

## The business value of enterprise modernization

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## Introduction

Over the last few years, you might have seen, heard or lived some of the following key facts regarding your mainframe applications and environment:

- *Billions of lines of mainframe code are running today's businesses, and more are being added every year to mainframe applications. Some of these mainframe applications have been maintained over a period of decades, not just years.*
- *Over time, your organization's significant investments have increased the value of your mainframe applications, which are critical to the success of your business. The applications are at the heart of your organization and enable you to manage and process the majority of your customer, product, supply-chain and critical business data.*
- *The number of developers who maintain your applications is decreasing. And often, your developers are spread across multiple locations, cities and in some cases, countries.*
- *Businesses are demanding more and more from IT, so it's often up to smaller development groups to deliver more-agile applications.*
- *Applications must also be delivered under the constraints of increased governmental regulations.*

This white paper outlines IBM's enterprise modernization "philosophy" for IBM System z™ organizations. Though it mentions some specific IBM offerings, it is not an in-depth, technical perspective. Our goal is to address enterprise modernization from a business perspective, that is, why should you modernize and why should you use your System z platform as part of that modernization effort. This paper discusses the platform itself, then moves to software, both tooling and your application code, and discusses your developers and their skills.

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### Highlights

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*Learn how your existing System z platform and applications can help in your modernization efforts.*

### What is enterprise modernization?

Traditional IBM System z or mainframe applications are large and sometimes complex solutions that address specific business functions. However, today's business systems increasingly involve composite applications that support a business process and include sets of related and integrated services that come from different existing application silos. Although these applications, along with the information and functions they contain, are invaluable to your business, they often compartmentalize your processes or hide duplicate functions and information. Such inefficiencies can inhibit agility, decrease responsiveness and slow your time to market. Furthermore, this complexity can increase application maintenance expenses, diverting your resources from strategic business initiatives and innovation.

To make your business more responsive, you need to make your existing applications more flexible, reusable and easy to maintain. However, rewriting them can be expensive, time consuming and risky, with no guarantee that they are any better. And replacing them with packaged solutions can also be problematic because you risk losing the intellectual capital that's buried deep in your systems. Repurposing or modernizing existing mainframe applications is both a financially sound and a time-tested approach to modifying existing assets so they can be included as part of a Web services architecture, such as a service oriented architecture (SOA). By modernizing your applications, you can make them more agile, flexible and robust, increasing your organization's responsiveness to marketplace dynamics and changing business needs.

Additionally, by streamlining application and operational processes, you can free up more resources to focus on developing new business requirements and capabilities. Best of all, modernization can be done in an evolutionary, not a revolutionary, manner that will help to minimize the risks to your organization.

### Enterprise modernization—hardware perspective

From a hardware perspective, why should you want to continue to modernize and deploy your applications on the mainframe instead of moving them to a different platform?

### Highlights

***The power and cooling costs for distributed systems can be significantly higher than those of a System z mainframe.***

### Energy Savings

From the Robert Frances Group, “RFG recommends that IT executives take a close look when comparing mainframe systems to distributed systems at total transaction throughput and calculating the energy per transaction to get a better estimate of the relative costs between mainframe and distributed applications for a true sense of energy efficiencies associated with each of these systems.”<sup>1</sup>

Energy costs have escalated significantly in recent years, especially this past year. This has a direct effect on an IT shop’s budget, because power and cooling requirements can account for up to 40 percent of the operational budget. A crisis can develop when you must decide whether to build new facilities to meet new power or cooling needs or stop all new application deployment, a risky business decision at best. According to the Robert Frances Group, one retailer found that a single IBM System z9® server replaced 200 Sun systems, and reduced the energy requirements by 97 percent. Not only did the z9 server reduce their electricity costs, it also used significantly less floor space. These savings are based only on the processors themselves and did not include the space, power and cooling savings that were associated with the external disk that the Sun systems required. For a comparison of the cooling requirements and costs, see Figure 1.<sup>1</sup>

