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Evolution of Modelling Techniques for Service Oriented Architecture

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ABSTRACT
Service-oriented architecture (SOA) is a software design and architecture design pattern based on independent pieces of software providing functionality as services to other applications. The benefit of SOA in the IT infrastructure is to allow parallel use and data exchange between programs which are services to the enterprise. Unified Modelling Language (UML) is a standardized general-purpose modelling language in the field of software engineering. The UML includes a set of graphic notation techniques to create visual models of object-oriented software systems. We want to make UML available for SOA as well. SoaML (Service oriented architecture Modelling Language) is an open source specification project from the Object Management Group (OMG), describing a UML profile and meta-model for the modelling and design of services within a service-oriented architecture. BPMN was also extended for SOA but there were few pitfalls. There is a need of a modelling framework which dedicated to SOA. Michael Bell authored a framework called Service Oriented Modelling Framework (SOMF) which is dedicated for SOA.

Keywords **-** BPMN, Service Oriented Architecture, Service Oriented Modelling Framework, SoaML, UML.

I. INTRODUCTION

Service-oriented architecture (SOA) is an extension of distributed computing based on the request- reply design of the system [1]. The business logic and functions of applications are modularized and presented as services to the consumers. SOA is the current trend in the IT industry.

Usually a software designed by UML. We can use UML for Service oriented Modelling(SOM) but it has some restrictions. We need to profile UML in order to use it for SOA. Even BPMN and SoaML were used for modelling but each has some drawbacks and efficiency in terms of designing. There is a need of modelling method which can be exclusively used for SOA. It will make easy the designing process by the analysts and also the consumers or clients can understand it in a better way. Service Oriented Modelling Framework (SOMF) is already authored by Michael Bell. We can use this Framework to develop a Tool dedicated for modelling SOA.

Research is available for SOA and attempts in order to make a complete independent modeling language for SOA. UML, BPMN, SoaML are few modelling paradigm which were used to model different scenarios for SOA.

There is no independent framework available only for SOA. In this review paper, first we will see the overall background of SOA and software design.

Later we will focus on different ways we can model the architecture of SOA. The evolution from UML to SOMF will be explained and different pitfalls of attempts made for it.

II. BACKGROUND OVERVIEW

2.1 Software Engineering

Software Engineering is the application of a systematic, disciplined, quantifiable approach to the design, development, operation, and maintenance of software, and the study of these approaches; that is, the application of engineering to software.[2]

Software process is defined as set of activities that leads to production of a software product. The software are custom built according to the need of customer. Now a days, Computer Aided Software Engineering Tools are available to ease the design of the software. There is no ideal approach for the development of the software. Some fundamental activities in software engineering consists of Requirement gathering, System analysis, Design, Development, Testing and Maintenance. Next section will focus on Software Design aspect.

2.2 Software Design

Software design is the process in which the overall layout of the software is designed. All the modules and their dependencies are defined. It includes algorithm design, architecture design etc. From the requirements of the software to the analysis the design is made. UML is used for software design. It focuses on different approach of implementation of the system. There can be multiple approaches but the

most optimal one is selected. Design Patterns are also used for software design.

2.3 Data Modelling

Data modelling is a process used to define and analyze the requirements of the business logic of the system. It is also used to design the actual data and the relationship between them. It must also match the scope of the system. Data modelers works with the users and stakeholders of the system.

The conceptual data is gathered from the requirement gathering phase and then translated to the logical data model. Logic data models defines the constraints and relationships between the data. Then it is finally mapped to the physical data model where the actual data is used by the system.

2.4 Modelling Language

A modelling language is an artificial language that can be used to define system, information in the structure defined by the rules of the system. Rules are used to interpret the association of components in the system. The modelling Languages are of two types:

2.4.1 Graphical Modelling

It used a diagrammatic approach to represent the system. There are symbols and lines that connect the symbols which is used to display the relationship between the system. Notations are used to define the constraints in the system.

2.4.2 Textual Modelling

It uses the keywords or special characters with parameters to represent certain information in natural language which can be used by computers for processing. Expressions are used to link the relationship among the text.

2.5 Service Oriented Architecture

2.5.1 Definition

SOA is a new kind of architecture which consists of elements and modules which can be categorized a services which are the units of the work desirable to the consumer. It loosely coupled and coarse-grained so that it benefits the enterprise users.[3]

There are several levels of abstraction. So that it can have multiple viewpoints for their stakeholders.

2.5.2 Key Characteristics of SOA

The characteristics are:

- There is quality of service.
- The software infrastructure is responsible for managing the system.
- Services and data are discovered and stored.
- Protocols use industry standards.
- Performance and Security are specified.

2.5.3 Service

Service is a reusable component which changes business data from one form to another. It is the only way the data is accessed. Services play essential role in controlling and managing the system.

2.5.4 Explanation

SOA is about distributed applications which has three main parts: a provider, a consumer and registry. The simple architectural view of SOA for Web Services is shown in the Fig 1.

