

in collaboration with



The Cloud and SOA

**Creating an Architecture for Today
and for the Future**

1 Executive Summary

The cloud is the future. It provides almost infinite flexible and scalable external computing and processing services that not only offer significant cost benefits, but also provide the ability to connect with customers, partners and suppliers like never before. However, without Service-Oriented Architecture (SOA), organizations will find it almost impossible to reach the cloud.

SOA, a flexible, modular approach to delivering IT services, is an essential foundation for emerging technologies like cloud. Plus, SOA provides significant advantages over current IT architectures. While it lowers costs, its primary benefit is the improvement in agility that it provides to organizations, enabling them to respond to the increasing rate of change occurring in nearly every business around the world.

The way organizations do business is changing at a rapid pace. In the 21st Century, organizations no longer operate in a fixed, predictable environment. Moreover, in this constantly changing landscape, the role of IT is changing as well. Yes, IT must support the business—without IT, no modern organization can hire a worker, receive parts from a supplier, ship a product or interact with a partner. But more and more, IT must provide services that are an integral part of an organization's business model. Thus, IT must enable rapid change and flexible relationships with customers, suppliers and partners.

The very real risk for today's organization is that while business and technical drivers will increase its need for SOA and cloud services, the organization will have failed to put in place the processes and procedures to confidently move to these new approaches and to benefit from those changes.

This is precisely the problem faced by organizations that did not anticipate the step-change heralded by PCs and the client/server architecture. In allowing individuals to use PCs independently, IT departments missed the shift to a new IT architecture and had to invest millions to retrace their steps and introduce standardized systems.

The cloud will enable real-time delivery of products, services and solutions over the Internet. It will become essential to business because of its capability to deal with rapid change in external markets. Therefore, it is vital that CIOs begin considering how they will operate in a cloud environment. To meet this challenge, IT directors must take a fresh approach to their IT architecture, moving away from today's static, internal, centralized architecture. Adopting SOA will enable IT directors to address today's critical challenges, while at the same time provide a solid foundation for enterprises to adopt cloud for tomorrow.

2 What Is the Cloud and Why Is It Inevitable?

What is the Cloud?

In just a few short years, the cloud has gone from being a hypothetical concept in analyst reports to headline news. Along the way, it has suffered from a great deal of industry hype and confusion, with many vendors attaching a “cloud” label to services that are probably closer to hosted applications or on-demand computing.

To begin this discussion on cloud, it’s important to clarify what the word “cloud” actually means. There are a number of computing models that are related.

Right now, most large organizations own their IT infrastructures. But that doesn’t need to be the case. It may very well be more cost effective to utilize computing infrastructures that are provided by an outside entity. By leveraging economies of scale, providers may be able to supply all the required processing power at a lower cost than could be achieved by organizations internally. This is especially the case when the required volume fluctuates significantly. This model is best defined as *utility computing*—the offering of pools of computing infrastructure that is delivered to users as and when they need it.

To complicate matters, some people call “utility computing” by a different term: “infrastructure-as-a-service.” These are simply two sides of the same coin. Utility computing is the model for an outside organization providing computing resources in a self-service model, where the consumer is using *infrastructure-as-a-service*.

Cloud computing is different. It is a specific type of utility computing. Cloud computing is the IT environment—encompassing all elements of the full “stack” of IT and network products (and supporting services)—that enables the development, delivery and consumption of cloud services. Properly defined, cloud computing has three key technical characteristics:

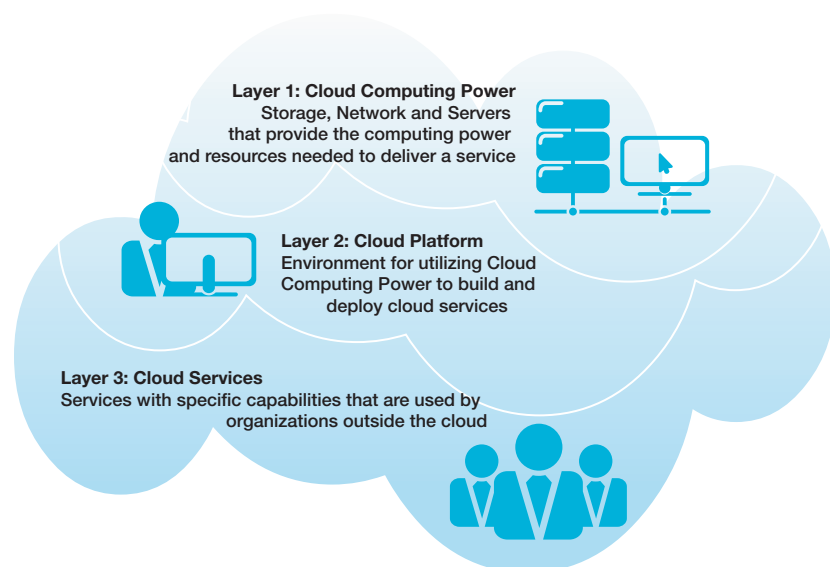
- **Scale:** cloud computing systems incorporate tens of thousands of servers, offering processing power vastly greater than a traditional data center.
- **Flexibility:** cloud computing can be used to handle very small or large processing tasks, and can be adjusted in real-time to match demand. If an organization needs 10 servers one day and 5,000 the next, the cloud can handle such a dynamically varying request.
- **Efficiency:** unlike traditional data centers, clouds offer pooled computing power, performing like a single large machine. Sharing tasks across this pool reduces costs and massively improves processing speeds.

Early examples of cloud computing include the Virtual Datacenter from virtualization supplier VMware and Amazon’s EC2 service. In addition, HP has been contracted to provide a cloud computing environment to the US Department of Defense’ IT services unit, Defense Information Systems Agency. HP is also involved in a joint project with Intel, Yahoo!, and academic and government partners to build cloud research testbeds in the US, Germany and Singapore to support hundreds of thousands of researchers.

Cloud services are different from cloud computing. They provide the automated processes that are delivered using cloud computing. Cloud services are a specific type of Software-as-a-Service (SaaS)¹, and can usefully be thought of as being made up of three distinct layers:

The first layer is all the computing power and resources that enterprises need to deliver a service or application, including storage, processing, networks and servers. Some cloud services may use all of these components; others just one or two. This layer is the same as cloud computing described above.

The Cloud



Source: Capgemini

The middle layer is a platform that enables the enterprise to add specific services that rely on the cloud computing layer for their power. Example platforms include Google Application Engine or Microsoft's Azure, which provide platforms that are available to developers running services that draw on generic and custom functions. Enterprises would possibly use different platforms for different situations—for example, a platform supplied by a company such as HP to manage access to all the technology services in the first layer of the cloud, and a subsequent layer from a company such as Capgemini to provide industry specific “services” for processes in the third and final layer.

This final layer comprises the *cloud services* themselves. Services may be internally or externally facing, and may be developed by the enterprise itself or by a third party. Many services will combine elements of both

approaches. For example, companies can use Yahoo!'s FireEagle location service and combine it with their own GPS tracking data to create a shipment tracking service. The resulting service could also be combined with an internal HR service to monitor working hours for drivers to create an entirely new service.

This third layer is important because this is where businesses can differentiate themselves in a SOA and cloud environment—by buying services, adding value and selling them, companies can create enormous flexibility and competitive advantage.

Why is Cloud Inevitable?

Within the next decade, Capgemini and HP believe that enterprise IT architectures will shift fundamentally. Rather than controlling a static, centralized architecture, IT leaders will be responsible for managing and delivering a network of flexible services.

To begin with, services will be used internally through SOA, providing greater efficiency, flexibility and cost-effectiveness. However, soon services will be exposed to third parties over the Internet, either solely or as part of new services. For example, consider the tracking service described above. The enterprise may have originally built this service to improve its internal processes. However, it may eventually combine its internal tracking service with a third party mapping

¹ SaaS can be implemented in the cloud model (and realizing the economic benefits), or by hosting separate instances of workloads that are not based on the cloud. For example, a large SaaS provider like Salesforce.com can be implemented by hosting separate instances of their CRM system—one for each customer. This is clearly more expensive than the actual implementation, where a single cloud-computing instance hosts all customers. The costs of the former would be one or two orders of magnitude more expensive per seat, even with virtualization, due to the increased complexity, licensing costs, and so on.

application from a company such as Yahoo! to create a user-friendly online tracking service that would be available to customers over the Internet.

