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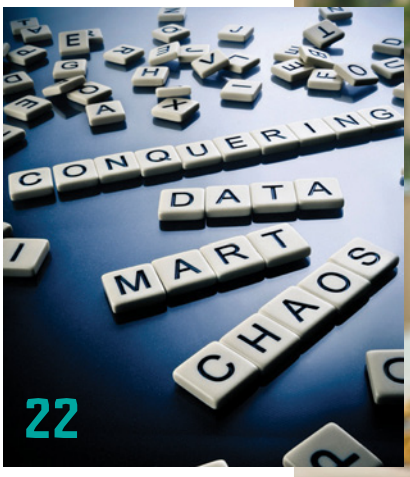

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Cover photo courtesy of IBM

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Mainframe edition
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We asked our contributors: What was your favorite subject in school?

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Keep Your Eye on the Ball

PHOTOGRAPH BY TRAVIS ANDERSON

Anyone who's played—or even watched—baseball knows something about real-time analytics. In the half-second it takes for the ball to travel from the pitcher's hand to home plate, a batter has a multitude of questions to answer.

For organizations, business analytics gives them that "batter's eye" to see what's coming and react; enabling them to glean insights by analyzing data approaching like a 99 mph fastball. By effectively reacting to—or even predicting—events like shifts in consumer demand, supply-chain issues or social media trends, they can gain an edge over competitors.

That keen vision is enhanced further with the zEnterprise* EC12 (zEC12), the latest addition to the zEnterprise portfolio, announced recently by IBM. Get your first look at the zEC12 in our cover story on page 18. For more details, check out our online coverage at ibmsystemsmag.com.

In addition, this issue focuses on how IBM System z* technology can deliver a comprehensive, secure data analytics environment. It includes two features on the topic—one explaining how the mainframe can help conquer the chaos often brought on by data mart proliferation (page 22), and the other on how the new SPSS* Modeler 15 enables split-second decisions through real-time scoring (page 28).

No discussion of analytics would be complete without mentioning big data. That's covered as well. The IBM Smarter Storage for Smarter Computing release (page 8) helps clients embrace information growth, deliver information faster and manage storage with less complexity.

One company familiar with creating order from disorder is Commerce Bank (page 14). When its application-development processes became unmanageable, it turned to a change-management solution from ISPW.

For information on IBM business partner solutions, see the 2013 Mainframe Buyer's Guide. Also included with this issue is the Women in Technology supplement featuring six key players in IBM's larger ecosystem.

Clearly, data analytics requires the latest and greatest platform, tools, knowledge and approach. When all of those come together, organizations are assured of hitting one out of the park.

Mike Westholder,
Managing Editor

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Bob Rogers

A way with words

A sought-after speaker and popular personality at SHARE conferences, IBM Distinguished Engineer Bob Rogers is rarely at a loss for words. This might be due, in part, to his interest in linguistics, despite no formal education on the topic. Today, Rogers describes himself as an amateur linguist, which he defines as "someone who loves to read about language, but is too lazy and undisciplined to actually learn any languages." His mastery of English, however, is evident in this issue's Tech Corner on page 32.

James Bennett

A sense for humor

James Bennett, illustrator for the "Split-Second Decisions" feature on page 28, has created humorous illustrations for multiple publications, including The New York Times, Sports Illustrated and Mad. The Pennsylvania resident also has illustrated books by comic legends Carl Reiner and Mel Brooks ("The 2000 Year Old Man Goes to School") and Jerry Seinfeld ("Halloween").

Transforming Data Into Value

Data can be of one your most valuable resources. And when you add the right specialized hardware and software technologies, it can change the way you do business.

Analyzing billions of pieces of information for patterns can help with everything from managing traffic to launching new products. It's all about making smarter, faster, real-time decisions to gain an advantage or avoid risk.

IBM System z* technology—with the newly announced zEnterprise* EC12 (zEC12) platform—can play a business-critical role. Our next-generation enterprise system brings together multiple architectures for real-time analytics, as well as hybrid computing for private clouds and simplified management.

We've found that if 50 percent or more of the data you access for a workload comes from the System z platform, it's most efficient to run it right there. Limiting how far the data moves before it's accessed reduces latency.

Likewise, System z technology features a comprehensive set of data warehousing and business analytics capabilities that help create new opportunities. Adding the IBM DB2* Analytics Accelerator to the environment can provide significant competitive advantage, according to internal IBM tests. In these tests, clients' query times that previously ranged from 25 seconds to 90 minutes took only eight seconds or less. And with the new zEC12 server, these numbers are expected to further improve.

For data mining and text analytics, SPSS is available with Linux* on System z. One of the unique attributes of SPSS* Modeler 15—the latest version—is its in-database scoring for DB2 for z/OS*. This real-time scoring of transactional data allows organizations to incorporate the newest and most relevant data as it's received directly into the decision-making process. The result is better, more profitable decisions.

Predictive analytics and scoring captures information about people's attitudes and opinions, and uses it to predict the outcomes of interactions before they occur. Organizations can proactively and repeatedly reduce costs and increase productivity to:

- Improve customer service through visibility into current inventory, ensuring the right stock is available when customers need it.
- Identify and manage transactions with a high probability of fraud.
- Increase marketing campaign success with higher response rates with fewer touches.

For integrated reporting, plans and scorecards, IBM Cognos* is available for either Linux on System z or z/OS. And the recent delivery of ILOG CPLEX Optimizer for z/OS helps companies solve complex business optimization problems involving millions of constraints and variables. It takes facts—costs and yields, available resources and demand, goals and constraints—and finds the best possible plan or schedule of activities, thereby solving tough planning and scheduling problems.

The System z approach is an inclusive and integrated solution that builds upon real-time operational data spanning the enterprise as the foundation for a new level of insight that can be delivered within the lifespan of an existing business transaction.

Greg Lotko,
Vice President and Business Line Executive for System z

PHOTOGRAPHY BY BOB MARTUS

Redefining Storage

Smarter solutions are designed to meet increasing demands for information

By Caroline Vitse

Organizations require constant access to information, which leads to accelerating storage complexity and cost. Increasingly, storage budgets are exceeding server budgets, a trend that puts storage in the spotlight. To meet the rising demand for information, IBM introduced Smarter Storage for Smarter Computing in June.

The amount of information that must be stored—and the rate at which it is growing—is greater than ever. Companies are harnessing more information and revamping business models to embrace trends like social media, analytics and cloud computing to serve customers and gain a competitive edge.

By the Numbers

An estimated 2.7 zettabytes of digital information will exist in 2012, up 48 percent from 2011, according to the 2011 Web conference "IDC Predictions 2012, Competing for 2020." Projects involving big data—data too huge and complex to be easily managed with traditional storage options—are expected to accelerate information growth, doubling or tripling the amount of information stored.

Storage infrastructures are struggling to keep up with this increasing volume. IT staffs are stressed to the limit because of inflexible architectures and increasing complexity. Outdated processes and technologies are difficult or impossible to adapt. Islands of information are formed as new applications are quickly deployed. Users

require faster storage provisioning and higher service levels. A hospital, for example, must store and be able to access thousands of medical records securely—possibly from a mobile device. This data must be accessed quickly, as each minute might be the difference between life and death.

Rapid growth and complexity have predictable results: Storage is a rising percentage of IT spending, and labor accounts for a growing percentage of such costs. "Rising costs and faster data growth are worrisome trends for operations managers," says Mike Barton of IBM storage marketing. "Think of storage like electricity or another utility—you need it, but you don't want to spend more than you have to."

Data centers often don't have the time and resources to take advantage of the full capacity of the storage they've bought. IBM Storage Infrastructure Optimization assessments confirm that the average data center uses less than 50 percent of its storage capacity. Utilizing the second half of a traditional storage system can be more complicated than using the first half, Barton explains.

Without a significant change in the way storage is approached, equipment and labor costs will consume an increasing percentage of the IT budget, reducing a company's ability to innovate and compete. Without changes, a digital divide will be created between organizations that can embrace the explosion of information and ones that can't.

Better, Faster, Smarter

IBM Smarter Storage for Smarter Computing helps clients embrace data growth, deliver information faster and manage storage with less complexity (see "New Storage Products," page 10). "IBM has learned how to transform storage environments, to give them the flexibility to better align with changing business requirements," Barton says.

Smarter storage enables data centers to use more of their storage capacity. According to the Forrester Total Economic Impact study of IBM Storwize* V7000, Smarter Storage can reduce physical space requirements up to 50 percent using storage virtualization. Internal IBM tests indicate smarter storage can reduce physical space requirements up to 80 percent using real-time compression. IBM Smarter Storage is self-tuning, delivering greater performance to the most-critical applications. It can manage

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Big Data represents a significant opportunity for organizations to further lower the risks and costs of doing business. With the right technology to process and analyze Big Data, IT can step up to help businesses increase profit margins, discover new and differentiating ways to upsell, and cross-sell to their customer base.

Topics include:
- Consolidating differently structured sources of information to create better insight
- Augmenting business decisions with new perspectives on your customer base
- Integrating data stored on System z with Hadoop clusters and the Big Data platform
- Real-time decision-making at the point of contact with customers

We'll also discuss real-world examples of organizations using System z and its information management portfolio for Big Data benefits.

FEATURING:

Mark Simmonds
Senior Product Marketing Manager, IBM Software Group

Harry Batten
Systems z Data Servicing Strategy Manager, IBM Software Group

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IBM and non-IBM storage as a single resource pool, helping reduce costs and complexity across the data center. This enables administrators to manage more capacity with less effort.

IBM Smarter Storage for Smarter Computing consists of three core attributes. To manage information growth and prepare for the future, storage must be: efficient by design to manage cost and capacity growth; self-optimizing to improve performance and productivity; and cloud agile to handle the new demands of applications and storage.

1 Efficient by Design

Storage systems are designed with built-in efficiency features; advanced features are pre-installed, ready to deploy and operate consistently.

An example is the patented Real-time Compression technology now built into Storwize V7000 midrange disk systems and SAN Volume Controller (SVC). Real-time Compression runs automatically, epitomizing the efficient-by-design idea. This IBM technology can support active primary data, which is a significant accomplishment. Other storage compression products work on secondary (or backup) data, limiting their practical use. Real-time Compression can reduce the cost per terabyte up to 40 percent compared to uncompressed storage, IBM estimates.

Another example is the IBM XIV* storage system, which can enable smarter storage by allowing clients to cluster XIV systems for increased scalability and management through cross-system, non-disruptive data migration and enhanced multisystem management capabilities.

2 Self-Optimizing Storage

Self-optimizing storage can analyze data access patterns and automatically adapt, balancing performance and cost. It increases throughput for critical applications and supports new workloads with high input-ouput operations per second (IOPS) requirements. IBM integrates self-optimizing capabilities into XIV and storage systems that support Easy Tier* technology, such as DS8000*, Storwize V7000 and SAN Volume Controller (see "DS8000 6.3 Highlights," page 11).

