

MODELING BUSINESS PROCESS AUTOMATION FOR CHECKING CERTIFICATE RETRIEVAL REQUIREMENTS USING SOMA METHOD

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ABSTRACT

Service-Oriented Architectures (SOAs) was founded as an Information and Technology strategy to meet business goals, so it can integrate various existing information systems in an organization especially in educational institutions. However, the main goal of this research is to design and analyze business process automation for checking certificate retrieval requirement using Service Oriented Modeling Architecture (SOMA) in the Faculty of Information and Technology Satya Wacana Christian University Salatiga, as well as confronting the business processes of checking certificate retrieval requirement before and after being integrated. As the result of this research, the benefits will be found from the services that are operating in the checking system of certificate retrieval requirement. At the time when systems were integrated each other, it could help the certificate retrieval management process, so that it can facilitate all related parties involved.

Keywords: *Information System, Integration, SOA, SOMA.*

1. INTRODUCTION

Information technology is used to improve the work performance and organization business processes. In optimizing the business processes of an organization, institutions utilize technology through making applications, where the applications are expected to be able to interact with each other and work together to fulfill these needs.

Information Systems is an important factor in educational institution. Satya Wacana Christian University has many information systems, it can be divided into several fields related on certificate retrieval management process such as Library Information System, Student Information System, Finance Information System, Laboratory Information System, Dormitory Information System and others. Every graduated student will fill out and complete the graduation registration form by taking care of the dependent to each part for graduation day and taking the certificate. Students take a long time because they have to go to each section to do the checking process. Each related part is located in a separate place and has a different system. The selection of case studies based on the number of Information Systems contained within the University, but there has been no integration between several Information Systems related to the business process of checking the certificate retrieval requirement. Related business processes are

Financial, Libraries, Dormitories, Student Services Section, Laboratory at Faculty and Study Program Information Systems. The lack of integration leads to many problems that arise in each of its parts as there is no coordination between each units in terms of checking the certificate retrieval. Therefore, it is important for integrating them using a SOMA method.

Activities and interactions can occur if there are interactions between several systems in an institution, which in its development uses Service Oriented Architecture (SOA). Service oriented architectures (SOA) and Web Services projects are typically undertaken to bring changes in processes to overcome problems associated with corporate data management, communicating and institutionalizing standards [1]. A current technological advance promising better reusability of software assets is provided by Service-Oriented Architectures (SOA). SOA is viewed as an abstract, business-driven approach decomposing software into loosely-coupled services enabling the reuse of existing software assets for rapidly changing business needs [9].

Service Oriented Modeling and Architecture (SOMA) include three incremental and iterative phases identifying, specifying and implementing services. In the first place, SOMA is designed to develop SOAs from scratch and does

not provide support for integrating legacy assets [4]. Through this research, the concept of a Service Oriented Architecture (SOA) methodology which will be implemented is Service-Oriented Modeling and Architecture (SOMA). SOA can bridge one platform with another one through an information system [1]. In a study titled "Model-Driven Software Migration", described the techniques carried out to bring problems into the SOA environment and one of the methods used is Service Oriented Modeling and Architecture (SOMA) [8].

Research entitled "Analysis and Design Techniques for Service-Oriented Development and Integration", it describes the analysis and design techniques for Service-Oriented Development and Integration. In addition, this journal also recommends using Service-Oriented Modeling and Architecture (SOMA) for its service model [5]. Research conducted by Hamdan, et. Al (2012) associated with SOA, which in this research explained that using the SOA applications are involved with some emergency systems that can be integrated. [2]

This research will apply Service-Oriented Modeling and Architecture (SOMA) method for modeling business process automation for checking certificate retrieval requirement at Satya Wacana Christian University (SWCU), Salatiga. Based on the problems aloft, the formulation of the problem in this study is how Modeling Business Process Automation of checking certificate retrieval requirements using SOMA Method so that it can facilitate all parties concerned.

2. LITERATURE REVIEW

2.1 Service Oriented Business Process Design

Service Oriented Architecture (SOA) is model of software engineering which integrated with business process in an information system, formed as a module of standardized components and can be reused by other business processes [5][6][10]. SOA is a framework that integrates business processes and supports safe IT infrastructure, standardized components (services) that can be reused, and included in changing business priorities [5]. Several key aspects in the SOA principle are: [7]

- Loose coupling, which is services that reinforce a relationship that minimizes dependence and they only need to maintain awareness between each other.
- Service contract, services are attached to a communications agreement, which is defined

collectively by one or more related service descriptions.

