

System Integration Model Based on Open Source Software (Oss)

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Abstract: Application system is an important component to support business organizations. Information, communication and information technology have made developing business becomes very competitive. It is very crucial for companies to have fast and accurate access to mission-critical business information in order to maintain its competitiveness. The ability to establish network connections between the existing systems becomes a must in order to optimize the use of critical information. To realize this, the implementation of system integration looks promising. However, system integration process is not an easy task because it involves variety of systems with different organizations backgrounds. The main objective of this paper is to propose an integration model that is generic and easily adapted by many organizations. The Information Management Division, Public Sector Department in Malaysia is chosen as a case study. The systems used in this department will be analyzed and problems faced will be identified. Research methodology conducted includes the Analysis Phase, Design Phase, Development Phase and Testing Phase. In order to support the proposed model, prototype called myIntegration is implemented based on OpenSyncro. OpenSyncro is an open source software (OSS) meant for Enterprise Application Integration (EAI). The Testing Phase was carried out by taking into account the actual test scenario involving the Department A (owner of the Malaysian Personal Record) and Department B (Human Resources Manager of Malaysian Civil Servants). Tests conducted have shown that the exchange of information between the Department A and B have been successfully realized. The finding from this research, where a new integration model has been created, can be referred by any government or private organizations in developing their systems integration facilities. The model also besides reducing the requirement of hardware; also reduces the dependency to proprietary products. In addition, the prototype developed, which based on OpenSyncro is capable in providing an alternative solution to the IT community to anchor any systems integration project at a lower cost and in a user friendly environment.

Keywords: system integration, middleware solution, integration model, open source software, Enterprise Application Integration (EAI)

1. Introduction

System integration refers to the construction of linkages among computer systems and databases (Markus 2000). System integration is necessary as organizations often have to add more functionality into the organization Information Systems (IS) portfolio, which frequently entails dealing with indispensable legacy systems. In order to support the business process during the development of information systems, most officers and IT staff put less emphasis on issues of integration and interoperability between systems. This integration issues have been addressed by Malaysian Administrative Modernization and Management Planning Unit (MAMPU) as the most important body in the development of Malaysian e-Government Applications. This issue is important to ensure the continuity of successful implementation of various systems integration in the near the future (Khairuddin, 2010). Several issues need to be addressed seriously before any attempts being made in integrating various systems. Among the issues are incompatible operating systems, different usage of data scheme, mapping methods, network stability and costing. According to Braue (2002), in average most organization allocate around 40% of their total IT budget to ease system integration. This may explain why agencies or even commercialized organizations which put less emphasis on the system integration aspect will face the risk of failure in their businesses. Our review on several studies suggests that research on system integration requirements modeling has been scarce; among those studies conducted, a significant number of them only focus on data integration (Schmitt and Saake, 2005). However every organization have unique business process and infra structure. Therefore, before proposing suitable integration model and selecting appropriate implementation solutions, a holistic and clear understanding of the enterprise-wide integration requirements among various internal and external systems is needed. In this study, the Information Management Division (IMD), Public Sector Department in Malaysia is chosen as a case study. The systems used in this division will be analyzed and problems faced will be identified. Therefore the main objective of this paper is to propose an integration model that is generic enough and easily adapted by other public organizations

in Malaysia. The paper is organized as follow: Section 2 will discuss the three system integration methods, section 3 reveals the issues related to integration system. In section 4 reports the analysis of the existing integration tool used at Information Management Division (IMD). While in section 5 states the various type of integration software. In section 6 discuss the design of proposed system integration model and the testing of this model is reported in section 7. Section 8 concludes the paper and proposal for future works.

2. Integration system method

According to Hohpe & Woolf (2003), integration system method can be implemented in four different ways: file transfer, shared database, remote procedure invocation, and messaging.

File Transfer: This method refers to the process of file or document movement from one system to another system through network and supported by File Transfer Protocol (FTP). This method allows the sharing of documents or materials among government sector. As an example, one department able to upload documents at their website and interested user can download the documents at the other side. The concept of uploading and downloading documents from government department has promotes the existence of efficient and effective electronic application. This process will increase accessibility of the documents through uploading and downloading without the users have to go to the department to get particular documents.

Shared Database: This method allows the system to integrate multiple information from various applications into centralized database. However the database schema needs to be analyzed earlier since most of the applications are developed separately and have different schema. Hohpe & Woolf (2003) states that integration process will be a lot easier with this method since it is able to adapt the SQL database features. The access to centralized database by different applications will limit the semantic dissonance problem. The challenge to this method is to construct a single database that has the same schema and definition, because normally the system is developed by different vendors and will have different needs, function and technology. Many organizations now have used a standard schema and data definition to increase the interoperability among application. For instance, Malaysian Administrative Modernization and Management Planning Unit (MAMPU) has introduced a standard reference called National Data Dictionary (NDD) to be used for system development that involved the used of schema and data dictionary.