This external dimension will expand over time and, within a few years, the market will see more symbiotic relationships between organizations, with collaborative services providing ad hoc, real-time IT services. Companies within a supply chain will be able to offer customers greater customization and choice because the supply chain can flex almost instantly, in response to customer demands.

Consider the case of a car manufacturer. One of its customers may desire a green car with gold upholstery, a luxury stereo package, and alloy wheels. As is usually the case, one company might be responsible for providing the car chassis, while another company provides the stereo, a third the wheels, and another company does the assembly and shipping.

Traditionally, this level of customization would be impossible. Each component would need to be ordered weeks in advance, which is why companies would usually manufacture products according to standard configurations. However, in a cloud model, it is possible for every company in the supply chain to share data in real-time, enabling the car to be built-to-order by synchronizing the manufacture and distribution of the necessary parts.

However, this scenario presents the provider of the IT infrastructure—someone working for the CIO—with some significant headaches. How does this individual or group of individuals plan to supply a service when they have no way of predicting how many people will access the service and when? How can they manage a process where multiple companies are collaborating, but nobody is necessarily in charge? Who ensures that the overall service being delivered is secure, reliable and available? These governance challenges are critically important to address, but they should not deter moving to a cloud model—they are solvable, and the benefits of collaboration between organizations provide extensive benefits to the business.

Another reason that cloud is inevitable is purely a cost differential. The vast majority of companies experience peaks and troughs in demand for IT services—perhaps at the end of the financial year for accountants or the run-up to Christmas for retailers. In a traditional environment that is built around internally-owned and operated infrastructure, companies are left with the choice of over-provisioning in anticipation of peaks (and being left with the bill during the troughs) or under-provisioning and failing to meet demand for services during sudden spikes in demand.

Cloud can also provide powerful business benefits to companies. For many IT departments, the time taken to procure, specify and implement new hardware and then to deploy and configure new IT applications and services can take so long that much of the business value of the new resource is lost. With cloud, this risk is eliminated since many of these elements can be accessed immediately as external services. This is especially important as the outlook for business suggests more frequent changes in both its external products as well as its internal systems in the increasing competition of global markets.

For these reasons—continuing to drive IT infrastructure costs down, improving time to market for new services, and enabling new models of working together—Capgemini and HP believe organizations will inevitably adopt cloud. It gives organizations immediate access to a massive pool of diverse computing resources—storage, applications and services—without the expense of building or buying it themselves. This reduces the cost and time involved in possessing computing power and services, and reduces long-term costs because assets can be spread across different organizations.

3 The Cloud: Questions Answered

When considering cloud as a model, a number of questions will likely present themselves.

Will organizations utilize a pure cloud model? Can this be combined with other models like “on demand computing” and “Software-as-a-Service?”

As described in the example above, the cloud provides organizations with powerful business benefits beyond those offered by other remote IT services such as Software-as-a-Service (SaaS) or infrastructure on demand.

SaaS provides enterprises with web-based access to a static application hosted by a third party, while infrastructure-on-demand offers access to processing power, with companies essentially paying for computing power delivered down a pipe. In a cloud environment, companies have rich, flexible access to a full range of computing resources—whether that involves processing power or applications—delivered as services.

It is likely that a hybrid environment will emerge where organizations combine services that are built internally with some that are sourced externally, frequently through the cloud, to meet business needs quickly and effectively. For example, a financial services organization might want to provide customers with real-time access to securities brokerage advice. This capability would combine many different services. The services required to price securities might be sourced externally, while the creation of the advice, the user interface and login would be provided by an internal application. Cloud services could easily be customized and personalized, with some swapped and replaced according to the capacity and capability needed at a specific time. This will require IT to manage the full service lifecycle for all services in such a hybrid environment.

How will I deliver my services?

