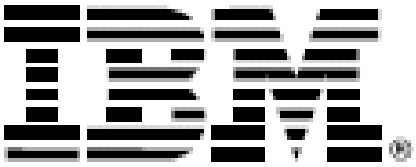

Deploying New Workloads to System z: Strategic Options

An Introduction to IBM System z Cost Benefits and Supporting Solutions

Contents

The System z Vantage **1**

System z Cost Benefits **2**

Reduced TCO *2*
Server Virtualization and Consolidation *4*
Disaster Recovery *6*

System z Solutions **6**

SOA Enablement *6*
Information Management *8*
Administration and Monitoring *9*
Security and Compliance *9*
Development Productivity *11*

Summary **12**

For More Information **12**

The System z Vantage

In the 1990s, the future of the mainframe looked particularly grim, with many pundits writing epitaphs for mainframe systems then being replaced with more “nimble” and “cheaper” client/server distributed architectures. However, the industry did not see the expected mass exodus from the mainframe, and instead is now seeing increased interest in the mainframe as IT managers realize that the mainframe has few equals when it comes to reliability, security and additional cost benefits.

Realistically, while the mainframe platform is far from extinct, the moniker may as well be. Today’s mainframe, or System z platform, has evolved to provide new compatibilities helping the platform play well in a distributed environment and compete favorably with other servers on the market. Continued advancements in the platform’s architecture provide customers with the traditional capabilities that have been proven throughout its existence in addition to offering the new capabilities that are expected in today’s highly dynamic Internet age. Ultimately, the System z platform continues to demonstrate that it is a premier platform in the distributed world.

System z continues to become easier to manage, exemplified by IBM’s dedication to simplifying its management through a $100 million investment to give System z a windows-style, ease of use, graphical user interface. IBM is not only making it possible for lesser skilled individuals to manage System z but is also making System z management appeal to the next generation of Windows born and raised managers and administrators.

The System z platform continues to gain in popularity from increasing enrollment in educational courses, a tripling in the number of startups using the platform in the past two years, and new workloads are being deployed on System z. More than 300 universities worldwide have adopted IBM’s mainframe education program for 21st century skills, and over 42,000 have been educated about the mainframe.

Organizations are turning to the System z platform to implement new workloads given the platforms proven reliability, ability to help reduce TCO, consolidate sprawling distributed servers, and provide disaster recovery. In conjunction with the hardware platform’s evolution, IBM has continued to provide innovative solutions for System z that address today’s business needs, including SOA enablement, security and compliance, and master data management. With middleware solutions including IBM WebSphere Application Server, WebSphere Portal, WebSphere Process Server, WebSphere Enterprise Service Bus, DB2, IMS, Tivoli Federated Identity Manager, Tivoli Composite Application Manager, and Rational based development tools, amongst others, IBM provides the required solutions for SOA implementations using the System z platform as an active participant. IBM has demonstrated it’s committed to the System z platform and is a leader in providing the required tools and resources to support it well into the future.

System z Cost Benefits

Where distributed systems were once viewed as potentially more cost effective and easier to manage than the mainframe, the demand for processing has increased the associated costs in this environment. Rising electrical costs and increasing personnel requirements for large distributed infrastructures have increased its total cost of ownership while the TCO of the System z platform continues to decrease. In attempts to address rising costs, many organizations are looking to virtualize and consolidate servers, capabilities the System z platform has been capable of doing for some time. The System z platform offers customers significant opportunity for reducing TCO, consolidating existing distributed infrastructures, and simultaneously simplifying disaster recovery efforts.

Reduced TCO

In years past, the System z platform and its lineage have been debated for its cost effectiveness. While the cost of the hardware may still be higher than its distributed counterparts, its total cost of ownership continues to drop and can be 5% to 60% more cost effective than today's distributed alternatives. Instead of considering single application TCO scenarios, as is often done, cases with multiple applications running either on a single System z or on multiple distributed Linux/UNIX or Wintel platforms needs to be examined. In this respect, the total cost of running a distributed environment may include multiple software licenses, added personnel, increased cooling requirements, more floor space and increased power consumption. All of these factors ultimately affect a company's bottom line.

Reducing the number of physical machines means less cost for data centers that may have large farms of distributed servers running single applications.

Labor and power costs associated with running distributed servers have exceeded the costs of the servers themselves

Lower Energy Consumption

It takes between 1.2 and 1.3 times the amount of energy a server consumes to cool it. IT managers frequently can't fill an entire rack because of the heat generated by the servers. Organizations need to make major changes to accommodate the cooling requirements with the increased demand for more processing power. Distributed blade servers have become so hot that there are solutions which bring water or other piped cooling systems back into the data center. In the 1990s, the mainframe was considered the hottest processor in the data center. Today, System z is now the coolest processor.