"IBM self-optimizing storage understands your usage patterns and automatically tunes the system, so you get the perfect balance of cost and performance," Barton says.

Rapidly growing analytics workloads and other low-latency applications are overflowing server-based storage, notes

NEW STORAGE PRODUCTS

The following IBM products were announced June 4:

Storwize* V7000
- Integrated Real-time Compression for active data
- Four-way clustering
- Fibre Channel over Ethernet (FCoE) to simplify infrastructure through use of converged networks
- Increase storage management efficiency for VMware environments with VAAI support

System Storage* SAN Volume Controller V7
- Integrated real-time compression for active data
- FCoE to simplify infrastructure through use of converged networks

Tivoli* Storage Productivity Center V5.1
- Intuitive, easy to use GUI based on XIV*/V7000
- Custom analytical and reporting capabilities
- Automated storage tiering optimization for performance and cost advantage
- Cloud support for storage

System Storage DS3500 Express and System Storage DCS3700
- Enhanced FlashCopy* saves time with high-speed backups
- Protect your data and improve recovery time with adaptive disk pooling
- Reduce storage expenses by saving capacity and increasing storage utilization with thin provisioning

Scale Out Network Attach Storage (SONAS) R1.3.2
- TPC support, gateway support for XIV and Storwize V7000

System Storage DS8000*
- 400GB SSDs, full disk encryption (FDE) for SSD, nearline drives, Easy Tier* includes FDE

Real-Time Compression Appliance* V3.9
- Capacity planner

System Storage TS76xx ProtecTIER* 7620, 7650 and 7650G
- File protocol support for backups, increased performance and capacity

LTFS Storage Manager Software V1
- Lifecycle management for files using LTFS

IBM Tape System Library Manager Software V1
- Consolidated view of multiple TS3500 tape libraries

—C.V.

DS8000 6.3 HIGHLIGHTS

With the Smarter Storage for Smarter Computing announcement in June, IBM enhanced the popular DS8000 storage solution

The DS8000* 6.3 offers 400 GB of solid-state drive (SSD) storage—33 percent more capacity than the previous release. Also available is the 400 GB SSD with full disk encryption, which encrypts the data as it's being written and decrypts it as it's being read. The 3 TB near-line drive also has a self-encrypting version, which means each drive tier offers self-encrypting technology. Offering traditional and encrypted SSDs now enables clients to deploy Easy Tier* technology with a fully encrypted system.

Easy Tier technology migrates data to the appropriate storage tier and within that tier automatically balances the data on the single-tier system to help increase performance. This smart-data placement intelligence leverages server resources and can further optimize performance because frequently accessed data is placed in a separate drive tier. The DS8000 6.3 uses this high-density SSD cache to enhance performance.

Enterprise Strategy Group's report, "IBM's Smarter Storage Takes Shape," states that "Easy Tier support now includes support for fully encrypted DS8000 systems, combining the benefits of data-at-rest security with the ability to effectively balance application performance and costs through intelligent data tiering and eliminating hot spots."

These enhancements to the DS8000 system allow users to enjoy the benefits of self-optimizing storage. They can improve the performance of their storage solutions, saving money in the process.

—C.V.

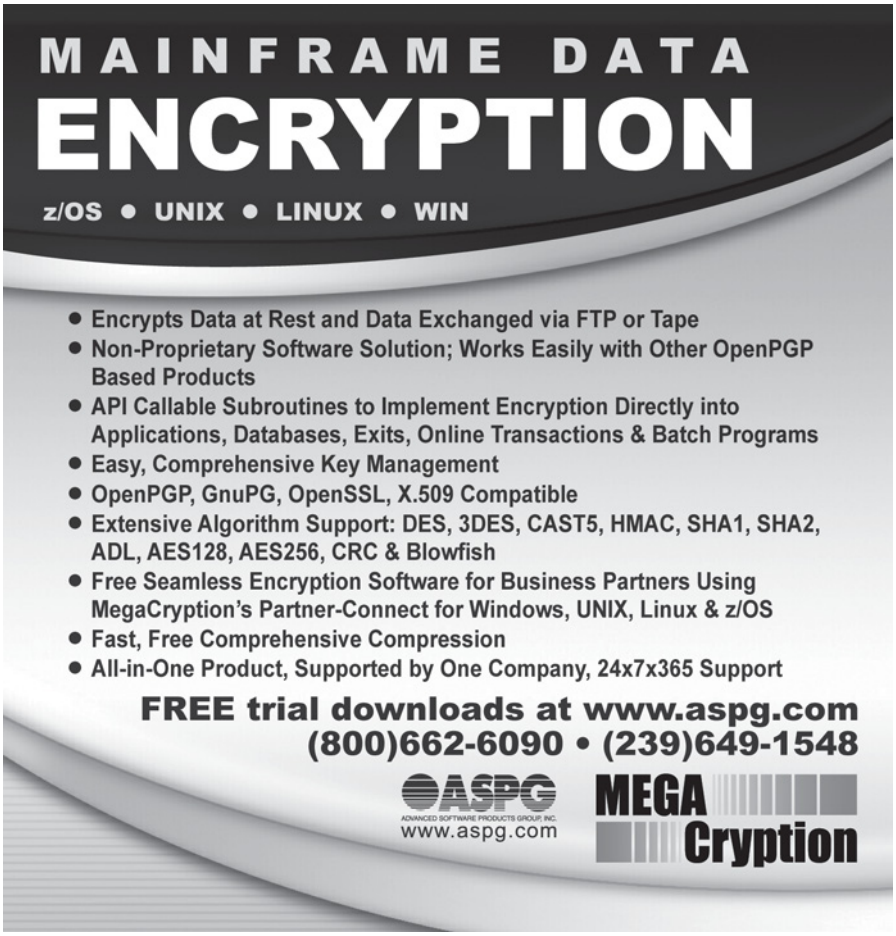
Barton. The Easy Tier function extends beyond traditional storage boundaries to leverage server-based flash. Applications can run faster and grow larger, while the function helps control complexity. It gives clients more cost/performance options for mission-critical applications.

3 Cloud Agile

Cloud computing has many benefits, but most importantly, it can improve business agility. Organizations are migrating applications and file systems to the cloud to increase service levels, improve flexibility and reduce IT costs.

"Storage virtualization increases agility, so it makes sense that virtualized storage is a core capability and requirement of cloud environments," Barton says. If your organization is hosting cloud applications, you need virtualized storage to support those applications with the service levels required. Having virtualization built into storage systems allows organizations to adapt to trends such as cloud computing while optimizing existing workloads.

"The ability to not only lower costs, but to also have multiple options at a lowered cost allows organizations



"IBM has learned how to transform storage environments, to give them the flexibility to better align with changing business requirements."

—Mike Barton, IBM storage marketing

to offer a menu of meaningful cloud services," he adds. "This allows users to choose their own balance of efficiency and advanced capabilities on a case-by-case basis. The ability to automate these policies allows organizations to implement self-service."

Cloud-agile storage is designed to fully participate in highly virtualized environments. Smarter storage manages storage platforms as one virtual resource pool; data is automatically synchronized between facilities and files can be transferred to users wherever they are. IBM smarter storage is optimized for rapid deployment of private clouds and provides essential infrastructure for public cloud providers.

The IBM Active Cloud Engine* solution enables easy creation and enforcement of policies to handle the rapid growth of unstructured file systems. It can move files to the right tier and location for optimal accessibility while maintaining a single view for easier searching.

Getting to Your Next Destination

IBM Smarter Storage for Smarter Computing helps enable new cloud, analytics and big data initiatives, adapting to changing workloads and trends.

"The future of storage is smarter storage, and we need Smarter Storage for Smarter Computing to build a smarter planet," Barton explains. "In the future, the toughest storage challenges will be automated and integrated into storage systems. With smarter storage, you'll be ready to embrace new initiatives that can increase the value of IT to your organization." Z

Caroline Vitse is a freelance writer based in Rochester, Minn.

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Current government agencies are struggling to cut costs from their operations and are in need of modernizing their IT systems. With the merger of GTSI Corp., completed for $76.7 million, http://washingtontechnology.com/articles/2012/06/18/gtsi-unicom-merger-closer.aspx, UNICOM now has the opportunity to provide inexpensive and effective hardware, software and services directly to the government on a large scale.

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BANKING ON IT

"I would think every organization needs a way to manage its infrastructure in order to maximize application availability. Otherwise, your technicians may be managing more problems than new features and functionality."

—Craig Danielson,
IT quality assurance manager,
Commerce Bank

TD BUSINESS

Commerce Bank employs an enterprisewide solution to track application changes

By Jim Utsler • Photography by Austin Walsh Studio

Change is inevitable—especially in IT departments, where new applications, lines of code and pieces of hardware are put into place every day. Overall, it's good; it indicates that organizations are amping up the services they offer.

However, keeping up with change can be daunting and seemingly endless. Spreadsheets are, in many cases, used as change-management tools, with developers updating them with their latest application alterations, for example. But this is a poor substitute for truly understanding what's changed and the potential effects of those changes.

Given the increasing regulatory- and auditing-compliance requirements, this isn't a trivial issue. In the banking industry, outside agencies are putting everything under a microscope—from the boardroom to the data center. That, in part, drove Commerce Bank to deploy ISPW's change-management system. It realized that while change is good, having a better handle on it is just as important.

Community First

Headquartered in Kansas City, Mo., Commerce Bank was established in 1865. It has a presence in five states—Missouri, Kansas, Illinois, Oklahoma and Colorado—with more than 200 branch locations and 400 ATMs. Among the 50 largest banks in the U.S., it offers banking services to commercial and private customers, such as savings and checking accounts, traditional mortgages, and debit and credit cards.

The bank's many honors are a testament to its community-first philosophy (see "Top Honors," below). "That's why our branch locations are so essential," says Craig Danielson, Commerce Bank's IT quality assurance manager. "People still like to be able to walk into a bank and talk with someone, and when they call and ask for a bank employee, they know they're going to be connected with a knowledgeable representative. Commerce's customer promise is: We ask, listen and solve. It's that kind of experience—the small things—that makes our customers feel special."

Behind the scenes, the company strives to offer add-on services that further enhance its reputation, such as sophisticated online banking. Supporting those initiatives is an IBM System z10* Business Class mainframe, which hosts a litany of applications. The organization also has an off-site mainframe for disaster recovery. Several IBM Power Systems* servers complement its mainframe processing, as well as an extensive Microsoft* Windows* environment.

Although Commerce Bank is relatively small compared to the large

TOP HONORS

Since its inception nearly 150 years ago, Commerce Bank has received many notable accolades, including:

- It's been ranked among the **TOP 10** on Forbes' list of America's Best Banks for three years in a row.
- Its holding company, Bancshares Inc., was named one of the **BEST** performing stocks of 2012 by Money magazine.
- It was named the seventh-best bank of the **TOP 150** publicly traded U.S. banks in 2011 by Bank Director.

