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# Getting the Most from System z

## Part I: Redefining Mainframe Economics with the Specialty Engines

November 2008

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## Executive Summary

With the market crisis, increasing efficiencies and reducing cost are greater issues than ever. Insurance CIOs may decide that expensive technology investments may need to wait, such as that long-planned and long-delayed policy admin replacement project, and will be looking for ways to continue modernizing without the cost.

According to the Celent report *Insurance CIO/CTO Pressures, Priorities, and Plans in 2008*, over 40% of large insurers and 31% of midsize insurers are running applications on IBM System z. For those that use it, more than 30% of their infrastructure can be found on the system. These percentages have been shrinking in the last three years, but the applications still running on z/OS tend to be the most critical—and the most difficult to replace.

One solution for insurers looking to increase efficiency with lower technology expenditure is to consider moving more systems onto the System z. The mainframe's reputation varies in the industry. For clients experienced with the platform, it is looked upon as a cost-effective solution with a high quality of service. Proponents of distributed infrastructures with less mainframe expertise often consider it to be the host of legacy systems with a costlier, price per usage model. With the System z specialty engines, the mainframe can be modern and cost-efficient while still providing mainframe reliability.

New tools and technologies allow insurers to turn the System z into a central component of their modern, distributed infrastructure. It is now possible to run Java and Linux on the mainframe, and, it is possible to do so without incurring the increased costs associated with mainframe processing.

## Introduction

In a 2007 report, *Web Services and SOA in Insurance 2007: Realizing and Communicating the Business Value*, Celent examined how service-oriented architecture (SOA) and Web services have become critical strategies in the insurance industry and how these technologies are being used by insurers. Though mainframes are typically considered “outside” the picture of modern infrastructure, more and more insurers are leveraging new tools and technologies to fit System z into the middle of the distributed environment.

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One solution for insurers that are looking to get increased efficiency with lower technology expenditure is to consider moving more systems onto the System z. The mainframe has a reputation for being the last mainstay of legacy systems as well as a costly, priced-per-usage solution. However, with the IBM’s System z specialty engines, the mainframe can be both modern and cost-efficient. It is now possible to run Java and Linux on the mainframe without incurring the increased costs associated with mainframe processing.

Whereas once an IT leader had to choose between continuing to nurse an isolated mainframe asset and replacing a working engine at great cost, System z can now be considered a central part of an insurer’s SOA infrastructure. Perhaps just as importantly, this can be done in a cost-efficient manner.

A forthcoming companion report by Celent will look in more detail at how and why insurers are moving work onto the System z. That report will review vendors that provide tools to integrate legacy mainframe applications into a modern infrastructure.

## Market Drivers for Mainframe Change

The mainframe has played a strong role in insurance infrastructure for a long time. But changing realities in available technology and the economy require an evolution in mainframe architecture and mainframe pricing models. The specialty engines, which will be explained in more technical detail in the following section, help the System z compete on both levels.

Many market drivers make such a technology advancement necessary.

- **They make the mainframe more cost competitive.** The simplest of explanations is that the specialty engines make the mainframes more cost effective, helping them compete against low-cost distributed servers.
- **They allow new workloads to be added to the mainframe.** A modern insurer needs to be able to run modern applications, and not all vendors support the System z. With the specialty engines, any Linux-supporting application is now a mainframe-supporting application.
- **They allow Java to run more efficiently on the mainframe.** Java applications are notoriously inefficient, and on the mainframe processing cycles cost money. The specialty engines provide a new model that allows Java applications to run on the mainframe without the additional processor charge.
- **They allow DB2 to be more competitive.** As databases power not just back office systems but also web-enabled applications available even to insurance shopping prospects, the mainframe needs to be able to compete in both technology and price with distributed databases. The specialty engines help make this possible.
- **They help realize the mainframe's role as an enterprise server.** All of the above items can be summarized in this final point. Companies are no longer just looking for back office processing systems, but enterprise servers that can power internal and external needs in a cost-efficient manner.

## System z Specialty Engines

The standard processor on the System z is the central processor (CP). It runs the z/OS and is priced via processing usage. In addition to the CP, IBM also sells specialty engines called zAAP, IFL, and zIIP. Each one serves a different function, but a key common factor is that there is no charge for software and processor use on these engines.

