A Flexible and Efficient System Development Approach for Enterprise System and Smartphone Application

Michiko Oba, Taku Yamaguchi
Media Architecture Department
Future University Hakodate
116-2 Kameda-Nakano Hakodate Hokkaido
JAPAN
michiko@fun.ac.jp, p4414002@fun.ac.jp

Abstract: -The business environment has accelerated sharply year by year. However, the information system does not catch up the rapid change. A certain gap arises between the business strategy and IT. On the other hand, the use of smartphones in the enterprise system has been increasing. The possibility of the use of BYOD (Bring Your Own Device) is also increasing. However, smartphone is necessary to cope with different platforms such as iOS and Android. There is a problem in development effort is increasing. Approaching this problem, this paper aims to resolve a combination of two concepts of SOA and BPM,. In the proposal approach, we apply the agile development process to which the change in the requirement is brilliantly accepted. The grasped requirement is listed and the order of priority is applied at the time of beginning of development. Next, it develops from the function with high priority one by one. When the change and the addition of the requirement occur, priority is reviewed. As mentioned above, our approach accepts the change and the addition of the requirement, and develops them according to priority. As a result, system implementation to be worthy for the customer in the delivery date becomes possible. In this paper, we propose the design-approach that combines BPM, SOA, and agile development for the enterprise system and smartphone application development to which the specification is not fixed. Additionally, we prove the effectiveness of our proposal by the application experience.

Key-Words: - Agile Development Process, BPM, Component, Feature List, Information System Development, SOA, Enterprise system, Smartphone Application

1 Introduction

Recently, the business environment has changed rapidly. There is a problem that the information system cannot follow rapidly to the change in this business environment. Consequently, a certain gap seems to arise in the business strategy and IT. In an enterprise, unchangeableness of the information system initially designed to match to the accelerating business environment becomes nonnegligible problem of management. There is an approach for attempting the solution by combining two concepts for this problem BPM (Business Process Management)[1][15] and SOA (Service Oriented Architecture)[2][14].

BPM is an approach from the business side. On the other hand, SOA is the one from the system side. The gap between the business strategy and IT can be patched by two approaches. The change in the business environment can be absorbed by the flexibility of the business process in BPM. Moreover, it is possible to develop systems efficiently by the combination development of service in SOA. Therefore, we come to be able to construct the information system that can follow the change of business promptly.

Up to now, we have practiced the development approach based on the method above. However, our development approach has the problem that the implementation cost becomes large when the specification has not been fixed. The reason is that the rework often occurs in the development of the information system because of the change in a frequent specification. On the other hand, the use of smartphones in the enterprise system has been increasing. The possibility of the use of BYOD (Bring Your Own Device) is also increasing. However, smartphone is necessary to cope with different platforms such as iOS and Android. There is a problem in development effort is increased in this case.

Therefore, the purpose of this paper is to suppress the implementation cost for the system development to which the specification is not fixed, and to propose a design approach that secures customer satisfaction. In the proposal approach, we apply the agile development process to which the change in the requirement is brilliantly accepted. The grasped requirement is listed and the order of priority is applied at the time of beginning of development. Next, it develops from the function with high priority one by one. When the change and the addition of the requirement occur, priority is reviewed. As mentioned above, our approach accepts the change and the addition of the requirement, and develops them according to priority. Resultantly, system implementation to be worthy for the customer in the delivery date becomes possible.

In this paper, we propose the design approach that combines BPM, SOA, and agile development for enterprise system and smartphone application development to which the specification is not fixed. Additionally, we show the effectiveness of our proposal by the application experience.

2 Development Approach that can Flexibly Step with Change

2.1 System Development Approach by BPM and SOA

There was a gap between the business and IT in the system development of the past. Therefore, there was a problem of taking time to absorb the change to the information system when the business environment changed [3]. A past information system was a structure of the tight coupling overall. The change part of the information system becomes wide-ranging when the business environment changes, and it costs time to change them.

