

SOA Takes Off – New WebSphere SOA Foundation Extends IBM's Lead with New System z9 Mainframes as the Hub of the Enterprise

About this White Paper

Service Oriented Architecture (SOA) is the most important software technology and architecture to emerge to industry-wide prominence since the Internet. The SOA enabling Web services technology and standards have now matured, and today support broad SOA adoption by all businesses, large and small.

SOA promises new levels of speed, flexibility, integration and adaptability for business applications in every industry and in every size of organization, and has become IT's hottest topic/fastest growing market.

In this White Paper, analysts Software Strategies evaluate and assess SOA, the benefits it offers, its maturity, and current adoption level. The role and fit of the mainframe as a central platform and host for enterprise SOA development and deployment is extensively examined throughout the Paper.

This White Paper provides advice on how organizations should start on their enterprise SOA adoption roadmap journey, identifying the types of external resources, products and services that are required.

To illustrate what major vendors can provide today to support such organization-wide SOA deployment, the Paper evaluates and assesses the comprehensive SOA Foundation Portfolio offered by SOA market leader IBM, and in particular its new WebSphere SOA Foundation set of products.

A glossary of SOA terms, and summaries of Software Strategies' recent, in-depth evaluation of the new System z9 mainframes and their recent middleware advances, are included in supporting appendices.

Written by: Ian Bramley

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Design & Layout: iok design – e-mail: info@iok-design.co.uk

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White Paper

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1. Executive Summary

This Executive Summary highlights our main White Paper research findings, developed fully in the main Sections following:

- **Collaborative Integration Vital:** Organizations worldwide are moving towards becoming On Demand Businesses. They want to become more responsive, flexible and adaptable to faster-changing, constantly evolving business conditions and markets. To do this, they are integrating internal operations, and linking with customers and partners externally in collaborative processes and applications.
- **Building Applications Challenging:** Building enterprise IT applications has long been difficult. Complex, distributed, heterogeneous IT environments compounded this. Recent faster business changes and challenges required the IT applications to change/respond faster, and be more secure and resilient, needs that IT could often not meet.
- **Prior Application Development (AD) Advances Fail to Resolve:** Many AD advances emerged over prior decades. However, none until now decisively solved the challenges. There remained a wide gap between what business leaders needed, and what IT could provide. A breakthrough was desperately needed.
- **Service Oriented Architecture (SOA) the Breakthrough:** SOA is the transformative business software architecture finally able to make this breakthrough. Other top analysts, and ourselves, consider SOA to be the most significant, applications advance ever to emerge. It offers drastic improvements in how business applications are built, supported, deployed and adapted to support core business processes and enable rapid change.
- **SOA Market Momentum:** SOA adoption has taken off on a large scale and at a rapid pace, as many indicators attest. *SOA is now the hottest topic and the fastest growing market for the IT industry in 2005/2006.*
- **IBM Mainframe Central SOA Platform:** The unique business values of zSeries, and of the new System z9 with its further advances, position the mainframe to serve as the enterprise hub platform for SOA and data. This places it at the epicenter of customers' collaborative computing and SOA developments.
- **New Redefined Distributed Computing Style:** SOA is an important, newer distributed computing style. It allows loosely-coupled, independent, reusable business software services (*interoperable & technology-neutral*) to be choreographed into Internet-based composite applications, to support transformed business process workflows.
- **Services Reuse Heart of SOA:** Business software services are reusable, so new applications can be built much faster. Services can be created from existing software assets and packaged applications, or be newly-built in J2EE™ or .NET. Composite SOA applications are flexible, can easily be adapted to meet business changes, and make enterprises more responsive to new market opportunities and competitive threats, etc.
- **Web Services, Standards Enablers:** SOA is not only based on, but extends, Web services technology, and exploits the now-broad, maturing set of open Web services standards. These allow SOA applications to integrate and inter-operate across all hardware, OS and middleware platforms via the Web.
- **Drastically Simplifies Business/System Integration:** Monolithic enterprise applications were hard and costly to integrate or change, and supporting both absorbed most IT capacity. For the reasons above, SOA applications are dramatically easier to integrate and change, freeing up scarce IT skills for new, high-business-value applications.
- **Brings Tight Business-IT Alignment:** SOA extends the valuable advances of Web services and now allows tight alignment between business and the IT team to be achieved – resolving this long-standing and major issue.
- **SOA Comes of Age – Start Now/Move Faster:** With universal and compelling SOA benefits, and maturing SOA solution offerings, we advise enterprises to now begin this important journey (*if not already begun*) or to redouble and accelerate their efforts (*if underway*).
- **Mainframe Investment Brought Resurgence:** IBM invested over \$5B this decade to make today's mainframe the most advanced, productive and cost-effective enterprise computing system for On Demand Business, we found in our recent System z9 study. Consequently, the platform has enjoyed a healthy resurgence in market share and esteem.
- **Compelling Case for SOA on Mainframe:** Our research finds compelling reasons why the mainframe should play a central role as the platform and the hub for enterprise customer SOA-enabled infrastructures, deployments of which are accelerating. *Our research finds compelling reasons why the mainframe should play a central role as the platform and the hub for enterprise customer SOA applications...*

- A wealth of **traditional enterprise application software and data assets** on mainframe are easily converted to business services for SOA.
- Five years of intense deployment of new workloads on the mainframe means a large, modern software portfolio is now also running on the platform, which can be readily adapted to plug-and-play in enterprise SOA architectures.
- **Unique mainframe business values** are highly supportive of enterprise SOA business composite application needs, not easily (*or not at all*) delivered by other platforms.
- **Advanced mainframe capabilities**, such as extreme virtualization and intelligent self-optimizing workload management, underpin these values, are highly complementary to enterprise SOA composite business applications, and can often best provide the performance, behavior and characteristics needed.
- Heterogeneous SOA infrastructures need **central co-ordination of vital SOA-wide functions**, and the mainframe now has well-advanced, specific capabilities and roadmaps to fulfill this enterprise SOA and data hub role well.
- **Approach SOA Business-focused:** Begin SOA with a sharp focus on business strategies, with business process transformations prioritized, and with full top executive support. The business benefits of successful SOA deployment are most compelling, although the associated IT benefits are also valuable. Experienced industry business consultants can help uncover and rank the processes most in need of treatment, if this is not already clear.
- **Do a SOA Readiness Assessment:** To clearly identify where your enterprise is positioned on the SOA capability-maturity curve, such an assessment is a highly-effective, rapid means of pinpointing the areas to be enhanced for fuller SOA adoption. Self-service SOA tools, and/or workshop services for this are available from some vendors.
- **Understand SOA Lifecycle/Roles:** Understanding SOA applications lifecycles, and the business and IT roles involved, will help match with existing resources, and will pinpoint capability/capacity gaps that need to be addressed. Joint business-IT "SOA Program Governance" is recommended.
- **Identify New SOA Resources Needed:** From the gaps identified above (*and our Section 5 "What You Need for SOA" checklist*), the additional SOA resources (*staff and/or skills, SOA middleware software, SOA tools, education, knowledge and information, methods and best practices, business and SOA technology services, etc.*) needed to realize the enterprise SOA plan can be identified.
- **SOA Vendor Selection:** A primary choice is between the few major vendors with more complete SOA "platforms", and offerings

An impressive new WebSphere SOA Foundation software suite stands at the heart of IBM's SOA offerings...

from small, "pure-play", newer vendors. Analysts expect the former to quickly dominate in the SOA market, because of the high investment needed and vendor risk perceptions. Wide differences in offering and platform strength exist between the major vendors, typical of an early market stage.

- **WebSphere SOA Foundation Software Centerpiece:** An impressive new WebSphere SOA Foundation software suite stands at the heart of IBM's SOA offerings, comprising these new or enhanced products:
 - WebSphere Business Modeler.
 - WebSphere Integration Developer.
 - WebSphere Process Server.
 - WebSphere ESB.
 - WebSphere Message Broker (*Advanced ESB*).
 - WebSphere Business Monitoring.

We found each tool was of class-leadership level, represented major advances on their predecessors, and made this the market's premier enterprise SOA software suite. (*See Section 7.*)

- **Mainframe Platform – SOA Support:** Enhanced, SOA-supportive, major middleware engine releases, already available for z/OS, underpin and support the new WebSphere SOA Foundation (*available by Q1 2006 on zSeries/System z9*). These position the mainframe as a premier SOA host and hub.
- **IBM the Only SOA Choice for Mainframe Users:** We found that where enterprises are substantially using IBM mainframes (*or mainframe plus diverse multi-platform environment*), the IBM SOA offering is not only the strongest overall, but is the only realistic SOA solution to adopt on the mainframe side.
- **IBM SOA Leadership Acknowledged:** IBM has created a formidable strength of broad offerings, and a clear leadership position in SOA, both thought and market, as confirmed by recent analyst surveys, holding three times the SOA leadership recognition of the nearest competitor.

- **IBM SOA Services, Support Unrivalled:** We found the services breadth, depth, scale and SOA experience of IBM Global Services (IGS) to far exceed any other SOA services vendors. Combined with the leadership WebSphere SOA Foundation software, a wealth of IBM SOA education, knowledge/information, tools/methods, and a fast-growing SOA partner ecosystem in place, these strengths make IBM the natural partner of choice for enterprise SOA deployments. (See Section 6.)

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2. On Demand, SOA & the Mainframe – Meeting the Challenges

On Demand Business Era Develops

In today's faster-moving, On Demand Business era, enterprises worldwide, in every industry, are changing their business models and core business processes to increase speed, to cut their costs, and to become more flexible and more responsive to customer demands, competitive opportunities and threats, and other marketplace dynamics. To do this, they seek to integrate their people, processes and information to new levels, both within the enterprise and to link directly with their ecosystems of partners, suppliers and customers.

Such improved business flexibility can best be achieved by standardizing, automating and integrating key business processes, and by then managing the performance of these processes. It also demands much closer and faster alignment between the business with its business processes and the software applications that support them; and therefore between the business and IT staff responsible.

Improved IT infrastructures, now often called "on demand operating environments", are needed to support this at the IT platform level. Major advances have been made in leading IT platforms over the last several years, to equip the latest servers, storage systems and operating systems to fulfill these demanding new requirements. The new IBM System z9 mainframe, its associated storage and its software, for example, delivers substantial further advances on its already resurgent and successful zSeries predecessors. Our recent in-depth assessment (see the "Related Software Strategies Research" Section on page 55, item 7) found these advances have enabled these mainframes to deliver the most advanced on demand operating environment available, enabling important, new enterprise-wide roles, along with new levels of unique business value.

Collaborative Computing Comes to the Fore

Companies once isolated by disparate IT technologies are now collaborating electronically to create these more on-demand operations. This requires that each firm's computing systems can be linked more easily, more flexibly, more securely, and at a lower cost than was previously possible. IBM is calling this **collaborative computing**. This means using technologies like business process modeling and monitoring, open standards, new software architectures, virtualization, and encryption to securely share information in real-time both inside the business and with ecosystem partners. Doing so enables all to work seamlessly together on shared business processes. The need is for end-to-end business process and application integration, both among internal operations and with such external ecosystem partners whose business applications were historically kept separate.

Collaborative computing is a big evolution from traditional, transaction processing-centric computing, imposing demanding new requirements on application architectures and systems capabilities, and is the direction for most enterprises as they seek to become a more mature On-Demand Business. The universal Web browser interface and the ubiquitous Internet universal network are collaborative computing backbones, their enormous success enabled by their open standards basis.

Bill Zeitler, IBM Systems Senior Vice-President and Group Executive Systems, speaking at an IBM Systems announcement on July 26th 2005, summarized this new computing model concisely, saying:

"As businesses and institutions integrate their operations internally and externally with customers and partners, the IT environment is changing dramatically. Where transaction processing has been the focus of IT for decades, we now see clients engaged in more interactive or collaborative processing. It's no longer about what you have, it's now about what you can accomplish through collaboration."

Business Application Software Challenges Multiply

Throughout the evolution of software technology over the decades, a number of recurring business application development challenges have remained. Since the dawn of commercial computing, these have included:

- Difficulty in **correctly aligning** business applications closely with the business/business process(es) that they support.
- Difficulty of **keeping alignment** of applications as the business and its processes changes.
- **Lack of flexibility**, preventing applications from being easily adapted to constantly changing business requirements.

- The **time, effort and cost** of original application development.
- The **time, effort and cost** of application maintenance and support.
- Complexity, time, cost and effort of **integrating disparate applications** that need to work together.

These long-standing challenges were compounded by soaring increases in the complexity of enterprise IT infrastructures over the last decade, which now include:

- Complex, **heterogeneous, multi-tier**, IT infrastructures for many enterprise applications.
- **Newer programming models** in widespread use (*notably Java/J2EE™ and .NET*), as well as traditional models.
- Application testing and debugging became yet more difficult and costly in such heterogeneous environments.
- Application performance monitoring and optimization became still more difficult in these environments.
- The now-essential extension of applications beyond the boundaries of the enterprise to customers, partners and suppliers posed many **new integration, security, reliability and technology challenges**.
- Widespread use of **the Internet as the global network** for enterprise collaborative applications, bringing many benefits.

The breadth and pace of business change today has also sharply increased, with:

- The transition towards on demand or real-time business, **demanding faster time to market**, and thus faster applications delivery.
- The need for much **faster adaptation and change** in business models and processes, and thus in the systems that support them.
- **Total dependence on IT systems** and applications are now widespread in almost every industry.

What was long needed was a transformative business software architecture that could finally address and overcome most of these difficult and intractable challenges decisively. However, this

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could not require complete replacement of massive, existing business applications portfolios. The increased pace of the On Demand Business, and the spread of collaborative computing for closer integration with ecosystem partners, compounded the need for improvements. How could business software applications be better built, supported, deployed and adapted to constantly changing business needs?

Previous Business Application Software Advances Insufficient

In the last forty years of commercial computing, several earlier software development/architecture advances emerged and were deployed, each yielding some gains. These included:

- The introduction of Third Generation, higher-level programming languages (*COBOL, FORTRAN, PL/1 etc.*).
- Structured programming and design approaches.
- Fourth Generation, Non-procedural Languages (*FOCUS, NOMAD, RAMIS, SAS etc.*).
- Model-based development/CASE (*IEF, IEW, Rational*).
- Object-oriented programming and development.
- Distributed object-programming models (*DCOM, DCE, CORBA*).
- Packaged enterprise applications (*such as ERP, CRM, SCM, and PLM*).
- Component-Based Development (*CBD*) and software component reuse.
- The explosion of the Internet, growth in Web applications and maturity of e-business.

Each contributed useful new concepts, and worthwhile AD advances, but none provided complete solutions to the increasing business application challenges above. Some were also, in retrospect, over-hyped by their marketing exponents at the time. Elements of most of these technologies have been carried forward, and provided some of the underpinnings for the latest advances.

Distributed computing, which had evolved and developed since the 1980s, had further complicated the world of business application software development. It introduced new processing models, such as client/server, parallel processing and clustered computing, new platforms such as Linux, and of course the most important of all, the Internet – now the dominant global network technology platform.

Distributed object programming models (such as COM and DCOM, DCE and CORBA) sought to support these newer, distributed computing models with more productive, open programming models, each providing some advances within their own silos. However, difficult or limited interoperability – because of their tightly-coupled integration approach and different standards – limited their value.

Since the late 1990s, the complexity of the IT environment has continued to grow/worsen, whilst large and costly efforts to integrate applications and data were made by most enterprises. This costly complexity will continue to worsen until companies take dramatic action and adopt a radically new approach to computing, SOA offering this solution. A class of integration middleware emerged, to help unify and combine these disparate application environments. Whilst much was achieved, this middleware added yet further complexity to the IT infrastructure. Earlier products included many point solutions, often using proprietary methods, although standards that are more open are now more pervasive.

The seeds for what has now become the definitive solution lay in this decade's emergence of just two, widely-used, modern distributed computing programming models – Java/J2EE™ and .NET. These, plus big developments in open industry standards, and a new technology called Web services (based on these new open standards and the Internet), enabled a major advance. After some four years of intense, industry-wide collaborative developments of the necessary open standards, and of the supporting middleware software and tools, 2004 saw Web services reach sufficient maturity, coverage and interoperability. SOA, enabled by, and based upon, these maturing open Web services standards and technologies, has now emerged to become the most significant advance in business application software architecture ever.

SOA... has now emerged to become the most significant advance in business application software architecture ever.

Service Oriented Architecture Takes Off

SOA has rapidly become the prime, unifying software architectural approach for the creation and deployment of business software applications on modern, distributed computing infrastructure, and is now supported across, and by almost the entire, IT industry. SOA has risen rapidly to this now-central prominence within the last eighteen months to become the most important, fundamental change in how business application software can best be built, deployed and integrated and managed that we have seen in the fifty-year history of commercial computing.

The concept of service-oriented software architecture is not itself new. However, the recent developments of Web services technologies, and their accompanying open systems standards, have brought the major breakthrough allowing SOA to become the transformative approach to business applications software architecture. In addition, leading vendors have now developed the robust and complete middleware software and development tooling, methods and best practices needed to support SOA development and deployment for mainstream customer use. These, in combination, now allow the SOA approach to bear centrally on, and to solve, many of the long-standing, and hitherto intractable, challenges of building, running, integrating and adapting flexible, responsive business applications that closely map to the transformed new business processes that we described above.

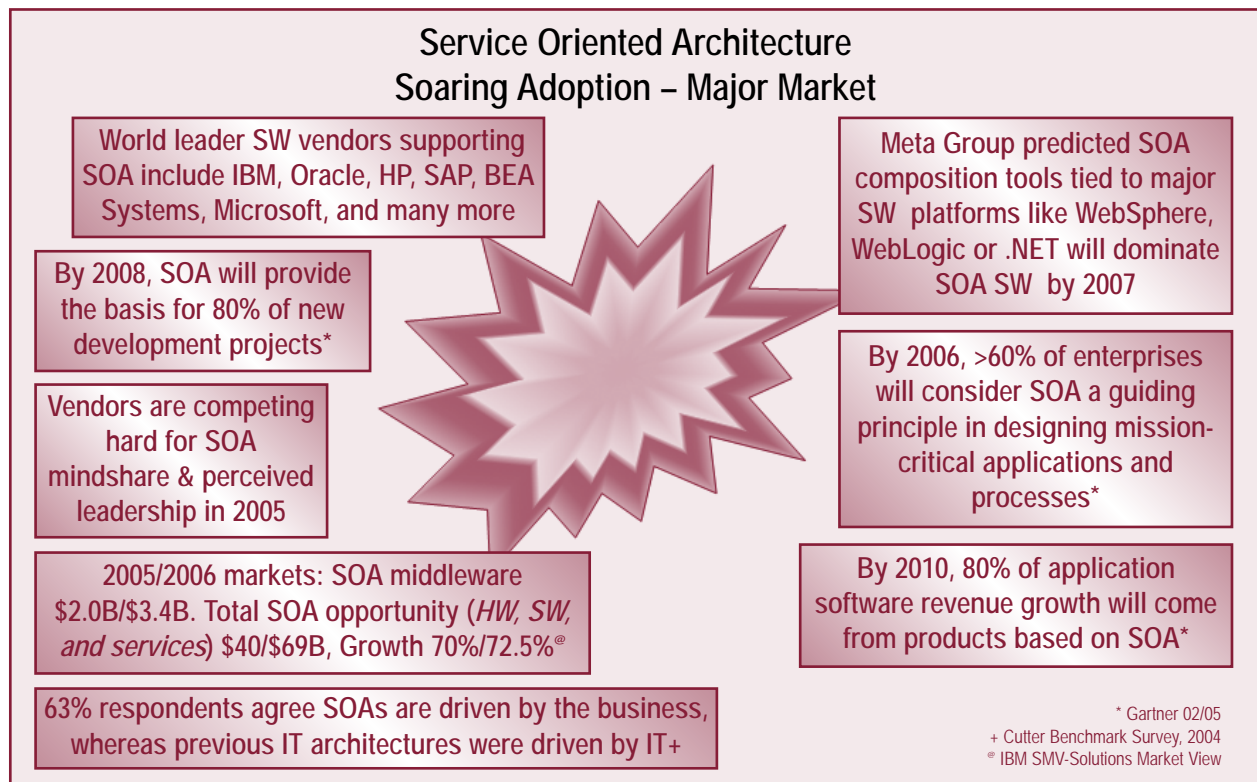


Figure 1: Service Oriented Architecture Takes Off – Some Indicators

Figure 1 shows a selection of important facts and assessments from other leading industry authorities. These highlight the large-scale, importance, rapid growth, and widespread adoption of SOA, and underline the rapid growth it is expected to undergo over the next several years. They also underline that now is the time at which all the essentials for take-off are now in place. Just highlighting a selection of these:

- **Widespread Major Software Vendor Support:** All the leading middleware software vendors have refocused and centered their middleware suites on supporting SOA, notably including IBM, Microsoft, BEA Systems, and Oracle, but also numerous smaller specialists. Leading enterprise application vendors are also actively re-architecting and re-basing their enterprise applications onto a SOA model for future releases. These include SAP and Oracle (*Oracle e-business applications, PeopleSoft, JD Edwards and Siebel*) and others. This unanimity and strength of IT industry support for this new architecture and applications technology is unusual, and confirms the central role SOA will play over the next decade.
- **Enterprise Customer Adoption/Fast Growth:** We estimate that over two thousand leading enterprise IT users have already begun adopting the SOA vision and begun implementing new business applications on a SOA model. For example, IBM alone claims to have already helped over 1,000 customers with their SOA plans, projects and products.
- **Top Analysts Forecast Fast Adoption:** Leading analysts are all forecasting rapid global adoption of the SOA model by enterprise IT users as its benefits become more widely understood, and now that the middleware, software tools, standards, best practices and methods needed have matured and become available. For example, by 2008 SOA will provide the basis for 80% of new development projects, according to Gartner.
- **Large, Fast-growing Market/Major Customer Expenditure:** Highlighting the scale of SOA adoption projected, SOA is expected to drive considerable customer expenditure growth specifically on SOA middleware, and the associated totals of the new hardware, software and services required. For example, IBM market research projects SOA middleware spending will grow from \$2B in 2005 to \$3.4B in 2006, a rise of 70%. The same source expects total SOA-driven spending (*software, hardware and services*) will grow from \$40B in 2005 to \$67B in 2006, a growth of 72.7%.
- **Business Focus/Benefits Driving SOA Adoption:** Driving this widespread and rapid adoption of SOA is the considerably increased business flexibility and responsiveness it finally brings to enterprise users. SOA's ability to enable rapid redesign of core business processes, and then to enable fast assembly of software services into the IT application solution that supports the new business processes, far more quickly and easily, is the winning benefit. One IT user survey found 63% of IT management respondents agree that SOAs are driven by the business, whereas previous IT architectures were driven by IT.

These indicators, and many others, show SOA as the most significant and compelling advance in application software to date.

These indicators, and many others, show SOA as the most significant and compelling advance in application software to date. It will be the vital enabler of business change, greater flexibility, and much closer business-IT alignment and on-demand speed and adaptability.

We explain the basic principals, concepts, standards, and business benefits of SOA in Section 3.

Mainframe Resurgence Positions System z9 for Central SOA Role

2004 saw the 40th anniversary of the IBM mainframe, which has been the central business application-computing platform for thousands of larger firms for up to four decades. Today, mainframes host several trillion dollars worth of business applications developed over this period, support some 80% of all machine-readable data, and process hundreds of billions of business transactions per year.

The IBM zSeries mainframe saw a dramatic resurgence in the market, and in industry-wide esteem and respect, between 2000 and 2005. It enjoyed a quite remarkable return to favor, gained 16 points of "over \$250,000 server" segment market share, and saw more mainframe MIPS sold in the last four years than in the previous 36; 75% of these devoted to running "new-to-mainframe" workloads. The platform had been transformed by deep changes, and several \$B of IBM investment, continuous innovation and development. This market revival began in 2000 with the introduction of the zSeries, and by 2004 it had strengthened to make the mainframe a dominant player in the market again. The zSeries mainframe had again become widely recognized as the "Five Star" enterprise computing platform, largely because of the unique business values and technology leadership it continued to offer to support business transformation to On Demand.

The newest mainframe generation, the System z9, which started shipping in September 2005, brought further advances, with focus on supporting surging growth in collaborative computing, now enabled by extensive support for SOA, under which the next generation of business applications are now being built.

Software Strategies researched and assessed the new System z9 109 systems in-depth in our recent Enterprise Server Spotlight Report. We had also previously published three substantial and widely-read White Papers charting, assessing and analyzing the intense development and innovation that led to this mainframe resurgence (see the "Related Software Strategies Research" Section on page 55, items 1, 2, 4, and 7). We isolated the unique business values and technology strengths that enterprise users continue to find so compelling on the zSeries, and now the System z9, mainframe platforms.

New IBM System z9 – Enterprise SOA and Data Hub

IBM described its new IBM System z9 109 high-end mainframe, first of a new generation of mainframe systems, as "one of the most sophisticated computing systems ever". A powerful enterprise computing system, the new IBM System z9 109 mainframe provides advanced middleware, security and virtualization capabilities which, the company said, are optimized to enable it to act as the **enterprise SOA and data hub** of a new era of **collaborative computing**. The result of a 3-year, \$1.2B, 5,000-people development, the System z9 109 doubles the power and capacity of its z990 predecessor, and is geared to continue accelerating the resurgence of the mainframe platform seen in recent years. Our summary of the positioning and main strengths of the System z9 109 is shown in Figure 2.

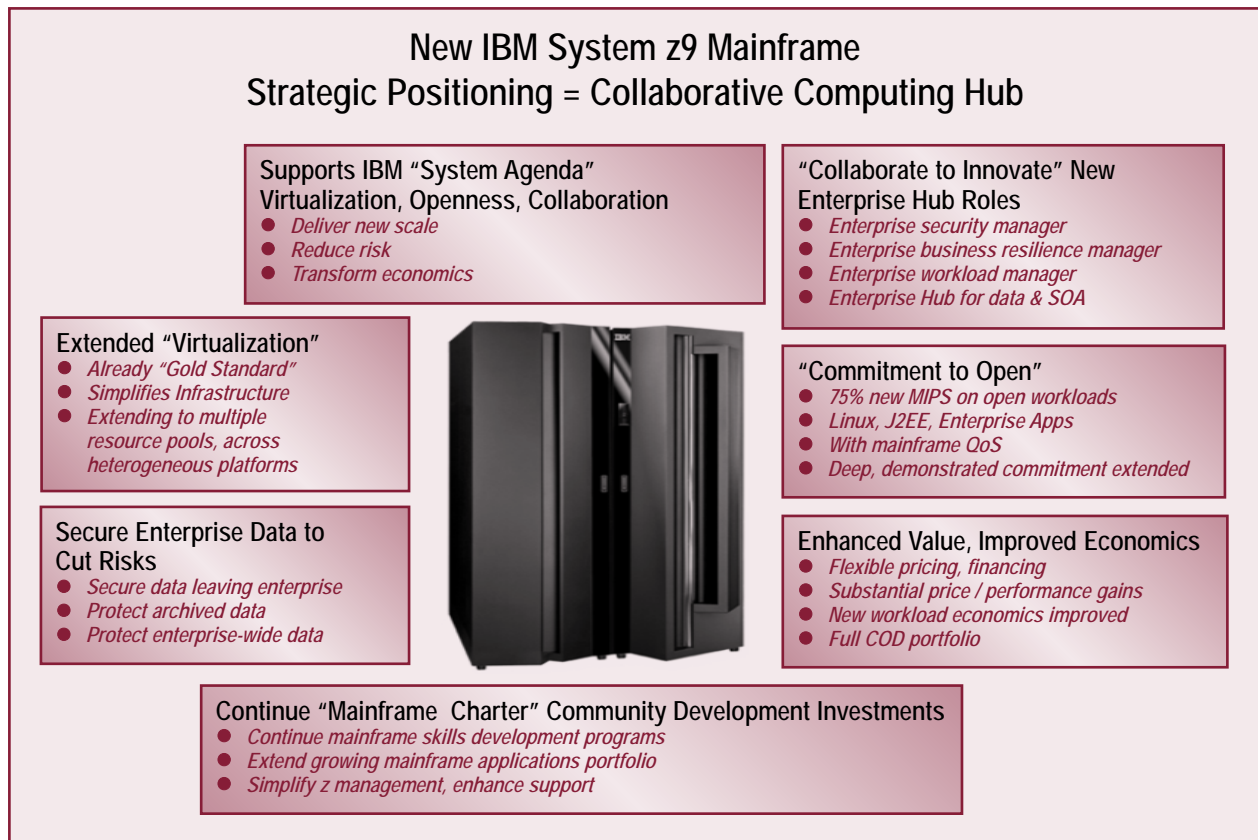


Figure 2: New IBM System z9 109 Mainframe Strategic Positioning - Collaborative Computing Hub

The Executive Summary from our recent Report is included in Appendix C for a fuller picture.

