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Integration of Service Oriented Architecture into Enterprise Applications: A Process Approach

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Abstract

Organizations not only use Information Technology-IT to manage their internal operations but also to collaborate with their customers and suppliers. For this, organizations use Enterprise Applications (EA). Enterprise Application Software is used to satisfy the needs of an organization rather than individual users. Service Oriented Architecture (SOA) is essentially a collection of services. These services communicate with each other. SOA as an architectural framework addresses the issues of EA like security, performance and reliability. Adopting a process approach for SOA integration into EA implies that an organisation can manage their businesses as a set of processes.

Key words; Service Oriented Architecture, Enterprise Applications, Process Approach

I. INTRODUCTION

Lately, organizations are utilizing Information Technology (IT) to realize competitive advantage in their businesses. Organizations not only use IT to manage their internal operations but also to collaborate with their customers and suppliers. For this, organizations use enterprise applications. Enterprise Application Software is used to satisfy the needs of an organization rather than individual users. Such organizations include businesses, schools, interest-based user groups, clubs, charities, and governments. Services provided by enterprise software are typically business-oriented tools, such as online shopping, and online payment processing, interactive product catalogue, automated billing systems, security, Business Process Management, enterprise content management, IT Service Management, customer relationship management, enterprise resource planning, business intelligence, project management, collaboration, human resource management, manufacturing, occupational health and safety, enterprise application integration, and enterprise forms automation. Organizations expect IT to address the shifting needs in the

demand environment. Currently, IT faces the challenge of integrating various systems into functions that can address organization on-demand needs and span over the organizational boundaries. SOA is essentially a collection of services. These services communicate with each other. SOA as an architectural framework addresses the issues of EA like security, performance and reliability. These issues are addressed by following a standard procedure when applying SOA. One of these standard procedures is a process approach. A process approach means that an organisation manages their businesses as a set of processes. The process approach is a management strategy. A process is a set of activities that are interrelated or that interact with one another. Processes use resources to transform inputs into outputs. They are interconnected because the output from one process often becomes the input for another process. When managers use a process approach, it means that they manage and control the processes that make up their organizations, the interactions between these processes and the inputs and outputs that tie these processes together. It also means that they manage these process interactions as a system.

II. LITERATURE REVIEW

A. *Introduction of Service-Oriented Architecture Adoption*

This study was focused on SOA adoption and performance, the factors that affect SOA adoption in an organization and the impact of SOA adoption on the performance of EA [1].

The researcher focused only on organizations which have already adopted SOA. Data was collected from skilled experts in SOA all over the world using online questionnaire. The overview of this paper does not address Non-SOA organisation related to existing enterprise application, it only addresses the impact and adoption of SOA organisation. However, there is a need to look at how non-SOA enterprise application can be integrated into SOA.

B. *The Collaboration of DevOps Automation and SOA to Accelerate Software Development Culture*

This study looked at the design analysis of software development, by collaboration with DevOps and SOA in the process of developing and implementing software as the foundation of software development culture. Design analysis is the creation of a software development culture that can minimize miscommunication between software developers and system users to accelerate the software development process.[2] The researcher focused on the collaboration between DevOps and SOA and did not fully address the integration of existing applications to SOA applications.

C. *Integration of Applications Based on SOA in Government Institutions*

This study looked at Analysis of existing hardware and software systems to propose a platform based on SOA which supported web services. After a final analysis of the select web services, the researchers recommended an integrated platform that enabled government institutions to 'talk' to each other. Web services based on this integration would cater for quantitative and qualitative services, which in turn would decrease the cost of the services

provided in a traditional way from the government institutions. Hardware and software platforms independence offer huge advantages for others systems which would be a part of this integrated and interconnect platform [3]. The researcher focused on how different systems from different government institutions communicated by first analysing existing hardware and software. The issue of structuring existing systems to SOA was not addressed in this research. SOA is the next generation software architecture and there is need for it to be added to non-SOA EA to reduce costs, cycle times and facilitate easy integration across the enterprise applications.