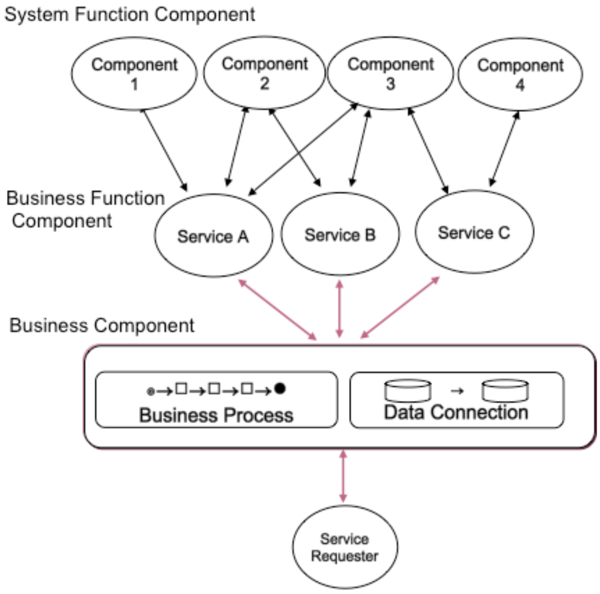
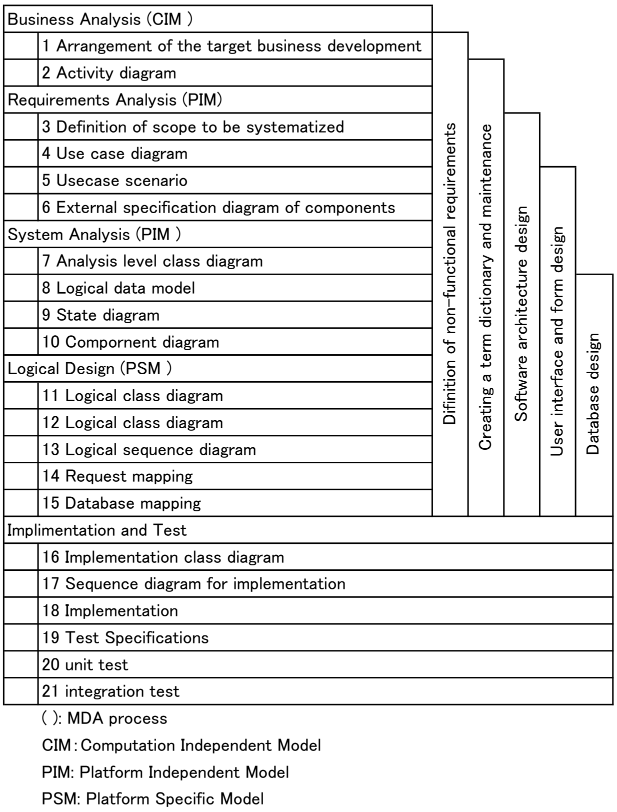


Fig. 1. Relation with Business Processes, Services, and Components.



		Difinition of non-functional requirements	Creating a term dictionary and maintenance	Software architecture design	User interface and form design	Database design
Business Analysis (CIM)						
	1 Arrangement of the target business development					
	2 Activity diagram					
Requirements Analysis (PIM)						
	3 Definition of scope to be systematized					
	4 Use case diagram					
	5 Usecase scenario					
	6 External specification diagram of components					
System Analysis (PIM)						
	7 Analysis level class diagram					
	8 Logical data model					
	9 State diagram					
	10 Compornent diagram					
Logical Design (PSM)						
	11 Logical class diagram					
	12 Logical class diagram					
	13 Logical sequence diagram					
	14 Request mapping					
	15 Database mapping					
Implimentation and Test						
	16 Implementation class diagram					
	17 Sequence diagram for implementation					
	18 Implementation					
	19 Test Specifications					
	20 unit test					
	21 integration test					

( ): MDA process
CIM: Computation Independent Model
PIM: Platform Independent Model
PSM: Platform Specific Model

Fig. 2. Development Process.

These problems can be solved by the development approach that combines BPM and SOA. In BPM, a real business is abstractly expressed by the business process. Therefore, the change in a real business is absorbed by changing the business process definition. The change in the program doesn't occur in this case. Changes can be seen only in the definition. On the other hand, SOA is an architecture that constructs the system with the combination of service. The change on the implementation side can be absorbed by the change in service.

The change on the implementation side can be absorbed by the change in service. Flexible correspondence to the information system becomes possible by these.

In other words, in a real business, when there is a change the business process model has been changed: service is hit to a new business process in the rediscount. It ends only when the business process model changes which is possible to allocate it with an existing service group. The change in the component that achieves an insufficient part and the change part and the development of the addition are only executed when service is insufficient or the change occurs.

2.2 Component Based Modeling

The design of the business process and the design of the composing service component are important to achieve the approach of the foregoing section.

Fig. 1. shows the relation between these business processes and service and components.

Here, the granularity of the component is defined by the following three hierarchies.

(1) Business component

It is one settled disposal of business affairs such as order and estimate, etc. It is composed of the compound of the business function component.

(2) Business function component

It is a unit of the element of the business processing of the order receipt and estimate answer, etc.