Unique Mainframe Business Values and System z9 Advances Ideal for SOA

In our above-quoted research, we isolated and ranked the nine foremost areas of unique business value that mainframe customers valued most highly about the platform. These are shown in the left-hand box of Figure 3 on page 12.

Several of these are widely understood and acknowledged throughout the industry (*Highest Resource Use Efficiency/Utilization, Highest Scalability & Capacity, Highest Performance & Quality of Service (QoS), and Low Risk via World-class IBM Support*). Others contradict widespread, but now obsolete, mainframe "myths" (*Lowest Total Cost of Ownership (TCO) & Cost/User, Much-improved System Costs*). All these are highly desirable attributes for a platform to host the next generation of SOA-based enterprise applications more closely aligned with the constantly changing needs of the On-Demand Business.

Unique Mainframe Business Values and System z9 Advances

Unique zSeries Business Values

- **Lowest Cost of Outages**
- **Lowest Security Breach Risks/Costs**
- **Highest Resource Use Efficiency/Utilization**
- **Highest Scalability & Capacity**
- **Lowest Total Cost of Ownership (TCO) & Cost/User**
- **Low Risk via World-class Support**
- **Facilitates Reuse/Modernization of Mainframe Application Assets**
- **Highest Performance & Quality of Service (QoS)**
- **Much-improved System Costs**

System z9 Advances

- **Stronger Security:** Improved hashing algorithms and stronger encryption
- **Extended Virtualization:** Including up to 60 logical partitions & IBM VE 2.0
- **Reduced Scheduled Downtime:** With concurrent book & memory add/repair/replace
- **Reduced Planned Outages:** With concurrent microcode upgrades
- **Greater Scalability:** Faster processors & up to 54 user engines on a single server
- **Improved Connectivity:** With 80% greater I/O bandwidth
- **Lower Costs:** Supports zAAP & IFL engines, plus many other price/performance improvements
- **Accelerated Application Development and Integration:** SOA applications across various platforms with extensive IBM WebSphere software for System z9 portfolio

Figure 3: Unique Mainframe Business Values and System z9 Advances

When considering enterprise platforms to host new, large-scale, SOA business applications that are to run central business-critical processes, and that will support ecosystems of partners and customers, three of the other unique mainframe values have particular resonance and power. These are Lowest Cost of Outages, Lowest Security Breach Risks/Costs, and the Facilitation Reuse/Modernization of Mainframe Application Assets. Highest availability and cutting the business costs of outages are essential for this new generation of business-critical SOA applications, and the mainframe offers the highest availability of all platforms, minimizing future business disruption costs.

With this new generation of extra-enterprise, collaborative SOA applications running over the Internet, and embracing and supporting external organizations in the business ecosystem, new levels of security, and lower costs of defending the applications from today's myriad of security risks are also a mandatory requirement. The mainframe offers the highest security of any commercial platform, and consequently the lowest costs of security defense, and is thus ideally equipped to support these SOA applications from a security viewpoint.

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enterprise applications that customers are building. With so many such core business assets on the platform, building and deploying these next-generation applications, reusing many of these assets, offers substantial time-to-value and performance advantages.

The new System z9 mainframe generation, shipping from September 2005, strengthened these unique zSeries business values considerably, and our highlights of these advances are shown in the right-hand box of Figure 3.

The System z9's extended virtualization and doubled scalability also enables these systems to run much larger SOA enterprise application workloads on a single server, with great efficiency and higher performance. Improved connectivity and doubled I/O capacity means these systems can accommodate the heavy I/O demands of global collaborative computing applications of massive scale.

With zSeries already the lowest cost per-user platform for enterprise workloads (see *Related Software Strategies Research*, page 55, items 1 and 3 for details), the further substantial price/performance advances of the System z9 extend these favorable mainframe economics (see *Appendix B*, page 51, paragraph 17 for overview), and will enable customers to run their largest collaborative SOA applications more cost-effectively than users of other equipment.

The System z9 extends and strengthens the extensive IBM WebSphere software for System z9 SOA portfolio, providing accelerated application development and integration, and providing the industry's best set of SOA middleware and tools.

These combined mainframe strengths/advances equip the platform well to serve as the enterprise hub for SOA and data, at the heart of customer's collaborative computing and SOA infrastructures. We explore and review this capability more deeply in later Sections of this White Paper.

These mainframe strengths and advances combined propound a claim for the platform to serve as the enterprise hub for SOA and data...

This White Paper – Who Should Read?

This Report was written for senior IT executives (including CIO, CTO and Senior IT Managers) in larger and medium enterprises who hold responsibility for their enterprises' business applications portfolio and development resources. Many of these organizations are zSeries mainframe users. Our focus is on the business value and benefits SOA can offer such enterprises, and on the central role their mainframe platforms should play in this next-generation of business software applications development and deployment.

Our Analysis

As enterprises across the world move towards On Demand, seeking to become more responsive, flexible and adaptable to constantly changing markets and demands, they are integrating their operations internally and externally with customers and partners with more interactive or collaborative processing systems and applications.

Building enterprise business applications has always raised difficult, even intractable challenges, much-compounded by the spread of complex, distributed, heterogeneous IT environments, and by the much faster recent pace of business change and response demanded of the IT applications that support today's businesses.

Whilst earlier decades saw many application development technology advances, none to date had decisively or comprehensively addressed or resolved these long-standing challenges enough. This, plus the factors above, compounded the wide gap between what business leaders needed and what their IT organizations could provide.

SOA has now emerged to become, in our assessment and that of other analysts, that much-needed transformative business software architecture...

The industry has long needed a transformative business software architecture that could finally address and overcome these challenges. To succeed, such an architecture must offer radical improvements in how business software applications are built, supported, deployed, and are adapted more quickly to today's rapidly-changing business needs.

SOA has now emerged to become, in our assessment and that of other analysts, that much-needed transformative business software architecture, the most significant such advance yet to emerge.

Many indicators, including widespread software industry support, analyst support and uptake projections, the substantial scale and pace of customer SOA adoption, a growing number of success stories, and the size forecasts for SOA-related IT markets, all confirm the momentum and importance of SOA.

The unique business values of the zSeries mainframe, and the significant further advances offered by the new System z9 mainframe generation, combine to stake a claim for the platform to serve as the enterprise hub for SOA and data at the center of customers' collaborative computing and SOA developments. These strengths and advances meet the demanding requirements to best support new-era collaborative computing and large-scale SOA application development and deployment.

The unique business values of the zSeries mainframe, and the significant further advances offered by the new System z9 mainframe generation, combine to stake a claim for the platform to serve as the enterprise hub for SOA and data at the center of customers' collaborative computing and SOA developments.

3. Positioning Service Oriented Architecture in the Enterprise

Service Oriented Architecture Introduction

For readers unfamiliar with the terms and concepts of SOA, we provide a fuller set of definitions in Appendix A. For these readers, an early browse of this is recommended. In this Section, terms defined more fully in the Appendix are highlighted by bold red text. The basic SOA concepts are shown and outlined in Figure 4.

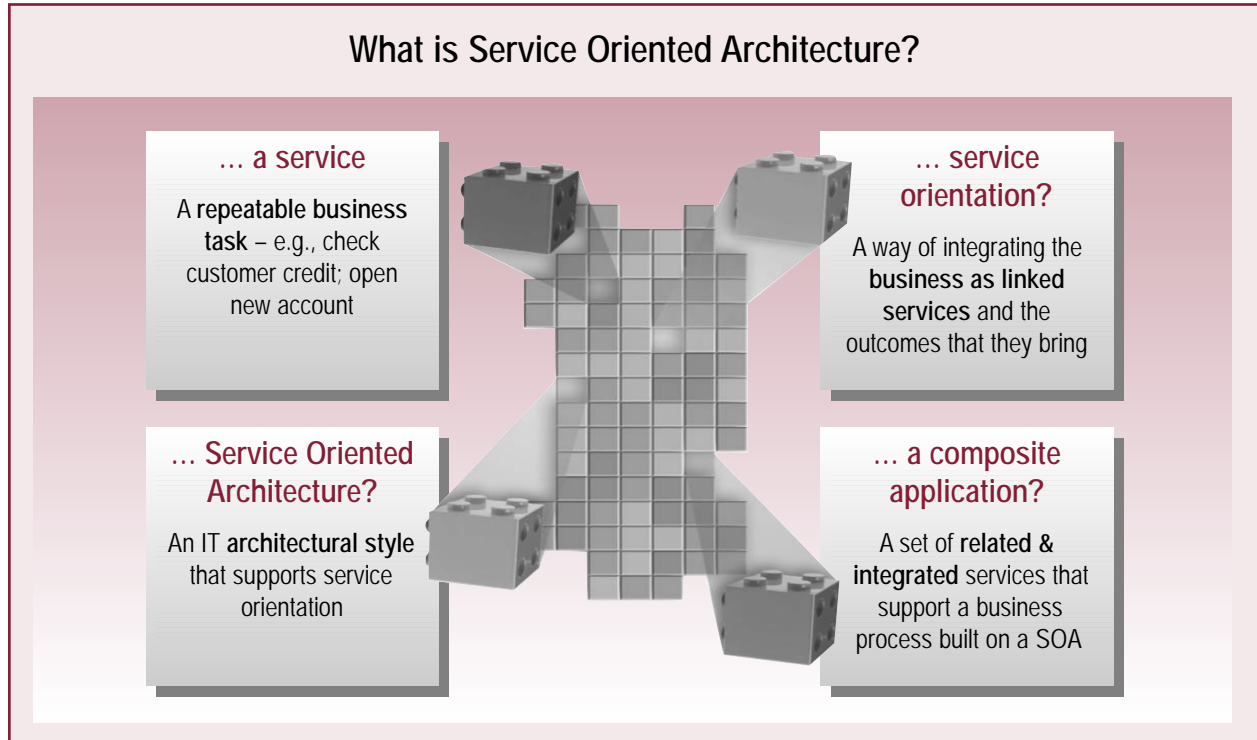


Figure 4: What is Service Oriented Architecture?

SOA is an architectural style of distributed computing that encourages the creation of **loosely-coupled** business **software services**. These **loosely-coupled software services** are interoperable, and are technology-agnostic, which enables much greater business flexibility. A SOA business application solution consists of a set of **business services** (*sometimes known as a composite application*) linked in a **business process workflow** that realizes an end-to-end **business process**. Defining the sequence of the **business process workflow**, and how the **business services** are linked, is termed **choreography** or **orchestration**.

Services are completely independent, and are accessed in a standardized way through a well-defined, self-describing, invocable **service interface**. Each service provides an interface-based service description, which enables it to be invoked to support flexible and dynamically re-configurable **business processes**, without requiring an understanding of its implementation. Services are defined using a **services description language**.

In a SOA, there can also be a range of **system services** that provide underlying IT systems operations that are treated in the same architectural manner as **business services**. Services may be provided solely within one enterprise, or by all the partners in a business ecosystem, who may choose to publish those services they offer for other organizations to invoke/use in a **services registry**. Prospective **service consumers** may consult the public or closed community **services registries** of their business partners and prospective **service providers** to discover what services are offered and how, and on what terms, they may be used.

At the simplest level, as indicated in Figure 4, business software services are like "Lego blocks" that can be plugged together through their sockets (*interfaces*), to create an infinite range of shapes or objects (*application systems*). Blocks can be extensively copied and reused in many other projects, assembly is rapid, and changes in shape are easily made.

SOA offers dramatic improvements in overall business performance management, when all these above elements are combined, as we show in the full SOA vision of Figure 5 on page 15.

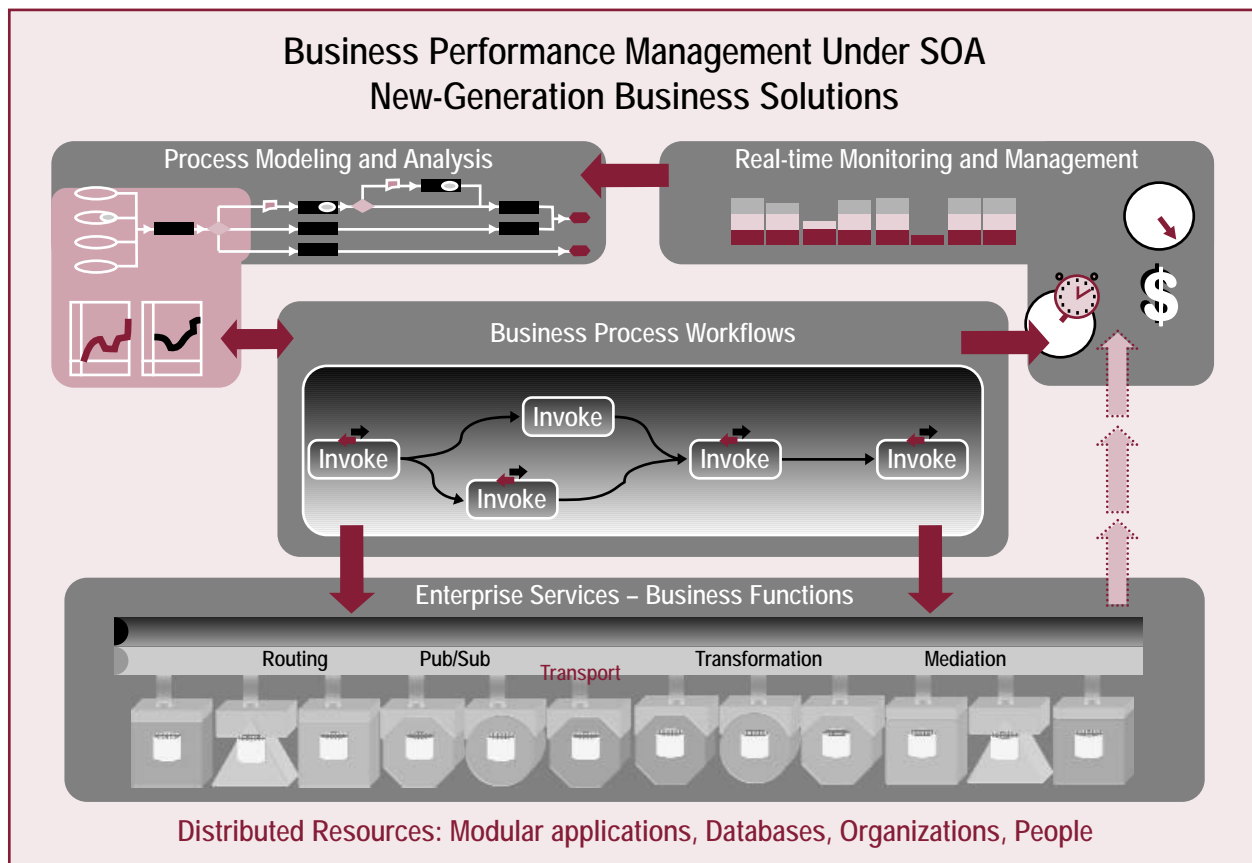


Figure 5: Business Performance Management Under SOA – New-generation Business Solutions

This shows the closed-loop, real-time monitoring and control of live running business processes that is enabled with a full SOA implementation. The **business processes** are defined, refined and tested with **business process modeling tools**. These generate the **business process workflow language** representing the desired workflow. System architects **choreograph and orchestrate** the business services required by the business process into the new SOA **composite application** that supports the **business process**. The **business software services** used will usually be a mix of existing company business software services, new business software services built by software developers, Web services-enabled existing software components, Web services-enabled packaged application components, or third-party software services. When the **process and SOA composite applications** are deployed live in production, **business process monitoring software tools** provide real-time control reporting, and **graphical dashboard displays of key performance indicators** generated via monitoring of the SOA software infrastructure.

This is a major business advance that supports business transformation. It enables significant business process improvement to be delivered through flexible IT applications built in lock-step with the business processes themselves, and that are easier to change and adapt as the business changes. The real-time business performance management enables rapid correctional management actions to be taken immediately, for any processes diverging from goals.

SOA should therefore be viewed, in our assessment, as one of the most business-transformative IT opportunities ever to emerge. Whilst the IT and technology benefits from SOA are also compelling and attractive, the business benefits are much more significant.

SOA Powered by Web Services

A SOA style can be adopted with several software technologies. However, it is **Web services**, with their now extensive set of **open standards and specifications**, that today enables the implementation of a SOA approach to deliver on its promise. Indeed, many now consider SOA and Web services almost synonymous. **Web services** are connected software services running over the Internet, using Web services open standards. The significance of Web services lies in this now-extensive set of **open industry standards and specification** that have been created and approved over the last several years, and that have been near universally agreed by the IT industry. discussed below. We discuss these overleaf.

Open Standards Vital Foundations for SOA

There has been a five-year ferment of IT industry-wide, collaborative open standards development for Web services, led notably by IBM and Microsoft, and with contributions from HP, Sun Microsystems, Oracle, BEA Systems and SAP, and scores of other vendors. Focused through standards bodies, including notably **OASIS** and **W3C**, and the **WS-I** interoperability organization, this unprecedented effort has now delivered a broad, maturing set of most of the standards needed for large-scale deployment of Web services under a SOA. The merging of Web services and Grid computing standards has been particularly noteworthy, unifying these two important technologies and extending SOA applications to Grid infrastructure advances.

To give a visual overview of the scale, breadth and sweep of this new open standards and specifications landscape, Figure 6 shows the seven major areas of Web services/SOA standards (*top right graphic*), and listings of the major current individual standards and specifications now available.

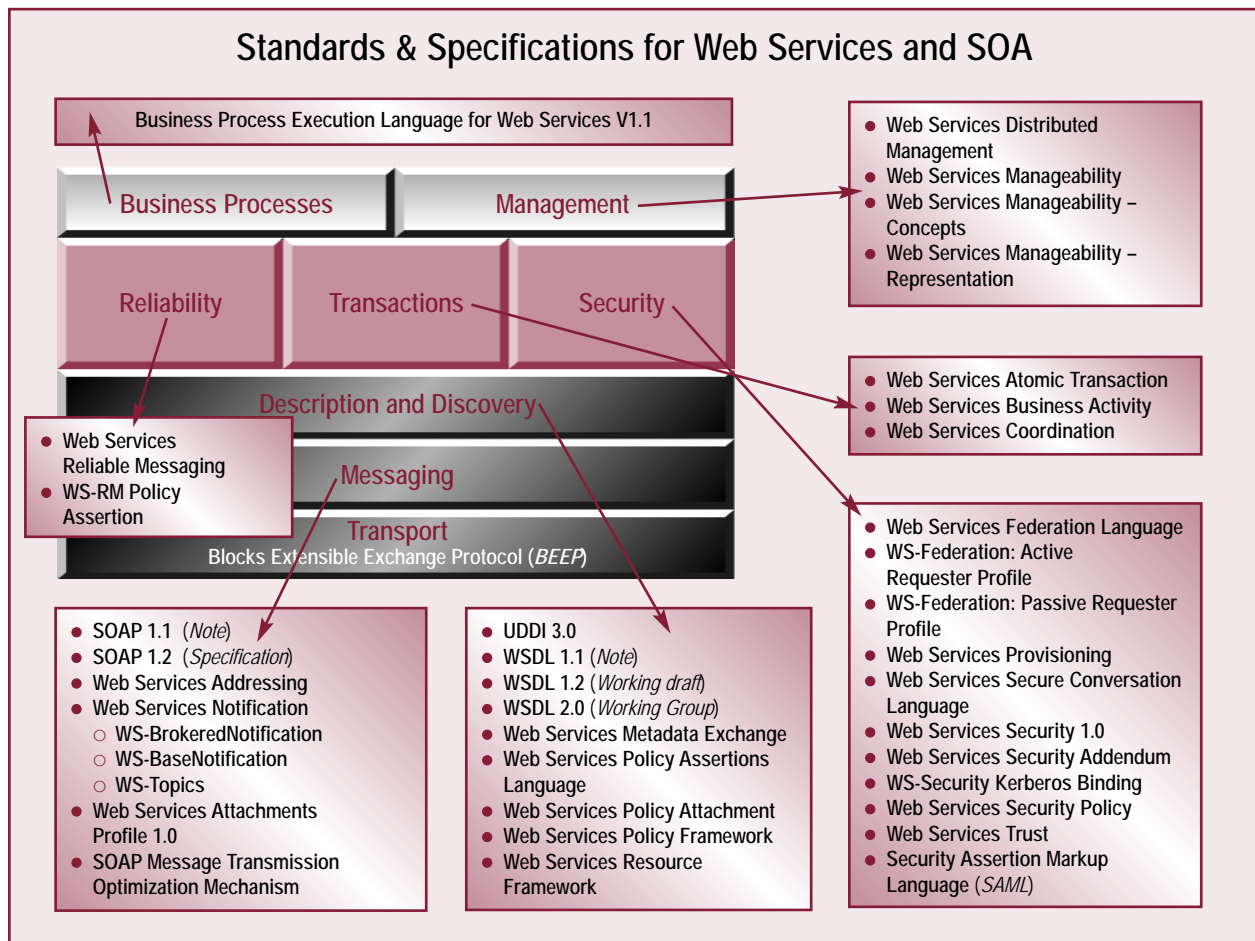


Figure 6: Standards & Specifications for Web Services and SOA

These build on established Internet standards such as **HTTP**, **XML** and others. The foundation standards of Web services are the triumvirate of **SOAP** (*Simple Object Access Protocol*), **WSDL** (*Web Services Description Language*) and **UDDI** (*Universal Description, Discovery and Integration protocol*). Whilst standards development work continues on more advanced and specialized areas (*identity management, systems management, security, and vertical industry standards, for example*), an increasingly stable standards portfolio providing the essentials for practical SOA deployment are now in place. In addition, a great deal of further work to ensure and validate interoperability between vendor offerings is ongoing. This really has been a revolutionary, unprecedented development, and showed a degree of industry collaboration, co-operation and contributions never seen in IT before. All players recognized that the immense promise of Web services and SOA could only be realized with a broad standards base that alone could provide real interoperability.

As always when such rapid developments of standards occurs, there are some competing/overlapping standards in a few areas, and today's profusion can be confusing, but this does not detract from the overall achievement, and the overlaps are likely to converge over time. Other analysts and we now assess that the standards development process passed the critical turning point of coverage and vendor product support in mid-2004, sufficient to enable large-scale Web services and SOA adoption.

These standards go far to enabling the seamless interoperation of Web services across different hardware, operating system and middleware platforms, and across different programming models, over the Internet.

There is a voluminous literature about Web services standards elsewhere, and any full exposition would occupy too much space in this White Paper.

Traditional Business Applications, Web Services and SOA – What is so Different?

How and why does SOA represent such a dramatic advance over traditional monolithic enterprise applications (*both customer built and packaged enterprise applications*), and over Web services alone? Figure 7 shows the three architectures graphically and highlights their essential differences.

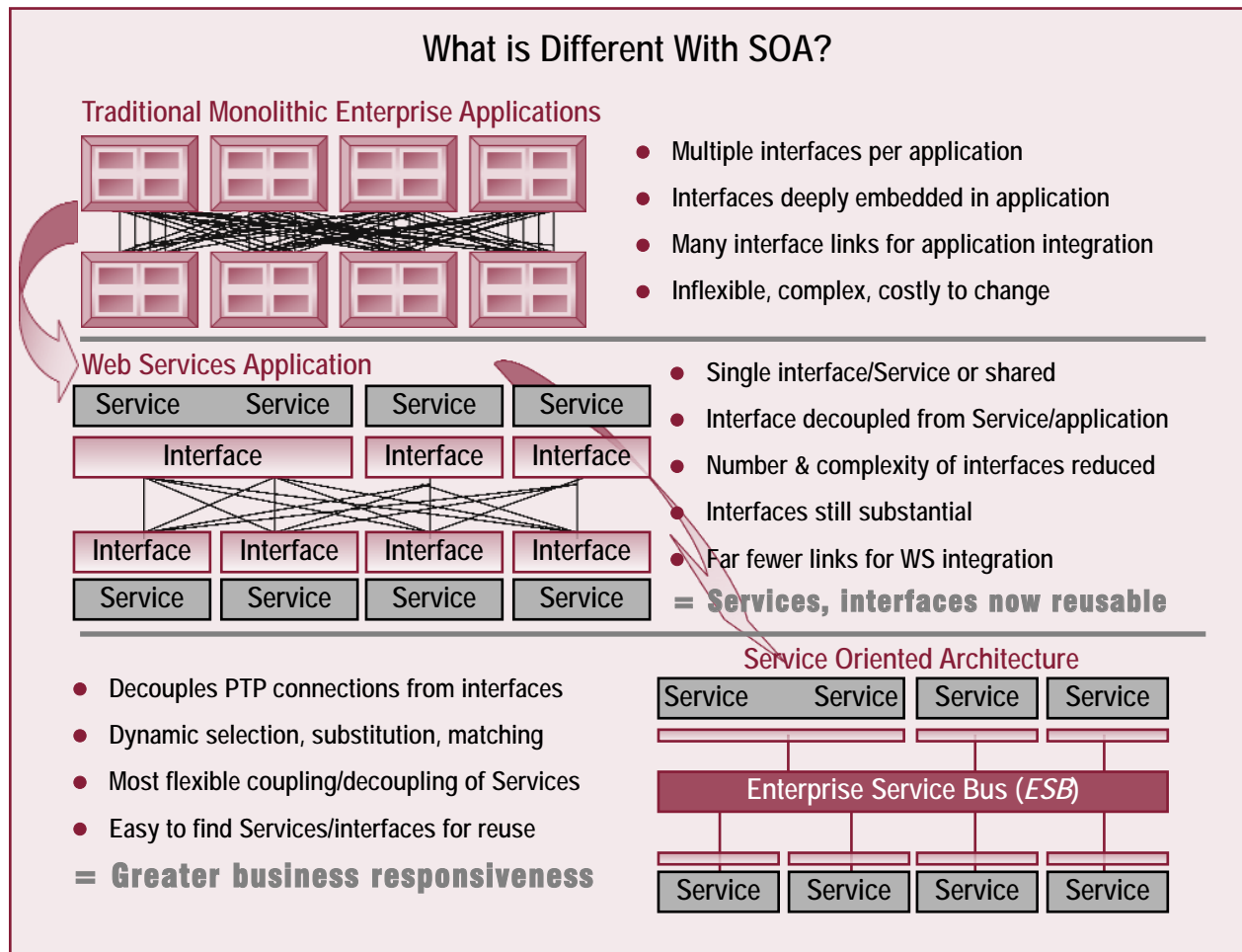


Figure 7: What is so Different With SOA?

- **Traditional, Monolithic Enterprise Applications:** Shown at the top of Figure 7, traditional enterprise business applications architectures support numerous enterprise applications, each essentially monolithic, self-contained islands or silos. Each monolithic application normally had a significant number of embedded and/or proprietary/specific interfaces. A typical large enterprise application architecture often contained 100 enterprise applications, each with 10 or 20 embedded interfaces. Each monolithic application itself was complex, hard and costly to change, and had its business logic and workflow deeply hard-coded into the system. Integrating such monolithic applications by implementing point-to-point links between specific interfaces was difficult, time-consuming and costly. This architecture also needed large numbers of integration links, shown by the links “spaghetti” depicted in the diagram. Each time an application itself changed, many of its integration links were “broken”, and required rework, causing heavy maintenance burdens, and preventing rapid change or flexibility. Traditional enterprise application integration middleware improved this integration challenge, by providing standard adapters, and by interposing a “mediation hub” that translated messages from one application interface to that required by another, reducing point-to-point development effort.