D. *Enterprise Application Integration (Middleware): Integrating Stovepipe Applications Using SOA through TIBCO Technology*

This study looked at Remote data integration, which is the fundamental for inter-organizational integration that helps to exchange data, to unify software components, and to streamline business processes. Also, research on enterprise integration where a model for integration among three different organizations was proposed using TIBCO technology [4]. TIBCO tech provides integration, analytics and event-processing software for companies to use on-premises or as part of cloud computing environments.

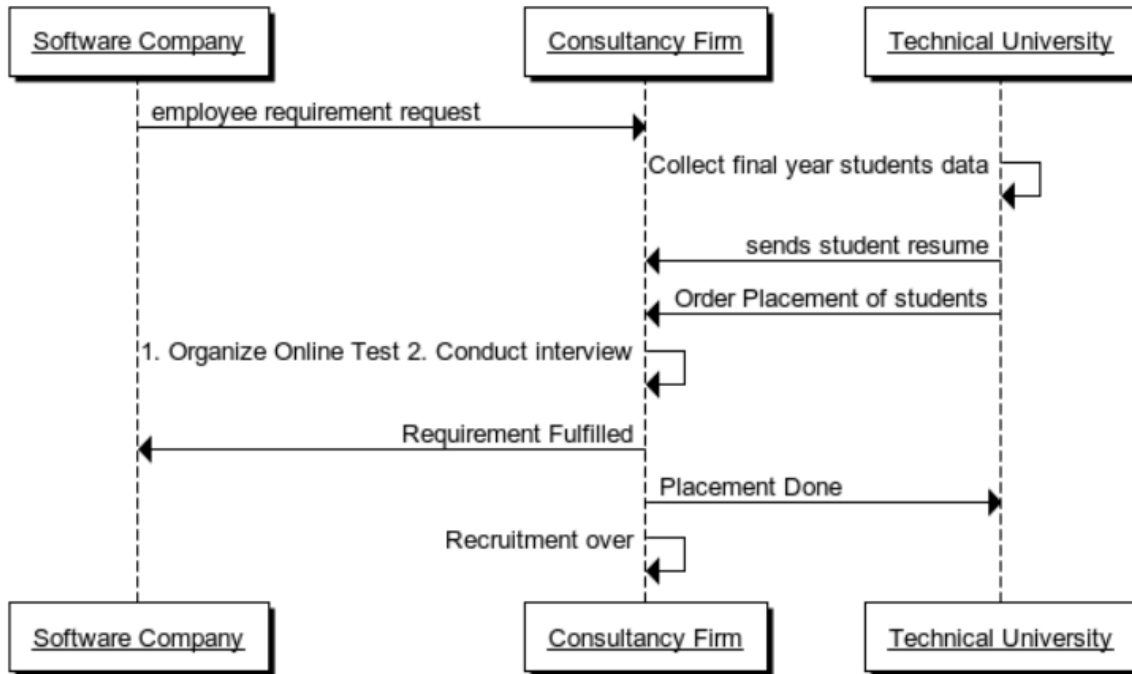


Fig 1: TIBCO

The researcher focused on data remote integration across different applications. The issue of structuring existing systems to SOA was not addressed in this research, SOA is the next generation software architecture and its integration to non-SOA is relevant so as to reduce costs, cycle times, and easy integration across the enterprise applications.

E. *Service Oriented Architecture in Enterprise Application*

This study looked at SOA in Enterprise Applications, the main problems faced by the evolution of enterprise applications into SOA [5]. The research focused on Service Oriented Architecture, Enterprise Application, Business processes, and integration but did not address the impact of the process approach when integrating SOA into non-SOA EA.

III. THE PROCESS APPROACH

This section of the paper looks at the practice of Integration of SOA to Enterprise Applications using a process approach.

