Autonomic computing: strengthening manageability for SOA implementations
Companies deliver more innovation when they can respond fast and effectively to business demands.

Worldwide, CEOs are not bracing for change; instead, they are embracing it.
(IBM Global CEO Study, 2006)

Introduction
Change provides an opportunity for organizations to pursue new forms of innovation in order to respond effectively to the increasing challenges that today’s business environments demand. CEOs worldwide feel that opportunities to win in the marketplace are expanding. Growth is a priority, and organizations recognize growth through innovation as a fundamental need. Today, organizations are focused on new ways to get the most of their people, processes and information assets in order to derive competitive advantage.

By focusing on Service Orientation, organizations are witnessing Service Oriented Architectures (SOA) emerge as one of the most significant shifts in the design, development and implementation of business applications in the last decade.

IT has become an integral part of the drive to help innovation—when combined with the usage of SOA principles, IT can become an enabler for prompt and effective response to business needs. It can be a source of business advantage, and as such, can be leveraged as a key asset to addressing ever-evolving business objectives—both today and in the future.

But by its very nature, IT can be an inhibitor for change as well. One way to help achieve innovation, aligning your IT to business needs, is through Service Orientation principles—a business approach that considers IT capabilities as resources that organizations can create, discover, combine, access and manage as needed. Along the lines of leveraging Service Orientation for adapting and embracing change, the IBM Global CEO Study also unveiled a need to innovate IT operations not only as an efficiency play, but as a way to help organizations to compete more formidable, take market share and grow revenue. To achieve operational innovation, CEOs want to automate processes and apply new science to persistent operational challenges.

The combination of different types of innovation—such as pairing Service Orientation principles with operational innovations—can often yield the most benefits. The real challenge is to be agile in achieving innovation while keeping consistency in the way the IT systems are managed.
Companies can be more agile when they use service orientation principles to reuse their core competencies and expand their reach to new markets, with new and improved products and services, starting at the most convenient SOA entry points.

Approaching SOA through a collection of linked services

SOA can enable unparalleled flexibility. A Service Oriented Architecture is essentially a collection of services. Services are repeatable business tasks—and it’s important to understand this as part of a business process. Don’t think about software or IT—think about what your company does on a day-to-day basis, and then break those business processes up into repeatable business tasks or components. Services are the building blocks, snapped together to form a full business process. These services communicate with each other. The communication can involve a simple data transfer or more sophisticated activities between multiple services in a coordinated fashion. Some means of connecting services such as an Enterprise Service Bus (ESB) are often employed. SOA can make it easy to snap services together into a business process just like snapping building blocks together into a structure.

Organizations may choose to exploit SOA differently. Experience has demonstrated that companies should approach SOA incrementally, successively building on prior successes. To get started, a well-identified set of SOA entry point projects can leverage the experiences of many IBM engagements, and are available as guidance to companies that want to embark in their own SOA journey. An integrated, open set of software, best practices, and patterns can help organizations get started with SOA more easily, taking advantage of existing information and business tasks to advance SOA implementation.

SOA is an architectural style that supports integrating your business as linked services.
A flexible and responsive IT infrastructure is needed to deliver robust business solutions to solve real business problems. The reality in many IT environments today is that customers are usually faced with a complex collection of technologies and components. Today’s business solutions are all too often left to their own devices when dealing with the complexities of IT infrastructures. IT infrastructures need to be more adaptive and dynamic in responding to the demands of business solutions.

To realize the full value of SOA initiatives, organizations need to leverage a planned and comprehensive approach in order to provide the appropriate infrastructure and system management capabilities. In particular, companies may need to consider extensions to their existing infrastructure and systems management in the areas of service security, management, and virtualization.

Management of SOAs may also lead to unique requirements that may necessitate revisiting the traditional ways of managing enterprise IT. An important aspect is to efficiently manage a SOA implementation with visibility and control of services and the associated components. Effective management techniques can reduce customer response times, improve IT operations productivity and expedite the release of new services to the market.

**SOA and self-managing autonomic capabilities**

SOA projects may be exercising the IT infrastructure in new and challenging ways. For this reason, SOA projects may accelerate the need for self-managing systems to address specific areas such as optimization, problem determination, impact assessment, solution deployment and configuration verification.

IBM self-managing autonomic capabilities have been available to customers for years and enable fluid response to change. Autonomic computing systems have the ability to manage themselves and dynamically adapt to change in accordance with business policies and objectives, which enables computers to identify and correct problems often before they are noticed by IT personnel. Self-managing autonomic capabilities can help companies transform their IT infrastructures into more resilient, responsive, efficient, and secure systems that deliver significant value. As an example, SOA implementations can count on self-managing autonomic capabilities to achieve reduced down time on the occurrence of problems in the underlying IT infrastructure, more efficient infrastructure, and faster time to value to provision new resources in support of SOA projects.
An inflexible, rigid IT infrastructure requiring a lot of human intervention for maintenance is a clear impediment to achieving the full promise of service orientation. IT environments are often complex, heterogeneous, distributed, and the loosely-coupled nature of SOAs can deepen the complexity and place even more stress on already overloaded IT personnel to maintain the underlying IT infrastructure.