- **zAAP:** System z Application Assist Processor. The zAAP specialty engine allows the running of Java applications (using Java 1.4 or higher) and WebSphere applications.
- **IFL:** Integrated Facility for Linux. The IFL specialty engine is a processor dedicated to Linux. With System z's virtualization features, it's possible to use one IFL engine to represent the equivalent of many distributed Linux servers.
- **zIIP:** System z Integrated Information Processor. The zIIP specialty engine can run a portion of general z/OS work, which is technically explained later in this report. It was originally used to run the DB2 Data Servers. DB2 can also be run on the CP engines, but on the zIIP engine an organization will not incur the same costs as capacity needs increase.

The specialty engines are both a big area to lower costs and a source of confusion. In order to understand the specialty engines, it's important to recognize that part of their purpose is to allow IBM to adjust its System z pricing structure.

Each specialty engine, according to current (April 2008) list prices, costs between US\$95,000 and \$125,000. Unlike the central processor, after the initial specialty engine purchase, there are no more costs incurred from capacity or system usage. This allows an organization struggling with the total cost of ownership of its System z to continue to increase its capacity and usage without the costs becoming too high.

### A Deeper Look at the zIIP

Knowledge of these technical details isn't required to understand the report or take advantage of the zIIP engine, so some readers may feel free to skip this section.

Mainframe integration tasks are primarily handled by a task control block (TCB) threading model and, in rare occasions, a lighter-weight service request block (SRB). TCBs—which typically involve transactions such as file I/O, security authentication, or certain regulated System z instructions—must be run on the central processor. The zIIP specialty engine is unique in that it will only accept instructions in the form of a SRB. This ensures too much work isn't offloaded to the cheaper specialty engines.

In the case of DB2 running on the mainframe, database requests coming from a distributed server outside of the System z can be processed as an SRB, handled by the zIIP. This means that as an organization attempts to create web-based access and utilize its mainframe as a database server in a modern, distributed infrastructure, the company will not incur significant additional processing charges. However, database requests that originate from within the System z—from legacy applications, for example—will still be processed as TCBs, handled on the central processor, and still incur the same processing charges as they did before.

## Java on the Mainframe?

If you didn't realize that Java is available on the mainframe, you are not alone. Many insurers that are struggling with integrating their legacy applications on z/OS with a modern infrastructure don't know this option exists. While running Java side-by-side a legacy application doesn't mean that your home-grown COBOL policy administration system will suddenly integrate into your distributed architecture, it's a good first step.

There are many benefits to running Java on the z/OS central processor.

- **Performance and Scale:** When distributed applications communicate via Web services, a lot of information needs to get transferred back and forth. Running your Java applications on the mainframe reduces the need for cross-network traffic, decreasing both the average CPU time per transaction and the amount of data that needs to be transferred per transaction.
- **Non-Functional Requirements:** Distributed infrastructures don't yet have the same reliability, availability, or security as the longstanding mainframes.
- **Integration into a Modern Architecture:** Finally, and most importantly, it provides all the benefits enterprises have come to expect of Java. With Java available on the Mainframe,

an organization can register Web services, work with Java messaging, and begin to work with legacy assets like any other modern application.

There is, however, a major liability as well.

- **Cost:** Java is a notoriously processor-inefficient programming language, and when you're paying based on processor usage, z/OS is an expensive place to be running any non-critical Java applications.

Unfortunately, expense-conscious organizations can find that increasing the workload on the mainframe too costly an exercise, overriding all the benefits. The zAAP engine allows an organization to take advantages of running Java on the mainframe without incurring the increased cost.

## Examples of Specialty Engine Use

An organization deciding between using DB2 on the mainframe and using Oracle on a distributed server might decide that the added processor usage on the mainframe would be an too much of an additional expense, and select an Oracle solution. With the zIIP engine, the organization can choose to run DB2 on the mainframe with only the added expense of the specialty engine, similar to the cost required to buy a new distributed server. The two solutions can now compete on equal footing, without DB2 penalized by IBM's mainframe pricing strategy.