- **Web Services:** Web services architecture, shown in the center of Figure 7, replaces monolithic enterprise applications with a collection of independent business software services that are much more granular than the monolithic applications they replace. 5, 10 or 20 “business services” might represent the same functionality as one monolithic application. Each business service exposes one interface that fully describes the service and its usage conditions and output, or several component services may share one interface. The interface is therefore decoupled from the service itself, not embedded, and is thus easier to change. Since services are completely independent, they can be linked in many different workflows or sequences easily and quickly, providing business flexibility. A single common service can also be reused many times in different applications, reducing development effort, time and cost. The number and complexity of the interfaces needed is considerably reduced, and the interfaces are standardized. Web services integration, relying on Web services open standards, is much easier, faster and more flexible. The interfaces themselves remain relatively substantial, to accommodate the diversity of interconnections with other services this architecture implies. Web services themselves can be constructed from existing application assets such as CICS or IMS transactions, be new components written in J2EE™ or .NET Web services programming models, or be packaged application components or services offering Web services interfaces, or connected through standard adapters.
- **Service Oriented Architecture:** SOA, shown at the bottom of Figure 7, extends Web services architecture primarily by interposing what is known as an **Enterprise Services Bus (ESB)**. Each service interface is connected only to the ESB, which automatically handles all the linking and mediation of communications between the business software services. Essentially, SOA decouples/eliminates the point-to-point connections needed in Web services completely. In SOA, the service interfaces, which now need only communicate with the ESB, become much simpler and smaller, the total number of links in the integrated architecture becomes far smaller, and maximum flexibility to re-orchestrate or re-choreograph new **composite applications** from the business services is obtained. The ability to reuse business software services is also maximized and made simpler. Because the interfaces are smaller and simpler, it becomes easier to find and understand what each available service does, so discovery is faster and easier when seeking available services to reuse in a development by searching applicable **services registries**. **Business process modeling** can be used to define, refine, create and test the business processes and workflow. Not shown in the diagram, most definitions of a full SOA today also include a **business process workflow engine** or **process server**. This executes **business process workflow language** specifications of the desired composite application workflow, invoking the appropriate business services in the correct sequence, handling the business events that occur, and guiding execution of the business process. **Business process monitoring** of the real-time operation of the whole business process then becomes possible, and is another essential component of a full SOA approach.

SOA Brings Profound Business and IT Benefits

The deceptively simple concept of SOA, together with Web services, now offers tremendous transformative power to the whole realm of business application software development, deployment and integration. The differences are profound and the business benefits of SOA are compelling. We summarize the business and IT benefits of SOA in Figure 8, and discuss each of these below.

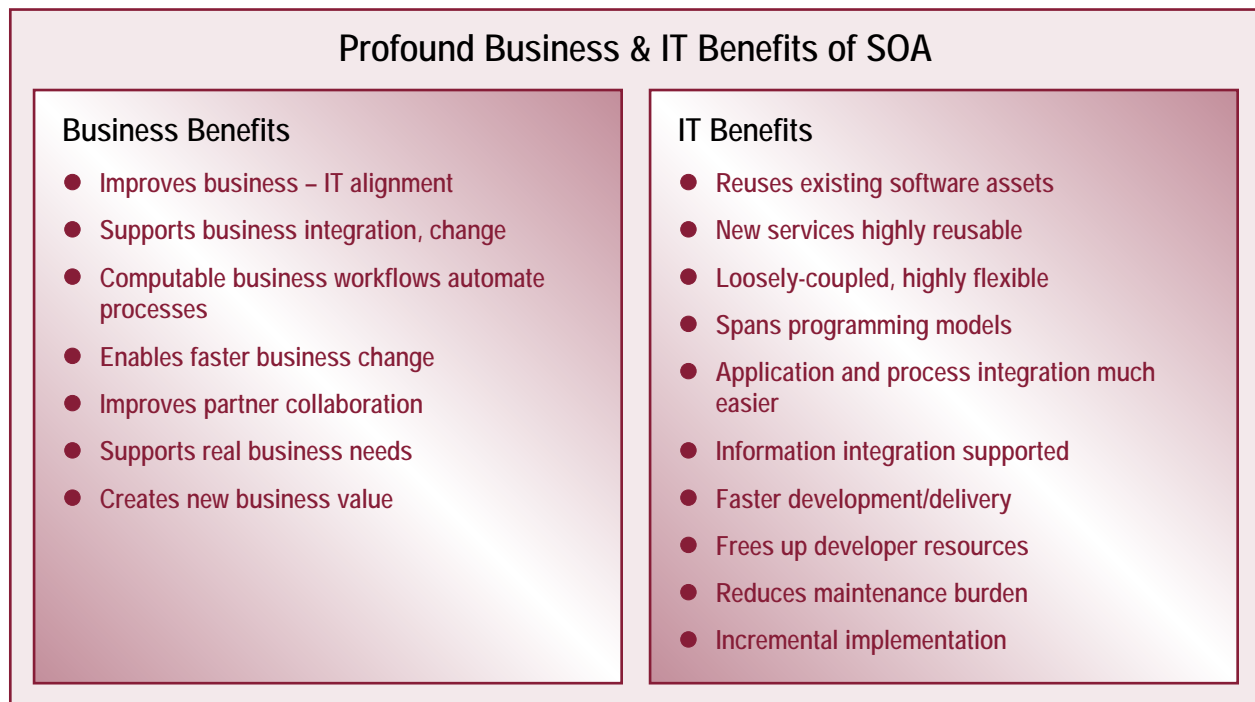


Figure 8: Profound Business & IT Benefits of SOA

The main business benefits of SOA adoption include:

- **Supports Business Integration, Change:** SOA provides a methodology and framework for documenting enterprise business process capabilities and supports business integration and consolidation activities.
- **Enables Major Business Process Improvements:** SOA supports and enables much more direct focus on the core business processes and how they can be improved, speeded, refined and optimized, by **supporting business process modeling and simulation** that allows proposed improvements to be tested and evaluated before they are deployed. This is a major advance.
- **Improved Business-IT Alignment:** Business process modeling of business workflows enables much closer and faster alignment between the business and the IT organizational teams, and thus between the core business processes modeled by business analysts, and the companion SOA composite applications, constructed to support them by IT professionals. This crucial alignment has long been amongst the biggest challenges in IT, and SOA offers major improvements here.
- **Reuses Existing Software Assets:** Existing applications, transactions and databases can be relatively easily converted into **software business services**, and reused in new business workflows and processes, without change to their underlying technologies.
- **Enables Faster Change:** The greater flexibility and adaptability of SOA composite applications allows faster and easier adaptation to today's higher rates of business change. SOA applications can be re-orchestrated or re-choreographed, to link in additional or updated business services, much more quickly and easily than with all previous and traditional application software architectures.
- **Supports Real Business Needs:** With business focus once again back on top-line growth, business agility and flexibility to respond quickly to market and business changes has risen to the top of executive and board agendas. For too long, IT has been unable to respond fast enough or flexibly enough to such business demands, primarily because it has been bogged down in supporting the complex enterprise applications infrastructures we discussed above. SOA brings a radical advance, enabling a new and higher level of IT flexibility, responsiveness, closer business alignment and greater speed in delivering the business application solutions needed.
- **Create New Business Value:** By enabling new business applications for new business models, collaborations and ventures to be delivered much faster, SOA helps enterprises create new business value and capture market opportunities more quickly and effectively. It helps enterprises meet today's pressure from customers and shareholders to drive top-line growth, and to keep the bottom line in check
- **Supports Mergers, Acquisitions:** Business combinations, mergers and acquisitions have long presented difficult challenges in merging and integrating the separate businesses to yield the business gains and growth, synergies, and cost savings that justify the combination. Integrating the often disparate IT applications and systems of the combined organizations has often proved difficult, costly and time-consuming, often delaying the realization of the anticipated/desired synergies. A SOA approach offers far easier, faster and more flexible systems integration, and the opportunity to embed the best business processes from both sides of the combined organization, in their new operating model.
- **Supports Outsourcing, Offshoring and BPO:** With the greater transparency, visibility and clarity of business processes and business models allowed by SOA business process modeling, it becomes much easier and clearer for enterprises to decide which parts of their process exploit core competencies and should be sourced in house, and which should be handed off to suppliers, partners, outsourcers or other external service providers such as BPO vendors. By enabling flexible, adaptable, componentized IT applications running over the Internet, SOA allows end-to-end composite applications to be used, where appropriate, not only across the enterprise itself, but by its chosen partners, suppliers, and service providers.
- **Improves Partner Collaboration/Integration:** Implementing a SOA improves communication and collaboration, not only within the business, but also with key business partners, getting the right information to the right people at the right time. With this more seamless information flow, the whole business ecosystem can react in real time to market changes, and more easily modify business processes. This is much easier and economic to implement with SOA than with earlier generations of partner integration technology, such as EDI and earlier B2B approaches.

The IT benefits of SOA are also broad-ranging, and include:

- **Software Services Highly Reusable:** Software **business services**, both existing and newly built, are highly reusable, reducing future development, duplication and maintenance effort, time and cost.
- **Spans Programming Models:** **Business services** and **composite applications** can inter-operate over different development technologies (*such as Java and .NET*), hardware and operating systems platforms, providing a easier way of integrating the complex, distributed, heterogeneous IT infrastructures that are so widespread.
- **Loosely Coupled, Highly Flexible:** Unlike traditional object-oriented architectures, SOAs comprise **loosely-coupled**, highly-interoperable business software services that can be quickly and easily combined (*orchestrated or choreographed*) into new composite applications, and offer a far higher degree of flexibility.
- **Computable Business Workflows:** High-level **business workflow languages** such as **BPEL4WS** or **WS-Coordination** take the services concept an important step further, by providing a means of defining and supporting computable business processes workflows. Such business processes can operate faster, more reliably and much more consistently.

- **Reduces Maintenance Burden:** The crushing burden of monolithic enterprise application maintenance and support, and of point-to-point integration maintenance and support (*which represents a big cost at many firms*), is reduced under SOA, because of services reuse, decoupling, and the much simpler integration approach.
- **Incremental Implementation:** Earlier enterprise software architectures (*for example distributed object models*), essentially required an unrealistic “big bang” or “rip-and-replace” of all existing applications to deliver their promised benefits. By contrast, SOA can be implemented incrementally, business process by business process, at the pace and scale the customer wishes, with the benefits yield increasing rapidly as SOA coverage expands. Key is the large-scale reuse and restructuring of existing enterprise software and data assets into business services for reuse under a SOA.
- **Frees-up Developer Resources:** SOA takes care of many of the usual “plumbing” and infrastructure concerns, reuse aids developer productivity, and maintenance burdens are sharply reduced. This means SOA users can free-up valuable developer resources to work on new business initiative application solutions, accelerating business change and adding more value.
- **Information Integration Supported:** Most large enterprises today operate numerous different databases and data files, across diverse database software and hardware systems, to manage the data used by the enterprise. Business integration requires not only business process integration, but also enterprise data integration, and SOA supports the newer enterprise information integration middleware well, so that new composite applications can benefit not only from combining business software services, but also from enhanced information integration.

The large majority of CEOs expect to transform their enterprises to become more responsive to customer and partner demands and business change over the next several years. But more than half the CIO respondents in a recent study considered their ability to implement such business change had been substantially constrained by inflexible IT. SOA offers the only definitive resolution of this bottleneck, and must therefore move to the top of CIO agendas, amongst all the enterprises yet to adopt the SOA approach.

Our Analysis

SOA is a newer architectural style of distributed computing. It is based on creating loosely-coupled, independent, reusable business software services that are interoperable, technology-neutral, and that can be choreographed or orchestrated into a composite application running on the Internet, to support a transformed or modernized business process workflow, and to integrate partners, customers and suppliers. Because business software services are reusable, new applications can be built more quickly. Business services can be created from existing software assets and packaged applications, a further level of reuse, as well as being new-built in the J2EE™ or .NET programming models. SOA provides much greater business and IT flexibility and adaptability, because composite applications can easily be changed and adapted, with integration almost completely automated by the architecture. Changing SOA-based applications to reflect future business change is thus dramatically easier and faster.

SOA is based on, but extends, **Web services technology** and exploits the broad, maturing set of open Web services standards needed for large-scale deployment, after a successful and unprecedented industry-wide standardization effort led by IBM and supported by Microsoft, over the past several years. These now enable a SOA to provide seamless interoperation of Web services-based business software services to run smoothly across different hardware, operating system and middleware platforms, and across different programming models, over the Internet, under open standards.

Traditional, monolithic enterprise business software applications architectures suffered deep, longstanding and intractable issues of slow and costly development, high maintenance costs, great difficulty and cost of application integration, and poor flexibility and adaptability. These heavy constraints have long prevented IT groups from responding and adapting to new business needs and changes fast enough, and supporting such portfolios has absorbed much of IT’s development and support capacity in many companies. A dramatically superior approach has therefore long been needed, and in our assessment, SOA is without doubt the most important and beneficial advance in business application software architectures seen to date.

SOA goes considerably further than the valuable advances provided by Web services, to create an environment where, for the first time, tight alignment between the business and its core business processes, and the IT team, and the business applications it provides to support the business, can easily be achieved.

With a SOA in place, enterprises can simplify and accelerate new business applications development and deployment. Developers can focus on writing innovative applications that directly support core business processes, without worrying about systems infrastructure issues. Because Web services are modular and they communicate with one another using open standards, services can easily be recombined and reused when business processes change. This dramatically cuts down on the time it takes to develop new applications, and makes the whole organization more responsive to business changes, new market opportunities, and competitive threats, etc.

SOA, using Web services, now offers tremendous transformative power to the whole universe of business application software development, deployment and integration.

SOA, using Web services, now offers tremendous transformative power to the whole universe of business application software development, deployment and integration. We assessed that the differences SOA offers over all previous enterprise software architectures are profound, and the benefits of SOA are compelling, particularly to the business itself, but also to its IT organization. We highlighted and discussed the major generic benefits to business and IT above.

It is therefore not surprising that the momentum of SOA adoption by enterprise IT users, package software ISVs and vendors is strong, as we illustrated in Section 2 Figure 1 on page 9.

In view of these universal and compelling SOA benefits, we urge all enterprises yet to begin implementing a SOA to begin this important journey, and those who have begun to redouble and accelerate their efforts. As they do so, questions of what roles major hardware platforms such as the zSeries/System z9 mainframes should play in SOA initiatives will be in many users' minds, and we address this in Section 4. All will also wish to know what they need to begin implementing an enterprise SOA, and who they should partner with to best support them on their journey. We define what is needed in Section 5.

4. The Mainframe and SOA – Marriage Made in Heaven?

Introduction

The resurgent IBM zSeries and now System z9 mainframe (*and their predecessors*) have long played a central role in thousands of larger enterprises. It is the hardware platform that does the “heaviest lifting” and runs the largest, most demanding and most mission-critical business application workloads and databases of those enterprises over the last 4 decades. As we related in Section 2, the mainframe has been substantially transformed in technology, economics, open standards support, scalability, and in its advanced software stack and tools, over the last five years. Its already legendary security, reliability, availability, resource utilization efficiency and automated workload and systems management have also all seen considerable further improvement, most recently with the new-generation System z9 109 mainframes that shipped from September 2005. Over \$5B of sustained IBM investment, as well as the deployment of up to 5,000 staff over the half-decade, have resulted in the industry's most advanced, productive and cost-effective enterprise system for large workloads, and triggered a resurgence of the mainframe in market share and esteem.

What role should the mainframe play in enterprise SOA deployments? Why is the mainframe platform of central importance when embarking on SOA? How have the above advances in mainframe technology equipped the platform for SOA?

Wealth of Traditional Software Assets and Enterprise Data on Mainframe

The first obvious and compelling consideration is that several trillion dollars worth of traditional mainframe application software assets, created over many years, with thousands of associated mainframe-resident databases, are running on the platform at over 10,000 sites in the world's larger and largest enterprises. One of SOA's crucial advantages is that it allows and supports the incremental reuse of the immense repository of valuable business logic and data represented in these tens of thousands of enterprise applications and data bases. They can be pried free from their current monolithic enterprise application architectures, into the more granular, flexible and reusable software business services that can be reused in the new SOA enterprise business applications systematically over time. The mainframe platform is by far the largest host for custom-written, large-scale enterprise applications in the world, and these mainframe-resident business software services will naturally form the heart of the majority of enterprise SOA environments for this reason alone.

CICS and IMS business transactions, for example, will be a prime source of “business services”, where traditional application transactions can be relatively easily decomposed

CICS and IMS business transactions, for example, will be a prime source of “business services”...

and wrapped as Web services of appropriate business functionality, whilst continuing to exploit the rock-solid, high-performance, high-security, underlying mainframe transaction processing technologies that underpins them.

Powerful tools to facilitate the discovery, analysis and decomposition of mainframe application and data assets, and their migration forward into composable, reusable business software services for redeployment under a SOA are already well-established and available, to speed and simplify this process.

The evolution from traditional enterprise application to SOA is likely to take quite a number of years to complete for most larger enterprises, but can be tackled step-by-step, and business process by business process, focusing first on the most critical business processes for transformation and improvement.

It is also often estimated that some 80% of the world's machine-readable enterprise data is hosted by the mainframe platform. Enterprise information integration is a crucial part of the SOA story, and easy, direct, low-latency access to this wealth of existing, mainframe-resident files and databases is an equally compelling reason to host much of the new generation of SOA-based applications on the mainframe.

Large Inventory of 2000-Decade New Workload Applications on the Mainframe

Whilst everyone acknowledges the scale of the traditional mainframe software and database inventory described above, fewer realize the explosive growth that has occurred since 2000 in customers running new-generation workloads on the mainframe platform.

Much of the resurgence in MIPS capacity growth (*75% of new MIPS sold since 2000*) of the growing mainframe installed based has actually been driven by new-to-mainframe workloads, not by volume growth in the usage of traditional mainframe OLTP and batch application, over this decade. E-business and Internet applications, enterprise portals, and the Linux platform bringing open source, new Linux infrastructure and new business applications package workloads to the mainframe are one group. New-generation, customer-built, enterprise J2EE™ applications, the extensive business integration developments of recent years, and major enterprise packaged applications such as SAP and Siebel running on the mainframe, are the other principal new workloads in this category.

For example, over 1,700 mainframe Linux installations have been made to date. These meld the open source software world with the uniquely high quality of service of the mainframe, and are now running a variety of Linux infrastructure, business intelligence, and modern packaged applications on the platform alongside z/OS workloads, both new and traditional.

There has been widespread and rapidly growing deployment of the WebSphere J2EE™ middleware portfolio, including the industry-leading WebSphere Application Server (WAS) on the platform (*WAS for z/OS is heavily optimized to fully exploit unique mainframe QoS attributes*). These have made WAS the premier software platform to build new-generation applications software components on the mainframe, many thousands of which are now in production.

This decade has also seen significant deployment of leading packaged enterprise applications, such as SAP and Siebel amongst others, on the mainframe platform, both in central database serving roles, for application serving duties, and often both. This class of previously rather monolithic packaged applications are themselves being modified by their vendors to offer SOA access to their functionality as business software services callable from other environments, which will, in time, facilitate their easier integration into SOA environments.

These more modern and recent software assets will, in most cases, also form a central part of SOA migration, with their technologies lending themselves better to Web services and SOA adaptation and redeployment than traditional mainframe applications.

Unique Mainframe Business Values/QoS, and Advanced Technologies

In Section 2, we sketched some of the unique business values offered by today's mainframe platform, extended by the new System z9 109 generation, based upon customer ratings analyzed in our earlier research. These mainframe business values and the associated QoS strengths, have additional power and value when the mainframe is used to host and run the new-generation, SOA-based enterprise applications described in the prior Section. In Figure 9, we highlight why and how these mainframe values are of special importance and value when running larger-scale SOA business services applications on the platform.

Top 9 Customer-rated Mainframe Platform Business Value Strengths – Software Strategies	
Business Value Strength*	What this Means for SOA Applications on Mainframe
Lowest Cost of Outages:	Extreme mainframe reliability and availability means mainframe-hosted SOA applications will be always available, for minimum outage costs, even more important than usual when whole core business processes and partner ecosystems are connected by SOA applications.
Lowest Security Breach Risks/Costs:	Bullet-proof, highly-defended security strengths ensure mainframe-hosted SOA applications are fully protected, require lowest effort to keep secure, and eliminate the costs and risks of security breaches so challenging on some other IT platforms.
Highest Resource Use Efficiency/Utilization:	Ensures dependable, rapid performance of mainframe-hosted SOA business services and applications, fully using hardware resources for highest efficiency and low per- user costs, through leadership virtualization and workload management technologies.
Highest Scalability & Capacity:	Granular capacity and extreme scalability (<i>17,800 MIPS single system with System z9</i>), to manage and run the largest global enterprise SOA business applications reliably, securely and cost effectively.
Lowest Total Cost of Ownership (TCO) & Cost/User:	Other characteristics above, extreme resource efficiency, and much-improved price/performance brings lowest business process cost per-user and per-task for larger enterprise SOA applications, driving down business process/transaction costs.
Low Risk via World-class Support:	IBM's legendary mainframe support and service eliminates customer platform choice risks for deployment of enterprise SOA on the mainframe platform.
Facilitates Reuse/Modernization of Mainframe Application Assets:	Covered in previous text subsection above.
Highest Performance & Quality of Service (QoS):	Policy driven, self-optimizing mainframe workload management and advanced virtualization delivers business-prioritized, assured mainframe-hosted SOA application performance and QoS. This enables the enterprise to meet demanding business Service Level Agreement standards for the new-generation SOA business applications, and for the business processes they are supporting.
Much-improved System Costs:	Major further improvements with new IBM System z9 extends above "Lowest Total Cost per User" (<i>and per business process/transaction</i>) advantage above.

* Source: Related Software Strategies Research, page 55, item 3.

Figure 9: Top 9 Customer-rated Mainframe Platform Business Value Strengths – SOA Implications

Today's mainframe platform deploys deep technological leadership strengths that enable it to deliver the unique business values above, which we isolated and highlighted in an earlier research paper. These technology strengths make the case for enterprises to host and run much of their larger, new-generation SOA enterprise applications on the mainframe platform itself. We detail these strengths, and consequent SOA advantages, in Figure 10.

Top 10 Mainframe Platform Technology Leadership Strengths – Software Strategies	
Technology Leadership Strength*	What They Mean for SOA Applications on Mainframe
Leadership Resource Virtualization:	The most sophisticated, advanced virtualization on any platform enables complete, secure isolation of SOA applications on separate, dynamically resizable partitions (<i>up to 60</i>) and/or hundreds of virtual servers concurrently. Many different business software services and applications can optimally share CP, memory, I/O and networking resources, and host development, test and production images, all on a single mainframe server. Memory speed interconnections between business services, within and across partitions, gives orders-of-magnitude higher performance/lower latency than distributed cross-platform deployment across the much slower public/private networks and switches they must use.
Near-continuous Availability:	With large-scale SOA enterprise composite applications, supporting faster-cycling core business processes, spanning not only within the enterprise, but also across ecosystems of partners and customers, those software services must be available almost all the time. The mainframe platform delivers the highest availability amongst standard commercial computing platforms, improved further with the new System z9.
Extreme Security & Business Resiliency:	Ensures dependable, rapid performance of mainframe-hosted SOA business services and applications, fully utilizing hardware resources for highest efficiency and low per- user costs, through leadership virtualization and workload management technologies.
Intelligent Workload Management:	Policy-driven, self-optimizing workload management ensures that business service quality goals are consistently met for all enterprise SOA applications workloads that are hosted on the mainframe itself. This enables the enterprise to meet demanding business Service Level Agreement standards for the new-generation SOA business applications on the mainframe.
64-bit z/Architecture:	The 64-bit z/Architecture of zSeries and System z9 mainframes enables large virtual memory addressing, supported by much larger physical memory, than on prior generations. This allows large SOA applications, comprising many business software services, to run concurrently in memory, and to intercommunicate with each other at memory speed, giving superior performance and response time.
Optimized Support for Java/J2EE™ & Open Standards:	Years of intense development have brought the mainframe a rich, mature, robust and highly scalable Java/J2EE™ programming model software platform for building and deploying new business software components ready-made to plug into a SOA architecture. Also, a decade of efforts to embed open standards at every level of the mainframe stack, have today made it amongst the most open of platforms, specifically in a SOA context, with comprehensive support for Web services.
Deep Business Integration Support:	In most enterprises using mainframes, the platform has long been a central point for integration with other distributed computing applications and platforms. With its now-extensive open standards support, and what we found to be the industry's strongest set of business and application integration SOA middleware, the mainframe is ideally equipped for the extensive new-style integration implicit in enterprise SOA architectures.
Special Designated Workload Processors:	Dedicated and low-cost Linux (<i>IFL</i>) and Java (<i>zAAP</i>) mainframe specialty processors, free of mainframe software license costs, free up general purpose PUs, and substantially improve the cost-effectiveness of running these important workloads on the mainframe, which will be central to many SOA initiatives.
Software Workload and Sub-capacity Licensing:	Unlike other platforms, mainframe middleware and software is now licensed according to the size of the partition it runs in, or on actual measured average capacity usage, not according to total server capacity or total CPUs (<i>as on most UNIX SW</i>). This makes it affordable to begin SOA deployment on a small, single partition, and slowly expand capacity as the new-generation SOA application portfolio grows, encouraging adoption and allowing pay-per-use software costs in-line with business growth.
Extensive Support for Composite Applications, Web Services, & SOA:	IBM has evolved, refined, extended and now completed a rock-solid, comprehensive middleware software run-time platform, and a suite of advanced tooling for SOA, optimized for the mainframe but also available on other platforms. We review this portfolio more fully in Section 7.

* Source: Related Software Strategies Research, page 55, item 3.

Figure 10: Top 10 Mainframe Platform Technology Leadership Strengths – Software Strategies – SOA Implications

Other Distributed Computing Platforms in the Enterprise

Most large enterprises today not only continue to use and grow their mainframe platforms, but are also using large numbers of the other distributed computing platforms that proliferated during the 1990s. UNIX systems of all sizes are widespread, although sales had declined. High-volume, standardized Intel-based servers were deployed in their hundreds or even thousands in some enterprises (running *Microsoft Windows*, and now increasingly *Linux*). Blade servers have been the fastest growing class of server platforms. The IBM iSeries continues to thrive in many medium-sized businesses.

SOA offers a new level of application software virtualization, abstraction and integration that can exploit business software services created as Web services on any and/or all of these platforms.

The resulting IT infrastructure complexity, soaring system support costs, and low utilization of such complex, heterogeneous environments is leading many enterprises to rationalize, virtualize, consolidate, and partially centralize these infrastructures. These efforts aim to render them more manageable, efficient and economic, a process that we expect to continue for several more years. Some of this consolidation and rationalization has fuelled the resurgence and growth of new workloads on the much more manageable mainframe platform.

SOA offers a new level of application software virtualization, abstraction and integration that can exploit business software services created as Web services on any and/or all of these platforms. It can orchestrate these into new enterprise SOA composite applications that support the enterprise's business processes far more easily and effectively over the Internet, or an IP network, than with previous integration technologies.

However, there remain difficult challenges in managing, securing, backing-up and recovering, cross-platform workload management and performance optimization of such multi-platform SOA enterprise or extra-enterprise applications that suggest some form of enterprise coordinating hub for SOA and data would add considerable value.