When delivering any business function, IT leaders must understand fully what will be the most effective model for delivering that functionality. Enterprises must be able to use internal, custom-developed and third-party services and deliver them through any number of delivery models—hosted internally, externally, or on an external infrastructure platform such as HP Flexible Computing Services or Amazon EC2. Service-Oriented Architecture (SOA) is the ubiquitous architecture that enables just such a flexible delivery and business model.

Each of these delivery models carries unique pros and cons, and the best-suited delivery model will depend on the security, performance, integration and other requirements for specific workloads. There may also be trade-offs around time, cost, ability to customize and control of the deployment architecture in each of these scenarios.

Can an enterprise use cloud services today?

It is possible to find start-ups offering cloud services today which may be suitable for running non-critical capabilities. This is a good starting point, but for most business critical applications, enterprises will require cloud services that provide the enterprise-level reliability that companies such as HP can offer.

Infrastructure-as-a-Service offerings are improving rapidly. They are increasingly able to satisfy customers who demand services that incorporate enterprise-class Service Level Agreements, workload management and automated flexing.

How will the cloud change the way enterprises buy and develop software?

In a cloud environment, the speed and flexibility of computing resources available to enterprises means that CIOs will only purchase or develop software that is truly differentiating—i.e. the rest will be accessed as services.

Requirements such as security might favor internal sourcing, whereas non-differentiating applications or clusters of services might favor external sourcing. Many internally-developed applications will remain internal because the risk and cost of shifting to delivery from outside the enterprise will outweigh any potential benefit.

The cloud will also change the way organizations collect, manage and think about data. Cloud services are pervasively available, so they lend themselves to connecting across businesses, people, experiences and time. The cloud encourages capturing data information in a form that is separate from applications, allowing it to be leveraged by multiple services. It encourages combining data with context—information including things such as the location, role and relationships of the user—allowing services to reason about a user's intentions, and in doing so, hide complexity and increase relevancy. The cloud also allows shifting the burden of integration from users to the provider—services can integrate in the cloud, allowing participants to connect once, rather than with all other participants.

For example, consider a manufacturer that needs to trace products and understand how materials flow through an extended supply chain to a final product. The traditional approach would be to connect each participant point-to-point, and publish information throughout the network. This can be expensive and complex; hence, frequently, it simply isn't done, and questions are either answered manually and slowly, or not at all.

If the companies in the supply chain share information through a cloud environment, each participant publishes data to the cloud, leaving the analytics to the cloud service, which can use a search-like approach to provide answers on materials. This is substantially more scalable and cost-effective because it decreases the burden on individual organizations and reduces the overall cost of the solution.

Overall, cloud services can, and will, transform business capabilities. Specialists such as Capgemini can provide the expertise to design and deliver competitive solutions using a mixture of uniquely written services integrated with existing cloud services.

4 SOA: Solving Today's Problems While Preparing for Cloud

Maximizing efficiency and agility today and investing in tomorrow

In today's global organizations, technology is more than a source of competitive advantage; it is frequently the product and sometimes the business itself. This means IT must provide services that are reliable, scalable, cost-effective and agile—able to adapt on one hand quickly to a change in business strategy or an emerging competitive threat, and on the other to create a new product to sell in online markets.

CIOs know that meeting this challenge is difficult. The conventional enterprise IT architecture—based on a static, centralized infrastructure and centrally-administered applications—is not designed to support rapid changes in functionality, or to handle sudden spikes in demand. Nether is it equipped to design, build and implement business applications quickly and inexpensively.

If a business needs to roll out a new customer service application in a traditional IT architecture, the process can be complex, time-consuming and expensive. First, the IT department must define and specify the software elements, consider the deployment of new networks, storage and servers. After developing and testing the application, IT must integrate the new technology into the existing systems, and attempt to predict what changes will be required across the entire IT environment.

This approach has become more costly and inefficient over time, and as the enterprise grows, the number of dependencies and the complexity of new integrations increases exponentially, so much so that this architecture impedes a company's ability to compete. And it is getting worse: the pace of change is increasing. Where companies might once have been able to specify who could access their systems and what platforms would be used, today's businesses must increasingly offer internal and external access to their data and services, using a range of languages, platforms and applications.