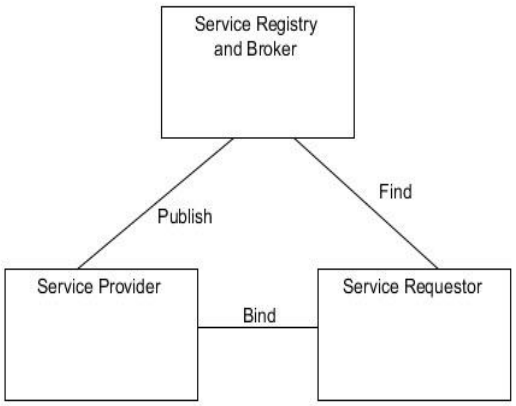

Fig. 1

The main part of the system is registry and broker. It helps the service providers to publish the service and the service requestor discovers it. It finds all the information for the system and binds to it.

III. EVOLUTION OF MODELLING TECHNIQUES FOR SOA

3.1 Introduction

SOA is the current trend in the IT industry. There is need to design an architecture or a model for a particular domain. There are many ways which can be used to design and model the services and architecture of the enterprise. Service Oriented Modeling (SOM) is the first step to model services of SOA[4]. So the approach for modeling SOA with the viewpoint from services is required. We will start with the classic approach of using UML.

3.2 UML

The major concern of the organization is to integrate information and to apply SOA to the current existing systems. It has loosely integrated set of service which contains the business logic. To implement SOA it is complicated so there is a need to design the system. UML is used for general purpose modelling of SOA and create visual models. The services were modeled as objects and general purpose of the design was made by it. But when the degree of complexity increased it was not that efficient. UML

was standard by OMG group which had different diagrams like use case diagram, sequence diagram, component diagram, class diagram, activity diagram, deployment diagram etc. But it lacks criteria to see the interconnections between the different views.[5]

There was a need of a language which was dedicated to SOA and had UML notations. So SoaML emerged, and it will be discussed after few sections. Meanwhile even BPMN was adopted for the designing the business logic of SOA.

This is how SoaML emerged: as a UML profile and meta-model for the modelling and design of services within a service-oriented architecture.

3.3 BPMN

Business Process Model and Notation (BPMN) is a graphical representation for defining various business process for implementation of a business logic for the system. It uses the flowchart technique to represent the business process in the Business Process Diagram(BPD). It is like the Activity Diagram of UML.

The goal of BPMN is to support the business process management for both the developers and clients. It provides simples notations for simpler graphical representation of the complex problem.

Business Process Execution Language (BPEL) is used to map different business processes.

BPMN is used to represent and design the Business Processes. Since SOA is made up of services and there is need to select and discover services the BPMN does not support service identification [6]. There no representation of automated service selection. The BPMN has granularity for processes rather than services. The BPMN shows the vertical architecture while SoaML shows the horizontal architecture[7]. There are several methods used to convert from BPMN to SoaML. So, SoaML was used for SOA design architecture.

3.4 SoaML

SoaML (Service oriented architecture Modelling Language) is from the Object Management Group (OMG), describing a UML profile and meta-model for the modelling and design of services with the SOA of the enterprise [8]. The existing models like TOGAF were insufficient in describing the architecture in precise standard ways. Even UML was incapable for defining consumer, service, registry etc.[9].

SoaML was created to support the following features:

- Indentifying services and their requirements.
- Defining service consumers and providers as well as the service itself.
- Specifying message pattern and protocols for the services.
- Different Service classification schemes.
- Integration and extension with OMG meta-models and BPMN.

There is a need of a framework which is only dedicated to SOA. There must also be different notations for all the components of the architecture.

So Michael Bell introduced a new framework called Service Oriented Modelling Framework (SOMF).

3.5 SOMF

The new era of SOM has begun. It is not a new concept it has a new paradigm of services and business aspects of the lifecycle. It is unlike object-oriented approach which is based on object based programming languages, the SOM has loose coupled of software asset, reuse of components and sharing it. It is indentified as service as a central part. Service encompasses application, software system, Web Service, Software Library, databases etc.

Finally, it is a model driven engineering methodology which focuses on business process and the it is part of the lifecycle. It can also be sued at standalone designing platform with other modelling languages such as UML, BPMN, or SoaML to enrich the language syntax. It can also set software development priorities during life cycle stages, and enhance the overall implementation view of the system.

IV. CONCLUSION

Thus we have seen the evolution of different modelling techniques used for service oriented architecture. Starting with UML, BPMN, SoaML and SOMF, the modelling process has varied. Rather going in depth wise it has expanded breadth wise. This will help the designers and modelers to have great insights about the system architecture. From service oriented modelling the idea to partition the system in terms of services has lead to the use of UML. But because of its pitfalls BPMN came which altogether can depict the system in terms of business processes rather than services. SoaML was also used with UML but the notation were not able to show the complexity of the system and there is a definite need to design altogether new framework for SOA. So, SOMF came into being which is only dedicated to SOA.

SOMF is the new framework for the modelling tool for Service Oriented Architecture. Future work, can be made to optimize the design and modelling framework which also depict the in-depth issues as well. There is a definite need of a software which has implemented the SOMF. With this software we can design SOA models of the enterprise easily.

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