2009

Piloting Service Oriented Architecture—A Case Study in the Oil Industry

Ashish Kumar Tewary
Infosys Technologies, ashish_tewary@infosys.com

Parag Kosalge
Grand Valley State University, kosalgep@gvsu.edu

Jaideep Motwani
Grand Valley State University, motwanij@gvsu.edu

Piloting Service Oriented Architecture—A Case Study in the Oil Industry

Ashish Kumar Tewary
Infosys Technologies Limited
Ashish_Tewary@infosys.com

Parag Kosalge
Grand Valley State University
kosalgep@gvsu.edu

Jaideep Motwani
Grand Valley State University
motwanij@gvsu.edu

ABSTRACT

The Service Oriented Architecture (SOA) paradigm introduced a few years back has already become the driving force behind enterprise systems. It is also a force behind most cutting edge technologies today. Although much is written about SOA, empirical studies on its implementation are next to none. This exploratory case study examines a pilot implementation at an oil-drilling equipment manufacturing company to understand the process and issues involved in SOA adoption. The study depicts the implementation methodology and the roadmap adopted by this organization to help connect its disparate systems using enterprise SOA. This paper can help researcher better understand SOA implementation and help them further explore the managerial issues involved in implementing this new technology.

Keywords

Service Oriented Architecture, SAP, implementation, ERP, application integration, pilot.

INTRODUCTION

Enterprise solutions are now routinely used by industries to automate their business processes. It is also common for the industry to cherry-pick the best solutions across solution vendors for each part and function of their business (for example, Tangen, 2005; Blau, 2006). Large organizations are characterized by an extremely complex network of enterprise applications, each based on different application architectures: a heterogeneous composition of solutions that do not easily communicate with each other. The typical IT structure is so dense and extensive that "it is a miracle it works at all" (Rettig, 2007, p.21). It makes the IT infrastructure unwieldy, rigid, and prone to errors; while making it difficult for an organization and its processes to be flexible and agile. An estimated 70% of a chief-information-officer's budget covers labor costs and more than half of these are on operations (Lindquist, Madduri, Paul, and Rajaraman, 2007). Large organizations like Airbus industries (Blau, 2006) are increasingly approaching Service oriented architecture (SOA) to overcome this problem. A recent Gartner study indicates that over 75% of businesses surveyed plan to use SOA for their customer relationship management and enterprise resource planning initiatives.

SOA promises to break down applications into standard-based components that can be recombined and reused for changing business conditions (Kim and Lim, 2007; Oh, Lee, and Kumara, 2007). It can help businesses rapidly reconfigure the business partnerships with customers, suppliers, and government to respond to market forces. It also streamlines and transform business processes to offer "business on demand," while offering cost-effective IT implementation (Walker, 2007) and reducing IT expenditure (Ladner, Petry, and McCreedy, 2008). It can integrate disparate systems, legacy or not, while "unlocking the information so it can flow to every user, human or automated, that needs it" (Vertex, 2006). SOA is also the paradigm currently driving most of the cutting edge technologies like mash-ups and composite applications (Dignan, 2007).

Although trade magazines are replete with SOA related articles, empirical studies on SOA are next to none. This paper examines the SOA pilot implementation in an organization engaged in oil and gas -well drilling equipments and services. The aim is to understand their process and experience of SOA adoption. First, the extant literature is reviewed, followed by the research methodology. We then describe in detail the SOA implementation at the chosen organization. We conclude with a discussion of the effectiveness of the SOA implementation and a brief comparison with the methodology proposed by IBM (Walker, 2007).

LITERATURE REVIEW

Service Oriented Architecture or SOA was coined by Gartner in 1996 (Schulte and Natis, 1996). Very few companies have implemented SOA and therefore there is a dearth of empirical literature. The literature may be grouped into five streams.

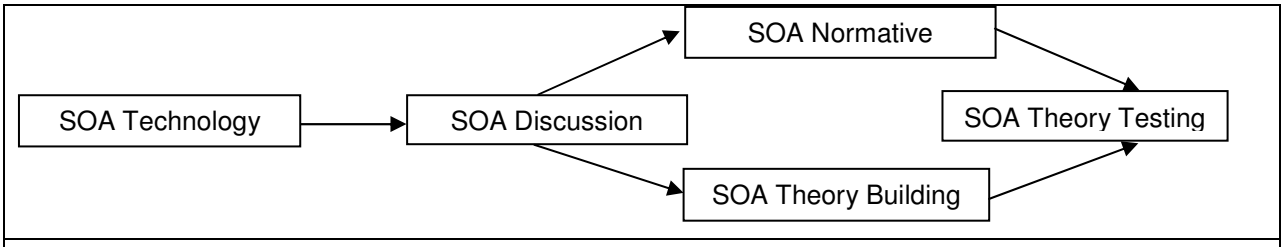

Figure 1: SOA research streams

The first research stream of *SOA Technology* deals with the technologies and frameworks that enable SOA deployment: technologies such as XML (eXtended Markup Language) and SOAP (Simple Object Access Protocol) and complex applications such as ERP. Some examples include exploring how to expose interactive functionalities of legacy systems as Services (Canfora, Fasolino, Frattolillo, and Tramontana, 2008), and presenting a service-description language and matchmaking algorithms for selection of services in SOA (Küster, König-Ries, Klein, and Stern, 2007).

The second stream of *SOA Discussion* address business related issues, such as a discussion on how SOA can revolutionize the banking industry (Bielski, 2007), and the management capabilities required for implementing SOA (Cox and Kreger, 2005). While *Normative* studies are primarily by practitioners, such as examining challenges to implementing SOA and ITSM spanning process, people, technology, and data, and examining implementation strategies (Keel, Orr, Hernandez, Patrocinio, and Bouchard, 2007).