Wall Street banks, it makes an effort to keep up with the latest industry technologies. Danielson calls the company a fast follower. "We don't adopt new technologies as soon as they're introduced. We prefer other companies do the beta testing for us and then deploy when we feel the time is right," he explains.

With that philosophy in mind, the developers are always hard at work writing new code or enhancing existing code. Systems administrators also roll out new hardware, as needed, often in support of the bank's varied lines of business.

Morning Reviews

Tracking all of its back-end changes can be a challenge, Danielson admits. "Since 2005, we've processed more than 47,000 changes in our production environment, but it wasn't too many years ago that we were looking at implementing maybe only five, six, seven changes a day. Now it's more like 500 to 600 a month. This might not seem like a lot to larger companies, but it is to us, which is why it's important that we have a process by which we can keep track of everything. We don't want to be disrupting our production systems and therefore our customers," he says.

The bank has diversified its IT infrastructure in the past 10 years, expanding to non-mainframe platforms and adding many open-system applications. While this is good for overall operations, it has created a disconnect between various IT departments, each of which has experts related to those disparate systems and software.

The issue becomes particularly acute when considering the various changes that must happen on the back end, including alterations to databases, core operational applications, customer-facing software and even desktop OSs. Not to mention the hardware that may be introduced to the data center, such as additional server racks, new cabling and upgrades to cooling systems.

To get a better handle on its disparate systems, Commerce Bank established a rigorous change-management regimen that includes tracking software and a people-based change-management escalation model. For example, every morning all of the company's IT department managers review changes that were created the previous day.

This information is based on change requests submitted by developers and technicians, which are reviewed first by application managers and then department managers. If the change requests make it through those first two rounds of approvals, any related issues will be discussed during that morning meeting. "By that point, the change requests have largely been blessed, so it's then a matter of bundling them to see how they might impact each other. We'll further assess and approve some of them, question some and put others on hold," Danielson explains.

The goal is to enable change while managing inherent risk, so changes don't get lost or, depending on their relevance, delayed for too long. This is also part of Commerce Bank's fast-following ethos, with the company wanting to promote agile project management. This agility, Danielson says, helps it push out critical services to remain competitive.

"What we're trying to do with our change management is be responsive to the business in a controlled fashion. And with our processes, change system and reports, we're creating accountability and visibility for change," Danielson says. "This results in an environment where everyone—no matter which IT department/function they're in—can see what's going on, which in turn, establishes a climate in which we're able to deliver new products and services in a timely manner."

Limited Impact

Although it had a change-management package in place prior to deploying the ISPW solution, Commerce Bank decided to investigate other options. Ultimately, the decision to go with ISPW was a fairly simple one. Its all-in-one solution ran on what the company considers the highly reliable framework of the mainframe and is not a piecemeal solution cobbled together out of many different change-

SNAPSHOT

CUSTOMER: Commerce Bank

HEADQUARTERS: Kansas City, Mo.

BUSINESS: Banking

CHALLENGE: Tracking application code and hardware changes

SOLUTION: Used ISPW to create a traceable and visual change-management environment to improve customer service

HARDWARE: An IBM System z10 Business Class server

SOFTWARE: A variety of packaged banking applications and the ISPW change-management solution

Craig Danielson

management systems running on different platforms.

"If we had gone that route, which we had briefly considered, we would have had to learn all of the ins and outs of each of these systems, which would have increased the complexity required for supporting, training and using the systems." Danielson recalls. "And on top of that, we'd also have to deal with multiple vendors should something go wrong. We just didn't feel that was the right way to go with this."

This was especially true given the critical nature of change management within the IT environment. So in 2007, Commerce Bank purchased ISPW software and pushed it into production after testing it and working with ISPW to ensure the system worked as desired.

Now, the bank has a single change-management solution running on the System z* platform that, in conjunction with its change-management systems, policies and processes, serves all of its needs. For example, when a developer is making a change to one of Commerce Bank's applications—and after it's been approved by the department heads during their morning meeting— ISPW can release the code to production based on a date and time entered by the developer. As more alterations are made, ISPW recognizes those changes, indicates they represent the latest version of the code and includes any additional pertinent information, such as who made the most recent changes.

In some cases, a script pushes the code to the appropriate production server, deploys it and then validates that the code changes were properly placed and the system is functioning as it should. Change implementations take place within an agreed-upon service-level agreement (SLA) window to minimize user impact. An SLA might stipulate, for instance, that changes must occur after 5 p.m. when no internal users are on the system, or in the case of customer-facing applications that run 24-7, when there's likely to be limited impact.

Most of this is managed with ISPW. Authorized users can upload and modify the code and then determine the date and time the code should go into production. ISPW then automatically releases that code on the specified date and time into the production environment, after which the validation process takes place. In all cases, testing and validation of code changes occur prior to deployment.

Commerce Bank uses various internal systems, processes and tools for tracking all changes, and it manages them by keeping the business and its customers at the forefront of its decision-making processes. Over the Fourth of July, for example, the company didn't deploy any changes that would have affected its ATM systems. "We want people to have access to their money even if our branch locations are closed, so we're very aware of those dates and conscientious when it comes to our customers' needs," Danielson adds.

This also applies to hardware deployments. Because access to the company's data center is highly restricted, the change process is used to track who was in that area and for what reason. If someone is laying cabling, that person must be authorized to do so at a specified date and time.

In addition to managing change and release dates, as well as data center access, ISPW also acts as an auditing mechanism, tracking every time code is checked out or new versions are created. This allows auditors to quickly and precisely determine which changes have been made to which systems, when and by whom. It also helps ensure the bank complies with applicable regulations, especially those pertaining to back-end systems.

Beyond Banking

Change is inevitable, but it's also manageable. For organizations like Commerce Bank, this is a boon. Instead of hoping that code changes are properly vetted before being put into production, ISPW ensures they have been—and then properly validates them afterward.

Although the banking industry is under additional pressure to track changes and retain an audit trail of everything that happens in its data center, Danielson notes that every organization deals with finances in some way. That's why he encourages all of them to look into change-management solutions such as ISPW.

"Audits are common everywhere, so it's incumbent upon every company to keep track of what's happening where and who's involved in what. It's not just in the banking industry. And not only that, but I would think every organization needs a way to manage its infrastructure in order to maximize application availability," Danielson says. "Otherwise, your technicians may be managing more problems than new features and functionality."

Jim Utsler, *IBM Systems Magazine* senior writer, has been covering technology for nearly 20 years.

"What we're trying to do with our change management is be RESPONSIVE to the business in a controlled fashion." —Craig Danielson

PHOTO COURTESY OF IBM

The Next Evolution in Hybrid Computing

IBM launches the second generation of zEnterprise—zEC12

By Ellen Carbarnes

IBM has introduced its newest mainframe—the IBM zEnterprise* EC12 (zEC12)—engineered to help enterprises respond to the rising processing and information needs of a smarter planet.

By utilizing IT, organizations can address data and transaction growth and offer additional capabilities to customers and new markets. To help IBM clients achieve these objectives, the new zEC12 is powered by 120 processors running at 5.5 GHz. And it scales up to 50 percent more capacity—or 78,000-plus MIPS—all in the same footprint and energy envelope as prior generations.

The IBM mainframe is a leading platform for transaction processing, consolidated and secure data serving, and support for enterprisewide applications. The zEC12 continues that tradition with new technologies such as IBM zAware and Flash Express that can provide greater manageability and improved availability. Also, it supports secure data serving with data protection whether at rest or in-flight. Designed for EAL5+ certification, the zEC12 partition support can provide peace of mind that confidential data is secure—even when it's contained in disparate applications.

The zEC12 is the first general-purpose server to incorporate transactional memory technology, which was used at the Lawrence Livermore National Lab to help make the IBM Blue Gene*/Q supercomputer, Sequoia. IBM has adapted this technology to the mainframe, enabling software to better support concurrent operations that use a shared data set, such as a banking application handling multiple transfers on the same account at the same time.

With its design, zEnterprise technology plays an ever-increasing role across all industries to help deliver on key business initiatives:

TAKEAWAY

- IBM zEnterprise EC12 is the fastest, most scalable and secure enterprise system to date, offering a 50 percent total performance improvement compared with its predecessor.
- The new zEnterprise System is the result of $1 billion in R&D investment and collaborative client input.
- Cutting-edge technology, including analytics and cryptography, is built into the latest System z platform to make it more intelligent, resilient and secure.

- Improve customer service by delivering insight into each transaction
- Enable continuous availability for processing critical transactions by intelligently monitoring the environment, in real time, to find unusual system behavior
- Secure data with cross-industry cryptography capabilities

Hybrid computing was driven by a need to reduce IT costs. The zEnterprise ecosystem is a multiarchitecture, tightly integrated environment—managed under one umbrella—that offers great efficiencies through large-scale consolidation. The next-generation zEnterprise hybrid takes this to a new level.

The zEnterprise BladeCenter* Extension (zBX) Model 003 supports up to 112 blades with a mix of Power Systems* blades, BladeCenter HX5 blades or IBM WebSphere* DataPower Integrated Appliance XI50 for zEnterprise. Single point-of-control management of the environment is provided by the zEnterprise Unified Resource Manager.

Driving Innovation

Focused on delivering an integrated, secure and available infrastructure, the next-generation hybrid enterprise system supports innovation and competitiveness through:

- **Operational analytics.** Integrated with real-time data and consolidated corporate data, operational analytics deliver information and insight across the enterprise. Building intelligence into each business transaction expands its value, creating new transactions and improving customer service, such as data management, warehousing, etc.

Using zEnterprise technology and the IBM DB2* Analytics Appliance (IDAA), queries can run up to 1,000 times faster than the previous analytics tool. The actionable insight, delivered with this type of speed and based on current data provides new business opportunities and intelligence into customer interactions.

For example, a U.S.-based hotel applies this intelligence to each of its 1,500 transactions per second to establish an optimal price point. Each reservation is based on occupancy levels at the requested hotel or nearby locations and can reflect client loyalty. Accordingly, the hotel can book inventory down to the last available room to maximize yield.

- **Trusted resilience.** With the explosion of data as well as regulatory requirements, enterprises must be assured users have access to data and applications and are protected from a security breach. Trusted resiliency means the zEC12 can deliver unmatched availability, reliability and security for core business processes and operations. To that end, zEC12 offers new availability features to help clients who value security, better performance and availability during diagnostics.

Using zEnterprise Unified Resource Manager brings mainframe governance to the multiplatform environment, with capabilities that help the installation make good use of its resources and maintain the highest possible throughput. It helps mitigate the risks and provide controls not previously available in a combined mainframe and distributed environment.

IBM zAware allows data center specialists to gain visibility into system behavior, helping improve availability through faster problem determination. It's an integrated, self-learning, analytics solution that can identify unusual system behavior in nearly real time. Intuitive drill-down techniques can pinpoint unusual message patterns to rapidly and accurately identify potential issues and speed time-to-service recovery.