New Enterprise Hub Roles for System z9 109 Mainframes – Notably SOA and Data

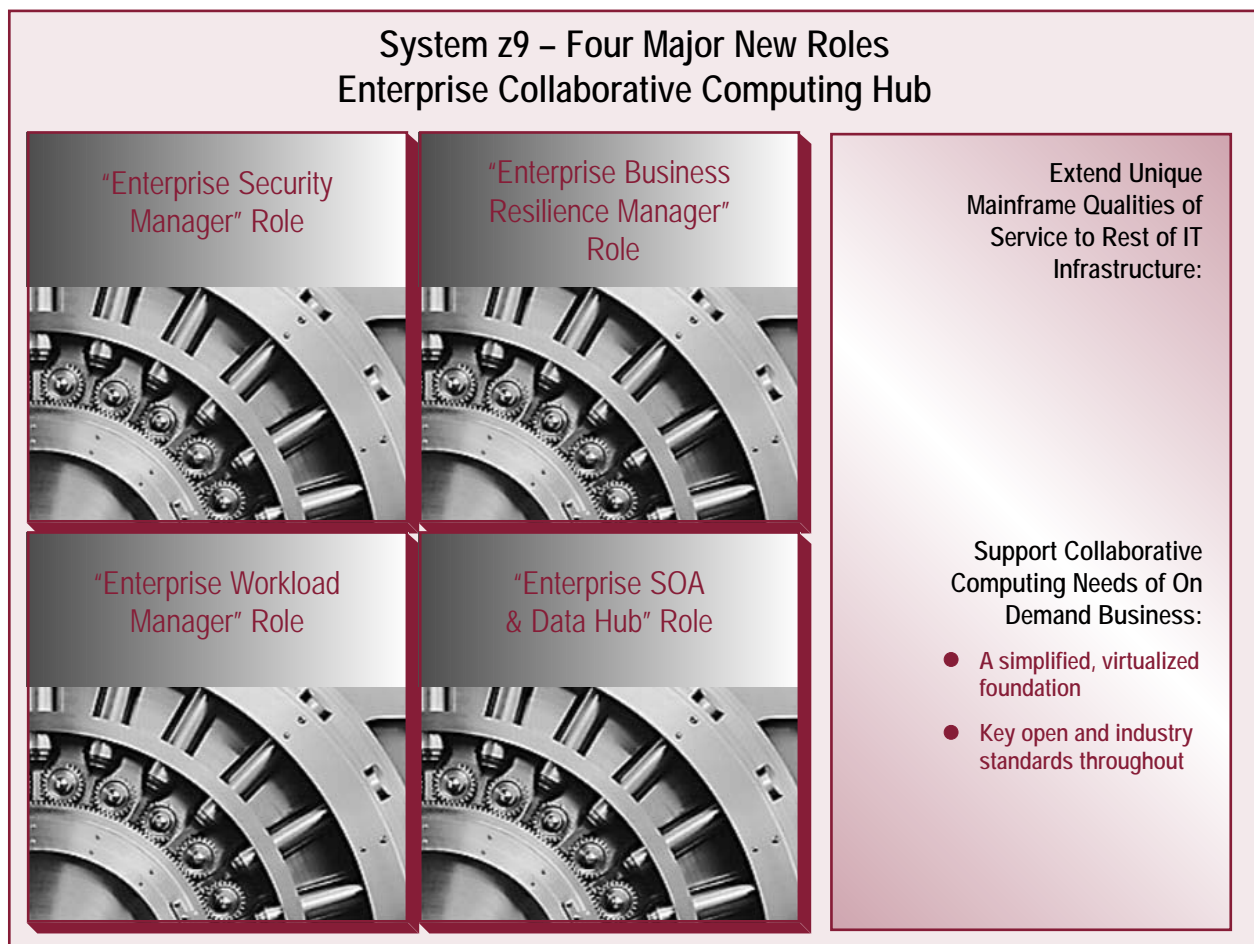


Figure 11: System z9 – Four Major New Roles as Enterprise Collaborative Computing Hub

The new System z9 109 mainframes (*and zSeries systems*) are designed to not only fulfill well-established, current mainframe roles at a new, higher level of scale, with reduced risks through extended security, and with further improvements in mainframe economics. The vision now calls for the mainframe to also assume four important new “Enterprise-wide Hub” roles at the heart of cross-business ecosystem, collaborative computing.

The aim is to enable the mainframe to bring its outstanding virtualization, QoS, extreme security, and advanced intelligent workload management to control and optimize heterogeneous, multi-tier infrastructures, not only within the enterprise, but also across customers’ ecosystems of collaborating partners.

With the System z9, IBM has now taken substantial steps along the roadmap to delivering on this “Grand Challenge” vision. The four new roles for the mainframe to serve as an Enterprise-wide Hub in large-scale, collaborative computing infrastructures are highlighted in Figure 11 (*on page 24*), and are:

- **Enterprise Hub for SOA and Data:** First in the context of this White Paper, IBM now proposes that the mainframe should become the enterprise hub platform for SOA and for enterprise data integration:
 - **SOA:** The mainframe, with major new IBM middleware software releases, is now equipped to fully support the next generation of enterprise business software applications, composite applications integrated under a SOA. The mainframe now provides a rock-solid hub for control, management, optimized workload management, enhanced security, and business resiliency for major SOA applications. Trillions of dollars worth of existing enterprise applications already reside on the mainframe, and many are now already being restructured into new composite applications under SOA. It is therefore a natural next step to leverage core mainframe strengths by utilizing the mainframe as the central hub for managing and maintaining new multi-platform, heterogeneous collaborative computing SOA applications for On Demand businesses. This includes not only those SOA application services actually running on the mainframe themselves, but the connected software services running on other enterprise platforms, and those of connected partners in the collaborative business ecosystem.
 - **Data:** The mainframe already has unrivalled capabilities to manage massive data volumes securely. It is already estimated to host some 80% of all machine-readable enterprise data by volume. With the enhanced data storage, security, advanced new Enterprise Information Integration (*EII*) and transformation middleware software, as well as newer releases of the established mainframe database management systems, DB2 and IMS, on the platform, the mainframe is now also well-equipped to play a central role as the most effective enterprise hub for managing, securing, protecting and sharing enterprise data across heterogeneous environments. With its tightly optimized mainframe integration with IBM’s high-performance enterprise storage systems, specifically the leading-edge TotalStorage DS8000 and DS6000 systems, and leadership storage virtualization software (*SVC and SFS*), the mainframe is powerfully equipped to fulfill this new role.
- **Enterprise Workload Manager:** Sophisticated, self-optimizing, policy-driven, cross-partition workload management has long been a key advantage that helped the mainframe deliver its exceptionally high QoS levels and efficient utilization of resources. The second new mainframe role is that of the enterprise workload manager. This has now become a reality, enabled by the IBM Virtualization Engine 2.0 platform with its extended Enterprise Workload Manager product. This extends well-proven and successful mainframe z/OS Workload Manager (*WLM*), Intelligent Resource Director (*IRD*) and Virtual Machine Resource Manager (*VMRM*) technologies to optimize and manage workloads end-to-end across heterogeneous, multi-tier applications to achieve set service policy goals. This breakthrough technology is ideal for SOA composite applications hosted in part on the mainframe, but also spread over other platforms.
- **Enterprise Security Manager:** To overcome and defend against the increasing number of security breaches and attacks reported, Software Strategies research found that the new System z9 is well-suited to become the enterprise security manager at the heart of enterprise infrastructures, extending its well-recognized leadership security strengths out to storage, and to other connected platforms. The System z9 brings substantial further security and encryption advances that enable this new mainframe “Enterprise Security Manager” hub role, bringing valuable new protection options we consider customers will warmly welcome. These advances include: securing data transported extra-enterprise; advanced new encryption; much faster Secure Sockets Layer (*SSL*) transaction processing; easier Internet security implementation for mainframe workloads; and enhanced network-based security with Cisco. These, together with the System z9 centralized key management capabilities, add further strength to the mainframe platform’s already legendary security. These extended security capabilities will be of particular value to enterprises deploying broad SOA applications over multiple platforms. This will fill a pressing SOA application need for centralized key management, enhanced encryption services, and central point for security management of the new SOA architecture.
- **Enterprise Business Resilience Manager:** The final new role is for the mainframe to provide extended Business Resiliency or Disaster Recovery/Business Continuity (*DR/BC*) services that not only embrace mainframe-hosted applications and data, but also those on other platforms in the infrastructure. Today’s mainframe environment offers the most advanced, sophisticated DR/BC options, as well as unrivalled capabilities to manage massive data volumes, and so extending these to serve wider collaborative computing networks makes considerable sense.

Our Analysis

IBM has invested heavily for over half a decade, pouring in over \$5B of investment and up to 5,000 staff, to now deliver in the latest mainframes the industry’s most advanced, productive and cost-effective enterprise system for large workloads, we found in a recent System z9 study. It has enjoyed a striking resurgence of the mainframe in market share and esteem as a result.

This White Paper finds there are compelling and definitive reasons why the mainframe should play a central role as the platform for many of the enterprise SOA application portfolio developments that adopting customers will be accelerating over the next several years.

Firstly, there is the wealth of existing traditional enterprise application software and data assets already running on the platform, containing much of the core business logic of the enterprise, and which can be migrated into business services for redeployment and use under an enterprise SOA architecture.

Secondly, and perhaps less well understood, five years of intensive new workloads deployment on the mainframe has created a large portfolio of more modern software workloads on the platform, many of which can be relatively easily adapted to plug-and-play in an enterprise SOA architecture.

Thirdly, the platform offers a number of genuinely unique business values that are highly relevant to, and supportive of, the new and demanding needs of enterprise SOA business composite applications, which cannot be readily or indeed at all be delivered by other platforms. We articulated and detailed these in Figure 9 on page 22.

Fourthly, a set of advanced technologies that underpin the business values of the mainframe above, are also highly complementary to enterprise SOA composite business applications, and can often best provide the performance, behavior, and characteristics customers must have for large-scale SOA applications. We explained and amplified these in Figure 10.

Finally, there are compelling arguments that heterogeneous, distributed, multi-platform IT infrastructures running next-generation enterprise SOA composite business applications need, and would be rendered much improved, by an enterprise hub for SOA and data. It is argued that this would provide a much needed single point of control and management, as well as superior cross-platform optimized workload management, enterprise-wide security management, and enterprise-wide business resiliency and continuity for the entire SOA architecture.

...there are sound, broad and well-founded reasons for the mainframe to play a central role in running and supporting much of the next generation of SOA collaborative applications on the platform...

No surprise that the prime candidate proposed for this role is the new System z9 mainframe. More surprising perhaps, to some, is how far and how fast plans to equip the mainframe to fulfill these vital roles have now advanced and are progressing, from their first October 2004 announcement.

We consider there are sound, broad and well-founded reasons for the mainframe to play a central role in running and

supporting much of the next generation of SOA collaborative applications on the platform, and for extending its strengths into the broader hub roles described. Mainframe and SOA, a marriage made in heaven? A good match for sure, at the very least!

5. Starting on Your SOA Roadmap

Introduction

In Sections 2 and 3 we explained what SOA is, why it is so important, and highlighted the widespread, major and enduring business and IT benefits that it brings to its adopters. We also outlined the rapid pace of industry-wide adoption that has already occurred during the last two years. This is now accelerating, with the full 2005 availability of the critical mass of open industry standards, SOA-supportive middleware engines and tools, and the fast-growing body of experience, best practices, methodologies and SOA services that are all needed for "early majority" customers to begin adoption.

In Sections 2 and 4, we also reviewed the continuing resurgence and transformation of the IBM mainframe, and the broad-ranging strengths it offers today as a foundation platform for enterprise SOA initiatives.

In this Section we offer our advice and guidance on where and how to begin SOA adoption, on some of the business and IT considerations that should be evaluated, propose guidelines on what users need for SOA adoption, and provide an overview of the "SOA marketplace". We also offer guidance on selecting a suitable vendor partner to assist and support your SOA journey.

Getting Started with SOA – Focus on Business Priorities

In Section 5, we highlighted and stressed that SOA is a business-centric and transformative technology that offers immense business benefits when correctly deployed, as well as compelling IT benefits. It follows that a business priorities-led and business top-management supported approach to SOA deployment is essential. The enterprise may already have a clear view of which parts of its overall business model, and of which of its core business processes, offer the greatest opportunities for improved top-line growth, increased cycle times, and/or reduced costs. Clearly, it makes sense to prioritize and focus SOA projects on these high ROI areas directly in line with enterprise business strategy and priority.

Smaller, less "mission-critical" SOA pilot projects are justified for proof-of-concept, staff skill and knowledge development, and tool/partner selection. However, these should, in our view be of relatively short duration, be targeted to worthwhile business improvement areas offering real benefits and high ROI, and form a short step on the overall SOA adoption roadmap of the enterprise. They can, however, help build early in-house trust, confidence and quantification of benefits.

Where an enterprise is not yet clear which are the critical business processes for improvement, or their relative competitive strengths, it will often be effective to engage business consulting services. By providing in-depth expertise in the latest business models, business processes and best-practices for the vertical industry and/or horizontal processes concerned, experienced consultants can help the organization more quickly assess the whole current business model and processes set. By systematically assessing which processes are core competencies, which are leadership level or lagging segment averages, and mapping these to overall business strategy, advisors can help enterprises quickly isolate and prioritize the highest priority improvement areas. Such studies can also highlight the non-core business processes or services that could best be considered for outsourcing, off-shoring, or BPO service partner provision.

Proven, systematic business methodologies that embed deep industry best practices can assist rapid business-wide convergence on a common view. For example, the Component Business Models offered for most major industries by the Business Consulting Services division of IBM Global Services offers rich, proven methodology and knowledge base of this type. Unisys' 3D Visible Enterprise approach is another.

SOA Readiness Assessment

In meeting many different enterprises, we find today many varying levels of business and IT integration, Web services adoption, and relevant SOA skill-bases, depending on what path the company has followed over recent years. A useful starting point for planning a SOA strategy and a new SOA enterprise application architecture is to undertake a SOA readiness assessment that highlights where on the capability-maturity curve for SOA the enterprise's developments have reached to date. The results of such an assessment will clearly highlight the areas that need to be advanced for the enterprise to migrate further towards full SOA adoption and the transformation towards becoming a fully real-time or On Demand Business.

One leading SOA maturity model, using seven primary levels of capability-maturity, is shown in Figure 12 and illustrates the point well. In 2005, the majority of enterprises are distributed across levels 2, 3, and 4. The early phase of SOA adoption really begins at level 4, so this majority group has one, two or three levels to climb to get to the SOA starting gate. The SOA early-adopter minority is mostly at levels 4 and 5 in their SOA software efforts, but with considerable attention being paid to adopting/applying virtualization across many parts of their infrastructure (*which is level 6*).

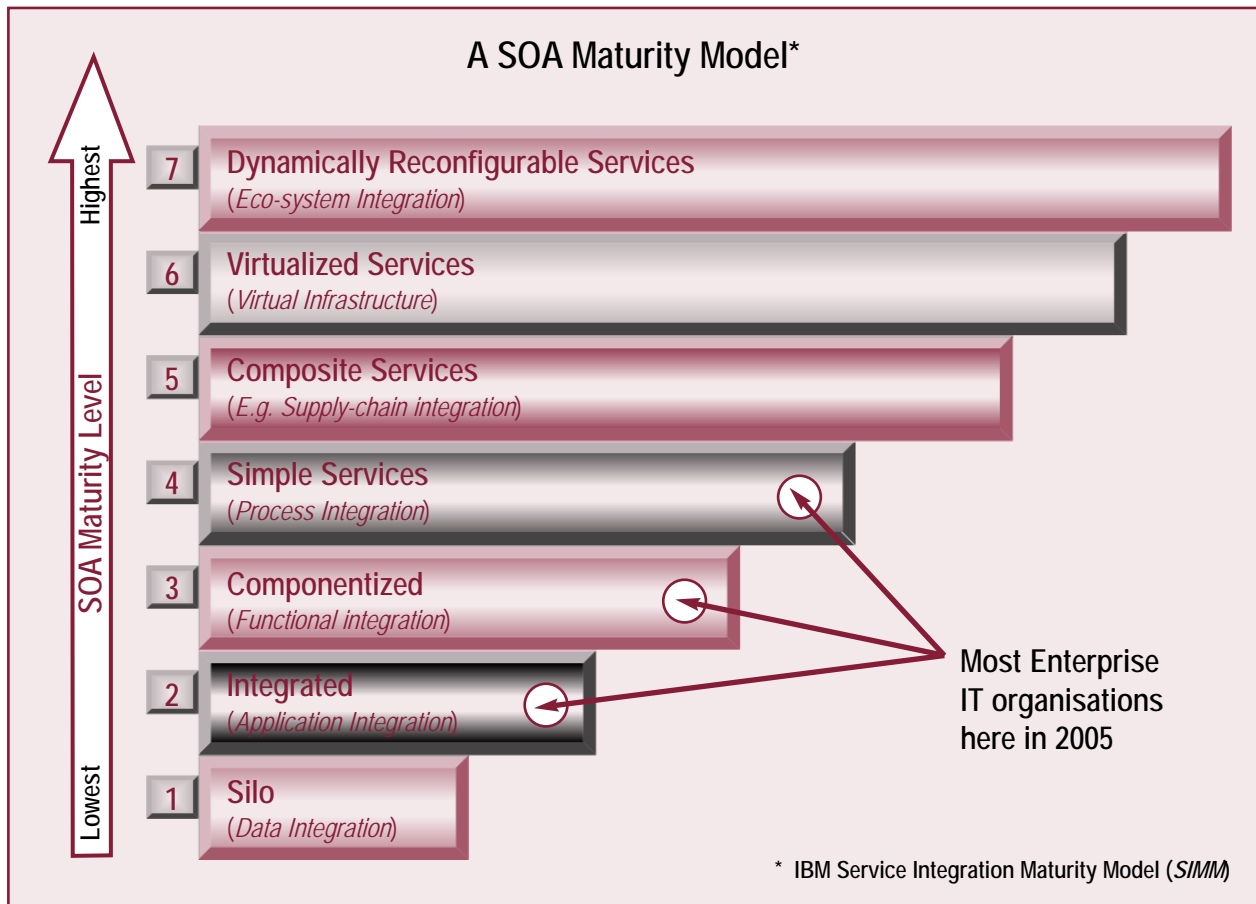


Figure 12: A SOA Maturity Model

Several SOA readiness assessment processes and models have been published, some as documents, but also as Web-based, self-service tools. These can help an enterprise baseline a good initial positioning summary of where they stand on the capability-maturity curve, and what their next steps should consequently be. Such assessments are also available as service offerings or on-site workshops from leading SOA consulting providers, which can provide a more comprehensive, team-based assessment.

SOA Lifecycle and Staff Roles

It can often also be helpful to consider SOA from a lifecycle perspective and viewpoint. This can help clearly identify the different business and IT roles and staff functions that are involved over the lifetime of a SOA application, and can also help in understanding the mix of business and IT staff skills and capacities that are needed. This view of a typical SOA application lifecycle is shown in Figure 13, with the eight main lifecycle stages shown around the circle, from “model the business” to “optimize the running SOA application and business process” stages.

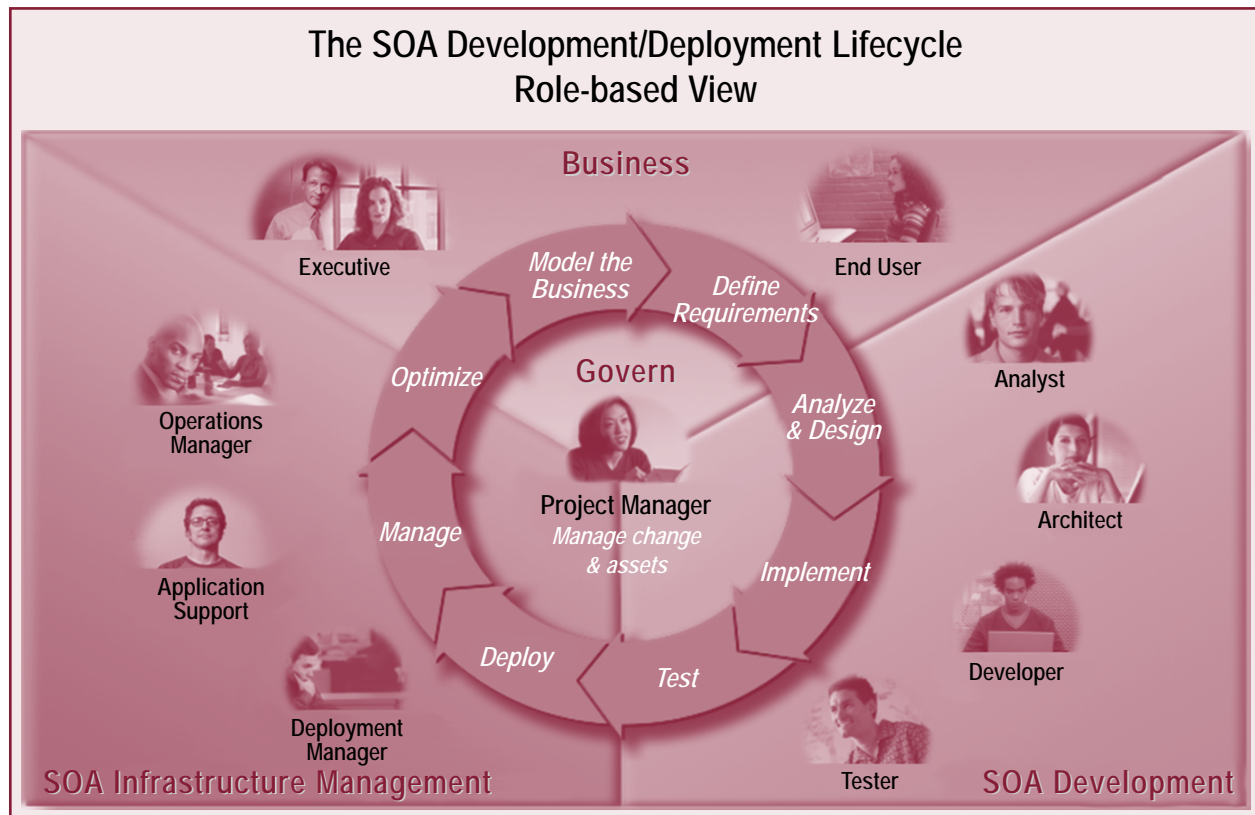


Figure 13: The SOA Development/Deployment Lifecycle – Role-based View

Four prime organization areas are involved:

- The **line of business organization**, for the business processes being covered (*with executive management, business analysts and representative end users*) who define the business design and requirements, create the business process models, and test/accept the system.
- The **IT SOA development organization**, commissioned to create the SOA application (*with its systems analysts, application architects, software and integration developers, and testers*) and which may be an in-house team, an IT development service provider team, or an offshore development team, or a mix of these.
- The **IT operations and SOA infrastructure management organization**, (*with its deployment management, applications and operations support, and infrastructure management personnel*) who deploy the completed SOA application into production on appropriate infrastructure, and support the production operation and optimization of the application over its lifetime.
- **SOA Program and Project Management**, the leadership function or team that drives, steers and manages both the enterprise's overall SOA strategy and program, and manages the individual projects within the SOA portfolio.

Given the importance, wide-ranging implications, and large potential benefits of SOA, some adopters are using the major Program Office (*or Board*) model to guide SOA. They appoint a leader and a representative group of business and IT professionals to steer and guide the overall effort, as well as accomplished IT project managers to manage the individual portfolio project. Such an Office (*real or virtual*) would also naturally guide the enterprise's SOA strategy, architecture, projects portfolio, internal standards and methods, and the important issues of SOA governance that arise, such as partner access to enterprise services, SLAs, etc.

SOA Market Adoption

In terms of the classic IT technology adoption curve, the SOA market in Q3 2005 is moving beyond the "early adopter" stage, with an estimated 2,000-plus enterprises already actively on the SOA path, some of these on a large scale and well-advanced. Many of these had been implementing Web services for up to three years, and moved onwards into SOA mostly from the end of 2003 to date. We consider the SOA market is now generally entering the "early majority" stage, having already "crossed the chasm", with widespread and rapid adoption by the much larger group of "early majority" type enterprises now occurring. This group, fairly quick technology adopters, but more conservative than the pioneers, require the more settled standards, the now more mature software stacks, the feedback and success stories from the pioneers, and the more widely-available services, methods and best practices. In our view, these enabling elements are all now in place sufficiently broadly for the large early majority group to take up SOA from late 2005 through 2007, which correlates with the industry adoption forecasts we cited in Section 2.

SOA Software Market Dynamics – Major Vendor Platforms and Pure-play Start-up Products

As always, in a relatively new, fast-growing and strategically significant IT software marketplace such as SOA has become today, a number of vendors are now vying for customer attention, and the level of marketing hype and promotion is rising to fever pitch. A small number of major, established vendors and service providers have moved into the SOA space, with varying breadths and depths of overall offerings. IBM, Microsoft, BEA Systems, Oracle and SAP are foremost in this category. In addition, there has been the usual burst of newer, specialized start-up companies offering SOA-oriented middleware software and tools, and claiming new-generation technology (*Sonic Software, Cape Clear and Fiorano Software are examples in this category*). Many more of these are expected to emerge over the next several years, given the size and potential revenue the SOA market offers.

Customers therefore again face an important strategic choice between basing their SOA adoption strategy on a major vendor's complete SOA platform for enterprise commonality, stability and long-term security, or adopting a patchwork of offerings from one or several of the smaller, pure-play vendors. Given the strategic business importance of SOA, the long-term nature of the commitment a customer would make, and the much higher degree of business risk associated with choosing the latter approach, we expect a large majority of enterprise SOA adopters will follow the former route.

...the SOA software market is already consolidating much more quickly... around a handful of major software vendor SOA platforms.

Indeed, analyst community opinion is that the SOA software market is already consolidating much more quickly (*than the earlier integration market*) onto and around a handful of major software vendor SOA platforms. In part, this is because of the broad span and scale of products needed for a full SOA platform, the level of investment required to develop and support them, and the wide range of standards they must support that are continually advancing. Many customers also require considerable business and SOA implementation consultancy services to assist their migration. These all require immense investment and technology muscle and business endurance from long-term vendors.

What do You Need for SOA?

When planning SOA adoption the enterprise business strategies and priorities must first be clarified, and current SOA capability-maturity level be understood and assessed. But what else does the enterprise need to acquire to progress further and faster up the adoption curve, to reap the business and IT benefits attainable, which we detailed in Section 3? We discuss below the main resources, products and services that are required:

- **Education and Training:** On SOA basics, technologies, methods, standards, tools, best practices, and early-adopter experiences. Education and training providers with deep SOA expertise, extensive practical experience, geographical reach, and offering the full variety of classroom, on-site and Web-based education and training delivery options, are obviously required. Such services are increasingly widely available from select vendors today.
- **Knowledge and Information:** Reports, White Papers, Web sites, case studies, Webcasts, seminars and conferences covering SOA-related topics are burgeoning with the swelling interest and uptake of SOA. Chosen carefully from authoritative sources, these can be invaluable, along with education and training as above, to provide enterprise SOA teams with the understanding, knowledge, information and guidelines they need. Tapping into the richest of such sources should be a central customer SOA strategy for rapid learning and guidance.

