Conceptual Approach for Gathering SPL Requirement from Goal Model

Imam Marzuki Shofi
Informatics Engineering Department
UIN Syarif Hidayatullah
Jakarta, Indonesia
imam@uinjkt.ac.id

Ahmad Nurul Fajar
Master in Information Systems Management
Bina Nusantara University
Jakarta, Indonesia
afajar@binus.edu

Abstract— The condition in difficulty for capture software product line (SPL) requirement in e-government system is critical in the government domain. It cause of the multiple business processes are highly dynamic and at even during execution require changes are needed. In order to response it, the mechanism and systematic approach for capture software requirement, called conceptual approach is needed. Besides that, the specificity in capture software requirement in Software Product Line (SPL) paradigm is urgent and needed to accommodate this situation. In this study, we proposed the conceptual approach to construct SPL Requirement from Goal Model. We choose document regulations that related in budgeting and finance. The results are the conceptual approach for gathering SPL requirement from goal especially in E-Government system. It supported with Goal Model and BPM (Business Process Modeling) Approach. The SPL Requirement will be a baseline for develop SPL Design**.**

Keywords— : SPL, Goal Model, BPM, Requirement

I.   INTRODUCTION

The benefit to accommodating software features diversity in similar domain is to construct Software Product Line (SPL). The impact of multiple developer construct the software product line is sharing similar software features. However, the mechanism to gathering SPL requirement is not easy. The fact said, the failure of it could make wasted resources and shortened software life time. Besides that, in the government system, there are multiple domain and environment which has the complexity of business processes and e-government applications also. The ability to respond this situation is by developing of SPL to accommodate flexibility software. However, in order to achieved the excellent SPL, we should aware and focus to construct SPL requirement. According to it, the phenomenon of goal model and business process model is rapid significantly. Its purposes is to achieved and control the quality of software that has developed. Goal model can facilitating system analyst to explore the detail requirement before construct the software. Related to goal model, it is challenge to using it, before develop SPL. Goal model can describe the reason also and not only what is the system think. Besides that, the variations of business processes are the fundamental challenge for business processes reusable**.** Business processes which has reusable, are can be used by developers to construct part of software component. In order to achieved business process reusable, we can do business process modelling concept. Business process modelling is a technique for describe the activity of situations, many goal in organization and also drawing the activity [1].It can described in phase of business processes analysis. BPM can represent the actor, goal, objective, and processes. Besides that, in order to support organization, It can representing them to information structures integrated systems [1]. In order to support the modelling of business processes, we can use Business Processes Modelling Language (BPML).It can be related to business process requirements that provides appropriate syntax and semantics [2]. BPML described the activity or mapping business processes using UML 2.0 Activity Diagram [2]. It is designed for modelling business process and flows in software systems. Furthermore, it can provide a high-level means of modelling dynamic system behaviour. There are various approach methodology and modelling in software requirement analysis, such as data oriented, process oriented, object oriented organization oriented and goal oriented. According to [3], in requirement engineering, goal and actor oriented are more have new challenging from traditional and procedural oriented. Besides that, according to [3], the government goal is doing the list of activity which is based on document regulations, either central government or local government. It makes government agency has the document regulation, and these documents will be a foundation to develop e-government applications. Goal model can be used to modelling the behaviour of the system before implementation phase in SPL construction. However, there is a challenge to eliminate failure while identifying software features to gathering software product line requirement. Software product line able to handle the diversity of software features in similar domain and multiple applications.