Theory Building is the academic exercise to develop conceptual models for assessing and implementing SOA. Some examples are: developing a procedure for integration of enterprise systems by decomposition into Web services (Lämmer, Eggert, and Gronau, 2008); and exploring the potential of SOA in development of interoperable electronic health records in the health industry (Raghupathi and Kesh, 2007).

The last stream of *Theory testing* deals with empirical research. As SOA is a recent development, there are few research papers available in this stream. These papers are discussed at length as we believe the present research lies in the last stream. Only papers that address managerial issues related to SOA were considered. This leaves us with the two papers: Dietrich et al. (2007) and Walker (2007).

Dietrich et al. (2007) conduct a case study in the shoe industry to apply SOA to mass customization. SOA, with its dynamic integration and networking capabilities, was thought to be a natural compliment to mass customization to allow enterprises to react quickly to changes in the business environment. The study, although quite technical in nature, describes how the technical representation of value processes can be established by integrating all the elements of business networks in a loosely coupled manner. Thereby it presents a SOA-based approach for mass customization. Walker (2007) describes the SOA implementation approach at IBM. Some of the implementation aspects presented by Walker are similar to those presented in this paper. The highlights of their SOA implementation process are described below.

Walker first describes the internal IT environment at IBM followed by describing their SOA strategy. Once the strategy is created the organization is ready for implementation. He describes two simultaneous approaches to implementation: top-down and bottom-up. The top-down approach ensures the integration of business strategy and process with data, application, and infrastructure. The bottom-up approach was led by the IBM programmer eager to use the latest technologies even before they were introduced by the management, often forcing management to implement the technology. Strong partnerships developed within the implementation teams leading to quick and intelligent decision making.

Next, the existing internal enterprise architecture governance mechanism was used to drive key SOA directives and policies. They had three teams: business transformation executives (silo-oriented), process transformation executives (cross-silo), and CIO-led enterprise Invest Review Board. Furthermore, a SOA Center of Excellence is formed consisting of the CIO team for

SOA initiative, the SOA guidance council and the technical leadership team. The paper ends with lessons learned in implementing SOA at IBM.

Walker (2007) is an engineer at IBM who presents the case study in the IBM Systems Journal about how SOA was implemented at IBM. It is a practitioner paper aimed at marketing IBM's SOA services to the industries at large. While this paper explains the SOA implementation, most of the paper is dedicated to describing the benefits of SOA as it tries to promote SOA to its readers. Furthermore, IBM's employees as well as IBM's organization structure and policies are geared to adopt latest technologies. This may not represent a typical organization at large. Therefore the present paper is probably one of the first studies to explore SOA implementation in an organization.

PILOT CASE STUDY: METHODOLOGY AND BACKGROUND

Technology implementations usually start with a pilot implementation, especially for cutting edge technologies such as SOA. This is the stage for most of the change management problems to emerge as the organization grapples with the change. An understanding of this stage helps managers anticipate problems, shape strategies, and better handle change management issues for successful technology implementations. The SOA pilot implementation at one of the biggest oil industries in the world is examined. The next sub-section explains the procedure used in obtaining data for the pilot case study. This is followed by the company background, and pilot project overview sub-sections.

Research Methodology

A three stage research strategy is employed: first, the research design is outlined, then data collection and followed by data analysis. A case study methodology was used to conduct this research as it allows the research to ask 'How' and 'Why' questions that help explore issues along with their context (Yin, 2003). Such single case studies are recommended to provide a better understanding of the environmental complexity and an in-depth understanding of the issues (Galliers, 1992; Yin, 2003).

The validity of the case study was increased by employing multiple sources of data (Yin 2003). Data was collected using observations, interviews, and archival sources. One of the researchers was also actively involved in the SOA implementation project and consequently possesses firsthand knowledge of the project, the meetings, and the interactions between the constituencies involved. Interviews were conducted with the SOA project consultants and the company employees. Data was also collected from the archival sources like reports, minutes of the meetings, memos, websites, and newspaper articles. This information provided documented evidence on the project management issues while enhancing the analytical objectivity of this research. Further, the project management consulting organization proof read and released the case, thereby eliminating any factual errors or errors in our analysis.

Case background

OLM[1] Inc. is a multi-billion dollar company and one of the largest OEMs (Original Equipment Manufacturer) in the Oil industry. It provides drilling tools, materials, and services to oil companies worldwide. In the oil industry profitability of an individual company is closely tied to efficient operations. The industry is highly automated with average annual revenue per employee pegged at over $500,000. Therefore small organizations compete by producing specialty products, while large ones go for economies of scale in production.

Much of OLM's growth has come from acquisitions. It is a combination of many innovative companies that developed and introduced technology for the petroleum industry. This also means that OLM inherits a plethora of information systems from various time periods, developed on a variety of platforms. OLM faces the challenge of deriving benefits from economies of scale, while struggling to have a unified information system.

For example, OLM is searching for efficient and standard processes across services and regions for the procurement of raw materials, the manufacturing of drilling tools, and the delivery of its drilling services. It also faces a variety of supply chain problems, while coordinating with multiple constituencies -- suppliers, customers, and government. Further, OLM's major

[1] Real company name disguised for anonymity.

global competitor has gone for extensive process automation, challenging OLM to maintain its market leadership. To address the situation OLM charged their SOA initiative to transform their supply chain processes. Along with standardization and automation SOA could now reduce operational costs, improve operational efficiency, and increase service reliability worldwide. This paper examines the SOA initiative at OLM's business division in the US.

