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# A Three Level Model of SOA Maturity: Toward Achieving Sense and Respond

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## ABSTRACT

Service Oriented Architecture (SOA) has been proposed as both a technical and managerial solution in making firms more agile in addressing ever changing business needs. This conceptual paper identifies 3 levels of SOA implementation maturity: 1. Stability, 2. Flexibility, 3. Sense and Respond. A process and governance strategy on how to achieve each level is theorized and supported by case examples. The highest level conceptualized, Level 3, holds promise whereby SOA intelligence informs business activities and decisions. A case illustration concerning the use of a Customer Priority Index (CPI), derived from Level 3 SOA, outlines how a customer focused Sense and Respond capability might be achieved.

## Keywords

Service Oriented Architecture, Maturity, Sense and Respond, Customer Priority Index, SOA governance, Service Level

## INTRODUCTION

The global competitive landscape is driving businesses to be more heterogeneous and more difficult to control. This situation is complicated by laws that often require segmentation of the business units or by complexities brought on by mergers and acquisitions. As a result, corporations are faced with the challenge of managing large volumes of data and finding new ways to integrate different business segments (Sambamurthy, et al. 2003). In response, IT managers are looking for new approaches that support heterogeneity and collaboration of software systems and services. Service Oriented Architecture (SOA) is proposed as a possible solution.

SOA is a technological service paradigm designed to integrate business segments by providing automated handshake mechanisms using meta-relationships (Knorr and Rist, 2005). Under SOA, uniquely identified business functionality are represented as software services and interconnected with each other through coordinating services that sequence and prioritize use. The services have no set dependencies on each other to perform their specific tasks. Rather, business requirements prompt the selection of a set of services; the interactions amongst the services are defined by a business rule engine. Services are self-characterizing and encapsulate reusable tasks that support a fast and cost-saving composition to underpin new or changed business processes (Keen et al. 2004)

A managerial effort that consolidates common functionality amongst various applications results in a platform to build an SOA. Customer facing applications subscribe to these services using an agreed upon protocol and information is mapped and provided in the particular format required by customers. The derived service layer results in a homogenous middle tier environment that serves the common business rules amongst various customer types. There is little need to dismantle or rework existing services built on languages such as .NET, Java, COBOL or XML to enable their connection to SOA.<sup>1</sup> A corporate-wide implementation of SOA has the potential to result in better control, less redundancy, less time spent in development and implementation, and greater uptime. A goal of SOAs is to aid attain business agility while leveraging current IT assets. Hence, it is viewed as a way of conducting business (Knorr and Rist, 2005).

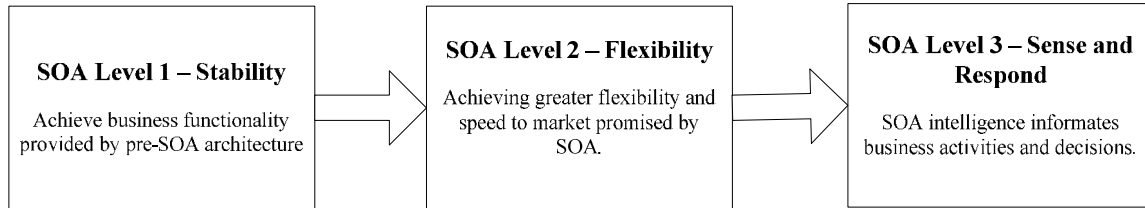
Over the past few years the popular press has been barraged with stories concerning the difficulty in implementation of SOA and the inability of companies to achieve these promises. However, similar to early implementations of ERP, SOA implementations are finally pushing past the horror stories and are beginning to reach a level of stability where they can at least deliver the same levels of functionality as the systems they replaced.

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<sup>1</sup> Extensible Markup Language (XML) is a language that has been used to represent data to the services also called Web Services Description Language (WSDL) using communication protocols such as SOAP.

We classify this as Level 1 SOA. While Level 1 is coming into the grasps of many firms, few firms have moved past Level 1 to achieve the “flexibility” that Level 2 SOA was supposed to bring and even fewer have leveraged the “business intelligence” (Level 3 SOA) that consolidation of services have the potential to deliver.

Even given its critics, we believe that SOA continues to offers the promise of flexibility and business intelligence. However, companies must learn to progress from Levels 1 and 2 to a Level 3 of SOA to enable a “sense and respond” capability, making it proactive to customer and market demands. Using case examples and process logic this paper conceptualizes the maturity path and governance required to move from Level 1 to Level 3 SOA.



**Figure 1: Three levels of SOA implementation**

Figure 1 shows the 3 levels of SOA implementation. First we summarily discuss Level 1, and what it takes for a firm to implement SOA and, at a minimum, deliver the functionality of the architecture it replaced. This level deals with the hurdles that a firm faces just getting SOA up and running. Next we briefly discuss, Level 2, outlining the governance that allows firms to benefit from successful SOA implementations in providing on-demand response to business needs. Finally, we provide a vision of a generally yet to be achieved Level 3, the level of sense and respond, we propose a SOA based business intelligence system that is pro-active and creates new opportunities. We should note that while many firms are still struggling to move through Levels 1 and 2, we will spend less space describing this transition as it has been more widely covered in the SOA related literature. Rather we direct our major focus to Level 3 and SOA unrealized potential.

The following sections explain each level in greater detail with a process guide and governance strategy followed by a case example.