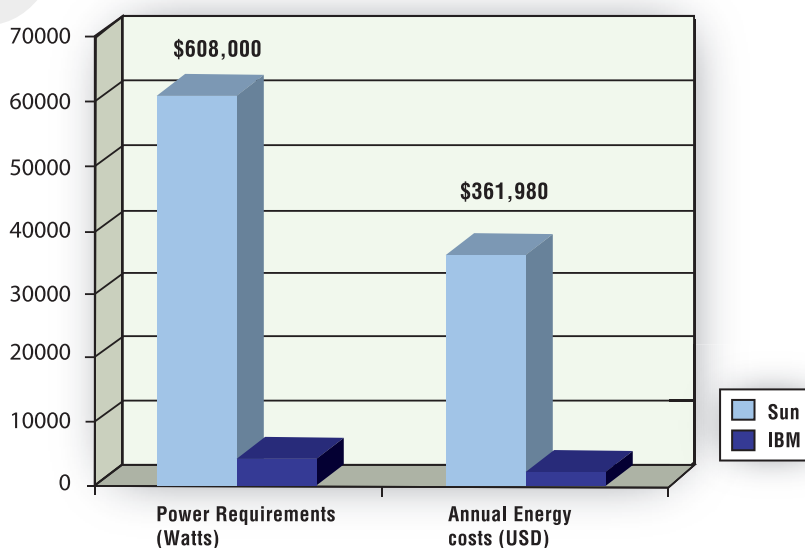


Figure 1. Sun versus IBM cooling requirements and costs

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## Highlights

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***The System z mainframe requires less energy than the distributed platforms required to support the equivalent application workload.***

In addition to the significant power and cooling savings, the Robert Francis Group found that distributed systems—in particular, rack-based systems—had a higher failure rate than mainframes. IBM System z mainframes can run at 99.999 percent availability with average unplanned downtime of under 5.3 minutes per year. As downtime costs approach an estimated US\$3,000,000 per hour, this level of availability can result in substantial savings.<sup>2</sup>

### Personnel costs

The increased rate of failure of distributed systems can increase the overall number of system administrators required to handle these failing systems, as well as the routine administrative tasks. This is in stark contrast to the fairly constant number of administrative or systems-based personnel associated with a mainframe environment. When new workloads are added to a distributed environment, this can mean additional systems, and thus additional personnel, unlike a mainframe environment, where new workloads can mean the addition of a logical partition (LPAR) or two, but not additional personnel to maintain them.

There is more than one way mainframes can save personnel costs. According to a recent Branham Group report<sup>3</sup>: “Thanks to many years of development, the self-healing, self-managing, self-protecting, and autonomic technologies of the System z platform have reached new levels. Not only are fewer personnel required compared to sprawling distributed platforms, there are also lower personnel requirements compared to the System z platform from years past. The addition of these autonomic capabilities has resulted in a reduction in System z staffing levels (operators and system programmers) per MIPS over the last several years.” And if there is one thing that an IT manager knows, it’s that while the cost per hardware millions of instructions per second (MIPS) has been going down, personnel costs have been going up in recent years.

### CIOs are seeing green

According to a recent article in *Manufacturing Business Technology*, the adoption of eco-friendly computing is emerging as a priority for CIOs.<sup>4</sup> Independent market analyst Datamonitor found that 75 percent of those surveyed considered eco-friendly IT as an important part of their IT strategy. This leads Datamonitor to predict an increase in both CIO interest and vendor offerings to fill the green IT market.<sup>5</sup> This change comes about because of the constant budget challenges that CIOs face.

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## Highlights

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The energy-efficient mainframe meets one of the first requirements of an eco-friendly environment. It consumes significantly less energy than the number of distributed systems required to support the equivalent application workload. The smaller physical footprint also provides a smaller carbon footprint, the goal of any eco-conscious person or company.

### Software savings

A different type of green that makes CIOs happy is the “green” of cost savings, in particular, software cost savings, from upgrading to a newer IBM System z9 server. Many independent software vendors (ISVs) and IBM license their software based on the number of consumed millions of service units (MSU) per hour or total MSU capacity. IBM’s newer System z machines typically have lower MSU ratings than their predecessors. As a result, organizations can run their existing IBM z/OS® applications on upgraded hardware and actually save money. Today’s System z9 server provides about 7.3 MIPS per MSU, compared to the 5.9 MIPS in one MSU on the older z900. Purchasing the latest hardware can actually help decrease software costs, offsetting software upgrades.