In their existing business process OLM gets a drilling service request from a customer. A quotation is created with multiple solution alternatives to optimally fulfill the customer request. Once the customer selects an alternative they give a purchase order and the order fulfillment process begins. Production orders are created for in-house manufacturing of tools. Purchase orders are created for procurement of raw and finished materials from suppliers. These goods are inspected and then entered into the ERP (Enterprise Resources Planning) system before they are issued to customers. A technician is assigned to deliver the service at the customer's oil-well. This process is summarized in Figure 2 below.

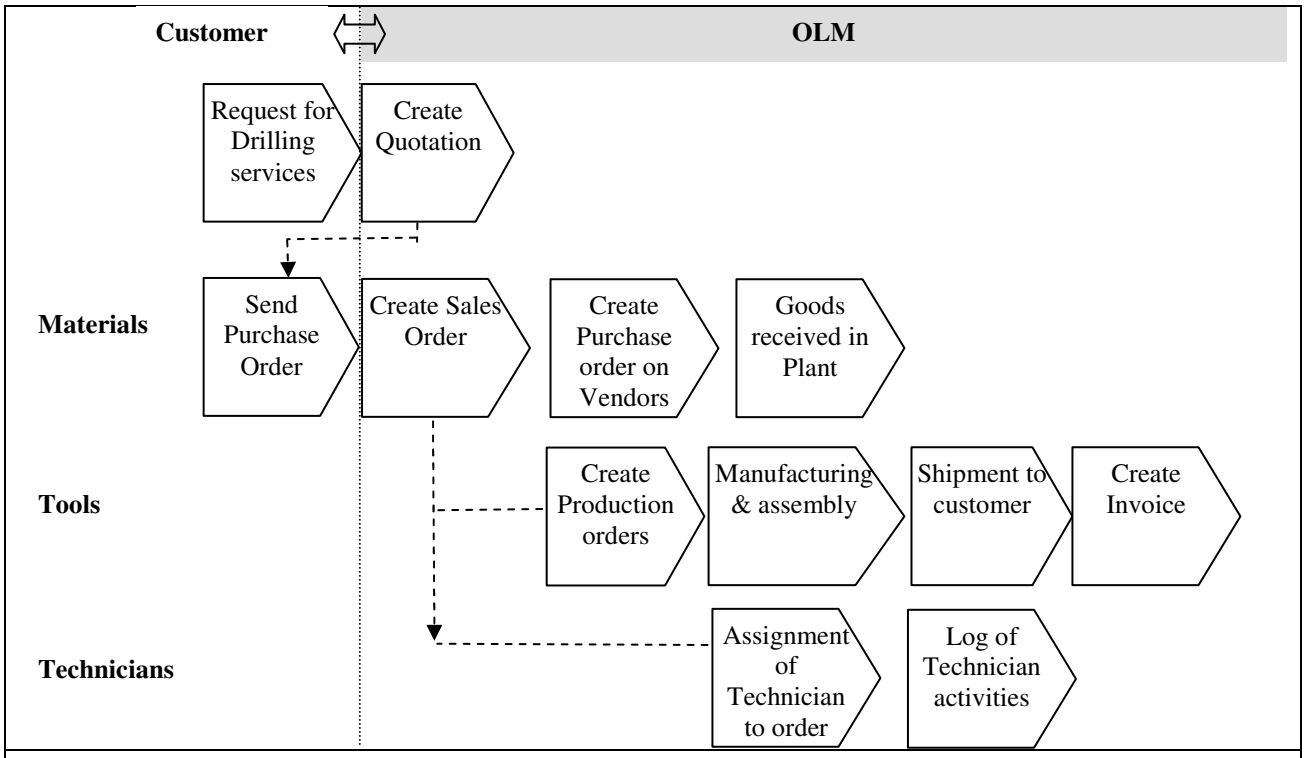

Figure 2: Key processes along the Supply chain

This process suffered from poor inventory turnover and long cycle for revenue collection of the services delivered. The process was not standard as it changed across services and regions. The business process required extensive collaboration amongst sales, engineering, manufacturing, and logistics departments. Each of these departments use different business applications based on different platforms, making it necessary to painstakingly orchestrate the business process across these applications. Further, the process artifacts need to comply with government regulation, leading to creation of various documents and drawings at different stages of the business process. These documents were required to be stored and referenced repeatedly during the whole process. The process owners had no visibility into the process completion status nor in the key business KPIs such as percentage utilization of personnel in value adding activity, percentage of time spent waiting, process cycle time, percentage of orders delayed, and the number of lost deals. Therefore OLM was unable to take corrective actions. The non-standard, distributed, and disconnected business processes were the root of these problems. In a bid to solve these problems OLM planned to use SOA by upgrading its SAP ERP environment to the latest mySAP 2005 as SOA is supported by mySAP 2005.

SOA ADOPTION PROJECT OVERVIEW

The SOA adoption project involved four external consultants and eight resources from OLM for the period of nine months. Resources from OLM represent all the application and integration technologies that exist in their IT landscape. The main part

of the project involved developing the SOA strategy and adoption roadmap along with blueprint for SOA COE (centre of excellence), evangelizing SOA through awareness and enablement sessions, understanding the technical feasibility through POCs (proof-of-concept), developing an overall governance process to drive the SOA adoption initiative, and identifying Pilot scenarios to understand business benefits for prioritizing SOA implementation. With the help of an SOA project consultant OLM went for a three stage adoption approach as depicted in Figure 3.