(3) System function component

They are part groups of the system functions of registration, update, reference and attestation, etc. of information. And the business function component is made by using these.

Up to now, we have practiced the development approach by BPM and SOA[4][5]. This practice is object-oriented type application development that uses both MDA[6][7] and UML[8]. We derive the business process from the stage of the job analysis, and make the analytic model on the assumption of deriving the component. Fig. 2. shows this development process.

In general, making the component is attempted in the making process of logical class chart in object-oriented development. The component with high recycling level cannot be derived when the process is in the upstream. There is no process where the component is derived. The component is derived at the stage of the use case chart and the use case scenario in this development process. They are refined in the following processes, and, in addition, the internal analysis model is made. The development style of an iterative type is general in object-oriented development. The iteration is executed in each phase of MDA in this development process. The iteration is executed in each phase of MDA. If the iteration in each phase is approved by the customer, it is a proceed in the following phase.

2.3 Problem of The Component Based Modeling

In the system development by the component base modeling, the specification is fixed in the business analysis process. The implementation phase is developed by the water fall type. The problems are as follows:

(1) If the requirements specification is not fixed, it takes a lot of time in the business analysis. As a result, process delay can easily occur. There are a lot of cases where the request is not fixed in a new business model.

(2) The return to the former process occurs when the specification changes in the implementation process. The cost of correction and test increases by becoming the post-processing. It leads to the delay of delivery.

(3) The man-hour making the document becomes large through the job analysis, the requirements analysis and the systems analysis process.

Moreover, it takes time to acquire the knowledge of UML.

3 Agile development Approach based on BPM and SOA

The target of the proposal approach is developing a system that the specification is not fixed. Our purpose is to decrease the implementation cost, to defend the delivery date, and to secure customer satisfaction. To achieve this purpose, the agile development process where the change in the requirement can be brilliantly accepted is applied. Moreover, the modeling for the business process and the service development is used based on the component base modeling. To take much time to documentation in this modeling, however, the idea of agile modeling[9] is introduced. As a result, using the documentation of the modeling tool can be simplified.

Agile development consists of a series of short period that is called "Iteration" with a technique for repeating development and release. It becomes possible to improve covering, realizability, and the correspondence of the requirement by developing while confirming the movement of the system. Agile development has a lot of techniques such as XP or scrummage, etc. [10][16].

"Feature drive type development (FDD)" is used in our proposal approach[11]. FDD is a method to define the function by using unit of feature in order to implement the function, according to the priority of the request of the customer. Changing management by priority is flexibly enforceable in FDD by the feature list.

3.1 Change Management and iteration

In new system development, it is difficult to decide the detail in the scope of development in the requirement definition phase. Scope is a meaning of range of requirement that a system should achieve. There are a lot of change management methods[12]. In this proposal, scope is decided based on the priority of the feature list or the use case. An example of the feature list is explained below.

The feature list is a table where the requirement was arranged according to the priority level. The process of the change management by the feature list is as follows:

(1) The requirement is understood when developing starting is dug up. According to each requirement, they are ranked into the following three stages. Priorities are set in each rank. They are sequentially filled on the feature list from A to C.

A: absolutely necessary

B: may be necessary

C: may not be necessary

Moreover, the estimate of the scale of each requirement is filled in there. The scope of development is decided based on a delivery date and past development production results.

(2) When a new requirement occurs, the rank is applied to it. After an existing requirement in the same rank is compared with the priority level, it is added to the feature list.

(3) After the requirement for the correspondence in the feature list is changed, the rank and the priority level are reviewed when the requirement changes. In this case, the feature list is updated if necessary.

When the project begins, the length of the iteration is decided. On the way, it is important not to change the length. It is general to delimit to iterations of one-four weeks in agile development and to repeat the development.

3.2 Proposal of Agile Development Process

The agile development process based on the change management and on the iteration described in the foregoing section is shown below.

(1) After the feature is listed, the requirement for the amount that can be developed by the iteration of the times when the iteration begins is sequentially selected from the place. The amount of development at first time is estimated based on a past development production.

(2) In each iteration, the requirements analysis and the design based on the content of the next section are executed.

(3)After the iteration ends, the development production is calculated. The amount of development in the following iteration is judged based on this result, and the requirement is selected and developed from the feature list.

(4) If it is necessary to narrow scope, it removes from scope in order with low priority.

(5) Development ends in any of the following cases.

- When the delivery date comes
- When all iterations end
- When all of the feature list are developed

Without corresponding the above-mentioned process, returns to (1).

The function with high priority can be implemented in the limited time according to the above-mentioned process.

