

# Insight and outlook, Part 11: The resurgence of the mainframe

## Reassess the mainframe as the center of your business management system

Skill Level: Introductory

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In this quarter's *Insight and Outlook*, learn why the mainframe remains a vital part of the IT architectural universe. IBM just introduced its newest mainframe, IBM System z10™ Enterprise Class, with great fanfare. Maybe you're thinking the mainframe is yesterday's hardware platform—that the days of big iron are behind us. Well, think again: IBM's promotional materials claim that "the future runs on System z™," and the market for IBM mainframes has expanded over the past two years.

### Introduction: Rescued from the back of the closet

The views expressed by author Paul Dreyfus are his own. He does not speak on behalf of IBM, the IBM System z team, or the IBM developerWorks Web site, and any resemblance to the official positions of the IBM company and the developerWorks team or System z and the mainframe are coincidental. Please address comments and questions directly to him at [pdreyfus@us.ibm.com](mailto:pdreyfus@us.ibm.com).

Fact: IBM has seen growth in its System z mainframe business for six of the last nine quarters, according to [IBM quarterly earnings statements](#).

A curious, possibly surprising development, eh? Midsize UNIX® boxes, grid computing schemes, and server farms made up of dozens of smaller systems seem to dominate today's IT infrastructure. On the software side, we hear about

lightweight scripting, high-level languages, distributed application architectures such as Web services and Service-Oriented Architecture (SOA), and so on. It seems a foregone conclusion that the days of CICS® programming and big iron are soon to be far behind us, right?

Wrong. Think about it for a second: Maybe you have a mainframe sitting in the back of the server closet, reliably crunching data. Or an application you've built for lighter weight hardware has relied on another application that sits on a mainframe. Or you've written an application to help expose mainframe data using the Web. You knew the mainframe was there, but you didn't talk a lot about it in this age of smaller servers, distributed applications, and lightweight programming languages.

Also, you may not have read as much about the mainframe while the Internet bubbled and burst. SOA, Web 2.0, and other modern trends caught your attention. Yet the mainframe has never gone away. Now, the market says it is again a relevant set of hardware and software technologies. And the mainframe is catching the industry's attention in ways that it has not since the advent of the first IBM System/360™, so named because it was supposed to serve the full circle of any IT client's needs.

IBM clearly still believes in its flagship hardware product, having just launched System z10 Enterprise Class, the highest capacity System z yet. And the company didn't just quietly slip this new mainframe out the door. IBM Systems group is striding confidently into the mainframe market behind the slogan, "[The Future Runs on System z.](#)"

Industry research suggests there is a foundation behind the IBM numbers. Earlier this year, BMC Software surveyed 1,000 mainframe customers worldwide. According to the September 2007 issue of [Enterprise Networks and Servers](#), more than half the respondents expect mainframe MIPS consumption to increase over the near and long term. The study is also cited in the September 2007 issue of [eChannelline](#), where it was reported that 90 percent of respondents took a positive outlook on the long-term health of the mainframe as a viable platform for new and existing applications. And in January 2007, the [Butler Group](#) predicted IBM mainframe growth in emerging markets, such as China, India, and South America, as well as in more traditional existing markets.

We asked our panelists to comment on the question, "To what do you attribute the resurgence of mainframe technology?" Let's look at what they had to say. Because we're focusing on matters of infrastructure architecture (that is, hardware), you'll hear a couple of different voices this time. After their comments, I'll complete our coverage with a few observations of my own and a roundup of resources that can help you understand why the mainframe could be relevant to you.

## Their ability to evolve and adapt



**Jorge Diaz**  
Solution architect

For the last 40 years, mainframes have served as the

cornerstone of most large IT efforts across the globe. They host most of the world's business data and run most of its core transactions. Various technology fads have come and gone, but the mainframe remains. It is one of the few strategic investments that has proven its worth to business many times over. Let us remember that the industries that are basing their core systems on the mainframe are not doing so because of their pure love of technology. They are doing so mainly because the mainframe enables a very flexible business platform with extremely efficient levels of resource allocation, high availability, scalability, and security.

