Integration of Library Data on Reference Books: with Service Oriented Architecture Implementation methods and (ESB) Enterprise Service Bus

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Abstract— Libraries have an important role in mastering science and technology as well as a center for information activities. Currently, the library extends its services not only in hardcopy but also in softcopy and provides faster information retrieval capabilities. Service Oriented Architecture (SOA) provides better multi-platform integration through network infrastructure. This job is to implement SOA in a Library Information System based on Glassfish Enterprice Service Bus and MySQL database. The methods for implementing library application design using SOA and ESB are built using a business process approach with several stages (M. Weske, 2006). The application of the methodology to be implemented with SOA and ESB is built using a business process approach with the following stages: The first stage, map design for integration of library requirements, the second stage is service interface design, the third stage builds relationships between services combine services that have been previously created by interaction with other services. The fourth stage is determining the logic flow that will evaluate the service logic flow that has been created with existing business processes. The fifth stage builds scenarios for shared perceptions and refining existing processes. The results show that the design has faster search capabilities that match the needs of the library.

Keywords— Web Service, Integeration SOA, Reference Book.

I. INTRODUCTION

Library is an organization which provides book and literature circulation services for public, student, teacher, and researcher. Services provided by Librarians have important roles to satisfy user's need. Besides perfectly and fast, all library's services should maintain its service flow well documented, including shelves layout, book location, book catalog, linked books, references book, customer database, and so on. For library systems that developed using different platforms, data communication problems occurred. Web services provide communication data features to solve this problem.

Based on those explanation, we tried to develop library information system using Service Oriented Architecture (SOA) in order to utilize web services. We hope that this system may connected and integrated with other different library systems to provide wider scopes of services for public and customers.

SOA has been widely implemented for data processing, including garment company which implements SOA for its bussiness process, providing output for processes to be further automated by web services to determine basic price for each products [1]. SOA also been implemented by universities for their research information management. Information from the search engines were integrated with internal data from their library repositories using web services [2]. SOA web service also been implemented by university in Yogyakarta to improve its service effectiveness in library searching services based on academic information and

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employee management system and might be accessed using Android mobile phones [3].

A. *Business Process*

Main activity in the library is references searching. Reference is content or material which treated as benchmark that has two criterias: general benchmark and special benchmark. General benchmark means that those materials or content become a benchmark for wider topics, while special benchmark means that those materials or content become a benchmark for a specific topic. [4]

Based on those definitions, we need to understand basic activities on the business processes, which is integration of planned and coordinated specific activities for target achievement. Business process might be added and integrated with other simulations, verifications, and expansions of an activity using service oriented architecture that will provide wider perspective for the company or organization [5].
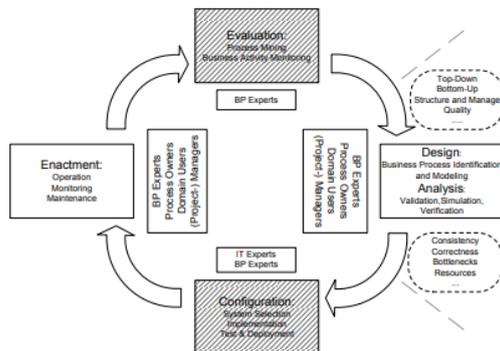

Figure 1. Cycle of Business Process [4]

Business process contains series of activities including input initiation, information transformation, and output producing. It means it needs analysis steps for each business processes to be identified, verified, and validated so main objective of the organization might be achieved through the business process. SOA is an application architecture which developed in the context of information system that implemented into services. This architecture was designed using perspective that system might provides specific service which combined with other services or conducts series of services based on the business processes. Services that

reflects logic automation models treated as small different units where the main service is distributed into separated units [6].
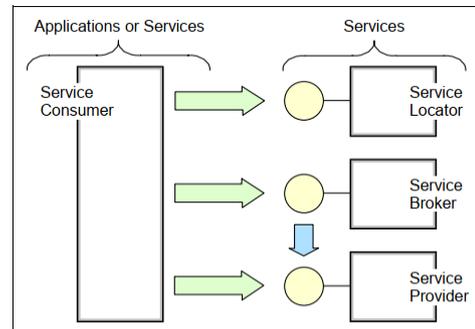

Figure 2. SOA terminology [7]

B. *Web Service*

Web service is a mechanism to provide data through computer network using eXtensible Markup Language (XML) which not depends on a specific operating system or computer programming language. The transmitted data called XML-Procedure Calls (XML-PRC) or Simple Object Access Protocol (SOAP) which forwards HTTP GET/POST messages as the data. Web service might be implemented as centralized service or decentralized service [8].