- **Staff skills and capacity:** SOA adoption and implementation does require the enterprise to acquire, develop and maintain new sets of staff skills, and to train and educate many existing categories of staff in SOA lifecycle skills, tools and methods. If suitable resources can be freed up in-house, education and training, plus an accelerated knowledge acquisition program can help equip the roles needed to play their part. Many enterprises will seek help from experienced SOA consulting and development service providers, to help set their SOA programs off to a start in the right direction, to provide the key new skills needed for early projects, and to enable skills transfer to their in-house teams.
- **Enterprise SOA Middleware Software:** The primary technology enabler for operating and running SOA is enterprise- class SOA middleware software that provides the run-time environment for SOA applications. Such middleware must include portal servers, application servers, ESB software, business process or workflow servers, and integration engines and adapters. Selecting this middleware and its vendor is the most crucial technology decision to be taken in SOA. The range of hardware platforms and operating systems the enterprise is currently using, and plans to use in future for SOA application, will be one important factor, and will limit options. Existing middleware software investments in some of these categories, together with hard-won skills and experience in using them, will be another important consideration. The broad choice between a cohesive, single-vendor, strategic multi-platform SOA middleware platform, or a policy of choosing “best-of-breed”, mixed/multi-vendor products, must be carefully considered. Enterprises should carefully consider whether they wish to act as the middleware integrator between multiple products and their vendors, and face the vendor risks of reliance on small vendors. Support for all the main, current SOA and Web services standards, and to capability to support rapid further evolution of these standards, is essential. Finally, the questions of vendor risk, support capacity and capabilities, long-term viability, and technology/investment capability must be carefully considered for such a fundamental, probably decades-long life, software platform. Most enterprises will select robust, fully supported commercial software for such a platform, although open source stacks are evolving and may play some part in the market later.
- **Comprehensive, Advanced SOA Software tools:** To complement the SOA enterprise run-time middleware above, the enterprise must select business process modeling, composite software service orchestration or choreography, software services development, integration development, testing and validation tools, and business process monitoring tools for the live SOA applications. Tools for turning existing software assets into reusable software services are also essential. These may be selected as a coordinated, integrated, single-vendor suite, with similar benefits to those cited above. Many of these different types of tools need to integrate and work closely with each other over the whole SOA lifecycle. Therefore, there are arguments in favor of mandating that the tools chosen should be based on an open industry standard-based, extensible tool software platform that provides such integration and commonality. The Eclipse tools platform is the leading example of such a framework.
- **SOA Management and Security Software:** New categories of software tools for performance and service monitoring and management of SOA application, cross-platform workload management optimization, and SOA security have emerged to support the wider deployment of SOA applications. With the business-critical nature of SOA applications, their monitoring, performance management and security is fundamental, and new tools and technologies here are essential for full SOA production deployment. Further advances are also expected in these technologies.
- **Open Standards Expertise/Commitment:** The whole SOA model is entirely based on an expanding portfolio of sophisticated open standards and specifications. In selecting all the software above, it is therefore critical customers assure themselves that the software selected fully supports all the key SOA and Web services standards and specifications, and that their chosen vendors are deeply expert in these standards. Typically, where the vendor has led or played a central role in the standards/specification process, they are more likely to implement it earlier and better in their products. Enterprises should also maintain a baseline set of the open standards their enterprise SOA architecture will be based on. This will improve the openness, interoperability and future integration of their SOA portfolio. The baseline set should clearly trail the “bleeding edge” of completely new standards formulation, and contain the robust, proven, fully-established standards and specifications, adding others as they mature to this level.
- **Business Consulting Services:** Many enterprises are focusing on transforming their business models and core business processes, and these changes will trigger their need to embrace SOA to effectively implement the flexible IT systems they will need to support the changed business. Employing business consultants with deep vertical industry and/or horizontal process expertise and experience, familiar with best practices and benchmarks in the sector, is one of the fastest and most effective ways to facilitate such transformation. The use of a systematic, proven methodology to conduct such engagements brings many advantages, and reduces time and cost to value, so is to be encouraged.
- **SOA Services and Support:** Much in SOA requires new thinking, new skills, knowledge of the new technologies and tools and, most of all, real-world practical experience. Bringing in experienced SOA consultants and technologists to lead, support and assist the in-house team to climb more quickly up the learning curve, or to take responsibility for sensitive early projects, can be an effective way to accelerate SOA adoption, deliver results earlier and build in-house skills. Clearly, such consultants should be deeply experienced in SOA methods, the chosen middleware software platform and tools, the customer’s hardware platforms, and preferably the vertical industry.

- **SOA Methodologies and Process Best Practices:** There is much merit in adopting a proven, structured SOA methodology and development process. This can short-cut the learning curve of trial-and-error approaches, bring consistency and best practices across all the SOA projects in the enterprise portfolio, which can help to ensure common standards and metrics are used. Several such methodologies have been proposed, and are often transferred via consulting services engagements.
- **Standard, Reusable Components:** There are already a significant number of what might best be termed standard, reusable IPR and software components, the use of which can save project time and cost. Availability of a rich source of these can expedite project delivery and reduce custom development work. Look for standard software adapters/interfaces to common software environments, standard business process models, packaged methodologies, standard vertical industry or horizontal process patterns, and standardized business process software service libraries or suites. We expect the range, depth and value of these elements to grow rapidly over the next several years, as project experience broadens, and as leading vendors create richer collections of such assets.
- **Enterprise Servers and Storage:** Whilst many SOA developments will be based on, and will leverage customer's existing enterprise server hardware and enterprise storage platforms, new SOA initiatives will also drive new systems and storage purchases. Selecting proven platforms with extensive open standards support, advanced virtualization, good SOA middleware platform options, with high availability and superior manageability characteristics, is important. As we discussed in prior Sections, the IBM mainframe remains in a unique class of its own for many large enterprise workloads, and will be a perfect fit for many SOA initiatives, for the reasons we articulated in Section 4 of this Paper.

SOA and Enterprise Application Packages

SOA has significant implications for the enterprise applications package software market, offering new software architecture compared to the prior generations of what were usually more monolithic and proprietary enterprise applications packages. Successful enterprise applications are certain to migrate onto a SOA platform over the next several years, for the benefits the approach brings to their developers, for the easier integration through open standards with other customer applications SOA enables, and for the greater business process orchestration flexibility they will allow customers. Those that have already migrated onto standard SQL databases, and open standard J2EE™ application server technology, will be able to extend to SOA rather quicker than others will. Customers contemplating the purchase of new enterprise applications packages should therefore ensure their choice is, or will be, available in a SOA-generation version of the package, and preferably that the middleware platform the package uses is that chosen for in-house developments. We also anticipate that wider adoption of SOA, with its much faster, more business-aligned approach to business application development, will swing the "Buy versus Build" decision (*whether to buy a package or build in-house for a proposed new application*). We expect it to move more in favor of the "Build" approach, especially when the richness and depth of standard, reusable components (*mentioned above*) reach a larger scale. The two largest vendors of enterprise applications, SAP and Oracle, are both moving in a SOA direction to different degrees.

Choosing a Partner?

To reap the full benefits of a SOA, most enterprises will need to select a main partner that can provide all or most of the SOA requirements above. Most customers will be looking for a partner who can offer deep industry and technological expertise and insight into how SOA technology can drive business value, that has considerable real-world experience of implementing substantial SOA projects, and that is a leading innovator in SOA technologies and standards. Cameos of select vendor partner candidates follow:

- **IBM:** Clear SOA market and thought leader in middleware, SOA tools, management and security, extensive SOA services and business-consulting capability, open standards creation, education and information. Offers multi-platform, enterprise-class WebSphere SOA Foundation suite on all IBM and main non-IBM platforms, offers deep J2EE™ support, and has all Eclipse-based tools. Only realistic option for SOA on zSeries/System z9 mainframes, and iSeries/i5 platform. Also provides leading-edge hardware platforms. Main footprint in enterprise IT markets, but growing in SMB.
- **Microsoft:** Powerful software player with .NET services programming model the main alternative to J2EE™, provides Windows Server middleware and associated tools with SOA capability. Played an important role in Web services standards development. Microsoft software runs only on Windows OS- and Intel-based platforms. The firm provides some information, education and support, limited direct services capacity, but works mainly with partners for services. Strongest footprint in SMB marketplace.
- **BEA Systems:** Independent middleware vendor with respectable SOA suite based around established WebLogic application server platform. Good open standards support and J2EE™ expertise, products mainly deployed on UNIX platforms. Provides some education, information and support, but limited services. Collaborates with HP, Sun and other system vendors. Seen as potential acquisition target by commentators.
- **Oracle:** Making big efforts to develop/complete its Fusion middleware suite for SOA, but well behind the leaders in completeness, maturity and market uptake. Heavily occupied with integrating multiple application software acquisitions. Good open standards stance. Its middleware is mainly deployed in Oracle DB-intensive shops. Some SOA information, education, and a substantial services capability.

- **Sun Microsystems:** J2EE™ pioneer, active open standards participant. Enterprise Java Suite middleware and tools are being evolved to support SOA, but stack not yet complete. Not a major player in enterprise middleware market, except in semi-captive Solaris operating system segment. Provides some good information, some education, and limited services capacity. Also offers servers and storage but has lost substantial share in recent years.
- **SAP:** Enterprise applications leader offers NetWeaver middleware for SOA and integration. Good open standards stance, J2EE™ and Eclipse support. Mainly deployed in highly SAP-centric accounts where SAP applications are the center of the universe, for integration with other systems. Manufacturing and distribution industries focused, mainly enterprise footprint, although now making some headway in SMB. Software supports leading hardware platforms.
- **Pure-play SOA Software Firms:** A group of young, small, specialized, pure-play SOA software vendors, including Sonic Software, Cape Clear Software, Fiorano Software, and others, offering a variety of SOA middleware platforms and tools.

Because this White Paper is focused on SOA deployments that include the mainframe platform as a host, in Section 6 we evaluate and assess IBM's overall SOA offerings only. This is because our earlier studies have clearly shown that the IBM SOA middleware offerings are the only complete and optimized solution for the zSeries/System z9 platform (*and iSeries*). For enterprise users planning to deploy SOA on both the zSeries/System z9 and other major platforms, and requiring a single, common SOA middleware and tools platform across their enterprise, IBM also has clearly the strongest offerings with its multi-platform WebSphere SOA Foundation suite. It is also the case that IBM has set the benchmark for its massive, corporation-wide SOA development efforts of the past three years, and so assessing the leader more deeply reveals what competitors now have to match to win.

Practically speaking, because of the prevalence of the Windows platform on millions of Intel servers, the Microsoft offerings are, and will also be, widely used, both for their own undoubted strengths, and for their high-volume, lower-cost business model.

Our Analysis

We recommend that SOA be approached primarily and foremost as a business-focused and guided initiative, with top executive support and concentration on the key business processes determined to be most in need of transformation, directly in-line with enterprise business strategies and main priorities. The business benefits that stem from successful SOA deployment are most compelling, although the associated IT benefits are also potent.

We recommend that SOA be approached primarily and foremost as a business-focused and guided initiative...

If the business process transformation priorities of the enterprise have not yet been identified and ranked, utilizing experienced industry business consultants to help the enterprise uncover and rank the critical areas for improvement can be a rapid and highly-effective way to get early clarity and internal agreement.

Undertaking a SOA readiness assessment, to clearly identify where the enterprise is positioned on the SOA capability-maturity curve, is also a highly-effective and relatively rapid means of determining what areas need to be strengthened to advance SOA adoption. Self-service SOA readiness assessment tools are available from several vendors, including IBM and Sun, or SOA consultants can assist with on-site, workshop-based team assessments.

We also recommend that the enterprise study and understand the overall SOA applications lifecycle and the various business and IT roles and responsibilities that are required through this cycle. From this, it is straightforward to determine the staff resources available, the new skills to be acquired, and the education and training needed to build the capabilities needed, or to be bought-in, for the SOA project portfolio identified above. Because of the closer than ever business-IT involvement and alignment that is central to SOA, we also recommend a joint business-IT SOA "program office", "board" or "steering group" team be formed and chartered to drive the overall program throughout, for clear leadership and governance.

We itemized and described above all the main resources, software, capabilities and methods that the enterprise will need to acquire externally to begin their SOA adoption process. Some of the parts will often already be in place, the others acquired from outside, and the readiness assessment will help identify the main gaps and needs.

Some of the main considerations of vendor selection were summarized, highlighting a primary choice between the few major vendors' complete SOA "platforms" and the offerings from small, "pure-play" newer vendors. SOA will form the foundation for a whole next generation of core business processes and major enterprise applications. Analyst consensus is that the major vendor platforms will quickly seize and hold a commanding majority share of this market, driven by the scale of investment needed and customer perceptions of vendor risks. Consolidation and change amongst the smaller players is seen as certain for several years. Our brief cameos of some major candidates highlighted the different offerings, platform strengths and positioning.

For enterprises making substantial use of the IBM zSeries/System z9 mainframes (or iSeries), our previous in-depth studies clearly showed that there is only one realistic choice for SOA on this platform - IBM and/or its SOA Business Partners. The giant also offers a full multiplatform solution for enterprises operating a mixed platform IT infrastructure, and has the broadest range of supporting offerings and services, etc.

For enterprises making substantial use of the IBM zSeries/System z9 mainframes... there is only one realistic choice for SOA on this platform - IBM and/or its SOA Business Partners.

For those reasons, and as a benchmark for comparisons with other vendors, in Section 6 we review and assess the IBM SOA portfolio, with a particular emphasis on its support for the mainframe platform.

6. IBM's SOA Portfolio Offerings Assessed

Introduction

IBM has made one of its larger, near-three-years-long, cross-company major efforts to create, refine, prove and deploy the extensive SOA portfolio it now offers today, at an annual investment level well in excess of \$1B p.a. This includes IBM's leadership participation in over 50 standards initiatives, which have enabled SOA to come of age with a good quorum of ratified Web services standards. It has seen the creation and recent announcement of a comprehensive WebSphere SOA Foundation middleware software and tools suite based on its market-leading, multi-platform, WebSphere software platform, and the creation of extensive SOA and related business consulting services offerings. In addition, extensive IBM research and development has led to many patented SOA innovations (over 300 SOA patents), methodologies, and a wealth of information, knowledge, education, and experience, most of which are now being made available to customers and partners through the various channels, programs and mechanisms we discuss below.

IBM argues that to reap the full benefits of a SOA enterprises need a partner that will work with them to understand the individual business needs and that can bring to bear wide industry and technological expertise and insight into how technology can drive business value. That partner needs hands-on experience of implementing SOAs from end-to-end and to be continuing to innovate in how they are best developed.

Modestly proposing itself for this role, IBM has in fact assembled a rich and deep portfolio of SOA offerings, which we summarize and assess below.

The IBM SOA Foundation Introduced

In particular, the recently announced (September 2005) IBM SOA Foundation, illustrated in Figure 14, considerably extends the scope and span of the already broad-ranging IBM SOA offering portfolio.

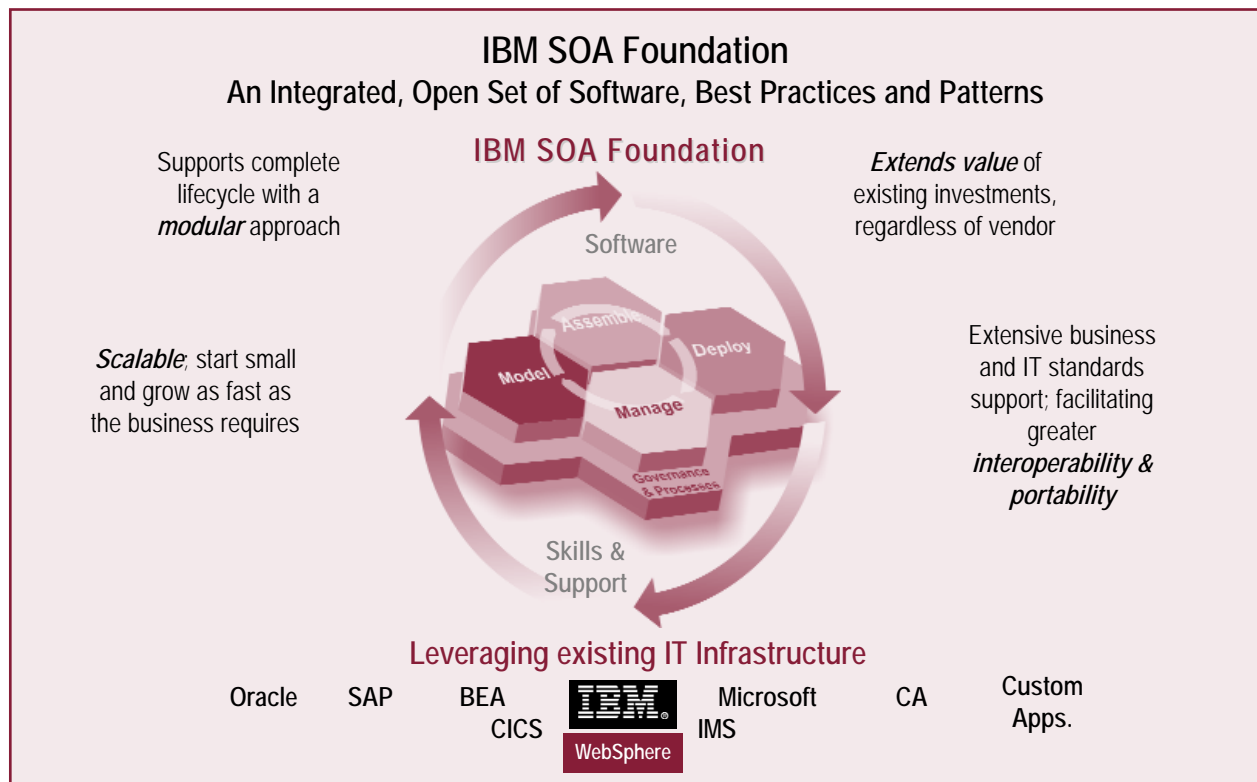


Figure 14: IBM SOA Foundation

At the center of this SOA Foundation are software and tools, skills and services that support all four central parts of the SOA lifecycle. These, shown at the centre of Figure 14, cover **Modeling** the business processes, **Assembling** the software services to support them, **Deploying** the new SOA application to production, and **Managing** the applications and infrastructure over its lifecycle. A central theme and focus of the IBM SOA Foundation is to enable customers to use it to leverage and take fullest possible advantage of their existing IT infrastructure, both IBM and non-IBM, and thus to fully exploit existing applications and data assets. This is particularly relevant to the IBM mainframe platform, where such a deep wealth of exiting assets and enterprise infrastructure is located. For example, the large number of customers existing, well-established CICS and IMS applications and transactions have already proved themselves as prime sources for reusable Web services components in SOA since the middleware engines were Web services enabled, and many thousands more such reuses are certain to occur.

Importantly, the IBM SOA Foundation is designed to be **scalable and incremental**, so that customers can start small at modest cost, and expand and spread their SOA coverage over time in manageable steps, making full use of what they already have. The IBM commitment to **deep open standards support** that enables integration and interoperation across the enterprise is also a central pledge.

SOA Education and Training

IBM has offered a substantial curriculum of Web services education and training classes covering the main new skill areas and roles needed for some time, and these are available on a global basis as a main enabler for customer staff skills and knowledge acquisition. Many other learning resources on SOA are also offered in a variety of media and formats, and some of these are cited below. Once SOA readiness and maturity has been assessed, we recommend adopting customers do take advantage of such training vehicles that can shorten the organizational SOA learning curve considerably, and bring back in-house best practices and experience at relatively modest time and cost.

SOA Knowledge, Information Resources and Learning Materials

IBM now offers a rich collection of packaged SOA knowledge, extensive information resources, learning materials, best practice materials, customer experience stories, and many other types of relevant material, to help customers and business partners rapidly build the SOA understanding, knowledge and skills. This valuable collection encapsulates, and makes widely and freely available, more than three years of intense IBM-wide and industry research, development and practical SOA experience. The IBM DeveloperWorks and main SOA Web sites are central entry points to these rich resources that include tutorials, Podcasts, technical articles, White Papers, Red Books, Webcasts, seminars, analyst reports and customer case studies, with a particularly deep coverage of Web services technology and open industry standards developments.

We recommend that customers beginning SOA adoption make the fullest use of these extensive IBM resources to accelerate their organizational learning and help them move more quickly up the SOA capability-maturity curve. There are also many other publicly available SOA resources to be found at specialist SOA and IT industry publisher Web sites, other SOA vendor sites, standards bodies, etc., as well as many industry conferences, seminars and briefings on SOA that provide additional rapid learning opportunities.

SOA Readiness Assessment Tool

IBM offers an excellent and free, Web-based, self-service SOA Readiness Assessment tool/service (*available at www.ibm.com/services/us/index.wss/summary/imc/a1011181*). This enables an enterprise SOA team to generate a rapid and quite comprehensive readiness assessment of where their organization stands today on the SOA capability-maturity curve (*as discussed in Section 5 and Figure 12 on page 27*). Such an assessment provides a sound baseline for planning the next steps in SOA adoption and its use is recommended. More extensive, chargeable SOA assessment and planning services are also available from IBM Global Services (*see Figure 17 on page 38*).

Service Oriented Modeling and Architecture

In January 2005, IBM announced the Service Oriented Modeling and Architecture (*SOMA*) service to help companies attain business change goals whilst freeing up IT resources to focus on new growth opportunities. The SOMA service/method provides a consistent way for businesses to develop flexible technology that provides maximum business return by implementing an enterprise SOA, a standards-based infrastructure that can support rapid business environment change. By building a SOA that aligns to the business goals, and directly ties the business processes to underlying applications through services, SOMA helps business to faster payoff. Using detailed identification and prioritization of the services a business needs to develop or expose to support improved business processes, SOMA provides a systematic approach to creating an optimized roadmap for implementing a SOA. SOMA is based on the more than three years of hands-on experience IBM acquired in working with early adopters of the technology, and is offered by IBM Global Services.

Business Integration Adoption Model

Based on proven customer SOA deployment experience, IBM has developed the Business Integration Adoption Model. This aims to accelerate SOA business benefits and to provide a roadmap for increasing customer business value over time. The model builds upon IBM's best practices, proven methodologies, investments in middleware, consulting and implementation services and open standards leadership. Through this model, IBM claims that businesses can achieve greater flexibility by aligning their business goals and directly tying business processes to underlying applications. It argues that the Model helps clients understand how best to apply new products and architectural models, whilst taking fullest advantage of existing investments, whether "going it alone" or partner assisted. The Model is shown graphically in Figure 15.

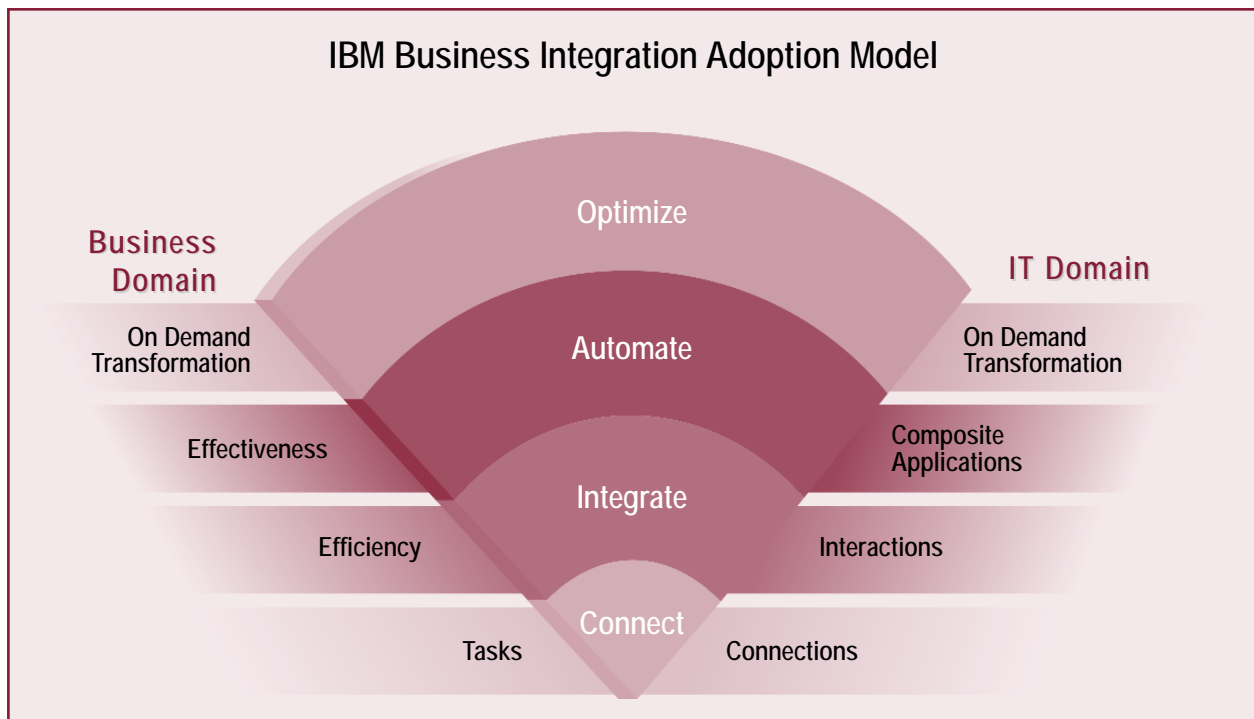


Figure 15: IBM Business Integration Adoption Model for SOA

The Model helps by setting a vision and by defining a series of prescriptive, incremental steps to realize that vision, from establishing basic connections, all the way to implementing the fully dynamic business processes of an on-demand business, with far greater alignment of business and IT goals.

SOA Foundation Software – Overview

At the heart of the new IBM SOA Foundations are six new, or significantly enhanced, WebSphere SOA Foundation software products, shown and positioned on the SOA lifecycle in Figure 16 on page 36.

- **WebSphere Business Modeler:** To model SOAs and business process, IBM offers a considerably enhanced new version of its WebSphere Business Modeler. This is an easy-to-use graphical modeling tool that enables both business and IT to work together to model and design the business process flow before deployment, and complements the SOA modeling capabilities of the Rational Software Architect tool for IT architects.
- **WebSphere Integration Developer:** To assemble (*choreograph or orchestrate*) new SOA applications, IBM announced WebSphere Integration Developer, an Eclipse-based application development tool to build and deploy business processes based on SOA. (*Eclipse is the leading open standards software platform for application development tools, supported by most tools leaders and players, that eases tool integration round the common Eclipse Platform.*) WebSphere Integration Developer allows developers of composite applications to view existing IT as services that can be easily wired together to compose full business processes. To further help customers assemble SOAs, IBM has also released a new version of its Rational Application Developer product, which is used to build new component services. (*WebSphere Integration Developer will supersede the current WebSphere Studio Application Developer – Integration Edition (WSAD-IE) product when available.*)

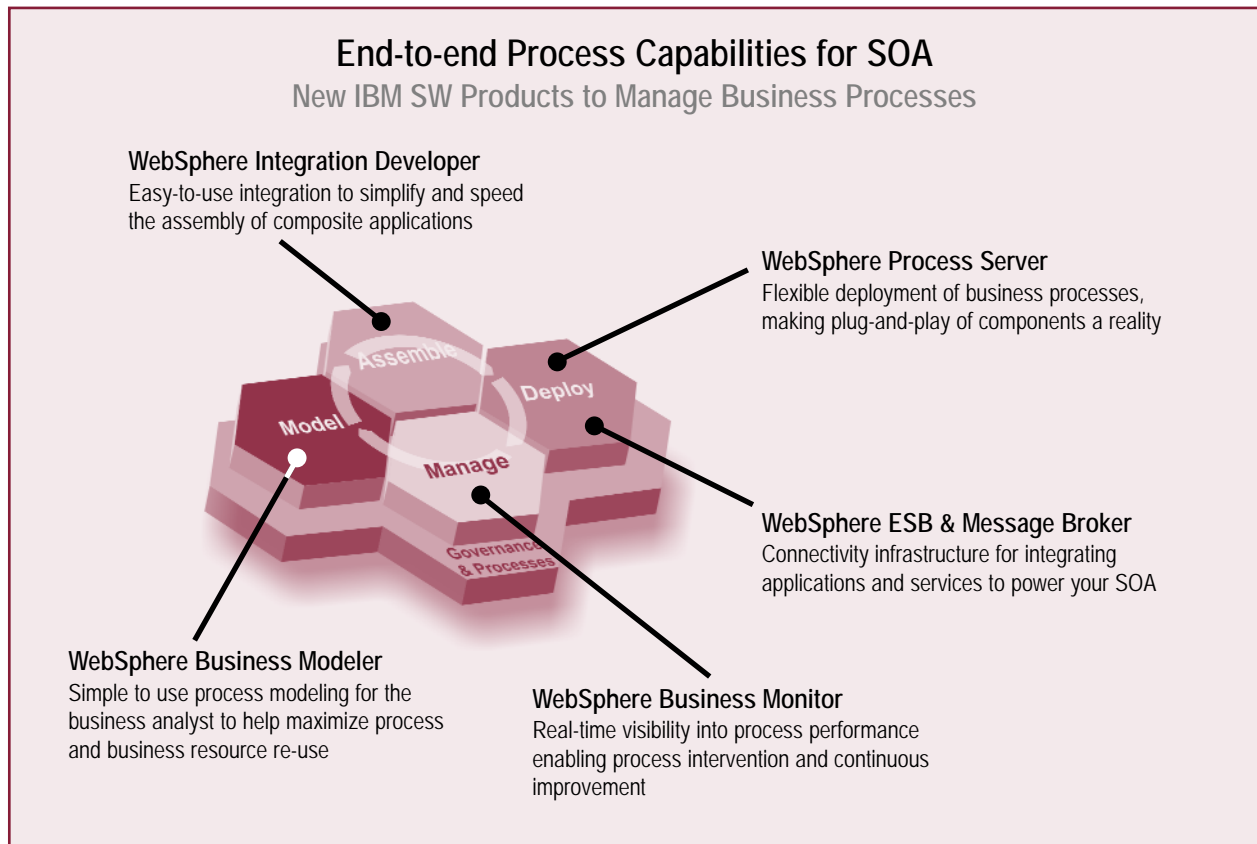


Figure 16: End-to-end Process Capabilities for SOA – New SOA Foundation Software

- **WebSphere Enterprise Service Bus:** To help clients deploy SOAs, IBM also announced its new WebSphere ESB product. Further strengthening its current ESB capabilities, the WebSphere ESB product provides connectivity and integration for Web services-focused applications and services. For advanced ESB functionality, IBM is to deliver a new version of WebSphere Message Broker, which has been a leader in providing universal connectivity and data transformation for applications, whether or not they comply with open standards. With this WebSphere ESB product, IBM has now bowed to the market inevitable, finally acknowledging that an ESB should be a specific software product, and not just an architectural pattern as it had previously argued.
- **WebSphere Process Server:** Also new for SOA deployment is WebSphere Process Server, open-standards-based software powered by WebSphere ESB that helps simplify the integration of business processes that span people, systems, customers and business partners. WebSphere Process Server can help reduce the time, cost, and risk of integration projects, because it simplifies the movement of information between applications based on business rules.
- **WebSphere Business Monitor:** To manage SOAs, IBM also announced an enhanced version of its powerful WebSphere Business Monitor product. This software helps monitor business process performance and key performance indicators to guide and aid the overall management and control of the business processes running under the SOA.