Alternatively, an organization interested in utilizing Oracle but dedicated to the mainframe can purchase the IFL engine, allowing the organization to run a Linux Oracle installation on the System z.

With the zAAP engine, an organization can push Java applications onto the System z, moving processor-intensive (and relatively inefficient) work onto the mainframe without raising the cost of processing for all applications on the mainframe. And, in the case of the IFL engine, an organization might be able to replace many distributed servers for the cost of one specialty engine.

# Advantages of the Specialty Engines

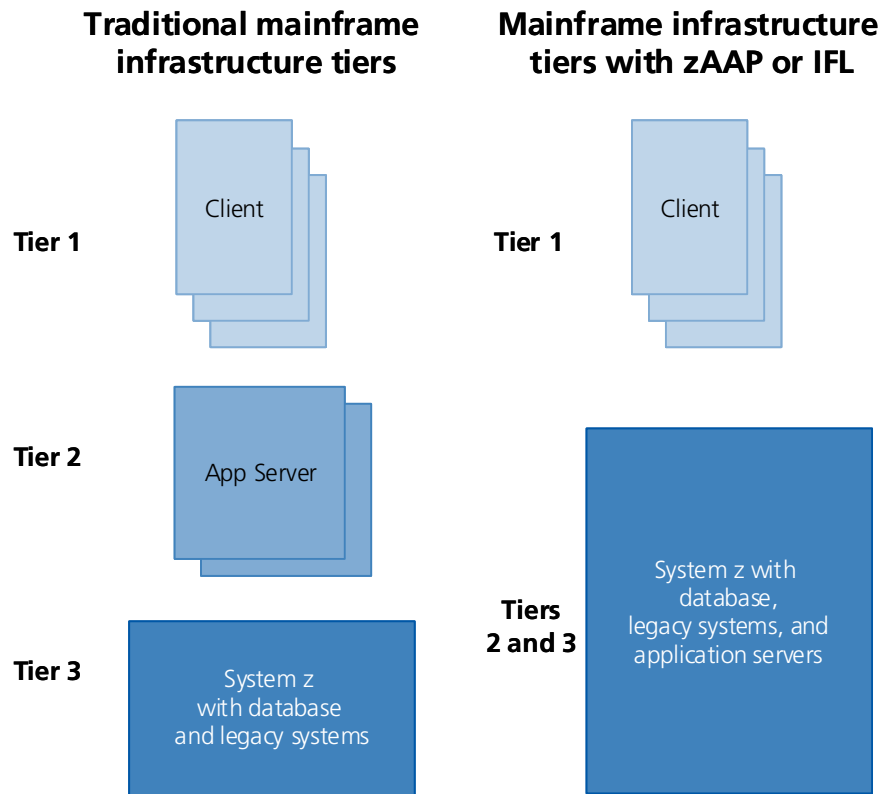
## Simplifying the Infrastructure

One advantage of utilizing the specialty engines is a simplification of the infrastructure. For an insurer using the mainframe, a traditional network infrastructure typically requires at least three tiers, where a tier is a server or a set of servers handling a critical function.

The first tier is typically where the web server or client applications reside, often on smaller, load-balanced servers. The second tier, in this instance, is where the business logic and application server or servers reside, on modern distributed servers. And, for insurers using a mainframe, the System z makes up the third tier, with the database and any legacy applications.

By running Linux on the IFL or a Java-heavy WebSphere application on the zAAP, however, this traditional model can be simplified. The second and third tiers can be combined into one tier, with the application server and business logic on the System z.

Figure 1: Infrastructure Tiers



Source: Celent

While there are many benefits to moving the application server tier onto the mainframe, insurers should not take it for granted that this is the best approach for them. Many factors go into deciding the right infrastructure topology. An upcoming Celent report will provide more detail as to the advantages and disadvantages of these configurations. Insurers with an IT staff skilled in distributed servers will likely weight the advantages and disadvantages before continuing to utilize a three tier model.

