Service Based Architecture for Manufacturing Sector

S. Nirmala Sugirtha Rajini [1], Dr. T. Bhuvaneswari [2],

[1] Research Scholar,Dr.M.G.R. Educational and Research Institute, Chennai., India

[2] Dr.M.G.R. Educational and Research Institute, Chennai, India

Abstract

SOA has been widely and quickly adopted in different organizations during recent years. SOA enables to solve integration complexity problem and facilitates broad-scale interoperability and unlimited collaboration across the organization. In this paper we demonstrate how Service Oriented Architecture (SOA) is important in Business Organizations based on a proposed architecture diagram and also, a case study is presented with the discussion about proposed SOA architecture in a manufacturing sector.

Keywords

Presentation Layer, Business Process Layer, Data Layer, Integration Layer, Enterprise Service Bus, Business Process Management (BPM)

1. Introduction

Service Oriented Architecture (SOA) is generally defined as a business architectural approach that supports integrating businesses as linked, repeatable business tasks or services [1]. It mainly aims to build a platform-and-language-independent technical layer based on various platforms. Business process management (BPM) is a systematic approach in improving an organization's business processes. BPM activities seek to make business processes more effective, more efficient, and more capable of adapting to an ever-changing environment. Today's important challenge in business is in integrating and interfacing new solutions with legacy applications. These applications use different technologies and platforms, and tight couplings exist between the BPM layers. Managing tight couplings and integrations under the environment, constantly changes the business processes. Due to tight coupling the organizations are affected with operational costs, increased time to restore services, and loss of business. Service orientation aims at loosely coupled services to support the requirements of business processes and users.

2. Proposed Architecture

The layered architecture depicted below aims at solving the communication problem between business processes, business services and technology. The architecture uses a separate services layer as an intermediate between business drivers and technical implementation. The architecture shows how corporate missions and strategies can be mapped onto business and supporting services.

The proposed architecture has divided into five layers which in turn improves the efficiency of an organization. The following architecture shows the relationship between the Business processes in an organization and Service Oriented Architecture.

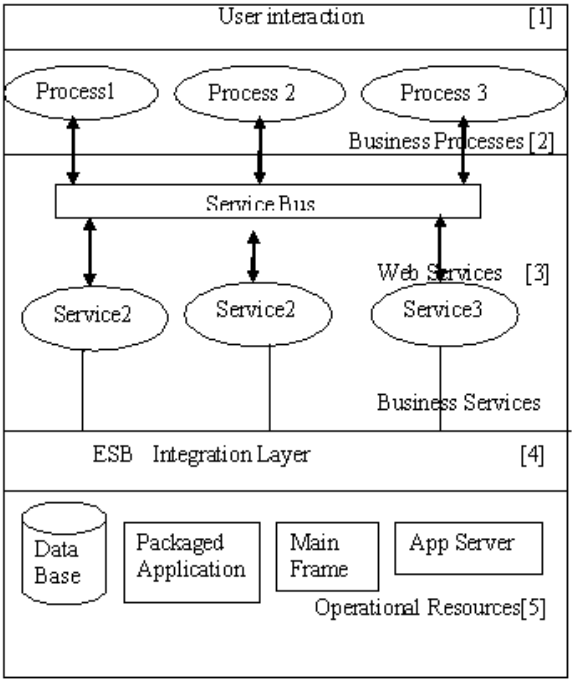

Figure 1 : SOA in Business

[1] Presentation Layer
[2] Business Process Layer
[3] Business Service Layer
[4] Integration Layer
[5] Data Layer

2.1 Presentation Layer

The presentation layer refers to the business offerings, defined in terms of products and services produced by business suppliers. The aim of this layer is to satisfy customers and resolve their problems, usually through the composition of complementary standalone products and services from one or different business

suppliers [4]**.** The communication layer is mainly composed of the Web browser, which acts as cross-platform. In addition, to that it also express layer protocol decoding and encoding picture and file format information [3]. Presentation layer are realized through JSP (Java Server Pages)/Applet/Java GUI/HTML [5].