Lately, SOA has become a popular architectural style for satisfying business requirements. The mainframe is nicely positioned to take advantage of this paradigm shift. Looking at the way that programs have been designed for decades within the mainframe realms, one can see that the business-driven approach used to externalize transactions fits the service-driven decomposition encouraged by an SOA. The shift allows for the reuse of a large percentage of key business logic, frequently without the need of costly re-engineering.

The mainframe throughout the years has been developed with backward compatibility in mind, which means that there are programs (and there are a lot of them!) written decades ago that can still be executed today. There is a good chance those programs might be able to be SOA-enabled with ease. This ability to enable old programs with SOA can facilitate the construction of complex SOA interactions, which may take other platforms years to achieve. For example, one of the reasons the service registry market has not taken off as some of the early thinkers thought it would is because most companies do not yet have the sheer number of services that would make registries a necessity. Enabling a potentially large number of mainframe-based services could change this.

SOA brings its own set of opportunities to the mainframe. The distributed nature of most SOA efforts may challenge the very protective, almost distrustful view of anything that's not a mainframe interacting with precious mainframe resources. Furthermore, software that is foreign to typical mainframe shops (maybe from a smaller niche vendor) may need to be accepted as part of a point-in-time SOA solution. Using software like that may be a difficult choice if stability is one of the

driving nonfunctional requirements, as it typically is in the mainframe domain.

Having said that, I think that the mainframe world has shown in the last decade an openness to evolving and adapting. Think of its use of Linux®, its support of Web standards, its addition of Java™ coprocessors, and so on. This openness positions the mainframe in a very positive light. Both the mainframe and modern- software architecture worlds will remain relevant in years to come. Both worlds will embrace SOA. It is through this cross-pollination of approaches that an emerging enterprise SOA environment can thrive.

The role of the mainframe in today's modern IT system is as central as ever.

## An ideal business platform for hosting multiple, disparate software solutions



Lots of analysts and others, who should know better,

**Jim Rhyne,**  
Distinguished  
Engineer

neglected the impact of software investments in defining the possible courses of action for an IT organization. We've seen tremendous growth in the use of nonmainframe systems to deal with new applications. We've also seen a few attempts to replace mainframes. Most of these attempts have failed because of cost and risks associated with replacing the software. The nonmainframe systems were not designed to support the existing software workloads, and the businesses could not be changed overnight to reflect the kind of compute-intensive workloads these systems could support. Moreover, as the pace of online business accelerated, the mainframe benefited because it was already handling the core business functions behind the new Internet-based front end. It did not take long for pundits to realize that they had overlooked these factors.

It will be very difficult to predict the future of the mainframe, because IBM can make it do whatever the market requires. In addition to the mainframe, IBM also makes and sells other forms of computing hardware and technology, allowing it to spread its technology costs across many platforms and to take quick advantage of shifts in technology and software deployment trends.

If you look at the role of the mainframe today, you'll see that it hosts the software that supports core business functions, including holding the databases of record for large enterprises. I expect that will continue. I look at software portfolio as an indicator of health for this role of the mainframe, and the software portfolio statistics are quite good. There is healthy growth in database size and database middleware currency, and there is healthy growth in traditional middleware hosted-application size and in traditional middleware currency.

I also expect the mainframe to capture some other applications in large enterprises. Recent hardware and software enhancements to the mainframe have created a new role for it as aggregator of other systems. There is new cost analysis showing overall savings in operating cost, floor space, power consumption, and heat dissipation when mainframes replace other systems. With the mainframe in an aggregator role, mainframe software and middleware will become even more integrated than we see today.