As energy prices continue to rise, datacenters face higher costs associated with powering and cooling a large number of servers. Analysts are predicting that by 2008, nearly 50 percent of datacenters worldwide will lack the necessary power and cooling capacity to support high-density equipment. By consolidating distributed machines to System z, customers can reduce their power consumption and cooling costs by up to 40 percent, in one-fourth of the physical footprint.

Reduced HR Requirements

The personnel costs associated with running a distributed environment, over the last couple of decades, have risen from 14% to 43% of total cost, while hardware costs have shrunk from 65% to 20%, respectively. The number of administrators required to maintain the operating systems, hardware, and networks of distributed systems increases nearly linearly as the workload scales, while a single System z's administrative costs see minimal, if any increases.

System z personnel costs are a fraction of those costs required for distributed systems

Server Hardware Costs

The System z platform is still a more expensive hardware purchase than its distributed counterparts, however this picture is much improved compared to past years, being considerably cheaper than its predecessors. In April of 2007, IBM announced the System z9 Business Class system with pricing starting at $100,000. Prior to this release IBM offered a $200,000 system (z890), but unlike that system,

the z9 Business Class is based on the same technology as IBM's high-end machines, the System z9 Enterprise Class (EC). The Business Class and Enterprise Class z9 systems share many of the same characteristics allowing the lower cost machine to be upgraded to an Enterprise Class configuration.

Specialty Processors

To help combat the costs associated with server software, System z also supports specialty processors for Linux, Java, and business intelligence related workloads. These processors help reduce costs by virtue of shifting execution to these processors, away from billable CPU totals.

Currently available specialty processors include:

- ⇨ *The Integrated Facility for Linux (IFL)*, is effectively a normal processor with one or two instruction sets (used only by z/OS) that are disabled. Linux does not use these instructions and can be executed by an IFL. While Linux can be executed by a central processor, an IFL can make a substantial difference in reducing software costs.
- ⇨ *System z Application Assist Processors (zAAP)*, are used to execute Java code (and possibly other similar code in the future). While the same Java code can be executed on a standard central processor, this specialty processor exists to not only control software costs but also to reduce the demands and capacity requirements on general purpose processors, which may then be available for reallocation to other mainframe workloads.
- ⇨ *System z9 Integrated Information Processor (zIIP)*, is specialized for processing database workloads. This helps reduce software costs associated around workloads such as business intelligence, enterprise resource planning, and customer relationship management.

Controlling Capacity

The use of selective software stacks in separate LPARs continues to help lower the costs of CICS and numerous other program products (including ISV products) by associating a smaller capacity with the software's use. Organizations are only required to pay for the capacity used and not the entire capacity of their machines. In contrast to distributed environments, customers are not required to license software for the entire capacity of a machine that typically only runs at 15% capacity.

With a higher average utilization, concerns for peak periods can be addressed through an on/off mechanism used to increase and decrease System z computing capacity as needed; a feature available since 2003 with the release of the z900 systems. An on-demand arrangement is less expensive than it would be to license additional unused processors with the intention to support peak workloads.

Upgrading between System z machines can also help reduce costs. IBM and many mainframe ISVs license software on the basis of consumed millions of service units (MSU) or total MSU capacity. Newer, "beefier" mainframes typically have lower MSU ratings than their predecessors. As a result, organizations can run their existing z/OS applications on upgraded hardware and actually save money.

Future Proofing

Another consideration is the future proofing of applications. Yesterday's mainframe implementations continue to run today, even on new hardware. System z is the only hardware platform that guarantees application portability across all supported levels of the hardware and the software. The z/OS has maintained over 40 years of backwards compatibility. This promise of compatibility is extended to the WebSphere transaction processing environment and by definition, to those products which run on top of it. What this means to customers is that investments in the technology today will not be lost tomorrow when new advances in hardware and software are made.

For example, investments in specialty processors today will provide even more benefits tomorrow. Specifically, the z/OS XML System Services, a system-level integrated XML parser to deliver optimized services for XML document processing, will take full advantage of the zIIP and zAAP specialty processors. These future enhancements mean that middleware and applications requiring XML parsing will be directed to these processors, further reducing a customer's total cost of ownership.