Remote Procedure Invocation/Call: This method used encapsulation principal in the integration process between systems. If an application requires data from other application, it will request the related data from the particular system. If the data are going to be modified later it will be done on the data that involve with that application only, whereas the original data remain the same. The data integrity will be secured. However Hohpe & Wolfe (2003) states that this method has problems with accessibility and stability.

Messaging: Most organizations and government agencies have more than one application to support their business functions. However, these applications are being developed by different vendors, with different programming languages and platforms. Therefore it is very crucial for the organization to share the information between applications in a very responsive way (Hohpe & Woolf, 2003). Messaging method seems promising to provide a solution to this problem. Messaging means all integrated applications are connected through the same messaging system, so that the data can be sent and received among the applications. According to Hohpe & Woolf (2003), this method will make the integration process easier, faster, and reliable.

3. Integration issues

In developing an integrated system there are several issues that need to be considered, such as the technology, human resource and policies (Ellison, 2005). **Technology:** the existing technology being used in the organization made the integration process possible. However the challenges that need to be considered are the unpredictability of network stability, which is one of the most critical factors in ensuring the success of system integration initiative. In addition, the different used of data schemas might slow down the integration process where the data need to go through the mapping phase in order to get a common schema. **Human Resource:** The attitude of the end user gives a big impact to the success of any ICT projects. Zaiton et. al (2000) report this phenomena has been one of the important deciding factors in project successes in Malaysia. Among the identified problem coming from the end users is computer-phobia phenomenon among some of the senior staffs, who are lack of

knowledge on the importance of system integration, change of duty and etc. **Organization Policies:** System integration project initiative normally requires efficient communication between two or more systems in the same or different organization. Therefore, the change of policies in any organization will affect the implementation of system integration. The changes normally tried to improve the quality of services, the delivery of service and the staff. Therefore the proposed system integration needs to consider these three issues during the development.

4. Analysis on current system

Before a new integration system is proposed, analysis was conducted on the current integration tool used at the Information Management Department. This department involved in the development of Human Resource Management Information System (HRMIS) Integration Interface. Analysis is done through reviewing related document such the integration document agreement between the human resource systems with other legacy systems, interviewing current employees, browsing the department website, and etc. HRMIS is an application system for managing information on human resource for public sector. To make the system more comprehensive it needs to integrate with 27 legacy systems from various government sectors. Among those are the National Registration Department, Putrajaya Hospital, Selangor State Development Corporation, and others. These 27 systems are connected through a server called iHub. This server is an integration tool that developed based on MS Biztalk and SQL2000. There are six functions of iHub, which are: accessing data from the source system, sending data to the target system, data mapping or data transfer process, data compressing or decompressing, data encryption or decryption, and saving the log transaction for data integration. To execute these six processes, one unit of iHub needs to be installed between two legacy systems. When the process of integration is needed, iHub at the HRMIS side will signal the other legacy system (target system) by sending a message and the request. When the target system received the message, it will response towards the request and replied back to HRMIS application. The sending and receiving process appeared as a batch or real time processing. This process is described in Figure 1.

