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Thinking from Reuse —
SOA for Renewable Business

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The promise of a service-oriented architecture (SOA) is facile systems – flexible, extensible, infinitely reusable, always predictable and reliable. SOA is a philosophy and methodology aimed at creating flexible, adaptable, sustainable businesses. Under SOA, the idea of reuse permeates the thinking of an entire organization, permeates the consideration of every process, project, and purchase. It is a journey of transformation that takes place over time.

In the world of SOA, we are able to model new business processes, leverage best practices, link and relink component parts together as business and technology act and react in seamless partnership. SOA enables organizations to overcome the traditional problems associated with applications that are too inflexible to support business change.

This paper explains the importance of SOA, explicates the fundamental elements of SOA and outlines key concepts in moving toward a service-oriented architecture.

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Renewable Business

Companies trying to react to competitive opportunities and threats are often thwarted by their existing infrastructure and by their very ways of doing business. Companies that can transcend these obstacles are in a position to gain market advantage, but rare are those companies. Companies never transcend these obstacles by continuing "business as usual." They must find a way to reinvent themselves.

For inspiration, we start with the example of how Toyota has dramatically reinvented itself over the last ten years. Toyota is producing hundreds of thousands of hybrid cars while its competitors are still trying to figure out how. The secret lies in Toyota's thinking from reuse.

When Toyota decided to produce a hybrid car, they did not design the car first and then determine the manufacturing requirements afterwards. They designed the hybrid Prius so that it could be built using any of Toyota's existing production lines and existing manufacturing processes. In this way, Toyota hedged its bet. If consumers rejected the Prius, Toyota could rapidly return to producing other models. If consumers loved the Prius, Toyota could switch production accordingly. All with little financial risk.

When enthusiasm for hybrids exploded, Toyota was not only able to quickly increase Prius production by 100,000 units per year, but was also able to explore producing hybrid versions of every other model in the whole Toyota range. No other car manufacturer has been able to do what Toyota has done.

The Business of SOA

So, what does what's happening at Toyota have to do with a service-oriented architecture, or indeed with information technology? It is precisely this kind of business transformation capability that is at the heart of SOA. SOA is the pragmatic, foundational architecture that enables reusable, flexible, sustainable systems. It is composed of three fundamental components:

- A flexible infrastructure with standardized interfaces
- A set of business services
- Business process management

Just as the manufacturing of the Prius leveraged existing Toyota manufacturing facilities, existing services (such as standardized nuts and bolts for all vehicles), and existing processes (such as production), SOAs enable businesses to reuse existing IT infrastructure, leverage key business services based on existing IT capabilities, and leverage established processes – techniques for bringing the right services together in the right ways to solve business problems.

SOA is about getting effective reuse from IT infrastructure and applications rather than from manufacturing infrastructure and machinery, but the benefits are the same: business flexibility, lower cost of change, simplified management.

The Industrialization of Software

Drawing comparisons between the business processes in a manufacturing plant and those carried out by IT systems may seem strange. They are at different stages of industrialization.

Modern manufacturing plants are designed for efficiency: Throughput is monitored regularly and manufacturing processes are perpetually improved. Manufacturing process continually evolves by driving costs out of the system. Manufacturing is an end-to-end activity and is optimized as such.

Enterprise IT has not yet evolved to this stage of industrialization. IT for most organizations is run like a collection of cottage industries, each of which

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serves a small department or section. The end-to-end business processes that might begin with a customer inquiry and end with the fulfillment of an order, are broken up into subprocesses, each of which is served by its own software application. These processes may only be connected together by email or telephone. The software equivalent of the production line does not really exist. Lack of standardization precludes flexibility in the whole arrangement.

The point of SOA is to make IT much more like manufacturing – with its innate efficiencies and flexibility. SOA gives organizations a computing infrastructure and layer of business applications that reflect the way the business chooses to operate. When implemented correctly SOA leads to the industrialization of IT revolutionizing business process. SOA transforms IT in the enterprise from a model of concatenated cottage industries to a model where standardized, interoperable business services can be easily linked to match the business process they are designed to automate.

The IT Predicament

Most of the IT spend of an organization is consumed in paying for the maintenance of what it already has. Figures vary, but in general 80 percent or more of the IT budget is spent just keeping things going. This might not be so bad were it not for the fact that much of the IT infrastructure and the business applications that run on it are not amenable to change. Indeed the litany of woes that beset the operation of IT is common everywhere. They include:

- Fragile systems that are inflexible and expensive to change
- Applications that were built to solve just one instance of a problem
- Silo applications and systems built to deliver a solution for only a part of the organization.
- Nonstandard interfaces between software applications
- Nonstandard interfaces to the software used by business partners making changes to business process difficult
- A wide variety of computing environments, platforms and products that have created a complex mix of technology

This technology nightmare is not due to a failure on the part of corporate IT. It is the result of IT vendors selling proprietary solutions meant to tie customers to their technology rather than creating standards-based solutions that open the way to competition. The technology development that turned this situation around and led to the formulation of SOA was the Internet. The

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Internet makes compatibility between software products and components more commercially advantageous than incompatibility.