#### **LEVEL 1 SOA – WHAT DOES IT TAKE TO ACHIEVE STABILITY?**

To implement SOA effectively, the organization itself needs to undergo a transformation to become more “Service Oriented”. Proper deployment of SOA usually occurs in conjunction with the re-design of business processes to make them more integrated, streamlined, and flexible (McAfee 2005). A Service Oriented enterprise organizes itself around autonomous components called services that interact with similar entities within the business ecosystem. Existing systems can be integrated into a SOA via programming a service-oriented facade around the systems in order to make them compatible with SOA (Baskerville et al. 2005). This is radically different from the earlier organization schemes that organize around functions. Undergoing this transformation presents business challenges that are difficult to overcome. These challenges and a proposed process and governance structure to begin to overcome these challenges are outlined as follows:

##### **Level 1 process**

To guide the implementation of SOA and the transformation to a service oriented enterprise, the organization needs to create an SOA team consisting of business managers, internal IT staff and business analysts. This team will be responsible for modeling the firm’s business logic and identifying the autonomous services. Once the firm has been “de-constructed”, this team needs to be able to “re-construct” or combine the identified services into the appropriate business processes.

Developers require considerable discipline to operate in the SOA environment. Training needs to be provided such that developers are unified in their thought process about developing SOA artifacts. Their creativity with code development will be constrained since SOA is more rigid in setting rules and regulations. A cross organizational regulatory body may be needed to ensure that developers follow a set prescription to develop a standard set of code that can be integrated well with other service-oriented code structures.

SOA implementation requires careful planning from a capacity planning, network engineering and information security perspective. Based on capacity planning estimates, certain services may not co-exist and will need to run exclusively on a set of physical servers. The protocols used for SOA require additional bandwidth to complete the transactions often resulting in the need to upgrade the network infrastructure. If the transactions traverse firewalls, the transactional characteristics may create additional overhead resulting in the need to upgrade the firewalls. Upgrades to the infrastructure need to be mimicked in the test environment to avoid problems with integration, performance and end to end testing.

Once the services and the network infrastructure are in place, the firm needs to implement an Enterprise Service Bus (ESB). This facilitates the communication between services allowing them to be combined into a composite business process. At this level, the process of discovering appropriate services for a business process is typically done manually. The manual orchestration process usually begins by determining what the customer needs. This is followed by analysis by a team which identifies the appropriate services to combine and any new services that need to be created. Once identified, these services are combined through the ESB to form a composite business process fulfilling the customers’ need. Proper deployment of SOA usually occurs in conjunction with the re-design of business processes to make them more integrated, streamlined, and flexible (McAfee 2005).

Typically at the time of the SOA implementations a migration strategy is adopted where both the silo application systems and SOA are updated with the features so that any reversals are transparent to customers. During the transition, service personnel have this extra layer to support in production along with the other services, often with no additional resources. Clearly, from this list of issues it is clear how some firms are struggling just to complete Level 1 SOA.

<b>Summary of level 1 process</b>
1) Formation of cross-functional SOA expertise team
2) Business model deconstruction / Identification of services
3) Reconstruction of services into business process
4) Adequate Budget Allocation
5) Developer facilitation and training
6) Capacity planning & testing
7) Network infrastructure planning and performance goals

**Table 1: Summary of level 1 process**

**Level 1 governance**

Governance is the underlying foundation of organizational transformation (Varadan et al. 2008). It is important that the governance system retain a good understanding of the business objectives and the application behavior necessary to achieve those objectives (High et al. 2008). However, like SOA in general, SOA governance was not a stand-alone concept that needed to be addressed separately from normal project management activities. Once questions of responsibility are resolved, service development priority is typically determined. IT departments often start work on services that have the least business impact. Developers and business analysts can be divided into two groups, one group of developers and analysts who support business requirements unique to customer types and the other tasked with building the common services. The latter group has the challenge of deconstructing the functional application silos and extracting commonality that can be developed as common services. As the development of a service often require an inter-departmental point of view, new project management techniques are required, promoting the further education of employees and facilitating change within the organization (Zhu et al. 2006). Testing can be carried out by the original test group that supports the IT department during the time of silo architecture. Enterprise Architects have the responsibility to coordinate inputs from capacity planning (operations and testing), Network Engineering, Information Security, Performance Engineering, Data Architecture, Backup and Recovery and Operations to deliver the technical architecture designed. Once design and testing is completed, the company’s IT Operations typically have the responsibility of coordinating with Development to implement the architecture. Resources must be actively engaged. In this realm, executive leadership is vital to the success of SOA implementation.

**Level 1 case study example:**

Farm Credit Canada (FCC) has gone through the steps in the Level 1 stage of SOA maturity (as discussed above), achieving a degree of “stability”. FCC provides financial services for Canadian agricultural businesses. FCC sought to differentiate themselves from their competition based on customer experience. This was to be achieved by standardizing the customer experience and enable cross-channel interaction. As chronicled by Smith and McKeen (2008) the initiative was championed by the CEO, who recognized that the IT funding model had to be changed. In earlier projects, funds were allocated to functional departments for their specific IT needs. However, with the new service-oriented approach the IT funding had to originate from the enterprise. This governance structure clearly defined the roles and responsibilities of all individuals involved. The next step was to train staff for effective SOA implementation. The company then assembled a team of experts who analyzed the company’s value chain and related process. As a consequence they deconstructed existing processes into components or services that could not only function independently, but also be combined to form more complex business

processes. To test the concept, they selected a single process (loan renewal) and developed the relevant services: the user portal, identity management, forms management, workflow, user interface and security. Once implemented, the business processes significantly improved the quality and ease of use for the loan renewal process and, ultimately resulted in cost savings since the SOA removed redundancy in the previous legacy architecture.

## **LEVEL 2 SOA – DELIVER FLEXIBILITY PROMISED BY SOA – CONFIGURABLE INTELLIGENCE**

A prime benefit of SOA is the opportunity for rationalized and incremental extension of business applications and processes in new configurations based on business need (Natis, 2003) In level 2, the firm moves from completely manual service orchestration to a more automated process where it exploits the capability to intelligently identify and combine services based on customer needs. This capability can be termed “configurable intelligence”. It allows the firm to deliver new business value with improved response time and substantially lower effort, thereby achieving promised flexibility in its operations. The higher the level of automation, the more flexibility the firm delivers.