2.2 Business Process Layer

The Business Process Layer refers to the business processes that are performed for the production of products and services. This level is dominated by the "business process logic" for the analysis of processes into activities and tasks [4].The functions of the business process layer are realized through the action in Servlet/JSP/Struts [5].

2.3 Business Service Layer

The service layer connects the integration layer and business process layer with the presentation layer. This layer provides the required components for invoking different resources [5]. The Business Service Layer contains the services that join together business and application functionality and allows for the flexible combination of application operations for the development and execution of business processes. This level is described by the service-orientation principles for the design, advertising, invocation, composition and execution of services [4]. The service is mainly responsible for dealing with the enterprise business logics. This layer deals mainly with application services and component services. The application services and the component services realize the main logic functions of the organization [3]. The functions of the service layer are realized through Java Beans/Session Bean [3].

2.4 Integration Layer

This layer enables the integration of services through the introduction of reliable and intelligent routing, protocol mediation, and other transformation mechanisms, often described as the enterprise service bus. An Enterprise Service Bus (ESB) is a standard-based integration platform that combines messaging, web services, data transformation, and intelligent routing in a highly distributed, Service Oriented Architecture (SOA). An ESB provides a messaging infrastructure along with basic transformations and routing. It combines message queuing and protocols such as Simple Object Access Protocol (SOAP), Web Services standards, Web Services routing, and provides for extensions. An ESB mainly uses open standards like Web Services to enable applications to communicate. Therefore an ESB acts as a SOA backbone for the organization [7].

This layer introduces special challenges in security and between heterogeneous platforms or operating systems [7]. It interacts with multiple layers providing ancillary services. The components consist of directories, a catalog, and security and monitoring services. The monitoring services support management tasks at all levels of the architecture stack. In addition, multi-layer monitoring allows system components to respond to changing environmental conditions. Various technologies such as the Globus Grid Security Infrastructure (GSI), firewalls and access control lists are used appropriately to enable a secure distributed computing environment [7]. It ensures quality of service through sense-and responds mechanisms and tools that monitor the health of SOA applications, including the all-important standards implementations of Web service Management.

2.5 Data Layer

The data layer illustrates applications, packages and databases that might be called upon by the various components and it includes all of the physical resources for computing, storage, and network connectivity distributed over the Internet. The data layer exchange messages via a peer-to-peer network [5]. This layer understands and maintains the underlying data to location, structure, format, synchronous mode and cross-reference relationship. It uses this information as a basis to provide data integration services, and reliable data to read and update, improve productivity and reduce the business service costs and complexity of creation and maintenance, in order to achieve SOA [3]. The functions of the data layer are realized through Entity Bean/JDO/ Hibernate/JDBC.

3. SOA in manufacturing sector

A service oriented architecture with functional layers in manufacturing sector is depicted in figure 2. The bottom layer consists of the existing or legacy applications that provide the foundation for how the business data is used. In an SOA, the integration layer is combined with an MSB (Manufacturing service bus). MSB is required due to high tractions; high parametric data load and near real time requirements for operations applications. The business services layer is an abstraction layer of services. These services are represented using WSDL (Web Service Description Language). The business process layer consists of business processes that are created by combining the services into the business services layer together to create composite applications. The last layer consists of data aggregation and visualization.