- Abstraction, all services that are described in a services contract, services hide logic from the outside world.
- Reusability, logic is divided to become services with the purpose of being reused.
- Composability, compiling the services that can be coordinated and collected to form different services.

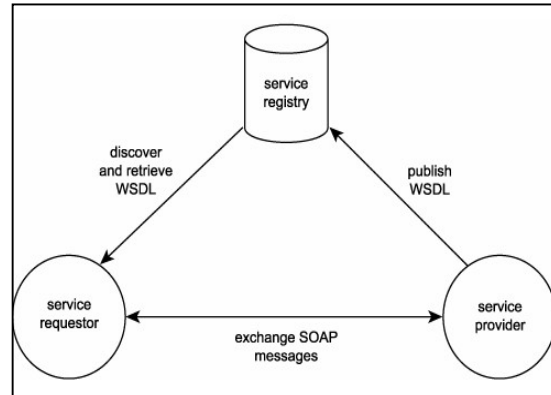


Figure 1: Early SOA Structure [7]

Figure 1 is an image of the SOA architecture was introduced early. SOA has 3 major important parts of the service requestor, the service provider, and the service registry. Between the service registry and the service provider is connected to the Web Service Definition Language (WSDL) which is a tool to define the services provided. While the connector between the services provider with service requestor is Simple Object Access Protocol (SOAP), which is the standard for sending messages from both services. In the service registry and service requestor there is Universal Description Discovery and Integration (UDDI) which is service registry standardization [7].

SOA can become a middle layer between business logic and application logic [7]. This shows that each service which is added does not affect existing parts, because the service is only put in between the two parts. This can be seen in Figure 2, which reveals that service is in the middle layer and does not get in another part because it is only a bridge to deliver between parts. Besides that, it can be seen that the service provided can be utilized by several platforms.

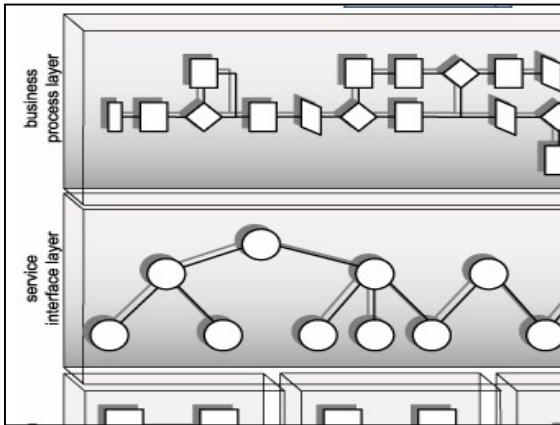


Figure 2: Service Architecture SOA [10]

Figure 2, according to Thomas Erl, service is divided into sections, but its scope is varied. Every service handles a process in the business process to the sub-process. It was done to facilitate the addition of new systems without having to alter the existing business process or architecture. Thomas Erl spells out the steps of constructing a service oriented business process design [7]. In addition based on Figure 2 show a service layer is divided into small parts that will serve certain problems. Therefore, every service has a specific function, but between one service and another service there is still a connection. This is like a principle from SOA which divides services into smaller parts to handle various problems.

2.2 Service-Oriented Modeling and Architecture (SOMA)

Service-Oriented Modeling and Architecture (SOMA) is a model and design method to model from a business model to an IT model using SOA [11]. SOMA method is an IBM offering that defines the three service modeling steps *identification*, *specification*, and *realization*. These steps consist of several sub-steps prescribing several artifacts to be delivered and recommending appropriate techniques (Figure 3).[3]

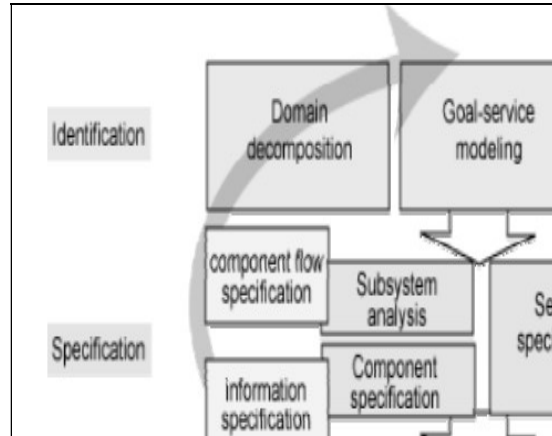


Figure 3: Identification, Specification, and Realization Service with SOMA [3].