The traditional view of a business process is a sequential flow of steps. In other words, the sequence of each step is pre-determined. However, in Level 2 automated process designs, the process can be dynamic, that is, the choice of subsequent steps (or services) depends upon the result or even partial result of the previous step. The new models need to support more than just decomposition; they must be able to capture processes with flexible sequences that are result based, rather than sequential with fixed decision points (Cherbakov et. al., 2005).

### **Level 2 process**

#### **1) Develop new modeling techniques**

As discussed above, the new process models need to be more flexible than those designed in Level 1. These processes do not follow a fixed sequence, rather based on the output of the previous step; they dynamically choose the most optimal next step. By acquiring this capability, the firm is able to automate and hence optimize the service composition (since several services combine to form a process). This imparts a certain level of “intelligence” to the orchestration process that leads to optimal configuration of business processes.

#### **2) Determine rules for service composition**

Requirements that hold true across the entire customer base are constructed as services. Such an approach helps application groups that support a particular customer type to concentrate more on their unique needs than on the requirements that are universal across the customer base. However, to effectively combine these services, a set of rules governing the mechanism by which these are combined to form an existing or new business process, need to be specified. Thus the rules that are developed need to reflect the dynamic nature of the process and implemented in a Business Rules engine, which becomes a part of the Enterprise Service Bus (ESB).

#### **3) Create a repository of services and metadata related to the services**

To be able to automate the process of orchestration, the firm needs to have a repository that stores information about the different services. This information includes the interface of the service, the inputs required, output produced, communication protocols and the service level expected. This information about a service is then used by the business rule engine to identify appropriate services for a customers’ need and then eventually facilitate orchestration.

#### **4) Integration of the business rule engine into the Enterprise Service Bus**

The Enterprise Service Bus (ESB) is the nerve center for such activity as shown in figure 2. It coordinates the interaction between different customer types with the common services offered by the firm. Also it interfaces with the data layer and provides the necessary information in a consistent manner. The ESB is a common platform that orchestrates the interaction between the customer and the services required. Also, ESB has the ability to communicate using various protocols that allows legacy applications and new applications to effectively talk with one another. Any new customer requirement is fulfilled by connecting the appropriate services together, orchestrated by the ESB providing a secure and consistent way of delivering the information to the customer.

#### **5) Provide robust communication and network management**

Speed to market is achieved by the firm’s ability to inter-connect services in a flexible fashion. Bottlenecks are easily identified since each service can be individually monitored for its performance. If a particular service is over-subscribed, it can be quickly activated and load-balanced on additional servers, without significant impact to performance. New or modified business rules for a particular service are interpreted and integrated in a standard fashion, with minimum disruptions to the business. As outlined in Table 2, the horizontal integration of requirements in the services tier results in less

redundancy, less time spent in development, greater uptime, but most importantly it provides the flexibility through configurable intelligence that provides the company more flexibility in addressing changing business requirements.

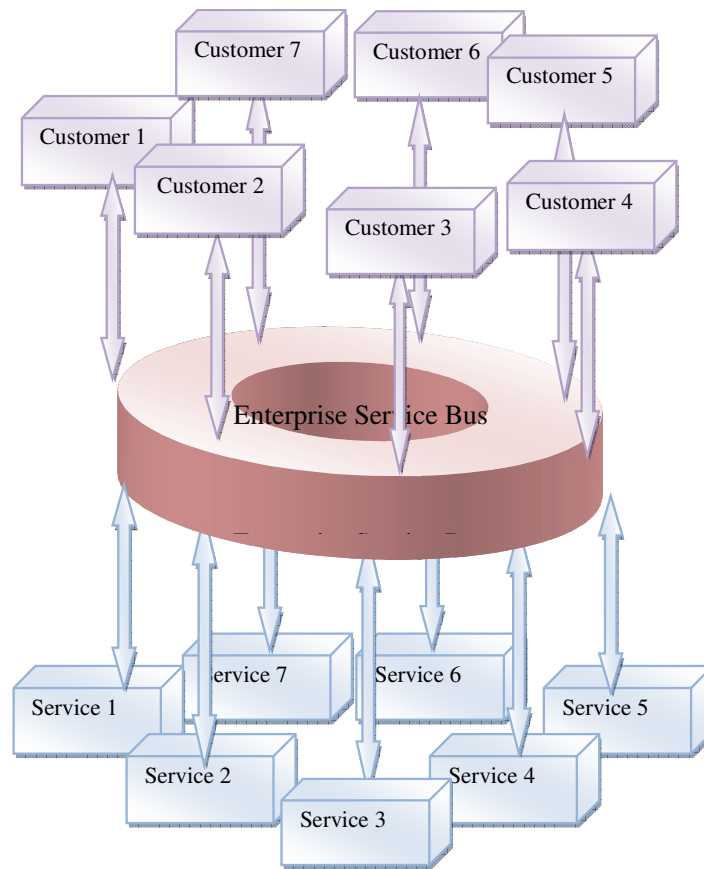


Figure 2: SOA

Summary of level 2 process
1) Develop new process modeling techniques
2) Determine Rules for service composition
3) Create a service metadata repository
4) Integration of the business rule engine into the Enterprise Service Bus
5) Provide robust communication & network management
6) Integration of all legacy and new systems through the Enterprise Service Bus

Table 2: Summary of level 2 process

**Level 2 governance**

Governance established for Level 1 should remain valid for Level 2. The only exception might be for a group from the existing set of SOA developers to automate the process of service orchestration. Their main task is to identify the inputs and develop mechanisms to automate the orchestration process within the SOA rules of engagement. Input from the Enterprise Architects are typically limited to situations where transaction levels exceed an agreed upon threshold. Upon exceeding thresholds, capacity and performance planners investigate the requirements to decide whether additional hardware needs to be installed to maintain previously achieved response times.