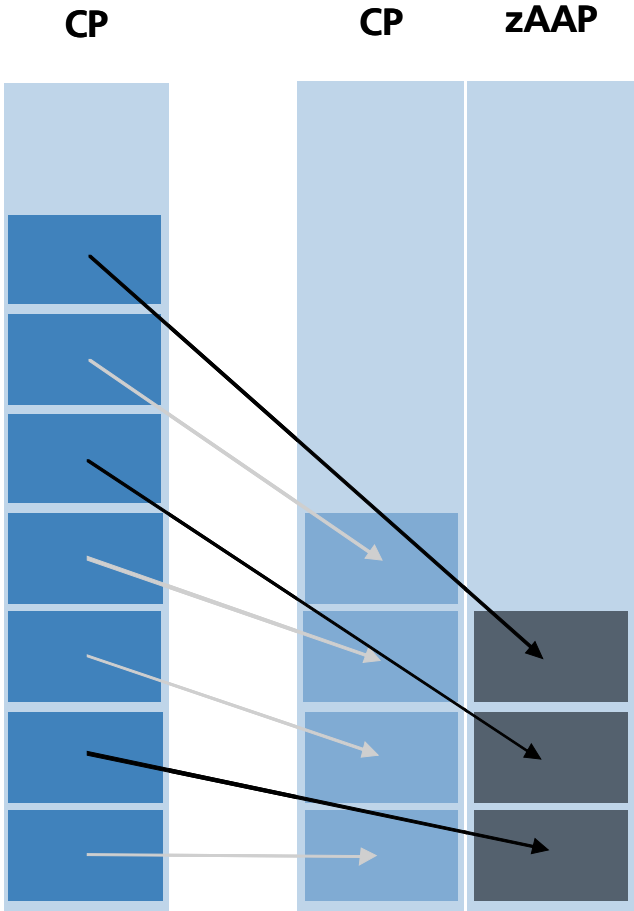
### Reduction in Processing Costs

By utilizing the zIIP, zAAP, and IFL, processing work can be offloaded to lower-cost engines, leaving the central processor for critical work. This does not necessarily mean that the central processor will be used less and that the specialty engines will mean less revenue for IBM. Many insurers have determined limits to the amount they can spend on mainframe processing, and actually throttle the work done on the Sys-

tem z to keep within those limits. Moving work to the specialty engines will free up cycles on the central processor, allowing the insurer to do more work overall while still remaining in the budget.

Figure 2 represents the move from a System z with only a central processor to a System z that also includes the zAAP specialty engine. If we consider each “block” a unit of processing work for the System z, the first configuration must handle all work in the central processor. However, after adding the zAAP specialty engine, all eligible units of work are handled there instead. This either provides an immediate cost savings or frees up the CP for additional processing within the same cost.

**Figure 2: Offloading Processing to Specialty Engine**



Source: Celent

## Specialty Engines Exploitation

Since the release of the zIIP, zAAP, and IFL engines, many vendors have come out with software intended to help companies better utilize the new technology.

The key to specialty engine exploitation is this: The more mainframe processing a company can move from the central processor to one of the specialty engines, the less that company will pay in mainframe costs.

The specialty engines make it possible to run software and systems on the mainframe that would otherwise be cost-prohibitive. Linux, DB2, and traditionally less processing-efficient Java applications can be run in an economically viable way. The vendors that provide specialty engine exploitation allow insurers to take things to the next step, pushing more and more processing onto the zIIP, zAAP, and IFL engines. These vendors provide tools that help monitor specialty engine usage, manually select specialty engine run times, or automatically break mainframe threads apart to get the most cost-efficient engine placement.

# Overview of Technology Vendors

There are a number of technology vendors that provide tools and services to help an organization take advantage of its System z specialty engines. This report is not intended to be an exhaustive overview of the space, but rather a high-level survey of some vendors that are known to be helping insurance clients. The profiles have not gone through Celent's extensive review process, meaning much of the information comes directly from the vendor without validation by reference clients.

## BMC Software: Mainframe Systems and Capacity Management Solutions

BMC Software (NYSE: BMC) is a global provider of IT automation and management solutions. The company has offices worldwide, with approximately 5,800 employees and over 15,000 customers.

BMC MAINVIEW and BMC Performance Assurance are suites of products for the mainframe that provide tools for system management, capacity management, storage management, and performance optimization. The suite consists of over 50 individual products, ranging from basic performance reporting to complex capacity planning.