For example, five years ago, a manufacturer might have offered selected business partners a constrained data exchange using EDI as a means to provide some degree of interaction. Today, the manufacturer is expected to offer access to any number of potential customers, who will expect customized product and pricing options with real-time availability and rapid fulfillment. Tomorrow, business options will increase exponentially with diverse, complex product and service partnerships, and IT must be able to support these. Conversely, such a change will require a similar set of capabilities with the manufacturer's suppliers, as well.

Companies like BMW are rapidly moving in this direction. Cars were previously sold based on undifferentiated customers. The manufacturer would produce a set number of standard models with a relatively small number of optional features, each targeted at a certain group of customers defined by taste, budget, or other common shared elements. Today, BMW shows how intelligent architecture and technology can turn this business model on its head—and remain profitable.

BMW offers customers the ability to highly differentiate themselves by specifying a large number of features on a new Mini Cooper, from the color of the upholstery to the power of the engine. This personalization is delivered at the same price and at the same speed as a regular, production-line car from a more conventional auto company.

While this might seem an expensive approach, industry figures suggest that BMW actually makes more profit per car on the Mini Cooper than on the mainstay BMW 3 Series. The company can only offer these services because it has taken a completely new approach to the way it designs, provisions and builds cars based on modularity of the elements—and it demands the IT capabilities are delivered in a similar manner.

These advanced IT capabilities are best delivered using SOA; a flexible, standards-based approach to IT architecture that uses a modular approach to delivering IT services. SOA is based on discrete, loosely-coupled functions or services that automate specific business processes. Services can be exposed to internal or external users over the Internet, and can be reused in multiple applications in an ad hoc fashion, making them extremely fast, reliable and cost-effective.

In addition, new functions can be quickly deployed in a SOA environment because IT organizations can reuse components from one service to create new services. Because SOA is being developed to meet the demands of a wide variety of industries for “services” that deliver abstracted tasks for reuse, it is easy to plug services together in new configurations now and with cloud in the future.

SOA also provides organizations with the ability to seamlessly integrate internal and external technology resources—third-party services can provide an instant pool of diverse, reliable business capability. Examples are already common—most organizations source credit scores, asset prices and weather data from external sources.

Acting strategically even in the short term

SOA is an excellent approach to building and deploying mission-critical applications. Its benefits of increased agility and decreased costs are already being achieved by companies around the world, and it will clearly become the dominant architecture for new business applications. Because of this, adopting SOA today will improve the way an IT organization is able to deliver now and in the future.

If an organization is interested in cloud, and Capgemini and HP believe that all organizations will inevitably choose to utilize the cloud, SOA is especially important. The best and perhaps the only way to prepare an organization to successfully exploit the cloud is to transform its internal IT infrastructure to utilize SOA. There are five key reasons for this:

1 Accessibility

The cloud is accessible through a SOA interface. All services are invoked using the protocols and standards that SOA utilizes. This has already been seen in the initial deployments of cloud—they are all delivered as standard SOA services.

2 Visibility

There are already thousands of different services that are available through the cloud, and the number grows every day. This is good news, because it becomes more likely that the process an organization wants to deploy already has a service written and available through the cloud. However, with so many services, how does an organization find the one it needs? Organizations using SOA have already encountered this issue and addressed it. In a well governed SOA, new tools and techniques are utilized to find a group of potential services and then to determine

which one most closely meets a company's needs. Unless an organization deploys SOA, it will not be able to utilize these techniques, and it will be next-to-impossible to find the service it needs.

3 Extensibility

It is great to be able to find services in the cloud and be able to access them, but there will be many cases where an organization cannot find a service that exactly meets its needs. It may need to put multiple services together, and from time-to-time it will certainly need to modify the operation of a service. How will that be possible? Cloud services can be modified and customized using SOA techniques; so organizations will want to utilize the same architecture in their in-house IT systems.