All of these new products are expected to ship on all supported platforms, including z/OS for mainframe, by the end of Q1 2006, and some considerably earlier. Exact general availability dates were not published for all these products at time of writing, and full pricing is likely to be disclosed with the individual availability announcements.

In our assessment, this was a cohesive announcement that strengthens and completes the core WebSphere SOA software stack in all key areas, and considerably clarifies and improves product naming and packaging, which some felt was previously unduly complex.

...capabilities, standards support and improvements in the individual products are impressive...

The individual capabilities, standards support and improvements in the individual products are impressive, and we assess each in more detail in Section 7.

IBM Virtualization Engine 2.0 – Fundamental SOA Underpinning

Virtualization is today's most important technology to gain more efficient utilization and superior management of server, storage and network resources, and to reduce ever-growing operating, management and support costs of today's complex IT infrastructures.

IBM pioneered virtualization technology, and has driven many virtualization advances across all its server platforms, storage systems, and software portfolio, over the last five years.

Now, under its new Systems Agenda strategy, IBM intends to “**virtualize everything**”, IBM is further accelerating and advancing these technologies to a much higher level of standardization, openness and support for open standards, programmatic control and integration with automated management, to aggressively attack the issues and inhibitors outlined above.

IBM's latest advance in virtualization technology, implementing this strategy, is the new **IBM Virtualization Engine 2.0** strategic platform, which offers unprecedented interoperability across systems, storage and networking. Open interfaces and implementation of standards allow other leading vendor partners, such as Cisco, VMware, Network Appliance, and others, to participate in this virtualization infrastructure. This is a major extension and new release of the IBM Virtualization Engine, first introduced in 2004. Our research showed that this extended, now open, platform will allow customers to better aggregate, pool, manage and optimize their IT resources across a variety of servers, networking and storage devices, to help improve the economics and operations of under-utilized IT assets. By so doing, it directly helps companies drive down the management and support costs that became such a burden. As IT infrastructures have continued to grow in complexity over the past decade.

The primary products, new and enhanced, that implement the IBM Virtualization Engine 2.0-platform architecture are:

- **Resource Dependency Services (RDS – new)**: Provides powerful facilities that enable companies to create and maintain mappings and views of and between of all their IT resources, and the applications (*and thus business processes*) they support.
- **IBM Enterprise Workload Manager (EWLM – Substantially enhanced)**: The IBM EWLM, first introduced in IBM VE 1.0, has been substantially extended and enhanced. EWLM is a sophisticated, dynamic, policy-based workload manager for resource optimization in heterogeneous, multi-tier IT environments, and supports IBM and non-IBM systems.
- **IBM Director 5.1 (Substantially enhanced)**: IBM Director is the successful, award-winning, integrated systems management suite of tools (*originally built for IBM's xSeries Intel/x86 architecture servers, and later extended to BladeCenter*) that now provides consistent, single-point management and automation extended across the portfolio of IBM eServer and non-IBM Systems.
- **IBM Virtual Resource Manager (New)**: Provides an insulating layer which allows the platform to plan, deploy and manage server partitions without worrying about the underlying partitioning technology used.
- **IBM Virtualization Engine Console (Enhanced)**: This second release of the IBM VE Console provides a single portal/console for administering virtual resources, and provides a consolidated, single view of system health across multiple operating systems and platforms.

The System z9 and zSeries mainframe is fully supported by the IBM Virtualization Engine 2.0, which considerably augments the already Gold-Standard virtualization capabilities of these systems. Virtualization of the IT infrastructure is the essential complement and the systems analogue to SOA software architectures for enterprise applications, and provides not only the resource use efficiency but the much enhanced manageability and support for provisioning and other automated infrastructure functions that are essential for On Demand Business.

IBM Tivoli Composite Application Management (ITCAM) Solutions

In addition, IBM offers advanced Tivoli management software for composite applications, to help customers manage and ensure the performance and availability of their SOA-based solutions. Proactive, real-time problem resolution is performed using a portal-based, end-to-end view of services, transactions and associated resources, across platforms and subsystems. Composite applications use business logic and data that span Web servers, J2EE™ application servers, integration middleware, and mainframe systems. ITCAM solutions fill the major gap many enterprises currently face, lacking an integrated solution to automatically monitor, analyze and resolve problems at the service, transaction, application and resource levels. The ITCAM solutions can monitor services and response times to detect potential slowdowns or performance bottlenecks, before the end-user is affected. They can mediate services and enforce policies. They can trace transactions and accurately diagnose problems by drilling down to the root cause. They can monitor and adjust resources to ensure they are used efficiently. They can isolate, diagnose and fix business-critical application performance problems. Three ITCAM products are offered:

- **IBM Tivoli Composite Application Manager for Response Time Tracking**: Pinpoints and isolates performance bottlenecks end-to-end through composite applications.
- **IBM Tivoli Composite Application Manager for SOA**: Manages, monitors and controls Web services applications, with drill-down to the application or resource layer causing bottleneck or failures.
- **IBM Tivoli Composite Application Manager for WebSphere**: Provides drill-down diagnostics for J2EE™, CICS and IMS application performance problems.

The ITCAM solution is part of the IBM IT Lifecycle Management solution and IBM's IT Service Management solution.

SOA Business & Technology Services

IBM Global Services (IGS) has developed, proved and deployed an increasing range of SOA business and technology services over 1,000 customer engagements, and now offers the comprehensive range of service offerings shown in Figure 17.

SOA Service	Service Description
Accelerators for Service Management for Orchestration and Provisioning	Accelerate implementation of IBM Tivoli orchestration and provisioning software.
Application Value Optimization Services	Offers an end-to-end, integrated solution designed to assess, transform and manage the enterprise application portfolio on a continual basis.
Business Enablement Services for Service Oriented Architecture	Business enablement services for SOA, including assessment, plan vision and transition plan.
Design Services for Service Oriented Architecture	Design services for SOA, including code development, support materials and deployment.
IBM Component Business Modeling Services (SM)	Helps enterprises gain significant new insights into the strategy, technology, operations and investment alignment of the organization.
Implementation Services for Service Oriented Architecture	Implementation services for SOA, including code development support materials and deployment.
IT Infrastructure Planning and Design for On Demand Business – Infrastructure Architecture and Design	Create a vision and architecture blueprint to enable an on-demand operating environment.
IT Infrastructure Planning and Design for On Demand Business – Infrastructure Services Readiness Engagement	Comprehensive assessment of preparedness for an on-demand implementation and recommendations to improve infrastructure readiness.
IT Infrastructure Planning and Design for On Demand Business – IT Service Management Design	Help to plan and execute a transition to a demand-driven, service-management strategy.
Management Services for Service Oriented Architecture	Management services for SOA, including comprehensive monitoring and management applications and services.
SOA Governance Services	Will set a baseline for measuring improvements, tracking SOA projects, building a pool of skilled resources, and establishing the structure for making decisions about SOA initiatives. This offering will help companies keep all their SOA initiatives, architectures and investments aligned to their business goals.

Figure 17: IBM Global Services SOA Business & Technology Services

IBM claims to have 40,000 developers actively working on Web services applications, and over 35,000 consultants with Web services knowledge/experience, and delivering this portfolio of SOA professional services. SOA/Web services Centers of Excellence provide focal points for the effort that has encompassed over 1,000 SOA customer engagements and successful implementations over the last three years.

With these resources, IGS is clearly the world's largest and most experienced SOA services organization. IGS also has extensive, deep platform technology knowledge and skills in all IBM hardware and software platforms, especially the zSeries and System z9 mainframe, that can help accelerate infrastructure transition to an on-demand operating environment in parallel with SOA adoption.

Particularly noteworthy, in our assessment, is the **Component Business Modeling** service. This method breaks down a business into a set of discrete components that can be measured and benchmarked, quickly and clearly identifying the weaknesses and strengths of individual business activities, allowing a client to better identify areas for process improvement. With well-proven,

*Particularly noteworthy, in our assessment, is the **Component Business Modeling** service.*

specific Component Business Models for most vertical industries, this systematic, visual method can help enterprises quickly focus in on which are the most important business processes for transformation, an essential precursor to business-focused SOA adoption planning.

IGS is also supporting the new SOA Foundation software with new professional service capabilities. A new service capability related to SOA Governance is shown in Figure 17, for example.

SOA Industry Teams for Industry Expertise

In addition, IGS recently announced new service units, each aligned to important vertical industries (*communications, distribution, financial services, industrial, public sector and small and medium business*) are now chartered to help customers ease deployment and generate business value faster from SOAs. These teams will harness the deep industry expertise of IBM BCS consultants to better enable use of IBM's new WebSphere software as the foundation of a SOA.

SOA Industry Accelerators – Common Services Delivery Platform (CSDP)

Reusable, industry-specific assets that build on the SOA Foundation are known as SOA Industry Accelerators, because they will speed customer implementations. IGS will now also use the SOA Foundation software to create, accumulate and use a repository of reusable SOA assets using IBM software and third-party applications. These assets will execute specific business processes such as claims processing or inventory management. The CSDP will collect assets from various sources, integrate it with CSDP software, best practices and intellectual property, and use WebSphere SOA Foundation software to deliver the completed business process. As this resource expands and grows, it will further accelerate SOA deployment by permitting higher reuse.

SOA JumpStart Workshops

To encourage and speed SOA customer adoption, IBM has also announced a free SOA Jumpstart Workshop. IBM says it will provide a team of software architects to conduct these multi-day Workshops on-site, without charge or obligation, to help customers find specific ways to use SOA for competitive advantage. Workshops will suggest specific product approaches and options within the SOA Foundation architecture to “jumpstart” customer SOA adoption initiatives. We expect this to be a popular and widely subscribed offering that will be helpful in clarifying next steps for many customers.

IBM SOA Business Partner Community

IBM takes the view that achieving the fullest potential of SOA will often require the skills and experience of more than one partner, whatever its own strengths. In June 2005, it announced its IBM SOA Business Partner Community initiative, to help its business partners, independent software vendors, and systems integrators to get up-to-speed in successfully implementing SOA solutions. Organized through the well-established framework of its PartnerWorld Industry Networks, the initiative offers a broad collection of tools and resources to help these partners identify, scope and expertly execute on SOA engagements with mutual customers. Since the June 2005 announcement of the SOA Business Partner Community, the group has more than doubled to over 100 members, and benefits have been extended. These now include:

- **Virtual Innovation Center:** IBM's award-winning knowledge and enablement portal provides personalized SOA enablement planning and technical support for partners.
- **Marketing Packages:** IBM SOA advertising templates, discounts and incentives for partner SOA marketing, and ready-to-use programs that help partners run their own SOA demand generation events.

Over time, many more of the 4,000 IBM PartnerWorld business partner program members are expected to join the SOA Community, to exploit the WebSphere SOA Foundation software and other assets above to deliver SOA solutions.

We consider this program is good news for business partners, providing an on-ramp to the rapidly growing SOA market. For enterprise customers, the increasing range of SOA partners will complement IBM's own offerings with specialist software, knowledge, experience and additional service capability.

Our Analysis – IBM Recognized SOA Leader

As can be seen from our summary of the comprehensive, wide-ranging SOA software, services, partnership and support it now offers, IBM has created a formidable strength and leadership position in SOA. This leadership has also been independently confirmed by the findings of two other recent industry analyst studies:

- **AMR Research (September 2005):** In a new research Report, “Service Oriented Architectures: Survey Findings on Deployment and Plans for the Future,” based on surveying IT executives, AMR found IBM to be the recognized leader in SOA. The report found IBM was cited as the SOA industry leader three times more often than its closest competitor, and was specifically cited by 37% of respondents, versus 13% for the second-closest competitor, and was mentioned as leader more often than the next three competitors combined.

IBM has created a formidable strength and leadership position in SOA.

- **IDC (August 2005):** A new report from IDC concludes that IBM Global Services is a leading "global market maker" for SOA. *"Officially entering the SOA space in the fall of November 2003, IGS has continued investing large amounts of time and resources to cover all opportunities around SOA, from a comprehensive portfolio of services offerings, to an in-depth verticalization. Since then, SOA has been center stage in the strategic direction of IBM."* said Sophie Mayo, Director for IDC's Worldwide Services and Services-Oriented Architecture Research. IDC said IGS' leadership in SOA is attributed to a company-wide strategy, deep vertical industry expertise and SOMA, a unique methodology that aligns a SOA to a customer's business goals and directly ties business processes to underlying software applications that support them. IDC defines Market Makers as firms at the forefront of SOA who have devoted significant resources to developing skills, tools and methodologies.

At the heart of this offering, the impressive new WebSphere SOA Foundation software is the centerpiece...

At the heart of this offering, the impressive new WebSphere SOA Foundation software is the centerpiece, comprising WebSphere Business Modeler, WebSphere Integration Developer, WebSphere Process Server, WebSphere ESB, WebSphere Message Broker (*Advanced ESB*), and WebSphere Business Monitoring. We assess and evaluate these important products in Section 7. These are complemented on the mainframe by an enhanced, SOA-supportive set of the major middleware engine releases already available, described in detail in Appendix D. Other WebSphere and Tivoli management tools (*such as the ITCAM offerings detailed above*), and the IBM Rational Software Development Platform, have been closely integrated with the WebSphere SOA Foundation suite, to round out a truly comprehensive SOA software offering.

The breadth, depth, scale and experience of IBM Global Services Business Consulting and SOA services far exceed those of any other vendor, making this unit the natural source of supply for SOA-related services for enterprise business and SOA adoption planning and implementation.

The breadth, depth, scale and experience of IBM Global Services Business Consulting and SOA services far exceed those of any other vendor...

A wealth of education and training, knowledge and information resources, tools and methods, and a fast-growing SOA partner community, round out a truly comprehensive and well-researched and resourced IBM SOA portfolio which will be invaluable to customers embarking on SOA adoption.

7. The WebSphere SOA Foundation Software – Our Assessment

Introduction

In Section 3, Figure 5 on page 15, we illustrated the full vision for full-scale Business Performance Management (*BPM*) under SOA, the next generation of business-IT solutions, describing the whole environment, from modeling, to assembly, to deployment to monitoring, that is needed to realize the vision. The IBM SOA Foundation software, described and assessed below, advances the market-leading WebSphere family to the forefront of SOA, by providing in-depth, enterprise-class, open-standards-based, new software support for all these stages of the SOA application lifecycle. We review and assess the WebSphere SOA Foundation products below.

WebSphere Business Modeler

To gather requirements, model, simulate, and design SOAs and business process, IBM offers a considerably enhanced new version of its WebSphere Business Modeler. This is an easy-to-use, intuitive, graphical modeling tool that enables business professionals or analysts and IT architects to work together to model, understand, analyze, and design improved business process flows before deployment. Within a single tool, WebSphere Business Modeler provides comprehensive business process modeling for processes, resources, information, organizational structures, analysis, collaboration, and business metrics. It now provides more granular and precise modeling of activities, an expanded user experience, and considerably enhanced analytical capabilities over previous versions.

The tool helps teams understand and analyze current processes, design new ones, and can use existing models. It can also simulate processes to visualize how changes will work before deploying them. Business processes developed with the tool can be shared and reviewed on-line on the Web, to speed validation and communicate designs. The tool also enables key performance indicators to be defined, identified and reviewed, which will later be used to monitor (*in WebSphere Business Monitoring*) the efficiency of the process when deployed.

The process simulation capabilities are now extensive, allowing the modeling of "what if" scenarios and results comparison, support weighted average analysis (*for a static, long-term view of the process*), and can handle sophisticated input statistical distributions. It can simulate resource utilization, costs and cycle times, branching and process concurrency, and allows replay.

The tool supports all three main roles for business process modeling: modeling for documentation & compliance, modeling for redesign and process optimization, and modeling for execution. It allows modeling of business processes, deployment, monitoring, and taking actions based upon KPIs, alerts, and triggers for continuous optimization. The tool complements the SOA modeling capabilities of the Rational Software Architect tool for IT architects.

WebSphere Business Modeler Basic (*a low-cost entry edition providing basic modeling*), WebSphere Business Modeler Advanced (*providing all the functionality above*) and WebSphere Business Modeler Publishing Server (*publishes business process models to a portlet-based server*) products are offered. As an Eclipse-based tool, the product also integrates closely with the other Eclipse-based SOA tools in the suite. These overall capabilities, in our view render WebSphere Business Modeler a class-leader in this category. Available from November 30th 2005.

These overall capabilities, in our view render WebSphere Business Modeler a class-leader in this category.

WebSphere Integration Developer (V6.0)

To assemble (*choreograph or orchestrate*) new SOA applications, IBM announced WebSphere Integration Developer, an all- GUI application development tool to build and deploy business processes based on SOA. The tool simplifies the hand-offs between business and IT, and lets developers get started quickly. It allows composite applications developers to view existing IT assets as services that can be easily wired together to compose full business processes of all types (*human, automated, rules, etc.*). The tool simplifies integration, with rich features making it easier to render existing IT assets as service components for reuse in a SOA. It allows IT integration developers to assemble complex business solutions with minimal Java skills required, enabling a business-driven development approach, by fully integrating with WebSphere Business Modeler to import models for rapid implementation. The tool also integrates testing, debugging, and deployment for service-based solution development. On-line modules and libraries are available that help speed development and reduce costs to facilitate reuse. The tool also supports advanced constructs for dynamic processes, including business rules, business-state machines and selectors, events, and role-based tasks capabilities, to represent and support complex process flows and behaviors. (*All supported by WebSphere Process Server at run-time.*)

The output code from WebSphere Integration Developer deploys on the WebSphere Process Server (*see below*). As another Eclipse-based tool, the product also integrates closely with the other Eclipse-based SOA tools in the suite, such as the Modeler above, and Rational products. To further help customers assemble SOAs, IBM has also released a new version of its Rational Application Developer product, which is used to build new component services. (*WebSphere Integration Developer supersedes WSAD-IE.*) Available from September 29th 2005.

We found WebSphere Integration Developer forms a core component of the WebSphere SOA Foundation integrated development environment, represents a significant further advance on WSAD-IE, and complements the new WebSphere Process Server well.

WebSphere Process Server (V6.0)

Also new for SOA deployment is WebSphere Process Server, open-standards-based software powered by WebSphere ESB (*see below*) that helps simplify the integration and automation of business processes that span people, systems, customers and business partners. WebSphere Process Server can help reduce the time, cost, and risk of integration projects, because it simplifies the movement of information between applications based on business rules. Together with WebSphere Integration Developer above (*from which business process models can be imported*), WebSphere Process Server provides a robust platform for building and deploying service-oriented, component-based, business process composite applications. WebSphere Process Server now provides a single, unified programming model (*Service Component Architecture*) to connect and use IT resources as service components that are easily reused. Process Server provides all the required constructs for dynamic processes, including business rules, business-state machines and selectors, events, and role-based tasks capabilities.

WebSphere Process Server provides a comprehensive runtime for long and short running processes, human workflow, and role-based tasks, incorporates WebSphere ESB to extend the reach and connectivity of business processes, and also includes select WebSphere Application Server V6.0 functionality, the leading J2EE™ application server. The product provides a high performance and quality of service run-time environment, with advanced fault-tolerance and error-detection capabilities. Other principal capabilities include:

- **Business Process Engine:** It includes a full-function WS-BPEL-compliant business process engine, a simplified process editor, and generic business process support, including operations/parameters, transactions/compensation, and full XPath 1.0 support, with service implementation details hidden.
- **Business State Machine:** A business state machine implementation, based on the UML 2.0 State Machine, supports event-driven business processes, creates WS-BPEL under the covers, and handles simple or complex states (*entry and exit*), and transitions (*guards, actions and timeouts*).
- **Human Task Manager:** A human task manager component allows applications to use human tasks, to invoke humans as services (*the 'classic' staff activity scenario*) and to allow humans to invoke services (*both services implemented by software, e.g. business processes or arbitrary Web services, and services implemented by humans*). It supports role-based staff assignment rules that can differ for editors, readers, administrators and potential owners, and both Web and portal-based clients. Multiple level escalation mechanisms are supported, including e-mail, staff assignment (*work item notification*), and priority aging.

- **Business Rules Engine:** WebSphere Process Server also includes a business rules engine that enables business logic and rules to be abstracted and externalized from applications representing the business process. This enables business rules that may change to be easily and centrally altered without modifying the underlying software services, and allows the rules to be dynamically updated on-the-fly on the run-time server via a Web interface. Rules are presented in a natural language form. Business rules functionality supported includes the most popular approaches of multi-dimensional decision tables, rule sets (*If/then rules*) and rule templates.
- **Common Event Infrastructure:** WebSphere Process Server is based on CEI (*Common Event Infrastructure*) to handle events, which are whenever something significant occurs in an application such as processing a new order, or a failure occurring. Event data is captured in a standardized event object format (*Common Base Event*), with business data supplied by the application, and with WebSphere providing the run-time details like server name, J2EE™ component, and business context. Event objects are handled by the event infrastructure to allow tracking of business process progress, audit trails, coordination of work between independent business processes, and the monitoring for exceptions in a business process (*e.g. processes not completing within time limits*).

The Server also supports Business-to-Business (*B2B*) through an included restricted-use license of IBM WebSphere Partner Gateway Advanced Edition. (*WebSphere Process Server supersedes the existing current WebSphere Business Integration Server Foundation (WSBISF) V5.1 BPEL4WS server and WebSphere Business Integration Server V4.3*) Availability: Multiplatform from September 29th 2005, z/OS early 2006 (*Q1*), and iSeries 2006.

In our assessment, WebSphere Process Server, the culmination of several years of IBM process server development, now provides a rich, and fully-featured, leadership enterprise-class business process server, integrating all the strengths of the WebSphere ESB and Application Server technology.

WebSphere ESB (V6.0)

IBM also announced the new WebSphere ESB product, designed to provide an Enterprise Service Bus for IT environments built around open standards and SOA. Further strengthening IBM's current ESB capabilities, and built on the proven messaging and Web services technologies of WebSphere Application Server, WebSphere ESB provides robust and easy to use connectivity, JMS™ messaging and service-oriented integration for Web services-focused applications and services to power a SOA.

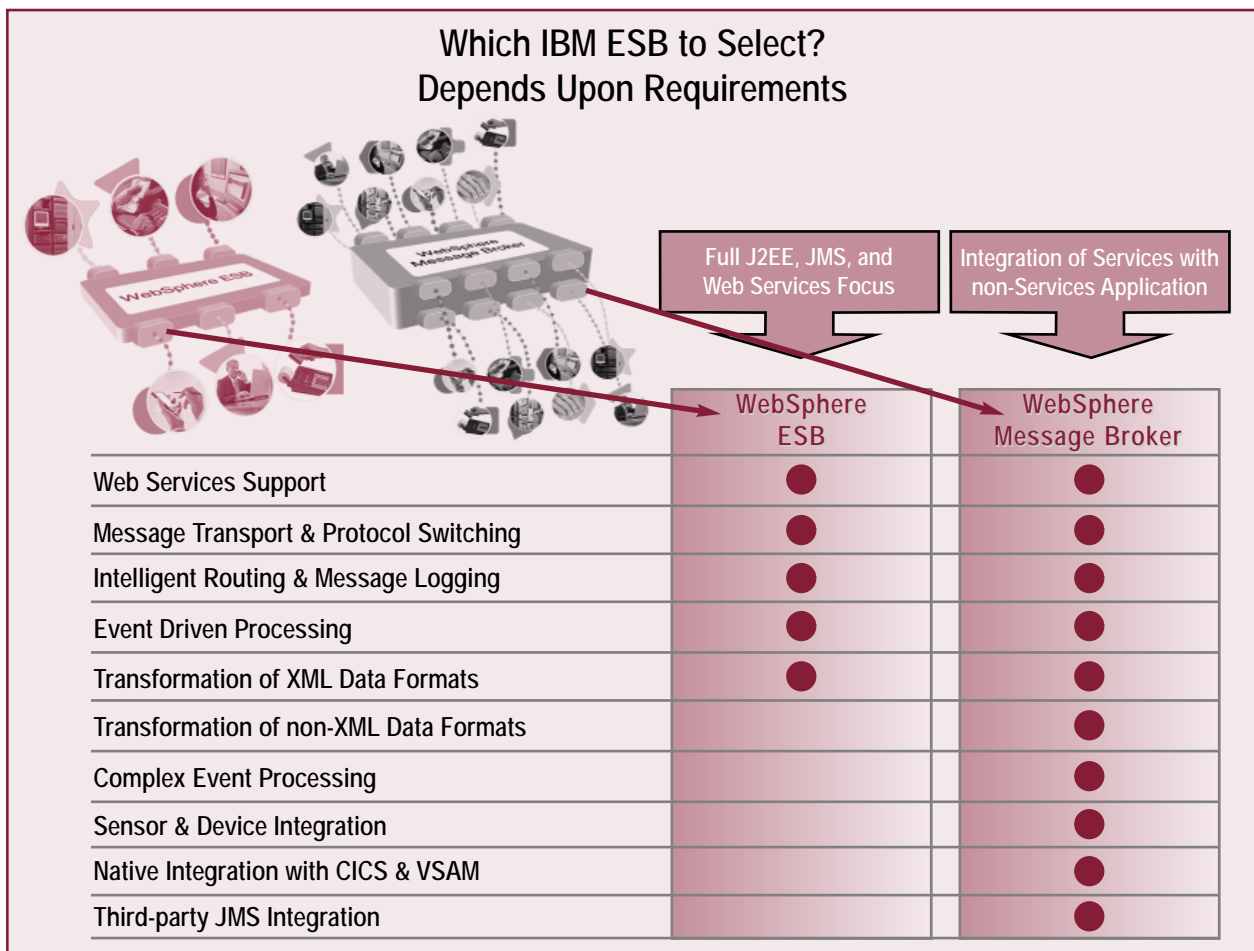


Figure 18: Which IBM ESB to Select? Depends Upon Requirements

WebSphere ESB, as an ESB, provides a flexible connectivity infrastructure for integrating applications and services under a SOA that reduces the number, size, and complexity of interfaces between those applications and services. The ESB performs the routing of messages between services, the conversion of transport protocols between requestor and service, the transformation of incoming message formats between requestor and service, and the handling of business events from disparate sources. WebSphere ESB therefore provides Web services support, message transport & protocol switching, intelligent routing and message logging, and event-driven processing capabilities in a simple to install, easy to configure, build and manage ESB at competitive prices. (See Figure 18 on page 42.)