Flash Express can automatically improve availability for key workloads at critical processing times by boosting paging performance, thus helping deliver superior availability during transition periods, such as start-of-day processing or during diagnostics collection. This is vital for organizations with customer-facing or service applications, including banks, the public sector, financial services companies and retailers.

Cryptographic hardware on the zEC12 can help protect data privacy and sensitive custom applications. The new Crypto Express4S is suited for applications requiring data encryption, cryptographic keys and digital signing. Earlier implementation of PKCS #11 (digital signing) was provided by z/OS*. Now the cryptographic coprocessor can be configured to meet public sector and

SOLUTIONS FOR ALL

Businesses and organizations can address their unique needs—for example, executing government initiatives, accelerating globalization to manage risk and responding to consumer demand—with a selection of 12 new IBM solutions. These offerings provide choice of approach and support enterprise information integration and access across one management platform.

System z* industry-focused solutions package software from IBM or ISV partners and services or assets from IBM Global Business Services*. These include the IBM Intelligent Operations Center for Smarter Cities*, IBM Health Plan Integration Hub, and two IBM Smarter Analytics offerings: Anti-Fraud, Waste and Abuse Solutions for healthcare or insurance, and the IBM Genelco* Insurance Administration Solution. —E.C.

European Union requirements where standardized crypto servers are needed, such as with smart passports, national ID cards and online legal proceedings.

A representative of online retailer Swiss Colony says, "Within zEnterprise exists numerous security components that help reduce our overall risk. For example, encryption on zEnterprise is critical to our company success to allow us to protect customer privacy data while it is stored on our mainframe and while it is exchanged with other parties for processing."

Efficiency at scale. Efficiency at scale enables consolidation and the flexible delivery of services through a private enterprise cloud. With its 50 percent total performance improvement, enterprises can use the zEC12 to consolidate workloads and free up resources for new services. It features a proven hybrid computing design capable of managing multiple architectures with the simplicity of a single system.

"When consolidating Linux* business support applications and Oracle databases operating at the EUROCONTROL Maastricht Upper Area Control Centre (MUAC) from distributed servers to the System z* ensemble, MUAC reduced floor space by 80 percent, reduced energy consumption by as much as 58 percent per year, reduced the need for hardware maintenance effort by 43 percent and saw 50 percent savings in software, particularly for Oracle, all running on System z with Linux," says Huub Meertens, head of the SUP Engineering Section of EUROCONTROL MUAC. "With the great savings achieved with the System z ensemble, MUAC saw a 43 percent ROI."

Impressive Investment

With System z, IBM shows a commitment to hybrid computing and to delivering new innovations to the market. The new technologies' core capabilities can provide the intelligence and protection your businesses needs, and its efficient scaling can deliver the cost savings organizations require to focus on new services and drive growth.

With the zEC12—the result of an investment of more than $1 billion in R&D—IBM continues to deliver the highest levels of value to enterprises across industries worldwide. Z

Ellen Carbarnes is a worldwide marketing manager for System z.

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CONQUERING
CHAOS

System z technology helps manage DATA MART complexities for business ANALYTICS

By Alan Meyer • Photography by Travis Anderson

For decades, organizations have achieved notable benefits implementing data marts for business analytics. Quick and inexpensive to deploy, they're frequently used to take advantage of specific opportunities: One data mart might be created to understand aging receivables, another to better target customers for a marketing campaign. Used to conduct root-cause analysis, data marts can save companies money and generate new sources of revenue.

Therefore, the choice seems simple enough: Deploy a commodity server, a couple pieces of software, or maybe a database and a query tool and the returns could be millions of dollars. A potential downside exists, however. Despite their value, data marts can become an overwhelming challenge for most organizations and can rapidly proliferate into an unmanageable nightmare.

Avoid such pitfalls by combining the capabilities of data marts with IBM System z* technology, and the result is an analytics environment that delivers even more. Through unparalleled virtualization capabilities, the mainframe can house myriad data marts, keeping business intelligence (BI) applications close to the accurate, secure and low-latency data they need to provide instant and smarter insights. The System z platform provides all of the benefits of a data mart—and so much more—for data analytics.

Unintended Complexity

Quick to deploy, usually within days or weeks, data marts are an attractive choice because they enable a small organization within an enterprise to control a key set of information for analysis and reporting. Because they're generally isolated, the workload can be separated and encapsulated from the production environment, the data warehouse and other data marts, so analysis is uninterrupted. However, proliferation can breed unintended problems:

TAKEAWAY

- Data marts are useful tools in delivering business insights to organizations, but they must be deployed in a cost-effective way.
- What if you could gain the ease of deployment and ROI of data marts, but do so more efficiently and effectively?
- Combined with the hallmarks of System z—constant availability, unsurpassed security and virtualization—data marts become even more valuable as part of an organization's analytics environment.

Rapid multiplication. Data marts seem to multiply like rabbits. Each request is brought forward individually; each with its own business analysis and unique requirements. So the answer is often to keep adding data marts.

A lack of architecture. Because data marts are frequently a short-term, tactical solution, they aren't part of the corporate architecture. So each places requests to extract a particular piece of data from the production system and analyzes it for its own purpose, multiplying the costs of extraction and downloading. Likewise, data consistency becomes an issue, so the accuracy of analysis is called into question.

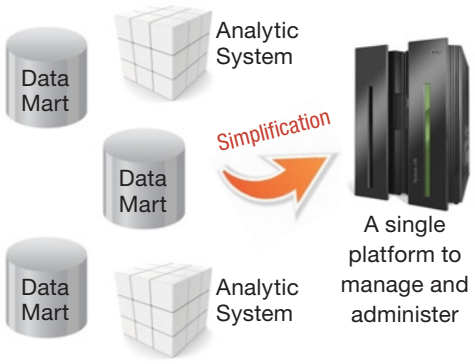
Administrative complexity. As data marts multiply, keeping track of hundreds of servers becomes a nightmare. Each may require a data refresh from one to five operational sources per day. As software goes out of date, individual servers must have software refreshed. Common, periodic failures must be addressed and followed by hardware upgrades.

Spiraling costs. All of these factors ultimately affect the bottom line, however, most corporations tend to ignore the costs associated with data marts until they review the aggregate costs across the organization (see "Infrastructure Complexity and Cost Are on the Rise," page 26). Beyond the initial hardware and software expenses, they include numerous extraneous production data extractions, administration, environmental impacts and the security vulnerability.

Figure 1

Data Mart Consolidation Into a Single Footprint

Utilize virtualization to optimize the use of resources while reducing costs and gaining new agility



- Lower software costs
- Lower hardware costs
- Lower administration costs
- Lower environmental costs
- Greater flexibility
- Less complexity
- Fewer points for security intrusions

Data Distribution Hub

Some organizations have addressed the issue of data consistency in data marts by implementing a data distribution hub, which acts as a clearinghouse for all data needed by the data marts. The sources are identified and the data is extracted at a predetermined time.

The data marts are then loaded with a single, consistent data set for

THE POWER OF CONSOLIDATION

A leading European financial institution sought to continue impressive market growth through a singular understanding of its clientele for smarter marketing and risk assessment, etc. Without integrated information, however, it lacked a holistic view of its customers.

Before implementing an IBM Data Warehouse, the firm had tried multiple siloed data warehouses, resulting in data inconsistencies. Also, the organization faced challenges meeting emerging compliance requirements, such those from Basel II legislation, and needed to market more effectively to individual consumers. Company leadership recognized a common, strategic platform was needed.

As a result, it chose to consolidate a data warehouse using IBM DB2*, in part, because the bank already relied on a DB2 platform and used IBM software tools, such as WebSphere*. As a result, it was able to continue to employ IBM's development methodology without reinventing the wheel.

In terms of direct marketing, the returns have been impressive. For example, about 1 in 10 mailings to potential customers have resulted in a sale. That's the power of consolidation.

—Mike Westholder

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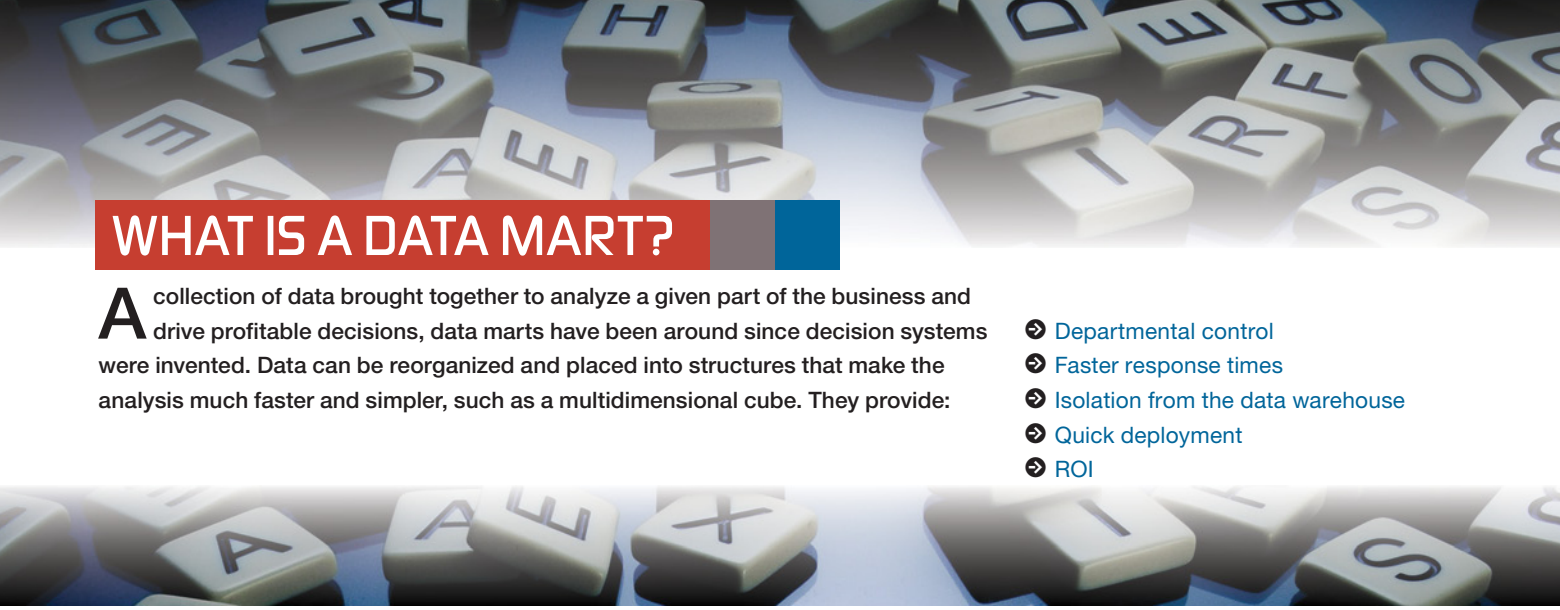

WHAT IS A DATA MART?

