without specific security authorization. Authorization controls are handled exclusively by systems personnel independent of the application developers, providing the separation of concerns essential to a secure environment.

Security benefits for the ESB include:

- Integrated security management, where identities associated with started tasks are not able to log in to the system and are controlled completely by system security personnel.
- Improved security compliance and reduced failures. For example, a large U.S. bank runs all of its critical business functions, such as its ATM network, on the System z platform. A security audit of its first IBM WebSphere application on the System z platform was scheduled for seven days and was completed in three days without finding any exposures.
- Potential to reduce fees from other vendors for security services. The z/OS operating environment provides robust support for public key infrastructure (PKI), enabling the business or agency to act as its own certificate authority. A large telecommunications company saved almost US\$10 million per year in fees by managing its own keys.
- Internal private network providing isolated private communication between components (z/OS, z/Linux, xSeries, iSeries, accelerators) to provide a secured network. This reduces costs without the need to firewalls and routers between z/OS components

Performance: The implications of colocating your ESB data on the System z platform

You should consider performance needs separately, because when your critical data is located on a System z machine, the performance implications of your decision of colocating or distributing your data and business logic (and connectivity logic, like the ESB) are tremendous.

Have you ever considered that refactoring business logic to be co-resident with z/OS data could achieve application-performance improvement? Here is the outcome of a proof of concept IBM ran for one of its customers in the transportation industry (see Figure 3). By colocating data and business logic, the average processing time per Enterprise JavaBeans (EJB) transaction was reduced by more than 77 percent, and the number of bytes of data transferred per EJB transaction was reduced by 99 percent. By consolidating tiers, you can avoid transaction latency related to network transmission and network formatting.⁶

