Intelligent Software Product Line For Supply Chain

Ahmad Nurul Fajar¹, Ditdit Nugeraha Utama², Gunawan Wang ³

¹ Information Systems Management Department, BINUS Graduate Program-Master of Information Systems Management, Bina Nusantara University Jakarta, Indonesia 11480, E-mail : afajar@binus.edu
² Information System Department, UIN Syarif Hidayatullah, Jakarta, Indonesia, E-mail : dit.utama@uinjkt.ac.id
³ Information Systems Management Department, BINUS Graduate Program-Master of Information Systems Management, Bina Nusantara University Jakarta, Indonesia 11480,E-mail:gwang@binus.edu

Abstract. Implementation of intelligent system that was utilized by research activities for numerous domains is very broad. Industry, transportation, health, and also government are several sector examples where such a system is incredibly beneficial. The condition of Indonesian government system for supply chain environment is a challenge for develop software product line which has intelligent mechanism. We proposed the Intelligent Software Product line for supply chain. We proposed conceptual framework which is a guidance for system developer to create system. We called the framework with I-SPL Framework.

1 Introduction

Software Product Line or SPL can be used to facilitate software features diversity in similar domain. The software features diversity occur while multiple developer construct the software system. The failure to develop SPL is can make wasted resources and shortened software life time. Besides that, the complexity of e-government applications is increasing significantly in the government environment. It can make an unpredictable changing in government policy. The ability to respond government policy changes is enabled by interoperability between business processes.

According to it, the variation of business process can be a challenge to reuse of parts of business processes. In order to construct intelligent system, it can supported with SOA Approach. However, People were actually getting confused about key differences between Service Oriented and Object Oriented. In fact, most of SOA development might have similarities methodology with software development. However, the quality of service that will be delivered possibly does not fully required nor support the services itself if SOA develop in software development perspective.

Service Oriented Architecture (SOA) is one of services technology provide integrity, compatibility, and support the smallest unit of business functionalities. Most of literature research, currently identified at least four methodologies for SOA development which is mostly under discussion. SOA methodologies including SOMA/RUP, SOUP Methodology, SOAF methodology, and SOADL. Furthermore, each methodology basically had been supporting business process either in bottom-up, top-down, and melt-in-the-middle. It would be depends on requirement based on company needs [1]. Based on four methodologies which consider as best practices for SOA

Development, according to several literature research performs that SOADL is one of the method which is provide flexible and adaptable toward some methodologies, especially software development. SOADL methodology, when all phases implemented, will provide independent cross multi-platform services and dynamic toward any other services [2]. In other hand, when SOADL work together with a software development approach, besides providing set of service composition,
it will deliver client application based on process-oriented [3]. Means, the service will be more flexible, even the business process must be changed both in codes or its processes. This flexibilities of business process toward services well known as orchestration—which is basically part of business logic for SOA abstraction. It's proven that SOADL methodology flexibilities toward software development in some way will deliver benefits in order to cover disadvantage while implementing SOA [2].

2 Related Work

Implementation of intelligent system that was utilized by research activities for numerous domains is very broad. Industry, transportation, health, and also government are several sector examples where such a system is incredibly beneficial. For instance in industry sector, intelligent system (specifically based on cyber-physical system) was used as a conceptual context to realize an intelligent chemical industry. It was practically used to improve the optimal control level for the whole process of the system [5]. Regarding the service oriented manufacturing system, intelligent system was also operated as an engineering framework. It was realized for becoming an intelligent automation control and execution of manufacturing system [6]. It was similarly used to optimize (as context-aware service system) in providing the information for miners according to real time situation in coal mine industry [7]. Furthermore, in transportation area, intelligent transportation system was applied every so often. It was explicitly executed for solving many kinds of problem that relate to road traffic and transportation. It was used as the way to protect the transportation infrastructure in the purpose for improving safety of transportation [8].

The intelligent system concept was adopted as well to construct the cooperative intelligent transportation system. Based on two main functions, the system can support to reduce CO2 emission and free traffic congestion by finding the best route [9]. It also was adopted to be implemented in preventing accident [10], in reducing negative impacts of road transport on the city environment [11], solving parking problems [12], or even in solving the problem of product distributing particularly in supply chain case [13]. In health sector, the intelligent system is very valuable. One of them is for diagnosing a child mental health disorder. It was applied in China for solving roughly 60 million mental health care issues [14]. The system was used also to record personal health data. It was operated in purpose to provide the health requirement analysis [15], the concept of intelligent system was adopted as well to develop the system of health care service [16]. Exclusively in government area, several researchers used intelligent system as a hot issues or methods infrequently to be studied. For example, it was operated for emergency response services [17], advisory service innovation [18], minimizing information gap in government agencies and public institution [19], and planning a national defense budget [19]. SPLE can be used to modify, customize and configure context [20].This approach can minimize cost and time to develop software systems, to improve the reusability of commonality features, to manage variability feature, time to market, and to improve product quality. SPLE consists of two processes that are domain engineering and application engineering [20].SPLE consists of domain engineering and application engineering. It can support to build a robust platform and build specific user applications [20]. SPLE requires many technical, financial, organizational, process and market considerations [20].

