

# Forrester Consulting

MAKING LEADERS SUCCESSFUL EVERY DAY

July 14, 2009

## The Mainframe Opportunity IT Strategies For Achieving Breakthrough Value

A commissioned study conducted by Forrester Consulting on behalf of  
CA

FORRESTER®



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## **Executive Summary**

Forrester conducted interviews with high-level managers and CIOs/CTOs of North American and European companies with revenues of more than \$1 billion to better understand their use of the mainframe, their mainframe strategies, and their perceptions of factors that might impede the expansion of mainframe usage in their own organizations and/or the marketplace at large.

### **Key Findings**

Forrester's study yielded four key findings:

- The mainframe is generally viewed as the most efficient, scalable, and reliable computing platform today. A majority of respondents said that they could not process a typical mainframe workload on any other platform. As the most recent z10 platform provides a very efficient way to rationalize and consolidate their data centers, a majority of mainframe sites have started consolidation programs using Linux on the mainframe.
- All respondents recognized that a mainframe operation requires detailed and specialized knowledge. As the mainframe specialists are aging and as college and university graduates do not typically receive a mainframe education, there is a perceived risk of skill shortages despite education programs sponsored by IBM and CA.
- The risk generated by this shortage is limiting the expansion of the mainframe, with two consequences: 1) it limits the addition of new workloads to the mainframe, and 2) it will result in workloads being taken off the mainframe as the perceived risk is confused with obsolescence.
- In order to address the skill shortage obstacle to mainframe expansion, a solution is needed that includes a single consolidated management stack, operation and deployment through an intuitive modern GUI, and embedded test practices based on the collective experience of experts.

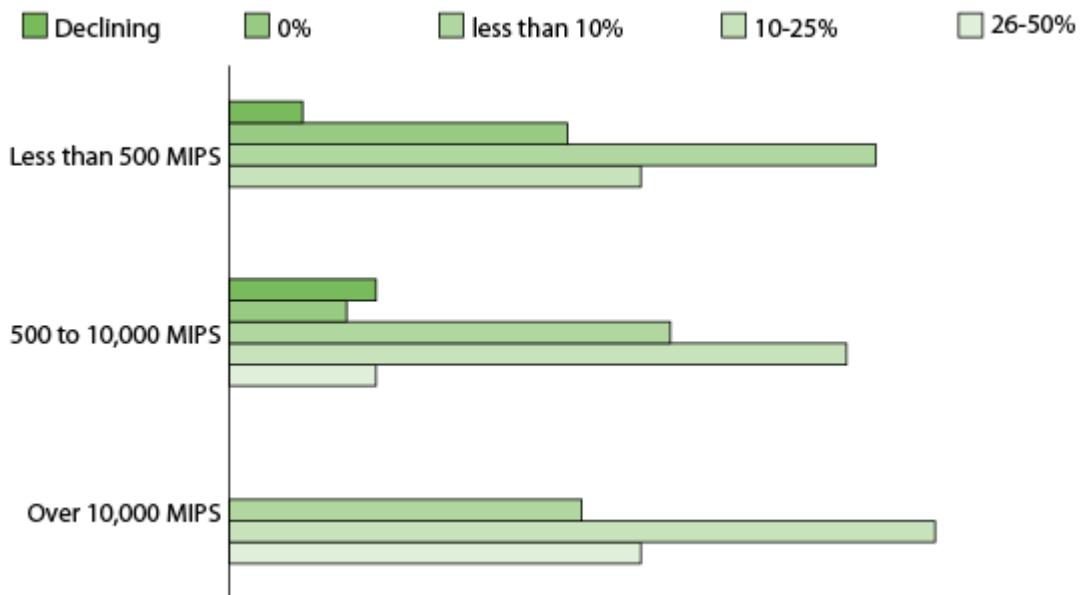
## Why The Mainframe Stands Out From The Crowd

In the early 1990s, Unix and Open Systems hit the market with the promise of greatly reduced hardware costs. The prospect of these lower costs led many people to prematurely believe that the mainframe was dead.

Almost 20 years later, the mainframe is not only still alive but thriving. Market growth since 2003 is reported at a very healthy 20% CAGR per year in MIPS (million instructions per second) in a worldwide installed base of about 15,000 sites.<sup>1</sup> More than 50% of these clients have an installed base of 1,000 MIPS or more, with a heavy concentration in financial services, banking, insurance, and government — about 60% of the installed base.<sup>2</sup>

Mainframe growth is largely dependent on the number of MIPS installed. While a fraction of users in the less than 500 MIPS and the 500 to 10,000 MIPS segments expect a decline in their mainframe activities, larger sites using 10,000 MIPS or more are experiencing a very healthy growth rate, which accounts for most of the overall MIPS growth year over year (see Figure 1).