SOMA identification can start both from business models via domain decomposition, which includes functional area analysis and process decomposition, and from existing systems. An additional goal-service modeling technique ties business goals, for example expressed as Key Performance Indicators (KPIs) to the identified service abstractions, facilitating runtime monitoring of business goals (a key business performance and service management issue).

The SOMA steps are present in an iterative and incremental fashion. During service specification, the artifacts comprising an SOA are formally defined, for instance composite and atomic services, as well as components implementing them along with their interfaces. Collectively, these specifications form the *service model*, a key SOMA deliverable that covers service invocation syntax and semantics, as well as operational and other cross-cutting concerns such as service ownership, dependencies, versioning, and governance issues. Realization of services and components is business-as-usual from an application architect standpoint, at least to a large extent; well-established tools and techniques such as patterns, for example IBM Patterns for e-business, can be used. [12]

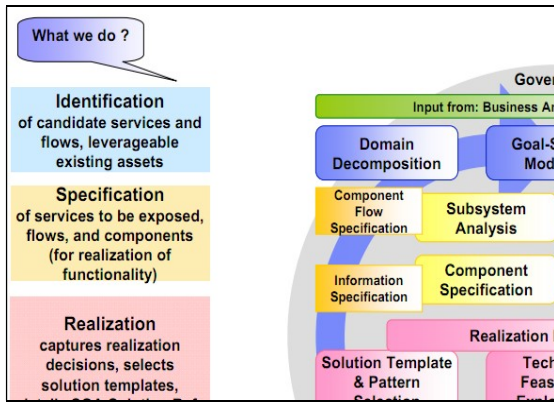


Figure 4: SOMA Method [11].

The explanation of SOMA method on Figure 4:

- Identification
The first process that is done in the SOMA method stage is identifying the problem that will be researched
- Specification
In this stage it will find the service and component specification that will used in system.
- Realization
In this stage, it starts to choose the solution that will be used, explaining about the details from Service Oriented Architecture which will be used in building the system
- Implementation
At this stage begin to do the implementation, monitoring, and deployment process.

3. ANALYSIS AND DESIGNING USING SOMA METHOD

In this study will be used one of the concept of SOA methodology is SOMA method. SOMA method is a model and design method to model from business model to IT model using SOA. This is in line with the case study because in the business process of checking the completeness of the certificate retrieval at SWCU, there are 6 (six) related units such as the faculty, dormitory, library, BIKEM, finance, and laboratory sections. Each unit has clear or distinct duties and responsibilities, therefore it is necessary to be integrated using the SOMA method. There are 3 (three) steps in applying SOMA method identification, realization, and specification process. The steps in the SOMA method are easier to understand than implementing SOA directly. Accordingly, SOMA method is used to bring case studies to the SOA environment.

Every unit that associated with the business process checks the completion of certificate retrieval requirements at SWCU, some of which already have their own system and databases such as in finance using SIKASA with MySQL database, whereas the library uses Oracle database therefore SOMA method is chosen to solve this problem because SOMA method not related to a particular technology, but rather toward approaches to software design that is more flexible and efficient.

3.1 Identification

The first process in the Service-Oriented Modeling and Architecture (SOMA) method step is to identify the problem to be studied. Modeling business processes automation for checking certificate retrieval is the problem that will be examined in this research. The problem environment that will be worked on is to fulfill organizational needs, supporting units that are related with the certificate retrieval management business process that will be built. The identification process is describe with Unified Modeling Language using use case diagrams for every unit that is related with the certificate retrieval management business process.

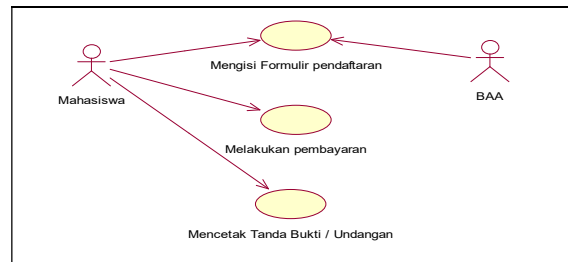


Figure 5: Use Case Diagram of Student Graduation Registration

Figure 5 shows Use Case Diagram of Student Graduation Registration, students fill out the registration form and complete the requirements for graduation and then returned to BAA again. Other student activities are making graduation payments and printing evidence or invitations.