Enterprise Service Bus (ESB) is an infrastructure to integrates applications and services. ESB might reinforces SOA by reduces quantity, size, as well as interface and service complexity. ESB is used to connects several IT resources in an infrastructure. ESB should be flexible to integrates and reinstall components according to business process' changes. ESB integrates components and provides ability to integrates system into SOA and distributes it gradually.
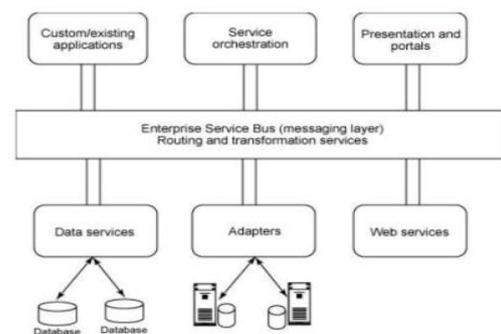

Figure 3 : Enterprise Service Bus (ESB) Infrastructure

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II. METHOD

This study is to implement library information system which designed using SOA and ESB that developed based on business process approach as follows: Step 1, designing a map for requirements integration which needed to describe whole business process. Step 2, designing the user interface.
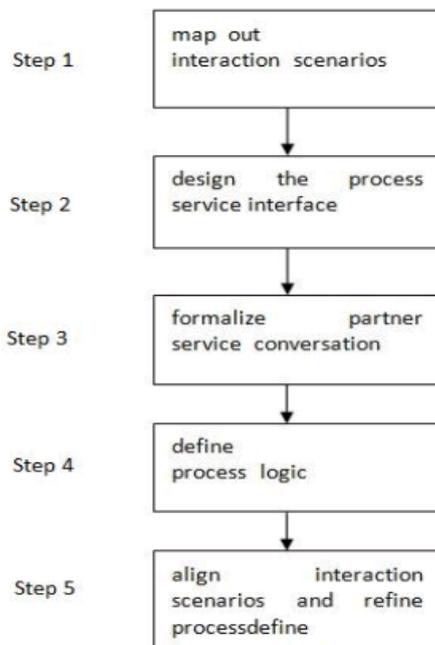

Figure 4. Steps of System Design [5]

Step 3, designing connection between services. Step 4, defining process logic between processes and services. Step 5, aligning all interaction scenarios and refine all business processes. In this study, we use MySQL, while all defined business processes constructed by interviews with librarians in Salatiga, Indonesia.

III. SYSTEM DESIGN

Problem that occurred in the library was there is no integration among services in library. Book searching only conducted in a library and there is no repository exchange between libraries that provide other repositories for the client or user. This study is trying to integrate all repositories and services, and the infrastructure design can be seen in figure 5.
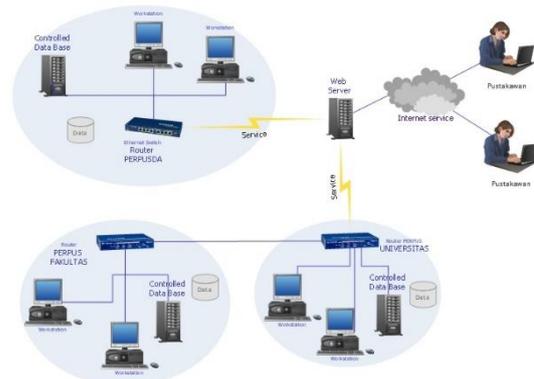

Figure 5. Design of Library Infrastructure

This infrastructure design implements data communication between regional library owned and managed by government and universities' libraries using Service Oriented Architecture (SOA) which allow each library provides all integrated and wider services to their client.