The benefit of SPLE compare to traditional reuse is maintenance [20]. According to [21], dynamic environment could be anticipate with the system architecture based on commonality and variability in business processes. Besides that, we can create business process model from goal model [22].Feature Model could be generated from business process model [23]. According to [24], FODA, is a method of domain analysis in order to compile the thinking process used in building software system in domain or related classes. Domain analysis supports software reuse by capturing domain expertise, including to support communication, training, tool development, software design and specification. The domain analysis offers the ability to identify and support the development of software resource reuse. The goal of FODA is to create a domain model that represents the system
family to be refined into the system as desired. The feature model visually represented in a tree-like structure in which the node represents the feature and relationship between features. According to [25], in the feature model, the connection between feature and feature grouping is the variability of the software product line. According to [23], the big challenge domain during the modelling is tracing the various events of the variant and understanding its interdependence. According to ref [26], the feature diagram is widely used for variant model of software product (software product line/SPL). FODA is built by storing all available information. By analyzing the characteristics of the domain variant, all variants follow the general categorization type and all have certain behaviors.

3 Results and Discussion

This study discuss about software product line in supply chain domain. We proposed conceptual framework which is a guidance for system developer to create system. We called the framework with I-SPL Framework. This framework constructed from systematic literature review, observation and interview also. The I-SPL Framework consists of two modelling: feature model and service oriented model. The first phase is how to modelling software feature in supply chain domain. The results are (a)list of software features, (b)feature model, and (c)feature diagram. We suggest to using software product line engineering (SPLE) approach, specificity in feature modelling for execute this phase. According to it, software product line or SPL in supply chain domain area can be built by SPLE approach. The software system represent SPL implementation. This phase focused to identification, analysis, design and modelling supply chain domain environment. This phase should concern about business processes, sub business processes, tasks, activity, role, rules, and policy in supply chain domain environment. In order to complete this phase, we should using template and guidance relate to it. Feature modelling is an approach to create feature model and feature diagram. It will consists of some of software features. The software features are divided into mandatory features, optional features, and alternative features. Feature diagram could be visualization using tools and standard notation in this study. The second phase is how to modelling services using service oriented analysis and design in SOMA [27]. According to it, the results are business services, process services, and task services. This phase is derived from modelling the feature.

Feature model and feature diagram would be a baseline before modelling the services. This modelling focused on how to analysis and design in information system based on services. Business processes in supply chain domain environment are could be transform into some of business services. Process services are created from business services. Supply chain business processes having complexity in flown of information and data. In order to take granularity, we should decompose business services, process, and task into atomic and can not to be decomposed more. Besides that, mechanism in intelligent system should be embedded to system architecture. Its purpose to adding intelligent system behaviour to take user profiling before make a recommendation. While we use SOMA to modelling some of services in supply chain domain environment, we should doing service oriented analysis and design.
Figure 1 above described our proposed framework, which is called I-SPL Framework. The second phase is focus to modelling some Decompose business processes is part of stage in modelling some of services. It will be reference to existing business processes in supply chain domain environment area. Its purpose is to represent granularity processing. After doing service oriented analysis, the next stage is service oriented design. This stage focused in task services, such as task centric design.

The guidance of to task centric design relate to [27]. The purpose of define workflow logic in task centric design is to find out which application service that will communicate with task centric. Task centric is identified based on entity centric. It would be classified as part of the business service layer. Typically, task centric is a service that could not be able to reuse. In order to implementation the services modelling, we use service oriented architecture (SOA) approach. The necessary part of SOA is interaction business process which transforms into BPEL (Business Process Execution Language). When a user would like to use web services, automatically, they will invoke the web services. The I-SPL framework also concern in intelligent system mechanism approach. There are some reason for it, such as to make a recommender system in software product line based on SOA. However, the recommender system should refer to the process of modelling the software features and modelling some services also. Its purpose to minimize the mismatch and lack of the needs of multi entities in supply chain domain environment area.

4 Conclusion

The I-SPL Framework has been propose to guidance the construction of SPL in supply chain domain environment. It has consists of 2 part in modeling, such as modeling software features and modeling some of services in software system. We use SOA Approach to support the create reusable business services, composite application and composite business processes. The I-SPL Framework also having intelligent mechanism system to support users activity in multi entities supply chain.
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