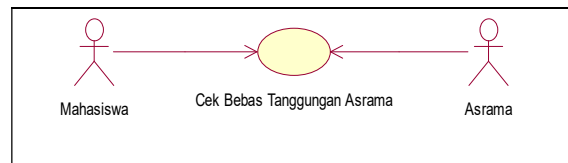


Figure 6: Use Case Diagram of Free Check The Dependents of Student on Dormitory.

Figure 6 describe Use Case Diagram Free Check Student Dependents on Dormitory, students complete the graduation requirements are free check dependent on dormitories checked by the head of the dorm.



Figure 7: Use Case Diagram of Free Check the Dependents of Student on Library.

Figure 7 describe Use Case Diagram of Free Check the Dependents of Student on Library, students complete the graduation requirements are free check dependent on libraries that are checked by the library administration.

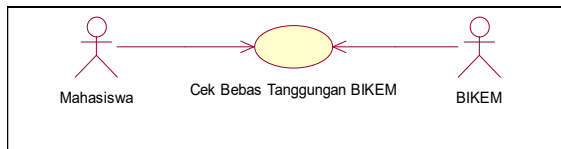


Figure 8: Use Case Diagram of Free Check the Dependents of Student on Student Affairs section (BIKEM).

In Figure 8, Use Case Diagram of Free Check the Dependents of Student on Student Affairs section, students complete the graduation requirement that is free check dependent on Student Affairs section which is checked by administration of Student Affairs Department.

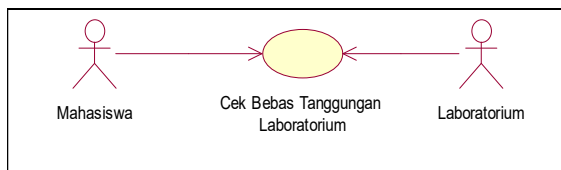


Figure 9: Use Case Diagram of Free Check the Dependents of Student on Laboratory

Figure 9 describe Use Case Diagram of Free Check the Dependents of Student on Laboratory, students complete the graduation requirement that is free check dependent on the laboratory checked by the laboratory administration.

In the identification stage, results are obtained in the form of the checking certificate retrieval requirement business process design that took place in the Information and Technology Faculty of SWCU after integrated. This can be seen in Figure 10.

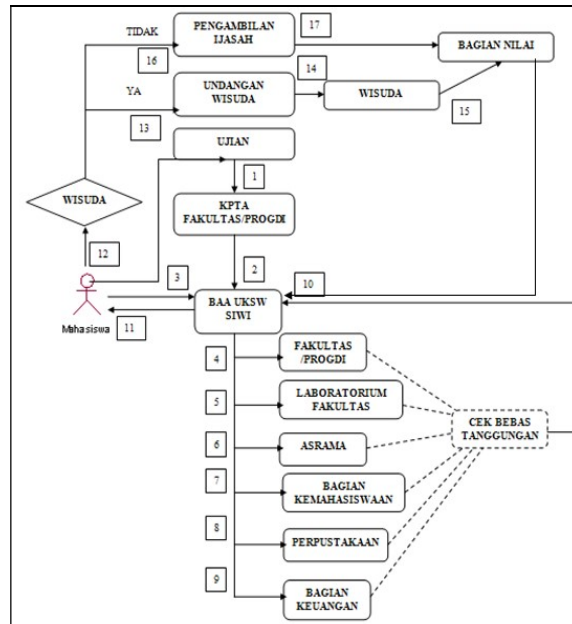


Figure 10: SWCU Information and Technology Faculty Checking Certificate Retrieval Requirement Business Process Design (Integrated)

Figure 10 explains about the Checking Certificate Retrieval Requirement Business Process Design with the system that has already been integrated. The explanation is as follows:

- First, Students who have done the exam will be listed in the list of students who have graduated, if not graduated then the student must re-exam.
- Section KP / TA faculty or exam committee every faculty entering the name of the student who has passed the graduation into Information System Graduation (SIWI).
- Students who have graduated must registration for graduation day in BAA as well as collect the required graduation requirements.
- Graduation Information System (SIWI) will automatically send a list of students who have passed the faculty to each unit related to the graduation business process to check the dependency of each student ie Finance, Dormitory, Laboratory, Library, and BIKEM which can be seen in stage four until the ninth stage.
- After checking the data of each unit will be returned again to SIWI so that it can be known that the student is already dependent or not.
- BAA will convey to the student concerned, when stated OK, then the student can do the graduation as in step thirteen, the student gets graduation invitation, then get the certificate, if not follow the graduation as in stage sixteen,

then the student get proof of certificate retrieval taking that can be taken in the value section.