**Level 2 case study example**

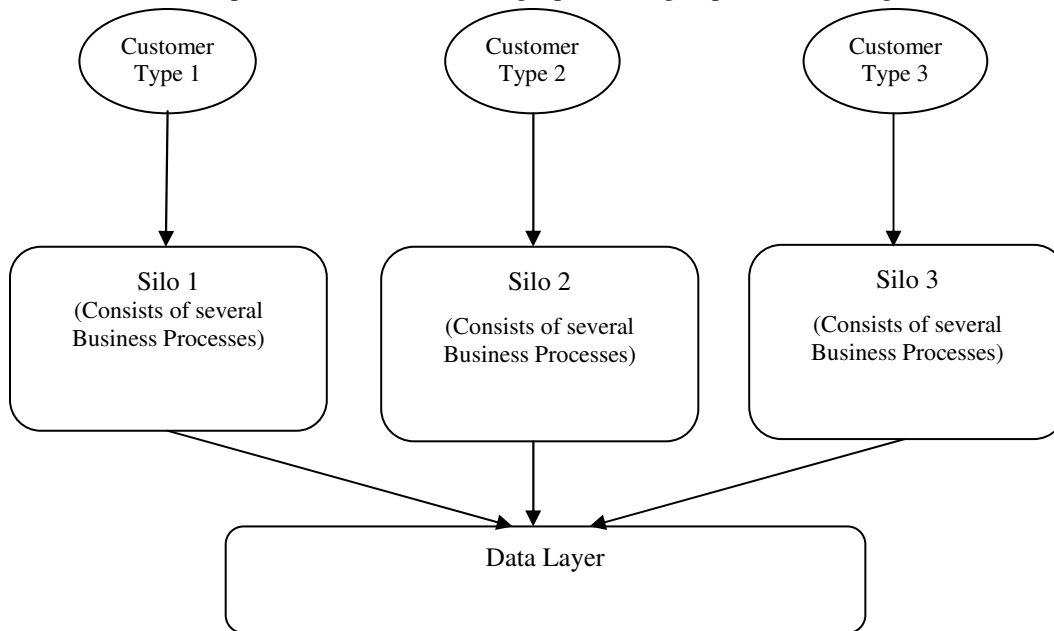
Based in Martigny, Switzerland, Groupe Mutuel provides a wide range of insurance services to more than one million customers representing 1.8 million insurance contracts. The company, made up of 14 loosely coupled business units, is the second largest health insurance provider in Switzerland. However, according to IBM (2008), to better achieve its goal of becoming number one in the Swiss health insurance market, Groupe Mutuel needed to become more flexible and cost efficient. Groupe Mutuel worked with IBM to map the key components of its business processes as a prelude to redesigning them. This allowed them to not only understand their own business processes, but also the business rules required to combine the various components into a composite business process. Next they specified needed IT infrastructure to support the SOA, which included the use of a business rule engine and a repository of service metadata. The components identified were implemented as an abstracted layer of service which could be easily reassembled or redeployed in any of the company’s operations without much integration effort. This was made possible through the implementation of the IBM’s ESB, which simplified the connection between Mutuel’s backend systems.

For Groupe Mutuel, the broader benefits of leveraging common business rules are two-fold. First, they facilitate the automation of a wide range of key processes, thereby increasing their efficiency and reducing their costs. Second, the fact that common business rules can be extended—to new business units, channels and acquisitions—gives Groupe Mutuel far more operational flexibility. In this way, the SOA implementation at Groupe Mutuel has achieved a “configurable intelligence” creating business value by automating the connection of appropriate services.

**LEVEL 3 – ACHIEVING SENSE AND RESPOND THROUGH SOA BUSINESS INTELLIGENCE**

SOA may deliver great opportunities for multiple areas of application, but it always depends on the business strategy whether a new technology, system, or infrastructural paradigm matches with the organization’s requirements and thus with the resulting IT strategy (Luftman 2000, 2003). Creation of service modules opens new opportunities that a firm can exploit. The information gathered from service usage and their priorities in business transactions can help companies rethink and realign their resources to cut costs or effectively offer personalized service offerings. SOA based business intelligence is the process of analyzing information gathered from the SOA and dynamically studying the impact this information has on various facets within the firm, as well as, its influence on markets. For many companies, the biggest immediate potential gain of Level 3 is in the area of customer service. For example, Level 3 benefits might be realized by addressing perplexing business issues, namely customer homogeneity and the addition of the service layer brought about by the SOA implementation.

1. **Customer Homogeneity** - Architecture implementations prior to SOA, typically served the needs of homogenous groups of customers. Their service expectation levels were reasonably well understood by their service management groups. This led to the development of silos, each serving a particular group as shown in figure 3.