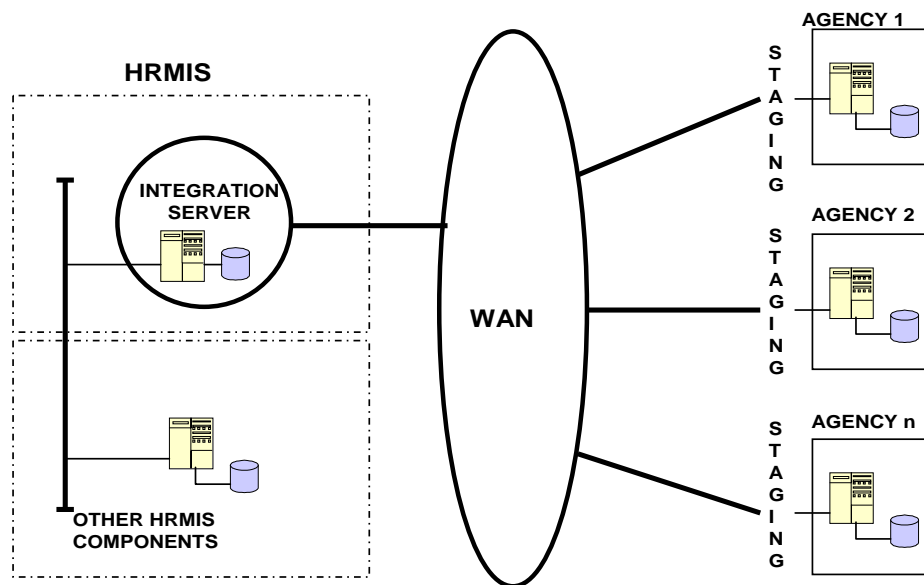


Figure 1: The integration of HRMIS with other legacy systems

Although iHub has been successfully implemented in the integration of HRMIS with other legacy systems, Information System Department believes there are rooms for improvement. Among the identified issues are high development and maintenance cost, and lots of equipments and hardware required. A study is done to propose a new solution or mechanism as an alternative solution to this problem. The study found that there is a possibility to use open source software to replace the proprietary software being used in order to reduce the cost.

5. Integration tools

To develop a system integration tool: we can choose whether to use proprietary software or open source software (OSS). OpenAdaptor is an integration tool that based on OSS with Java/XML technology. This tool is efficient for fast development since less programming is required as it comes

with lots of embedded functions. OpenAdaptor is known for its friendliness in implementing the integration processes. OpenSyncro, another open source based integration tool is developed by Smilehouse Research and Development. It is a very light software application that based on Java platform and uses Apache Tomcat as the application server with MySQL as the database. Both of these tools are free. At the Public Service Department in Malaysia, an integration tool called iHub which was development by local company is being used. This tool is able to integrate human resource application with 27 existing legacy systems. However this tool requires two unit of iHub for every two integration systems to increase the communication. Therefore to integrate 27 systems, 27 units of iHub are needed! This will increase the cost and the maintenance activity as well. The intention of this study is to reduce the dependency to proprietary software. This will lead to reducing the cost of development and maintenance. This study intends to investigate the possibility of using integration tools that based on OSS. Simple investigation is done on OpenAdaptor and OpenSyncro, and as the result, the latter has been chosen at the end. The main justifications for the selection are based on its plug and play features, and the ease of programming burden.

6. The design of the proposed integration system: myIntegration

OpenSyncro which is an open source software was used in the development of the propose model. This software has generic and open feature, therefore the proposed model is design according to these features. The elements that need to be considered during the design for the integration model are the transaction type, integration approach, and transaction method.

- **Transaction Type:** The design of integration system is highly depending on the type of transaction chosen. There are two types of transactions, which are request/response and notification. Request/response transaction requires back and forth communication between the integrated systems. Therefore, an accessed to the integrated system is needed (Grants.Gov, 2007). However, notification transaction only sends data from one system to another system without requires any answers.
- **Integration Approach:** The choice of integration approach also affects the integration design. There are two integration approaches. They are either integration based on files or integration based on real data. Integration based on files refers to the used of text or XML file in the process of sending and receiving data between the integrated system. Integration based on real data means the real data that exist in the database is used for the integration and the table is predetermined at the earlier stage.
- **Transaction Processing Method:** Two transaction methods which will affect the design of the integration model are batch processing and real-time processing. Batch processing normally refers to non critical transaction and requires a support from scheduler component to execute or monitor the transaction processing. This transaction is normally done outside the prime hours. Real-time processing is a critical transaction and requires fast and urgent accessed to the system. HRMIS integration with the Putrajaya Hospital requires this type of transaction method. A support from equipment that can monitor the system and the network status is really required.

OpenSyncro offer the features that are able to integrate various systems by transferring data from source system to target system (and vice versa) through the concept of piping. This piping has three main components: source component (SC), destination component (DC), and converter component (CC). The components are described as below:

- **Source Component (SC):** This component saves the configuration information on the data access of the source system. There are thirteen embedded source component which are provided by Smilehouse. The developer can choose any one of these source components and make necessary adjustment according to the scope and integration development requirement. Among the components are: Directory Source (accessing data directly from the file and folder), FTP Source (accessing data source using FTP), HTTP Source (accessing data source using HTTP), and etc.
- **Destination Component (DC):** This component will identify the destination of data. Smilehouse has provides ten embedded destination components to be used by the developer. Among those are JDBC Destination (directly send the data to Java database), HTTP Destination (directly send the data to destination using HTTP, and etc.
- **Converter component (CC):** This component allows any changes on data format to be done during the process of sending and receiving. This component is important to overcome the complexity that may exist between two systems that are going to be integrated, such as the used

of different data format. Smilehouse has also provides thirteen converter component templates to be used and adjusted accordingly to suit the development requirements. Among the components available are ASCII-to-XML converter (to change the ASCII format to XML format) and many others.