A collection of data brought together to analyze a given part of the business and drive profitable decisions, data marts have been around since decision systems were invented. Data can be reorganized and placed into structures that make the analysis much faster and simpler, such as a multidimensional cube. They provide:

- Departmental control
- Faster response times
- Isolation from the data warehouse
- Quick deployment
- ROI

analysis. This provides the insight into redundancies of data marts and opportunities to consolidate them. It also enables information from various data marts to be compared and contrasted with reliable, repeatable results.

Consolidating data marts and a data distribution hub onto a System z can provide all of the benefits of individual data marts, and remove most of the disadvantages (see Figure 1, page 24). Using virtualization, each data mart can still be isolated within a small community of users. In general, about 20 processors of data marts can be consolidated onto a single System z processor. Because software is generally licensed by the processor, consolidating 20 data marts—each with roughly one processor—to a single, more powerful system translates to proportional cost savings.

Data mart consolidation can eliminate prolific commodity servers and their floor space requirements as well as decrease environmental costs such as electricity and cooling. It removes the need for network interface cards and the complex networking that ties users to each data mart server, potentially eliminating hundreds of points for security intrusions. In addition, when all data mart users are finished working for the day, the processing power can be reclaimed for other purposes.

Simplified System z Environment

With the System z platform's virtualization capabilities, new data marts are easier and quicker to deploy, often taking hours instead of days or weeks. With a single administrative environment, each data mart can be monitored and administered simply and from one consistent interface.

When data is extracted from the OS, it can be quickly moved to a new database instance via HiperSockets* at memory speed to the data distribution hub. This reorganized data can then be moved again to the data mart for use without the expense of moving data off the system. For data that requires a higher degree of currency, change data capture software can synchronize a data mart directly with the production system or the data distribution hub, which then could synchronize with the downstream data marts. This provides near-real-time access to production data.

Because the data is within the highly secure System z environment, security concerns are minimized. Users can rely on the 99.999 percent availability, no longer hassling with the outages of commodity hardware. And because they're on a System z platform, the data marts can also participate in the industry standard for backup and recovery. Therefore, users can rest assured the data they're analyzing will be providing answers whenever needed.

Another advantage of System z for analytics is the capability to share a DB2* Analytics Accelerator, which can handle queries up to 2,000 times faster. Users who must perform more complex

Infrastructure complexity and cost are on the rise

- Growing number of physical servers and network gear
- Excessive energy usage and heating problems
- Inadequate power and cooling infrastructure
- Data silos and data synchronization
- Linear per-processor software costs
- Linear staffing costs
- Frequent outages

On the Web Read more on how the System z ecosystem helps organizations create a secure enterprise information hub for analytics: ibmsystemsmag.com/mainframe/trends/security/information_hub

queries can see the results while they still remember the question.

Called train-of-thought analysis, queries that once took hours to run now take seconds. This gives organizations the ability to quickly analyze a situation and use fact-based information to drive decisions. Like most System z resources, a single Analytics Accelerator can be shared across multiple users, databases and virtualized systems, providing the best ROI.

Under Control

When managed properly, data marts can be valuable resources. Common approaches to data mart consolidation on System z include:

- Merging data from multiple data marts to one
- Migrating the data mart onto DB2 from other data store technologies
- Moving the data mart and its technologies onto System z

Depending on the course selected, the target environment may vary between the following deployment options: DB2 for z/OS* with a DB2 Analytics Accelerator; DB2 for z/OS; DB2 or another database on Linux* on System z; or Linux, UNIX*, or Windows* on a zEnterprise* BladeCenter* Extension (zBX).

Each choice has its own advantages, and data marts can be moved from one technology to another, providing maximum flexibility and performance. These options help ensure an organization can consolidate quickly with the least amount of disruption.

Panacea or Plague?

Are data marts a panacea or plague? The answer depends on how well they're managed. They can be a virus, growing out-of-control, consuming every resource the organization throws at them, or they can be well-behaved, effectively managed resources that provide answers in a consistent, timely, cost-effective manner to deliver fact-based information. It all depends on how and where they're deployed.

Alan Meyer is a marketing manager for data warehousing in IBM's Information Management System z organization.

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SPLIT-SECOND DECISIONS

SPSS Modeler 15 offers real-time scoring for faster, more effective insights

By Rebecca Wormleighton

Illustration by James Bennett

According to the 2011 IBM Global CMO Study, the No. 1 priority for chief marketing officers is to enhance customer loyalty. For CEOs, the top priority is to get closer to the customers. And for CTOs, improving analytical skills across the company will be the largest investment area over the next five years.

Predictive analytics is the key to gathering and analyzing customer insights to understand behavior and take action to prevent churn or market the most relevant product to the right customer. Ultimately, knowing your customers better and engaging them throughout the customer lifecycle will lead to better results.

With an increasing demand to better understand and service customers and citizens, organizations are under added pressure to optimize all areas driving customer satisfaction and loyalty, which can ultimately maximize performance and increase revenue. Companies can optimize customers' lifetime value by creating tight-knit and trusting relationships with them through analytics.

Consumers are more likely to become repeat buyers and recommend a company's products to their friends and family once trust has been established. Companies earn that trust by consistently delivering the types of results and experiences customers expect and through exceeding their expectations by anticipating needs in advance.

Scoring Big

To improve the accuracy of real-time decision making, exploit the point of interaction and build customer trust, many companies are investing in real-time scoring of their transactional data. With access to the latest information about consumers' attitudes and opinions, it's possible to predict the most desirable outcome for the business.

Approximately 70 percent of all data transactions in the banking, insurance, retail, telecommunications, utilities and government industries originate on the System z* platform, and many organizations now have a distinct opportunity to change the game with real-time predictive scoring.

Accurate and useful real-time scoring results depend greatly on complete, relevant and current data. The faster someone can use the latest and most relevant data in the decision-making process, the higher the quality of the decision. Because most relevant data—financial information, customer lists, personnel records and manufacturing reports—originates on the System z platform, it makes sense to bring predictive analytics to the data residing there.

The superior performance, security and scalability of System z can help organizations make the most of their predictive analytics solution. They can process and analyze the staggering volumes of ever-changing and increasingly varied data and base decisions on the newest and most relevant information—as it's received.

For example, with the capability to understand real-time inventory, demand can be assessed and anticipated to ensure the right products are in stock and personnel is available. Or, by scoring transactional data in real-time at the point of impact, clients can reduce fraud in such applications as credit card transactions and insurance claims, or they can improve the up-sell and cross-sell of other high-volume customer marketing and sales initiatives.

Introducing IBM SPSS Modeler 15

IBM SPSS* Modeler helps organizations use predictive analytics to gain insight into their business and make improvements. With SPSS Modeler 15 for Linux* on System z, they can:

- Integrate transactional applications running on IBM DB2* for z/OS* to improve the accuracy, speed and

TAKEAWAY

- Organizations make myriad transactional decisions daily, affecting operations, customer satisfaction and, ultimately, their bottom lines.
- Real-time predictive scoring provides an opportunity to leverage this transactional data originating on the System z platform.
- The new IBM SPSS Modeler 15 delivers real-time scoring and can help organizations use predictive analytics to gain better insight from their data and make business improvements.

performance of real-time scoring, while reducing cost and complexity

- Create models using both structured and unstructured data
- Effectively manage the entire data-mining cycle from one workbench
- Fine-tune selected models based on statistical confidence levels
- Work with a variety of file formats pulled from (and written to) various databases for data preparation
- Automate the execution of models and deploy the results into existing systems and processes

The combination of DB2 for z/OS and SPSS Modeler increases the timeliness of scoring because it offers a more efficient, reliable process and makes it available to more users. The qualities of service of IBM System z are designed to offer improved accuracy, speed and performance in scoring data while reducing the overall cost and complexity. It scores new and relevant data directly in online transaction processing (OLTP) applications, scales to larger data volumes to improve the accuracy of data models and patterns created, and provides the performance needed to meet or exceed the service-level agreements (SLAs) of the OLTP applications and departments.

IBM SPSS Modeler 15 for Linux on System z is an integral part of the IBM Predictive Analytics on System z portfolio. This combination can change how organizations weave analytics into the fabric of their business to fuel the processes, decisions and actions that optimize outcomes.

IN THE BALLPARK

Approximately 70 percent of all data transactions in the banking, insurance, retail, telecommunications, utilities and government industries originate on the System z platform.

IBM Analytical Decision Management is designed to optimize and automate high-velocity decisions and consistently generate results. Using IBM business analytics technologies, it provides predictive models, business rules, optimization and scoring that help organizations weave analytics into the fabric of their businesses.

SPSS Statistics software can help companies solve business and research problems with ad hoc analysis, hypothesis testing and predictive analytics. Organizations use it to understand data, analyze trends, forecast, plan, validate assumptions and drive accurate conclusions.

SPSS Collaboration and Deployment Services for Linux on System z provides a unified platform for IBM SPSS Modeler and IBM SPSS Decision Management, helping provide a secure, reliable and scalable foundation for the integration of analytic results into existing enterprise infrastructures.

Linux on System z and the Analytics Environment

Combining the analytics environment with Linux on System z can eliminate server sprawl and complexity; support energy efficiency and environmental initiatives; and meet growing security, compliance and regulatory demands. In addition, it adds value to SPSS Predictive Analytics investment with:

- **Timely, accurate and secure access to information.** Everything needed for business insight is on the same platform as the source data, increasing business agility while keeping data safe.
- **Superior scalability, availability and performance.** Organizations can scale up and out, perform without degradation in application response time, and offer continuous solution availability.
- **Reduced costs and complexity.** Organizations can gain a significant savings in the hardware, software, operating and labor costs associated with the management and maintenance of an enterprise predictive analytics infrastructure.
- **Rapid deployment and expansion.** The time associated with deploying a new predictive analytics

The IBM Predictive Analytics on System z Portfolio

- SPSS Modeler 15 for Linux on System z
- Analytical Decision Management 7.0 for Linux on System z
- SPSS Statistics 20 for Linux on System z
- SPSS Collaboration and Deployment Services 5.0 for Linux on System z

application, increasing capacity or both can be reduced.

IBM Predictive Analytics for System z helps organizations improve their capability to gain detailed insight into present conditions and evaluate likely events and results. Because analytics is combined with System z, a single platform covers production, development, test and failover requirements without dedicating specific resources to individual needs. The dynamic allocation capabilities of System z help a predictive analytics solution get what it needs, when it needs it, without discernible delay.

Smarter and Faster Insights

The System z platform is ideal for modern business analytics and data warehousing because its core value proposition aligns perfectly with the new requirements that changing market dynamics demand while also helping to reduce operating costs and complexity.

As those hosting transactional data on System z already realize, it's one of the most secure, available and reliable platforms on the market—one that can scale to accommodate increasing data volumes and a growing number of users. The System z platform simplifies the deployment, maintenance and management of business analytics and data warehousing solutions, and enables organizations to more easily deliver against today's aggressive business requirements.