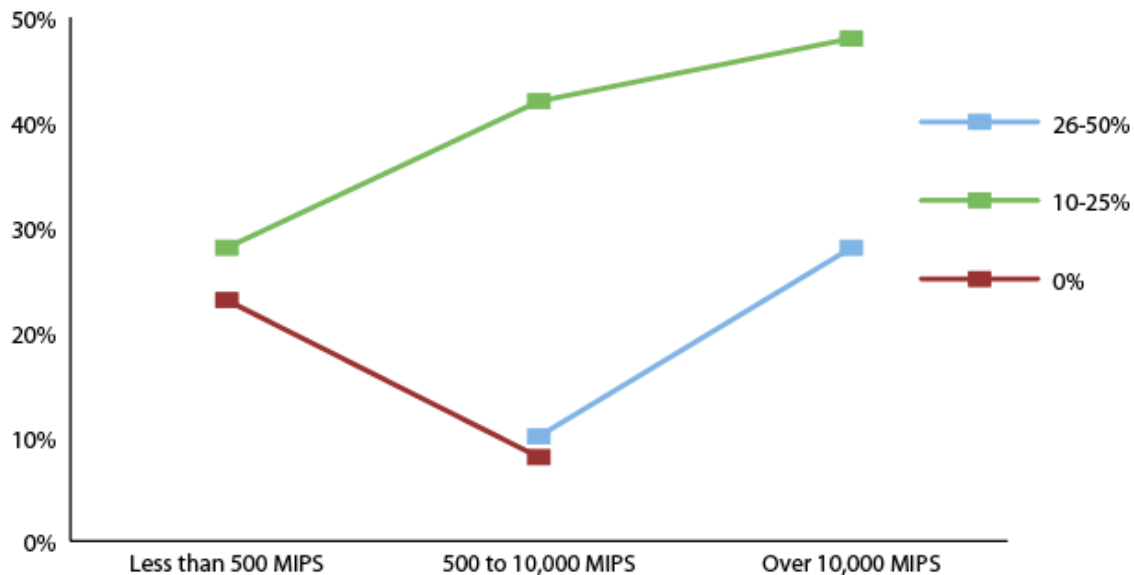
Figure 1: Expected MIPS Growth Rate As A Function Of Installed MIPS



Source: Arcati Mainframe Yearbook 2008

The survey data suggests that the lower range of installed MIPS is more likely to stagnate in terms of MIPS growth, while the larger installations are actually experiencing record growth rates.<sup>3</sup> Figure 2 shows that the stagnating sites (red line) are more likely to be smaller (in the less than 500 MIPS and 500 to 10,000 MIPS range), than the high-growth sites (purple and blue lines)

Figure 2: Decline And Growth Trends As A Function Of Installed MIPS



Source: Forrester Research and Arcati Mainframe Yearbook 2008.

### The Mainframe Advantage

Forrester conducted in-depth interviews with mainframe users and identified the following advantages related to mainframe usage:

- **The mainframe is the most efficient computing platform for medium and large operations for certain workloads.** This is the key point that all respondents identified. There are actual workloads that distributed systems cannot possibly handle. For example, one of the users interviewed — a biotech company — has about 50 petabytes of data that it has to manipulate for simulations and other data- and computing-intensive operations.<sup>4</sup> Such a workload is impossible to process on distributed systems. Other respondents cited the mainframe's reliability and scalability when it comes to online transaction processing. The number of transactions per second that a mainframe can handle is far superior to any available multi-tier platform and at a fraction of the complexity and operational costs of multi-tier clustered systems. However, some of the users interviewed cited the high cost of software licenses on the mainframe as an obstacle to its expansion. However, as most software solutions are priced per processor, we should consider that a z10 BC (Business Class), at the low end of the IBM mainframe lineup, can actually perform 10 times the amount of work that an Intel Xeon or Itanium processor could process and yet cost the same in software license fees. A z10 BC starts at \$92,000, which represents a 50% increase in performance and a 50% decrease in price, and yet it could be used to consolidate hundreds of Linux-based systems.<sup>5</sup> A majority of the interviewees for this paper believe that they could never achieve the same level of performance with distributed systems.
- **The mainframe is the "ultimate virtualization resource".** The System z virtualization stack can give complete workload isolation while still providing all of the high-speed inter-server connectivity. System z10 Enterprise Class can scale up to 64 applications processors. It is a massive consolidation platform capable of up to 60 logical partitions and the addition of thousands of virtual servers under the direction of z/VM technology. Known