The potential complexity added by loosely-coupled services that interact in dynamic ways can impose a higher level of challenges to the administration of the underlying IT infrastructure.

Any infrastructure in support of SOA implementations should be able to identify its own problems, and automatically initiate processes to fix them—without having to wait for an administrator to figure them out. Unlocking the full potential of the flexibility represented by Service Orientation implies that IT systems may need to monitor themselves, automatically adjust resource consumption, queue sizes and priorities, consider degrees of parallelism to ensure the resources of the system are being used efficiently, and to route around bottlenecks. The optimal SOA-ready IT infrastructure should automatically reconfigure itself as needed to meet service level objectives. This is important not just because it will reduce administrative overhead, but because humans cannot typically respond quickly enough to handle the kind of dynamics that occur in many business marketplaces—managing IT as a business.

Some of the traditional procedures used to maintain IT infrastructures might not be adequate, or even suitable, to support the management of SOA implementations. For instance, Services may rely on highly-distributed resources, and pinpointing the root cause of a problem or an undesirable latency might not be trivial.

In fact, the core challenges of managing a SOA implementation are traditional IT management problems. IT typically consists of at least three separate organizations, each with their own technologies, best practices, approaches, and terminology. An SOA project will affect each one of these organizations in some shape or form:

- The systems and network team will be looking at the impact SOA will have in their systems, bandwidth, how to secure the environment, how to scale up and out.
- The data storage and information management group will be concerned with where the services will be retained, the levels of business continuity and resilience required for services, and how to make information available as a service.
- The application development and integration team will be concerned with how to manage virtual applications created with services, as well as with the services themselves.
CIOs faced with challenges imposed by their existing business applications will also have to take into consideration how the implementation of SOA projects will impact their operations. For instance:

- The impact of the reuse and creation of services to the IT infrastructure might generate excessive IT operations workload.

- Each new service deployment might be a new IT project. Manual intervention might be required, in addition to what the IT team is already chartered to do, in light of existing workloads and procedures.

Moving towards “built-in” IT systems manageability

As SOA projects are expanded and grow in complexity, IT infrastructure may be under increased pressure. Reliability, scalability and performance may become the primary needs for any successful SOA implementation. The effects of failing to build manageability in from the start may be only exacerbated in SOA environments as the individual services and components can be reused over and over again. Eventually, monitoring and management capabilities should become part of the business services, in tandem with the vision of IT becoming an instrumental element of business success. Services could then benefit from self-managing capabilities to streamline and simplify management activities and minimize human intervention.

Notice that IBM self-managing autonomic capabilities can be used to optimize the IT infrastructure in support of existing non-SOA business models as well as those based on SOA. There will be the need for coexistence between existing implementations and SOA projects, which will vary for each organization. In this sense, autonomic computing capabilities are already in place in support of on demand environments, which can be the natural choice to support SOA projects. By using those capabilities in support of both SOA and non-SOA projects, organizations can extract more value from their IT investments and work on a smooth and gradual transition between the architectural paradigms.

It is important to preserve the investment in existing IT management and avoid over investment in products that may not adapt to the demands of large scale SOA projects. The usage of autonomic capabilities to gain efficiencies can become an important consideration when looking at the specific management needs as SOA projects expand and evolve.
IBM Service Management (ISM) is the preferred methodology for managing SOA environments because it:

- Helps IT staff provide a resilient SOA infrastructure more efficiently and effectively.
- Creates an SOA infrastructure that is compliant with business policies.
- Leverages best practices, process integration and automation across the entire SOA Infrastructure.
- Delivers IT services responsively and reliably.

IBM Service Management (ISM) is the preferred methodology for managing SOA environments, as it provides a platform for business service delivery and support. Services that are ITIL\textsuperscript{®}-aligned (business service in IT domain) can be delivered within a SOA, much like business services are in vertical industries. IBM can help by offering predefined codified processes that guide the delivery of such IT business services. The same or equivalent tools used to codify the vertical industry processes (composite business services for insurance or financial sector for example) are also employed in ISM to model, construct and assemble the ISM processes that deliver business service. IBM is progressing with this strategy, expanding beyond business services in the IT domain to include delivery of service and asset management of physical artifacts.