BMC Performance Analyzer for Mainframes is a component of the BMC Performance Assurance suite that is a robust performance reporting engine. With no coding, it provides hundreds of out-of-the-box reports that can be accessed via the web, including utilization analysis reports for specialty engines. This allows technical staff to quickly see what current System z workload is eligible to be run on the specialty engines.

BMC Performance Predictor for Mainframes provides the capacity management functionality of the BMC Performance Assurance suite, including help for companies looking to exploit the zIIP and zAAP engines. It analyzes the business-applications on the mainframe and ties utilization, service, and technical data to business and financial data. This allows it to analyze performance data and predicts future requirements and specialty engine usage.

The BMC Performance Assurance suite of mainframe analysis products attempts to answer not just what work can be offloaded to the specialty engines, but also how this will affect the workload. The BMC Performance Predictor for Mainframes takes a more complex look at capacity planning. It can simulate adding processors with analytical modeling and queuing algorithms to see how workloads will change. It allows IT to create “What if” scenarios for components or applications and can show which mainframe components will go up or down in utilization and processing.

Though the specialty engines provide a lot of value, they also come with overhead. If there are not enough workloads that can be moved to the zIIP engine, it may end up just adding overhead, burning processing cycles while not being used. The BMC Performance Predictor can help IT simulate adding one or more specialty engines in advance, checking the impact on each workload.

BMC MAINVIEW for z/OS provides a web interface for getting detailed real-time views of the mainframe. It can show the percentage of applications that have been offloaded to zIIPs, including its own workload. It also provides views of mainframe services over time as they are offloaded to specialty engines, allowing IT to properly set priorities. This allows real-time manipulation to take better advantage of the specialty engines.

BMC CMF MONITOR allows a breakdown of the mainframe processors to a deeper level of granularity, driven by processors over intervals. Unlike BMC MAINVIEW, it shows the different mainframe processors rather than each job, letting an organization know if the processors themselves are over- or underutilized. CMF helps an organization do capacity planning and forecasting for workload management policies.

BMC MAINVIEW for z/OS and BMC CMF Monitor have also been enhanced by BMC to take advantage of the specialty engines. By pushing 50% or more of the processing onto the zIIP engine, these solutions not only allow customers to plan for more cost-efficient usage of the mainframe, but the solutions themselves are less expensive to run on the mainframe.

The BMC mainframe solutions support z/OS, z/VM, Linux for z/Series, and USS and work with databases DB2 and IMS. The core technologies of the monitoring and reporting components include CICS, IP, VTAM, WebSphere MQ, and WebSphere Application Server. BMC Software states that implementation timeframes for new installations can take under a week.

## CA, Inc.

CA, Inc., (NASDAQ: CA), is a global company focusing on enterprise IT management solutions, with more than 13,000 employees worldwide. With a broad scope of solutions, CA serves many leading insurance companies including Mutual of Omaha and Shelter Mutual Insurance Company and the majority of the Forbes Global 2000. The company serves customers in virtually every country in the world and reported fiscal year 2008 revenue of US\$4.3 billion.

With regards to the System z specialty engines, CA is both providing tools to better analyze and leverage the zIIP, zAAP, and IFL engines and retooling its own products to exploit these specialty engines, allowing customers to run CA solutions to reduce their overall mainframe costs while freeing up general processors for additional workloads.

Tools that help companies analyze and leverage the specialty engines include:

CA SYSVIEW Performance Management and CS MICS Resource Management, which both aid in capacity planning and utilization of the specialty engines, are configured to run on the zIIP processor.

CA SYSVIEW Performance Management is a real-time solution that displays and collects information for analysis during intervals and measures the activity associated with general and specialty processors. This includes information regarding CPU percentage activity associated with IFLs, zIIPs, and zAAP processors. Eligible workloads that could have been processed on zIIP and zAAP processors are collected, enabling a business to simplify the cost analysis process associated with offloading workloads to the specialty engines. Also, customers that have deployed the specialty processors can perform cost/benefit analysis against the workloads being processed and offloaded. Interval records, graphical analysis, batch reports, and online displays associated with workload manager and prism provide valuable information businesses can utilize for justifying the existing cost or potential cost savings associated with zIIP and zAAP specialty processors.