**Several System z specialty processors can also help ensure that software costs are lower by shifting execution of specific workloads to these processors.**

Several specialty processors can also help ensure that software costs are lower by shifting execution of specific workloads to these processors. They include:

- *Integrated Facility for Linux® (IFL) processors, which enable companies to move Linux workloads from standard central processors to the IFL at a lower cost.*
- *System z Application Assist Processors (zAAPs), which process Java™ code, again allowing companies to control software costs and to reduce the demands and capacity requirements on general-purpose processors, making them available for reallocation to other mainframe workloads.*
- *System z9 Integrated Information Processors (zIIPs), which are specialized for processing database workloads. This helps reduce software costs associated with workloads such as business intelligence, enterprise resource planning, and customer relationship management. Today, with no code changes to applications and no configuration changes to IBM DB2® software, zIIP specialty processors are activated automatically without any tuning requirements, significantly reducing workload by redirecting it to the zIIP.*

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***The built-in security of the mainframe and its virtualization capabilities offer additional reasons for running today's applications on the mainframe.***

### Other reasons to move applications to or keep them on a mainframe

In addition to the energy and financial reasons already mentioned, there are more reasons to use the mainframe for your business critical applications.

#### Security

The security-rich holistic design of the IBM mainframe can mitigate the risk of security breaches and help to protect your organization's brand image. Originally designed to be shared by thousands of users, the IBM mainframe has security built into nearly every level of the computer, from the processor level, to the operating system to the application level. This design helps protect the System z platform from malware, viruses and threats from insiders.

System z security features can help you to meet regulatory reporting needs with confidence. These features include encryption solutions to help secure data from theft or compromise, access control management and extensive auditing features, with the simplicity of centralized management. System z security is one of the many reasons why the world's top banks and retailers rely on the IBM mainframe to help secure sensitive business transactions.

#### Virtualization

Virtualization has become the buzzword for businesses wanting to lower their total cost of ownership and improve reliability and flexibility. In simple terms, virtualization offers a way to help consolidate a large number of individual small machines on one larger server, easing manageability and more efficiently using system resources by allowing them to be prioritized and allocated to the workloads that need them most at any given time. Thus, you can reduce the need to over-provision for individual workload spikes.

Partitioning and virtualization are complementary technologies that are most effective when combined, but it is still important to understand the distinction between the two. *Partitioning* provides the ability to divide physical system resources into a number of distinct, isolated regions that operate independently from each other. In general, there is a one-to-one relationship between a physical resource and the region or logical partition it is assigned to, creating the equivalent of a "box within a box." All the physical pieces behave and perform exactly as they do if partitioning were not present. *Virtualization* takes this concept one step further in that it provides the ability

to simulate the availability of hardware that might not be present in sufficient amount—or at all! Virtualization uses the available physical resources as a shared pool to emulate missing physical resources. Virtualization is capable of very fine control over how and to what extent a physical resource is used by a specific virtual machine or server.

Virtualization technologies can ultimately help:

- *Reduce financial pressures.*
- *Improve security and operational resiliency.*
- *Protect sensitive data.*
- *Accelerate time to market.*
- *Deploy new capabilities.*
- *Reduce “islands of information.”*

Through System z virtualization technology, rapid server deployment and provisioning can help enable new virtual servers in real time, and virtual blade technology can support multiple diverse workloads in a protected and isolated environment. Low network latency between virtual systems allows you to map physical server topology onto the System z landscape and allows you to manage tens to hundreds of virtual servers from a single point of control.

During spikes in demand, the IBM mainframe’s ability to quickly redistribute system resources and scale up or out can make the difference between flawless execution and the cost of slow response times or system crashes. For example, a single System z mainframe can scale up to millions of transactions per day or scale out to manage tens to hundreds of virtual servers. It can also dynamically redistribute system resources to autonomically manage varying server demands on the system’s resources.



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***The goal of the five-year, US\$100,000,000 simplification initiative is to make the mainframe easier to use and manage.***

### Simplification initiative

In late 2006, IBM announced a cross-company effort to make the IBM System z mainframe—the world’s most sophisticated business computer—easier to use for a greater number of computer professionals by 2011. The goal of this five-year effort, which will include an investment of approximately US\$100,000,000, is to enable technology administrators and computer programmers to more easily program, manage and administer a mainframe system, as well as to increasingly automate the development and deployment of applications for the mainframe environment. The initiative, involving a team of hardware and software experts, uses IBM’s expertise in automation and systems management.