In my view, this will result in an application environment where it is easy to "assemble" applications into solutions and to manage the solutions in a common and consistent way—especially when the solutions consist of mixtures of old, mature, and young software. The mainframe becomes a nearly ideal hosting platform for businesses that acquired multiple, disparate software solutions during the great software build-out and buy-out of the 1980s and 1990s, who are now struggling to integrate these solutions.

I also believe that the hardware shift to highly parallel cluster architectures will benefit the mainframe. Our deep experience with virtualization and load balancing will give IBM an efficiency advantage over less robust architectures and will be a critical advantage in an era when silicon and system assembly costs are the same for everyone.

I would be remiss if I did not mention the advantages offered by the mainframe in scalability, resilience, recoverability, and security. Of these, security is becoming more critical every day. As we have seen, distributed security is very hard to achieve. Consequently, IT organizations are tending to centralize operations. This trend benefits the mainframe.

## Mainframe programmers: Don't leave your day jobs



**Calvin Lawrence**  
Certified Executive  
IT Architect

Quite often, today's IT practitioners conclude that

succeeding at our jobs is merely a matter of providing technical solutions to functional IT problems. Our predecessors took a different approach. For them, IT excellence was rarely achieved by solving functional problems. They achieved it instead by satisfying nonfunctional requirements that enabled functional systems to run faster, more efficiently, and more reliably—and most importantly, in a way that would solve business problems.

The latter is why the mainframe will continue to be the deployment model for business applications and the core system for many of the world's largest companies. Quite simply, whether Jimmy can withdraw \$50 from his ATM machine is of little significance. My 13-year-old daughter could build a rudimentary application to provide this functionality and run it on her \$300 laptop. Instead, whether Jimmy can withdraw \$50 securely, reliably, and quickly is the more important—and more difficult—IT business problem to solve.

The mainframe excels at solving problems like that. Mission-critical and business-based applications have lived on the mainframe for years, but not because they couldn't provide functionality on less powerful and less costly distributed boxes. Why, then? It's simple: the mainframe is the most mature, reliable, robust, secure, efficient, and performance-oriented platform in the industry. Oh, did I mention that it's the most mature? Yes, of course I did. There is no doubt that, for total cost of ownership, the mainframe is the most cost-effective way of processing transactions. Because the mainframe is a proven environment for meeting the nonfunctional requirements mentioned earlier, transferring mission-critical applications and data off of the mainframe is not an option for most business-focused IT leaders.

So, the question is not how we transfer solutions off of the mainframe, but better, how do we take advantage of the critical nonfunctional requirements built in the mainframe to transform legacy application-based mainframes into systems using SOA?

Transforming legacy environments using SOA helps to solve some of the age-old mainframe pain points:

- Slow time-to-market because of complex and poorly understood code. This may prevent the system from satisfying the evolving business requirements, because simple changes take too long to complete and test. Changes tend to cause significant ripple effects and require more regression testing. This in turn increases maintenance and evolution costs.
- Monolithic architecture with little or no modularity, along with redundant code. These two issues are usually related to extensive patches and modifications as well as duplicate or similar functionality implemented in different systems by separate teams.
- Closed and outdated technology that is difficult to integrate with new, open technologies and modern distributed architectures.

SOA solves these pain points by helping in the discovery and identification of useful processes and tasks and exposing them as services. Those services can later be used by collaborating applications that can consume other services. But more powerfully, these new services can be consumed by applications and other services that run on servers outside of the mainframe environment.

Simply, SOA makes the mainframe even more powerful. Many practitioners believe that legacy applications running on the mainframe are well suited for exposure as part of an SOA environment that includes modern-day distributed applications. The earlier applications were designed from a business function perspective—add a customer, order a product, debit an account. With the advent of technologies like Web 2.0 and Web services, these business functions can be exposed to a wider audience of potential users. SOA provides the ability for the mainframe to offer new capabilities that solve a new set of business problems. SOA also provides the ability to offer older functionality to a more diverse and expanded consumer community.