CA MICS Resource Management captures and organizes IT resource utilization data from varied sources including database, messaging, and networking subsystems, and maintains that data in a common data repository, which can then be used to help manage capacity, performance, availability, and costs. By reviewing trends and using the capacity planning tools available, a user can determine if there is a bet-

ter way to deploy mainframe resources to optimize the use of the specialty engines and save capacity on the general processor engines for work that cannot exploit specialty engines.

CA leverages the specialty engines as follows:

In addition to providing tools that help companies better analyze the mainframe for specialty engine exploitation, CA is also adopting its large set of mainframe solutions to make use of those engines. Once these solutions take advantage of the zIIP, zAAP, or IFL engines, companies can use them at a lower cost on the mainframe, even if they are processor-intensive.

CA has enabled the CA IDMS and CA Datacom databases for zIIP utilization. The company has also zIIP-enabled CA software such as CA NetMaster, CA Vtape Virtual Tape System, and CA Tape Encryption to reduce the CPU cost impact.

CA notes that, with the CA IDMS database, it does not limit what types of workloads can run on zIIP. Significant portions of any CA IDMS workload are eligible to be handled by the zIIP engine, whether those requests come from mainframe CICS, CA IDMS/DC, CA ADS, or batch applications or from a distributed source.

Applications for CA IDMS and CA Datacom are built using COBOL, PL/I, Java, .NET, their own 4GL (CA ADS and CA IDEAL respectively), and other languages.

The CA solutions use a mainframe-based pricing model, where pricing is based on server capacity. These mainframe solutions typically support unlimited users.

## DataDirect: Shadow version 7

DataDirect Technologies was founded in 1987 with a focus on data connectivity, providing early leadership in developing the ODBC and JDBC standards. Acquired by Progress Software in 2003, DataDirect continues to operate as an independent business unit, providing software products for data connectivity, mainframe integration, and XML data integration to both enterprise IT customers and the ISV community.

DataDirect's Shadow is mainframe middleware software that bridges the integration of mainframe data, business logic, and screens with new Java, .NET, or web applications. Using industry standard interfaces (SOAP, XML, and SQL), Shadow enables organizations to extend their

mainframe systems to participate with SOA, business intelligence (BI) initiatives, and/or composite application development. Shadow's functionality can be summarized in two major benefits:

1. Reduced complexity and cost: Shadow provides a single, unified integration architecture for reduced integration complexity and overhead, transforming mainframe data and applications into compatible data formats and services that allow IT to more easily integrate mainframe assets and distributed applications using industry standard Web services, direct SQL access, real time events, or orchestration via BPEL 2.0
2. Lower mainframe TCO: Shadow includes a patent-pending technology that diverts workloads from the mainframe general purpose processor to specialty engines. This functionality allows companies to reduce costs while getting more capacity, without having to reengineer their existing assets.

#### zIIP and zAAP Exploitation

As described earlier in this report, the zIIP and zAAP Specialty Engines allow companies to get more capacity out of their System z mainframes without incurring additional charges. However, even with the specialty engines, there are still limits to what mainframe work can be moved off the general purpose processor, capping the benefit. DataDirect Shadow removes the limitations surrounding the zIIP specialty engine and allows a wider variety of mainframe target systems and integration methods to take advantage of the no-charge processing.

Of particular relevance to mainframe-centric organizations is the ability offered by Shadow to divert SOA-related workloads (those involving SOAP or XML parsing) associated with transforming mainframe business logic or screens applications from CICS, IMS/TM, IDMS, or Natural. Shadow offers a broad range of data queries that can run in the zIIP—beyond DB2—to include Adabas, IMS/DB, and VSAM.

DataDirect's Shadow utilizes a patent-pending model that works around the mainframe thread limitations (described in an earlier section). By creating hybrid threads that combine TCBs and SRBs, it allows the sending of a wide range of SOA and data-related integration processing to run on the zIIP. For the zAAP Specialty Engine, Shadow utilizes a Java Virtual Machine, located within its server component, to run BPEL and other Java workloads on the mainframe, offloading the processing to the cheaper processing of the specialty engine.

