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Message Oriented Middleware for Library's Metadata Exchange

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Abstract

Library is one of the important tools in the development of science to store various intellectual properties. Currently most libraries are managed by standalone systems and are not equipped with data exchange facilities with other libraries for sharing information. Sharing of information between libraries can be done with integration metadata owned library. In this research, the integration architecture of metadata exchange is done with Message Oriented Middleware (MOM) technology. This MOM redeems the collection metadata that matches the standard Dublin Core format. In this research, database structure, MOM structure and set of rules to perform data sharing process. With the proposed MOM architectural design is expected to search process information between libraries will become easier and cheaper.

Keywords: *metadata, dublin core, integration, message oriented middleware*

1. Introduction

Library is a place to manage the collection of intellectual property. It requires good management in order to provide maximum benefits for the development of science. Good management can be done by applying information technology in all of the library transaction process. The development of information technology encourages the management of conventionally library transaction process develop into modern libraries. Modern libraries manage their business processes using computer technology [1], so its governance will be more accurate and the process more efficient and efficient. It will help search of library information by library readers much more easily and quickly.

So far most of modern libraries manage their library collections through the website and add search facilities to make it easier for readers who want to know what collection they have. The currently library collection search system only allows searchers to search the library collection list on the web of each library. This condition causes the search of intellectual property collection cannot be made simultaneously to many libraries, so it takes a long time to get a collection of libraries from various libraries at once. Shorten search time can be done by sharing metadata collection of books owned to be used in conjunction with other libraries.

Metadata is data about data used to find, classify, or explain data structures [2]. Metadata describes the characteristics of a data about the content and quality of data written with the same structure. Metadata also can be used to indicate the location of library's collection documents so that metadata can be used as a source of information exchange. The benefits of metadata are confirmed by [3] that metadata can be used to filter information because through metadata cross reference data sharing becomes easier. Other studies [4] said that metadata contains a summary of information about data that is important to classify and categorize data so the process of searching data or related new information can be done more quickly.

To quickly search metadata collections, metadata must be stored with the same data format standard. The obstacle is metadata often written in different formats. There are several standard metadata formats [2] such as: AACR2 / RDA, CCO, LCNAF, LCSH, MeSH, AAT, DC, MODS, MARC21, VRA Core, MARC 21 (ISO 2709), MARCXML, Dublin Core / RDF, or Dublin Core/XML. [5] Presented a literature review that the arrangement of metadata through a web-based system, performed with MARC, Dublin Core, MODS. While [1] states the exchange of library metadata via the Internet can be done with Z 39.50 and Dublin Core. [1], [5] declare

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Dublin Core can be used as standard library metadata. This means, Dublin Core can be a sharing information standard between modern libraries.

Sharing information can be done by utilizing system integration technology. This is reinforced by [6] which states that the sharing of data between various systems can be combined with system integration. System integration makes data exchange and communication between systems can occur despite involving systems with different technical structures and different implementations [7, 8] Asserted that system integration is cheap because it not required a new infrastructure implementation, in this research data exchange is done through a database by API technology.

Various studies on metadata usage and system integration have been done. In [4] metadata is used for forensic analysis of digital data to find correlations between files based on given parameters. In [3] developed a system that shares files with open archives and OAI-PMH technology with the Dublin metadata conversion system. [9] Discusses the techniques of designing, developing, applying and exchanging metadata of statistical data using the SDMX format to support interoperability data via web services. [10] Studied exchanging Dublin Core metadata through system integration for plagiarism detection with a website portal that provides document collections. [11] Studied data exchange uses the Message Oriented Middleware (MOM) mechanism through the Yahoo messenger application. [12] Uses Dublin core and OAI-PMH to archive student's FTI UNISSULA thesis files. Research [13] introduced the application of Dublin Core Application Profile for Analysis Patterns (DC2AP) to find out the metadata profile so that a pattern of relationship analysis of data can be found in a metadata.

Based on some previous research that has been stated above, in this research we will do metadata sharing use system integration technology so the searching of intellectual collection of several library websites can be done at once. In this research, system integration is designed Message Oriented Middleware (MOM) technology using commercial messaging service for metadata exchange in accordance with standard Dublin Core format. It is expected that with this architecture, the process of searching metadata collection information between libraries becomes easier and faster.