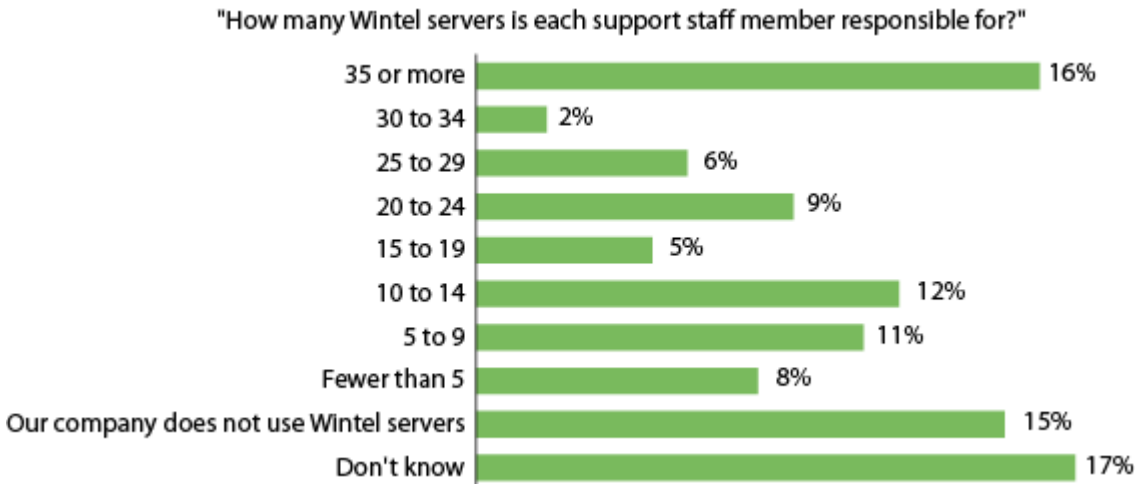
for its high levels of capacity utilization — 90% to 120% without degradation — its virtualization stack can create a much lower life-cycle cost outcome. If virtualized environments are being deployed across a distributed x86 environment, sustained capacity utilization rates much above 25% are rare. The result is not only wasted idle CPU cycles but still costly power and cooling for idle servers. System z has numerous management tools for the intelligent and autonomic management of a diverse set of application workloads. One of the repeated benefits cited is easier systems management through a single point of control for administration and operations.<sup>6</sup>

- **The mainframe usage and market is actually expanding.** The z10 models that IBM announced in 2008 — EC: Enterprise Class and BC: Business Class — represent a giant step forward in terms of processing power (170% of the maximum capacity of the previous z9 model). Even at the lower end of the scale, the z10 BC offers up to 10 specialty engines, of which five can be used for traditional workload and five to support Linux. (As an alternative, all 10 engines could be used to support Linux.) These five Linux engines can be used to consolidate up to 134 Solaris servers. If we take the average ratio of Unix servers per administrator to be about 15, the economy of scale may prove substantial.<sup>7</sup>
- **The cost/availability/performance of the mainframe is far better than the equivalent ratios for distributed systems for certain workloads.** According to some users interviewed by Forrester Consulting, one key element that actually limits mainframe expansion in some data centers is the fear of change and the perception from higher levels of management that the mainframe is an obsolete platform and is inherently complex to operate. This perception, however, is very dependent on the size and, therefore, the importance of the mainframe in the enterprise: The mainframe itself presents a 50% operational cost advantage at 5,000 installed MIPS, which grows to 70% at 25,000 MIPS over the equivalent processing power coming from distributed systems.<sup>8</sup> All respondents that Forrester Consulting interviewed agreed that mainframe availability is without equal in the distributed world and that no other platform can achieve such results: “5X9s” — i.e., availability of 99.999% — is a typical service-level agreement for mainframes, while 99% CPU usage is also the norm.
- **The mainframe embodies the cloud concept.** Because of its versatility in terms of workload, the mainframe is an ideal solution for consolidation. Legacy applications can of course be deployed on mainframes, but they can coexist on the platform with consolidated Unix applications using Linux-based specialty engines. In fact, among the mainframes deployed, 48% effectively participate in Web services deployment, 41% run Java applications (with 15% more planning to use it), and 31% run Linux on the mainframe (with 11% planning to do so). This consolidation and versatility also affect the carbon footprint of the data center. At a time when the power and cooling of data centers is starting to emerge as a strong obstacle to the unlimited expansion of IT in many enterprises, the centralized and efficient mainframe solution appears to be an alternative to the internal cloud systems that are starting to appear on the market, such as Cisco UCS and HP BladeMatrix.
- **Security is an added benefit of the mainframe.** The CIO of an insurance company stated that:

*“All open systems have their own vulnerabilities. We are constantly dealing with thousands and thousands of vulnerabilities — and identifying them. If we can pull into a single operating environment, we can minimize the effort to keep track of and address security risks. You don’t hear about people breaking into mainframes, but there are still security concerns we deal with. But the more everything is bundled into a suite with shared security rules, the greater the benefit.”*