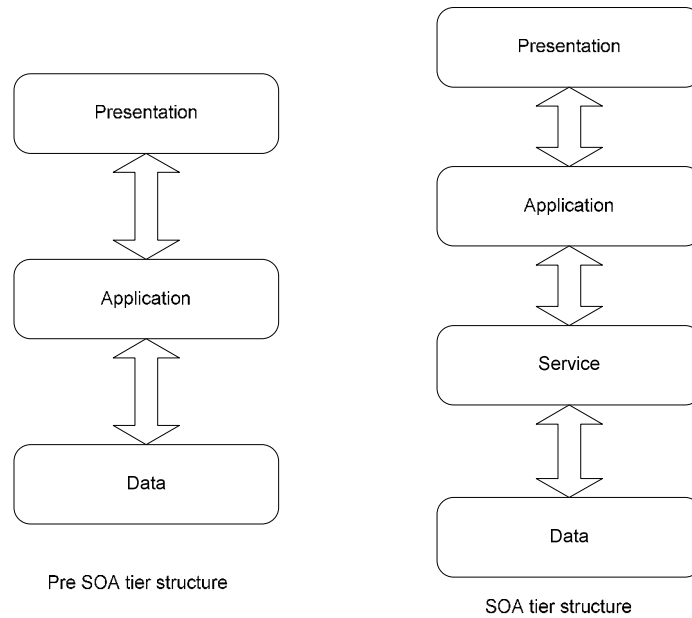


**Figure 3: Homogenous sets of customers with unclear delineation of business and services used.**

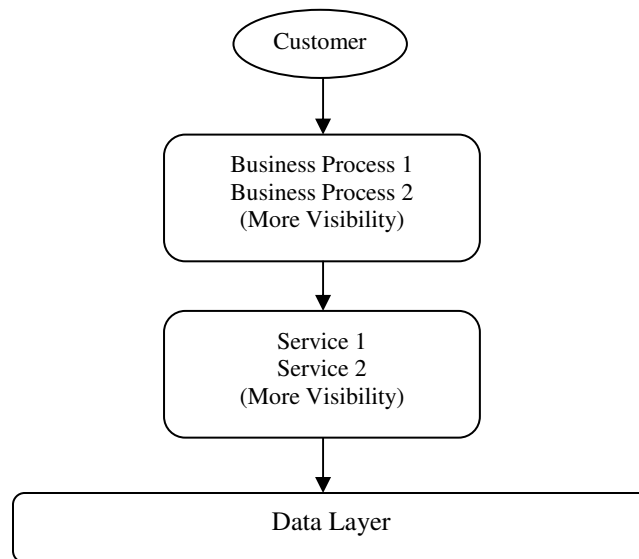
However, SOA implementation dismantles these silos and extracts similar functionalities to create a set of common services that are accessible to all customers. As a result, the company is typically forced to adopt a much more generic internal

Service Level Agreement (SLA) for its entire spectrum of customers. This potentially negative immediate consequence of SOA prevents the firm from catering to the unique needs of its different customers, which may cause misalignment of service level expectations of a customer relative to the service levels actually delivered. This potentially negative consequence of Level 1 SOA stability must be overcome.

**2. Addition of the service layer** - Furthermore, the introduction of SOA results in the creation of an additional common service layer critical to all operations and adds overhead to service management, as shown in figure 4. The current mechanism of using generic SLA's may lead to misalignment of resources and priorities. Krafzig, Banke, and Slama (2005) proposed a hierarchical perspective on SOA, in which includes the Application Front End, the Service, the Service Repository, and the Service Bus. Accordingly, only the Service child has children, consisting of Contract, Implementation, and Interface. Finally, the proposed hierarchy is composed of Business Logic and Data, children of Implementation.



**Figure 4: the addition of a service layer creates overhead for Service Management**



**Figure 5: SOA improves visibility into the business process and component services used by customer base**

To address these potential problems of misalignment between expectations and delivered services, firms may resort to just raising their generic service level to meet the requirements of the customer with the highest service level expectation. While this solution is simple, this means that all customers will get a similar “highest” level of service from the company,



regardless of their specific needs or expectations. This will effectively neutralize the financial benefits realized by componentization and reuse, by tying up valuable resources and possibly offering the highest levels of services to customers with lower expectations or demands. Clearly, under this scenario, SOA is not achieving the promise of analyzing the needs and expectations of each customer, and using derived information to prioritize and assign its resources appropriately.

Resolution of these critical problems requires focus on a vital attribute of SOA; namely, visibility into the components of a business process. SOA breaks up business processes into reusable, independent components, which means the data is now available at the component level rather than at the business process level as shown in figure 5. The links that services allow are of many sorts: company-to-company, activity-to-activity, agent-to-agent, or person-to-person. Thus, each individual service can be plugged into the business process which makes the business process change more flexible, enabling new types of collaborations between businesses [Haugen 2000]. From a business intelligence perspective, SOA differentiates the components (services) that makeup a business process, resulting in a granular view of the services used by the customer. This property of SOA can be exploited to accurately determine customer priorities.

In the remainder of this section we will focus on the development of a potentially critical Level 3 SOA capability to improve customer sense and respond. While we recognize that other Level 3 capabilities can and will be developed, we focus on the creation of a Customer Priority Index (CPI) that could offer a strategic response to the two major problems discussed above and that would represent a maturity level indicative of promised SOA “Sense and Respond.

The business process and its service components are clearly identified in an SOA implementation. The CPI is the service plan for an individual customer created by exploiting the ability of SOA to reveal the service components that makeup the business process. The previously mentioned problems related to customer homogeneity and addition of the service layer can be resolved with the creation of the CPI. Not only does the firm benefit from the agility and speed to market promised by SOA, visibility into the business process offers the opportunity to better predict customer priorities leading to better customer service and proper alignment of internal service personnel.

<b>Summary of SOA level 3 benefits</b>
1. Cross- Sell products/services to existing customers
2. Create new product/service offerings to meet customer demands in the future
3. Help Svc. Mgmt area manage resources better (select the most appropriate resource and apply the correct amount to a problem depending on determined customer priorities)
4. Manage customer expectations by using internal derived SLA’s.