A. Book Searching Process

Business process is a stream of activities which contains of input initiation, information transformation, and output generation [9]. Main activities in the library information system are searching, borrowing and returning books. In this study, we tried to integrate all connected repositories from different institutions for searching service. Once a user search a book, it searches not only in the origin repository, but also in all connected repositories. Figure 6 shows how searching business process works.
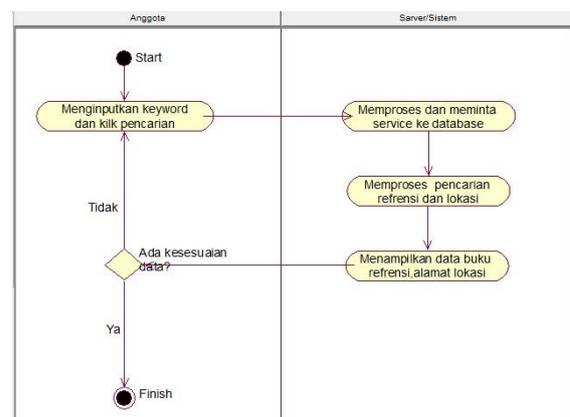

Figure 6. Book Searching Business Process

B. Architecture Design

Based on the design and steps, this library information system will implements web

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services. Each service requirements will be forwarded to activities to determine each process sequences [10]. In the step of SOA persentation, the interface design is conducted by using Web Services Description Language (WSDL). This service is developed in the abstraction step by combining all developed interaction services. The result will point the search based on linked book references in all connected repositories (figure 7).
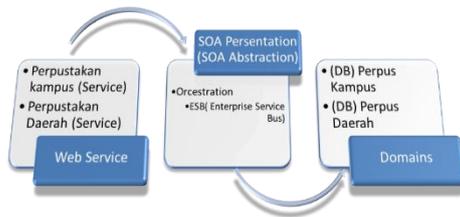

Figure 7. Design of Library Information System using WSDL

C. Use Case Diagram

The developed library information system figures out the functionality of the subjects (librarian and the client) called actors which interaction creates stream of events in activities such as book searching, book borrowing, and book returning. Use case diagram is a diagram which shows communication and interaction between actors or subjects. By using use case diagram, we can clearly see all interactions and communications among actors (figure 8) [11].
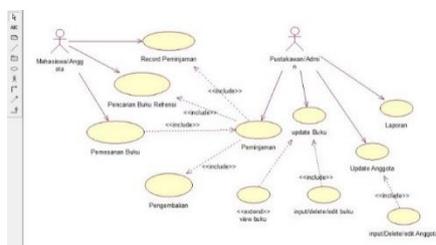

Figure 8. Use case diagram of the library information system

From the use case diagram, we can describe all roles of the actors. Table 1 shows all actors and their roles in the developed library information system.

Table 1. Actors of the library information system

Actor	Role
Library member	Book searching Book borrowing Book returning
Librarian	Serving all processes and inform the availability of the searched books and their locations

D. Activity Diagram

Activity diagram is a diagram which shows control flow between activities in the business process that been implemented in the application both in sequential or paralel forms [12]. In the activity diagram, all activities are mapped as seen in figure 9.
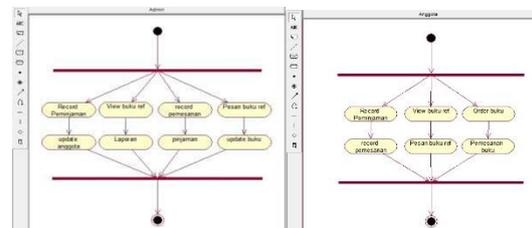

Figure 9. Activity diagram of the library information system

E. Class Diagram

Class diagram is a structure which describes all connections between classes in the sub system which is inheritance of the given definition. In the class diagram showed attributes or properties of the sub system which connects all events to manipulate a method, function, or operation [13]. In the class diagram we recognize the term of attribute, method, operation, package, class description, object, inheritance, containment, and association.
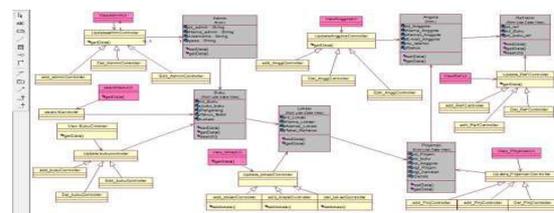