II.   LITTERATURE FOUNDATION

According to [4], definition of requirement engineering for system development is the process for exploitation, gathering, collecting and identifying user needs. It means a process for capturing and identifying user needs, goal of system, and documenting in a template or form [4]. Regard of it, there are two approach such as traditional approach and goal oriented approach. The different between goal approach and traditional

approach is goal approach used for development of software which has characteristic in much complexity. It is because goal approach has a characteristics for having goal orientation in actor. Software Product Line (SPL) is a software product that constructed from SPLE approach [5]. It can facilitate the diversity of software feature from many of software developers [5]. Goal Oriented Requirement Engineering (GORE) has orientation of goal and actor that has increased dramatically in popularity[6]. The most traditional approaches has characteristic for modeling requirement in the form of low-level in the data, operation, and other that are more many understood by other internal programmers & developers. However, while they tend to focus with the modeling like that, Goal model in GORE is also equipped in the its high-level side [7]. Besides that, relate to the classification of GORE method, there are two level and has different concern of the classification. The focus of strategic are called high, and the focus of technical are called low. The table 1 below describe the classfication of gore method
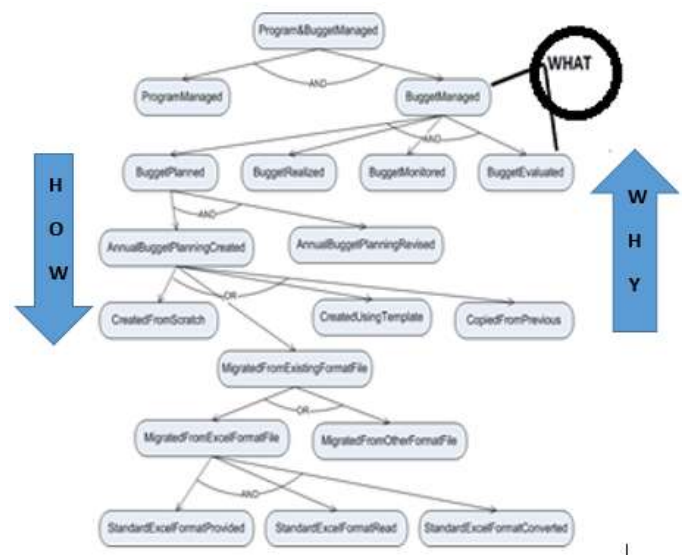
Table 1. Classfication of Gore Method

RE Coverage Methods	Elicitation	Analysis	Specification	Management
DTEBS		√	√	√
GBRAM		√		√
AGORA		√		√
VVA		√		√
GOIG				
GSTH	√			
KAOS	√			
GSP		√	√	
DOSS			√	√
A-BT		√		√
GSTH	√			
GRL	√	√	√	
Congolog		√		
Albert language		√		
F3	√	√		

The Goal Model example is described in figure 1 below. Figure 1 below is relate how to create goal model from document regulations in the case of E-government application, that called Laksana Information System (LAKIS) [4]. Figure 1 below described the three dimension of Goal Model, such as what, why, and how. It is derived from document regulations in budgeting domain.

Figure 1. Goal Model of Laksana [4]

According to figure 1 above, it shows the example of goal model from LAKIS application in Ministry of Information and communication at Indonesia government. The purpose of the applications are used to accommodating business processes of planning, monitoring, realization, and controlling of budgeting mechanism also. The users are consists of three level, such as operational level, managerial level, and strategic level. that, the whole activities in budgeting domain are supporting by its application.

III. RESULTS AND DISCUSSION

As we know, the SPLE Paradigm can be used to enhance flexibility of software. It is because of the objective is to produce mass software customization in similar domain area. Besides that, It has capability for identifying, design, and exploration in software features of commonalities among related products [9]. It can be said that the commonalities characteristic are used to create a product platform. Meanwhile, it also can be used as a common baseline for all products within a product family [9]. In order to explore the SPLE Paradigm, ,there are two part of SPLE : (1).domain engineering, and (2). application engineering. Regard of it, we can construct a robust platform and also specific user applications when we use SPLE Paradigm [9]. There are five aspects which we should be prepare while using SPLE paradigm, such as technical, financial, organizational, process and market considerations [9]. On the other hand, the benefit is we will be able to manage maintenance software reuse, while SPLE compare to traditional reuse [9]. In the case of Indonesian Government, it has similarity, intersection, and specific characteristic in document regulations, business processes, and applications also. It will influence happened