2. Research Method

This research is using System Development Life Cycle (SDLC) development methodology. The SDLC method divides complex work into simpler stages. [14] There are many models of system development concept ie Waterfall model, Iterative model, V-shaped model, Spiral model, Extreme programming, Iterative and Incremental Method, Rapid prototyping model and Big Bang Model with each of its advantages and disadvantages [15]. In this study selected waterfall model which is a classical software engineering model. This model ensures system development through needs analysis, new system design, coding implementation, and maintenance. This waterfall method ensures the lack of each stage before it is developed to the next stage. Waterfall methodology makes the design more detailed and easy to understand [15]. This research performs steps are analysis of system requirements, process analysis, database modeling and modeling the set of rules of the MOM, then implement it so that the prototype is obtained. The resulting prototype is tested to be sure the process of in teradata exchange between integrated libraries can occur. The step steps in this method are illustrated as in Figure 1.

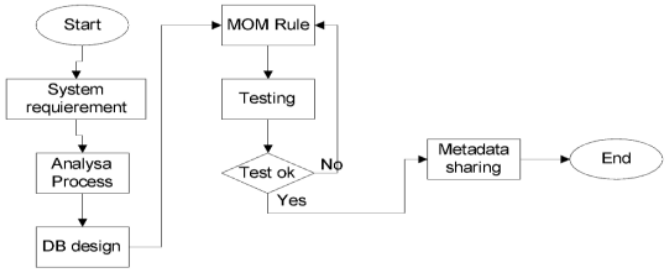

Figure 1. Methodology system

3. Results and Analysis

3.1. Theoretical Background

3.1.1. Library

Library is a place to provide collection of library materials such as magazines, books, research results and various sources of literature to be studied and used as material development of knowledge. Library needs good management. Library management done with catalogues. It is categorizing collection of library materials so the management can be managing easier [2]. Based on the cataloging and collection way, there are several types of libraries such as ancient libraries, traditional libraries, semi-modern library, modern library of digital libraries, virtual libraries/virtual. Nowadays most of the library management is help by computers but most of the collections are printed books. Printed books make file sharing to be more difficult to do. It causes emerging digital library technology that suppresses the ownership of the collection in digital files. Digital libraries cover two fields, first is the process of digitizing collections and the second is library digitizing business processes to facilitate user access [1]. Library digitization is necessary because manual management causes the library cannot serve its readers maximally either from the accuracy of the collection lending record, the speed of library collection search, and the guarantee of copyright security. The automation process in digital library makes governance, information provision and library's services produce high accuracy information [2].

3.1.2. System Integration

Information availability is very important for an organization, but often organization does not pay attention to the system that will be the information source. Usually organizations have variety platforms information systems. It makes it difficult to provide comprehensive data about the organization this situation can be overcome by integrating all of available data provider information system. System integration is the process of connecting various types of information systems in order to exchange data. Integration process becomes difficult because it has to connect multiple systems with different technology and design system requirements. Integration can occur through data storage media, middleware, applications, interfaces, and even integrate manually. There are many technologies of integration methods in computerized systems such as Common Object Request Broker Architecture (CORBA) technology, Common Object Model (COM) Service Oriented Architecture (SOA), Extensible Markup Language (XML) [7]. In some cases data integration requires database synchronization. Database synchronization is a two-way automated process for adjusting data between integrated databases. Several methods have been used using audit log [6] and binary log [16]. Database synchronization is used to synchronize data across multiple databases stored in different server locations that are why it is necessary to copying data regularly or directly in every time changes occur in the related database [17].

3.1.3. Metadata

Metadata is data about data. It is used to find, classify, or explain the structure of a data [2]. Metadata is information collection for managing files in a database. Metadata serves to identify information sources, group similar information, provide specific file information, and even provide a function of the location of the data source; this makes it easier for information seekers to get detailed information.

Detailed information from various sources requires a standard of writing for information seekers to view data in the same way. There are many metadata standards. There are several standard metadata formats such as: AACR2 / RDA, CCO, LCNAF, LCSH, MeSH, AAT, DC, MODS, MARC21, VRA Core, MARC 21 (ISO 2709), MARCXML, Dublin Core/RDF, or Dublin Core / XML. This standard is aimed at particular interests as well as interdisciplinary standards, such as library science, education, arrangement of archives, arts and other things [2]. Several types of standards for representing the structure of metadata data include Dublin Core, FGDC, SNI Metadata, and ISO 19115 [3]. Each metadata standard will define the elements that are the content rules to find data about the stored data. This rule allows drawing of information resources from data for identification and retrieval of information, documenting the source of information for file management, and knowing the relationship between objects and other objects to create new objects. Metadata is stored in databases connected to the data source.