A. *Methodology*

A process is a set of activities that are interrelated or that interact with one another. Processes use resources to transform inputs into outputs. They are interconnected because the output from one process often becomes the input for another process.

1. *Non-SOA EA*

In this process non-SOA EA are identified in an organisation. Non-SOA applications don't support services to communicate with each other across different platforms. In this process a non-SOA application is identified and also existing architecture is analysed. The focus is on the business value of the EA and its visibility

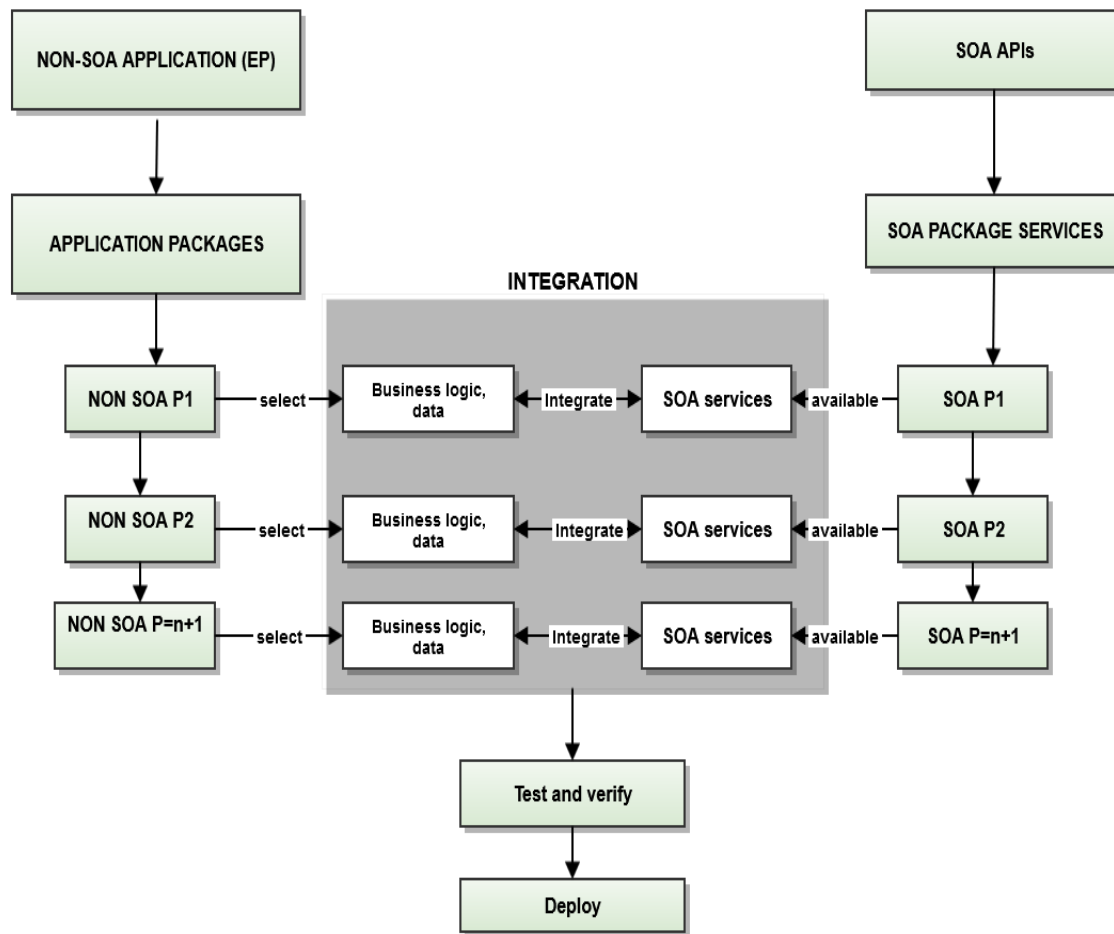


Fig 2; The Process Approach

2. Application Packages

All packages existing in an EA are identified and listed down for recurring execution. An Application package is a logical container for coordinated objects related to a particular task, with optional programming logic. Application packages provide a simple runtime data connection model (one connection per Application package) and a context for defining and executing transactions.