IBM Data Warehousing and Business Analytics solutions on System z deliver a complete portfolio of business and technology solutions that help everyone—including executives, data analysts and employees on the front line—gain insight and foresight. Real-time monitoring, reporting, analysis, dashboards and a robust set of predictive analytics enable everyone in a company to make smart, proactive business decisions. With an enterprise data warehouse infrastructure as the foundation for a business analytics investment, users are ensured consistent, secure access to accurate and timely business information. Z

Rebecca Wormleighton is an IBM product marketing manager for Cognos software, focusing on synergies between Cognos business-intelligence software and IBM products.

IBM Systems Magazine Webinar

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From Small Beginnings

The what and why of zEnterprise millicode

By Bob Rogers

Most people in the mainframe community have heard the term millicode, but what is it? The short answer is it's a form of microcode—one of the greatest ideas in computer engineering. Millicode embodies a very clever refinement of the basic idea.

First, let's start by defining microcode, which is a layer of hardware-level instructions involved in the implementation of higher-level machine code instructions. This means microcode is a set of instructions in a simple architecture used to implement the instructions of a more complex architecture.

Microcode was originally a simpler method of developing the control logic for a computer. Complex logic can be implemented with a sequence of simpler microcode instructions. Because it's essentially a program, logic errors can be fixed with a reload without making any actual hardware changes. Microcode patches can be used to work around errors in the hardware during development or even in the field.

An important part of the mainframe's history, microcode enables machines with differing internal designs and built on different hardware technologies to present a single architecture to software. Its introduction was a major contributor to the success of the IBM mainframe architecture in becoming the de facto standard for large-scale computers. Microcode made it all possible.

A Very Brief History of Microcode

IBM used microcode to create a full line of IBM System/360 processors in the mid-1960s, covering wide ranges of price and performance. They were built on different circuit technologies yet able to run the same programs. Prior to S/360, each computer was basically a

Historical footnote

The floppy disk was invented by IBM to provide a means to load microcode. Sometime around 1971, IBM started using 8-inch floppy disks as a medium for loading microcode into its System/370 computers prior to system IPL.

one-off with its own unique instruction set. Programs written to run on one computer would not run on the next version. As a result, programs needed to be constantly rewritten, or at least recompiled, to run on the newer, faster machines. It's hard to make progress in that sort of environment. On the other hand, it's been said that the IBM mainframe platform has amassed more than $3 billion worth of software over the decades, all of which is able to run on the latest IBM zEnterprise* System server.

Microcode can be used to enable an inexpensive low-end machine to look at software just like an expensive high-end computer. An example of this from the S/360 era was the Model 30. Physically, the Model 30 was an 8-bit machine with 8-bit registers and 8-bit data paths. The architected general-purpose registers were not hardware registers at all, but actually resided in core memory. Yet, by using microcode in a read-only store (ROS), the Model 30 presented the full basic S/360 architecture—in which the registers and operations are defined—as if it were a 32-bit machine.

Programs developed on a Model 30 would run on an S/360 Model 75, which was a high-performance machine with nearly everything implemented in hardware. Customers could buy the next model up and make changes to their software. Other machines in the S/360 line implemented the simpler, more performance-sensitive S/360 instructions in hardware and the more complex, less performance-sensitive instructions in microcode. In a sense, these machines were actually two machines—the native S/360 processor and the microcode processor—cooperating to present the complete S/360 architecture to software.

Obviously, this was a brilliant idea, and it's had a profound effect on computer design since its conception in 1953 by M.V. Wilkes.

The Advantages of Millicode

From the days of the S/360 until the mid-1990s, most computers were designed as a symbiosis between a native processor and microcode processor. A good example of this design is one of the early complementary metal-oxide semiconductor (CMOS) processors called the IBM System/390* 9672 G3. It used a type of microcode very similar to familiar machine language instructions, but the microcode

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architecture was much simpler than the target S/390* architecture. Most of the frequently used simple instructions were implemented directly in hardware. The more complex functions were implemented in microcode that ran on a distinct microcode processor, which acted somewhat like a coprocessor. The microcode programs were executed from special memory.

Because more microcode existed than could fit into the special microcode memory, the microcode for some instructions had to be paged in from regular memory before execution. This was a reasonable design but not for very high performance.

The next IBM mainframe processor, the IBM S/390 9672 G4, was quite different. It had a lot of microcode but no distinct microcode processor. It ran the microcode on the native processor and eliminated the need to design and build a separate microcode processor. The microcode language was a subset of the S/390 architecture—of course with some additions—so the microcode of this processor, being of a higher level than typical microcode, was dubbed millicode.

Besides the elimination of the separate microcode processor, there's another great advantage to running millicode on the native processor. A large amount of time and money go into the design and fabrication of the native engine to achieve maximum performance. The System z* processor of the latest zEnterprise System, the z196, is a high-frequency, superscalar, out-of-order instruction processor with four levels of processor cache. The complexity of the z196 is nearly beyond comprehension. Since the millicode is executed just like normal z/Architecture* code, it benefits from this performance optimization. By contrast, microcode processors of the past were always much simpler and slower than the native processor they worked with. Therefore, they were getting comparatively slower with each processor generation.

Of course, for the millicode to do its job while running on the native processor, some additional hardware has to be added to that processor. It must have an additional execution mode, called millimode, to execute it. This requires distinct registers (general purpose, access and control registers), an instruction address register, and other special registers. There must be additional instructions available only in millimode, for example, to move values between the architected and millicode registers, and to control hardware capabilities not available through the architected instruction set. When millicode is entered to execute an instruction, the hardware also does some initialization processing, like simple validity checking and setting up millicode registers.

Why Millicode?

Processor designers will provide an instruction implemented in millicode for numerous reasons:

- Complex instructions can be implemented with reasonable engineering expense. Conversely, the ability to implement instructions in millicode provides the freedom to define very complex instructions. Examples include program call (PC) and program return (PR), compare and form codeword (CFC) and update tree (UPT), which are used for sorting.
- Compatibility can be provided across processor generations by an early implementation in millicode preceding a higher performance implementation in hardware. Examples of this are the Long Displacement Facility in zSeries* z900 and the Decimal Floating Point Facility in zSeries z990.
- It has access to hardware facilities that are not available to normal code. One instance of this is move character long (MVCL) when the operands are 4K blocks on 4K boundaries. The millicode has access to a special hardware data mover that doesn't drag the data through CPU cache but moves it directly from memory to memory.
- Instructions can perform multiple storage updates without fear of interruption. A primary example of this is perform locked operation (PLO); another example is extract CPU time (ECTR).
- It runs with high authorization. This allows well-defined operations that require authorization to be performed without needing to invoke the OS. The branch and stack (BAKR) instruction, for instance, saves registers and other status into storage that the application doesn't have authority to access.
- A millicoded instruction can provide common functions almost like subroutines. This can help avoid code bloat. This is seen in MVCL, particularly its padding capability, and compare character long (CLCL), which can even compare strings of different lengths.

Massive Impact

On the 9672 G4, and all succeeding IBM mainframe processors, millicode is used for much more than implementing complex instructions. It augments hardware in the areas of system configuration and initialization, virtualization for logical partitioning, I/O functions, interrupt-processing and other control functions, reliability, availability and serviceability (RAS), recovery, and instrumentation. Millicode running on the native processor is a major element in every aspect of the modern mainframe. Z

Bob Rogers is a z/OS designer and evangelist. An IBM Distinguished Engineer, he frequently presents at SHARE and other conferences.

Simplifying Data Management in a Big Data World

New DFSMS features increase the availability of data on System z

By Cecilia Carranza Lewis, Terri Menendez and Jaya Srikrishnan

Data sources have increased exponentially in the past decade. IDC estimated in a July 2011 study that worldwide data volumes double every two years. While traditional data sources yield a larger and more varied set of information, new sources are added almost daily. The volume of information from each source also grows as computing capacity is added to the smallest of gadgets.

For each person on the planet, an estimated 45 GB of data exists. Most of it ends up stored in corporate IT departments, with up to 1.8 trillion GB created in 2011. Experts predict that number will grow 60 percent annually. The cost of managing this data is staggering. Not only does it require growth in storage media, but also in administrative expense for managing it all.

The Data Facility Storage Management Subsystem (DFSMS) was originally developed to reduce the administrative cost of managing storage and data, but it also works effectively with other components in z/OS* and storage hardware to more efficiently manage storage. Two examples of this are Extended Address Volumes (EAVs) and Control Area (CA) Reclaim in the VSAM access method.

Extended Address Volumes

EAVs were introduced with the IBM TotalStorage* DS8000* family of products to provide relief to customers constrained by disk capacity growth as they approached the device number limit. EAVs are defined as volumes with more than 65,520 cylinders and supported only with 3390 Model A devices. In z/OS V1.10, EAVs four times as large as the prior maximum size volume (54 GB) could be created, enabling

volume growth up to 223 GB, or 262,668 cylinders.

However, with continued rapid data growth some customers required greater capacity. On z/OS V1.13, EAVs can grow by another factor of four, or up to 1 TB of disk storage per volume, equivalent to 1.182 million cylinders. Yet some customers predict exceeding this newer EAV maximum size within five years.

Incorporating EAVs into an installation does more than relieve disk capacity constraints. It also allows growth without adding more devices. The ability to manage more data with fewer volumes helps simplify the job of storage administrators. When additional capacity is required, they can increase volume capacity while keeping the volume online through another important storage feature, dynamic volume expansion (DVE).

This can eliminate the need to migrate data to new volumes; even better, it can eliminate the need to quiesce applications to take the volume offline. One exception is that copy services relationships—FlashCopy, peer-to-peer remote copy or extended remote copy—must be quiesced prior to volume expansion.

To manage performance for larger volumes, storage administrators can take advantage of the Hyper Parallel Access Volume (HyperPAV) function of the DS8000 family, which enhances management of concurrent I/O requests. HyperPAV technology allows the assignment of PAVs, as needed, to reduce the need to queue-optimize concurrent I/O requests. EAV, DVE and HyperPAV work together to simplify data growth.

Introducing EAVs takes only a few steps:

- First, use the tracking facility (CNZTRKR) to help detect which applications might need changes to work with EAVs before creating one. This will identify jobs, program names and program offsets where changes might be needed. In addition, refer to the EAV migration considerations documented in the IBM publication "DFSMS: Using the New Functions Starting With z/OS V1R10."
- Next, configure EAVs on your DS8000 storage system by creating a new EAV or expanding an existing volume using DVE. Add EAVs to the appropriate storage groups. Specify EATTR when appropriate to override system-determined data set eligibility for placement in the extended addressing space (EAS) of the EAVs. EATTR is specifiable in IDCAMS, JCL, dynamic allocation, System Managed Storage (SMS) data classes and ISPF. Allow the system to allocate new data sets on an EAV by specifying USEEAV=YES in SMS PARMLIB member IGDSMSxx. SMS policy can now begin to take advantage of the additional capacity.

EAVs are well positioned to handle the increasing rate of data storage with an architectural limit supporting hundreds of terabytes.