- If otherwise NOT OK, it means the student has to take care of each section to confirm further, and complete the existing requirements.

3.2 Specification

In this specification stage, service specifications are found that will be used in every business unit that is bound with the checking certificate retrieval requirements business process according to the use case diagram UML, which was made in the identification stage. In this stage also explaining the path that take place in each part using UML, which is an activity diagram.

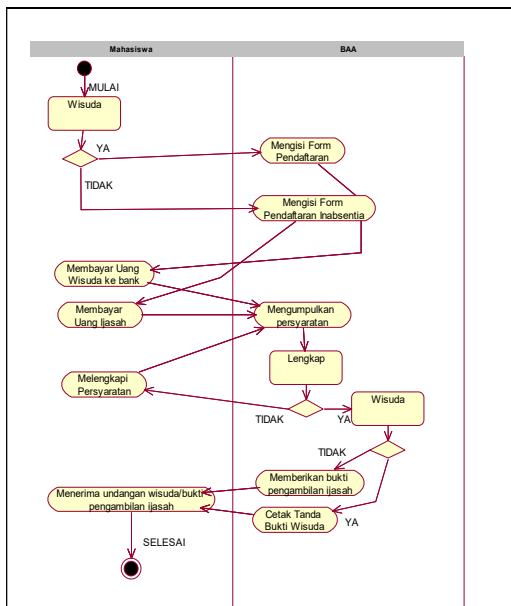


Figure 11: Activity Diagram of Student Graduation Registration

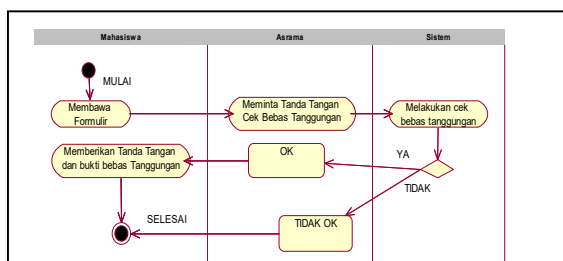


Figure 12: Activity Diagram of Free Check the Dependents of Student on Dormitory.

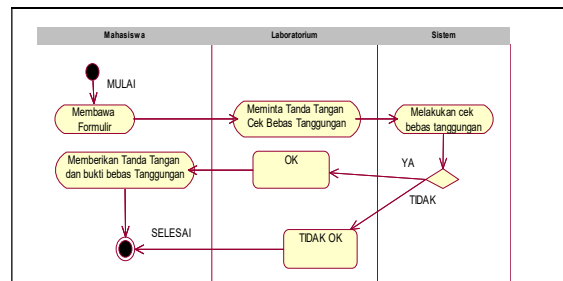


Figure 13: Activity Diagram of Free Check the Dependents of Student on Laboratory.

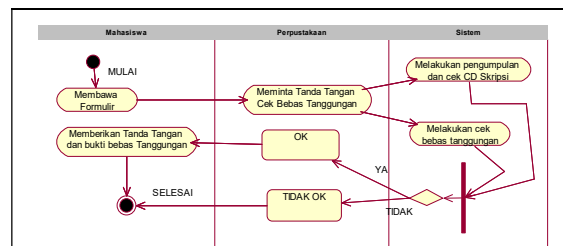


Figure 14: Activity Diagram of Free Check the Dependents of Student on Library.

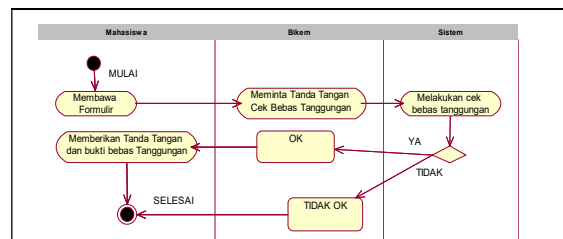


Figure 15: Activity Diagram of Free Check the Dependents of Student on BIKEM

Figure 11, 12, 13, 14, 15 show activity diagram of Free Check the Dependents of Student on to every party concerned for checking the certificate retrieval requirement management. Related business processes are Financial, Libraries, Dormitories, Student Services Section (BIKEM), Laboratory at Faculty and Study Program Information Systems.

3.3 Realization

In realization stage, it starts to choose the solution that will be used, clarify about the specification from SOA which will be used in construction of the system.