Service-Oriented Architecture

SOA is the architecture of reuse. It is a set of IT design principles for creating adaptable and reusable business applications. SOA resolves the inflexibility of existing IT applications without the need to rip them out and replace them. SOA creates a framework for the standardized integration of all aspects of the software environment, from the management of software through to the execution of business transactions. It creates a framework for defining and implementing flexible, adaptable end-to-end business processes. Like efficient manufacturing plants, SOA maximizes the productivity of assets.

Scalable Infrastructure

Most computing infrastructures consist of a network and a combination of computing resources spread across an organization, linking all parts of the organization together. A service-oriented architecture must enable the various services that are part of the SOA architecture to interact. Critical to an SOA approach, is an enterprise service bus that acts as the traffic controller, ensuring that the right resources find each other. In addition, the IT management environment must understand how to keep performance predicable and secure.

Business Services

Business Services define what the company does and the rules governing its practices. For example, take the example of an insurance company that has codified how a claim is processed or a mortgage company that has codified the technique it uses to calculate a thirty-year mortgage. Both claims processing and mortgage calculation exemplify business services.

Traditional systems create business services as part of a large integrated program designed to meet the requirements of a business unit to solve a specific problem. The business unit has its own software, and typically, nuance and subtlety renders one business unit's software "not quite right" for another unit.

In the world of SOA, instead of incorporating each service into each specific program, the service is designed to be independent of its implementation. The result is that when the service itself needs to change, it needs to only change

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in one place and all the systems that use it change simultaneously, ensuring consistency and ease of maintenance.

An insurance company that relies on a traditional full system that included claims processing along with hundreds of other components must change the entire system every time any element of the system needs to change. Under SOA, the company can create new applications by selecting from all the codified and approved services that are available to be used to solve any business problem. The result is consistent, reliable, manageable applications that can be created and changed quickly as needed.

Linking Services Based on Process

SOA looks at a business from the perspective of its processes, seeing the business as a complete set of integrated business processes. Business processes are specific to the business. Sample business processes include, for insurance, processing a claim; in a hospital, admitting a patient; in a furniture store, selling a cabinet.

In SOA we think of a business process as consisting of people, business services, and the interfaces between business services. Process management software manages the flow of work between people and between specific business services. This is illustrated in Figure 1.
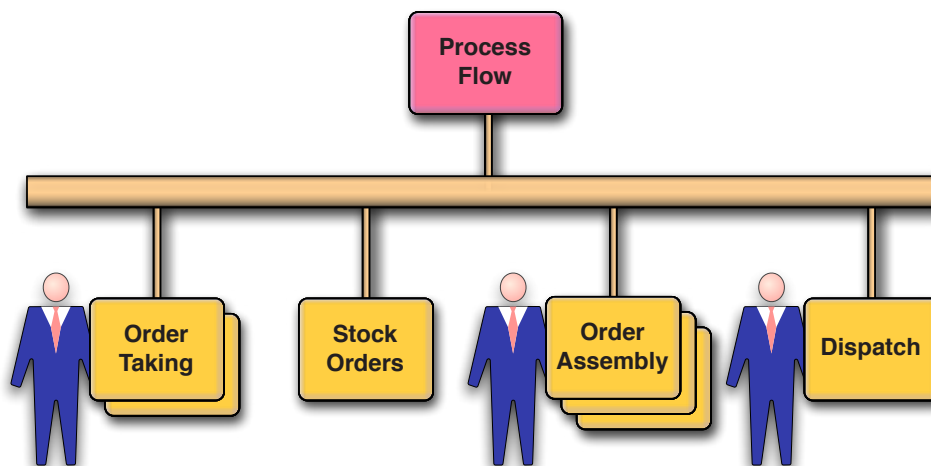

Figure 1. Sample Business Service

Business services, such as "taking an order," placing "stock orders" to replenish stock, "order assembly" for an order and "dispatch" of the order are functions from business applica-tions. The small boxes marked "I/F" represent the interfaces between these and other business services. These interfaces are simply adapters that allow one business service to pass information or instructions to another. The process flow manages the flow of activity from person to person and from one business service to another. Often the flow of activity in business processes is not fully automated and may even be completely manual. For simplicity sake, we represent it here as fully automated. When the flow is completely auto-mated the businesses services form a composite application.