4 Matching expectations

One of the most intricate parts of working with the cloud in any significant manner is ensuring that the service is provided in a way that matches the expectation of the user. Two common questions illustrate the point: When is the service available? What type of response time does the service deliver? It is critical that both sides understand and agree upon the answers to these and many more questions: What is the escalation procedure if there is an issue with the service? What is the change process? What is the enhancement request process? How frequently can the service be called? How much data can the service accept? Even, how much does the service cost? If there is a misunderstanding between the two parties on any of these questions, the relationship will likely be rocky at best. Again, SOA has already dealt with this issue, with the concept of “contracts”—agreements that specify the responsibilities of each party. When an organization uses the cloud, everyone in IT should know how to work with contracts, and the best way to create this knowledge is by using SOA as the internal architecture in addition to the interface to the cloud.

5 Adherence to standards

Since services delivered through the cloud will use SOA, it is important that a company's applications follow all standards that the cloud service will expect. How does the enterprise ensure that all its services meet these standards and even industry-wide best practices? Policy enforcement is used within a SOA to automatically ensure that standards and best practices are followed by all of the services accessing the cloud; so again, it is important that a company utilizes SOA in its organization. And if the organization has standards that need to be followed, for example concerning data access security, policy enforcement can be critically important.

Five Key Reasons to Utilize SOA On the Way to the Cloud

- 1. Accessibility:** The cloud is accessible through a SOA interface
- 2. Visibility:** SOA tools and techniques can help an organization find services that meet its needs
- 3. Extensibility:** Cloud services can be modified and customized using SOA techniques
- 4. Matching Expectations:** Cloud services require clear SLAs; deploy these using SOA contract-management techniques
- 5. Adherence to Standards:** SOA policy management techniques validate that an organization follow appropriate cloud standards

5 Getting started on SOA

Many organizations have already begun an IT transformation to utilize a Service-Oriented Architecture and are seeing the benefits of increased agility and reduced costs. Others have begun the SOA journey but have not yet seen success, and still others haven't started utilizing SOA.

The very real risk for today's CIO is that business and technical drivers will increase the need for SOA and cloud services, and the organization will begin to deploy SOA incorrectly. The benefits of SOA are much more easily achieved when the organization uses design-specific SOA processes and procedures— some analysts even say that without these processes, adopting SOA is bound to fail. This approach requires understanding how to define the services from a business perspective around individual business tasks as much, or even more than, from a technology perspective.

It is strongly recommend that CIOs begin considering how they will operate in a SOA and cloud environment. This doesn't mean ripping out architecture and starting again; it means building a roadmap of how the organization will make the shift to SOA (including how it will use services from third parties) and how it will introduce the usage of the cloud later.

It is important to realize that tools and technologies alone cannot deliver the value of SOA and the cloud—business processes, skills and approaches are even more important. For example, for SOA to be successful, CIOs must put in place the policies and procedures that will control a SOA environment as soon as SOA has passed out of the “proof of concept” phase.

Broadly speaking, these processes can be split into three key groups: SOA governance, service management and service quality.

SOA Governance

While most organizations are using SOA services in some way, few today are following methods and best practices in all their services. This is a mistake—a large part of SOA's value comes from reuse and open standards; this cannot be achieved without consistent procedures and policies.

SOA governance is the definition and implementation of enterprise-wide policies for activities including:

- proposing and developing new services
- modifying existing services
- retiring services at the end of the lifecycle
- exposing services to third parties
- publishing and finding services
- reuse of services
- monitoring the progress of SOA
- determining the value of SOA.

If standards for these processes are not clear from the outset, individual projects will inevitably end up creating services that are not interoperable. These services are then difficult or impossible to use and manage effectively. The end result is that investment in SOA is wasted because services will not be reused—this clearly increases the cost of future projects. It is easy to see how applications built using SOA could be more expensive than a traditional application.

If a company is already in the early stages of using SOA, it must ensure that governance policies are defined as soon as possible. If an organization hasn't yet embarked on SOA, then governance is best defined before the outset of the project. Also, it is important to ensure that service management policies are defined before any applications using services go into production.

One of the most difficult aspects of SOA governance to get right is escalation and lines of responsibility. In a traditional, centralized “command and control” IT architecture, it is easy to establish lines of responsibility and to create escalation procedures for situations when things go wrong. In a SOA environment, this model needs to be completely re-thought. If a service is run by a third party, then what happens in the event of an outage? This service may be a critical part of important applications. How will the cause of the problem be found and its solution expedited?