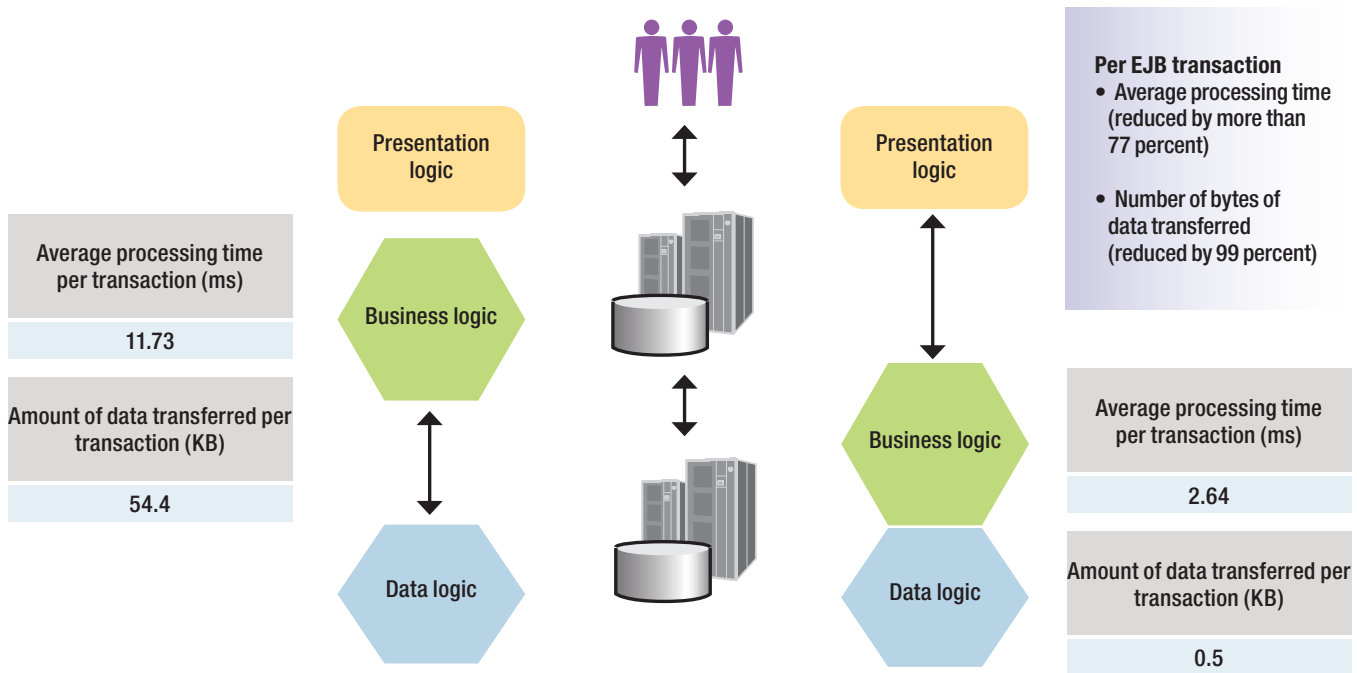


Figure 3: Performance: The value of proximity

The z/OS operating environment and its related products provide high-speed and efficient native z/OS interfaces, including shared-memory areas, internal networks and hypersockets. The new zEnterprise system will provide independent specialty accelerator blades and hardware to provide extended performance for selected operations on the zEnterprise system. Other improvements in hardware offer improve performance in the area of Warehousing. Specific hardware has been introduced to cache warehouse data for high-end data queries. This approach significantly increases performance as have critical improvements to DB2 since version 8 targeted at data warehousing.

- A special purpose, network attached query accelerator system
 - Offload typical DW queries from traditional database server to the accelerator
 - Based on IBM research prototype called BLINK
- No changes to the applications
 - DB2 transparently exploits the accelerator for applicable queries
- Improving performance of typical DW queries 5-10x
 - Vector processing—evaluation of all predicates in parallel
 - Consistent Query Response Times
 - Achieving linear scaling with the number of CPUs
 - Data Compression ratios of more than 90 percent
- Significant price/performance and TCO improvement
 - Offloading very CPU intensive execution from System z
 - Order of magnitude performance improvement for offloaded queries
 - Significant reduction in DBA effort for tuning offloaded queries (MQTs, indexes, etc.)
 - Managing the data consistently, coherently, and securely on z/OS

Also, the System z server provides infrastructure for two-phase-commit coordination, which helps reduce the number of required interactions between resources in the two-phase-commit transaction.

With fewer physical tiers and operating-system instances to enable for high availability, the z/OS operating environment helps reduce the cost of building a solid multi system infrastructure to run your critical applications. Reducing the number of physical tiers helps minimize the complexity of building a high-availability environment, and helps decrease the amount of testing and setup required. Also, as is becoming a big consideration in today's environment, can greatly reduce your energy foot print which makes your installation "greener." One example is of a customer being informed their datacenter energy usage must be reduced by 20 percent by local utilities. Consolidation provided a much needed critical and required relief for this situation. The z/OS environment can accomplish this through Parallel Sysplex and multinode/ensemble hardware and technology, which can cluster multiple operating system and hardware images into a single, logical operating system.

A zNext Ensemble is a collection of 1 - 8 zNext Nodes managed as a single virtualized pool of server resources. A zNext Node is a single zCEC with 0 to 4 racks with up to 1 to 2 blade centers per rack. zNext nodes can be deployed within active Sysplex distances. They can contain Blade Workload Accelerators and Power and x86 general purpose blades. zEnterprise provides new Integrated Advanced Virtualization Management which starts when the server is first booted and implements well-defined external interface to data center service management functions with virtual resource management and optimization.

In fact, distributing the data- and business-logic deployment can affect some execution characteristics, such as:

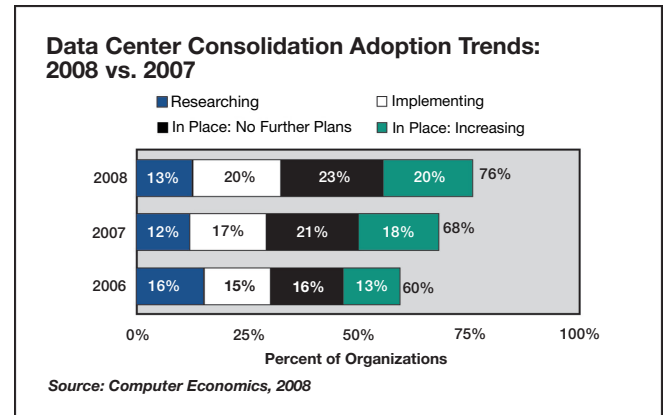
- Transactional capabilities
- State management
- Performance
- Security and encryption
- Problem determination
- Workload-management policies