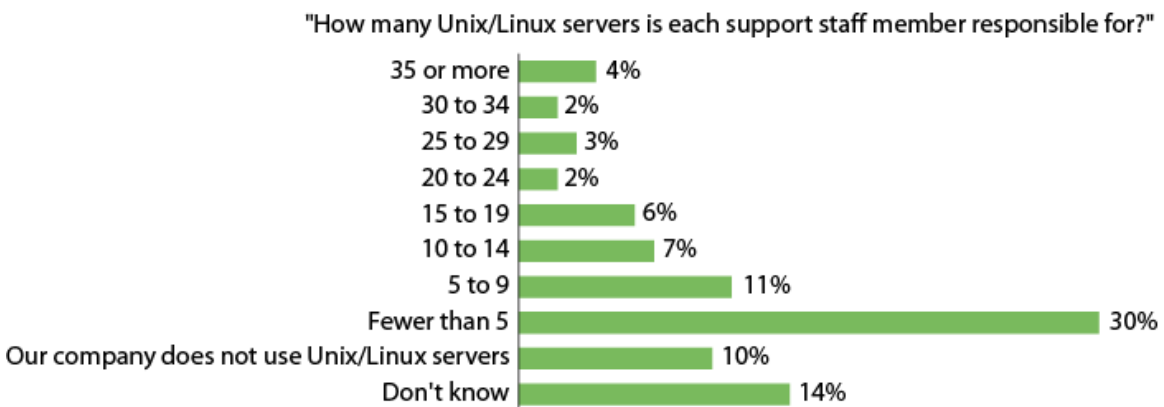
- **The mainframe’s centralized management is an advantage.** The high degree of automation in mainframe administration means that one person can sometimes administer several systems. In the case of server virtualization on mainframe Linux, it really means that one person can administer hundreds and sometimes thousands of virtual servers. This compares very favorably with either Windows or Unix servers (see Figure 3 and see Figure 4).

Figure 3: Server Support Ratio For Wintel Servers



Source: Forrester Research, Inc.

Figure 4: Server Support Ratio For Unix/Linux Servers



Source: Forrester Research, Inc.

The mainframe is the ultimate workhorse of the data center: The hypervisor-based z/VM provides a highly flexible test and production environment for enterprises deploying a wide range of application types — from high-workload transactional and data-intensive applications to server consolidation. z/VM’s “software-derived” hypervisor is integrated with the hardware, so it can carve up CPU, memory, and I/O to share equally, and z/VM can also virtualize everything else due to the “shared everything” nature of a mainframe. This creates a virtual network (virtual switches/routers), virtual

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I/O (mini-disks, virtual cache), as well as virtual appliances. Forrester clients tend to all weigh in with the same common set of benefits from using z/VM for Linux infrastructure optimization. The most obvious benefit is being able to run hundreds or (in some cases) thousands of virtual Linux servers on a single mainframe, easily maintained and deployed without adding the costs associated with any new server footprints. Even at their highest possible score of 35 servers per support person, Unix-x/Linux and Wintel servers cannot approach the administration efficiency of the mainframe.

## Mainframe Users' Strategies

Mainframe users interviewed for this study have adopted the following strategies:

- Large users are relying on the mainframe to support critical applications that require massive amounts of processing power. Distributed systems would be unable to achieve this at a competitive price point.
- Some users have found that consolidating Linux workloads onto the mainframe offers cost reduction in terms of both administrators and power and cooling efficiency.
- Even though the reality is that they may be better off keeping their legacy applications on the mainframe, some users perceive themselves as being "stuck" with those applications because they lack the expertise to move them off the platform and/or because the cost of doing so is prohibitive.

Mainframe users with a high growth ratio are very dependent on their mainframe operation. An IT operations manager at a large insurance company told us:

*"Most of our mainframe development efforts are behind us in terms of large-scale new projects, and we are now consolidating. We are running a very large z10 architecture system — more than 25,000 MIPS. Most of our processing is dependent on the mainframe. We have front-end systems — thick client, Web application on J2EE, and some portions on .NET. We are moving to zLinux. We are currently heavily into regular Linux. We have a long-term commitment to z/OS: You can't just rewrite all that. We are aiming toward the Web, which is a huge part of the business: We are moving technology in that direction with SOA wrappers. We have upgraded the mainframe systems to be more up to date and more powerful. We are now heavily into DB2, which allows us to talk better with front-end Web applications; our core systems are entrenched in mainframe, which is why we have a long-term commitment. Our server farms continue to grow like mushrooms after a spring rain. We have a large virtualization program and have done a lot on Microsoft; we are now working on Linux. This impacts power and floor space."*

On the other hand, users experiencing slow growth are more concerned about the continuity of legacy applications, as this IT manager from a large Telco told us:

*"Although the mainframe is a more reliable platform than distributed systems, we do not believe that this could not be done by distributed open systems. We have a large number of legacy applications that we cannot move today, and we have been stable in our mainframe usage, with limited evolution due to the organic growth of the business but with a very stable application base. We do not create any new mainframe applications."*

For some users, the ability to do capacity on demand as well as the ability to consolidate distributed servers is key to their mainframe strategy. An IT operations manager from a large defense contractor said:

*"The mainframe is the most efficient system for transactional applications. We can turn on the capacity as desired, and no other solution offers that kind of scalability. This is the reason why we have consolidated many distributed platforms on the mainframe. It*

*is easier to manage and provides a level of reliability and scalability that cannot be replicated by another platform.”*

An IT operations manager from a government agency said:

*“I don’t see our number of z/OS images growing, but I see the number of zLinux images growing. We are consolidating little boxes into a mainframe area where we don’t have to worry about hundreds of boxes and hundreds of power strips and a large support staff.”*

*“We are trying to pull the server farms back into the mainframe. It used to be on the mainframe. Then ownership of the box became a concept and grew. That has implications for power, people, and physical space. We looked at the IBM pitch about getting rid of a server farm and it resonated. Move to 1:20 or 1:25 per box for labor to manage all of this. There are hundreds, possibly thousands, of servers out there. We had better control over a mainframe environment. We didn’t have this control at the server farms.”*