The major areas of IBM’s mainframe simplification strategy include:

- *Automated configuration checking, to make it easier for information technology administrators and computer programmers to predict and avoid technical problems.*
- *Modernizing the mainframe user interface, including tools for network configuration, systems management, and data center hardware configuration that are designed with both existing IT staff and the new generation of IT workers in mind.*
- *Improving asset management technologies for software, to make it easier for users to control software costs, as well as simplify and automate the acquisition of software services.*
- *Modernizing the mainframe’s development environment, with visual tools that enable novices to quickly learn how to program for the mainframe. More on this in the next section.*

### Enterprise modernization—software perspective

Now let’s look at enterprise modernization from a software or application perspective. IBM enterprise modernization solutions<sup>6</sup> are designed to address today’s critical enterprise modernization issues of maintenance costs, using existing assets, architectural complexity, siloed teams, cross-platform support and skills. (See Figure 2.) With decades of leadership in enterprise modernization, IBM is well positioned to provide the capabilities that your organization requires to cost-effectively and incrementally evolve your

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enterprise systems toward modern architectures and technologies.

IBM enterprise modernization solutions can help your organization adapt business processes quickly and flexibly by reusing existing applications and data. Developers can unite and use their skills in disparate programming languages and work within a single, integrated development environment. This environment helps to form the foundation for your enterprise modernization initiatives.

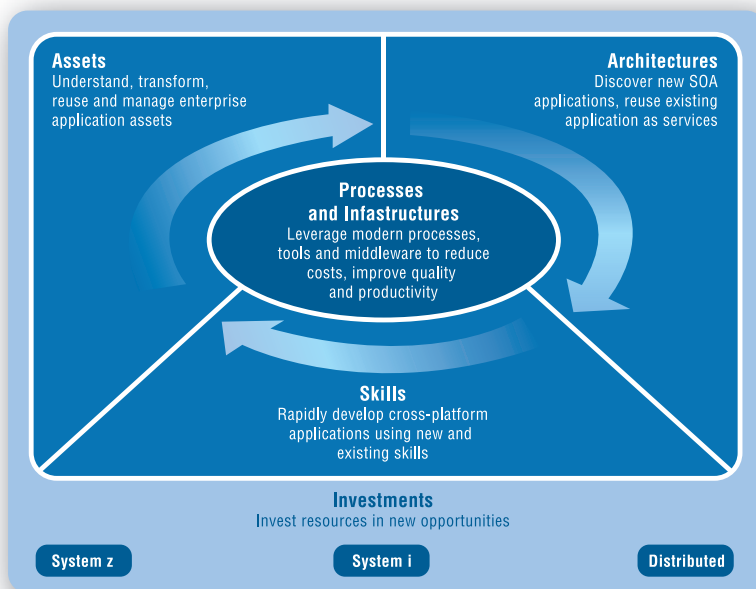


Figure 2. IBM enterprise modernization solutions are designed to address an enterprise's critical modernization issues.

**Any successful modernization effort, whether for SOA or to improve application maintenance, requires insight into existing applications.**

### Asset modernization: Extending the value of existing enterprise assets

Successful modernization initiatives require deep insight into targeted applications. Asset discovery and transformation tools can help your development teams generate detailed reports and graphics that enable rich understanding of existing applications. With this knowledge, developers can quickly identify the business rules embedded in core business processes, and

they can restructure code, remove dead code and create reusable components that can be enabled as services within an SOA. In addition, asset modernization tools can help you:

- *Manage and govern the design, development and consumption of software assets and services.*
- *Eliminate the need to research, catalog and assemble the information for each service request.*
- *Identify assets that could be affected by proposed changes.*
- *Reduce the cost of ongoing application maintenance.*
- *Shorten the learning curve for new developers.*
- *Improve the productivity of existing IT staff.*

Asset modernization tools can help analyze their business software and identify components that can be reused. Component identification within their applications provides an organization the ability to modernize incrementally to minimize risk and costs. According to Jeffery Poulin and Brent Carlson, the industry-average cost to develop new software is approximately US\$100 per line. “This means that every 1,000 lines of reused code yields a Development Cost Avoidance of \$80,000!” This certainly makes the case for reusing existing code in any modernization effort.<sup>7</sup>

#### **Support the lifecycle of assets**

When you begin the process of creating reusable assets, it is also important to properly manage and govern your services. By establishing a comprehensive picture of your software assets, you can improve asset reuse, which in turn can help you quickly deliver innovative IT solutions and help you control costs, reduce application backlogs and improve business flexibility and responsiveness. IBM Rational® Asset Manager can help improve productivity and software delivery through asset reuse by enabling you to create, modify, govern and locate any type of development asset, including SOA and systems development assets. IBM WebSphere® Service Registry and Repository provides better management and governance of your deployed services, providing tangible business value from your SOA implementation.