The operational characteristics that can be affected include:

- *System automation*
- *High availability and disaster recovery*
- *Policy management*
- *Version control*
- *Logging and auditing*
- *Maintenance*

As Carl Braunstein of Robert Francis Group points out, "...it should be noted that when performance is a key application criteria [sic], architects and designers should seriously consider having as many SOA components as possible on a mainframe complex. By having the application and data components on the same processor or in the same Sysplex, the networking performance issues can be minimized."

Computer Economics "...Over the past three years, the trend toward consolidating data centers has been growing, as shown by the adoption percentages in Figure 1. In 2006, 60 percent of organizations had some level of activity in the area of data center consolidation. In 2007, that percentage rose to 68 percent, and in 2008 it now stands at 76 percent. Likewise, the percentage of organizations increasing their level of data center consolidation has risen from 13 percent in 2006 to 18 percent in 2007 to 20 percent in 2008. (Source: <http://www.computereconomics.com/article.cfm?id=1386>)



Growth: The System z platform supports increased ESB workloads

Applications rely on the ESB to connect to partners in a timely fashion to support their individual service-level agreements. How can you help ensure that you respond quickly to support growing workloads?

The deployment platform might hold the key to your ability to grow. The System z platform offers the best linear scalability in the industry. In addition, the Parallel Sysplex environment allows for highly efficient interconnection of multiple systems to achieve near-linear scaling for most applications. System virtualization built into the new zEnterprise moves resources to where they are needed the most in an automated fashion. This is accomplished by new features in the Work Load Management architecture. The unique DB2 data sharing offered by the Parallel Sysplex environment enables each system to benefit from a local cache while the system helps ensure the consistency and integrity of each cache.

The System z platform supports shared queues, enabling the ESB to place requests in a coupling facility where ESB instances on each member of the sysplex can pull the requests. This capability brings the power of multiple systems to the workload so that when one system is very busy, another system can handle the task. WebSphere MQ makes key usage of this facility by providing not only shared resources across images but supporting High Availability of application components providing access to shared data.

The design of the System z platform supports a large cache that is shared by all processors in the system. The large cache coupled with fast context-switching makes System z an extremely effective platform for mixed workloads, whereas other designs tend to prefer dedicated workloads to minimize stress on the cache. The System z design enables the entire

system capacity to be available to every workload. When one workload doesn't need capacity, it is available to other workloads. The IBM z/OS Workload Manager built into the z/OS operating environment manages dispatching priority based on specified service-level goals, helping to maximize total system throughput while meeting the goals of each workload. It is common for a System z machine to run in excess of 95 percent utilization for extended periods. Most other systems tend to run much lower utilization (e.g. 5 percent) because they are optimized for homogeneous workloads (to avoid stress on the cache), and hence must be configured to support the peak needs of a single application. An example of such a configuration is illustrated by Figure 4. System z incorporates a unique collection of supporting processors to offload I/O processing, helping to free the central processors to perform application work. The result is that distributed systems typically run at much lower utilization, while mainframes are designed to handle total utilization.