for commonality and variability in software features at e-government applications [8]. In order to minimize the inconsistency meanings about government environment, we defined the definition of government environment. The definition is described in figure 2 below :

$$Org = \{AF_1, AF_2, \ldots\ldots AF_n\}$$

$$AF = \{PB_1, PB_2, \ldots\ldots PB_n\}$$

$$PB \in WS \cap AF$$

$$WS = \{PB_1, PB_2, \ldots\ldots PB_n\}$$

$$AF_1 \cap AF_2 = \{PB \mid PB \in AF_1 \land PB \in AF_2 \land PB \in WS \land PB \in AF_1 \land PB \in AF_2\}$$

Legend:

Org : Organisation

AF : Area Functional

PB : Business Process

WS : Work System

Figure 2. Government Environment Definition

According to figure 2 above, we make four definition for government environment , such as Org, AF, PB, WS. The meaning of each component are Org is organization, AF is Area Functional, PB is Business Process, and WS is Work system. Furthermore, we proposed the conceptual approach for gathering SPL requirement which is consists of four stages, and the results will be a baseline for SPL design. The conceptual approach stages are begin from government documents, it means document regulations collection. Then, the next stage is create goal model which is derived from government regulations documents which has choose . After that, we analysing goal model to doing the next stage for create activity diagram from goal model. The last stage is construct SPL requirement from activity diagram using the mapping mechanism based on functionality. However, the conceptual approach in figure 3 below is high level stages. In order to achieved the implemented guidance, we proposed in each stage has multiple and many of specific procedures. In order to build SPL design which has agility characteristics before doing development of SPL Product, we need SPL requirement to make sure the needed and compliance of user requirement.
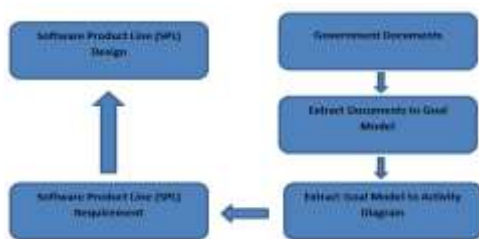

Figure 3. Conceptual Mechanism for gathering SPL Requirement

According to figure 3 above, the mechanism for gathering SPL Requirement that has GORE approach is concern about what the needs to discover, on *what* problem what should be solved, *why* such a problem needs to be solved, and *who* should be involved in the responsibility of solving that problems [10]. Today, GORE approach has increased for system development. It is because of the having orientation of Goal and Actor recently has the popularity.

According to [10], Goal is a condition in the world that the stakeholders would like to achieve. Relate to the concepts of goal, the goal type is based on functional requirement and non-functional. In SPL Requirement. We use three types of goal, such as *achievement, soft*, and *maintenance goal* for our proposed mechanism in figure 3 above. We proposed the process of gathering software product line (SPL) requirement using goal model approach. It needs procedure for extract document regulation to goal model and also extract goal model to activity diagram. After that, we make procedure to described and mapping activity diagram to SPL requirement. Besides that, Government document policies describe the thematic, rules and the objectives. It consists of dependency and independent of rules. The documents also consists of constraints among the level in the hierarchy government policies. There are M…N   relation between theme, rules and objective. Based on theme and objective, it will representation rules. Figure 4 below describe the document structure:
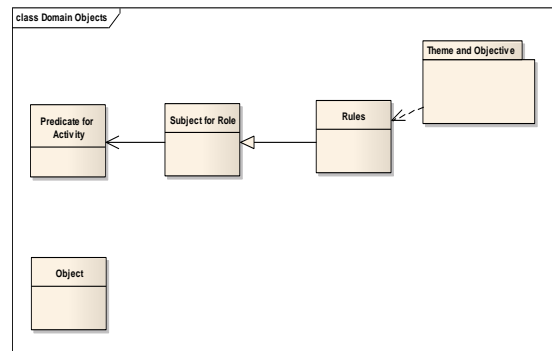