3.3.1 Service Oriented Analysis

This stage is an early stage, where it can determine the potential scope from SOA, the service field that is mapped, and the individual services modeled as service candidates that include things related with SOA. A modeling service process which is in the form of steps service modeling process is provided as a part that will be

illustrated in the service-oriented analytical phase. Table 1 shows the service candidates.

Table 1: Mapping the Business Process to the Candidate

NO	BUSINESS PROCESS	SERVICE CANDIDATE
1.	Student Graduation Registration	- Service Asrama - Service Perpustakaan - Service Laboratorium - Service BIKEM - Service Keuangan
2.	Free Student Dependents Check To Dormitory	- Service CekDataAsrama - Service GetDataAsrama - Service Asrama
3.	Free Student Dependents Check To Laboratory	- Service GetDataLaboratorium - Service CekDataLaboratorium - Service Laboratorium
4.	Free Student Dependents Check To Library	- Service GetDataPerpustakaan - Service CekDataPerpustakaan - Service Perpustakaan
5.	Free Student Dependents Check To BIKEM	- Service GetDataBIKEM - Service BIKEM - Service CekDataBIKEM
6.	Free Student Dependents Check To Finance	- Service GetDataKeuangan - Service Keuangan - Service CekDataKeuangan

Based on the considerations in the previous step of establishing the service context, it was decided that legacy systems in Satya Wacana Christian University (SWCU) to the SOA environment should be adopted using the SOMA methodology, this also done based on various strong arguments. There is a clear mapping between business processes and service candidates, as seen

in Table 1.

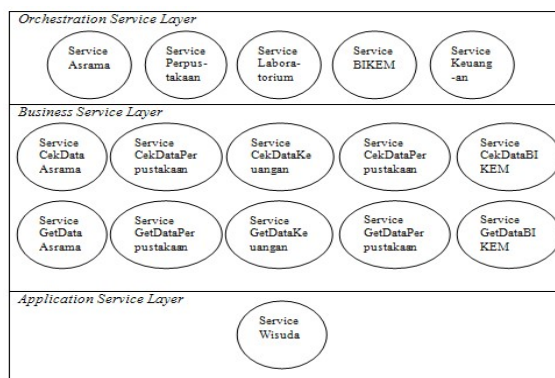


Figure 16 : Service Candidate

Figure 16 is a sixteen service candidates obtained from the previous identification process.

4. ARCHITECTURAL DESIGN

One of the ways used to implement SOMA method is web service. Web services are an appropriate technology to integrate the data. Therefore in this research using web service for its implementation. The architectural design of the graduation system to be constructed can be seen in Figure 17.

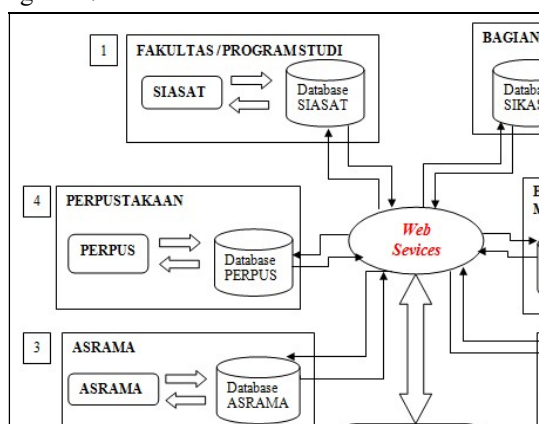


Figure 17: Architectural Design

Figure 17 is a description of the architecture to be created. There are 6 (six) units related to the business process of checking the completion of certificate retrieval which will be integrated, as follows:

1. Faculty Section, there is no application to send student data that has been passed to BAA.
2. Finance section using SIKASA application that is application to check student finance.
3. Library, there is an application to check the obligations of students in the library.
4. Student Services section, there is no application in this section for free check dependent student service.

5. Dormitory, there is no application in this section for free check of student dependents on dormitory use.

6. Faculty Laboratory, there is no application in this section for free check of dependents of students to the laboratory.

The graduation application will be used to analyze the data. The five units will be linked using a web service for data exchange, making it easier for all parties associated with the business process to check the completion of the certificate retrieval.

5. IMPLEMENTATION

4.1.1 Graduation Information System (SIWI)

Graduation Information System (SIWI) is a system integrated with other systems related to the business process of checking the completeness of the certificate retrieval. SIWI is used by the BAA department to handle the problem of checking the completion of the certificate retrieval.