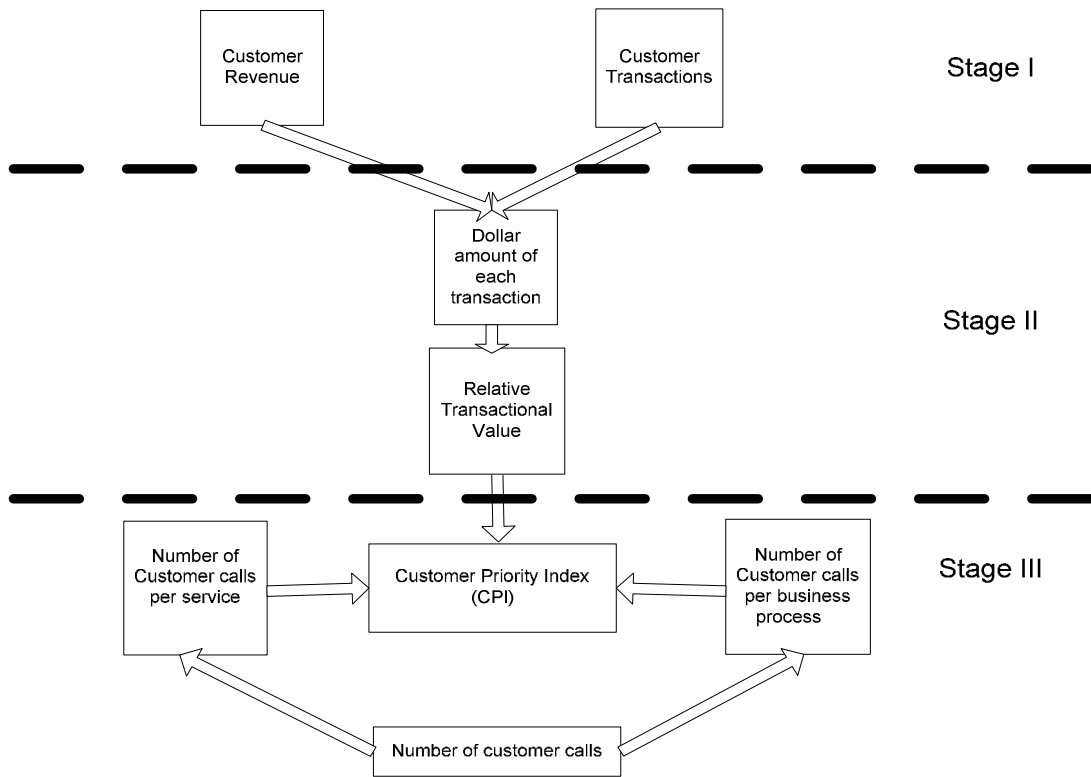
**Table 3: Summary of SOA level 3 benefits**

A process of Level 3 SOA implementation for a CPI might consist of the following steps:

1. Consult with relevant groups.  
Enterprise Architects, Business leads from revenue, Marketing and operations. Technical leads for SOA development to prioritize, understand the business requirements for CPI.
2. Obtain revenue, transaction data and customer service logs.  
Most firms collect a large amount of data from their daily operations. This data when used and processed properly can be invaluable to understand various aspects of the business. In order to calculate the CPI, data on revenue and transaction volume should be obtained from the appropriate departments. (Please refer to case study for more details).
3. Calculate CPI by analyzing transaction value and customer priority for service.  
This process consists of three stages as depicted in figure 6. The first stage begins by considering the following
  - a. Total number of transactions committed by the customer. This will include Business Process calls and individual service calls.
  - b. Total revenue the corporation earns from the customer.

The second stage consists of calculating 2 factors.

- a. Calculate the dollar amount of each transaction by considering the ratio of customer revenue and transaction from Stage 1.
- b. Calculate the relative transactional value by taking a ratio that compares a customer with the customer who has the highest transactional value. (Table 8)



**Figure 6: Three Step process to calculate the CPI**

The third stage calculates the CPI by tying the relative transactional value with the following information

- a. Number of customer service calls per customer broken down by service. (Table 6)
  - b. Calculate the Ratio of the individual services to the total number of calls placed by the customer. (Table 6)
  - c. Calculate the Ratio of the individual business process to the total number of calls placed by the customer. (Table 7)
4. Automate the creation of CPI.  
To exploit the full potential of the CPI, it is important to automate the CPI generation such that a customer service agent can retrieve a customer’s CPI in real time. (More details on automating the CPI can be found in the governance section).
  5. Educate customer service and technical support teams on how to use the CPI dashboard.  
For the project to be successful, it is important to educate the end users and support teams on how a CPI dashboard works. Support teams need to understand what process is critical to keep the CPI functioning to remedy any issues.
  6. Plan and test customer retention techniques before full implementation.  
It is always necessary to test all project functionalities before implementation. Also, the implementation of the project should be carried out in a phased manner. It is also important to make sure that the user interface is easy to use and intuitive. By building prototypes of the dashboard for the users to test, the development and testing team ensures that the project is adopted and used widely within the firm.

<b>Summary of level 3 process</b>
1. Consult with other relevant groups.
2. Obtain revenue, transaction data and customer service logs.
3. Calculate the CPI by analyzing transaction value and customer priority for service.
4. Automate the creation of CPI.
5. Educate customer service and technical support teams on how to use the CPI dashboard.
6. Plan and test customer retention techniques before full implementation.

**Table 4: Summary of level 3 process**

**Level 3 governance**

Considering the number of departments involved in a Level 3 effort, a great deal of support and direction will be required from senior executives (Walker 2007). The top management in marketing, IT and revenue would be required to engage in several rounds of discussion to determine their roles and responsibilities and create an environment conducive to realization of the CPI. This newly formed team should directly report to the CIO. Such a move will ensure focus and implement a concrete strategy to progress from idea to implementation. The support shown by upper management should include CPI creation as a performance measure in the annual evaluation of employees concerned. This will result in greater ownership and recognition and thereby lead to employees on the CPI team attributing higher priority to support the effort.

The Responsible, Accountable, Consulted and Informed (RACI) method (Gartner Research, 2006) might be used to identify the role and authority for the various parties involved in the creation of the CPI as shown in table 5. *Responsible* refers to the person(s) who produces the CPI. The developer has the role of developing the dashboard using the formula developed. The database advisor would have the responsibility of importing data from Service Oriented transactions, revenue and customer service databases. The business analyst would prioritize and organize discussions with various groups involved on topics ranging from prioritizing which customer type receives the first CPI to understanding business requirements from marketing, customer service center and operations that would eventually be used in developing the CPI. The number of developers, database administrators and business analysts in the CPI team should be proportional to the number of services that need to be implemented. *Accountable* refers to the person(s) who have the ultimate decision-making authority.