Mainframe programmers and administrators: Don't leave your day jobs. You'll continue to be a valued asset, because the role of the mainframe in today's modern IT system is as central and crucial as ever.

## Scalability to play with the big guys



**Florence Hudson,**  
Vice President  
System z  
Marketing & Strategy

The power and cooling cost of the mainframe can be

one-twelfth that of distributed systems. Energy costs are big considerations. Some studies by IDC show that by 2010, power and cooling costs could be nearly the same as the new server-hardware costs. You really have to look at these costs if you choose the distributed version over the mainframe.

[Note: Florence Hudson's comments are excerpted from an interview with her that appeared in the *IBM Systems Mainframe Edition* magazine. To see the complete text of her remarks—and other expert commentators on the mainframe—please [read the interview.](#)]

The mainframe brings value in other ways, such as consolidation and virtualization, which are big trends in the market. The mainframe is also a highly secure server for a logically partitioned environment. When you do put these virtualized servers onto one system, you know that it's highly secure. If companies are trying to collaborate with their business partners and their clients, a lot more people have access to the systems. They're not closed boxes anymore. People see the opportunity of consolidation and virtualization as a way to save costs, get the most secure server platform they can get, and have very high levels of scalability.

Large companies are consolidating to the mainframe. Nationwide, the insurance and financial services company, is consolidating hundreds of servers to Linux on the mainframe. The company projects saving \$15 million over three years. We have new companies that are seeing the value of the scalability, the security, and the potentially lower costs of the mainframe. A company called Nexxar Financial Group, consolidated x86 Intel™ servers to the System z platform and saved about 75 percent of its people cost in managing its information technology.

Hoplon Infotainment is a gaming company that runs a massive multiuser online gaming experience using a mainframe and Linux. Linux on the mainframe was wonderful for the company's IT team, since it was able to continue to code in the Linux environment it understood. The company also gets high levels of security. As the company says, gamers are pretty good hackers. The company has to maintain the gaming environment and not let anyone get into the administrative system. The

company also uses the capacity on-demand features, where you can pay for performance that you need, when you need it. There are so many people that are seeing the value that the mainframe offers. It allows you to scale to play with the big guys.

## Questions of proliferation, reliability, and cost



**Don Dejewski,**  
Executive Software  
IT Architect

I have been around the mainframe for some time. I have

seen the pendulum swing back and forth. In the early days the mainframe was king. Then in the client-server days it was a dinosaur. Then we started hearing that "big iron" wasn't dead yet. So in my opinion, now's the time for a mainframe comeback.

Why is now the time? There are many reasons why I think it is time to revisit mainframe technology. Ask yourself some questions about three key issues:

**Proliferation of distributed systems.** Another way to look at this is "server sprawl." How many servers do you have in your organization? What is their function: database server? application server? HTTP server? Other? How effective is their utilization? Twenty percent, maybe? Did you expect to have as many servers as you do today five years ago? How many servers do you expect to have five years from today?

**Reliability.** How often are your servers down? How often do you have to bring them down to apply maintenance?

**Acquisition and ongoing costs.** Was the initial cost of your distributed servers fairly reasonable? How many did you have to buy? Do you have a set of servers for each application? How much does it cost now? Had you considered the costs of heating, cooling, electricity, floor space, and staffing once you made your initial purchase?

Here's how the mainframe addresses these issues:

**Proliferation (and virtualization).** There is no need to proliferate mainframes. The System z has the ability to run multiple mixed workloads all at the same time. It even has the ability to virtualize your environment so you can run development, testing, and production all on virtualized resources.

**Reliability (and availability).** System z mean time before failure (MTBF) is measured in decades. Every processor has a duplicate just waiting to take over, just in case. Maintenance can be applied without the need to take the system down.