3.1.4. Dublin Core

Dublin Core is a metadata scheme for library metadata exchange through internet media. This standard arises because MARC as the previous standard design is very difficult to implement on the web system. Dublin prepared not only for library cataloging, but also for the layman and applicable to all disciplines. Dublin can be detected by robots or spiders on web systems as it is embedded with web page systems [18]. Dublin Core consists of 15 basic elements named after a simple name in one word. Naming them are Title, Creator, Subject, Description, Publisher, Contributor, Date, Type, Format, Identifier, Source, Language, Relation, Coverage, Rights. Dublin standards is flexible, it is allowing the addition and subtraction of elements to be displayed in metadata [3].

3.1.5. Message Oriented Middleware (MOM)

Middleware is liaison application software provided outside the operating system software components. Middleware can bring together different platforms of network, hardware, operating system and programming languages, as well as their combination. Middleware allows between applications to communicate even though both run on different platforms. The migration of mainframe-based server applications to client / server application can also be done with middleware [8].

One of the middleware services is Message Oriented Middleware (MOM). MOM is a mechanism of data exchange between applications as alternative message exchange architecture. MOM is like a postal service that has various messaging capabilities, including point-to-point message model, message subscription spread, message selection, messaging and message delivery once or many times according to the rules given to the MOM rule [11].

3.2. Systems Result

3.2.1. System's Architecture

Business process in each library website runs as usual. The integrated library only needs to configure a new database on the existing database. Existing system business process result will be synchronized to data collection table with the standard Dublin format. The sync result will be the source for library metadata exchange. Integrated library needs to configure the existing system database by adding tables to support the set of MOM's rules. Implemented MOM in every library website will run set of rules to perform metadata searching both in internal existing system and library partner. Messages search and the results will be exchanged over the internet. This process is illustrated in the system architecture as shown in Figure 2.

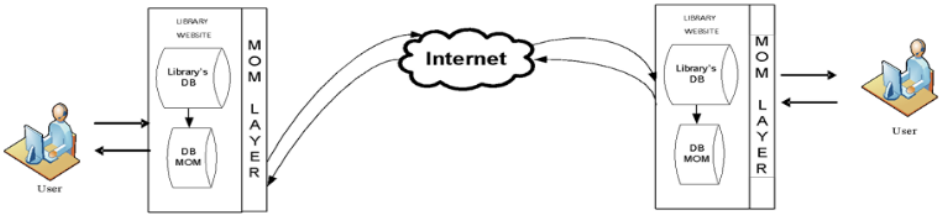

Figure 2. System architecture

3.2.2. MOM's Architecture

The designed MOM consists of 4 parts including Application Programming Interfaces (APIs), Metadata, Query builders, and layer Connectors services. Application Programming Interfaces (API) is used to exchange messages. In this study the used MOM's application is a commercial existing application, so it is not necessary to create a new program. Metadata created metadata will show the structure and location of the file from the table in the library database that has been successfully collected by MOM application. Query builder is a machine that has function to query or search data that has been received by service layer. Service layer is MOM's part which is provide data search services to metadata based on keywords provided in MOM database designed. It is need a new table structure that contains a list of services that refer to information in accordance with Dublin Core standards. Next the service list and query

builder will process the user request results. Connector is a middleware as a database link that is used to connect database with the application. This connector will connect the application with DBMS. DBMS that can be used are Access, MySQL. Connectors that can be used to connected to the other application, such as ADO, BDE, DBExpress, ODBC, or JDBC. The MOM designed is as shown in Figure 3.

3.3. Requirement Analysis

To perform the metadata search process, the information seeker will be active on one of the existing integrated library websites. Through the search application, a collection finder will input search criteria and location where the desired metadata search. First, the sought search criteria are keyword that is store in master service table. Second, the inputted data is one of the library names that are integrated which has store in library table.

The set of MOM's rules will matched the inputted data and determine whether the collection search is performed on only one partner or all of integrated libraries. In addition, the set of rules also works to check the search source position whether it is for internal database or partner library's database. If the choices data is only against one criteria or one partner, then the process will be directly directed by the set of MOM rules to the intended partner. Where as if the option entered is all of the criteria or all positions the looping search process will be done on all list partners and all services on the available metadata.