3.3 Applied Modeling

In agile development process of the proposal, the practice of the following agile modeling is executed

(1) Think modeling as a mean of understanding and the discussion, not of the information transmission between work.

(2) Various modeling techniques are used widely, and shallowly.

In (1), modeling assumes execution by multiple people. Modeling is executed by an easy method here. It is as an example by using making the model of the card type in XP, writing the model of UML on a white board, and the tag paper.

In (2), various modeling techniques including UML are used widely and shallowly. The modeling technique recommended by agile modeling reaches the technique of 32 kinds. In the proposal method, the modeling technique is freely selected from component base modeling and agile modeling. For instance, the design of the business process are drawn as the activity diagram on the whiteboard. Therefore, information is shared.

3.4 Development Approach for Smartphone Application

The approach we propose , it is possible to reduce man-hours by the sharing of functions implemented using the concept of SOA. Then , I will show below the specific concept . Part to use of smart sensors , such as device -specific developed as a native app to fit the different platforms to develop as a server - side application or Web application a common part of the other . Intersection herein also include logic in the enterprise system . Further , it is possible to reduce man-hours by the implementations and uses native application development environment for multi-platform . Implementation of the common part of the latter to use the tool , "Web application development of multi-platform " . By using the view that displays the Web page in the native app , Web page of the latter can be hiding the display of the URL, it can ensure the security in the BYOD. Further , it is possible to realize the Look & Feel integrated with the native apps together .

4 Application of the Proposed Method

We applied the proposed method to the development of the prototype system of the inventory management of the IT operations system. An existing IT operation system is that manages the asset of hardware and the software license. This system takes an inventory regularly by online and the person. This system for development is an additional function of this system, and the prototype system of the application to manage the inventory of hardware with a smart phone.

In this development, the firstly fixed requirement was the following.

(1)The application uses a feature function of a smart phone.

(2)The application makes the inventory faster and easier.

The condition of this development was following.

It was a commissioned business from the client, and the delivery date was six weeks.

4.1 Agile Development Process

The system development for which the client and the developer used a smart phone was an initial experience.

Fig. 3 shows the screen transition of this system.

Table 1 shows details of the implementation environment.

Table 2 shows the development result.

In this development, the entire development period was six weeks, six times iterations

The addition of the function and the correction occurred six times.

Using modeling tool is as follows. Here, the simplification was aimed at besides with whiteboard and card, etc. though use case scenario was made as a document. Other documentation used the whiteboard and the card and the simplification was attempted.

- Feature list
- Mind map
- Use case chart
- Use case scenario
- Class chart
- Component chart

Table 3 shows number of business processes, total components, common components and the recycling rate of a common component.

4.2 Efficiency of Smart Phone Application Development

Proposed approaches are as follows .

(1) Development Platform

Portion using a camera or the like is dependent on platform implemented in development environment platform , each implemented in the Web application is a common part that is platform independent . In addition , Web application part took the system to

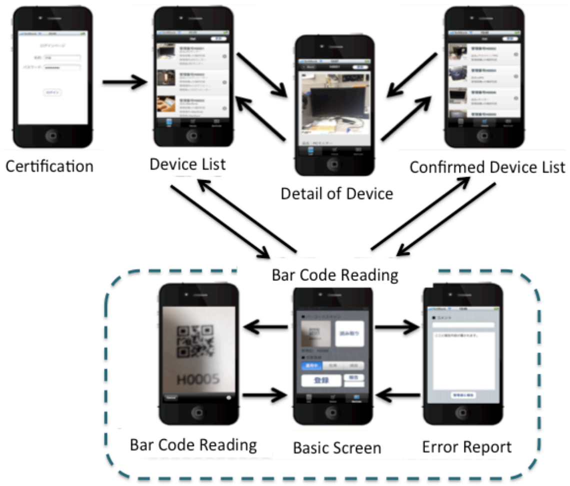


Fig. 3 Screen Transition of This System.

Table 1. Development Process.

	Client	Server
Hardware	iPhone 4S	Dell Power Edge
OS	iOS5	Cent OS
Development Environment	X Code 4.2	Apache/MySQL/PHP
Language	Objective-C	PHP/HTML5/Java Script

Table 2. Result of Development

Iteration	Preliminary Work or Development Function	Change	Development time(Week)
	Creation of an Environment for Development and Technology Investigation		2
1	Bar Code Reading	Modifed	1
2	Devices List	Modifed	1
3	Certification	Modifed	1
3	Confirmed Devices List	Added	
5	Report	Added	1
6	Selection of Device Condition	Added	
	Total	6	6

Table 3. Number of Business Processes, Components, and reusability.

