Business Process Composition Based on Meta Models

Riyanarto Sarno[1], Endang Wahyu Pamungkas[2], Dwi Sunaryono[3], Sarwosri[4]
Informatics Department, Faculty of Information Technology
Institut Teknologi Sepuluh Nopember
Surabaya, Indonesia
riyanarto@if.its.ac.id[1], endang.wahyu.pamungkas10@mhs.if.its.ac.id[2], dwi@its-sby.edu[3], sri@its-sby.edu[4]

***Abstract*— Nowadays, Business Process Management (BPM) technology has been developed and widely applied in small and large scale. There are many companies and organizations implemented business process oriented information systems. Therefore, the flexibility issues become very important in managing large quantity of business processes because business processes are always changing overtime. There is a need of flexible business process models so that every possible changes can be done easily every time. Flexible business process models are represented by a reconfigurable model. In this paper, we proposed a method to manage business process model variations in order to efficiently develop the business process repository. The variation management is done by storing the common business processes and its variation in the repository. Then, we also propose meta models which contain information about the models stored in the repository. The results show that the meta models support the composition process of a new business process based on the common business process. The variation management has achieved to reduce storage redundancy up to 82%.**

Keywords—business process model variation, flexible business process model, meta model, variation management.

I. INTRODUCTION

Nowadays, Business Process Management (BPM) technology has been well developed and widely applied in small and large scale. The fact, there are many companies or organizations that implement business process oriented systems like Enterprise Resource Planning (ERP). ERP vendor must be able to provide a business process model which is best practice in every section of industrial process [1]. Then consumers can customize existing business process based on their needs. Business process changes can happen because of changes in organizational structure or operating standards [2]. So, vendors need to develop flexible business process model design. On the other side, flexibility is one of the challenges in Process Aware Information Systems (PAIS). PAIS is a software system that is set up and run the operational processes that associated with human, software, and information system based on process model [3]. Today, many companies are adopting PAIS that offers promising perspectives with a flexible enterprise computing [4]. In PAIS, flexible business process is a business process that can accommodate any occurred changes that in its environment.

Based on that, there is a need to design a flexible business process. Flexible means easy to do changes or usually called reconfigurable. A reconfigurable model is a model that can be rearrange into other model variation. Reconfigurable model can utilize to reduce the number of redundancies in the repository. It is done by conducting process variation management. Variation management is done by storing the variation in the repository by providing metadata. It will help in composing a new business process model. Moreover, It will help to improve effieciency of the business process models storage. Because, we do not need to save all business process model. But, we just need to save reconfigurable model with its variation. Furthermore, this study also present a method to compose a new business process from reconfigurable model to its variation model.

In the first part of this paper will discuss the introduction about this research. Then we discuss about several related studies about this research. In the next part, we explain about our propose method consist of business process variation, variation management and process composition. We also spell out about the method to manage variation of business process until produce the storage metadata. The important part is a experiment to prove that the method is successful by implementing all of method sequentially. In the last section we will present the conclusion from this research as well as some further research plans.

II. RELATED WORK

Some previous research has been done several approaches in managing variation of business process models. They have similar background to help managing repository of business process models and also to reduce redundancy in the process models storage. Another benefit from variation management is to help composing a new business process model from existing reconfigurable model. So, beside flexibility, reusability is also can be upgraded. There is a method in managing variation with a process life cycle approches that use framework named Provop [5]. Provop provides a set of features to support managing

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process life cycle. Provop also provides facilities to configure business process by utilizing maintainable process variations. This framework allows user to perform configuration at running time. The final result, Provop give good facilitation to user in developing and managing process variation with a series of integrated phase [6].

[7] propose a method to manage business process that support dynamical changes. This method is emphasizing on the flexibility aspect in the execution of business process. It improves effectiveness of business process variations. This method was implemented in a framework. This framework gives facility to search and retrieve process variations with similarity search process. This method gives advantages by providing quantitative measurement in calculating similarity between process variations. So, it will facilitate the work of Business Process Management to do reuse, analysis, and discovery process. Another research in [8] try to identify and compare the notation of business process models that support variation management. This research conclude that there are a lot of modeling language for business process with configurable feature. However, there are not many tools can be used to analyze and build a customizable business process models. Furthermore, [9] identify connection between business process variation. This method is classifying variations with the same connectivity and build a consolidated models. Connection value obtained by identifying process's business driver and calculating structural similarity between processes. This method is able to reduce storage redundancy up to 50%.