Figure 4. Documents structure

Furthermore, Business Process Model or BPM has role and activity as usually. We proposed the relation between BPM and Goal model for make SPL requirement and design. The relation between goal model and BPM is used to achieve the requirement. The procedure to determine the Role give activity and define activity is described in figure 4 below:

```
Begin
        Search objective and theme
    For each Role of theme do
        Classify activity based on theme
            If Role = 1 then
                Active (activity of theme)
            Else
                Define (activity of theme)
            End if
    End
```

Figure 5. Procedure to determine the Role give activity and define activity

According to figure 5 above, the purpose of the procedure is to identifying the role, activity, and the relation between role and activity. It will be a foundation to drawing the business processes activity using activity diagram. Indonesian government system has the rules and policies central and local government are related each other. Figure 5 below represent the Indonesian government environment. Indonesian ministry and council using central government policy when doing their activity, and It has several level rules and policies. Local governments divide of district and agency. The impact of it, there is a phenomenon in commonality and variability of rules and policies among local governments. Besides that, central and local government has commonality and variability policy in district and region. In order to accommodate this situation, the document regulation could be convert to business process model (BPM). It is purpose to represent the business processes and activity in the environment context. We suggest, there are many application could be derived from BPM. Besides that, the application consists of many software features. The central and local government can use the common application and common software features, but also using the specific application and specific software features. From document policies that relate to a theme, the applications is derived from BPM. There are 11 applications : payment, budgeting, cash management, accounting, income management, finance management, asset management, tax and retribution, legal and registration, procurement, and investment. The applications used by many unit organization in the government. Several functionality of application are common and integrated. There are application integration based on functionality :

1) Payment integrated with budgeting,cash management and accounting
2) Budgeting integrated with payment,cash management,asset management and accounting
3) Cash management integrated with payment, budgeting, income management, finance management and accounting
4) Accounting integrated with cash management,payment and budgeting
5) Income management integrated wih cash management and tax&retribution
6) Finance management integrated with cash management

7) Asset management integrated with budgeting and procurement
8) Tax and retribution integrated with income management and legal&registration
9) Legal and registration integrated with investment and tax and retribution
10) Investment integrated with legal and registration
11) Procurement integrated with asset management

The application could be classified based on :
   a)User : organization
   b) Type of services : front office or back office
   c)Object services : G2G, G2B, G2C
   d) Major functionality

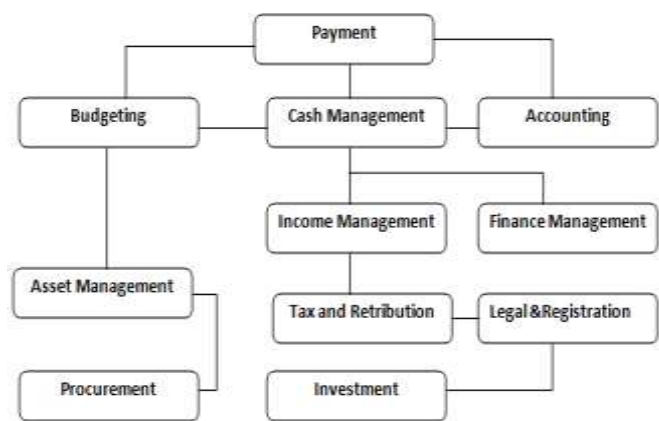Figure 5 below describe the applications and integration of application :

Figure 5. Application and Integration application

IV. CONCLUSION

Software Product Line Requirement is a baseline before development of SPL Design. It is a challenge to create the conceptual mechanism for guidance user to use it. These mechanism is using Goal model and BPM approach, and it is using for the government case. The characteristic of the government is should have commonality and variability software features. These mechanism flow are begin from government documents, it means document regulations. Then, create goal model which is derived from government regulations documents. The next stage is create activity diagram from goal model. The last stage is construct SPL requirement from activity diagram. However, in these stages, in each stage has multiple and many of specific procedures

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