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**Architecture modernization can help integrate the complex architecture of mainframe applications with Web applications that users are demanding today.**

### **Analyze existing enterprise applications**

Often, enterprises have hundreds of project teams simultaneously making changes to application code and data structures. An automated asset-analyzer application, such as IBM Rational Asset Analyzer, can help your people cut through the complexity of the applications and interdependencies across your enterprise to increase productivity and improve product quality. Rational Asset Analyzer scans mainframe and distributed software assets, stores related application information in a repository, and makes the data available in graphical and textual format through a Web browser.

### **Transform existing software assets into reusable components**

IBM Rational Transformation Workbench helps you identify reusable components and business rules that can be extracted and converted into a Web service, which is a key part of enterprise modernization. Identifying these rules can help accelerate strategic and tactical modernization initiatives by allowing development teams to quickly transform existing assets and discover reusable business logic for creating services.

### **Architecture modernization: Driving innovation with technology advancements**

Your modernization initiative must also address the complex dimensions of architecture. Fragmented business processes, workflows, data and tightly coupled application architectures reduce your flexibility and agility. To transform your core systems into flexible applications and services while avoiding costly and high-risk rip-and-replace approaches, you can work with what you already have. Architecture modernization can help you reduce time to market, improve business alignment for growth, cut costs and limit business risk. Design and construction tools from IBM are designed to:

- *Speed the efficiency of System z development, Web development and integrated mixed-workload development.*
- *Break skills silos by simplifying and accelerating cross-platform development.*
- *Increase productivity and reduce training costs by extending host applications to modern user interfaces.*
- *Accelerate the adoption of SOA by rendering existing IT assets as service components, which encourages reuse and efficiency.*
- *Create enterprise data standards, verify compliance and generate compliant models.*

#### **Speed maintenance of your traditional applications**

As you transition to a more modern enterprise, it's important to maintain your traditional applications even as your developers begin doing more Web-based development. IBM Rational Developer for System z includes capabilities that help improve the speed and efficiency of development projects, including System z development, Web development, integrated SOA-based composite development, and COBOL, PL/I, C, C++, EGL, High Level Assembler (HLA) and Java projects. Optimized for WebSphere and System z environments, Rational Developer for System z:

- *Supports multivendor runtime environments.*
- *Runs on the Eclipse open source platform so developers can adapt, extend and customize their integrated development environment (IDE).*
- *Supports creation of services deployable to the IBM CICS®, IBM IMS™, IBM WebSphere Application Server and IBM DB2 stored-procedure environments.*
- *Supports development of multiple types of user interfaces, including traditional 3270, Web, Rich Web, Java Server Faces (JSF), Java Server Pages (JSP) and JavaScript.*

According to a recent study by the Branham group, when compared to using the traditional ISPF/TSO combination of tools, developers using IBM WebSphere Developer for System z (the predecessor to Rational Developer for System z) could be up to 44 percent more productive when coding, testing and debugging complicated real-world applications. Unlike with tooling such as Rational Developer for System z, developers using the traditional tooling were unable to easily meet the study requirements for creating and testing Web services or Web applications.<sup>8</sup> This gap is now extended further with new tooling support for Web 2.0 applications.

#### **Easily extend your applications to the Web with reduced cost and risk**

Making your existing mainframe applications available through the Web can help extend their value while increasing efficiency and promoting asset reuse. With IBM Rational Host Access Transformation Services (HATS) for Multiplatforms, you can create Web applications (including portlets, rich client applications and applications targeted for browsers on mobile devices) that provide a standard and easy-to-use graphical user interface (GUI) for your 3,270 applications running on the System z platform. You can also use

Rational HATS to create Web services that provide standard programming interfaces to business logic and transactions contained within host applications. Rational HATS is also designed to:

- *Help improve the workflow and navigation of your host applications, without access or modifications to the application source code.*
- *Transform host-screen components in real time.*
- *Enable you to add lists, hot links, tables, buttons, valid-value lists, tabbed folders, graphs, and other elements such as logos, graphics and backgrounds.*
- *Help you create programmed navigation through multiple terminal screens to improve the productivity and usability of your host applications.*
- *Help you create Web services from existing applications, so you can reuse those services as building blocks within your SOA solutions.*