The example shows the business process of taking and satisfying an order. A clerk takes the order, perhaps checking on stock before accepting it. This process automatically links to a process that places orders for new stock and checks to see if any stock reordering is necessary. The order is passed to an assembler and then passed to dispatch. The process flow manages the linking together of each activity and each business service, passing data and instructions to the person or the business service where necessary. We can think of the people represented in the diagram as carrying out business services that have not yet been automated or which cannot be automated (packing boxes or making phone calls, for example).

Notice that what we have here is a kind of production line. The business process could be any business process, from "prescribing drugs" to "approving a second mortgage." It will follow a set path or perhaps one of several possible paths, until it completes. The path it follows is determined by the process flow. In traversing the path various business services will be executed and various manual tasks may be carried out. The process will be repeated many times, perhaps millions of times. If for business reasons we choose to change the process, we must change some of these elements, possibly adding new ones or removing some.

Business Process Transformation
The view of business process that we have described can be used to represent all business processes whether they involve significant amounts of IT or not. We use it to highlight two important aspects of SOA:

• In order for SOA to deliver on its promise, we need to be able to

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encapsulate business services, we need to have well defined interfaces between business services and we need to implement a workflow capability. IT needs to be able to deliver this through a standards-based framework that allows new business services to be added without additional development work.

- With SOA we solve a problem that has stymied software development for decades: The inability of software development to understand what business management wants to achieve. Now the business management and the software development can use a common framework to interact effectively.

A primary goal of SOA is to enable business leaders to better evolve their businesses. Unlike traditional IT, SOA focuses on business drivers and aligns key IT assets with these business drivers. SOA approaches both business and IT from the point of view of reuse. Because business and IT are inextricably tied together, SOA holds the business view of the organization and the IT view of the organization simultaneously. SOA is about renewable, reusable, sustainable business – and how to get there from where we are.

SOA requires that both business leaders and CIOs think in terms of business services and how they support business processes. The role of business leadership is to codify the best practices of each business service and determine the way a process should be handled at any point in time. Using a service-oriented architecture, the IT organization can support this business practice by providing a foundation based on a highly scalable computing infrastructure, business services based on application assets, process management software that can easily be used to assemble those services and the web services interfaces to insure that these pieces can talk to each other.

Once a business is in position to manage and evolve its processes using SOA as its foundation, it can focus on its business priorities and it can reinvent itself when it needs to.

As the example of Toyota suggests, intelligent innovation is really reinvention that capitalizes on existing core business assets and competencies. This approach to business success is what SOA is all about. To this end, SOA focuses on the reuse of business process, workflow, business services and standardized interfaces that allow core services to be linked together easily.

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By separating out computing assets and converting them into modular, reusable parts, we break down rigid, inflexible IT applications into smaller, more manipulable components that can be used again and again – allowing the business to change its business processes without having to do major surgery on applications or build much that is new. Furthermore the business can have confidence that new business services will be based on software that is proven and consistent with other applications.

SOA Layers

SOA separates the corporate computer network and its IT resources into three distinct layers: an IT infrastructure layer, a business service layer and a business layer, as shown in Figure 2.
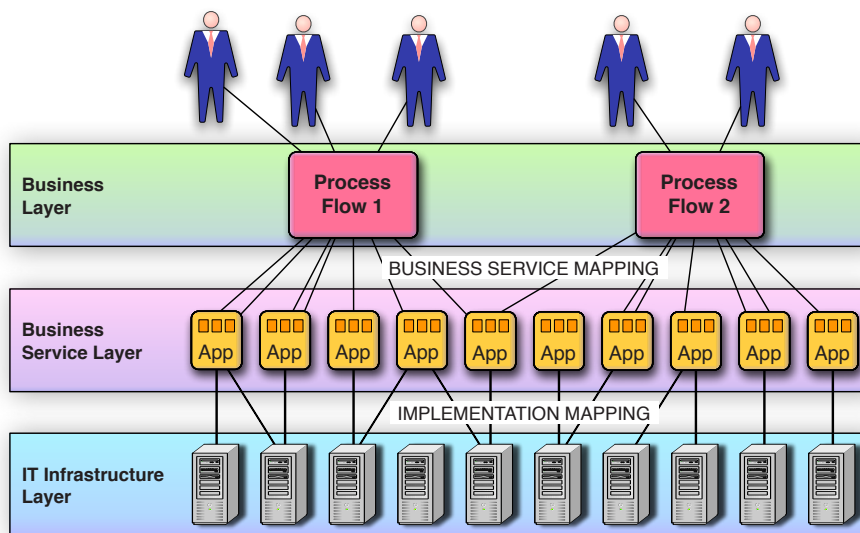

Figure 2. The 3 Layers of a Service-Oriented Architecture

In Figure 2, the lowest layer is the IT Infrastructure Layer – the technology plumbing. The IT infrastructure layer consists of all the computers in the corporate network, including desktop computers and access devices, together with the networking equipment, the operating software and networking software that runs it all. It also includes the management software that runs all the business applications, schedules events, makes back-ups, identifies failures and so on. This layer may be highly complex, but it should be hidden from the business, or at least from the non-IT staff.