Server Virtualization and Consolidation

For a long time, and in some respects even today, many IT executives felt that distributed platforms were simpler, and thus, easier to plan, build, and run. This has proven false as distributed environments become even larger, both in configuration size and sheer number of servers. Many customers are dealing with thousands of servers, with complexity increasing exponentially. These deployed processors are often underutilized for many reasons including anticipation of peak loads. Thanks to the increasing electrical, personnel, and physical costs associated with so many implemented distributed machines running at low capacities, virtualization is becoming increasingly popular as a means for consolidating, integrating, and simplifying the network infrastructure, helping reduce the overall costs of IT network ownership.

Server virtualization technology provides a means to configure and deploy multiple logical server configurations on a common physical footprint to provide processing and usage benefits beyond those of the physical configuration. The physical server's resources are abstracted to accommodate the concurrent deployment of multiple "virtual server" instances. Each virtual instance, or virtual machine (VM), is capable of operating separate OS instances and its associated software stacks as if each instance was deployed on a separate physical machine.

Innate Capabilities

Virtualization is not a new topic. In fact it's over four decades old. IBM recognized the importance of virtualization in the 1960s with the development of the System/360 Model 67 mainframe. The Model 67 virtualized all of its hardware interfaces through the Virtual Machine Monitor (VMM). With the ability to run operating systems on other operating systems, the term hypervisor resulted (a term coined in the 1970s). Today, z/OS is optimized for running multiple workloads concurrently using a common set of hardware resources. This is achieved through virtualization techniques employed at multiple places in the hardware and software stacks.

The emergence of virtualization technology on the x86 and Itanium architectures and the evolution of tools such as VMWare are increasing utilization levels for distributed systems, but they still fall short of the System z capabilities. The IBM System z platform supports two virtualization implementations:

Virtualization on System z can reduce network equipment costs by 75%

- *Processor Resource/System Manager (PR/SM)* is a Logical Partition (LPAR) or virtualized computing environment abstracted from all physical devices. LPARs safely allow combining multiple test, development, quality assurance, and production work on the same system, equivalent to physically separate servers. This allows processor utilization levels to reach more than 90 percent, while providing a single point of management control for their workloads. PR/SM provides other virtualization capabilities such as high-speed virtual LANs that allow software images to communicate across LPARs at SMP memory speeds not seen on TCP/IP external networks operating at wire speeds. These communications can also occur without additional overhead, for example, when the communicating software images are deployed on separate physical server platforms.
- *z/VM* is a System z implementation that provides virtualization capabilities and resource abstraction beyond PR/SM to accommodate large numbers of lower utilization VM instances. It provides many functions designed to accommodate the concurrent development and testing of new application workloads on a single server footprint. Additionally, z/VM can virtualize logical instances of server resources that don't physically exist. For example, it can create virtual processor instances and then transparently time-share their execution on a single physical processor, creating the illusion of a multiprocessor server. The z/VM implementation of IBM virtualization technology provides the capability to run other full-function operating systems, such as Linux and z/OS, under z/VM as "guest" systems. z/VM supports 64-bit z/Architecture guests and provides each user with an individual working environment. The virtual machines under z/VM share the total system resources. Processor and memory capacity is designed to be allocated to the servers that need it, when they need it. The virtual machine simulates the existence of a dedicated real machine, including processor functions, storage, and I/O resources.

The multi-purpose roles of System z, with its inherent superiority in partitioning and virtualization, provide the same options now being considered on non-mainframe platforms, but with stronger and more proven technology. In fact, PR/SM in the System z9 has achieved an EAL5 (Evaluation Assurance Level 5) security level on the Common Criteria certification for virtualization partitioning, significantly higher than non-mainframe platforms that have achieved only EAL2 or are not listed at all. Customers can have the utmost confidence when using virtualization on System z where sensitive data is concerned.

Virtualization and consolidation on the System z platform can also decrease costs in more than the immediately obvious ways. For example, z/VM now supports ten times more virtualized memory and up to 256 GB of real memory. This can increase the opportunity for consolidating more memory-intensive workloads, such as database applications, onto a single copy of z/VM as opposed to multiple images, further benefiting from the zIIP specialty engine.

Linux on System z

Admittedly, the System z platform is not right for every application. Many organizations have developed a significant number of web-based applications to run on the UNIX, Windows, and Linux-based servers, some proliferating extensively. These scenarios have spurred interest in IBM's Linux for System z and even WebSphere middleware which offer SOA and multiplatform integration capabilities.