### **Skills modernization: Using and modernizing existing and new skills**

Your traditional IT professionals have decades of experience and domain knowledge. The question is, how do you use this experience to improve your current enterprise applications and take advantage of the new architectures and technologies that are available on these platforms? IBM offers several tools that support higher development productivity through the powerful, platform-neutral, business-oriented Enterprise Generation Language (EGL). Because it's platform independent, EGL enables developers to build cross-platform applications and automatically generate and deploy native Java and COBOL code that's optimized for the target platform. EGL hides the details of the target execution platform and associated middleware, enabling developers to focus on the business problem rather than on the underlying implementation technologies. Even developers with little or no experience with Java and Web technologies can use EGL to create enterprise-class services and applications quickly and easily.

IBM skills modernization tools can help your company:

- *Use new technologies and innovation without retraining your existing staff.*
- *Assign new employees to any project, no matter what the target platform is.*
- *Speed the efficiency of System z development, Web development and integrated composite application development.*

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***Rich Internet Applications (RIAs) are applications offered through a browser, but behave like a desktop application. RIAs are easy to maintain because new versions are made available by simply refreshing the browser page, and no installation is required. However, Web 2.0 and RIAs are hard to build because developers have to learn many different technologies, such as XML, Ajax, SOAP and so on. Rich Web support in IBM EGL was specifically developed to help developers easily create these highly responsive, rich Web applications without having to understand new technologies.***

### Using EGL, a major advancement in business languages

Because larger enterprises can have numerous development platforms and skill sets, a platform-neutral development approach can help eliminate skills silos and create a unified pool of business-oriented developers who can be freely shifted across projects according to business demands. IBM Rational Business Developer can help you build such an environment by enabling your developers to focus on the business logic rather than the platform or complex runtime technologies on which the solution will be deployed. The application is based on EGL, an end-to-end rapid development approach that provides:

- *Higher development productivity through a powerful, platform-neutral, business-oriented specification and a wealth of rapid development tools and wizards.*
- *Simplified SOA support and tools to help quickly define, test and deploy services to a variety of platforms, including automated services generated from models.*
- *An easy-to-learn language that enables developers with general programming skills to be more productive in the delivery of robust modern applications. EGL is part of several IBM IDEs including Rational Business Developer and Rational Developer for System i for SOA Construction™.*
- *Extension and modernization of existing applications through built-in interoperability with COBOL, PL/I and other programs, enabling you to reuse existing investments as new services or Web systems.*

Another Branham Group productivity study concluded that for simple Web application development, IBM EGL productivity is similar to, if not better than, Microsoft® Visual Studio® 2005 .NET. Additionally, IBM EGL provides higher productivity for cross-platform, enterprise-level application development through a single IDE and language. For example, the Visual Studio product did not support creating a COBOL/CICS server program to manipulate a VSAM data file, which was part of the study application requirements.<sup>9</sup>

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***Ensuring that all components of a cross-platform application are at the required level is critical to avoiding expensive downtime.***

### **Process and infrastructure modernization: Improving team collaboration and responsiveness**

Organizations have traditionally managed mainframe development separately from other platform development. However, this separation not only can hinder collaboration and productivity across the software life cycle, it can also lead to errors that result in application failure or downtime. IBM tools for process, quality, and change and release management help automate and enforce development processes and enhance collaboration and productivity across multiple operating platforms throughout the application life cycle.

These tools help you:

- *Enforce software governance policies and procedures across functionally diverse and geographically distributed teams.*
- *Ensure that business goals and requirements drive downstream design, development and testing.*
- *Lower costs by eliminating duplicate tools and processes.*
- *Realize improved end-to-end communication and traceability across the life cycle.*
- *Verify software builds and document the exact software versions that are deployed.*
- *Manage quality across the software-delivery life cycle.*
- *Strategically integrate application security throughout the software-development life cycle.*
- *Validate the scalability and reliability of complex applications before deployment.*

### **Govern change and release processes**

Solutions for change and release management can help boost productivity, improve visibility into projects and processes, unite distributed teams, and provide audit trails and traceability across the software-development life cycle for fast delivery of high-quality software. Further, tools such as IBM Rational ClearCase® software, with its support for the IBM z/OS operating system, can unify workflows for software configuration management and software change management. They can also help manage the software-development life cycle by using built-in replication and synchronization capabilities to provide integrated version control, workflow management and defect tracking.