All of user search data entered by will be stored in the request list. MOM where the search originated will send the request list to the MOM destination library. The MOM in destination library then matched the search criteria on the list of submitted requests with the appropriate Dublin-based synchronization table in that library's database. The matching results will be saved into the search results table and then the set of MOM's rules will send back the request result to the requester via the search website. Data search results will display in website that activated searcher. This series of processes is shown through the flowchart as shown in Figure 4.

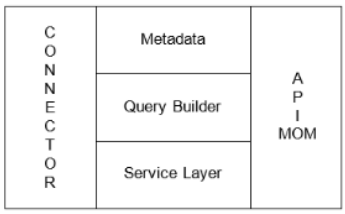

Figure 3. MOM architecture

Figure 4. Flowchart process

3.4. Database Design

3.4.1. The Design Database on the MOM Layer

The database in each integrated library requires a new database structure design so the set of MOM rules can use to share metadata. The structure database design is done by configuring the tables in the integrated library application system database. The new table's results of this configuration are table to accommodate requests submitted by users or searchers

of information, and MOM's processed results that will be sent back to the information seeker. It takes several new tables based on the process flow in the flowchart Figure 4. First is prepared temporary table according to Dublin standards which is store the result of synchronization process from tables on the existing system. And second is the library's metadata that will be set up multiple tables to record the search query collection and the results.

The MOM database consists of 6 tables. Table Dublin, which is a table with a universally applicable data exchange format. All data collection from each library will be sent to this table by the result of one-way synchronization process performed DB Sync of all related tables in the existing database. Service table, will accommodates user request data requests and records the location of the service request sender. This request should be written in the keyword format in the service table. Position table is used to record the master data position of the user request. Result table is used to contain the results of search result requests that have been done by MOM applications. Partner Table, is to store data integrated library partner. Service table is used to collect the list of services that will be provided by the MOM application rule. List service accommodates keywords used to search fields in accordance with the format of Dublin to the destination database in accordance with the format in the metadata. The Metadata database consists of 2 tables. First Library_Metadata table, it is used to store a collection of table names from an integrated library system. Second, Metadata_librarydetail, it used to store the metadata detail of library collection. The required table is illustrated in Physical Data Model Design on the picture of relationships in the integrated library database as shown in Figure 5.

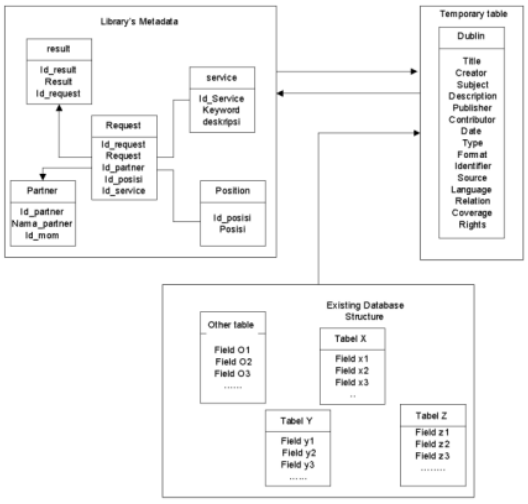

Figure 5. Physical data model layout

3.5. Application Testing

Users who are searching library collection information will access a library website. The user entered the desired search criteria in search of library collections through the website. This search criterion is done by selecting the contents of the keyword service field and the position of the metadata location partner searched through the combo box provided on the search form. Users can search for certain criteria and positions or search for all criteria or positions. Users searching library collection information will access a library website. The user included the desired search criteria in search of library collections through the website. This search criterion is done by selecting the keyword service field and the position of the metadata location partner searched through the combo box provided on the search form. Users can search for certain criteria and positions or search for all criteria or positions. Users can select only one criteria and search position or can select the all option which means that the process of searching will be done in all database partner against all keyword criteria.

4. Conclusion

Integration of different library information systems platform can be done using Message Oriented Middleware (MOM) technology. Implementing the MOM can be done by modifying the existing system database structure and configuring the MOM design throughout the integrated system. The configuration of MOM design architecture in this research consists of API, library metadata, query builder, service and database connector. It is expected that the architecture in this study can be used as a reference in the process of sharing the metadata collection information owned by the integrated libraries in order to better service quality to library users.

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