3. Non-SOA Package

In this process a package is selected, business logic and data to be merged to SOA available service are identified then package business logic and data

from non-SOA is merged to SOA available services with help of referencing its functionalities from existing architecture. After fully integrated then another package is picked previous processes are repeated up to $P=n+1$ where n represents number of packages

4. Integration

This process shows how non-SOA EA business logic and data are merged to available SOA services. The process modelling for SOA has to be done in detail. It is important that we model the process in detail so that we identify individual activities that are atomic from the perspective of execution. Then we automate the EA without major modifications. In SOA, this requires

mapping the Business Process Model and Notation-BPMN model into the executable representation in the Business Process Execution Language-BPEL, and connecting the BPEL process with partner links, that is, with services. In other words, it is required that we relate process activities to the various services. This is ideal when existing services that are re-usable and match SOA characteristics are known.

5. *Test and verify*

This process shows checkpoints in the overall process to determine whether objectives are being met, and also testing tells what level of knowledge or skill has been acquired. All processes finished are verified to confirm whether are accomplished very well.

6. *Deployment*

This process shows all the process required for preparing a merged SOA application to run and operate in a specific environment. It involves installation, configuration, testing and making changes to optimize the performance of the application.

IV. ANALYSIS

A. *State of the Art*

In today's enterprise application arena, SOA is the most powerful and popular topic due to its agility and reaction to an upcoming demand in enterprises that are more efficient and quicker. Enterprise applications are big business and highly complex applications which need to satisfy hundreds or thousands of separate requirements. Also, enterprise applications need to adapt to the changes driven by SOA very fast.

When we talk about implementing business processes the terms Business Process Management (BPM) and SOA are often used. In a process centric approach to SOA the business process is translated into a service orchestration (mostly in Business Process Execution Language-BPEL) and executed with a business process engine (BPEL engine). This service orchestration calls services which need to be provided by IT applications [6].

The success of the SOA development cycle relies on correct process modeling. Only when processes are modeled in detail can we develop end-to-end support that will work. Exceptional process flows also have to be considered. This can be a difficult task, one that is beyond the scope of the IT department (particularly when viewed from the traditional perspective) [6].

To make process-centric SOA projects successful some organizational changes are required. Business users with a good understanding of the process must be motivated to actively participate in the process modeling. Their active participation must not be taken for granted, lest they find other work "more useful," particularly if they do not see the added value of process modeling. Therefore, a concise explanation why process modeling makes sense can be a very valuable time investment.

B. *Desired prospect*

Enterprise Applications need to become more flexible in order to adapt to the fast-changing business environments of today's enterprises because it is questionable whether enterprises can actually maintain a focused strategy long enough to align their core business processes with IT.

C. *Gap*

The process approach is not flexible enough. You need to know each possible path in your process at design time. In reality however, in lots of situations the process flow is only determined during the execution itself. The use of a central process engine maintaining the process payload can lead to synchronization issues between the process state and the applications. For example, due to errors during service calls. This way of executing / automating business processes is mainly based on representing a business process with a service orchestration. This is trivial and it ignores the nature of business processes: transforming resources. Closely related to the previous point, a process approach doesn't automatically lead to the right services, business objects, and messages. It is not impossible to define the right IT architecture when using process engines, it's just an easy pitfall

to just focus on the process and define services for it, instead of looking at these concepts from a Systems point of view [7].

D. Way forward

An alternative for the process approach to SOA is what one can call, the information approach to SOA. This approach attempts to solve some of the problems of the process centric approach. Instead of supporting business processes by defining service orchestrations as fixed flows, the information centric approach supports business processes by defining activities with pre and post conditions.