Tens or hundreds of Linux instances can run on a single z/VM host – potentially providing serious savings in terms of time and resources. When Linux is run as a guest of z/VM, the mainframe's power and resources are utilized as needed, so organizations do not need to purchase and maintain separate dedicated hardware for each Linux server. As a bonus, responsiveness is improved thanks to shared system resources and the virtual network connections between them, which can be much faster than those of a physical network. One of the major benefits of running Linux on z/VM is the ability to create new instances as needed, without requiring further investment in additional servers, floor space, etc. Fast, simple and repeatable deployment of virtual Linux servers under z/VM is provided with the IBM Director Extensions for Linux on System z.

System z offers the highest concurrent workload with hundreds of applications versus a few per server

While Linux instances are running on the System z platform, these instances are still considered distributed implementations and as such continue to be administered and monitored as distributed architectures; distributed administrators need not be intimately familiar with z/OS. With provisioning software designed to help take advantage of Linux and the technology within z/VM, the creation and configuration of many Linux instances takes minimal effort and z/VM knowledge, but provides maximum efficiency. For example, a "filesystem snapshot" allows the installation or upgrade of software on a Linux base system, with a subsequently new snapshot of any updates. As a result, completing an update can be accomplished by replacing existing snapshots with the new one. Administrators only need to install the software once as opposed to in every Linux instance in the z/VM environment.

z/VM support for IFL processors is designed to run Linux workloads without increasing the IBM software charges for z/OS, z/OS.e, z/VM, VSE/ESA, and applications running on System z standard processors. Only Linux workloads in an LPAR or Linux guest of z/VM can operate on the IFL processors. Linux users can take advantage of many features that are unique to the System z, including HiperSockets connectivity to CICS, DB2, and IMS running on z/OS, as well as System z quality of service and reliability features.

The System z platform is more than a COBOL or z/OS play. It's a bona-fide server consolidation platform, thanks to z/Linux. Consolidating Linux based distributed infrastructures on System z as opposed to larger distributed servers affords additional benefits such as leveraging the strength of security, backup and restore processes; capacity backup for emergency situations; and easier systems management through a single point of control. Linux on System z can also be used as a stepping stone to the further consolidation of IBM middleware products from Linux to z/OS, including the WebSphere Application Server, DB2, WebSphere Portal Server, Tivoli Security solutions, and more.

Organizations can replace existing servers on a one-for-one basis and add servers here and there to try and keep pace with data growth, but what about reducing floor-space requirements and power

resources? What about improving the infrastructure's manageability and availability? The System z platform can occupy up to one-twenty fifth the required floor space of distributed equivalents, one-quarter of the associated networking hardware requirements of distributed equivalents, and one-fifth the administration personnel costs of distributed equivalents. These savings and more add to further cost savings beyond the capabilities of virtualization and consolidation on a distributed platform.

Disaster Recovery

While the System z platform is designed to be the workhorse in the datacenter, it also provides a significant platform for disaster recovery and continuous availability. One of the primary methods for providing these capabilities to a System z based multi-site enterprise is with the Geographically Dispersed Parallel Sysplex (GDPS). GDPS automatically mirrors critical data and balances workloads between sites. Through this technology, the System z platform offers continuous availability, efficient movement of workload between sites, resource management, and prompt data recovery for business-critical applications and data. This provides a synchronous solution that helps to ensure no loss of data.

Thanks to the on-demand capabilities of System z, processing power can also be turned on (or activated) when needed and turned off when it is no longer necessary. This provides the potential for a significant cost savings compared to distributed implementations where additional licenses are required for standby servers. Specifically, two System z servers can be built with enough additional processing capacity available to handle each other's workload in the event of a system failure, paying for this additional capacity only when required.

System z Solutions

System z is more than a platform designed to help organizations reduce costs through energy efficiency, consolidation, and disaster recovery. Through SOA, System z also allows organizations to capitalize on existing assets, leveraging and associating them with new business processes, helping to create a more agile business and compete in today's business world. Complementing the System z platform, IBM provides customers with the required tools to address many of today's IT challenges.

SOA Enablement

Service Oriented Architecture (SOA) provides a significant avenue for the simplification of legacy asset migration, as well as legacy enablement and legacy rejuvenation. As such, "reuse" is one of the key motivators for SOA. SOA provides new avenues for the retrieval of information without having to undo or rebuild existing assets, and provides new services without having to contend with 20 years of existing architecture; creating re-usable services that mirror existing business processes.