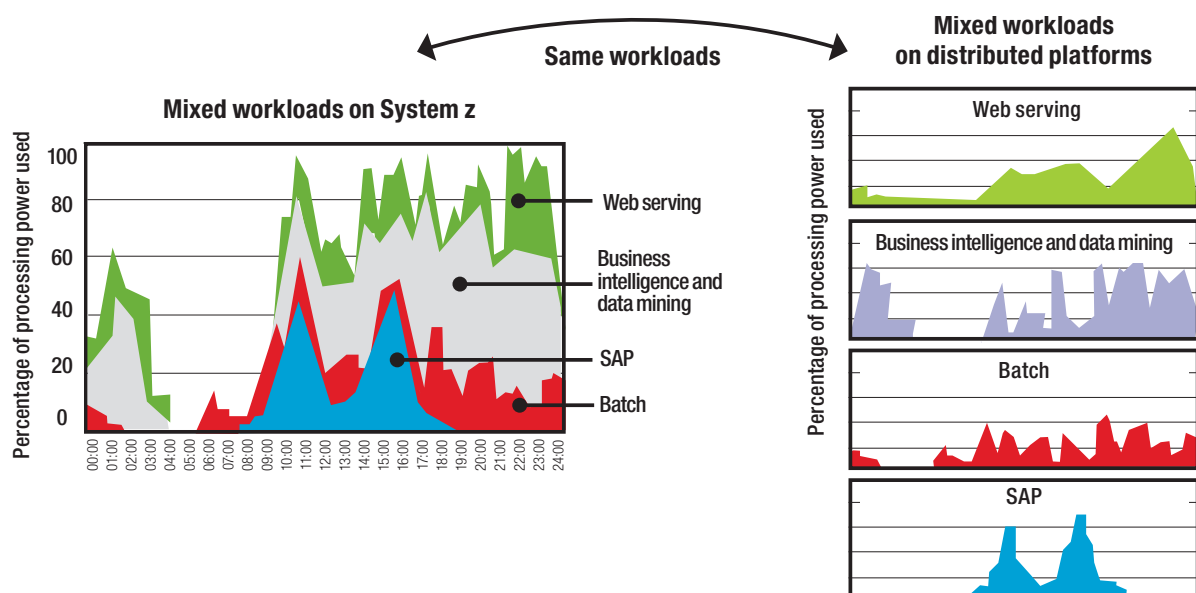


Figure 4: The System z platform offers unique economics of meeting increased ESB workloads.

In addition, IBM Capacity on Demand offerings enable you to pay only for what you use. So, if you see a peak in usage during certain time periods, you pay only for that increase rather than paying a higher flat rate across the board.

Flexibility and choice: ESBs on System z from IBM

As mentioned previously, IBM has multiple ESB offerings that can be used on their own or together in any combination to provide a powerful and flexible ESB to enable your SOA across your entire business. These offerings enable the flexibility to select a solution which matches your business objectives and existing environment.

For customers that have relied on CICS as their mainframe transaction server there are many improvements that provide enhanced integration into the SOA ESB architecture. CICS application connectivity provides new web services capabilities include support for security specifications and large message size optimization. Communication is introduced between CICS regions over TCP/IP for Distributed Program Link. There are enhancements for HTTP and TCP/IP workloads CICS application reuse. Enhancements to channels and containers include 64-bit exploitation. Integrated translator support is provided for C/C++. CICS service management. Improvements include easier management of program libraries; support for enterprise-wide workload management; enhancements to CICSplex System Manager and its web user interface; and threadsafe enhancements for file control and WebSphere MQ. Larger capacities are introduced for shared data tables and VSAM entry sequenced data sets; there are improvements to monitoring and statistics. You can now specify a WebSphere MQ queue-sharing group for the CICS-WebSphere MQ connection, so CICS uses any eligible queue manager in the group when it reconnects to WebSphere MQ, rather than waiting for a single queue manager. Queue-sharing groups increase reliability when you reconnect to WebSphere MQ, and help you standardize this

aspect of CICS setup across CICS regions and z/OS images. The performance of XML parsing in CICS has improved with the introduction of the IBM z/OS XML System Services (XMLSS) parser, which can be accessed directly from CICS. The XMLSS parser also allows XML parsing to be offloaded to a System z Application Assist Processor (zAAP), which can reduce the cost of transactions. The XMLSS parser uses above-the-bar storage, leaving more below-the-bar storage available for user programs. Non-invasive detection and emission of business events from within CICS applications will provide insight into business behavior. This is similar to what message broker offers at the node level of a message flow and can be routed to a BPM system for management.