Simply said, each activity in a business process is represented by an implementation of that activity and a pre and post condition for this implementation.

V. INDICATIVE RESULTS AND ANALYSIS

A. Results

The table below shows the results of process approach integration of SOA into Enterprise Applications

Requirement	Integration services	Enterprise services
Design	Expose existing application functionality and data	Provide services aligned with Enterprise Business Model
Semantics and Data	Based on operational data models, required significant transformation services	Based on enterprise semantic model. Some aggregation, minimal transformation
Invocation	<ul style="list-style-type: none"> • Event driven, or invoked by other services: • Synchronous request/reply, events, fire-and-forget 	Invoke by a business process Asynchronous request/reply or fire-and-forget
Development	Requires specialized adapters for connection to legacy systems	New development using Enterprise Service Bus Application Program Interfaces directly
Important features	<ul style="list-style-type: none"> • Synchronous request/reply, • events, publish and subscribe • Integration • Message Processing • QoS • Security and Management 	<ul style="list-style-type: none"> • Asynchronous request/reply • Service Interaction • Process Orchestration • SLA • Security and Management

Table 1: Indicative Results

B. Analysis

SOA is method of design, development and management of both application and the Software infrastructure where: all software is organized into business services that are network accessible and executable, service interface are based on public standards for interoperability. SOA is an architectural approach that allows distributed deployment by expose enterprise data and business logic as loosely coupled, discoverable, structured, standards-based, coarse-grained, stateless units of functionality called services. Furthermore allows reusability by choose a services provider and access to existing resources exposed as services. By allowing reusing the existing applications Service-Oriented Architecture enables enterprise to influence existing investments. Another importance is composability by allowing assemble new processes from existing services that are exposed at a desired granularity through well defined, published and standards complaint interface. Also provide interoperability by share capabilities and reuse shared services across a network irrespective of underlying protocols or implementation technology.

Key characteristic of SOA: quality of service -response time, security and performance, service is cataloged and discoverable, data are cataloged and discoverable, protocols use only industry standards

Tools include;

- Support service construction
- Incorporate architectural concepts
- Implement Service composition
- Provide platform independence of business logic

By introducing SOA infrastructure into EA, a clear distinction of EA packages is created and these packages are transformed into well-defined services. According to SOA infrastructure, these services will be able to communicate with each other. In SOA, a service is a function that is well-defined, self-contained, and does not depend on the context or state of other services. Services use service contracts to express their purpose and their capabilities.

The clear definition of the enterprise services encourages loose coupling where services make use of little or no knowledge of the definitions of other separate services. Loose coupling also helps

to build an abstraction layer between the service producers and service consumers i.e. changes to the aspect by service providers in the interaction don't require corresponding changes by the service consumers.

Enterprise Applications through SOA can be remodeled into composite entities and reusable business services or components. Re-use makes processes more consistent because they depend on the same reused components and at the same time reduces the cost of integration because the re-usable service or component has already been integrated. Reuse also helps to eliminate duplicate processes.

Integration of SOA into EA changes software-deployment activities to a more dynamic, less-time-consuming model, which is more appropriate to the business and makes SOA solutions available to all sizes of organizations.

A service registry is one of the main building blocks of SOA. Service registries are highly scalable; they evolve seamlessly when systems grow. They also support the visibility of available services.

Visibility allows speedier development, greater application reuse, improved governance, and better business planning and management. It also reduces the time spent in looking for available services.

[7, 8 ,9]

VI. CONCLUSION

Introducing SOA infrastructure into EA, imparts a clear distinction of EA packages and these packages are transformed into well-defined services. According to SOA infrastructure, these services will be able to communicate with each other. The success of the SOA development cycle relies on correct process modeling. Only when processes are modeled in detail can we develop end-to-end support that will work. Exceptional process flows also have to be considered. To make process-centric SOA projects successful some organizational changes are required.

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