The first step in creating a SOA is to identify the atomic business actions and encapsulate those services. Services within a SOA are coarse grained, meaning that business analysts need not be concerned with the technical intricacies or the *how* of a service's inner workings. Thanks to this loose coupling – the focus on *what* and not *how* – services become technologically agnostic. Specifically, consumers of a service are not interested in the underlying technology or languages used by a service. This independence affords service developers the freedom of choice for hardware, operating systems, databases, or programming languages. As such, developers need not create entirely new applications but are free to utilize existing applications and assets; "rip and replace" is not a requirement. Therefore, any enterprise wide SOA implementation strategy needs to not only include System z, but should start with a plan for how to move these most critical systems into a SOA.

In addition to being technology agnostic, services in a SOA also provide location transparency. This means that consumer applications do not care where a service is located. This affords increased flexibility to move services to more powerful machines, virtualized machines in an effort to reduce hardware and related maintenance expenditures, or if desired, to an external provider. This affords the ability to move and consolidate services created on disparate distributed systems onto the System z platform as throughput, processing, and scalability requirements are increased.

Simply incorporating the System z platform as a passive participant in a SOA implementation, however, does not fully leverage the inherent strengths of the mainframe (i.e. reliability, performance, scalability, security, etc.). Any mainframe-based organization which is implementing SOA should be particularly interested in how well they can leverage their mainframe-based capabilities in their SOA infrastructure, as they plan and build a SOA. The System z platform can be integral to building out SOA given how the creation and development of new software services puts new demands on network performance and security. In short, the System z platform is becoming a service provider on top of existing transactions.

To demonstrate, IBM CICS (Customer Information Control System) Transaction Server and IBM IMS (Information Management System) are high-volume transaction-processing platforms of choice for most large enterprises in a wide variety of industry sectors. These applications represent a rich profusion of proven applications that organizations have come to depend on to run their business reliably and securely. This inventory of highly valuable, critical business applications is a major business asset. However, these applications are often locked into processes that prevent them from being redeployed in a flexible fashion. IBM WebSphere Process Server is designed to provide a platform for transforming business processes through a SOA approach using open standards based technology and a unified programming model that spans people, workflows, applications, systems, platforms and architectures. WebSphere Process Server with the latest CICS Transaction Server and IMS web services capabilities can deliver the flexible platform customers need to move their organization toward implementing strategic SOA initiatives on System z.

WebSphere Process Server along with CICS Transaction Server and/or IMS in a SOA helps maintain full transactional control and IT governance over business processes integrated end to end, with advanced fault-tolerance and error-detection capabilities. Business processes directed by WebSphere Process Server are choreographic critical line-of-business (LOB) applications, composed into business services, to form a business infrastructure that can be used again and again.

Once multiple services are made available through a SOA, they can be combined into composite services or composite applications. For example, a business workflow or process, which traditionally required three separate interfaces and three separate, manual processes, can be combined to provide a single interface, automating those same three manual processes through a single user interaction. Ease of use, reduced training costs associated with new personnel, and increased productivity of existing personnel are some of the first benefits that come to mind. With a slight alteration to the presentation, this same data and these same services can also be used to provide different interfaces or different representations of data for a variety of personnel, based on job descriptions (account reps, fulfillment, etc.).

Co-locating SOA infrastructure with core z/OS assets enables the use of native interfaces for optimizing connectivity, and also enables organizations to make the most of the ability of the z/OS platform to satisfy a wide range of nonfunctional requirements. Some key contemplative concerns that support this perspective include:

- ⇨ the availability of existing middleware for increased productivity, decreased implementation times, and ease of maintenance
- ⇨ the advantage associated with deploying the composed workload in proximity with the System z platform, as opposed to splitting the workload between distributed servers at the front end, adding additional latency communicating with the processes on System z
- ⇨ the impact of two-phase commit coordination between new workload and existing functionality using XA (distributed deployment, tight coupling) or RSS, and potentially in combination with WebSphere MQ for assured delivery
- ⇨ failover requirements either to a local or remote server(s)
- ⇨ the number of interactions between additional tiers and the volume of data being coordinated between them
- ⇨ requirements for passing security contexts between application components and systems
- ⇨ the performance advantages of cross-memory communication (such as hipersockets) as opposed to network latency, some of which could be mitigated if high-speed lines were available
- ⇨ the cost of administering the operation of a single centralized system compared to multiple systems that work together for providing composite business solutions

Role of the Portal - Applying SOA makes it easier for software developers to build composite applications to provide self-service functions via a Web Portal. This also gives developers a common framework for building composite applications. The role of WebSphere Portal Server as an aggregation tool for presentation is a key component of any SOA infrastructure. Initially, the portal was mostly seen as a way to consolidate access to different Web applications according to user profiles and to provide a way to display information. Now with the advent of applications composed of portlets, the role of the portal within the SOA infrastructure is emphasized. Portlets can be run remotely from a portal allowing a portal infrastructure to become more distributed running on various platforms including System z. On System z, use of the zAAP specialty processor means that the Java workloads of the portal can be run at an attractive cost. WebSphere Portal on z/OS leverages the self-configuring, self-healing, self-optimizing, and self-protecting z/OS platform to deliver workload management, scalability, near-zero downtime, and service level agreement management guaranteed results.