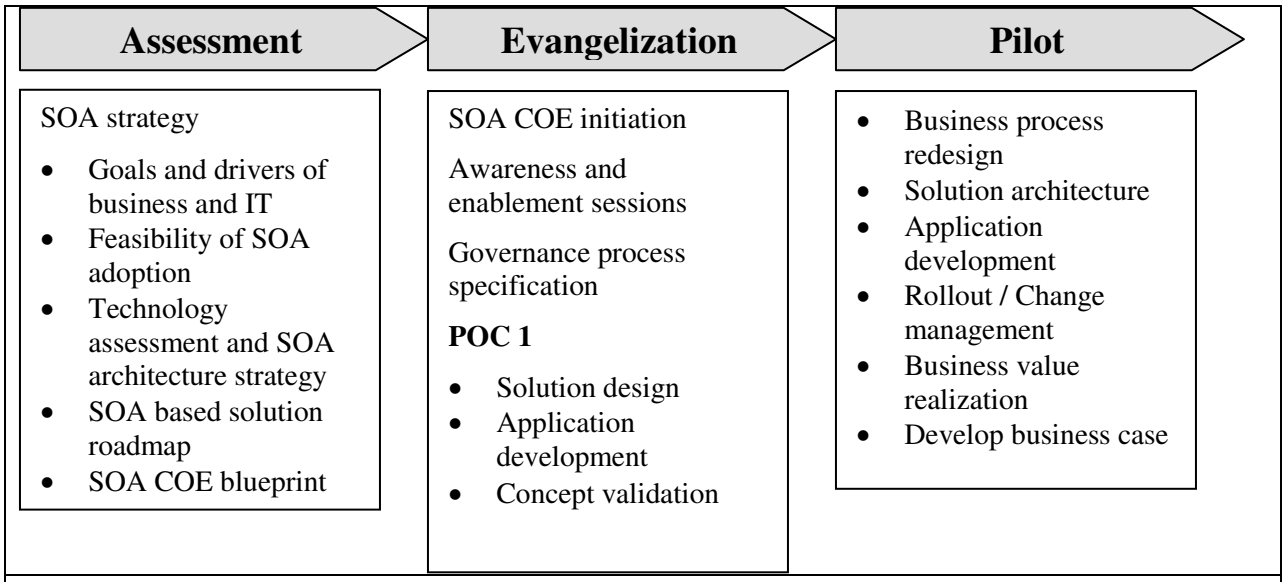

Figure 3: SOA adoption approach

Assessment

The first stage of assessment understands the SOA applicability and adoption. The assessment was a fine balance between standardization on the modern enterprise solutions provided by mySAP 2005 on one hand, and maximizing the reuse of existing IT investment on the other hand.

A business process driven approach was adopted to study the existing business processes and IT integration application landscape, as seen in Figure 2 and Figure 3. Business process assessment was carried out to identify the business pain points along the supply chain. Pain points such as, poor personnel productivity due to manual paper based process, lack of support for collaboration across users, and poor visibility and control across business process were documented as they were the process change drivers. Various performance indicators were identified to measure the effectiveness of existing business processes, such as cycle time per order fulfillment, percentage of time order is fulfilled from excess stock, percentage of order delayed, percentage of customer request rejected due to not able to find stocks, and personnel utilization in value added activities.

OLM's IT landscape revealed a heterogeneous system, an accumulation of different systems based on different platforms, such as the imaging system on main frame, the testing application - a desktop based legacy system in C++ on Windows 98, the workshop scheduling systems on main frame, and the SAP 4.6 on Windows server. Analysis of application integration landscape was carried out on following dimensions for each application-to-application integration:

- business scenario supported
- reuse factor
- technology used
- number of consumers
- profile of consumers
    - applications and their technology platform
    - users (external or internal)
    - mode of access (intranet or internet)
    - mission criticality
    - whether XML based

- routing requirements
- transformation requirements
- point to point integration
- synchronous or asynchronous communication
- type of business semantics begin supported
- can this interface be replaced by out of box enterprise services provided by mySAP

Accordingly, appropriate solution was sought through business process redesign and automation through SOA. The SOA strategy document consisted of: AS-IS scenario of application integration; answers to "why SOA," SOA strategy describing architecture layers, SOA adoption roadmap describing quarter wise activities for next 3 quarters, SOA COE blue print describing the governance structure, activities and roles and responsibilities of different players.

The key focus of SOA strategy document was to achieve inter-operability in heterogeneous application landscape having interfaces with 70% of legacy technology based, 15% on EAI based, 15% SAP proprietary based.

Simultaneously, the assessment phase was also characterized by efforts at securing a buy-in of the major stakeholders within IT groups as well as business divisions. Workshops were conducted as part of the SOA feasibility assessment. These workshops addressed the IT staff as well as the business division staff. There was substantial eagerness and excitement amongst the stakeholders as seen in workshops as a variety of questions were asked to understand SOA and the changes it would bring. OLM's IT architects and developers participating in the workshops wanted to know about SOA before they shared their IT practices, architecture and their pain points. They were often found discussing amongst themselves about how SOA was different from any other architecture initiatives. A common refrain was: "SOA talks about interoperability but can it really solve the web services interoperability issues between multiple technology platforms?"

On the other hand, in the workshops with business divisions, managers wanted to know if their business process customization requirement can be met quickly. They needed to get a look and feel of what it means to use SOA. A common refrain was: "the concept is great but let us see the working model [of SOA] for non-standard, disconnected business processes in a heterogeneous application environment of ours." Some were concerned about the amount of efforts required: "reuse will be possible only if we know enough about the existing functionalities and interfaces. Do we even know how much effort we need to put in to document AS-IS details? and will it be worth it?"