The data is obtained from the graduation data of each faculty entered by the faculty TA (Final Thesis) department. As a discussion will be taken graduates data sample from Faculty of Information Technology. The initial view of Graduation Information System (SIWI) website can be seen in Figure 18.

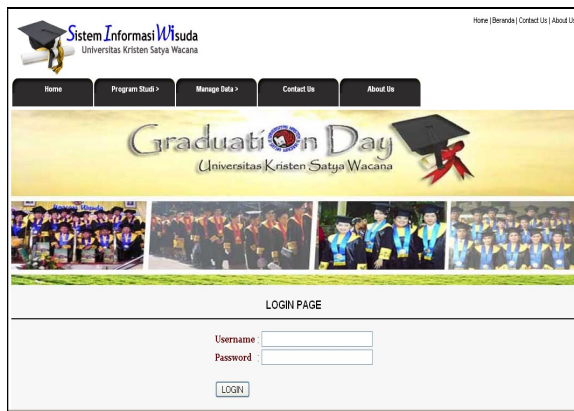


Figure 18: Graduation Information System (SIWI)

Graduation data entered by section TA (Final Thesis) department Faculty of Information Technology into SIWI then stored in database of SIWI. Student data that has been done doing graduation process then will be sent to every unit that is included in the graduation business process by using web service. Implementation of web service on SIWI can be seen in Figure 19.

```
require_once('nusoap/nusoap.php');
$server = new soap_server;
$server->register('getDataWisudaLab');
$server->register('getDataWisudaAsrama');
$server->register('getDataWisudaKeuangan');
$server->register('getDataWisudaPerpus');
$server->register('getDataWisudaBikem');
$http_raw_post_data = isset($_HTTP_RAW_POST_DATA) ? $_HTTP_RAW_POST_DATA : '';
$server->service($_HTTP_RAW_POST_DATA);
```

Figure 19: Web Service Implementation (SIWI)

SIWI get the data of students who have been checked by calling the web service that has been provided by each unit associated with the business process of checking the completeness of the certificate retrieval SIBIKEM web service callings can be seen in Figure 20.

```
require_once('nusoap/nusoap.php');
$client = new soapclient('http://localhost/BIKEM/ServerBikem.php');
$data = $client->call('getDataWisudaBikem');
```

Figure 20: Web Service SIBIKEM.

Figure 20 is a SIBIKEM web service call in the form of student data already checked.



Figure 21: BIKEM Information System

Figure 21 show the initial view of BIKEM Information System website can be seen in Figure 21. BIKEM Information System (SIBIKEM) is used to handle all activities related to section of student affairs.

```
require_once('nusoap/nusoap.php');
$client = new soapclient('http://localhost/PERPUSTAKAAN/ServerPerpus.php');
$data = $client->call('getDataWisudaPerpus');
```

Figure 22: Web Service SIPERPUS.

Figure 22 is a SIPERPUS web service call in the form of student data already checked by system. The initial view of : Library Information System (SIPERPUS) website can be seen in Figure 23.

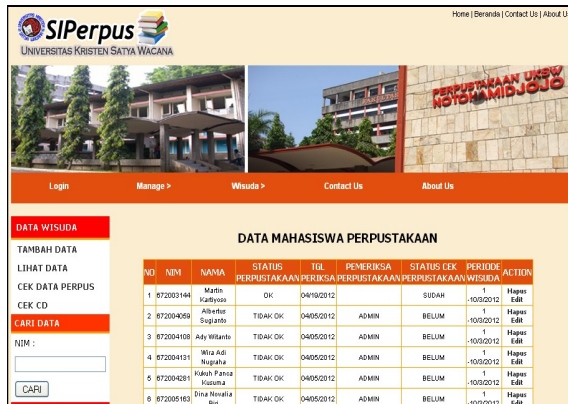


Figure 23: Library Information System (SIPERPUS).

Figure 23 describe Library Information System (SIPERPUS) is used to handle all library related activities.

All student data already checked by each unit related to the graduation is returned to SIWI, then the result is OK or NOT OK status on student dependent check in each unit can be seen in Figure 24.

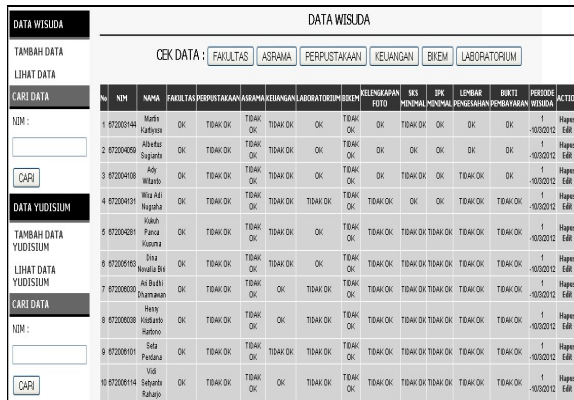


Figure 24: Student Data Already Checked.