IBM middleware solutions support the changing role of the System z platform, enabling it to become a full-fledged, active participant in a SOA implementation. For example, WebSphere Process Server for z/OS is designed to connect System z data to complex business processes via a SOA and the WebSphere Enterprise Service Bus for System z provides transformation and routing of messages within the SOA.

Information Management

An estimated 75% of the data in Web pages is derived from databases. Similarly, with the movement towards Web 2.0 applications comes an increase in reliance on back-end software. While syndication of Web 2.0 differs only nominally from the methods for publishing using dynamic content management, it typically requires much more robust database and workflow support. These increased requirements can lead to excessive hardware sprawl in distributed environments which can be curtailed through use of the System z platform.

Using System z for data server implementations, such as DB2 and IMS, delivers unsurpassed information availability, scalability and security along with immediate and direct total cost of ownership savings. For example, z/VM supports up to 256 GB of real memory allowing consolidation of memory-intensive workloads such as data servers onto a single copy of z/VM as opposed to multiple distributed images, easing administration and infrastructure complexity. Further, a common code base helps ease migration to DB2 on z/OS from distributed systems further capitalizing on consolidated cost savings. Relegating DB2 overhead from the central processors to the System z Integrated Information Processor (zIIP) specialty processor can additionally reduce costs since it is not subject to software costs. Factors such as proximity of applications to data, and zIIP processors also help improve performance and reduce response times helping increase customer satisfaction.

As much as 70% of the world's data is on the System z platform

DB2 for z/OS can also provide organizations with more active means for measuring corporate performance and increasing customer satisfaction than simply decreasing response times. Thanks to legislation such as Sarbanes-Oxley in the United States and international accounting standards, many organizations have been driven to evaluate their master data management (MDM) systems. The recent emphasis on MDM, a requirement to enable consistent computing between diverse system architectures and business functions, has also created a focus on information services, which leverages enterprise data to derive new knowledge about investment opportunities. DB2 for z/OS provides dynamic warehousing capabilities through embedded analytics that can be leveraged as part of business processes. Through support for more real-time access to production information presentable in dashboards, DB2 can provide a more current view of valuable information compared to relying solely on traditional data warehousing solutions that may provide information long after it would have been most valuable.

With the majority of service oriented architecture communication performed via XML, and an increasing number of industry specific XML formats (e.g. HL7 for healthcare and GJXDM for federal government

applications), DB2 also addresses issues associated with storing, converting, and querying this information. Through its true support for XML, DB2 eliminates the requirements for storing XML data as a single record (Character Large Object – CLOB) or shredding the data to fit relational tables. With the introduction of pureXML, IBM DB2 9 supports both XML and relational data in a single database management system. Handling XML as a new data type stored in a hierarchy structure – different from relational data – that reflects the structure of XML, pureXML provides integration of XML with relational data, speeding application development, improving search performance with optimized XML indexes, and is capable of both SQL and XQuery queries on XML data.

DB2 on z/OS helps organizations capitalize not only on the new capabilities of DB2, but also on the added benefits of the System z platform. Depending on factors such as data access, geographies or users, integration needs with other data and/or applications and security, data server workloads not currently running on System z can make sense to migrate to System z given the added benefits. IBM System z Data Servers (DB2, IMS, etc) are trusted platforms and provide the necessary support for today's business including SOA, dynamic warehousing, and OLTP requirements.

Administration and Monitoring

Discussions of the System z platform need not conjure up images of traditional mainframe management through green screen, ISPF, and command line tools. If administrators are still trying to get by only with System Monitoring Facility and Resource Monitoring Facility (or CICS Measurement Facility), they are working way too hard.

The IBM OMEGAMON z/OS Management Console is a new, no-charge monitoring product designed to help the new generation of IT professionals. The console's advanced graphical user interface provides real-time health-check information (provided by the IBM Health Checker for z/OS) and configuration status information for z/OS systems and sysplex resources. The IBM OMEGAMON z/OS Management Console has built-in alerting and expert advice capabilities that can offer detailed contextual information about alerts and corrective actions. IBM has been delivering significant enhancements to help simplify mainframe administration including new point-and-click controls to help administrators manage system performance, tighter SOA integration, and improved monitoring of z/OS health.