Mr. John Doe, OLM's manager was advised by project consultant to conduct awareness sessions on SAP Discovery system to make business executives and employees aware of SOA. The SAP Discovery system provides developers and enterprise architects a clear risk-free first step in experimenting with enterprise SOA. They can test-drive the simplicity and flexibility of composing new business processes using enterprise services in a standalone SOA environment. SAP Discovery is pre-configured to give immediate access to the latest software and tools from SAP as well as a comprehensive set of sample business scenarios.

This demonstration was important for the OLM manager, John Doe, as he had to build his internal team on SOA. The executives were agnostic about the technology as long as it delivered the results. John organized awareness sessions and weekly workshops to bring everybody on the same page to get the sign off on the SOA strategy document described before. These executives were owners of the supply chain processes in different business divisions. They were responsible for ensuring an efficient supply chain while meeting the customer requirements. Nine weeks after the project launch John Doe was able to get the sign-off on the SOA strategy document from all the key stakeholders.

Other important aspect covered in detail was the different layers of SOA. People in OLM carried multiple perspectives about SOA. A person engaged in EAI (Enterprise Application Integration) thought SOA was all about integration; the SAP application developer thought it is all about exposing modular application functionalities through standard interface for other non-SAP applications to consume; a business process worker thought it is all about orchestration of web services. Then there were questions on "what if" scenarios and discussions on security, monitoring, etc. Finally, SOA layer evolved to address the needs of all parties involved.

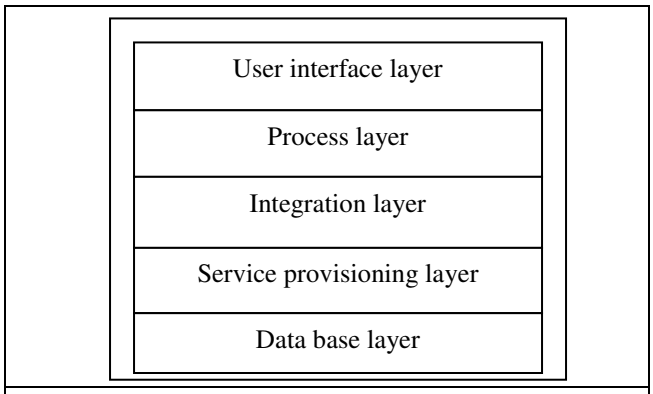

Figure 5 : SOA layers

Next, the roadmap to adopt the SOA within OLM enterprise was laid out as follows:

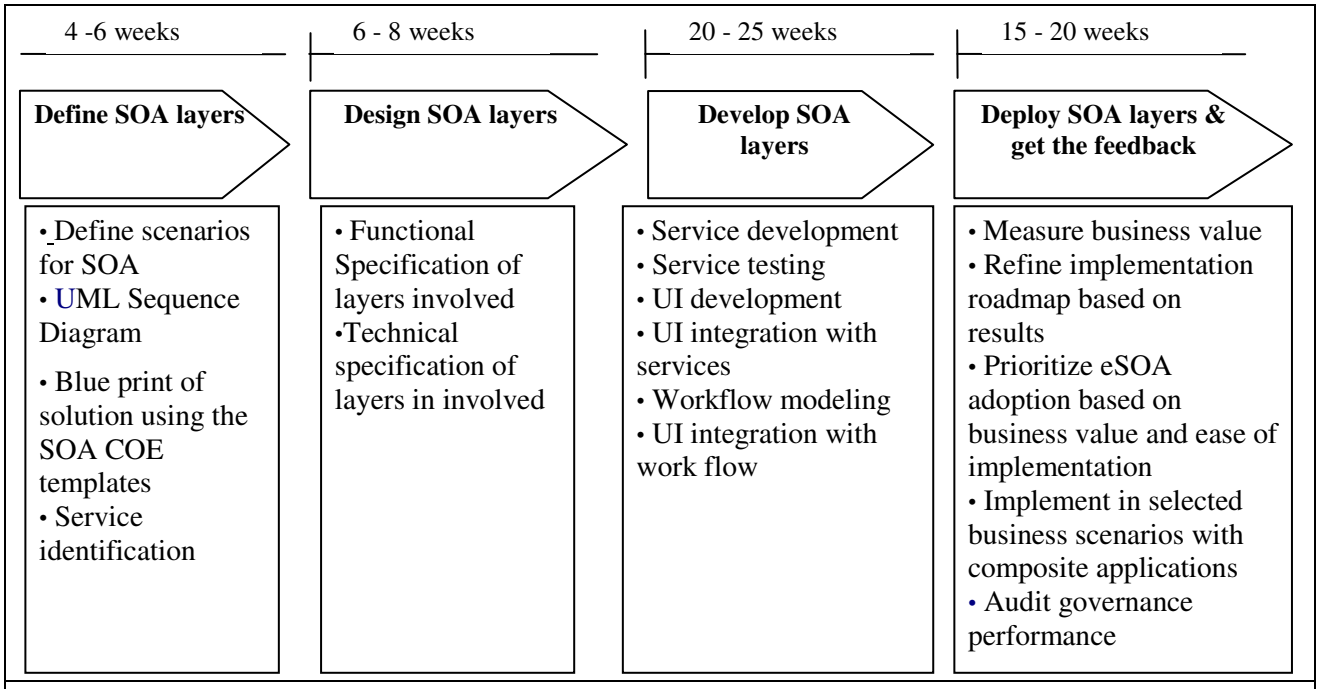

Figure 4: SOA solution roadmap

Evangelization

SOA strategy recommendations led to initiation of activities on multiple tracks:

- SOA COE (centre of excellence) initiation
- Awareness and enablement sessions
- Governance process specification
- POC (proof of concept)
- Identification of Pilot projects

SOA COE (centre of excellence) initiation

The COE's main responsibility was to evangelize and establish a SOA program within OLM's enterprise. The COE consisted of four members from the project consultant and eight from OLM with John Doe as the overall program manager. The key issue for COE was to address the project management requirements for SOA projects.