III. THE PROPOSED METHOD

The proposed method includes three steps as described in the following subsections.

A. Business Process Variation

Business procees variation resulted from changes of business strategy, policy, and the other unexpected events [7]. Business process variations includes task for adding, subtracting, and merging activity of business process. The form of business variation can be atomic activity or business process fragment. One business process can have many kinds of variations. Because, every organization will have its own version of business process based on their basic needs. Fig. 1 is an example of reconfigurable model. Fig. 2 shows the variation model from the reconfigurable model. Reconfigurable model is produced by doing AND operation in every variation of business process.

B. Variation Management

Variation management process begins by collecting all the variations using AND operation. The aim

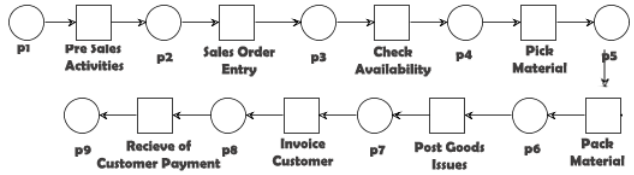

Figure 1. Main business Process

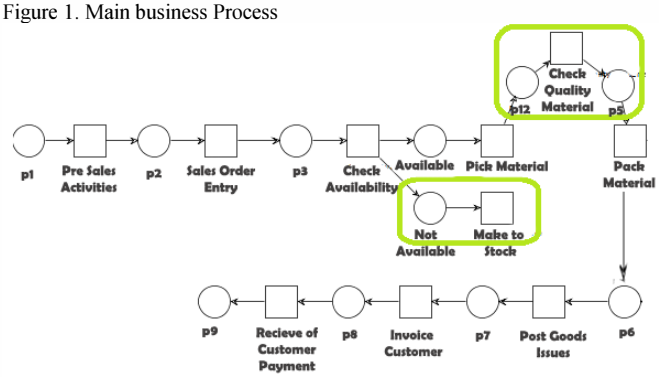

Figure 2. Business process variation

of this process is to ensure that the reconfigurable model can be rearrange into its variations. Every variation need to be labelled so that it can give information about the original model or even the activity relation. Label is represented in the form of meta model. It is mapping every variation to its origin and facilitating the discovery process in order to rearrange the model. However, meta model needs to be analyzed further to accommodate the needs of discovery and composition. Meta model concept of storing reconfigurable model in [10] is being adopted and modified in order to store all variations. Fig. 3 is the meta model proposed to store business process model information.

C. Process Composition

This process utilizes meta model that has been formed before. A reconfigurable model needs to be chosen and an appropriate variation is added to the reconfigurable model by using query. However, some information have to be added to the meta model. We take similar definition to [11].

Definition 1: {N, E, G, V} are a reconfigurable business process model where

- N is a node that represents activity in the business process.
- E is a directed edge that shows relation between activities.
- G is a gateway that represents braches that consist of join and split.
- V = is a variation of activity which is owned by reconfigurable model.

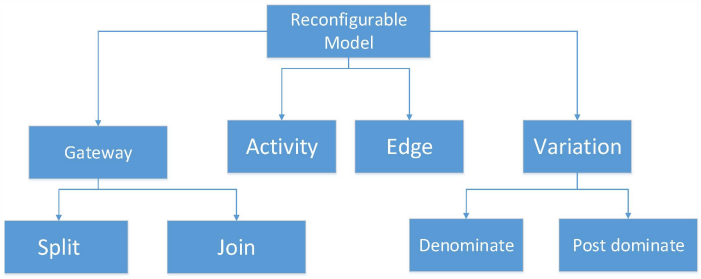

Figure 4. Metadata reconfigurable model

Dominate and post dominate term are used in the adding variation process to know where to insert the variation model. These are adopted from [10]. For example, activity B is the dominate of activity C and the post dominate of activity A. So, activity B is inserted between activity A and C by adding 2 edges in each end. Given a definition.