Fully integrated with the WebSphere platform, WebSphere ESB exploits WebSphere QoS (*clustering, failover, systems management and security*) and improves application flexibility by adopting service-oriented interfaces. The product is claimed to be easy to use, with tools requiring minimal programming, simplifies the handling of integration logic, and speeds up time to value in services integration scenarios. Pre-built mediations are also available; to save time and development costs. The product can be dynamically re-configured whilst running to meet changing business processing loads. WebSphere ESB supports WebSphere Process Server (*in which product an instance is embedded*), and tightly integrates with the IBM Tivoli security and systems management offerings. Availability for z/OS expected late Q1 2006.

With WebSphere ESB, IBM have bowed to the market debate, and created a pure open standards, light- to medium-weight ESB product that provides a cost-effective and capable integration bus solution for Web services SOA deployment.

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WebSphere Message Broker V6.0 (Advanced ESB)

For advanced ESB functionality, IBM is to deliver a new version of **WebSphere Message Broker**, which has been a leader in providing universal connectivity and advanced data transformation for applications, whether or not they comply with open standards. WebSphere Message Broker fulfils all the attributes of an ESB plus, and can therefore be considered as an advanced ESB, meeting all and more of the extensive requirements customers may have as they extend their ESB to connect to all their existing business-critical systems. It offers advanced integration capabilities such as universal connectivity, any-to-any transformation, and supports a wide range of adapters to many other common software packages:

- **Provides universal connectivity:** WebSphere Message Broker provides Web services connectivity and non-standard interface connectivity, with the ability to also integrate many systems, platforms, devices and APIs. The product also facilitates service-oriented integration.
- **Provides universal data transformation:** WebSphere Message Broker also provides advanced message transformation, enrichment, and routing, full support for numerous industry standard data formats (*AL3, HL7, SWIFT, HIPAA, EDI, etc.*), and supports the option to use the new WebSphere DataStage TX product for sophisticated transformation/aggregation of data. These capabilities transform and enrich in-flight information from disparate sources of information, to provide a level of inter-mediation between applications that use different message structures and formats.
- **New & improved pre-built capabilities:** WebSphere Message broker takes advantage of existing skills with rich Java and XML support, allows the implementation of complex event processing with no programming, and provides simple, easy-to-use tools, all of which help speed time-to-value and improve ROI.

WebSphere Message Broker also offers the high performance of traditional transactional processing environments. WebSphere Message Broker includes the WebSphere Event Broker functionality, which is available separately where customers need only publish and subscribe/other distribution capabilities using multiple protocols, without the full-power transformation features provided by the former.

WebSphere Message Broker is therefore essential where advanced ESB capabilities are needed for the parts of the business where the applications are not compliant to service-oriented standards, complementing the pure standards-based integration provided by WebSphere ESB. Figure 18 shows a side-by-side comparison of the core capabilities of both products. Availability for z/OS is expected late in Q1 2006.

WebSphere Business Monitoring (V6.0)

To manage SOAs, IBM also announced a significantly enhanced new version of its WebSphere Business Monitor product. This new software monitors business process performance in real-time, provides visual display of business process status, and key performance indicators to guide overall management and control of the business processes running under the SOA. It also generates alerts and notifications to key users on defined events that enable continuous business process improvement. WebSphere Business Monitoring is tightly integrated with both WebSphere Business Modeler and WebSphere Process Server, described above.

WebSphere Business Monitor also includes one copy of WebSphere Business Modeler Advanced, providing that product's sophisticated, intuitive modeling and simulation capabilities, which can be used to build a business measures model identifying activities to be monitored, such as events, business metrics, and key performance indicators.

The product provides a customizable dashboard, implemented as WebSphere Portal pages that are visually intuitive, featuring scorecards, key performance indicators, and gauges, allowing business performance to be measured and ensured against targets. The dashboard supports multidimensional analyses and reports with embedded business intelligence capabilities. It also provides alerts and notifications to essential users about business-critical situations requiring action, and about anomalous situations, facilitating continuous business process improvement. An Adaptive Action Manager invokes selected real-time actions, or a set of actions, based upon predefined rules and policies.

The product tracks business process flows and monitors business process metrics such as working time and elapsed duration, using customizable analytic components to deliver monitoring as specified by the business user, with user-controlled filtering of the reports. It also provides support for the Common Event Infrastructure, using Common Base Event (CBE) format to receiving and emitting events, as implemented through the WebSphere Process Server. WebSphere Business Monitoring incorporates the real-time analytics acquired from Alphablox, and embeds this and various limited-use DB components for data management and analysis. Availability from January 31st 2006.

WebSphere Business Monitoring V6.0 is a major further advance for the WebSphere SOA Foundation, providing sophisticated and customizable business process monitoring...

In our assessment, WebSphere Business Monitoring V6.0 is a major further advance for the WebSphere SOA Foundation, providing sophisticated and customizable business process monitoring that fully supports business process operation and optimization on the Process Server.

Complementary New Software Supports WebSphere SOA Foundation

A major set of new releases of the **main z/OS platform middleware server engines** has been delivered through 2004 and 2005, much of the advances providing extended SOA and Web services support, latest J2EE™ support, and other infrastructure advances. These are heavily leveraged by the new WebSphere SOA Foundation servers and tools assessed above. We provide our summary findings on these main z/OS middleware engine advances in Appendix D. They include WebSphere Application Server for z/OS Version 6, WebSphere Portal for z/OS Version 5, and WebSphere MQ for z/OS Version 6. WAS V6 for z/OS has also been optimized to fully exploit the System z9 zAAP, which provides price/performance benefits for clients integrating existing core applications and data with new Java-based technologies on the mainframe. The new CICS Transaction Server Version 3.1 and CICS Transaction Gateway Version 6.0 releases of these widely-used middleware products bring enhanced application integration capabilities and improved performance for clients seeking to build flexible SOA applications reusing core software assets. Finally, major new versions of the two primary mainframe DBMS platforms, DB2 Version 8 and IMS Version 9, were also released in 2004/05. These mainframe "foundations" provide capable underpinning for the WebSphere SOA Foundation suite.

The complete **Rational Software Development Platform** is also an important part of the overall SOA offering, providing the developer modeling and AD tools to build new software services, team development and process support, and testing tools that complete the overall IBM SOA development environment. These are well established, and space limits preclude coverage here.

Our Analysis

The WebSphere SOA Foundation, in our assessment, now provides the industry's strongest SOA middleware and tools suite...

The WebSphere SOA Foundation, in our assessment, now provides the industry's strongest SOA middleware and tools suite, extending the established middleware market leadership of the WebSphere platform into this important and fast-growing market. The culmination of several years of intense IBM development, several component acquisitions, much open-standards support development, and considerable optimization

and enrichment efforts on both the servers and the tools, stand behind this considerable achievement.

Significant repackaging and much-improved product naming make the components of the Foundation more flexible and easier to understand.

When combined with the extensive SOA education, knowledge and information, professional services capability, methodologies and other supporting elements assessed in Section 6, we consider IBM is well-positioned to strengthen its already clear overall SOA market leadership over the next two years.

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The zSeries/System z9 mainframe should, in our assessment, play a key part in enterprise SOA deployment and centralized control. It is to be well equipped with this up-coming WebSphere SOA Foundation suite, due out on z/OS before end Q1 2005 or earlier, and with existing equivalent products already available now for early starters.

Appendix A: Service Oriented Architectures – Main Terms Defined

SOA introduces many new terms and acronyms that have specific meaning to this architecture. For readers unfamiliar with SOA terminology, this Appendix provides explanation and definition of the main SOA terms used in our White Paper. You will encounter these, and some variations, in vendor marketing and media coverage. Items highlighted in bold dark red are terms defined elsewhere in Appendix A.

- **Asynchronous Messaging:** Message exchange architecture not requiring synchronous communication between participants. Sometimes termed “fire-and-forget” messaging, because those participating in an asynchronous messaging system need not wait for a recipient response; they can rely upon the messaging infrastructure to ensure and guarantee delivery. Asynchronous messaging is a central underpinning for loosely-coupled systems like **Web services**, because it ensures reliable, assured communication and message delivery between those participating, even if one or more participant is temporarily offline, busy, or unobtainable. Asynchronous messaging systems are also much more scalable than those relying on direct connections, such as Remote Procedure Calls (*RPCs*). Asynchronous messaging services are provided by **Message Oriented Middleware (MOM)**, **Message Queuing Systems (MQ)**, **Enterprise Service Busses (ESBs)** and **Enterprise Message Systems (EMSs)**. IBM WebSphere MQ is the most widely-used, asynchronous messaging MOM middleware, and is dominant in zSeries mainframe environments.
- **BAM – (Business Activity Monitoring):** Monitoring, summarizing, aggregating, and presenting views and pictures of the status and performance of a running business operation. BAM software creates a picture of business activity by monitoring and recording metrics from a variety of different sources within an enterprise’s software infrastructure. Because BAM understands the business context (*business process workflow and KPIs*) of the information it collects, it can translate disparate software events – for example, the creation of sales orders and invoicing – into overall management information about how the business is performing, such as calculating inventory turns or days sales outstanding. This in turn may allow real-time corrective action to be taken. BAM software often provides “dashboards” of key business performance indicators that highlight the most important performance metrics clearly. IBM’s enhanced WebSphere Business Monitoring is a leading example.
- **Business Process:** A coordinated set of actions, steps or tasks that produce an overall business result. A business process can flow either entirely within a single organization, but today increasingly may operate across several collaborating partner organizations. Whereas IT has traditionally automated specific tasks or pre-defined business process workflows, the advent of SOA and Web services has now realistically opened up the prospect of automating entire end-to-end processes without sacrificing business agility. This agility arises because the **composite application** that supports the business process can be **re-choreographed** much more quickly and easily than in any previous generation of software, to accommodate changes to the business process.
- **BPM (1) – (Business Process Management):** Management activities that control, optimize and direct **business processes**, with the aim of improving their responsiveness, speed and efficiency, and including activities like design, deployment, instrumentation, direction and analysis. Important elements include **business process modeling**, **business process orchestration or choreography**, and **BAM**.
- **BPM (2) – (Business Process Modeling):** **Business process modeling** tools allow business analysts and professionals to rapidly graphically model, test and simulate **business process workflow** models on a computer, and can generate the required **business process workflow language** from the model. Systems architects and integration developers can then **choreograph** or **orchestrate** the software services required to support the **business process workflow** specified more quickly and easier.
- **BPM (3) – (Business Process Monitoring):** Synonym for **BAM**, see definition above.
- **Business Service:** A self-contained, stateless business function which accepts one or more requests, and returns one or more responses, through a well-defined, standard interface, performing a business-level unit of work. Services should not depend on the state of other functions or processes. The technology used to provide the service, such as a programming language or hardware/OS platform, forms no part of this definition. Hence, technology-independence is implicit to SOA. Updating a loan application or performing a credit check are typical examples of business services. One or many software services may be linked to provide a business service, which are generally more coarse-grained. Several business services may be **choreographed** or **orchestrated** to create a complete **business process workflow**.
- **Business Workflow/Process Workflow:** Description of the order of the tasks (*services*) to be performed, often involving invoking numerous **business services**, human agent interactions, and event handling, to complete an overall business process. The co-ordination and management of workflow is an important part of **business process management**. A **business process workflow language** (such as *BPEL4WS*) precisely defines such a workflow. **Business process monitoring** software can then report on the executing business process in real time, and show key performance indicators through graphical dashboard displays for On Demand responsive management of the process.

- **Business Workflow Language:** A standard language for describing a business workflow precisely for computation. **BPEL4WS** is now the most widely recognized standard business workflow language. Business workflow language programs are executed by a **business process server** or **business workflow engine/server** at run-time.
- **Choreography:** The co-ordination of events in a process. Overlapping with the related concept of **orchestration**, choreography directs and manages the on-demand assembly of multiple component **business services**, to create a **composite application** that operates a **business process**. Choreography implies a lighter touch than **orchestration**, and usually refers to co-ordination across multiple autonomous IT infrastructures, rather than within a single organization/enterprise. Choreography can best be viewed as the layer in **business process management** that takes multiple **business software services** and assembles them into **business processes**. These services may be transaction system components, or application server software components such as CORBA or J2EE™, they can be XML Web services called with UDDI, SOAP and WSDL, and they can be standard enterprise application package services exposed through an adapter. Virtually any form of service can be linked using Web services interfaces, including e-mail, RSS, EDI and vertical industry-specific services such as SWIFT, SITA and HIPPA.
- **Composite Application:** A business application built by combining (*choreographing or orchestrating*) several **business services**. A composite application consists of functionality drawn from several different sources within a **Service Oriented Architecture (SOA)**. These services can be individual Web services, selected functions from within other business applications, or entire systems whose outputs have been packaged as Web services (*often legacy systems*). **Choreography** of a composite application defines the sequence, **business process workflow** and events handling with which the component services are linked to support the overall **business process** covered.
- **Componentization (Software):** Decomposing monolithic software into interchangeable pieces. For a decade, software innovators have sought to make application software more like computer hardware, which is now assembled from cheap, mass-produced components that connect together using standard interfaces. **Component-Based Development (CBD)** used this approach to assemble software from reusable components, but within specific software frameworks such as CORBA, Sun's Enterprise JavaBeans (*EJBs*) and Microsoft COM. Such reuse increases flexibility, drives down costs and speeds application development, and has seen moderate enterprise uptake. The new SOA approach, based on Web services, goes a substantial step further by encapsulating components as standards-based services with a defined interface, which allows service components to be reused outside their native frameworks, and across heterogeneous environments and multiple participating organizations. Componentization concepts can also be applied to business organizations and processes, through subcontracting and outsourcing. Indeed, IBM Global Services' "**Component Business Model**" approach to overall business modeling and analysis adopts this approach.
- **EAI – (Enterprise Application Integration):** Connecting diverse business applications within an enterprise. EAI middleware software generally provides a hub that translates data and messages between different applications, a process termed **mediation**. (*"Hub-and-spoke"*.) EAI became needed as enterprises sought to exchange information between separate 'silos' of automation, such as ERP and CRM systems. EAI software therefore performs **mediation** to translate between the different participating applications. EAI is generally regarded as more tightly coupled and less flexible than alternatives based on the newer Web services and SOA models.
- **EII – (Enterprise Information Integration):** Linking information within an enterprise. In most enterprises, information is stored in many separate databases, data warehouses and applications, usually on multiple, heterogeneous computing platforms. EII middleware products enable users and applications to combine information from these different data sources on demand. These products establish an intermediate data services layer that makes it possible to access the data in a standardized way, instead of having to interact directly with each separate back-end data source. Although EII is named after the above **EAI** class of technologies for linking applications, EII has adopted a more service-oriented model than traditional EAI products, and so fits more neatly into SOA environments.
- **ESB – (Enterprise Service Bus):** Universal integration backbone. An ESB acts as a shared messaging layer for connecting applications and other services throughout an enterprise-computing infrastructure. It supplements its core **asynchronous messaging** backbone with intelligent transformation and routing to ensure messages are passed reliably. Services participate in an ESB by using either Web services messaging standards or the **Java Message System (JMS)**. Originally defined by analysts at Gartner, ESB is seen by many proponents as a core component in a service-oriented infrastructure. There have been fierce arguments as to whether an ESB should be considered primarily as an architectural construct or pattern (*which can be implemented with a number of existing middleware product technologies*) or as a specific, new class of middleware product that provides the above ESB functions only. Pure-play SOA infrastructure vendors offering specific ESB products (*Sonic Software, Cape Clear, Fiorano Software and others*) promoted the latter view. Until recently, IBM argued the architectural pattern viewpoint, but recently reversed its stance with the introduction of WebSphere ESB and WebSphere ESB Advanced (*WebSphere Message Broker*). Yet another group (*including Microsoft and SOA fabric vendors such as Blue Titan*) argues that ESBs are a transitory product category whose functionality will be subsumed in (*their*) wider SOA fabric architectures. Clearly amongst the most controversial topics in SOA today!

- **Governance:** General term connoting how an organization controls its actions. Governance describes the mechanisms an enterprise applies to ensure that its members follow established processes and policies it has defined. In the more loosely-coupled and multi-enterprise environments envisioned by SOA, governance becomes the main means of maintaining oversight and accountability in these more loosely-coupled, organizational and systems structures. A sound SOA governance strategy implements systems to monitor and record what is going on, takes steps to ensure compliance with agreed policies, and provides for corrective action in cases where the rules have been ignored or misconstrued for all participants in the SOA ecosystem.
- **Granularity:** How small or large the **services** are. When an existing application system is split into components (*services*), developers must select the right level of **componentization**. Smaller, finer-grained components/services give more flexibility to assemble the exact needed combination of functionality, but are more difficult to coordinate. Rather larger, coarser-grained components/services are easier to manage, but may become too unwieldy. Performance and management issues now favor more coarsely-grained services in a SOA, which map more closely to **business services**, whereas earlier generations of distributed computing preferred a much finer level of granularity.
- **Loose Coupling:** The loose linking of software components enabled by Web services (*or any SOA*) without friction. Loosely-coupled services, even if they use incompatible system technologies, can be joined together on demand to create **composite services** or **applications**, or disassembled into their functional components. Participants in the loosely-coupled environment must establish a shared semantic framework to ensure messages retain a consistent meaning across participating services. Loose coupling offers many fundamental advantages, enabling a far wider diversity of service types to be connected more easily, enabling late binding, and providing much greater flexibility and agility. The opposite is tight coupling. Earlier distributed computing models, such as CORBA and DCOM, as well as traditional OLTP/DB environments, use tight-coupled integration, which is much more “hard-wired”, more difficult to implement, and renders interoperation with other worlds much harder. Tight coupling, however, does provide some advantages in the areas of high performance, security, and transaction integrity.
- **MOM – (Message Oriented Middleware):** MOM software connects separate applications by carrying and distributing messages between them. The messages may contain data, software instructions, or both. MOM middleware is usually built around a **Message Queuing (MQ)** core that stores messages before delivery. The middleware also keeps track of each message to monitor that it has been successfully delivered, and when, to provide assured delivery. Most MOM systems also support autonomous publish-subscribe messaging. MOM products originally used proprietary messaging technologies, but emerging open standards specifications, such as **JMS** and **WS-ReliableMessaging**, are now enabling open standards-based MOM infrastructures. Well-known MOM product examples include IBM WebSphere MQ, MSMQ from Microsoft and TIBCO Rendezvous. Open MOM middleware is generally regarded as a foundation technology for an **ESB**. See also **Asynchronous Messaging**.
- **Orchestration:** Sequencing **business services** to coordinate events in a **business process**. Orchestration is similar to the related concept of **choreography**, and directs and manages on-demand assembly of multiple component services, to create a **composite application** or support a **business process**. Orchestration implies a single coordinating force, whereas **choreography** also applies to shared co-ordinations across multiple autonomous systems. After protracted debate, and the evaluation of the several earlier competing specifications, majority informed opinion has now adopted **BPEL4WS** as the core standard for Web services orchestration of **business process workflows**.
- **REST – (REpresentational State Transfer):** A Web services architectural style based solely on **HTTP**. REST advocates consider the Web already has everything necessary for Web services, without needing the extra higher-level WS specifications such as SOAP and UDDI. The biggest real-world example of a REST system is the Internet itself. In this style, any item can be represented at a **URI**, and, subject to appropriate permissions, can be manipulated using one of the simple operations of HTTP. (*These are GET (retrieve information), PUT and POST (to modify), and DELETE (to remove).*) REST advocates argue that using simple HTTP semantic structure is the best way of preserving fullest interoperability between all Web participants. The view is emerging that the WS standard set (*SOAP, UDDI, WSDL, etc.*) is evolving to cater for more formal, more controlled, more structured business enterprise Web services applications. The simpler, lighter-weight REST Web services architectural style is suitable for more informal, less structured Web services applications. REST is not a standard.
- **Registry:** A recognized and generally accessible **services directory**, a registry stores information about the services in a SOA. At its most basic, the registry includes information other participants can consult to find the location of the service and what it does (*the UDDI specification defines a Web services standard for this*). A registry may also include additional information about service policies, such as security requirements, QoS commitments and charging. Some registries are extended with document repositories, providing still more detailed information about the operation and constraints of the service that are intended to be useful to developers, administrators or users.
- **Service Consumer:** The function, business or organization that consumes the result of a **software service** supplied by a **service provider**.
- **Service Provider:** The function, business or organization that performs a software **service** in response to a request from a **service consumer**.

- **Services Management:** The management of automated **software services**. A generic term for software and techniques used to monitor and control software-based services, usually within a **SOA**. These include identity and access management, policy configuration, usage metering, availability monitoring, performance measurement and **business activity monitoring**. The SOA-specific implementation of application systems and enterprise systems management, with a particular focus on business service-level management.
- **SLA – (Service Level Agreement):** A contractual service commitment. A long-standing, general IT industry term widely used to contractually define the service standards an IT **service provider** will offer to a **service consumer** (e.g. in an *IT outsourcing or application hosting contract*). A SLA is a document that describes the minimum performance criteria the provider undertakes to meet while delivering the offered service. The SLA also usually defines the remedial actions, and any penalties that will take effect if performance drops under the standard promised. A SLA will therefore be the essential underpinning of any legal contract between a **service consumer** and the provider. In a SOA environment, conceptually each **software service** should have an implicit or explicit SLA, so that **service consumers** may know what they can expect if they consume the **software service**.
- **SOA – (Service Oriented Architecture):** A more recent distributed computing software architecture that treats all components as independent **software services**. Although not a new concept, SOA has accelerated in market importance with the advent and maturing of **Web services** and their open standards. **Software services** may be both **business services** and **systems services**. SOA is rapidly becoming the definitive enterprise software architectural approach likely to predominate over the next decade. In a SOA, software services are provided to other participants in the network as independent services. All participants can “consume” or use them in a standardized way through standard interfaces. This provides for much more flexible, **loose coupling** of software resources than in traditional distributed systems architectures. The ability to reuse software services many times in different **composite applications** provides for much more rapid and productive development of new business solutions. Traditional application components, such as zSeries mainframe CICS and IMS transactions, may be presented as **services** and thus participate in a SOA. The SOA may also be extended far outside the enterprise over the Internet, and can provide to, and consume services from, suppliers, business partners, advisors and customers within a single **composite application** that supports a modernized **business process workflow**. Most current definitions of a SOA stress the use of Web services and their open standards, and often propose an **ESB**, a **services registry**, and a **workflow engine** or **process server** as foundation software platforms for SOA.
- **SOA Design and Development:** The modeling and design methodology for SOA applications has now become generally known as **service-oriented analysis and design**. The SOA functions both as a software development framework and as a delivery framework. For a SOA environment to operate successfully, software developers need to adopt the approach of focusing on the creation of common services which clients or middleware then orchestrate to implement processes. Development of systems using SOA requires a commitment to this model in terms of planning, tools, and infrastructure.
- **Stateless:** Not depending on any pre-existing condition. In a SOA, services should not depend on the condition of any other service; e.g. they should be stateless. They should receive all the information needed to provide a response from the request. Given the statelessness of services, **service consumers** can sequence (*orchestrate or choreograph*) them into numerous workflows to perform business application logic.
- **System Service:** Business services may call upon **system services** to perform discrete units of computational work such as editing a file, processing a transaction, updating a record in a database, checking an identity or spawning a new virtual server image. System services in a SOA should also follow the same general characteristics of **business services**. System services have taken on a much-extended role with the merging of Grid computing and Web services management services standards under the **Web Services Resource Framework (WSRF)** standard.
- **Web services:** Automated **software services** accessed via the Internet. Web services are software-powered services, resources or functional software components, the capabilities of which can be accessed at an Internet **URI**. Standards-based Web services use **XML** to interact one with another. This interface allows them to be linked up dynamically, using **loose coupling**, into **composite applications**. Web services and their core standards have today become the foundation enabling technology and standards for most SOA efforts.
- **Workflow:** A sequence of tasks within a **business process**. A workflow describes the order of the tasks that need to be performed by various software and human agents to complete a given **business process** within an enterprise and/or collaborative ecosystem. Often connotes more repetitive workflows that are often automated, particularly in organizations that handle high volumes of forms or documents according to fixed procedures. (*Banking, insurance, healthcare, etc.*)
- **Workflow Engine/Process Server:** A software server that provides a run-time execution engine to execute a **business process** and its business services, defined in **business process workflow language**, as well as providing other process management supportive services. IBM's WebSphere Process Server and WebSphere Business Integration Server Foundation, and Microsoft's BizTalk Server are leading examples. Along with application servers and **ESBs**, workflow engines/process servers are one of the central run-time foundations of a SOA environment.

Appendix B: The New System z9 109 Mainframe Generation – Analyst Overview

We recently published an in-depth, Enterprise Server Spotlight Report (*see the “Related Software Strategies Research” Section on page 55, item 7*) assessing and reviewing the new System z9 109 mainframe hardware, software and storage, highlighting their significance and value to enterprise IT users and vendors worldwide. This Appendix is the Executive Summary of our findings and assessments from that Report, with important SOA-supportive features noted, included to provide a concise picture of the platform here:

- 1. Spectacular New System z9 109 Mainframes – Designed for Collaborative Computing Era:** The new System z9 109 mainframes (*shown in Figure B1*) are positioned to support **collaborative computing**, which IBM sees as the next generation of enterprise computing. Enterprises today must collaborate with their partners more efficiently, with global collaborative processing tightly integrating people, processes, technology and data to their traditional transaction processing under SOA. This calls for systems that can be more easily, more rapidly, and more intelligently linked to securely support On Demand Business. IBM claims that the new System z9 109 mainframes lead in collaborative computing technologies like virtualization, open standards and encryption that uniquely equip these systems to better share information and processes within and across collaborating businesses.
- 2. System z9 Exemplifies New “Systems Agenda” Strategy:** IBM also unveiled a new “Systems Agenda” systems strategy. Its main thrusts are to **“Virtualize Everything”**, **“Commit to Open”**, and to **“Collaborate to Innovate”**, and to extend IBM’s deep strengths in these areas to better support the firm’s On Demand Business vision launched in 2002. The new IBM System z9 109 (*code-named Danu*) mainframe advances exemplify this new strategy.



Figure B1: The New IBM System z9 109 High-end Mainframe

- 3. System z9 109 – New Enterprise Hub Roles:** The System z9 109 was designed/optimized to serve as the **enterprise hub** in this new **collaborative computing** era, offering new levels of security, enhanced reliability, extensions to its leadership virtualization capabilities, and much-increased scale/capacity. This vision defines four new mainframe **enterprise hub** roles in collaborative computing infrastructures, as well as its traditional, roles.

These are:

- Enterprise Security Manager.
- Enterprise Workload Manager.
- Enterprise Business Resilience Manager.
- Enterprise Hub for Data and Service Oriented Architecture (SOA).

With the IBM System z9 109, IBM delivers significant steps along the charted development roadmap of this “Hub” strategy, announced in October 2004, as well as extending support for traditional mainframe roles in numerous other advances.