SOA has three layers: service consumption layer, service integration layer, and service provider layer. The COE came out with project processes and thirty-two new templates to address each of these layers. OLM IT division had its own process and templates for regular IT projects. They were concerned that SOA project specific processes and templates were creating a significant overhead. After a series of discussions the processes and templates were categorized as:

- processes and templates common to any project
- processes and templates for service consumption layer
- processes and templates for service provider layer
- processes and templates for service integration layer

The idea was to first analyze each SOA project to identify the layers involved for applicability of appropriate project processes and templates.

A technology primer

A technology primer is necessary before we discuss the awareness sessions. The key components of SOA are:

- Service provider, who provides service functionality in the form of web services that arepublished by the Service Broker
- Service broker, who maintains a registry of services, their interface descriptions, provider information and invocation methods
- Service consumer, who locates the required service, and all information for binding/invoking the service, from the Service Broker

The following diagram sketch depicts the interaction amongst key components of SOA.

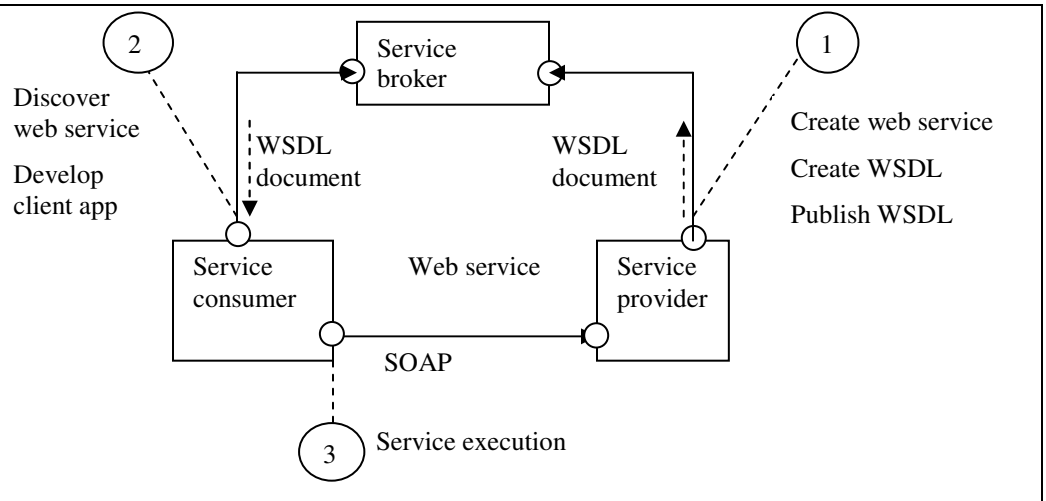

Figure 5: SOA in action

SOA is based on following key technology standards:

- **WSDL**: Web Services Description Language – is an XML document used to describe Web Services. It specifies the location of the service and the operations (or methods) the service exposes
- **SOAP**: Simple Object Access Protocol – a platform and language independent protocol used for communications between applications specifically web services.

- **UDDI**: Universal Description, Discovery and Integration is a directory service where businesses can register and search for Web Services.

Awareness and enablement sessions and Lab demo

SAP discovery server environment was used to demonstrate the SOA working. For such a demonstration the system was set up as follows: WSDL was used to model and describe some of the SOA web services. The first set of web services WSDL were created from SAP BAPI (Business Application Programming Interfaces) using WSI (web service infrastructure). BAPIs enable access to SAP functions with formal, stable and dialog-free interfaces. These interfaces can be used by any external applications. The WSDL were stored in the integration repository of the XI (eXchange Infrastructure) layer of Discovery server. The SAP XI is SAP's enterprise application integration (EAI) software that facilitates the exchange of information among company's internal systems and those of external parties. SAP XI is compatible with software products of other companies.

Finally, these services were consumed in the Web Dynpro based user interface created in Discovery server. Web Dynpro is the SAP programming model for user interfaces. It provides support when developing the Web representation of business applications. The Web Dynpro has the following features: clear separation of business logic and display logic, uniform metamodel for all types of user interfaces, execution on a number of client platforms, extensive platform independence of interfaces.

The business scenario of searching for customer was implemented. The URL of the user interface was published over the Internet so that users who neither have access to the Discovery server nor have discovery server installed on their machine can also use these user interfaces to search for customers. Study material was handed out describing SOA concepts, SAP Netweaver technology components and their working to enable SOA. The goal was to make OLM's stakeholders aware of SOA and its business benefits while removing some of the misconceptions. Representatives from each business division were also invited to lab demo and later provided with a kit explaining the why, what, and how of the SOA solution to help them plan their activities and set realistic expectations. This demonstration of the technology generated excitement and it scotched many rumors and doubts about the technology. It also helped to clearly communicate the objectives of the SOA adoption project and the future plan. The lab demo gave a big boost of confidence to the OLM's SOA team as well as the SOA project consultant team. Fortuitously, the lab demo also created an ambassador in OLM who took upon himself to champion the SOA initiative and spread the news about its benefits. Now that the lab demo was successful, preparations began in earnest for the POC (proof-of-concept) implementation. However, skeptics were still around and it was common to hear in workshops and meetings that "in these tight timelines of project delivery, we never thought about putting governance around controlling the new functionality development. How can we ask our business to wait for new functionalities and that it will only be done once SOA governance get established"

Governance process specification

The next step for the SOA COE was to define the roles, responsibilities and processes over the SOA project life cycle. SOA derives values only if the services are reusable and this will be ensured by proper SOA governance. The various SOA project life cycle stages that were defined were:

- Service conceptualization phase
- Service Design Phase
- Service Development Phase
- Service deployment and roll out phase
- Service Change-time Phase

The major roles to be defined as part of the SOA governance framework was divided into three groups:

- Owners – Consisting of Business Process Expert, SOA Strategy team member and an Enterprise Architect.
- Contributors – Consisting of Service Development team, Service policy owner and the Infrastructure team
- Consumers – Consisting of Business Process Analyst and Application team.