*“Currently, we could pull a large workload onto the mainframe. We purchase our mainframe capacity like a utility. If we need more, we can have it in 30 days. Our ability to expand mainframes in the future is easier than it was 10 years ago. This allows for easier technology refreshes. The two major factors when it comes to dealing with hardware and software are: Can we do it without increasing workforce because that is our highest cost? Can we save money on software? Those are the two predominant questions. That’s what we are trying to achieve — across-the-board savings without losing functionality.”*

## Obstacles To Mainframe Expansion

The obstacles to mainframe expansion identified in this study are:

- **The complexity and diversity of mainframe systems.** Most mainframe solutions use an explicit interface for configuration and deployment. Mainframe management solutions were also often adopted as purely reactive and tactical measures. This results in a diversity of management solutions, each with their own interfaces and operability characteristics. This requires skills and experience that unfortunately do not seem to be taught in most computer science classes.
- **The difficulty of finding skilled and experienced personnel.** There is a scarcity of IT skills across the board. However, because mainframe education is lacking, the issue seems to be more acute than in other IT segments. Many mainframe solutions require detailed and specialized knowledge built over years of experience and will be difficult to replace. This compounds the complexity issue.
- **That mainframe users are unwilling to change in many situations.** The perceived risk of changing products and disrupting the mainframe operation often results in inertia when mainframe evolution and usage expansion is considered. The consequence is that new workloads, for which the mainframe would be the most efficient solution, are often deployed on an alternative platform.

The IT manager of a large telecom company illustrates this last point:

*“Our company uses the mainframe to support old legacy applications that cannot be re-implemented in another platform, but no new applications are being written or moved to the mainframe. It is front-ended by MQ series and 3270 emulations, but basically it does not grow or evolve. We are in a situation where we cannot make any changes to old legacy applications. Although we believe that this is a more reliable platform, the skill scarcity makes us believe that the mainframe is a risk.”*

The CIO of a large biotech company sums it up:

*“Special skills are critical. For us, going offshore is not an option, and while we are still able to attract some talent, education is not where it should be. It is difficult to find able recruits out of college. Management solutions cannot be installed on the mainframe without the required skills in the engineering staff. The college graduates have been educated on rich clients and cheap Intel servers. They do not have the capability to formulate scripts for the mainframe. We have established our own training program: We recruit the brightest students, offer them a university-like lifestyle, and educate them on the mainframe.”*

The CIO of a healthcare organization shares the same view:

*“There is a global shortage of personnel across the IT industry, but the major complaint is that the available people are not educated on mainframes and specifically not educated in system management.”*

This could lead to costly errors and problems, as witnessed by an operations manager in a global financial operation:

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*“A syntax error resulted in resources not being allocated to a pool in Sysplex and a limitation to only eight concurrent sessions. It took a long time for someone to pickup on this anomaly and resulted in a lot of headaches.”*

One of the major issues, if skills are critical and new skills are not available, is the aging population of system engineers and administrators around the mainframe.

The manager of the performance and capacity management group in a large insurance company sums up this issue:

*“The average age of our mainframe staff is 52. This represent almost centuries of accumulated experience in this technology, and that is not going to be replaced easily.”*

*“There have been times over the years when the implementation of a tool caused errors in production implementation. For example, errors in how a given product is set up are not noticed until you’re trying to use it. At that point, it can come back to bite you very hard. There is some redo work that is often needed, and any redo work is expensive.”*

IBM started an academic initiative that includes 480 schools and 29 separate classes in order to improve mainframe understanding in the new generation of college graduates, but this is still years away and may not be sufficient given the deficit of specialized skills in IT operations. CA is also driving a similar initiative.

Automation has been an early asset of mainframe management and has resulted in a spectacular reduction in the number of administrators around a given system. But skills are still needed to implement these solutions. As stated by the operations manager at a defense contractor:

*“Even though we have raised the level of automation to the point that one person can operate a complete environment, we still need specialists to build that level of automation, and it’s not easy.”*

## Requirements For A New Approach In Mainframe Management

An operations manager at a large government agency summarized the major issue in implementing system management on the mainframe:

*“You need a number of products to monitor and automate your operation. Each product has a different interface and requires a perfect understanding of what the product does to what part of the environment to be implemented correctly. The demand on skills is high, and failure to implement correctly may be expensive.”*

The multiplicity and diversity of mainframe management products and the resulting difficulties are exemplified by this quote from a large defense contractor:

*“There is mass confusion coming from mixing vendors together. Most of the time, the administrators know the product name, but not who the product vendor is. They are often unable to identify quickly who to call for support. I would suggest that vendors include their support telephone number on each and every screen of their products.”*

In fact, the mainframe users interviewed promote an approach that would eliminate diversity, enhance integration of the different solutions that are needed to manage the mainframe from A to Z, establish standards in interfaces, and embed best practices to reduce the risk of errors. Implementing a single, intuitive, and modern graphical user interface (GUI) for configuring and operating these solutions would help reduce the dependence on skills that are becoming increasingly scarce in IT operations. This type of solution would:

- **Provide management solutions that require fewer specialized skills to operate.** As stated by the operations manager of a government agency:

*“To date, we have a series of products acquired from various vendors. A common look and feel is lacking. If we could standardize products and add an integrator that gives the same look and feel for all tools, it would make it easier for newer employees to work with mainframes.”*

- **Provide management solutions that are easier to deploy and that reduce the potential for configuration and implementation errors.** Such solutions should be highly automated to require fewer manual interventions making deployment and operation easier.