Through the Tivoli family of products, IBM can provide the necessary components for system automation including z/OS, IMS, CICS, SAP, WebSphere MQ, WebSphere Application Server and more. Administrators can deal with both distributed and System z workloads through a single framework and interface whether the distributed workloads are consolidated on the System z platform or not. For example, IBM Tivoli OMEGAMON is a suite of data center management products that provide solutions for the System z platform, distributed and data server environments. IBM Tivoli OMEGAMON DE for z/OS combines multiple OMEGAMON products in one workspace to provide a single enterprise viewpoint.

Further extending the productivity gains of administrators, is the fact that Tivoli OMEGAMON and Tivoli Monitoring product suites share a common infrastructure. The Tivoli Management Service infrastructure comprises a set of components shared by monitoring agents of these product suites, allowing both families to display data through the Tivoli Enterprise Portal, for a complete view of an enterprises IT infrastructure.

Similarly, DB2 is also providing more autonomic tools to optimize database administrator efficiency and accuracy, providing an experience more consistent with other relational databases. These and other enhancements are collectively helping reduce the System z specific skills a DBA might require.

While the System z platform has maintained 40 years of backwards compatibility, the tools for system monitoring and administration are not the same as those used 40 years ago. System z monitoring and administration tools have evolved to provide the ease of use expected from today's graphical user interfaces, and help increase productivity and reduce learning curves for newer System z administrators.

Security and Compliance

Security is a concern for any organization. The number of incidents organizations face on a daily basis is increasing. Add to these concerns, the requirement to address compliance with a growing number of

government and corporate security policies, standards and regulations, and security implementations can increase in complexity quite dramatically.

The System z platform innately provides security benefits through features such as HiperSockets communication between LPARs, which eliminate the opportunity to intercept network connections between them. Similarly, there are many features and facilities in z/OS specifically designed to protect one program from affecting another, either intentionally or accidentally. This is why z/OS is known for program integrity as well as security. System z can provide customers with a plethora of security related features and the necessary tools to monitor, audit, manage access and privileges, and provide encryption.

In addition to the base z/OS product, an optional Security Server feature provides the Resource Access Control Facility (RACF), which incorporates elements of security such as user identification, authentication, and access control. One of the most important features of a centralized authentication and access control mechanism such as RACF is the ability to record and analyze security information from a single focal point. This audit data is essential for organizations to ensure that security policies are being adhered to.

Keeping in line with tools already covered for system monitoring and administration, IBM can similarly provide tools for helping ease security and compliance requirements on the System z platform. For example, through the recent acquisition of Consul, IBM provides Tivoli zSecure, a suite of tools that offers an integrated solution to enable System z administrators to maintain security servers, monitor threats, audit usage and configurations, and enforce policy compliance. Similarly, Tivoli Compliance Insight Manager can provide an automated solution for monitoring, investigating, and reporting on user activity throughout the enterprise systems and data. Tivoli Identity Manager for z/OS can provide user provisioning to address the full lifecycle management of users throughout an enterprise. Tivoli Directory Integrator for z/OS helps administrators synchronize user data between various identity repositories to establish an overall set of authoritative sources for user data. Tivoli Directory Server for z/OS is a primary source of key user data, and is a complete LDAP directory running natively on z/OS.

The System z platform can also contribute to the security of an organizations SOA environment through the Security Authentication Facility (SAF), which provides a common API for System z applications to use the services of an extended security manager (including RACF, CA-ACF/2, and TopSecret). Similarly, major System z subsystems such as CICS, IMS, and DB2 use the facilities of RACF to protect transactions and files. New security and compliance tracking capabilities of DB2 v9 for z/OS allows the simplification of existing processes for the management of reporting of changes to production database systems. Column and row-level security within DB2 helps provide additional security and compliance assurance.

Given the distributed potential of SOA implementations, identity federation in conjunction with composite applications becomes a requirement. It is not ideal to have a single system account complete business processes on behalf of users since the individual initiating the individual services cannot easily be tracked. Through IBM Tivoli Federated Identity Management, the security context of users can be passed to CICS applications and web services through a loosely-coupled model for managing identity and access to resources. This management can span companies or security domains without a requirement for replicating identity and security administration. For organizations implementing SOA and Web Services, Federated Identity Manager provides policy-based security management for federated Web services.

z/OS works together with the System z hardware to provide a secure computing platform with multiple recovery levels built in. z/OS works together with RACF, or equivalent vendor products, to protect and secure System z resources including those resources used by the WebSphere Application Server and WebSphere Portal. Instead of building security into new applications, organizations can leverage existing IT security structures, easing auditing of all information for compliance.