Even without constraints on the number of devices, EAVs are an attractive way to simplify overall storage management. Significant additional capacity with less storage management is a storage administrator's dream. Additionally, EAVs are well positioned to handle the increasing rate of data storage with an architectural limit supporting hundreds of terabytes.

Control Area Reclaim

The term "big data" and the phrase "a world that never sleeps" may be familiar to many, however, few understand the pressure these place on data-access methods. No matter how big the data is, or where requests originate, access rates must keep pace. Even our most trusted access methods must keep up with a demanding online world. This is especially true for one of the most popular access methods, VSAM, and its most-used structure, the key sequenced data set (KSDS).

KSDSs provide high-performance, direct data access by using a B-tree style index structure that tracks individual

Managing Big Data

The amount of data continues to grow with no end in sight. Managing it takes increasing effort. Two new features in the Data Facility Storage Management Subsystem (DFSMS) can simplify the management of growing data on the IBM System z* platform:

1 Extended Address Volumes (EAVs) allow an installation to increase disk capacity to support an aggressive data-growth rate without adding more devices.

2 Control Area (CA) Reclaim enables the reuse of CAs, eliminating the need for costly VSAM data set reorganizations.

In both cases, DFSMS can increase the availability of data with less manual effort on the part of the storage administrator.

—C.C.L., T.M. and J.S.

data record locations in each data set. Unique keys stored within data records—defined by programmers when data sets are defined—are used to locate records. KSDSs comprise two physical components, the index and data components. Index components contain the index structures, and data components contain actual user data records.

KSDS index structures consist of individual sequence set (SS) records. Each points to a logical grouping of data records or CAs. Each CA is divided into smaller record groupings called control intervals (CIs). An SS record points to a CI by saving the highest key value for the CI. CIs are the units of storage used to transfer VSAM data records.

When more than one SS record exists, higher-level index records, referred to as the index set, are added to point to groupings of SS records. Each SS record is pointed to by saving the high key for each record, allowing VSAM to quickly conduct a B-tree or top-down type search for a given key. SS records are also chained, allowing the flexibility of both sequential and random data access. While KSDSs provide flexible, efficient data access, VSAM performs complex space management activities to allow records to be inserted or erased anywhere in the data set.

When records are inserted into a KSDS and new space is required, a new CI is obtained. Half of the records are moved into the new CI, splitting the CI into two parts. If the SS record runs out of space during a CI split, the index record is split in two, resulting in a CA split. When all of the records in a CI are erased, it is reclaimed and can be used for new CI splits within the same CA. However, when all of the records in a CA are erased, the CA is not reclaimed. The high key for CA is saved even though no records exist in it and can only be reused if keys in the same range are again inserted into the data set.

The existence of empty CAs can be considered a fragmentation issue and may result in both performance and space problems for the data set. When CAs cannot be reused, new CAs must be obtained, unnecessarily increasing the data set sizes and potentially the number of index levels. Size increases can result in out-of-space conditions, and increasing index levels can lengthen direct searches. Additionally, sequential searches will take longer because SS records and empty data CIs must be retrieved to determine if any

IBMSystems magazine WEBINAR

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records exist in the CA. When VSAM buffering is active, performance may be affected because empty SS and data CIs can consume valuable buffer space.

Before z/OS V1.12, the only remedy for fragmented KSDSs was to take data sets offline and reload the data records. This process removes empty CAs, reducing the overall size of the data set and restoring performance. With z/OS V1.12, VSAM provides a new enhancement, CA Reclaim, which will reclaim SS and index set records when the last record is deleted from a CA. Reclaimed index records are placed on free-chains to be reused for CA splits anywhere in the data set. Reusing CAs can control data set growth and helps stabilize performance.

Nothing to Fear

With z/OS V1.12 and CA Reclaim, VSAM demonstrates that the most trusted mature access method still rises to the challenge, meeting the demands of a rapidly expanding computerized world. Big data and a world that never sleeps might be today's reality, but with VSAM, they are nothing to be afraid of.

With EAVs and CA Reclaim technologies, the z/OS technology and DS8000 family of products are working together to make it easier for storage administrators to handle data growth with minimal impact to availability and without compromising performance or adding complexity. Z

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DATE	EVENT	LOCATION
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October 21 - October 25, 2012	Information On Demand 2012	Las Vegas, Nevada
October 23 - October 25, 2012	2012 IBM Systems Conference	San Paulo, Brazil
October 29 - November 2, 2012	2012 IBM Power Systems Technical University	Las Vegas, Nevada

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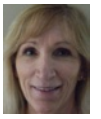
Cecilia Carranza Lewis is a senior technical staff member, holding numerous technical leadership positions related to z/OS, within the IBM Systems and Technology Group.



Terri Menendez is a senior technical staff member in the IBM Systems and Technology Group and the chief architect for the VSAM CA Reclaim function.

Jaya Srikrishnan is a Master Inventor and Distinguished Engineer in IBM's Systems and Technology Group, and has worked in software and firmware for more than 25 years.

Solutions

What's new in the marketplace

CICS JS/Server V1.1

Matter of Fact Software

A new offering, CICS* JS/Server V1.1, allows the Dojo Javascript* Toolkit to be installed and controlled on the IBM mainframe in partitioned data sets and served to Web applications via CICS. Such Javascript tools are frequently used for rapid development of browser-based UI functions. The CICS JS/Server:

Features simple installation and implementation

Can scale to meet the needs of high-performance systems

Supports Dojo Javascript Toolkit, V.1.5.1, 1.6.1 and 1.7.2

OS SUPPORT: z/OS* 1.10 and above; CICS TS versions 3.1 and above
PRICE: Variable
URL: www.plexspy.co.uk

DR/VFI

21st Century Software

The latest release of the mainframe data-protection solution DR/VFI 4.4 includes new features and functionality that can enhance real-time operational recovery and can provide a guaranteed recovery time regardless of the application and assurance of meeting business service-level agreements. New features include:

Enhanced virtual recovery simulator functionality, which pre-evaluates applications' capability to recover within the production environment

Enhanced in-flight data reporting, a real-time component that provides a point-in-time indication of opened files, both VSAM and non-VSAM, and those potentially in a compromised state

Virtual tape reconciliation for replicated environments that—in conjunction with in-flight data reporting—provides an accurate depiction of compromised data

The Real-Time SMF RT/SMF logger to capture and archive significant real-time events

OS SUPPORT: Up to z/OS* 1.13
PRICE: Variable
URL: www.21stcenturysoftware.com

JCL-QA

DTS Software

DTS Software introduces JCL-QA, a new product within the MONitor suite that performs JCL analysis, validation and reporting. Expanded from the base Scan JCL feature in MONitor, JCL-QA uses the z/OS* Converter/Interpreter to perform JCL conversion and then scans the converted data definition statements to extract necessary data set usage information. The new release can:

Scan individual JCL job streams, entire libraries or job streams extracted from job scheduling systems

Enforce installation standards

Perform system validation tests on local or remote systems running JCL-QA

Process system-created control blocks and drive them through validation routines or installation rules for standards enforcement

OS SUPPORT: All z/OS versions
PRICE: Variable
URL: www.dtssoftware.com

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The IBM 1440 is displayed in this brochure image circa 1962.

A Big Iron Golden Anniversary

A 1440 data processing system finds new life after 50 years

By Ryan Rhodes

Fifty years ago, IBM unveiled its second printed circuit data processing system, the 1440. This accounting and business information system was targeted to "smaller volume businesses," although the system still required its own room.

Essentially a lower-cost version of the 1401, the 1440 didn't quite attain the same commercial success. As such, 1440 components—designed and built in Endicott, N.Y.—are difficult to find.

To preserve historical computing technologies like the IBM 1440—a precursor to the modern mainframe—entities have emerged such as the Binghamton, N.Y.-based Center for Technology & Innovation (CT&I) and its TechWorks! Prototype Workshop.

"Electronic packaging and miniaturization are huge advances made by IBM Endicott," says Susan Sherwood, CT&I executive director. "The 1440 is a very interesting midpoint in that packaging evolution, which is why we're so interested in it."

With its IBM 1440 Project, CT&I is bringing together original 1440 components and restoring operational functionality. To date, the center has procured a 1441 processing unit, a 1447 console and a 1311 disk drive—as well as cables and manuals—largely on loan from the IBM Archives. In March, it acquired one of only three known IBM 1442 Card Readers, which was in much better condition than some 1440 devices.

"Some of these things had been in storage for 20-plus years, so several of the gates that contained circuit cards were loaded—saturated really—with mouse nests," says Fred Petras, a project team member. "So, we had a considerable cleanup task before we could even get to the point where we could power it on."

After the 1440 was cleaned, it hummed with life for the first time in decades, and the team exercised system functions using the original programming language and established communications among the various components.

"I think the IBM corporate archivist who acquired the 1440 system and transferred it to us would have been happy if it simply looked good, but we're going a little further than that," Sherwood says. "At TechWorks!, we want to delve a bit deeper and show how things work. We don't want to display machines that just sit around, but rather, machines that actually function."

The 1442 Card Reader is the only 1440 component on hand with visibly moving parts, which will allow visitors to see card decks being read, processed and then output punched results. Sherwood would like to procure an IBM 1403 chain printer fast enough to play music from a card deck, thereby completing a 1440 system. It would likely be the only such fully functional system.

"We may not have the complete system up and working by the 50th anniversary date [Oct. 11], but we'll have most of the 1440 components running, which is a pretty impressive accomplishment considering we started with a system clogged with mouse nests," Petras adds.

Ryan Rhodes is a freelance writer for *IBM Systems Magazine*.