IBM is driving its Service Management strategy to help enable automation in support of business service delivery and support. This includes operational management products – existing ones and Web services related – properly supporting efficiencies for organizations deploying ISM solutions. Products and components may be installed in standalone situations, or may exist already in the IT environment, but may live within the overall IBM Service Management strategy. In addition, policies associated with these tools and the exploitation of self-managing autonomic capabilities can harness service management and enhance governance and compliance while minimizing manual intervention for system administration. With their value demonstrated since the emergence of on demand environments, self-managing autonomic capabilities have been used in support of strategic innovation, and are constantly maturing and evolving to readily deliver value in the context of the demands of SOA-based environments.

As part of the IBM Service Management vision, autonomic computing can help organizations efficiently manage and proactively deliver much needed IT services that drive business performance. Because self-managing systems can automatically detect improper operation of systems, transactions and business processes, and then initiate corrective action without negatively impacting system uptime, companies can innovate while delivering information and services to their customers and prospects whenever needed.

Autonomic computing technologies support and complement service oriented architectures by enabling the flexible “self-managing” IT infrastructure needed to deliver business value in today’s complex world. Autonomic computing supports
and enables management and integration in concert with principles and practices of SOA, equipping the IT infrastructure with self-managing capabilities to best support SOA-based project implementations.

Autonomic computing becomes increasingly important in any SOA environment, particularly as these environments expand. The services that comprise SOA environments are loosely-coupled, logically-distributed, and highly shared and reused. A failure in one service may well impact many other services.

Autonomic computing architecture is itself predicated on SOA principles and is founded on a number of key technologies and open standards. Autonomic computing is now delivering architecture, technology and standards that, when leveraged in concert, provides dynamic, adaptive capabilities for service management. It’s precisely these kinds of service management capabilities that SOA environments need today as well as in the future.

Self-managing autonomic capabilities used within the IT infrastructure may be extended to also support SOA-based environments. This is particularly interesting from an investment protection perspective, recognizing that IT infrastructures will have to support the coexistence of existing business applications while SOA projects gain more space within organizations. In this sense, self-managing autonomic capabilities that were already in place in support of on demand environments can become a natural consideration in support of SOA projects. By using self-managing capabilities in support of both SOA and non-SOA projects, organizations can extract more value from their IT investments and work on a smooth and gradual transition between past and future architectural paradigms.

Autonomic computing has proven its value on large scale, enterprise-level infrastructures by delivering needed capabilities, including expediting problem resolution and resource optimization. Taking from that experience, self-managing autonomic capabilities are uniquely positioned to support the demands of SOA environments because they fortify the IT infrastructure in support of complex business scenarios.

While self-managing autonomic capabilities can increase uptime and reliability of any or all of an organization’s IT applications, self-managing IT will make its greatest contributions to shareholder wealth by reducing the time to market of SOA-based projects and increasing the uptime of related SOA-based business applications.
IBM Customer Success Story

“Using IBM Problem Determination technologies, we can simplify management of our SOA-based services and more rapidly diagnose and resolve problems.”
— Matthias Brunner

businessMart used a self-managing autonomic environment for problem determination that automates processes and provides staff with greater insight into IT outages.

While SOA delivers superior business flexibility for businessMart, it also poses challenges in the management of IT infrastructures as services reflect business tasks that can be dispersed across different environments, loosely coupled, and assembled based on business priorities. Problem determination can become very complex in SOA environments, and the procedures traditionally used in monolithic, self-contained infrastructures may not be effective. Finding a problem’s origin in an architectural approach that structures IT assets as a series of reusable services calls for innovative capabilities to minimize the time and skill required to pinpoint the root cause of issues and propose corrective actions.

As businessMart sought to improve its problem determination processes, it needed a solution that would provide staff with insight into the entire IT infrastructure and SOA components. This required the ability to:

• Quickly convert disparate log formats from heterogeneous components into a common language for faster integration and analysis.

• Automate correlation and analysis of log data generated by loosely-coupled services so administrators could quickly locate the root cause of any problem.

• Create a knowledge base of known problems along with associated solutions and staff directives to accelerate problem resolution times.

The elimination of manual processes enables IT staff to focus on business growth, exploiting SOA to build new marketplaces or enhance existing services. Finally, rapid deployment of new services helps the company maintain an edge in a competitive marketplace, fulfilling the promise of SOA for maximum business flexibility.

With the evolution of SOA and its wide adoption, we can envision the convergence of business processes and IT processes. In this new scenario, the lines between IT resources and other kinds of resources blur. This may allow for monitoring and managing services within a SOA style to be done in a unique, consolidated fashion, where best practices, policies and process efficiencies closely tie business needs to IT resources. Self-managing autonomic capabilities can become critical to delivering on the promises of Service Management in order to simplify, gain efficiencies, and enable innovation through SOA.

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