**Cost (and efficiency).** Acquisition cost is not the same as total cost of ownership. Although the initial cost of acquiring distributed servers may be less than the cost of a mainframe, it will cost you more in the long run to maintain them. Here are some things to keep in mind while you think about the third issue raised here (that is, cost):

- Mainframe labor costs hold steady as workload grows.
- IBM pricing policies are designed to favor the addition of more workload.
- IBM provides special hardware pricing for new workload types that allows for additional new workload without your having to pay additional monthly license fees.
- The mainframe has lower software costs per transaction as workload grows.
- The mainframe has lower electrical and air-conditioning consumption than server farms.

Let's not forget that in the Internet age, we are not just handling static Web pages. We are handling robust, transaction-oriented applications. The applications need to perform well in a secure environment. This is the sweet spot for the mainframe.

In summary, it is my opinion that organizations should revisit the mainframe, or visit it for the first time. The mainframe has changed. It's not your grandfather's mainframe anymore. Let us not forget that it runs Linux now, too. It is a robust platform that can handle today's technologies and applications and reduce your organization's overall costs. What better platform to choose as IT moves forward in the 21st century?

## Standing at the intersection of IT trends

Our experts paint an intriguing picture. How can one not be interested to find that one of the dinosaurs of the industry walks among us? Let's look at a few trends and facts about the mainframe that flesh out this picture.

### Longevity pays

First, in many ways it seems almost inevitable that a computer like the mainframe should have this kind of longevity and be less subject to the evolutionary whims of the IT world. Doesn't every hardware platform strive—at least in some ways—to become a mainframe? How many times have people joked about pocket-sized mainframes (or even supercomputers)? Other computers tend to be optimized for single users (after all, aren't they "personal?"), or narrow sets of purposes. Yet the mainframe is optimized for multiple users and purposes, all working at the same time. Who in the world of IT would not want that set of capabilities?

Of course those capabilities come at a cost. The mainframe is not cheap to purchase, deploy, administer, and maintain over time. But in the end, mainframe shops experience overall economy. Because the mainframe makes efficient use of its processing capacity and enables centralized, and therefore simplified, management, the overall investment in mainframe computing power can end up being less than an investment in the same power delivered by a server farm of less expensive systems. In the past, making that investment might have seemed impossible. Now, a number of intersecting IT trends are making it seem impossible not to at least consider the investment. These trends are the following:

- Increasing size and complexity of modern "applications," many of which process and combine large amounts of data. I put the word applications in quotation marks for a reason. What we think of as applications are now sets of smaller applications or services, each of which is an independently functioning set of code. These services communicate with one other and act in concert so the user appears to see one unified "application" that actually ties together a variety of code sets. Many of those services involve processing large amounts of data, combining different sources of data into a single result, and doing it all quickly.
- High demands of modern technology users necessitating application and data availability and reliability. Today's computer users rely on the just mentioned applications to be available all the time so they can access business or personal data. Once upon a time, that kind of high availability and reliability were required only by mission-critical corporate applications. Now, the Internet-using public has come to expect the same characteristics of its online experience.
- Network-based (in particular, Web-based) access to application services and data. Computer users increasingly reach way beyond their desktops to accomplish computing tasks, whether those tasks are related to their business or personal lives. As I write this column, I use a word processing application that sits on my computer, but I also use one Web-based application to ask a question, another to look up a word, a third to learn the publication schedule for this article, another to check the names and titles of the expert commentators, and still another to check my fantasy basketball team and take out an injured player. (A vital part of any writer's

workload is high-quality, random distractions that have nothing to do with the subject at hand.)

- Security needs. Data and services are widely available over the Web; therefore, data and services must be protected from those who would steal or corrupt it. Never has there been a greater need for appropriate security schemes for online resources.
- Skyrocketing energy costs. I once had the opportunity in the 1990s to visit the network operations center for a major online services provider. I was absolutely stunned: Hundreds of servers occupying warehouse-sized rooms. A weather-predicting station manned by meteorologists to anticipate power outages. A room of batteries for back-up power and three large generators for back-up back-up power. The protective berm outside the building that could prevent a tank from penetrating the building. These were the heady 90s when Internet stocks were expensive and power was cheap. Fast-forward a decade and the situation has changed dramatically. The cost of energy means that server farms could price their owners out of existence. Analysts across the industry find that energy costs are one of the major problems facing IT. Some suggest that the cost of energy will become significantly higher than the cost of hardware and software over the life of the solution.