Figure 24 is the Graduation Information System (SIWI) display for student data already checked, when the student status is OK, the student is entitled to a graduation invitation for those who attend the graduation or get proof of certificate for those who do not follow the graduation.

4.1.2 Analysis and Discussion

Based on the research outputs, a system design is obtained confront with the elderly system. In Table 2, the certificate retrieval requirement system design uses Service-Oriented Modeling and Architecture (SOMA) in a more flexible way compared with the previous system. This makes it possible to check the certificate retrieval requirement automatically.

Table 2 : Certificate Retrieval Checking Business Process Before and After Being Integrated (Students)

NO	Business Process Checng Certificate Retrieval Requirement SWCU	
	Before Integration	After Integration
1.	Students perform the exam if the pass is included in the graduation student data if it does not mean re-exam	Students performing the exam if the pass is included in the data of the judicial student if not, it means retesting
2.	Students come to BAA take the form and confirm the graduation or not.	Students come to BAA to confirm graduation or not and collect other supporting conditions.
3.	Students make graduation payments if they will attend the graduation ceremony, if not they must pay student administration of certificate retrieval.	Students make graduation payments if they will attend the graduation ceremony, if not they must pay student administration of certificate retrieval.
4.	Students go to ASRAMA for dependent check. If declared dependent, it will be given a signature as evidence of dependent. If not the student must complete the duties that exist in the dormitory until declared free dependents.	Graduation Information System (SIWI) will check automatically.
5.	Students go to FINANCIAL for dependent checks. If declared dependent, it will be given a signature as evidence of dependent. If not the student must complete the existing obligations in the finance until declared free dependents.	If it has been declared OK, Students get a graduation invitation for those who follow the graduation if not then it will be given proof of certificate.
6.	Students go to LABORATORY for free check dependents. If declared dependent, it	

	will be given a signature as evidence of dependent. If not students must complete the obligations in the laboratory to be declared dependent.	
7	Students go to LIBRARY for dependent checks. If declared dependent, it will be given a signature as evidence of dependent. If not students must complete the obligations in the library until it is declared free of dependents.	
8.	Students go to BIKEM for dependent check. If declared dependent, it will be given a signature as evidence of dependent. If not the student must complete the obligations in BIKEM until it is declared free of dependents.	
9.	Students come back to BAA to collect forms and other supporting terms.	
10.	If declared complete, then the Students get a graduation invitation for those who follow the graduation if not then will be given proof of certificate.	

into the SOA environment is not its execution but the service specification owned by the system to be integrated, with the existence of clear service specification, the integration of the system will become more manageable because the complexity can be simplified

The SOMA method is not related to a particular technology, but more towards the approach to software design is more flexible. Therefore it supports the integration of some systems that have different databases, programming languages or different platforms. The results of analysis in the process of integrating the system could not be done in a decentralized unit only because it is connected with authorization which is very important. Checks should still be made in each unit associated with the business process of checking the completion of the certificate retrieval requirement.

The business process of checking the completeness of certificate retrieval taking at SWCU before it is integrated requires a lot of time due to the many processes that need to be done, while the business process of checking the completion of the certificate retrieval after being integrated is much faster and easier when viewed from the user side is the students. In terms of TA (Final Thesis) department, BAA, Dormitory, Finance, Library, BIKEM, and Laboratory simply access the system that has been provided and check automatically because the system has been integrated with each other to facilitate each unit associated with the graduation business process. In the business process checking the completeness of certificate retrieval taking before and after integrated service standard for each user involved compared to before integrate.

6. CONCLUSION

Based on the experiments that have been done, it can be concluded that the business process automation modeling of the completeness of the Satya Wacana Christian University (SWCU) certificate retrieval can be done using the Service-Oriented Modeling and Architecture (SOMA) method. In the process of integrating the system could not be done decentralized in one unit only because it deals with the authorization which is very prominent. Checks should still be made in each unit associated with the business process of checking the completion of the certificate retrieval requirement.

SOMA method simplify and facilitate the process of system integration, the significant thing that must be considered in integrating the system

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