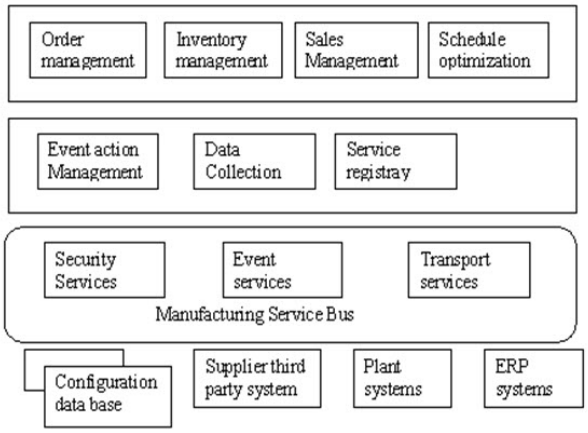

Fig 2. SOA in Manufacturing Sector

4. Case Study for manufacturing Sector

In a more efficient scenario, common tasks would be shared across all processes. This can be implemented by decoupling the functionality from each process or application and building a standalone authentication and user management application that can be accessed as a service. Within one organization, three separate business processes use the same functionality, each encapsulating it within an application.

In such a scenario, the service itself can be repurposed across multiple processes and applications and the company owning it, alone has to maintain the functionality in one central place. This would be a simple example of Service Oriented Architecture in manufacturing sector. The resultant IT infrastructure would resemble Figure 3.

In this scenario, the login function and the ability to change the user name are common tasks implemented redundantly in all three processes. In this environment users might have to remember multiple login username/password tokens and manage changes to their profiles in three separate areas. Additionally, if a manager wanted to deny a user access to all three processes, it is likely that three different procedures would be required.

The shared user account tasks have been separated from each process and implemented in a way that enables other processes to call them as a service. This allows the shared functions to be repurposed across all three processes. The common service bus is really a virtual environment whereby services are made available to all potential consumers. Also it reduces total number of network connections since it provides a layer to reduce the network traffic between each service. Each time a service or channel is added, it could get connected for accessing all the information through the SOA bus. This helps in improving flexibility, lower labor time and costs, reduce risk, and optimize the value of each customer.

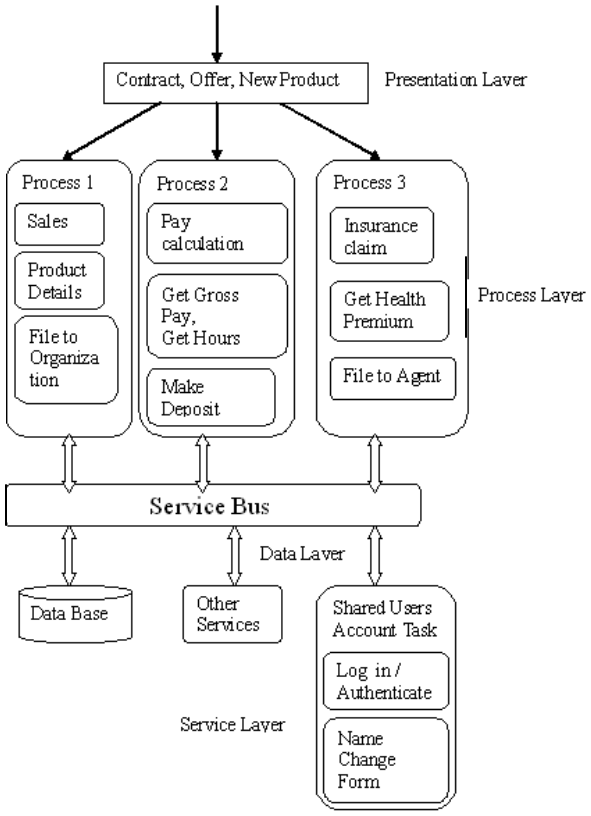

Figure 3 : Implementation of SOA in Manufacturing sector

5. Conclusion

SOA provides flexibility and agility to address changing business requirements in lower cost and time to market via reuse [1]. BPM is a backbone for SOA-based services of an organization. BPM and SOA combination can be leveraged to design and implement truly end-to-end automated solutions, built by using existing functionalities, resulting into huge costs savings and decreased time to market. Businesses can fully exploit the combined capabilities of BPM and SOA to quickly scale the solutions to higher transaction demands. In future one more layer could be added for using reusable components and to implement the proposed architecture in other organizations also.

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