Enterprise change management, such as IBM Rational ClearQuest®, can help protect your software assets globally, and help ensure that changes are linked to approved requests and that those changes are driven by a valid business requirement. IBM Rational Build Forge® software provides build and release management, and helps IT groups automate repetitive tasks and enable consistent, repeatable processes. IBM Rational solutions can also help your globally dispersed teams manage the complexity of parallel development with multiple changes and releases that typically occur in the development shop.

### **Development investment modernization: Enabling business flexibility**

Modernizing how you invest your development dollars is the final key to enterprise modernization. Investment modernization includes moving investments to key platforms, architectures, and applications that can return maximum ROI. Organizations that continue to rely on inefficient existing applications and non-relational databases are finding that their ongoing maintenance costs are skyrocketing. To avoid this scenario, you need to make the transition to open, modular and proven software-development platforms that span the entire software-delivery life cycle.

Application development offerings from IBM can help you:

- *Devote resources to new development rather than to maintenance or to supporting the operating infrastructure.*
- *Move to the latest modern architectures and use the capabilities of the IBM Rational Software Delivery Platform.*
- *Make incremental improvements within the context of a long-term strategic modernization plan.*

### **Skills improvement**

Although COBOL was the language taught to college students in the early 1980s, that later changed to languages such as Basic, C/C++ and Java. CIOs and others are wondering where they are going to get the skills they require to maintain and enhance their extensive System z platform applications. IBM has several programs designed to help address these issues. One, the Academic Initiative, is a program where IBM has committed to training

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***The IBM Academic Initiative is training thousands of students to help meet the industry need for z/OS skills.***

20,000 students by 2010. Working with more than 1,000 universities around the world, the Academic Initiative has educated over 10,000 students on z/OS so far, and these numbers are growing. Phil Murphy of Forrester says that “CIOs with extensive investments in the [IBM] zSeries® platform should leverage the academic programs by hiring and pairing graduates with veteran workers who are nearing retirement.”<sup>10</sup>

A second initiative is mainframe simplification. As mentioned previously, the goal of this US\$100,000,000 investment is to make it easier for technology administrators and computer programmers to program, manage and administer a mainframe system. To again quote Phil Murphy of Forrester, “Supply and demand are forces that affect every market. When any commodity is in short supply and high demand, its price increases, stimulating alternate sources of production. IT graduates with mainframe skills are no exception.”<sup>10</sup>

Recent evidence of the interest in mainframes came in another project that IBM conducted, the IBM Student Mainframe Contest. More than 700 students from more than 85 different universities and colleges participated. The contest, which involved students remotely connected into a mainframe to perform certain tasks, consisted of three levels, in which each level presented a task that was more difficult than the previous one. What this contest showed IBM and the mainframe community was that there are students out there with mainframe skills who are excited about the platform.

## Summary

Mainframes not only run your business in a secure, dependable, and flexible way but can also offer a lower TCO. These are just a few of the reasons to make your mainframe the centerpiece of your application modernization efforts. To summarize:

- *Mainframes are dependable and available. They have fewer than five minutes of downtime per year, and the mean time to failure can be measured in decades. You are likely to upgrade your system well before it fails.*
- *Mainframes are expandable because you can add capacity and software updates without a reboot; adaptable because they respond automatically to spikes in workload demands; flexible because they align processing priorities with business priorities; and scalable because they can run hundreds of virtual servers concurrently.*
- *Customers see significant business advantages through ease of management, high utilization, 99.999 percent availability and software pricing that can often offer the lowest TCO. Customers have also learned that mainframes running multiple workloads with maximum utilization are the most cost-efficient platform.*
- *IBM offers development tooling for the full application life cycle to make your cross-platform development efforts more efficient and more productive.*
- *Mainframe developers can deliver and support a broader range of applications, including some of the core application models running customer businesses today—Web, Web2, CICS, IMS and batch. And arguably a higher percentage of IT personnel in mainframe organizations can be used for development, ultimately returning profit. This is due to the mainframe's lower human support costs versus distributed systems.*
- *IBM is committed to the mainframe and expanding education worldwide. Over 230 schools are teaching mainframe education, and more than 10,000 students have received mainframe education since 2004.*



### For more information

To learn more about the IBM enterprise modernization solutions for System z, please contact your IBM marketing representative or IBM Business Partner, or visit the following Web site:

[ibm.com/software/info/developer/solutions/em/systems/z/index.jsp](http://ibm.com/software/info/developer/solutions/em/systems/z/index.jsp)

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