According to the IT operations manager of a large defense contractor:

*“The issue is dependent on the type of management software. People with the right education will not make a lot of errors, but finding them is an issue. The new kids all want a rich client interface. Vendors should have provided standardized interfaces a long time ago.”*

- **Provide a cost reduction on operation and implementation.** An integrated approach that uses an intuitive GUI for deployment, configuration, and operation and that embeds best practices programmatically in the solutions would save time and resources and reduce the risk of errors.

The same IT operations manager sums it up:

*“A standardized management stack with the right graphical interface would considerably reduce the cost of configuration and deployment by removing the complexity of deployment. It is also a sales incentive. Issues like these have stopped people from replacing old software.”*

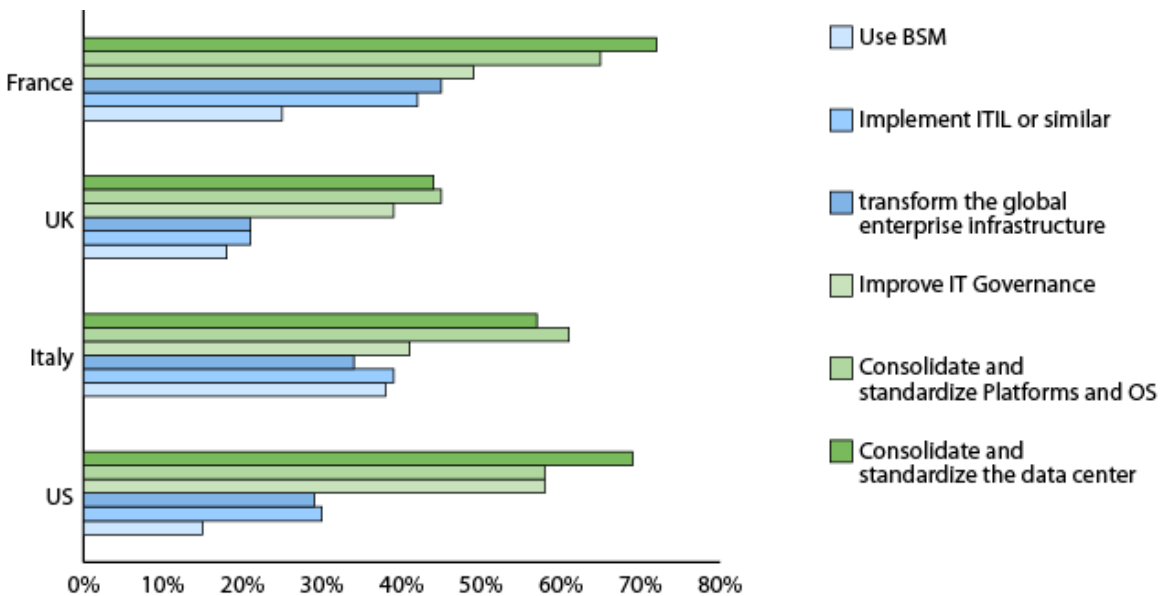
*“Errors are costly — not only because they may prevent the normal operation of software, but also because of the resources they consume in chasing problems and de-installing and re-installing what didn’t work the first time. In some instances, this can happen several times for a given management product.”*

## Reduced Complexity Leads To Expansion

All the users interviewed for this report agree that the mainframe is a robust platform that is eminently reliable and provides an unsurpassed ability to handle the largest and most difficult workloads.

Because of its ability to combine legacy workloads with a Linux environment, the mainframe is also the only platform that provides users with the ability to actually consolidate all types of Intel-based distributed systems through virtualization and all types of Unix workloads through Linux migration. This offers the ability to standardize the data center environment on a single platform, which should lead to considerable benefits in reduced personnel resources. Standardizing and consolidating platforms and operating systems and consolidating data centers is one of the first measures taken by enterprises looking for IT cost reductions (see Figure 5).