The end result is that, with Shadow, significantly more work on the mainframe is processed in the zIIP or zAAP engines, reducing the total cost of mainframe ownership. DataDirect's Shadow helps a company integrate its mainframe with its distributed infrastructure and therefore move more processing to the mainframe, but also helps the company keep the cost of mainframe processing down.

For many at IBM, DataDirect is helping to renew and expand the opportunities for the System z platform within key verticals that have come to rely on this technology, particularly within SOA, where it is critical that the mainframe not only seamlessly integrate but also do so within a cost structure that is competitive with other technologies.

### The Mainframe as an Industry Standard Server

In the addition to the specialty engine exploitation, DataDirect's Shadow helps integrate the mainframe to a wider distributed infrastructure. Development and administration of Shadow is handled with Shadow Studio, which provides an Eclipse visual environment for working with mainframe data, business logic, and screen environments, allowing organizations to integrate them with other technologies in the company's IT infrastructure. The user who maps the mainframe asset will benefit from knowledge of the transactions (whether it is a DB2 query, a CICS copybook, or green-screen interactions), but the development process is a streamlined point and click interface without the need for coding to build the integration stream.

With the Shadow server in place on the mainframe, it becomes a unified point for any platform to connect to any mainframe asset. An organization's IT can now use modern integration methods such as SQL, Web services, XML, or messaging to communicate with Shadow, and Shadow will handle the back-and-forth with previously difficult to reach mainframe data and applications. Because Shadow intercepts all this external mainframe communication, every interaction is tracked and available for review or troubleshooting via the diagnostics capabilities in the Studio.

In addition, since Shadow is BPEL 2.0 industry standard compliant, it is possible for a company to utilize Shadow to create or orchestrate heterogeneous Web services (both on and off the mainframe) into long-running business process. Shadow provides the flexibility to deploy the BPEL workflow from within the mainframe (using a JVM leveraging the zAAP engine) or to use an industry-standard BPM tool to manage how the newly integrated mainframe and distributed assets support their overall business optimization. With Shadow in place, a mainframe asset can be treated like any other modern service.

## Implementation and Pricing

As previously indicated, Shadow is a middleware software product comprising a distributed component and a mainframe footprint. Implementation times vary for Shadow and are based on IT architectural requirements. DataDirect states that many organizations are able to install, configure, and begin using the product within five business days. For organizations that want assistance with these efforts, DataDirect offers professional services.

The DataDirect Shadow product family has a global installed base within the insurance industry, including the largest Life and Property & Casualty firms. A sampling of customers would include: AIG, Allstate, Berkshire Life, AXA Equitable, Euro-Nederland, Frankenmuth Mutual Insurance, New York Life, Nordea Liv, Norwich Union, Progressive, SAFECO, and Winterthur Life.

Pricing for Shadow is based on deployment and configuration and starts at \$40,000.

## Conclusions

One sure thing in the current market is that insurers—and all companies—are looking for ways to cut costs and to be more efficient. For IT, this may mean attempting to do more with existing hardware, or it might mean replacing inefficient systems with more modern ones that can drive down expenses. In the case of the System z specialty engines, it might be a combination of both.

By adding a zIIP, zAAP, or IFL to an existing System z, an insurer may be able to quickly cut down mainframe processing costs with little effort. For an insurer that already relies heavily on the System z in its infrastructure, some research into the specialty engines is definitely in order. Specialty engines are not guaranteed to reduce mainframe costs, but a host of vendor solutions in the marketplace exist to help companies determine what course is best for their bottom line.

Any insurer using the System z should ask the following questions:

- Has mainframe utilization been capped because of processing costs?
- Does the organization want to move more onto the mainframe?
- Does the organization want the mainframe to play a larger role in the distributed infrastructure?
- Have any new applications been placed on a distributed server because the mainframe solution appeared too costly?

The second report on the System z will spend more time evaluating the mainframe's role in an insurance organization. It will look at total cost of ownership and try to help insurers decide if they should be using their mainframes more or less, and whether modern SOA technologies make the System z a smart place to anchor a distributed, web-based environment. For now, it's clear that a smart insurer can be looking to make more efficient use of its existing mainframe investment.

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