RACI	
Activity	SOA Level 3 Implementation
Responsible	Developers, Database Administrators, Business Analyst.
Accountable	SOA Intelligence Manager
Consulted	Enterprise Architects, Customer Service, Revenue, Marketing, SOA development
Informed	Senior Executive Committee, CIO

**Table 5: RACI**

The CPI manager can consult with the Enterprise Architect or peer managers before taking decisions such as resources required to import information from the various databases and escalating issues with regards to development issues. *Consulted* refers to the person(s) who must be consulted with before action is taken. The creation of CPI requires collaboration amongst the Enterprise Architects, the CPI development team, database advisors of revenue, customer service, SOA and business leads from operations and marketing. *Informed* refers to those who should be informed that a decision or action is being taken even though they have no control over the action. The senior executive committee and the CIO need to be continually informed about decisions related to CPI creation.

**Level 3 case study example**

For the purposes of illustrating how Level 3 might be implemented, the following case example is provided. This case example is based on assumptions pertinent to a world leading transportation company. In this illustration, the firm offers various services to its customers. The shipping process is one such offering, made up of the rating, routing and tracking sub-components or “services”. This company was at Level 2 SOA when the CPI was being considered, namely, they could fulfill customer requirements quickly and achieves speed to market hitherto not unattainable with previous architectures. Their performance metrics met and in some cases exceeded benchmarks set by previous implementations. However, there were two issues that the firm was struggling to resolve.

1. The treating of customers as a homogenous group was causing disruptions in service levels. To fix this problem, the company raised their generic service level to meet the requirement of the customers with the highest expectations. The firm was allocating excessive resources for some customers (with lower expectations), while just meeting the minimum requirements for others (with higher expectations). In other words, the firm was expending considerable resources on providing mediocre service levels.
2. The support staff was working long hours to fix issues, often spending time on a lower revenue customer, thereby making higher revenue customers wait in line. Furthermore, the introduction of SOA resulted in the creation of an additional layer (the common service layer), critical to all operations and added overhead to service management.

This, the current service contractual method of using generic SLA’s was leading to misalignment of resources and priorities.

As mentioned previously, the componentization of the business process available as a Level 2 SOA implementation should provide the firm with increased visibility. In other words, the company possessed a powerful lens to gain an insight into the patterns of customer behavior at a much finer level.

Visibility was operationalized using two factors

1. The number of calls per service made by each customer.
2. The transactional value attached to a service per customer calculated as the ratio of the number of transactions to the revenue generated using that service.

It was seen that, in general, customers with higher transactional value called the customer call center more often to seek resolution to their issues. However, in some cases, it was noticed that customers with lower transactional value called the customer center with more calls than customer who had a higher transactional value. For instance, customer F, who had a \$50 value for every transaction, had called the customer center 3 times to have the tracking service fixed. However, customer G never called to report a problem even though their transaction value was \$70. Thus, each service held a value proposition that was different from one customer to another.

The CPI calculation takes the number of customer calls and their transactional value into consideration. To better conceptualize this, the customer center logs for the shipping process, made up of rating, tracking and routing service, were examined. Customers have the ability to avail the business processes or just an individual service. For instance, the rating service provides customers the ability to check the rates on shipping between two cities without having to make an actual shipment.

Customer	Rating	Routing	Tracking	Total
A	5	3	2	10
B	6	4	7	17
C	3	6	4	13
D	4	4	3	11
E	2	3	6	11

**Table 6: Shows the service center calls made by the customer**

Business Process			
Customer	Shipping	Reservation	Total
A	4	6	10
B	10	7	17
C	7	6	13
D	1	10	11
E	4	7	11

**Table 7: Shows the breakdown by business process.**

Five customers, A, B, C, D and E were examined. All customers utilized the business processes and the individual services. To demonstrate the calculation of the CPI, a hypothetical value was assigned to transactional value for each customer, Customer A - \$5, B - \$10, C - \$15, D - \$20, E - \$30. (Please refer to Tables 6, 7, 8)

Customer	Transaction Value (TV)	Max TV	Relative TV
A	5	30	0.166666667
B	10	30	0.333333333
C	15	30	0.5
D	20	30	0.666666667
E	30	30	1

**Table 8: The transaction value for each customer relative to the highest transaction value**

Customer A’s CPI for the rating service in the shipping business process is calculated as

$$5/10 \text{ (from Table 6)} * 4/10 \text{ (Table 7)} * 5/30 \text{ (Table 8)} * 100 = 3.33.$$

As summarized in table 9, Customer A has a higher CPI value than Customer D even though customer D has a higher transactional value. The service management area is able to prioritize their work by giving higher priority to A even though D had a higher transactional value. It should be noted that in the situation where the CPI’s are similar, higher transactional value might decide who gets serviced first. E and B have similar CPI’s. Given that Customer E has a higher transactional value than B, service management might prioritize customer E over B since E has a transactional value of \$30, whereas B only has a transactional value of \$10

Customer	CPI (for rating service/shipping business process)
A	3.33
B	6.92
C	6.21
D	2.2
E	6.61

**Table 9: CPI calculation for Rating Service in Shipping Business Process**

The CPI can help marketing improve the effectiveness of their campaigns by tailoring their message to target service and business priorities of the customer. As shown in figure 7, based on the CPI, the customer retention program should be able to devise a credit system for each customer based on his service and business process. The CPI allows the firm’s marketing department to understand customer B’s priority for the rating service.

At the time of contract renewal with customer B, the firm can offer a higher service level to the rating service. Thus, this information has the potential to provide this shipping firm a competitive edge over its main rivals by both retaining existing customers and acquiring new ones.

The calculation of CPI helps with: 1) improving customer service quality thereby increasing customer retention and 2) managing service management priorities. Figure 8 explains the inputs that went into the creation of the CPI and its benefits to the firm. By exploiting the visibility and the ability to connect several functions provided by SOA seamlessly, a firm can develop priority indicators to drive their strategy.