Figure 5: Strategies To Reduce IT Costs



Base, 124 US and European IT Executives

Source: Accenture Survey 2006

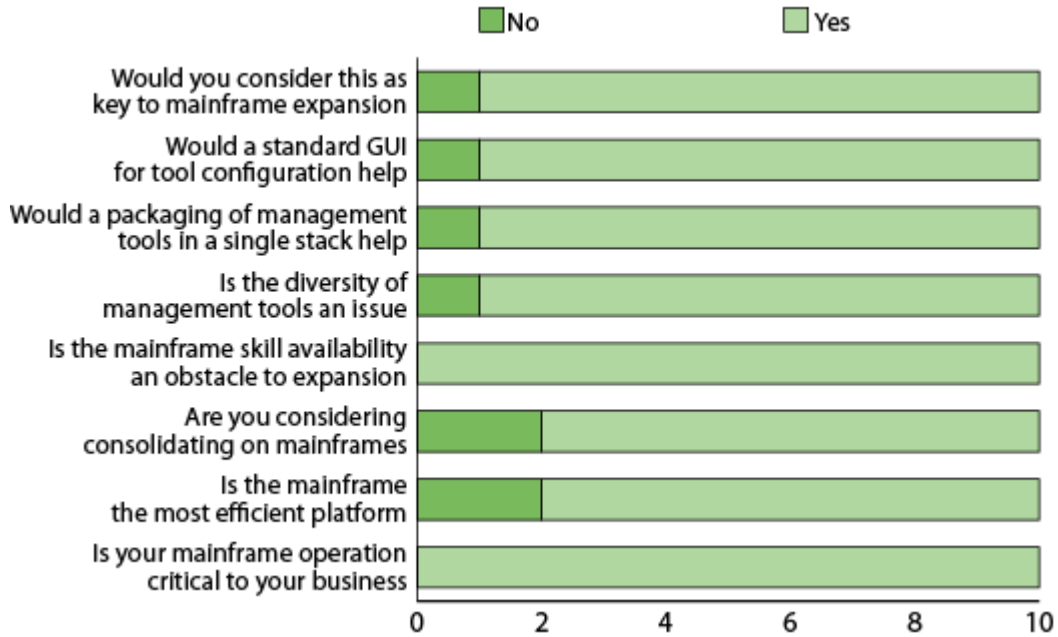
Because of its wealth of management solutions, the mainframe is also a perfectly automated environment, which contributes to cost reduction. The major obstacle to the expansion of the mainframe is the complexity of configuration, deployment, and operation of the very management solutions that make the mainframe such an automated and efficient platform. This complexity requires specific and experienced skills, and these skills are becoming rare, as colleges do not usually train their students on mainframes. In many cases, the solution would be to find subcontractors from abroad, but many users in sensitive areas are unable to do so for security reasons.

If this complexity is lifted through the use of a single, standardized set of management solutions that use a common intuitive interface, the major obstacle to mainframe expansion would disappear. Although this would not lead to all mainframe sites expanding their operations, a majority of the

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users interviewed for this report would see a resulting increase in their mainframe operations beyond what they do today (see Figure 6).

**Figure 6: Summary Qualitative Chart**



Base: IT executive interviews

Source: A commissioned study conducted by Forrester Consulting on behalf of CA, June 2009

## Appendix A: Methodology

In this study, Forrester interviewed 10 organizations in North America and Europe to evaluate the long-term challenges associated with managing the mainframe environment. Survey participants included decision-makers in IT operations from organizations with more 5,000+ employees, overall revenues of more than \$1 billion, and more than 2,500 MIPS installed.

Participants in this survey were asked to do the following:

- 1) Provide a summary description of their mainframe strategies, the criticality of the mainframe as an application platform in their enterprise, and their view on the economic value of the mainframe.
- 2) Provide their view on the situation of the mainframe market, the efficiency of the platform, and whether mainframe usage was increasing or decreasing in their companies.
- 3) Provide a summary description of the main issues they found in operating a mainframe and, in particular, the issue of skills shortages.
- 4) To indicate whether a consolidated solution with an appropriate GUI would be a solution to these issues.
- 5) To indicate whether, in the case of such a solution becoming available on the market, it would be a reason to expand their use of the mainframe and consider it as a potential consolidation platform for distributed systems.

Respondents were offered a copy of this thought-leadership paper in return for the time spent on the survey.

The survey began in April 2009 and was completed in June 2009.

## Appendix B: Supplemental Material

### Related Forrester Research

June 10, 2009, "Decoding Mainframe Pricing Mechanics And Metrics" Forrester report (<http://www.forrester.com/Research/Document/0,7211,54283,00.html>)

April 21, 2009, "Q&A: Consolidating Linux Workloads On System z" Forrester report (<http://www.forrester.com/Research/Document/0,7211,54273,00.html>)

February 27, 2009, "The State Of Emerging Enterprise Hardware Trends: 2008 To 2009" Forrester report (<http://www.forrester.com/Research/Document/0,7211,46497,00.html>)

February 17, 2009, "Q&A: Choosing IBM's System z10 BC Mainframe" Forrester report (<http://www.forrester.com/Research/Document/0,7211,48216,00.html>)

March 27, 2008, "The State Of Enterprise IT Budgets: 2008" Forrester report (<http://www.forrester.com/Research/Document/0,7211,45001,00.html>)