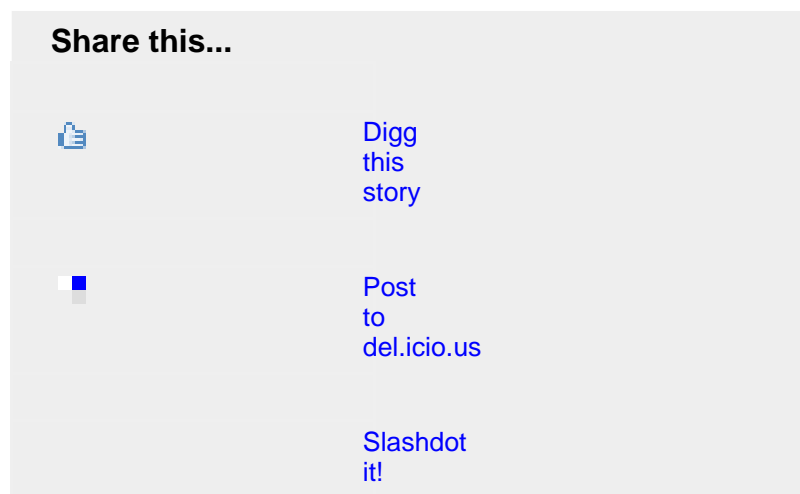
## Design and serendipity

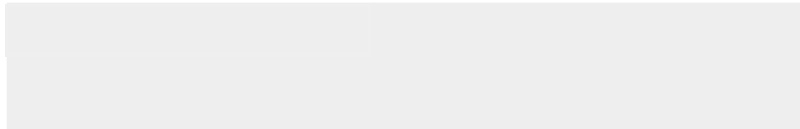
Some might claim that today's mainframe—with a proven decades-long track record plus modern features and technologies—is *designed* to meet these needs. Instead, it is probably more to the point to say that the emergence of these needs creates a serendipitous situation for IT vendors like IBM, where the needs of the market can again be met by mainframe technologies. Some of the vital mainframe features include the following:

- Modern application architecture runtime. The mainframe provides a powerful runtime for complex applications, including significant parts of an SOA-based system. Additionally, z/OS® provides a variety of advantages for running Java-based application code, which often provides the guts of an SOA service. For more about the mainframe as a runtime environment for SOA, see ["Make SOA happen on z/OS"](#). For details about writing Java applications for and running them on the mainframe, see ["z/OS concepts for Java developers."](#)
- Linux runs on System z. This may not directly address any of the issues mentioned above. But if you are used to Linux programming and looking for a powerful runtime for your applications, isn't it nice to know you get that with the mainframe? Read more in ["Mainframe New Realities: Linux Delivery that Weds the Best of Both Worlds."](#)

- **Virtualization.** IBM implemented virtualization on an IBM mainframe system 40 years ago and has continued to develop mainframe virtualization technologies. This may sound like a brag, considering its source (OK, it is), but it is also true. Today's mainframe enables you to consolidate functionality from a large number of individual small machines on one larger server, easing manageability and more efficiently using system resources. Incidentally, mainframes typically run at close to 100 percent processor utilization when virtualization is implemented correctly, which means you do not pay for processing capacity that you do not use. For more about mainframe virtualization, see the [Mainframe Virtualization page](#).
- **Data serving and security.** The mainframe is one of the original secure data-crunching computer systems. Its power and reliability for storing, processing, and serving data over a network—whether to an end-user or another computing system—is just another modern mainframe feature, as is the mainframe's security architecture. Read more about mainframe data capabilities and security at the IBM mainframe [Data serving](#) and [Security](#) Web pages.
- **Energy efficiency.** In what can be considered an irony of modern computing, it is only a partial stretch to call System z a "green machine." For example, a Robert Frances Group study analyzed consolidation of hundreds of UNIX servers to one System z mainframe. The calculations showed monthly power costs of \$30,165 for the UNIX servers compared to \$905 for System z. For more on that study and the latest on "green z," see the [Mainframe Energy Efficiency](#) Web page. For a comprehensive collection of mainframe energy efficiency information from across the industry, see the developerWorks [mainframe space](#).