The next layer up, the Business Service Layer, contains all the business applications that the IT infrastructure runs for the benefit of the business. Under SOA, applications that run on the business service layer are applications that have been developed or changed so that their business functions are available as business services. Traditionally this layer is the set of applications used by the business users of an organization: the HR system, the accounting systems, order processing, email and office software and so on. To run efficiently, this layer is deployed on (i.e., mapped to) the available resources in the computer network, from the desktop to the mainframe.

The top layer, the Business Layer, is new. This layer transforms the business applications in the layer below to business services linked together by process flows that correspond directly to specific business processes.

A service-oriented architecture is implemented on top of an existing computer network and its applications. In implementing SOA, we establish a framework that allows us to design, build and enhance IT systems in terms of business processes.

Smoothing Out Corporate IT Structure

Depending on its age and IT adoption history, organizational structure often reflects its use of IT. Historically, organizations were hierarchical and IT resources were centralized.

With the advent of the PC, PC networks and servers, hierarchies were flattened to some degree and business magazines talked of federated organizations. Both IT and organizational structure became more distributed. Departments and even small sections of an organization had a level of control over their IT.

The Internet dramatically enhanced the ability to network applications and the inefficiencies between departmental silos were exposed. Organizations set up intranets to allow different departments to publish information and lean heavily on email as an informal means of integrating one departmental silo with another.

Moving to SOA, organizations have the opportunity to adopt the paradigm of the modern production line. If the IT infrastructure is flat, the organization can be organized around the business processes of the organization and blissfully unconcerned with the complexity of the IT infrastructure and operations that support it.

Moving to SOA

SOA presents an incredible opportunity for organizations to restructure, repurpose and reuse their existing IT assets. It lays the foundation for flexible, renewable systems critical to business longevity. The promise of SOA is compelling, but achieving SOA is challenging. Here are ten aspects of SOA we think critical to your understanding:

1. **SOA is a journey.** SOA is not a quick fix. It is a journey of transformation that requires considerable planning and continual focus. Like optimizing the production line, continual focus on optimizing process will drive out cost, improve efficiency and reduce maintenance.
2. **SOA is technically elegant.** SOA is build upon 15 years of work in creating highly distributed computing environments that take into account everything from load balancing, software distribution, security, and data management including meta data management and a registry. Transitioning to SOA is achieved incrementally.
3. **Manageability of the whole must be a priority.** SOA will only work if organizations focus on the manageability of the whole IT resource. By its very nature SOA demands the aggregation of IP from many different sources. Scalability comes from the architecture, not development technique.
4. **SOA requires defined business process.** SOA will only work if it is implemented within the context of business process.
5. **The atoms of a business process are business services.** SOA is predicated on leveraging business services that represent the component parts of your business.
6. **SOA involves standard components.** SOA assumes that each component part is equipped with a clearly implemented web services interface based on standards.
7. **SOA demands different application design.** SOA applications are a series of tightly defined services intended to be loosely coupled within a container.
8. **SOA requires containers.** Business process must be contained in a well-defined process flow or composite application.
9. **SOA must be standardized.** SOA requires standardization across all vendors' implementations of SOA. SOA standards are in place and have been agreed upon by all major IT vendors.
10. **SOA facilitates change.** Under SOA, change is the norm, as its intention is to give business the ability to change easily when needed. If an SOA does not easily accommodate change, it is flawed.

Thinking from Reuse — SOA for Renewable Business

Achieving SOA is no mean feat, but ignoring SOA is life threatening. Organizations bent on staying in business in today's market will adopt SOA or be throttled by the complexity, unmanageability, rigidity and fragility of their own IT. SOA is the route to renewable, sustainable business and transforms corporate IT from business liability to business advantage.

About Hurwitz & Associates

Hurwitz & Associates is a consulting, research and analyst firm that focuses on the customer benefits derived when advanced and emerging software technologies are implemented to solve pragmatic business problems. The firm's research concentrates on understanding the business value of software technologies, such as Service Oriented Architecture and Web services, and how they are successfully implemented within highly distributed computing environments. Additional information on Hurwitz & Associates can be found at www.hurwitz.com.

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