Development Productivity

IBM continues to improve its tools for application lifecycle management on System z. These tools provide graphical user interfaces similar to those found in today's windowed development environments. More and more developers are experiencing the benefits of increasing accessibility and reduced learning curves.

Admittedly, even with graphical user interfaces, existing mainframe applications can involve a maze of intertwined relationships and dependencies that could be a nightmare to learn for new developers if it were not for tools such as WebSphere Studio Asset Analyzer (WSAA). With a significant reduction in effort, WSAA helps developers get up to speed quickly on existing application relationships, while experienced developers can remove obsolete and dead code, restructuring or simplifying applications to lower future maintenance costs.

WebSphere Studio Asset Analyzer helps developers understand dependencies within and across applications and associated data across the organization, supporting both System z related as well as Java EE application related programs. Through interactive textual and graphic reports, WSAA captures the relationships between z/OS and distributed application assets whether they are in partitioned data sets (PDSs) or partitioned data sets extended (PDSEs) on System z, directories on Windows or AIX systems, or in one of a number of source configuration management systems. Additionally, IBM Asset Transformation Workbench uses a Web Services interface provided by WSAA to perform deep interactive impact analysis. Application visualizations help identify application artifacts (such as programs, screens, and transactions) that might otherwise be affected by proposed code or operational changes.

Once these relationships are understood, WebSphere Developer for System z (WDz) provides an environment for developing, testing, and integrating existing applications into a SOA. Developers can build web services from existing CICS applications and IMS transactions, aggregating multiple transactions into a high-level business process through visual modeling. Built on Rational Application Developer, WDz helps bridge new and existing technology by including all of the Java EE web development tools. Developers can generate JSF/Java EE web front ends and a COBOL backend running on System z, through the same tool, reducing learning curves for multiple tools.

While there has been some discussion that COBOL developers may be difficult to secure where organizations still implement these applications, proficient knowledge of COBOL is no longer a requirement. IBM Rational COBOL Generation tools are designed to allow developers familiar with Java, Visual Basic, or COBOL to create SOA-enabled z/OS applications by using a platform-independent language – Enterprise Generation Language (EGL) - that is then translated into COBOL.

Traditional development methods however, such as COBOL, are not a requirement on the System z platform. Thanks to continuing enhancements to DB2 and IMS data servers, support is available for Java, JDBC, XML, Web Services, and other current developer technologies. For example, DB2 and IMS both provide support for the same XQuery language. Developer productivity is increased through visual representation of data, common programming models, and integration with WebSphere and related tools. Developers can quickly transform and expose existing IMS transactions through Web Services, and invoke distributed WebSphere applications and Web Services through WebSphere Studio tools. These enhancements help simplify development, automation, and optimization of applications.

Many users that have grown up with Windows development environments may have a perception that development for System z requires knowledge of older development tools, or languages that were predicted to be extinct at this point. Today, making this comparison could be like saying Windows developers need to use DOS tools to create Windows applications; not the case in either instance. IBM continues to advance its development tools not only for a distributed environment but also for the System z platform. IBM WebSphere Developer for System z includes capabilities that can help make traditional mainframe development, web development, and integrated SOA-based composite development fast and efficient.

Summary

The mainframe has lived through the transition from a centralized mainframe environment to client/server in the 1980s, which was eventually followed by the Internet's return toward centralized application logic that leveraged the thin clients of the web. While the mainframe remained a constant, being the quintessential platform providing much of the core IT value in the organizations that depended upon them to run their businesses, the platform hardly stood still.

Where the System z platform may once have been the hottest server in the datacenter, it is now one of the coolest. The platform has evolved to provide significant cost savings with respect to energy consumption and reduced administrative overhead. With continued advancements in virtualization and consolidation, and developments with respect to MSU pricing and the availability of specialized processors, the System z platform continues to be an ever growing presence in IT departments, globally.

System z is a proven offering with a strong backing both from customers and ISVs alike. IBM continues to demonstrate its commitment to the System z platform with continued R&D investment, and new product innovations, making it a strategic platform for deploying new workloads into the foreseeable future.

For More Information

Contact your local IBM representative today for more information about how you can achieve business results well ahead of your competition.

Visit http://www.ibm.com/software/os/systemz/en_US/index.html for more information about IBM System z software and solutions.

IBM Corporation
Software Group
Route 100
Somers, NY 10589
U.S.A.

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