## Conclusion: It's back





This is not a complete list of mainframe attributes, and I will not belabor the point to the extent that this sounds like a long-winded advertisement. I think what's been written gives you the picture: Our experts said it. The market shows it. And the facts behind the IBM System z mainframe computing platform provide the reasons why the mainframe is back.

## About the experts

### **Jorge Diaz**

Jorge Diaz is a solution architect with IBM Software Services for WebSphere®. He focuses on delivering strategic and tactical architectures in the areas of middleware and distributed systems integration, working throughout the Americas and Europe. Jorge works closely with large customers, helping them to adopt SOA using a variety of technologies, including Web services.

### **Jim Rhyne**

Jim Rhyne is an IBM Distinguished Engineer. As an enterprise software platform chief architect at the IBM Silicon Valley Lab, Jim focuses on modernization of legacy applications, connectivity for legacy applications, and development, deployment, and testing of mixed J2EE and legacy applications.

### **Calvin Lawrence**

Calvin Lawrence is an executive architect on the IBM Software Group emerging technology team. His responsibilities include advancing strategic IBM architectures, technologies, and products in support of key strategic initiatives and ensuring the success of customer implementations using IBM technologies. He is former Chair of IBM Software Group Worldwide Technical Leadership Council.

### **Florence Hudson**

Florence Hudson is the Vice President of Marketing and Strategy for System z mainframes globally for IBM. Since joining IBM in 1981 as a sales representative, Florence has held a variety of leadership positions in sales, marketing, development, channels, strategy, and management. Florence graduated from Princeton University with a bachelor of science degree in mechanical and aerospace engineering.

### **Don Dejewski**

Don is an Executive IT Architect for IBM in the New York area. He has focused on IT architecture for the past 10 years, specializing in e-business, WebSphere, Internet, and client-server solutions. He has also been a technical leader in mainframe and client-server projects in banking, financial, media, and distribution industries. He currently serves as a System z architect, assisting accounts employing SOA designs that incorporate System z.

## Resources

- [Participate in the discussion forum for this content.](#)
- Wikipedia includes a good [general introduction to the mainframe](#), describing many of its capabilities.
- [Q & A: Big Iron's Big Resurgence No Accident](#), an *Enterprise Systems Journal* article from a couple of years ago, provides insight from an IBM executive that you might find interesting.
- The Singapore Country Manager for IBM System z offers [his thoughts on this issue](#) in *SDA Asia*, an online publication for the Asian IT manager.
- For specifics on the return you can expect see on an investment in the mainframe platform, see the Wintergreen Research white paper on mainframe ROI.
- developerWorks recently published a series of podcasts on the mainframe called "[Did You Say Mainframe?](#)" In a separate developerWorks podcast "[Massive data mining and the resurgent mainframe](#)," two college professors weigh in on the topic covered here.

## About the author

Paul Dreyfus

Paul Dreyfus is the Web strategist for IBM System z. Previously, he was an editor on the developerWorks staff working on the Service-Oriented Architecture (SOA) and IBM Systems areas of the site. He has previously written and edited technical material for software developers at Apple Computer, Netscape, and IBM Rational software. For comments or questions, you can contact Paul at [pdreyfus@us.ibm.com](mailto:pdreyfus@us.ibm.com).

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