For environments that are predominantly standards-based, and focused primarily on integrating web services, IBM WebSphere Enterprise Service Bus (WebSphere ESB) might be a good choice. It delivers a robust, security-rich and scalable foundation, as well as being able to host services in addition to integrating with other services. IBM WebSphere ESB for z/OS fully uses the advantages of System z through the underlying IBM WebSphere Application Server for z/OS platform.

Where businesses have environments that are a mix of different technologies, with a number of key applications in CICS, IMS, DB2 for z/OS, as well as potentially new and evolving web services, IBM WebSphere Message Broker is a highly adaptable ESB, built on IBM WebSphere MQ, the messaging backbone for SOA. WebSphere Message Broker has been a market-leading integration server since 1999. With each release it has evolved to continue to meet the changing needs of IBM clients, and it now provides a comprehensive ESB that can connect just about any application or service to any other application or service. This is because WebSphere Message Broker handles the broadest range of transports and protocols, such as WebSphere MQ, Java Message Service (JMS),

Version 1.1, HTTP Secure sockets (HTTPS), web services, file (both Broker and MQFTE compatible), user-defined and TCP/IP. It handles practically any data format, including C and COBOL SOAP, data structures, XML and industry formats (such as SWIFT, electronic data interchange [EDI] and Health Information, Portability and Accountability Act [HIPAA]).

In addition, WebSphere Message Broker enables you to bring together both existing and new applications and services, because it provides support for existing applications whether through WebSphere MQ, CICS, IMS or Virtual Storage Access Method (VSAM), as well as support for newly written or wrapped web services. Message Broker also provides an EIS integration capability that allow you to connect to you enterprise information systems (i.e. SAP, Siebel, and PeopleSoft, etc). The product now additionally offers integration with databases through Java or database nodes to allow connectivity to other system databases. Message Broker on distributed platform allow connectivity to CICS via EXCI TCP/IP interfaces. The product has robust capabilities to control how requests are passed between applications and services. The current releases of Message Broker have greatly reduced the installation footprint and has reduced the number of required components. As an example the Configuration Manager and runtime database are no longer required. And because IBM WebSphere Message Broker for z/OS is tightly integrated with the z/OS platform, it can provide the same look, feel and operational characteristics as a z/OS subsystem.

If you've used WebSphere MQ, you can find a lot of similarities, and make the most of the z/OS capabilities that enable its tremendous quality of service and dynamic workload management: WebSphere MQ shared-queue support, DB2 data sharing, CICS EXCI support and Resource Recovery System (RRS) global transaction coordination. Using the WebSphere MQ administration tool, WebSphere MQ Explorer, you can administer both WebSphere MQ and WebSphere Message

Broker with a single tool, obtaining a single view of your enterprise messaging backbone with the ESB. Access to the MQ Explorer has been improved for z/OS customers. The explorer is now available for free as a download. WebSphere MQ now supports a fully functional Publish and Subscribe engine with an improved API for Pub/Sub integration. This replaces the Message Broker Pub/Sub engine in the Event Broker. The new Pub/Sub Engine is now available to z/OS customers and in now an integral part of the MQ product.

WebSphere Message Broker provides advanced and unique functionality, such as complex-event processing and file-based integration. With complex-event processing, you can use WebSphere Message Broker to detect patterns between messages as they pass through the bus, which is useful for scenarios such as fraud analysis. For VSAM, WebSphere Message Broker can read data from VSAM files, write VSAM file data and convert it to online WebSphere MQ messages. WebSphere Message Broker also integrates closely with WebSphere MQ File Transfer Edition to enable a combination of file transfer and file processing with the reliability and management delivered by the WebSphere offerings. This is described in more detail below.

All Message Broker nodes have the capability to implement node level monitoring. This event-based interface provides customizable events from the message flow that can be administered or programmed into the Message Flow runtime deployable. These events can feed you BPM system for monitoring and real-time information feeds from your systems.

Recent updates to WebSphere Message Broker include patterns—representing IBM best practice implementations of many common integration tasks within WebSphere Message Broker. These can be selected and quickly deployed to ensure a fast and reliable start to many implementations within the

ESB layer. To boost relevance for all businesses and increase reuse, patterns can now be captured to represent any common function, enabling much greater commonality of functions as an SOA becomes more pervasive across a business.