SOA COE was responsible for delivering the project processes with corresponding artifacts and its distribution across roles.

Towards POC implementation

The purpose of POC was multifold:

- To put the processes and templates created by SOA COE into action
- To demonstrate the working of different variants of SOA
- To evangelize the concept of SOA within the organization

Eight POCs were conducted representing four scenarios of Figure 6. The two axes in the figure represent the applications that are exposing themselves as services (Service provider), and the applications that are going to use or consume these services (Service consumer).

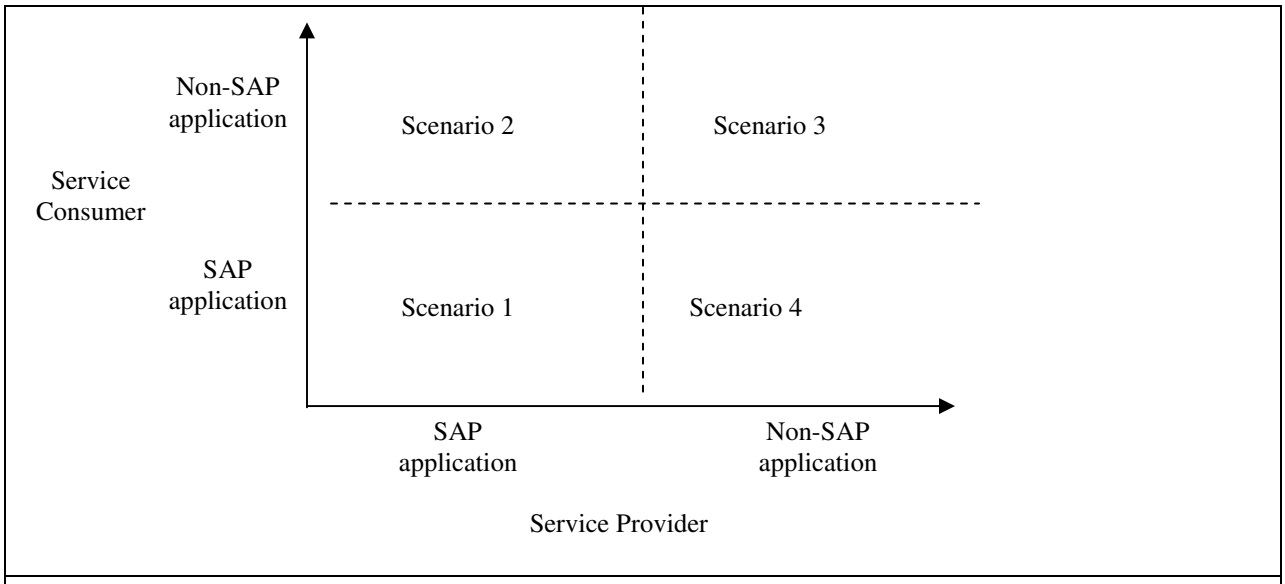

Figure 6: POC scenarios

All the templates and best practices that were created by COE were used to write the requirements, and functional and technical specifications for the POCs. This helped demonstrate the working of these artifacts in live projects. Need for workflow driven methodology was felt to ensure that project processes defined by COE are adhered to. To achieve this separate project was initiated to create a workflow around web services repository for adherence to project processes and templates. Simple business scenarios of inventory look up, saving of documents in non-SAP applications were used. These were able to demonstrate the technical aspects of service consumption through user interface alongwith application to application integration through web services. It also helped in establishing the benefits OLM can in terms of enhanced user interface and standard based integration. These POCs were also demonstrated to other business divisions and OLM IT group started receiving a lot of request for similar program for divisions.

The success of POC gave a big boost of confidence to the OLM's SOA team as well as the SOA project consultant team. Fortuitously, the POC also created an ambassador in OLM who took upon himself to champion the SOA initiative and spread the news about its benefits. Now that the POC was successful, preparations began for the pilot implementation. Earlier concerns about SOA acceptance and feasibility were now replaced by, "Will it not increase our license and support costs as we need to have so many technology components to address each layer of SOA?"

Pilot

After the completion of first two POCs dealing with scenario 2 and 4, the team felt confident to launch a pilot project. Pilot scenario was identified with the idea of "start small," supporting business transactions of Quote-to-delivery and covering breadth of SOA components.

The following benefits are visible at this early stage:

- Percentage utilization of personnel in value adding activity was 30%. Now improved to 70%.
- Percentage waiting time when the process is idle is dropped to zero
- Process cycle time is improved by 40%
- Percentage of order delayed is zero
- And the number of lost deals is zero
- Reduction in license and training cost due to application architecture consolidation to one technology platform

The pilot provided many other benefits such as: establishing the methodology for SOA implementation including a set of standard templates for discovery, design, implementation, and testing of SOA layers; establishing an engagement model to formalize infusing of SOA in all upcoming projects; getting agreement from all impacted stakeholders on metrics to measure effort and benefits.