Business Process	4
Compornents	11
Common Compornents	4
reusability	36%

display a Web page in the native app .

(2) multi-platform development

Part that depends on the platform using Titanium Mobile [13] as a native application development environment for multi-platform . Was a method in which parts that are platform independent in the same manner as in (1)is implemented by the Web application displays native app the Web application portion .

For the development of only native application development environment , reduction rate by sharing became a reduction rate of 32% , respectively , 52 %, respectively . For (1) , features a common moiety by Web is about 10% percentage of the total . On the other hand , (2), feature common part occupied in the whole is about 78% , feature common part by Web and Android / iOS common multi-platform development of the former 63% , respectively , and 14% effect is remarkable . I can be seen from above , there is a very effective development in the native application development environment for multi-platform .

4.3 Summary

The action of the change, the delivery date, and the efficiency improvement of development are as follows:

(1) Action of change

The addition and the correction occurred six times on the way. It was possible to deal flexibly by the addition of six components and the change in the business process.

(2) Efficiency improvement of delivery date and development

The system development ended before due date. Further, the sharing of functions implemented by introducing the concept of SOA, compared to the native application development platform for different, have contributed significantly to the development efficiency is a reduction of 50 percent from about 30 percent. Also, I think simplification of documents in agile development process also contributed to the efficiency of the development.

Therefore, we were able to develop the system that the client satisfied before due date by the proposal approach in spite of the requirement for the uncertainty. A further verification is necessary for large-scale system development. However, it is conclusive that this proposal method was able to show effectiveness in the development of the small system and the prototype system.

5 Conclusion

In this paper, concerning about enterprise system and smartphone application development to which the specification is not fixed, we suppressed the implementation cost by the approach that combines BPM, SOA and agile development, and to propose the design approach that secures customer satisfaction, offering the effectiveness of our proposal by the application experience.

This proposal approach was applied to the development of the prototype system in which effectiveness was shown.

The application experience must be increased in order to the improvement and the effectiveness of the problem will be pursued in the future.

References:

[1] Mathias Weske: “Business Process Management: Concepts, Languages, Architectures”, Springer Publishing Company (2010)

[2] Thomas Erl,: “Service-Oriented Architecture: Concepts, Technology and Design," PRENTICE HALL (2008)

[3] S. Latronico, F. Battista: “ How a business process vision may boost innovative ideas”, Transformation and Innovation (2007)

[4] Shinichi Kirikoshi, Mai Asai, Hiroshi Hamaguchi: ” Report of component base modeling for SOA”, Information Processing Society of Japan Research Report, IS-57, pp.35-42 (2007) (in Japanese)

[5] Hiroshi Hamaguchi, Keiji Fujii, Takuya Haraguchi, Shinichi Kirikoshi: “Structure of documents for component base modeling”, Information Processing Society of Japan Research Report, DD-53, pp.25-31 (2006) (in Japanese)

[6] MDA http://www.omg.org/mda/

[7] David S.Frankel , ” Model Driven Architecture: Applying MDA to Enterprise Computing (OMG)” , Wiley (2003)

[8] UML http://www.omg.org/spec/UML/

[9] Robert C. Martin: “Agile Software Development, Principles, Patterns, and Practices”, Pearson Education; International ed. (2011)

[10] Scott W. Ambler: “Agile Modeling: Effective Practices for eXtreme Programming and the Unified Process”, John Wiley & Sons. (2002)

[11] Palmer, S.R., & Felsing, J.M.: A Practical Guide to Feature-Driven Development. Prentice Hall, (2002)

[12] Scott W. Ambler, Mark Lines: “Disciplined Agile Delivery: A Practitioner's Guide to Agile Software Delivery in the Enterprise”, IBM Press (2012)

[13] http://www.appcelerator.com/platform

[14] L. Wenbin, G. Jinii, Y. Jiangeng, W. Wingfeng, A. Xin, Research on maintenance and safety-ensuring information platform in refining and chemical enterprises based on SOA, WSEAS TRANSACTIONS on SYSTEMS archive, Vol. 9 Issue 5, pp. 528-538, May 2010

[15] TUČEK, D., TUČKOVÁ, Z. IT and SW support of Business Process Change Management, In: Proceedings of the 5th WSEAS International Conference on Economy and Management Transformation, Vol.2, pp. 698- 703., 2010

[16] E. Corona, F. E. Pani, A Review of Lean-Kanban Approaches in the Software Development, WSEAS Transactions on Information Science & Applications, Vol. 10 Issue 1, pp. 1-13, Jan2013