Other new functions include enhancements to database input nodes allowing flows to be triggered with operational control. Also CICS Request nodes are now included to provide high performance multiplatform access to CICS systems and handling the responses generated. As already mentioned both WebSphere ESB and WebSphere Message Broker can be deployed on both z/OS and z/Linux to maximize connectivity deployment options and ensure that for all workload profiles and assets you have the most complete integration solution.

In addition, IBM offers a unique ESB in the form of a hardware appliance.

IBM WebSphere DataPower® XI50 Integration Appliance is a rack-mounted network device capable of transforming between different message formats, including binary, existing and XML, and providing message routing and security. This ESB is particularly effective at offloading the cost of processing web services calls and XML processing from servers, especially mainframes where processing cycles are always at a premium. Its unique architecture and capabilities enable it to extend your ESB to make your business more effective, as well as allowing you to deploy the appliance as an ESB where speed of implementation, simplicity and ease of maintenance are key. The newly released zEnterprise system offers an extended Blade chassis that provides plug-in capability to the z/OS system and management of the DataPower appliance from within the virtualized z/OS system.

To add scalable security processing when the security volumes for web services increase, you can use the seamless integration between WebSphere Message Broker and WebSphere DataPower XI50. While configuring WebSphere Message Broker with flows to handle the expected data, built-in integration between WebSphere Message Broker and WebSphere DataPower XI50 enables the WebSphere Message Broker flow developer to simply check a box to offload validation and security processing of the XML data content to the WebSphere DataPower XI50 appliance, reducing the workload for WebSphere Message Broker quickly and simply. This integration enables you to configure the WebSphere DataPower XI50 device using the WebSphere Message Broker operational console, and deploy WebSphere Message Broker flow endpoints and security profiles to the WebSphere DataPower XI50 device using common description and tools for security processing. This has the added benefit of ensuring that as the processing is performed by the DataPower appliance it does not add additional workload on the System z partition.

You can use any of these solutions on their own, or in combination, to help to implement SOA in your enterprise. Take advantage of the latest integration between the ESBs, the new IBM WebSphere DataPower configuration console in WebSphere Message Broker, which enables seamless integration between WebSphere Message Broker and WebSphere DataPower XI50. Or make the most of WebSphere MQ—the messaging backbone for your SOA.

A new product released recently is IBM WebSphere MQ File Transfer Edition for z/OS V7.0 (or MQ FTE) which provides a reliable, managed file transfer solution for moving files,

regardless of size, between IT systems. It enables files and documents to be transferred across WebSphere MQ as a backbone, which serves a dual purpose backbone, as it also handles messages. This product has just had integration support provided in Message Broker with the release of FP 1 for Broker.

IBM offers a comprehensive rules management system that runs on z/OS. iRules is a business rule management system (BRMS) enables organizational policies—and the operational decisions associated with those policies, such as claim approvals, cross-sell offer selection, pricing calculations and eligibility determinations—to be defined, deployed, monitored and maintained separately from application code. WebSphere ILOG® BRMS provides the ability for non-technical business users to be directly involved in business rules management, enabling flexible decision automation for applications and processes that are subject to complex, variable and evolving business rules.

IBM WebSphere ILOG Rules for COBOL provides a cost-effective way to add powerful business rule management system (BRMS) functionality to an existing COBOL-based system to implement or greatly improve policy change management and automated decisioning. IBM WebSphere ILOG Rule for COBOL allows WebSphere ILOG JRules BRMS rule sets to be generated into COBOL copybook code for use inside COBOL applications. It works by giving mainframe COBOL programs access to core features in IBM WebSphere ILOG JRules, the market-leading BRMS product. Rules for COBOL is ideal for companies that deploy business rules in COBOL but want to benefit from the latest BRMS technology. The rules in a COBOL application can be incrementally migrated to a central business rule repository for external management, even directly by business users, and still be executed in COBOL code.