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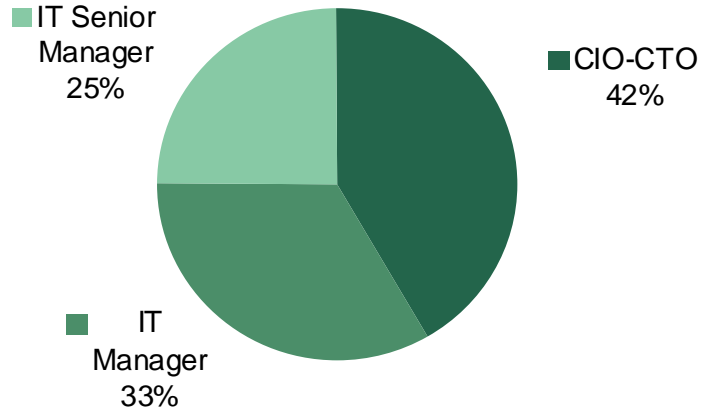
Arcati Mainframe Yearbook 2008: (<http://www.arcati.com/newyearbook08>)

Source: Accenture Survey 2006

([http://www.accenture.com/NR/rdonlyres/2FAF3301-C1F2-46BB-A3AA-8AD15962DEC8/0/HighPerformanceInfrastructureResearch\\_GOVTRReportFINAL2.pdf](http://www.accenture.com/NR/rdonlyres/2FAF3301-C1F2-46BB-A3AA-8AD15962DEC8/0/HighPerformanceInfrastructureResearch_GOVTRReportFINAL2.pdf))

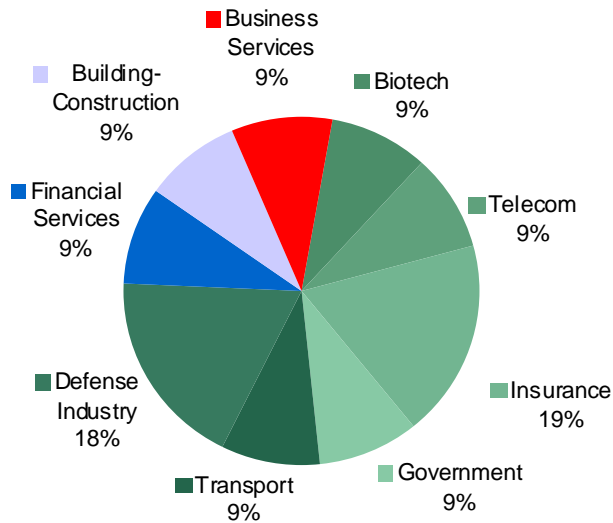
## Appendix C: Demographics

What is your current job title?



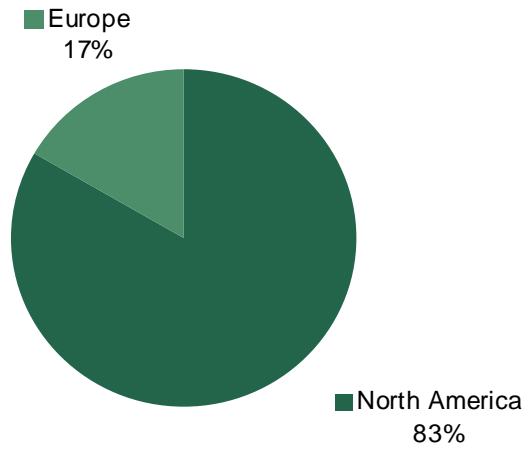
Source: A commissioned study conducted by Forrester Consulting on behalf of CA, June 2009

What is your industry?



Source: A commissioned study conducted by Forrester Consulting on behalf of CA, June 2009

What is your location?



Source: A commissioned study conducted by Forrester Consulting on behalf of CA, June 2009

## Appendix D: Endnotes

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<sup>1</sup> Source: February 4, 2005, "2005 Mainframe Market Outlook" Forrester report (<http://www.forrester.com/Research/Document/0,7211,35098,00.html>).

MIPS stand for millions of instructions per second and is the common measure of CPU power for mainframes.

<sup>2</sup> Source: Arcati Mainframe Yearbook 2008 (<http://www.arcati.com/newyearbook08>).

<sup>3</sup> Source: February 4, 2005, "2005 Mainframe Market Outlook" Forrester report (<http://www.forrester.com/Research/Document/0,7211,35098,00.html>).

<sup>4</sup> A petabyte is a quadrillion bytes or 1,000 terabytes.

<sup>5</sup> Source: June 10, 2009, "Decoding Mainframe Pricing Mechanics And Metrics" Forrester report (<http://www.forrester.com/Research/Document/0,7211,54283,00.html>).

<sup>6</sup> Source: April 21, 2009, "Q&A: Consolidating Linux Workloads On System z" Forrester report (<http://www.forrester.com/Research/Document/0,7211,54273,00.html>).

<sup>7</sup> Source: September 3, 2003, "Server and Database Support Staffing Ratios" Forrester report (<http://www.forrester.com/Research/LegacyIT/0,7208,32420,00.html>).

<sup>8</sup> Source: October 28, 2004. IT Staffing Ratios: Survey Data  
<http://www.forrester.com/Research/Document/0,7211,35696,00.html>