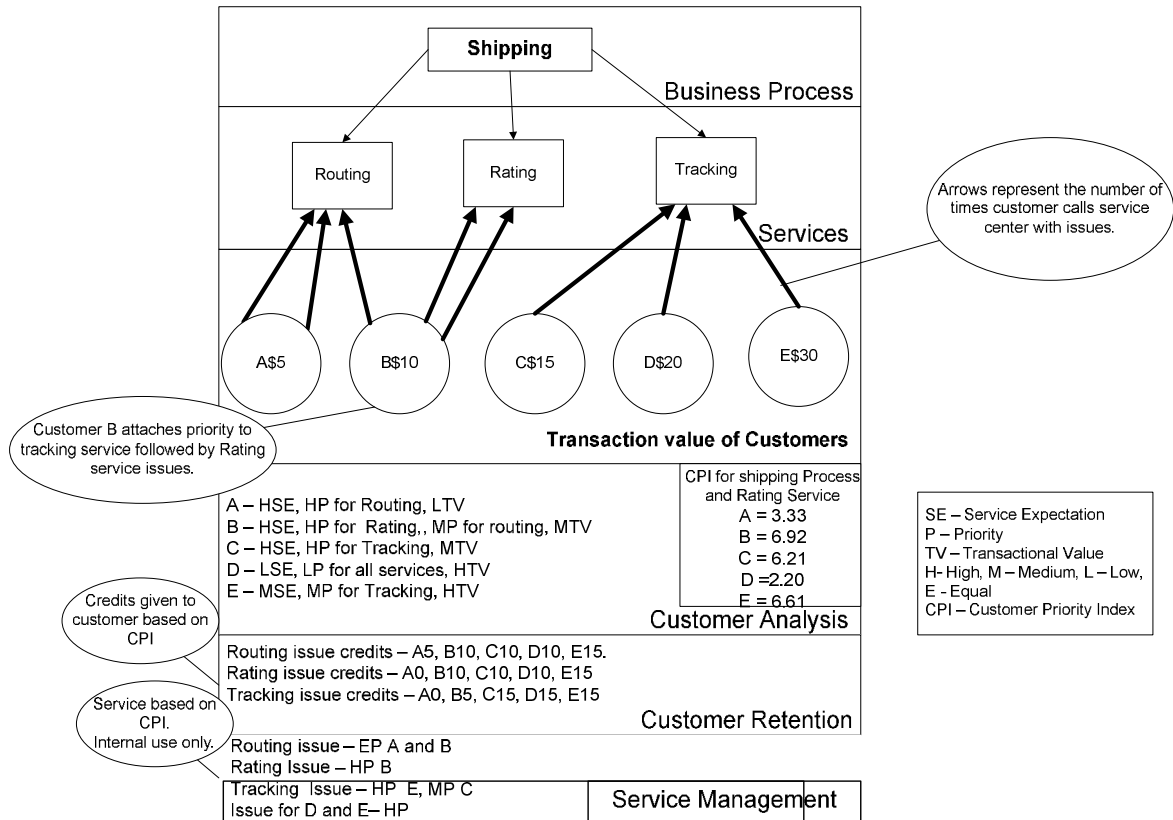


Figure 7: CPI calculation scenario

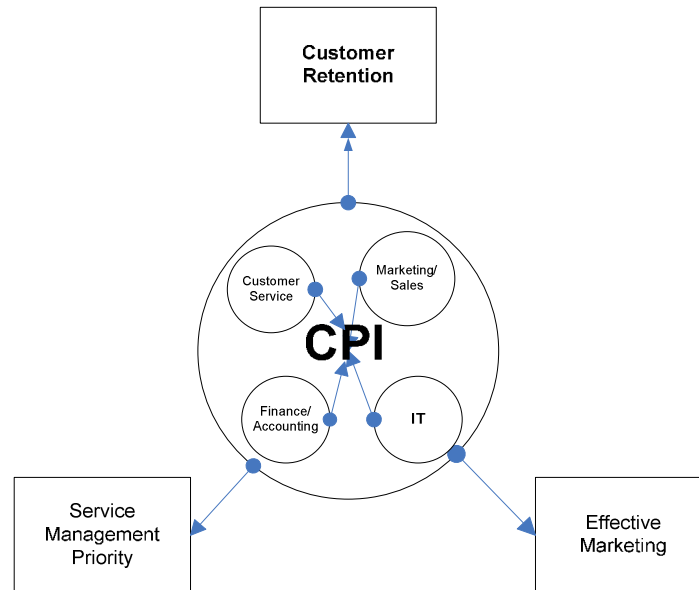


Figure 8: CPI - Inputs and Impacts

## CONCLUSION

This paper provides much needed spade work in conceptualizing what a SOA maturity path might look like and what business value lies ahead. It is anticipated that this article forms the basis for future empirical research exploring the validity of the proposed maturity model and the diffusion of Level 3 capabilities, like those developed through the CPI. In addition to advising companies on how to reach and govern Level 1 SOA (Stability) and Level 2 SOA (Flexibility), this paper presents a vision of the next level of SOA implementation (Level 3 –Sense and Respond). The ability to “sense” the customer’s needs and configure a customized solution would give a company a crucial head start in the competitive race to be more heterogeneous while being in greater control. In addition, new business processes can be built based on existing services reusing them. Therefore, the development efforts can be reduced which in turn leads to a shorter time-to-market, offering greater flexibility at lower costs to the organization (Baskerville et al. 2005).

It was also revealed that SOA can sometime have the unanticipated consequence of creating new problems for customer quality and the misalignment of service management resources. This paper puts forth recommendations for managers engaged in SOA implementation to overcome problems in upper management commitment, inter-departmental collaboration and consistent governance needed before Level 3 can be reached. Finally, this paper begins to provide managers with a step-by-step process for understanding SOA maturity. Once the managers better understand at which level there company currently sits, they can use the guidelines set forth in the paper to move towards the “Sense and Respond” Level 3 stage of SOA implementation.

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