4. **\$1.2B IBM Investment:** The System z9 109 took three years, cost \$1.2 billion, and used 5,000 global IBM developers and engineers to develop. This continued the multi-\$B mainframe investments IBM has consistently made since the late 1990s that have fuelled the market resurgence seen in recent years.
5. **New Branding:** All IBM servers, (*including the zSeries mainframe*), have been branded with the “eServer” prefix since October 2000. The brand evoked the sharing of IBM’s best technologies across its (*then four*) server lines, and supported its corporate “e-business” (*later “e-business on demand”*) strategies/messages. With the System z9 109, “eServer” is dropped, and the “System” brand returns (*a.k.a. System 360, System 38*). The next generation pSeries, iSeries and xSeries can be expected to follow suite. “eServer” worked well for five years, but became slightly discordant with the “On Demand Business” corporate message, so retirement was appropriate. IBM Systems’ marketers place much emphasis on branding, although analysts and customers are less moved.

6. **Doubles Capacity, Scalability:** Impressive technologies double the high-end capacity of the System z9 109 to 17,800 MIPS

Impressive technologies double the high-end capacity of the System z9 109 to 17,800 MIPS in the new top-end 54-way system.

in the new top-end 54-way system. (*Up from 32-way on the z990*). The System z9 109 also supports double the memory at 512GB, and increases system bandwidth by 80%, in a balanced design that enables it to support much larger collaborative processing workloads. (*All compared to the z990*). IBM claims a new System z9 109 (*54-way*) can securely process 1B

transactions per day, and that a maximum 32-system Parallel Sysplex cluster of System z9 109s can handle 25B transactions per day, ample for the largest business on the planet.

7. **Five-model Range:** The System z9 109 offers a five-model range – the Models S08, S18, S28, S38 and S54 – offering low entry points and fine-grained increments for exact system sizing. All five models shipped from September 16 2005, the 54-way S54 two months earlier than previously announced. Comprehensive upgrade paths, both within the new range and from most z990 and z900 systems, are offered as usual with IBM’s mainframes.

8. **More Powerful, Dual-core Processors, and Flexible Designation:** For the System z9 109, IBM built a new, near 600-MIPS Processor Unit (PU) (*35% up on the z990 PU*). Each PU may be designated and used as a CP (*general-purpose workload processor*), a System Assist Processor (SAP – *I/O processor*), an IFL (*specialty Linux processor*), an ICF (*specialty Sysplex coupling processor*), a zAAP (*specialty Java workload processor*), or as a spare processor. This allows customers considerable flexibility to configure an optimum System z9 109 system for their workload and budget. The IBM z9 processor chip is again a dual-core SOC that includes one or two active processor cores (*as on the z990*), L1 cache, and memory-bus interfaces. The z9 processor ships with a clock speed of 1.65GHz. (*up from 1.2GHz., on the z990’s z8 PU*), and delivers 580-600 MIPS (*up from 450-480 MIPS on the z990, both depending on workload*).

9. **Now Just 2 Spare PUs Per System Needed:** In a welcome development, a minimum of only two PUs across the whole system need to be reserved for use as spares. Previously, the z990 required two spare PUs per book (*1-4 books per system*). This frees up 6-8 PUs for customer designation on higher-end System z9 109 models. A minimum of two SAP (*I/O*) processors per book must also be designated, to provide I/O processing horsepower.

10. **Dense Physical Packaging:** The System z9 109 server occupies almost identical floor space, and uses similar electrical power, whilst providing twice the capacity/throughput of its z990 predecessor, an impressive packaging feat. A single two-frame chassis houses the entire system, with most of the space devoted to up to three I/O subsystem cages. The System z9 109 uses similar modular “book” construction to that of the z990, with one (*Model S08*) to four books (*Models S38 & S54*) per system. The z9-109 uses a dense, new, 3.5B transistor Multi-Chip Module (MCM) that mounts 16 chips in total, including eight dual-core z9 processor chips, and four Level 2 cache chips. Each book houses one MCM, and up to 128GB of shared main memory.

11. Secures Enterprise Data to Cut Risks With New Security Advances: Substantial security and encryption advances will enable the proposed new “Enterprise Security Manager” hub role for the System z9 109, bringing valuable new protection options we consider customers will warmly welcome. These include: securing data transported extra-enterprise; advanced new encryption; faster Secure Sockets Layer (SSL) transactions; easier Internet security implementation for mainframe workloads; and enhanced network-based security with Cisco. These, and the System z9 109’s centralized key management capabilities, add further strength to the mainframe platform’s already legendary security. This security capability will be of particular value to enterprises deploying broad SOA applications over multiple platforms.

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12. Virtualization Virtuoso: The System z9 109 extends mainframe virtuoso virtualization strengths, enabling customers to simplify their overly complex IT infrastructures. The System z9 109 now supports up to 60 LPARs (*double the 30 on the z990*), can support thousands of virtual servers on z/VM, enjoys/exploits the major IBM Virtualization Engine 2.0 platform advances, and adds important new storage virtualization developments/directions, extending its “virtualization fabric hub” leadership. For higher levels of SOA implementation, fullest virtualization of the IT infrastructure enables greatest efficiency and automation, and the System z9 clearly holds industry-leading advantage here.

13. Extended Reliability and Availability: System z9 109 extends already legendary zSeries mainframe reliability and availability with further significant advances, especially in further reducing planned outages. The System z9 109 offers new availability features, including specialty engine capacity back-up, enhanced book availability, higher memory availability, and more non-disruptive hardware driver maintenance. These all help drive down the number and duration of planned outages still further.

14. Outstanding Enterprise Workload Management: Extension of the well-proven mainframe intelligent workload management strengths to other heterogeneous, IT platform-based applications is especially noteworthy, and addresses major user challenge. The IBM VE 2.0 Enterprise Workload Manager now enables the System z9 to optimize SOA application workload management and performance across heterogeneous environments.

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15. Middleware Fully Supports Next-generation SOA Applications: Collaborative computing demands new-generation, SOA based, composite applications. For the System z9 109, in our assessment IBM now offers the industry’s most comprehensive, robust, and advanced SOA middleware and tools suite bar none. All the main z/OS middleware software engines, and their associated tools, had all been substantially upgraded though 2004 and 2005. These new servers included WebSphere Application Server for z/OS Version 6, WebSphere Portal for z/OS Version 5.1, WebSphere MQ for z/OS Version 6, and CICS Transaction Server Version 3.1/CICS Transaction Gateway Version 6, all of which have enhanced support for SOA, Web services, and J2EE™ 1.4. WebSphere Business Integration Server Foundation for z/OS Version 5.1 provides a business process server today. With the recent SOA Foundation announcement, WebSphere ESB, WebSphere Process Server, and a new version of WebSphere Message Broker (*Advanced ESB*) are also slated for Q1 2006 availability on z/OS. Recent DB2 for z/OS Version 8 and IMS Version 9 releases also offer enhanced and complementary database support. These engines provide full run-time support for deploying next-generation, collaborative computing applications under a SOA, implementing the “enterprise SOA hub” role envisioned for the System z9.

16. SOA Tools Complement Platform: The SOA Foundation announcement brought the much enhanced WebSphere Business Modeler process modeling tool for business analysts to design and model business processes. It also added, the new WebSphere Integration Developer for assembling SOA composite application, and the powerful WebSphere Business Monitoring tool, for monitoring live business process composite applications. When combined with the Rational Software Development Platform AD and team development tools for new software development, and the extensive suite of Tivoli management tools for z/OS, these provide a comprehensive suite of SOA development, monitoring and management tools for mainframe SOA solutions.

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17. Double-digit Percentage Price/Performance Gains for Enhanced Value and Improved Economics: The System z9 109 family continues the mainframe’s rapid price/performance advances, at double-digit percentage improvement per-year rates, for both hardware and software. Continuing previous aggressive moves, IBM has again improved price/performance substantially on many mainframe hardware and software cost items, to extend this sharp improvement in mainframe economics that had already made it the lowest TCU platform for enterprise-scale workloads.

18. Broad Operating Systems Support: The System z9 109 supports z/OS, z/VM, VSE/ESA, z/VSE, TPF, z/TPF and Linux for System z9 (31-bit and 64-bit distributions), supporting ESA/390 and z/Architecture modes that ensures current applications will run unchanged. The flagship z/OS, in new Release 1.7, provides fullest support for the new systems and for their most advanced features.

19. Holistic Design/Extensive Collaboration: IBM has worked hard internally to design and optimize this sophisticated new mainframe system, its hardware, operating system, middleware and services, in a holistic approach to provide balanced, all-round performance, price/performance, security, reliability and manageability gains across all levels of its stack. It has also collaborated

The System z9 109 adds extended support for open-standards-based SOA application development, and for virtualization...

extensively with such select major partners as Cisco Systems, Network Appliance, enterprise management software vendors, and others. Under the Mainframe Charter, into which large investments continue to be made, extended support for and collaboration with ISVs has encouraged many new partners to offer their products for the mainframe software platforms.

20. Commitment to Open: New open workloads drove 75% of new mainframe MIPS sold in the last four years. The success of Linux on the platform has been particularly noteworthy, with over 1,700 installations to date. The System z9 109 adds extended support for open-standards-based SOA application development, and for virtualization, and supports all other significant and established open industry standards, many IBM-driven. Today, the mainframe is actually now amongst the most open, accessible and interoperable of all-commercial systems.

21. Will Extend Mainframe Resurgence: IBM shipped more mainframe MIPS since 2001 than in the previous 36 years, and gained 16% share points in the "over \$250,000 servers" segment (*in which it holds a commanding lead*), highlighting the scale of the mainframe resurgence. Sustained technology innovation, the core strengths and unique business values and QoS it offers, superior economics for large workloads, and a wholesale market rediscovery of current mainframe advantages, stand behind this resurgence. We assess the System z9 109 will accelerate further resurgence and growth, with its impressive portfolio of advances on all fronts.

22. Continues to Preserve Customers' Mainframe Investments: One of the most important strengths and advantages of the mainframe platform, carefully preserved and maintained by IBM, is the high level of customer investment protection that it offers. Upward hardware and software compatibility, high hardware residual values, stable core APIs, affordable hardware upgrade paths, multiple operating systems support, and compatibility for customers' existing applications, are long term "givens". Ensuring no disruptive discontinuities in the hardware and software roadmaps, together with highest-quality support and maintenance, are also established mainframe heritage strengths that are continued and extended with the System z9 109. These desirable attributes are difficult and costly for any system vendor to achieve. They are far from common in this industry, where even major vendors have often imposed costly and disruptive technology transitions on their customers that wrote off much of their users' prior investments. Microsoft (*middleware software stack*) and Hewlett-Packard (*server lines consolidation 2003-2005*) are prime examples.

23. Coolest Computer System on the Planet: IBM, in its usual conservative style, described the new mainframes as "One of the most sophisticated computing systems ever". "Coolness" is just as an important a marketing and adoption factor in the IT industry as in fashion and popular culture. The "coolest" technologies in the industry today included dual core processors, SOC, virtualization, high-density, reliability, security, encryption, SOA, and several others. With its winning leadership on all of these technology "coolness" factors, the new System z9 109 can now justly be considered the "Coolest Computer System on the Planet".

24. Next Generation of Mainframe Staff in Training: Over 150 universities are now participating in the zSeries/System z9 Academic Initiative, and IBM/SHARE have pledged to add 20,000 new mainframe professionals to the global workforce by 2010. Each year thousands of new generations of young IT professionals are discovering the outstanding attributes and capabilities today's mainframe offers with astonishment and interest. Many now graduate with these skills to join the established staff teams of mainframe users, who have long understood the mainframe's unique advantages.

25. Attractive & Compelling Upgrade: Our assessment found the System z9 109, first of a new generation of IBM mainframe systems, provides an attractive and compelling upgrade for both high-end z990 customers and mid-sized z900 and z990 users. With its massive increase in scale/capacity, superior virtualization, extended security, enterprise hub support, extensive SOA

software stack, much-improved price/performance, and further enhanced availability, these new mainframes offer an attractive blend of benefits and advances. These advances, together with these system's still lower per-user costs (*that run 3-4 times lower than UNIX or Windows systems on enterprise workloads*), render them ideal "enterprise hubs" for collaborative computing.

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Appendix C: System z9/zSeries – Other Recent Major Middleware Advances

Major z/OS	Key Feature/Function Advances in New Middleware Releases
DB2 UDB For z/OS Version 8 <i>Released 03.26.2004</i>	<ul style="list-style-type: none"> ● Enhanced SQL: More functions, better diagnostics, tighter DB2 UDB family compatibility, extending DB2's SQL beyond its current boundaries. ● Schema Evolution: "Alter a table and go" – no need to drop and redefine. This important change brings less system downtime and more data availability. ● 64-bit Virtual Storage Support: Simplifying main storage, increasing system availability and scalability. ● Longer Names for Tables & Columns, Longer SQL Statements: Enhancing DB2 family application portability and increasing database functionality. ● Enhanced Java™ and Unicode Support: Improving application support and reengineering for international business. ● Enhanced Utilities: Full utility support for the extensive changes in DB2 for z/OS, plus greater DB2 family compatibility. ● Multilevel Security at Row Level: Enables finer-grain database security at row level. ● DB2 Tools: Extensive suite of 32 complementary DB2 tools, all aligned for DB2 V8.
IMS Version 9 <i>Available since October 2004</i>	<p>IMS Version 9 Database Manager:</p> <ul style="list-style-type: none"> ● Broadened Access: Java™ & XML enhancements plus XML data storage in IMS databases. ● Integrated IMS Connect Function: Provides fast-to-install, easy-to-use, high-performance/high-volume, and secure transparent access to IMS apps./data from any app. environment, including Linux. Offers network management, workload-balancing commands for better resource utilization. ● Ease-of-use/Extended Access: Expanded, autonomic, user-friendly commands and interfaces that are accessible across environments. ● Easier to Handle & More Secure: Easier installation/system generation enhanced security and serviceability. ● Improved Availability and Recovery: Fully integrated on-line reorganization for HALDB, providing concurrent on-line updates and availability of data. ● Improved Performance and Capacity: For Virtual Storage Constraint Relief (<i>VSCR</i>), Database Recovery Control (<i>DBRC</i>), and Fast Path. <p>IMS Version 9 Transaction Manager:</p> <ul style="list-style-type: none"> ● Integrated IMS Connect Function: See above. ● Enhanced AD & Deployment: Broadened AD and execution tools, with XML and Java enhancements. ● Extended Autonomic Network Switchover Capability. ● Easier to Handle & More Secure: Easier installation and system generation, as well as enhanced security and serviceability. ● Improved Performance and Capacity: Improved system availability, performance, and capacity for VSCR, DBRC, and Fast Path message handling. <p>IMS Tools: Enhanced, extensive suite of 36 IMS tools, all aligned for IMS V9.</p>
IBM Tivoli NetView for z/OS Version 5.2 <i>To be available October 2005</i>	<ul style="list-style-type: none"> ● TCP/IP and SNA Network Systems Management: Focuses on network manager productivity with graphical displays and embedded automation capability for both TCP/IP and SNA networks. ● Eases z/OS TCP/IP Deployment: Familiar tools allow easier TCP/IP deployment, exploiting all sophisticated z/OS TCP/IP capabilities (<i>including DVIPA</i>) across virtually any Sysplex. ● Reduces Downtime, Speeds Issue Resolution: Integrated business-critical network management functions, enables rapid network problem isolation, and automates correction. ● Bridges Mainframe/Distributed Network Management: Provides direct central support for both distributed and mainframe environments, combining previously isolated islands of management. ● Comprehensive Set of Tools: Enables the enterprise to maintain/manage complex, multi-vendor, multi-platform networks and systems from a Single Point Of Control (<i>SPOC</i>) with lower effort. ● Java-based Management Console: Provides a modern SPOC and management for enterprise networks. The NetView Web Application provides a simple Web interface and SNMP services that enables easy access to console information from any location. ● Production-ready Automation/Ease of Install: Reduces manual resource definition and complex automation set-up through production-ready automation, allowing simpler and easier customization through the NetView style sheet that speeds NetView installs and time-to-value. ● Standalone/Collaborative: Provides management functions that can inter-operate and integrate with other management products, but can also function alone as a network management end-point. ● Supports Linux on zSeries: Increased platform flexibility through Linux support for IP resource discovery and management, SNMP services and NMC Topology Server (<i>all on Linux on zSeries</i>), and NMC Topology Console (<i>Linux on Intel</i>).
CICS Transaction Server V3.1& CICS Transaction Gateway V6.0 <i>Available since March 2005</i>	<ul style="list-style-type: none"> ● CICS Applications as Web Services: Enables CICS applications to be exposed as Web services, both as a Web services service provider and now also as a service requestor, enabling fullest CICS participation in business integration. ● Standards-based Connector Architecture: Enables superior interoperability between CICS apps. and new J2EE™ and .NET apps. loosely coupled under Web Service standards. ● Full SOA Support: Provides standards-based interfaces to CICS software component functionality, enabling service consumers to use CICS services without detailed, internal knowledge. ● Increased Ease of Integration: Web services to extend CICS capabilities to a SOA and support of industry-leading SSL protocol to provide standards-based security. ● CICS Web Services Assistant: Enables simple transformation of CICS functionality into Web services, whether written in COBOL, C/C++ or PL/I. Speeds/simplifies new CICS-based Web services creation for inclusion into new business process workflows.

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<p>CICS Transaction Server V3.1& CICS Transaction Gateway V6.0 <i>Available since March 2005 (cont.)</i></p>	<ul style="list-style-type: none"> ● Enhanced Application Transformation: Single, productive development tool (<i>WebSphere Enterprise Developer</i>), plus optimized CICS data exchange capabilities. Overcomes prior 32KB limit, passes data in a more structured way, simplifies program design, reduces storage needs, and provides a suitable deployment environment for C++ and Java programs. ● Major Advance Over "SOAP for CICS" Feature: Major advance over the well-received SOAP for CICS capability first offered in the previous CICS TS Version 2.1, offering significant enhancements in workload distribution and resource management. ● Improved CICS Workload Throughput: Delivered via an enhanced Open Transaction Environment (<i>OTE</i>). ● Enhanced CICSplex System Manager: Comprehensive Web UI now provides full, traditional TSO interface functionality in this CICS system management capability, plus extensions and enhancements. Denser screen displays, user favorite views for rapid navigation, role-based user profiles views and extended selection lists are offered for improved productivity and an integrated single view. ● CICS Information Center: All CICS documentation now held in consistent, open-standards, Eclipse platform-based information center application, with task-oriented structure and new feature learning. This makes it faster and easier for developers to access CICS guidance and usage information, and to link quickly to the product documentation for a growing number of other IBM products (<i>such as DB2 and z/OS itself</i>) that use the common, Eclipse-based, information center platform. (<i>Available on the workstation and other platforms, now including z/OS itself</i>). ● CICS Transaction Gateway Version 6: Companion new release of popular CTG offering.
<p>WebSphere Application Server for z/OS Version 6.0.1 <i>Available since March 2005</i></p>	<ul style="list-style-type: none"> ● New Messaging Engine: Brand new messaging engine, now a Java Messaging Service (<i>JMS</i>) engine, completely written from scratch. Runs up to five-times faster than WebSphere Application Server V5.0 messaging and integrates better with enterprise backbone products like WebSphere MQ. ● SOA Building Block: Delivers a SOA today. Allows zSeries/System z9 customers to increase ROI and lower TCO by reusing existing zSeries IT assets using standards-based messaging, and the latest Web services standards. Reduced costs, faster time-to-value, and increased business flexibility are the main benefits. ● Secure, Optimum Resource Utilization: Provides a secure, dynamic platform for e-business that fully exploits unique zSeries/System z9 capabilities. Businesses can do more work with less resource when combined with the zSeries/System z9 platform's unique scaling abilities and ultra-high-security features. ● Full J2EE™ V1.4 Compatibility: Supports full J2EE™ 1.4 programming model and extensions, including Servlets, JSPs, EJBs, and Web services, plus additional programming model enhancements to provide a secure foundation for a SOA. This support: <ul style="list-style-type: none"> ● Dramatically simplifies connecting applications to an ESB with JMS 1.1. ● Enables more demanding business applications by leveraging SDK 1.4.2. ● Facilitates easier connection to multiple, back-end data sources through standard interface with Service Data Objects (<i>SDO</i>). ● Allows dynamic Web user interfaces with drag-and-drop development using standards-based JavaServer Faces (<i>JSF</i>). ● Rapid Development and Deployment: Enables fast time-to-value with enhanced development and deployment capabilities that reduce development cycle time. Businesses can improve time-to-value and make the most of existing skills with features enabling ease-of-use and high, out-of-the-box performance. ● Tight Integration With IBM Rational Tools: Provides a productive development environment built on Eclipse, the open systems development environment. ● On Demand Infrastructure: Provides the scalable, robust, flexible and manageable environment businesses today need; eliminating lost business opportunities with near continuous uptime for mission-critical applications. ● Tight Security: Integrates closely with Tivoli offerings and z/OS security services (<i>including embedded Tivoli Access Manager</i>), for centralized security management among J2EE™ and Web resources. Supports the Web Services Security open security model for easy interoperability with third-party, customer-created or legacy security solutions.
<p>WebSphere MQ Version 6.0 <i>Announced 04.19.2005</i></p>	<ul style="list-style-type: none"> ● Improved Usability: Enhancements to configuration, operations and management, focusing on simplicity and ease-of-use. ● Enhanced Management Capabilities: Improving visibility of information flows across business by logging and outputting more operational data/statistics, used by WebSphere MQ tooling or other system management applications, to help deliver on SLA commitments. ● Better Performance: Meeting growing performance needs by further improving on the already enterprise level of performance/scalability of prior releases, with higher availability and greater throughput. ● Extended Connectivity: Adding new ways in which applications can be connected together, making use of the strengths of WebSphere MQ across networks. ● Open Standards Support: Leadership open industry standards support – for example, the Java™ Messaging Service interface standard JMS v1.1, including publish-and-subscribe messaging – making it the leading JMS provider. ● Speeding Time-to-value: Enabling faster, easier deployment of new application integration links and connections, with less development efforts, through standardization and tooling. ● Complementing zSeries QoS: Provides the same high scalability, reliability, availability and manageability for the applications integration infrastructure as zSeries/System z9 platform itself provides to its workloads, and is complementary to these platform strengths. ● Strong Security: Offers comprehensive security options using SSL, the Internet standard for secure communication.
<p>WebSphere Portal Enable for z/OS Version 5.1 <i>Announced 05.24.2005</i></p>	<ul style="list-style-type: none"> ● Scalable, Reliable Portals: Helps build scalable and reliable portals that can improve employee productivity and increase customer loyalty. ● Single Interaction Point: Delivers a single point of personalized interaction with applications, content, processes and people. ● Process-user Integration: Integrates business processes and portal users via orchestrated workflow. ● Powerful Content Management: Features IBM Workplace Web Content Management for keeping your portal up-to-date, accurate and in control. ● Collaborative Components: Includes ready-to-use collaborative components that provide access to services portal users can use to find, connect, and work with people inside and outside of the organization. ● Simplifies Portal Integration: Enables quick portal integration with back-end systems via portlet builders and open standards. ● Leverages z/OS Strengths: Leverages self-configuring, self-healing, self-optimizing and self-protecting z/OS platform; delivering best-of-breed workload management, scalability and near-zero downtime. ● Exploits Unique System z9 Capabilities: The only portal offering that builds on the strengths of z/OS-unique clustering and workload management to provide Service Level Agreement management.

Figure C1: Recent New IBM Major z/OS Middleware Release Advances

Related Software Strategies Research

1. **"Spectacular System z9 Mainframes Leap Ahead with Doubled Power, Enterprise Hub Roles – Virtualization, Security, Availability, SOA & Value Advances."** Software Strategies Enterprise Server Spotlight Report, September 2005, 72 p.p., 28 charts and tables. *(In-depth assessment of new IBM System z9 109 mainframe platform hardware, operating systems, middleware, storage and virtualization capability, first major new system to emerge under IBM Systems' new "Systems Agenda" strategy for the emergent era of collaborative computing.)*
2. **"New IBM Systems Agenda Strategy Revealed – Announces New High-end System z9 Mainframes, Virtualization Engine Version 2.0, & new Blade.org."** Software Strategies Analyst Announcement Assessment, August 2005, 48 p.p., 22 charts and tables. *(IBM's most important Systems announcements of 2005 (July 26th) debuted its new "Systems Agenda" strategy for the emergent era of collaborative computing. This Assessment provides a comprehensive, independent review/analysis of these industry-significant developments.)*
3. **"Maximizing Business Value With Resurgent zSeries Mainframes – Platform Readiness Key in 2005."** Software Strategies White Paper, September 2004, 56 p.p., 26 charts and tables. *(Focuses on key business values delivered by resurgent zSeries mainframe platforms, and assesses main advances in the 2005 mainframe software stack that combine to provide compelling advantages of adopting platform-readiness strategies exploiting these mainframe advances fully.)*
4. **"Enterprise Integration Challenge – Vendor Middleware-based Integration Solutions Offer Major Advantages Over Custom In-house Solutions."** Software Strategies White Paper, 2nd Edition, April 2005, 36 p.p., 20 charts and tables. *(Reviews the actual methods enterprises have used to date for enterprise/application integration, and evaluates the case for using vendor enterprise integration middleware. Also reviews IBM WebSphere MQ Version 6, the latest release of this industry-leading integration MOM middleware suite.)*
5. **"Enterprise Transformation, Modernization & Integration Top Priority Today – Resurgent zSeries Mainframe Stakes Powerful Claim for Expanded Role."** Software Strategies White Paper, 3rd Edition, April 2004, 46 p.p., 20 charts and tables. *(Enterprise transformation, modernization and integration with resurgent zSeries. Software stack-centered, in-depth assessment of the mainframe as an enterprise platform as at Fall 2004.)*
6. **"New Power-driven, High-end and Modular Enterprise Storage Systems – Game-changing Server Technologies/Advances Supercharge IBM's Storage Market Leadership Bid."** Software Strategies White Paper, 2nd Edition, November 2004, 42 p.p., 21 charts and tables. *(In-depth technology assessment of IBM's new DS6000 and DS8000 enterprise storage systems.)*
7. **"IBM WebSphere Business Integration Leads the Way with Fullest J2EE™ and Eclipse Support – Business Integration Software Swings to Open Standards."** Software Strategies White Paper, 2nd Edition, September 2004, 24 p.p., 16 charts and tables. *(Comparative evaluation of WebSphere Business Integration Suite & open standards support.)*
8. **"zSeries Mainframe Resurgence Beyond Question – Software/Costs See Major Advances: IBM Tools Break USV Grip."** Software Strategies White Paper, January 2004, 50 p.p., 18 charts and tables. *(zSeries resurgence and software stack assessment.)*

Software Strategies

Software Strategies is a specialist analyst firm focused on e-Infrastructure platform strategies and issues. Since 1997 we have published reports, white papers and newsletters, hosted and spoken at numerous successful industry events, and have worked closely with industry leaders, including: IBM; Microsoft; Intel; ICL; Unisys; Computer Associates; BMC; Stratus Computers; Misys Plc; Notability Solutions; and many others.

Specialist expertise on mainframes, servers, storage, processors, Microsoft technology, Intel environments and enterprise middleware has been a common thread. Tens of thousands of enterprise IT users have benefited from our authoritative events, presentations, conferences, newsletters, white papers, and reports.

About the Author



Ian Bramley
Managing Director – Software Strategies
ian.bramley@software-strategies.net

This White Paper was researched and written by Ian Bramley, Managing Director of Software Strategies, and this second edition was published in November 2005. The views expressed are those of Software Strategies, and are based on our proprietary research. Bramley founded Software Strategies in 1997, is an experienced enterprise infrastructure analyst, a keynote speaker at many industry events, and has published many reports and papers. Before this, he served as Director of Enterprise Platforms at Butler Group and was Founder/Chairman of the Enterprise NT Management Forum from 1998 to 2001. Previously, he held a variety of executive positions with 4 international software and services vendors over a 30-year industry career.