Further, since SOA-based applications use services created by a number of providers—exactly the opposite of a traditional application approach—it is important to ensure that expectations between the parties are clearly understood on both sides. These contracts need to clearly specify responsibilities, service-level objectives, escalation procedures, costs, and compensation levels for outages, and CIOs must put processes in place to enforce the adherence to these contracts.

SOA Service Management

The second key management process is service management. This is distinct from the governance policy—a governance policy concerns how services are created and how they are woven together into applications; management is about how well the service works day-to-day.

Service management policies should specify who monitors each service and how it will be monitored. How will an organization validate that the service is performing at the expected level, and who reports on the performance and availability of services and applications that they are used to create?

Service management also deals with what happens when problems occur. Policies must specify who is responsible for reporting problems and who takes action to resolve them—no simple matter if multiple organizations or teams are involved in delivering a service or application.

Service management is particularly important in a SOA environment because if a single “service” or business process fails, the problem may be experienced by a large number of applications. For example, if a service such as determining the available credit of a customer becomes unavailable or provides inadequate performance, multiple applications such as quoting, order entry, shipping and invoicing will be affected.

Having a set of service management policies is also useful in driving adoption of SOA services. When people know there is monitoring and management in place, it is easier for them to trust the services and to use them. Monitoring also makes it easy for the IT organization to demonstrate performance metrics such as number of messages handled, uptime, performance and others.

For service management to work, it is important to think of the development model as being based on separate services rather than large IT projects. A new service might be created as part of a specific project but services are meant to be reused, so each needs a lifecycle separate from any application that uses it, as well as monitoring that is separate from applications.

It is important to appoint an owner for each service. This person, known as the “service provider,” is responsible for making sure that the service works, that problems are addressed, and that change-requests receive responses. These activities must be considered separately from any project funding.

An organization must consider where its limitations may lie in regard to service management. If the company is not sure how applications and services can be monitored, it should consider working with a specialist third party that can provide and manage the services and the applications, and ensure that a strong focus on the business is maintained even in IT operations.

SOA Quality Management

When an organization bases a business application on SOA, it must change its approach to quality management. Application developers will not simply trust service developers and therefore will hesitate to use a service, regardless of whether the service developer is an internal or external provider. To create this trust, there needs to be an independent process for validating the quality of all services.

SOA quality management is the process of making sure the services and applications that are being built meet the requirements of the business, and so can be trusted. For example, quality management will consider whether services:

- will do what they are designed to do
- will scale to planned usage levels
- are secure
- will be developed according to the specified lifecycle
- follow all appropriate standards.

SOA quality management also includes the management of the entire testing process—Who should test what? What should be tested when there are not enough resources to go around? When should a service be promoted out of Quality Assurance (QA)? And how should the quality status of a service be effectively reported to all its stakeholders?

These aspects of SOA quality are similar to quality management in a traditional architecture—so a company can leverage its existing organization and processes. However, in a SOA environment, it will probably be necessary to appoint different people than a regular software tester—the ideal SOA quality manager is someone with knowledge of both testing and developing—because of a number of aspects of SOA. First, there is no user interface for services, so the method of testing must be different. In addition, services used in a Service-Oriented Architecture will change more frequently than in a static IT infrastructure, so the team must be able to automate a larger proportion of testing, and to validate that the service works in many environments. Finally, the QA team must be able to anticipate every way that a service might be used, and not just understand the intended use of the initial application.

If an organization has already put in place effective SOA management and SOA quality management, then it will be better equipped to take advantage of cloud services, because the processes of service management and quality management for SOA can be applied to cloud services.

6 Critical Success Factors for SOA and Cloud

While SOA requires new policies around governance, quality and service management, these policies alone will not guarantee a successful SOA architecture, nor will they ensure successful use of the cloud. It is recommended that organizations also consider the following critical success factors of SOA and cloud.