Definition 2: variation v of a reconfigurable model is defined by V{a, b} where

- Activity v is the dominate of activity a.
- Activity a is the post dominate of activity b.
- A and b is not always an activity but can also be a gateway.

A simple composition process is visualized in Fig.4. Here the steps to do composition process :

- User have to choose the reconfigurable business process to be built. In the picture above, the reconfigurable model is indicated by the green line.
- Query all variations that belongs to the reconfigurable model.
- User selects the desired variations as indicated by the red line.
- Pairing the selected variation according to the dominate and post dominate information.

A final business process is a business process that only has one start and finish point and interconnected between the activities.

IV. Experiment

There were 33 business process models used for the experiment. These models were made based on SAP standard. That module is broken down into the atomic process to improve the modularity. This set of modules were organized into business processes adjusted to the company needs. One example of the process was the ordering until paying process. Business process models were represented in Petri Net notation. There were 4 main business process used in this experiment as shown in Table I. Every business process has more than one variation.

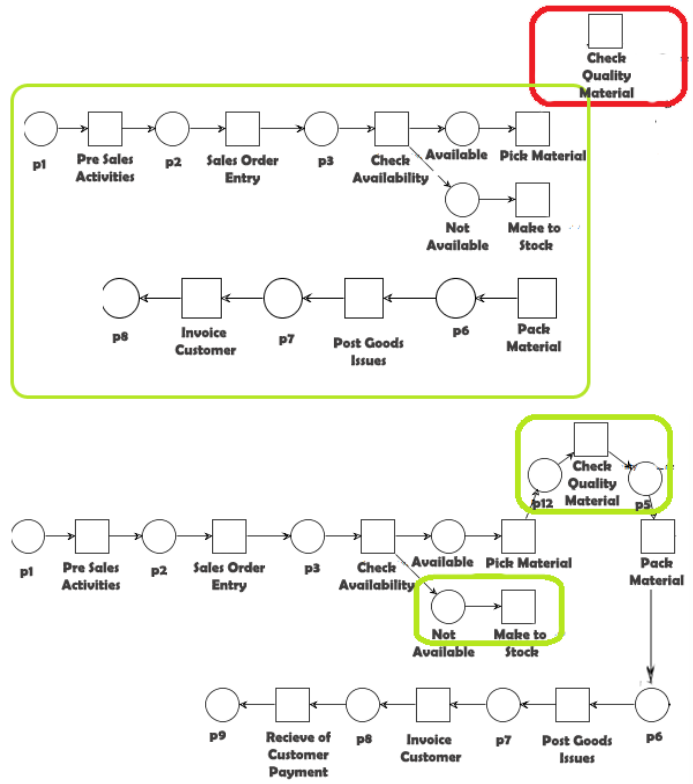

Figure 3. Decomposition process illustration

TABLE I. Experimental Result

No	Business process name	Total of all activity	Total of all activity by using the method	Ratio
1.	Order to Cash	222	32	86%
2.	Forecast to Stock	54	14	74%
3.	Request to Payment	252	35	86%
4.	Hired to Fired	124	24	81%

First of all, we calculated the similarity value for all 33 business process models. We used Jaccard Structural Similarity. After that, some clusters were formed based on the similarity calculation result. Hence, similar models would be in the same group. There are 4 big clusters consist of 6 to 9 business process models. Reconfigurable model and the variations would be taken from these clusters. Every main business process has to be able to compose back into the original model and could be used as a blueprint to form a new business process according to user's needs.

This formation of reconfigurable model and variations management method has been able to improving storage efficiency. We calculated the total number of activity to know how much space must be provided by the repository. The experiment result is shown in the Table I. This method could decrease the level of redundancy in the storage about

82%. The ratio is depend on total variation owned by every business process.

V. CONCLUSION

In this paper, we presented a variation management method of business process models to make storing, developing a new model process, and composing process more efficient. A series of process has to be done in order to accomplish that. The experiment results indicate that there are a significant improvement in the storage efficiency. Repository only has to store 4 main business processes and some of the variations instead of 33 processes. In addition, the method of querying reconfigurable model and connecting it with the variations helps user to develop new business processes. It is a more effective method than arranging business process from the very beginning. The result also shows a good results where redundancy can be lessen to 82%.

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