The pilot results were mixed:

- It was successful in demonstrating the reuse of legacy applications to support new business scenarios. However the pilot size was not big enough for establishing a strong business case.
- The methodology was successfully established and also demonstrated through simulated pilot environment
- It was felt that more meetings and discussions were needed to agree on an engagement model that is integrated with OLM's IT project management methodology
- Discussion on metrics were postponed as parties involved were not ready to make any commitment till the engagement model got finalized

Nevertheless, with the pilot, SOA was established as a viable architecture strategy for OLM. It was also realized that with SOA, the non-technical issues consumed more time and efforts for resolution than the technical ones.

CONCLUSION

This paper described the SOA implementation in a manufacturing company in the oil industry sector. The SOA implementation had a few steps common with Walker (2007), but the complexities and the issues were quite different from the ones he encountered in IBM. Comparing with Walker's description of SOA at IBM, the employees at OLM were technology agnostic and were instead looking for business benefits. Many were skeptical of the new technology and/ or had misconceptions about SOA, requiring a lab demonstration using SAP Discovery. This secured their buy-in and cleared the path to SOA implementation.

In OLM, the SOA center of excellence was required to be a much smaller body in order to aid rapid decision making. Also, there were not enough SOA-savvy employees to create multiple SOA implementation teams. When the strategy was created it had to be revised with project realities such as the need for a lab demo. Only the top-down strategy worked, as the bottom-up strategy was not possible, as employees, line managers as well as IT managers, had to be educated in SOA. This resulted in project team partnerships that were not as cohesive and the SOA project consultants had to intervene to make the project work. Also, as the existing internal enterprise architecture governance mechanism was not adequate, a SOA governance structure had to be constructed.

Therefore the SOA pilot implementation was not as smooth as described by Walker (2007). However, the initial results indicate that SOA may well deliver on its promise of integration and process transformation leading to substantial business benefits in terms of increased process performance and decreased IT expenditure.

REFERENCES

1. Bielski, L. (2007) Project Runways. *American Bankers Association. ABA Banking Journal,* 99, 12, 44.
2. Blau, J. (2006) Airbus flies on Web services. *Network World,* 23, 24, 27.
3. Canfora, G., Fasolino, A. R., Frattolillo, G., and Tramontana, P. (2008) A wrapping approach for migrating legacy system interactive functionalities to Service Oriented Architectures. *The Journal of Systems and Software,* 81, 4, 463.
4. Cox, D. E. and Kreger, H. (2005) Management of the service-oriented-architecture life cycle. *IBM Systems Journal,* 44, 4, 709.

5. Dietrich, A. J., Kim, S., and Sugumaran, V. (2007) A Service-Oriented Architecture for Mass Customization-A Shoe Industry Case Study. *IEEE Transactions on Engineering Management,* 54, 1, 190.
6. Dignan, L. (2007) Gartner's top 10 technologies for 2008: SOA precursors; fabric computing; Real world Web; WOA, Accessed at: http://blogs.zdnet.com/BTL/?p=6560&tag=rbxccnbzd1, on February 2009.
7. Galliers, R. D. (1992) Choosing information systems research approaches, In R. D. Galliers (ed.), Information Systems Research: Issues, Methods and Practical Guidelines, Oxford: Blackwell Scientific,
8. Keel, A. J., Orr, M. A., Hernandez, R. R., Patrocinio, E. A., and Bouchard, J. (2007) From a technology-oriented to a service-oriented approach to IT management. *IBM Systems Journal,* 46, 3, 549.
9. Kim, J. W. and Lim, K. J. (2007) An approach to service-oriented architecture using web service and BPM in the telecom-OSS domain. *Internet Research,* 17, 1, 99.
10. Küster, U., König-Ries, B., Klein, M., and Stern, M. (2007) DIANE: A Matchmaking-Centered Framework for Automated Service Discovery, Composition, Binding, and Invocation on the Web. *International Journal of Electronic Commerce,* 12, 2, 41.
11. Ladner, R., Petry, F., and McCreedy, F. (2008) E-Government Capabilities for 21st Century Security and Defense. *International Journal of Electronic Government Research,* 4, 1, 1.
12. Lämmer, A., Eggert, S., and Gronau, N. (2008) A Procedure Model for a SOA-Based Integration of Enterprise Systems. *International Journal of Enterprise Information Systems,* 4, 2, 1.
13. Lindquist, D., Madduri, H., Paul, C. J., and Rajaraman, B. (2007) IBM Service Management architecture. *IBM Systems Journal,* 46, 3, 423.
14. Oh, S.-C., Lee, D., and Kumara, S. R. T. (2007) Web Service Planner (WSPR): An Effective and Scalable Web Service Composition Algorithm. *International Journal of Web Services Research,* 4, 1, 1.
15. Raghupathi, W. and Kesh, S. (2007) Interoperable Electronic Health Records Design: Towards a Service-Oriented Architecture. *E - Service Journal,* 5, 3, 39.
16. Rettig, C. (2007) The Trouble With Enterprise Software. *MIT Sloan Management Review,* 49, 1, 21.
17. Schulte, R. W. and Natis, Y. V. (1996) "Service Oriented" Architectures, Part 1, Accessed at: http://www.gartner.com/DisplayDocument?doc_cd=114358 on May 2008.
18. Tangen, J. (2005) Starwood Hotels Named InfoWorld 100 Finalist for Implementation of Actional SOA Management Platform; World-Wide Hotelier Recognized for Ground-Breaking SOA Migration. *Business Wire,* 1.
19. Vertex, B. (2006) How tax departments can profit from new computer architecture. *International Tax Review,* 1.
20. Walker, L. (2007) IBM business transformation enabled by service-oriented architecture. *IBM Systems Journal,* 46, 4, 651.
21. Yin, R. (2003) Case Study Research: Design and Methods, Sage Publications,