Skills and Training

Clearly, moving to SOA and to cloud will entail the use of new technologies, new processes and even new ways of thinking. In many ways, learning new skills and approaches, along with other traditional change management issues, is the largest challenge an organization will face. Many organizations over-emphasize technology training; it is important to understand new programming techniques and standards, but they need to include training that concentrates on how to introduce new business processes as well.

Another barrier to adoption is that organizations simply do not understand the potential benefits to the business. As with many new technologies, SOA and cloud have been hyped by suppliers, creating fear, uncertainty and doubt in the market, resulting in some resistance among business leaders to SOA adoption. It is therefore important to be clear in communication about SOA and focus on business value and on meeting business challenges—i.e. to make sure that SOA and cloud are not seen as technologies in search of a problem. It is also important to recognize that the traditional IT business case based on reducing the cost of administering a particular business process will be joined by a new range of business cases covering developing new markets, new products, etc.

Requirements Gathering

How will an organization define and specify services? How will it know if it is using the right cloud service? This might sound obvious but if a company is moving to a Service-Oriented Architecture, it is vital that it have in place common ways of defining services, and how they will be created. This is a relatively new area but Capgemini has been involved from an early stage with the development of VPEC-T, a business technology framework that helps IT organizations to understand the complete implications of a change and the desired (as well as the risk of undesired) outcomes.

Security

While the cloud undoubtedly presents enormous benefits to the business, moving away from a centralized IT architecture can open up a business to new risks. Utilizing specific techniques within SOA can improve security, such as using an intermediary for communication and run-time policy enforcement to ensure that communications are secure. In a cloud environment, it is important to always investigate who is responsible for securing the cloud and whether their security matches the organization's expectations. If not, the organization should work with a partner to ensure that all areas of security across the architecture are sufficient. Planning how to measure and test security means SOA contracts can be proposed while SOA services are still relatively small in number.

Scalability

One of the key advantages of a Service-Oriented Architecture is the ability to integrate with new services quickly and easily, enhancing an organization's agility. However, it is important to know where the breakpoints are in terms of scalability of services. For services that an organization hosts internally, validating service performance is something that should be done whenever a new or modified service is put into production or when a major new group of users begin utilizing the service. Further, it is recommended that performance testing be considered—even when an organization is using cloud services—before major new applications are launched.

Define relationships in terms of service user and service provider

It is critical to ensure there is a match between the expectations of the service consumer and the service provider. For example, if a service provider typically uses the weekend for preventative maintenance, it is critical that this information be available to all potential users so they can determine the service's applicability. This clearly extends to many other operational aspects. For example, the change procedure, target performance goals, escalation process and cost, must all be well understood by both providers and consumers. If the organization has clear terms of use (frequently called a contract) relating to a service, it's easier to set expectations and easier to measure whether agreements are kept. This contract doesn't need to be a formal document—like a legal contract—but it should set a precedent that there are mechanisms in place for controlling activities. Establishing this process early in the SOA lifecycle means change management and provisioning will be easier later on.

7 Summary

For today's CIOs, the message is clear: SOA and cloud are coming and companies need to be prepared. In the near future, organizations that do not deploy SOA and attempt to take advantage of the cloud will face a serious risk of being outperformed by their competitors who do.

Capgemini and HP believe that SOA is the only realistic direction to address today's challenges while also preparing the way for the future using the cloud. SOA is already being adopted across the technology industry as technology vendors look to deliver the new requirements driven by the business's demand for flexibility. Again, the cloud is inevitable in this respect due to its far superior cost profile and ability to enable new business models.

The challenge today's organization faces is how to embrace the change and use this disruption to increase competitive advantage. The question isn't when to adopt SOA and prepare for the cloud, but how. The answer is to prepare a roadmap to SOA and the cloud now to create competitive advantage in the future.



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Capgemini, one of the world's foremost providers of consulting, technology and outsourcing services, enables its clients to transform and perform through technologies.

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HP, the world's largest technology company, provides printing and personal computing products and IT services, software and solutions that simplify the technology experience for consumers and businesses.

HP completed its acquisition of EDS on Aug. 26, 2008. More information about HP (NYSE: HPQ) is available at <http://www.hp.com/>.

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