Once businesses have connected their applications and services through an ESB, then not only will they be gaining productivity benefits from streamlined connectivity, and reduced cost and complexity of development and maintenance, but there are additional benefits that can be leveraged. With all or most data now flowing through an ESB, and capable of being formatted for widespread consumption by interested parties and subscribers, then additional value can be derived that may have been hard to see before the ESB was in place. By leveraging this flow of data—moving through the business in real time, other offerings such as the business rules solution from ILOG described above can take advantage of this flow of information to add additional value onto the data, increasing the business benefits of the ESB integration. Other benefits can be seen including taking advantage of this flow of data to access service metadata held in a repository.

All three ESBs are able to access service metadata dynamically at run time with IBM WebSphere Service Registry and Repository for the dynamic publishing and lookup of services, as well as providing SOA governance through definition and enforcement of policies to govern your SOA and manage operations. The ESBs integrate with IBM WebSphere Process Server to provide optimized business process management (BPM), capable of using a specialized ESB connectivity layer, which is even embedded within WebSphere Process Server. You can also monitor and manage your ESB with IBM Tivoli® Composite Application Manager for SOA and other Tivoli solutions in this area. And you can extend the data-transformation capabilities of your ESBs with IBM WebSphere Transformation Extender and IBM WebSphere Adapters to provide universal transformation for any data types and formats with the support of specific industry standards.

All these capabilities are delivered on the System z platform, enabling you to take advantage of the unique platform capabilities that have been discussed in this white paper. With an effective end-to-end ESB deployed in your enterprise and with specific ESB deployments meeting the needs of your enterprise, your business has the core of the connectivity it is likely to need for its SOA whether using z/OS, z/Linux or both.

Total cost of ownership

Having considered the deployment factors and the available ESB solutions on the System z platform, you should consider their cost. When making your deployment decision, it is easy to fall into the trap of looking into the acquisition costs, like software licenses and any additional hardware costs for your

production system. "...As a result, customers can integrate the management of zEnterprise System resources as a single system and extend mainframe qualities, such as governance and manageability, to workloads running on select IBM POWER7 and System x blade servers. With the ability to manage workloads across systems as one, the zEnterprise System can drive up to 40 percent lower acquisition costs and reduce cost of ownership by 55 percent..." (Source: Engaget). What about people? Who is going to implement and administer the new solution? The cost of people continues to rise, with around 45 percent of the total cost of ownership being attributed to people costs today (see Figure 5). The ability of System z to scale up means that as the workload and capacity grow, the number of administrators required to manage the growing infrastructure hardly changes, while on distributed systems it increases nearly linearly as workload grows.

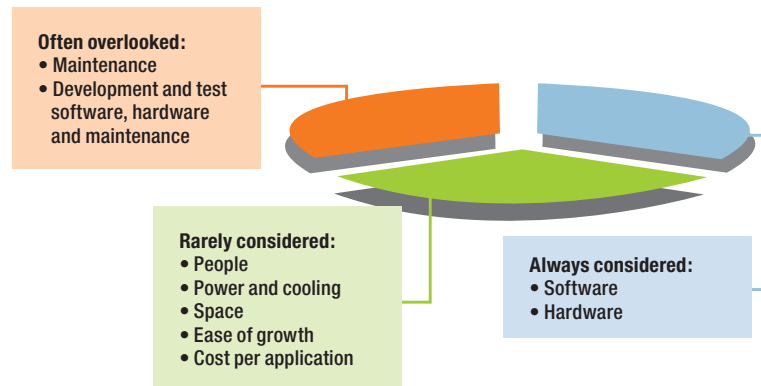


Figure 5: When considering your ESB deployment, consider total cost of ownership compared to TCA.

This white paper has already touched on the economics of growth. The license cost per unit of workload goes down as workloads increase and specialty processors and accelerators, such as IBM System z Application Assist Processor (zAAP) for Java workloads, DB2 Integrated Information Processor (zIIP) and the Data Warehouse appliance drive the costs down even further. To illustrate this point, consider the number of users, your customers, the new ESB is going to support. According to Arcati, the average cost per user will be around 33 percent of that of a UNIX® implementation (see Figure 6).