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- IBM zEnterprise Server Processor Technology: Latest Status and Directions
- IBM zEnterprise Server I/O Technology: Latest Status and Directions
- What's new in IBM z/OS Support for the Latest Server
- IBM z/VM 6.2 Migration to Single System Image Hands-on Lab
- z/VM and Linux on System z Performance "Best Practices"
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October 15-19
IBM SmartCloud Symposium
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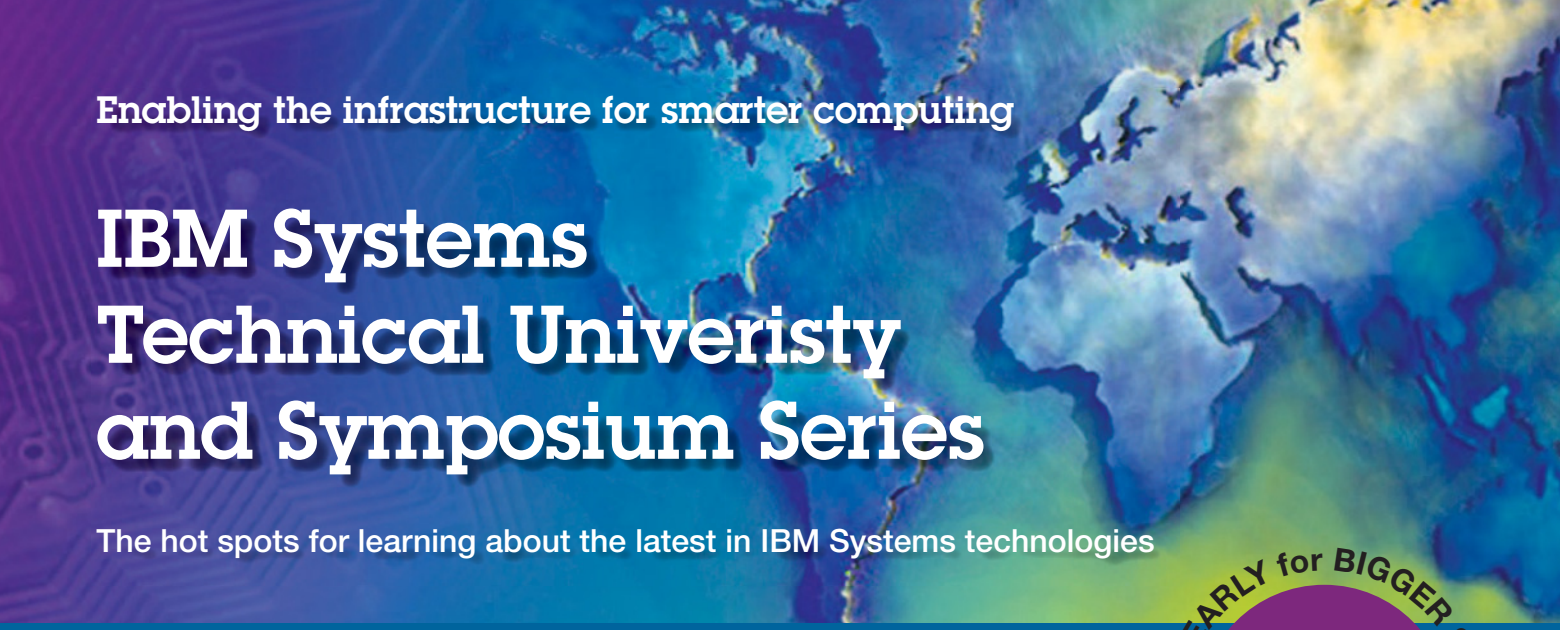

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SALES AND MARKETING DEVELOPMENT MANAGER
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Congratulations to the Champion!

… a passionate evangelist for the Mainframe platform.

We want to congratulate Troy Coleman for being selected to the prestigious IBM Champions list. This deserving individual authors weekly blogs on our IBM Systems Magazine website titled DB2utor and is an IBM Systems Magazine technical editor.

For a complete list of 2011 Champions and their profiles visit: http://www.ibmcom/developerworks/champion/

Troy Coleman's blog: http://ibmsystemsmag.blogs.com/db2utor/

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ussACTION delivers the same superior functionality as eventACTION for the z/OS USS system environment.

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eventACTION
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- Compliance issues in a z/OS system environment

ussACTION
Automatically and transparently track and control changes in z/OS UNIX Systems Services

- Automatically and transparently track and control changes in z/OS UNIX Systems Services

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Mainframe Best Practices in Action

While IBM Systems Magazine, Mainframe Edition, relies on top IBM and industry experts to keep readers in step with the latest mainframe advancements, it also features customers leveraging their mainframes to the fullest. Here are a few examples:

"The recovery time is unbelievable. Before, if someone needed data, we'd have to find out what tape it was on, find that tape and then mount it. That might have taken 44 hours. Now, we can do it on the fly, with restore requests coming in at around 15 minutes." — Lacey Griffith, Furniture Brands
www.ibmsystemsmag.com/mainframe/casestudies/manufacturing/furniture_brands/

"At Primerica, the mainframe is the file server for all legacy, intranet and Internet applications. This is not only because the mainframe is easier to recover in the event of an emergency, but also because we don't want to have to restore some 400-plus servers individually if something were to happen." —Abel Melchiore, Primerica
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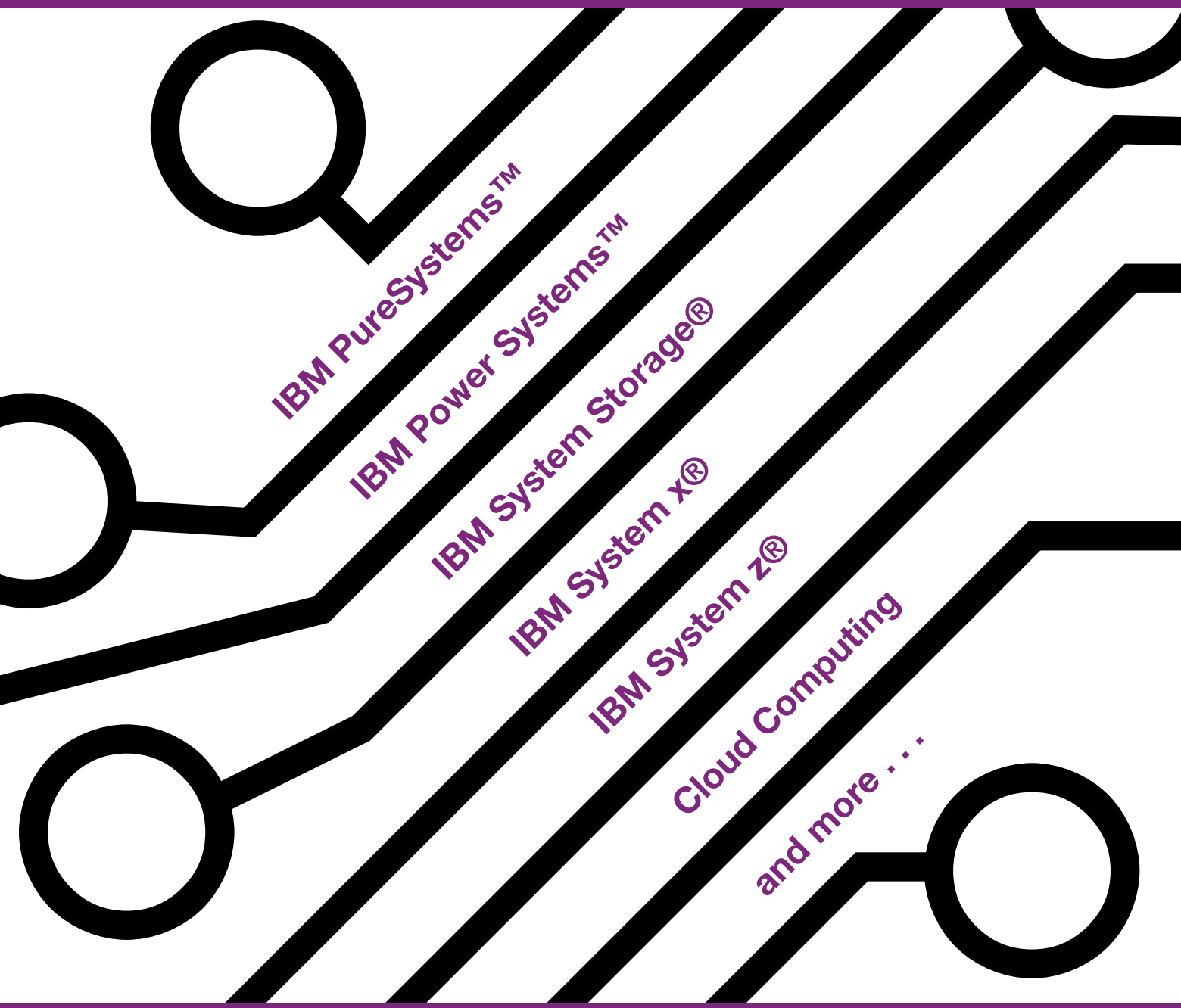

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Dino-Software

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DTS Software

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Whitepaper: *What's New in z/OS V1R12 & V1R13*

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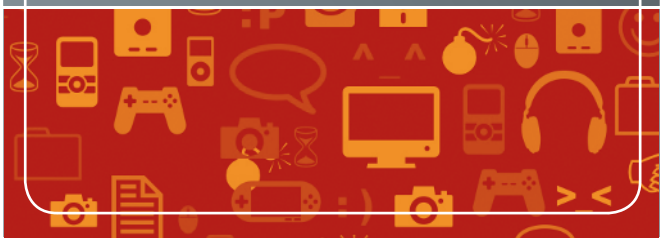

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PKWARE SecureZIP PartnerLink
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Serena Software provides orchestrated IT and product-development solutions to the Global 2000. Serena's mission is to help enterprises orchestrate their processes for tremendous competitive advantage. Its 4,000 active enterprise customers, encompassing almost 1 million users worldwide, have made Serena the largest independent application lifecycle management (ALM) vendor and are now using Serena to orchestrate IT service management and other vital processes.

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[1]2,000 customers, 7M MIPS with DFSort, 2% Sort, 35% reduction with $4,500 per MIP cost = $220 million in savings

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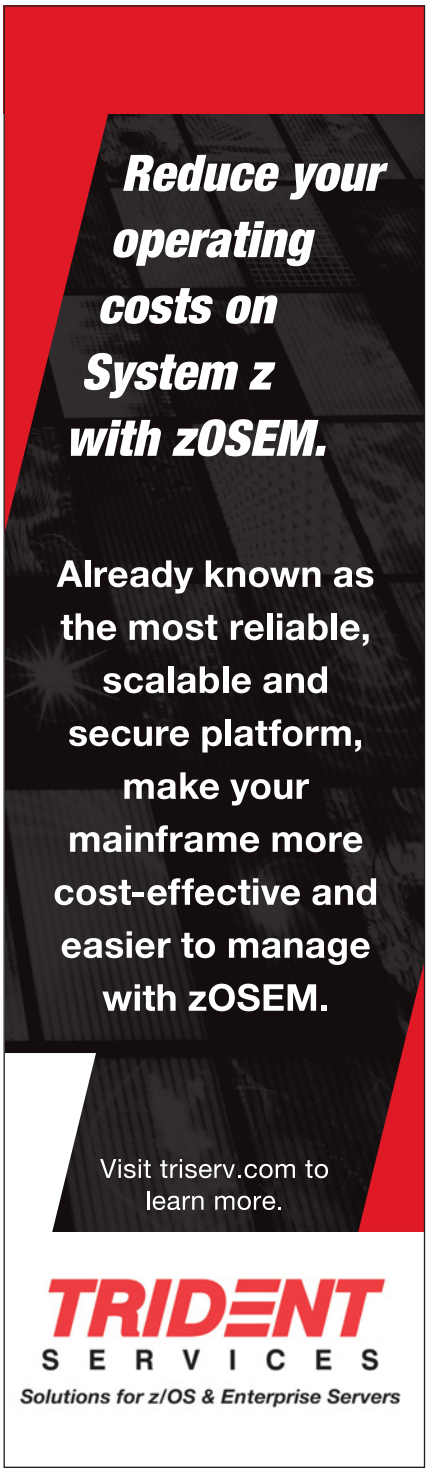

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