Figure 2 shows the proposed integration model called myIntegration. This model shows an integration process between Department A and Department B. As a prototype, myIntegration is able to do these three functions: sending data to target system, receiving data from target system, and saving the transaction log during data integration process.

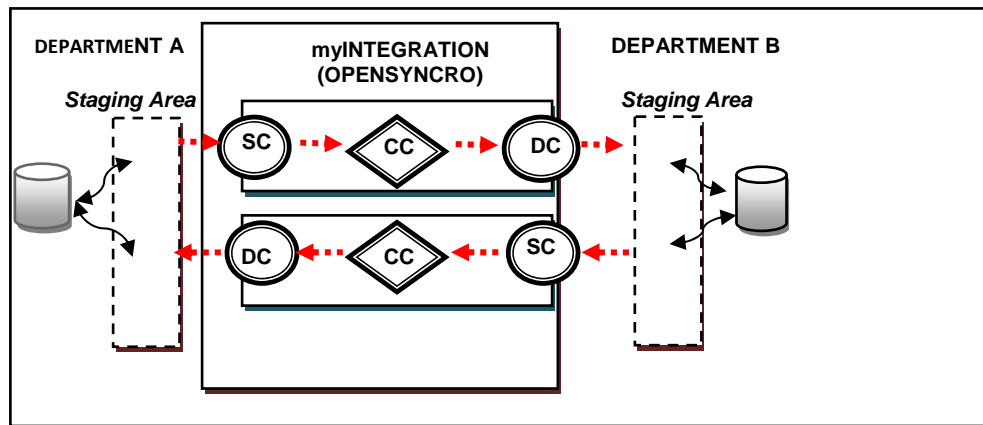


Figure 2: Integration system model: myIntegration

MyIntegration consists of eight modules to support the integration process, which are users, components, pipe list, pipe editor, pipe setting, component editor, transfer log and pipe execution queue. This tool has eight embedded database table to ease the integration process development between the systems.

7. Testing

As a prototype myIntegration is tested on its capabilities to send and receive data, and to modify the data that being transferred. Therefore, the objectives for myIntegration testing are:

- To test whether data from source system can be read and transferred to target system and vice versa,
- To test whether the integrated data are able to be modified
- To check whether myIntegration is capable enough to be an alternative solution to the existing integration system at Information Management Department.

The activities that were carried out during the testing of myIntegration are:

- Integration Testing – component testing, accessibility testing
- Pre-User Acceptance Testing – testing that involve the staff at IMD
- User Acceptance Testing – testing that involve with the subject matter expert, system owner and the end user.

The Testing Phase was carried out by taking into account the actual test scenario involving the Department A (owner of the Malaysian Personal Record) and Department B (Human Resources Manager of Malaysian Civil Servants). Various testing is done to myIntegration as reported in Table 1 and the results obtained from those testing.

Tests conducted have shown that the exchange of information between the Department A and B have been successfully realized. Even though myIntegration had failed in three testing as shown in Table 1, Integration System Sector at Information Management Department (IMD) identifies that these function are not critical. Therefore, the result obtained at the end of the testing phase indicates that the listed objectives above are achieved. In future, it is hoped that myIntegration can be seen as a solution to the system integration problems faced by IMD.

Table 1: The testing criteria

	Testing Criteria	Result	Priority
1	Send data electronically	Pass	Very high
2	Receive data electronically	Pass	Very high
3	Change the data file format from text to XML or vice versa	Pass	Very high
4	Data compression and decompress	Fail	Low
5	Data encryption and decryption	Fail	Low
6	Transaction Integration Report	Pass	Very high
7	Transaction Scheduling	Fail	Very high

8. Conclusion

The main focus of this study is to propose a new system integration model for BPMJPA. An integration tool called myIntegration is build to support the proposed model. Compared with the existing proprietary system integration model, iHub, myIntegration is based on OpenSyncro which is free software. With the generic features and free software application, the developed tool is easily adaptable by any organization who plans to integrate their system. In addition, the tool developed which based on OpenSyncro is capable in providing an alternative solution to the IT community to anchor any systems integration project at a lower cost and user friendly environment. However as a prototype, the developed integration transaction function for myIntegration only deals with temporary folders. Integration process that directly link to the database is not allowed for security reasons. Therefore as a future extension, a new model for system integration that is able to link directly to the database is really needed. The finding from this research, where a new integration model has been created, can be referred by any government or private organizations in developing their systems integration facilities.

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