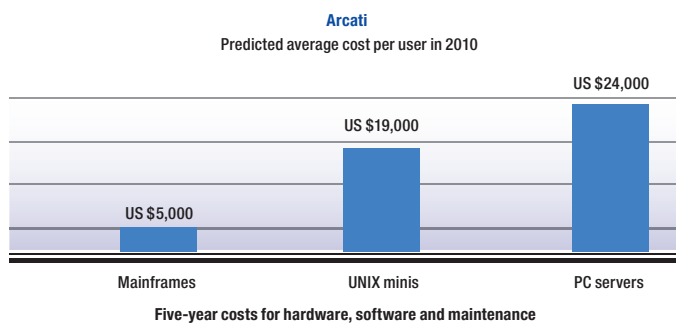


Figure 6: Average cost per user for mainframes compared to UNIX and PC systems⁸

The flexibility of the System z architecture also helps to lower the total cost of ownership. Taking advantage of zEnterprise and the mission critical levels of service for the most essential resources offers benefits in terms of security, reliability and performance for new and existing assets. However these deployments can run alongside deployments taking advantage of z/Linux environments on the same System z architecture to offer greater choice of deployment options and can provide more adaptable total costs of operation.

The cost of power and cooling requires special consideration, because it is gaining more and more attention within data centers worldwide. The Environmental Protection Agency (EPA) in the U.S. has recognized data centers as an area for significant energy savings, stating that the data centers can be made about 50 percent more energy efficient.⁹ As the world recognizes that human activity significantly affects the environment, the data centers are also becoming constrained in their growth by the limitations in the floor space available and the cost of power and cooling. With power costs increasing steadily, managing power and cooling needs, as well as meeting the floor-space requirements, forces companies to rethink their data-center design. According to Gartner Research, “By 2008, nearly 50 percent of data centers worldwide will lack the necessary power and cooling capacity to support high-density equipment.”¹⁰ zEnterprise can help here with the previously stated computing increase with the same power consumption with the capabilities to consolidate many of your existing infrastructure servers into one centrally managed virtual system.

As organizations add green issues to their agenda, wouldn't it be good to be reassured that becoming greener actually makes business sense? With the zEnterprise platform it really does, because System z enables careful power management with increased processing that can actually help you save money. "...The new zEnterprise also paves the way to enhance the energy dynamics of our data centers. As one of America's greenest banks we plan to take full advantage of the additional capacity and advanced power and cooling capabilities unique to zEnterprise. Citi's unified technology decision making model and its recent efforts to gain efficiencies prepared us to invest in these innovative technologies that benefit our clients....." (Source: Eengadget)

As power and cooling costs continue to rise, choosing the zEnterprise platform for your ESB gives you an opportunity to not only contribute to saving the planet, but also to boost the IT reputation in your organization by making real contributions to the bottom line.

Conclusion: Reinvest your System z capital with ESB on System z

IBM has reinvented the System z platform over the years. You can reuse your System z assets and continue to derive value from them by exposing them through an SOA solution, but you can also make this solution cost-effective, flexible and reliable to meet your business requirements, such as handling

complex transactions, roll-back, security and availability. In addition, choosing System z as your deployment platform enables you to grow easily, cost-effectively and in an environmentally friendly way. With the ESB solutions on System z from IBM, you gain a unique ability to achieve real business value.

"The workload is less predictable than it used to be. In the 1970s and early 1980s...we knew exactly what to expect in terms of year over year workload increase. Then we started to see the first manifestations of customer-driven workloads and things changed."

—Kevin Kelly, senior IT architect and strategy consultant, Kemar Solutions, Inc.³

For more information

To learn more about ESBs on IBM System z, contact your IBM representative or IBM Business Partner, or visit: ibm.com/software/integration/esb and ibm.com/software/os/systemz

To find out how to get started with SOA on the System z platform, visit:
<http://www.redbooks.ibm.com/abstracts/sg247651.html>

To learn more about the SOA experiences of other companies, you can purchase the book *Secrets of SOA: An Enterprise View on Service-Oriented Architecture Deployment Revealed* at: www.secretsofsoa.com

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