Figure 10. Class diagram of the library information system

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IV. RESULT AND DISCUSSION

In the phase of implementation, we developed web services to provide data communication channels for all business processes. These services were developed based on given parameters which used for all activities using Extensible Markup Language (XML). The XML packages will be received and shown by Simple Object Access Protocol (SOAP) [14] to response and request required elements. Figure 11 shows codes for book searching.

```
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
            targetNamespace="http://xml.netbeans.org/schema/LoanquoteSchema"
            xmlns:tns="http://xml.netbeans.org/schema/LoanquoteSchema"
            elementFormDefault="qualified">
    <xsd:complexType name="LoanQuoteInput">
        <xsd:sequence>
            <xsd:element name="LoanType" type="xsd:string"/>
            <xsd:element name="amount" type="xsd:double"/>
            <xsd:element name="period" type="xsd:int"/>
        </xsd:sequence>
    </xsd:complexType>
    <xsd:complexType name="LoanQuoteOutput">
        <xsd:sequence>
            <xsd:element name="description" type="xsd:string"/>
            <xsd:element name="MonthlyPayment" type="xsd:double"/>
        </xsd:sequence>
    </xsd:complexType>
    <xsd:element name="LoanQuoteRequest" type="tns:LoanQuoteInput"/>
    <xsd:element name="LoanQuoteResponse" type="tns:LoanQuoteOutput"/>
</xsd:schema>
```

Figure 11. Book searching codes

These services were implemented using Bussiness Process Execution Language (BPEL) with Glassfish Enterprise Service Bus (ESB) and MySQL relational database based on the defines business processes. In other words, the services were implemented using WSDL and sent by using SOAP in the form of WSDL encapsulated database.
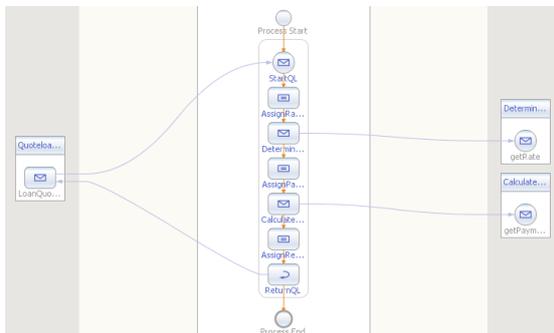

Figure 12. Design of BPEL flow

During the process, the Enterprise Service Bus (ESB) has been designed as composite applications [15], which means all parts of the application that use MySQL database were used to built a set application which contains different parameters [16]. Each parameter or sub system provides well defined description as seen in figure 13.
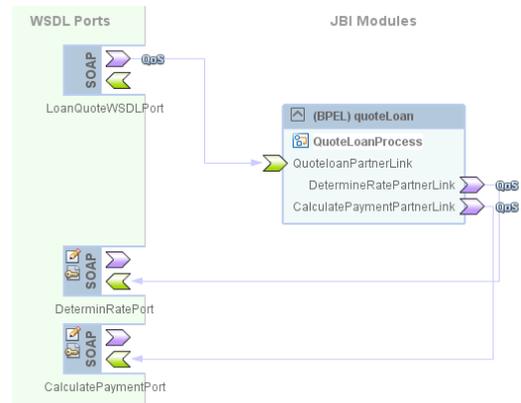

Figure 13. Design of the ESB composite application

Based on the implementation, we found that input processes by the librarian create composite test on the Enterprise Service Bus (ESB) where all parts might be constructed by input informations as a basis for reference book searching.
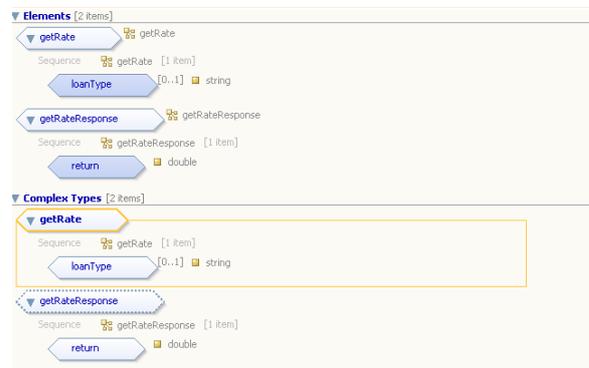

Figure 13. Test of the composite input

During the evaluation phase, several scenarios were tested, and we found that 1) All integrated services using OpenESB were ran well while generate BPEL and composite applications. 2) OpenESB integrated web services were found stable without rename the operation, input, and output reformating. We only need to recreate BPEL because OpenESB uses WSDL staticaly. 3) Designed main services and methods were ran well, which to show all information related to book searching using Ns: HMRequest and Get Info methods, while service to show all

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information related to book referencing using tns: Kref and Get Info methods.

V. CONCLUSION

The usage of Service Oriented Architecture (SOA) and Enterprise Service Bus (ESB) in the web service development may generate better performance during searching process using large database such as library repository. For future study, we recommend to implement in larger scale of libraries network to test and evaluate the designed architecture of this library information system.

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