A Database Integrated System Based on SOAP Web Service

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Abstract **– An academic scientific digital data collection management (i.e., lecturers, researchers and students) in all educational institution, including Universitas Mulawarman, is very necessary. The purpose of digital data is to guarantee availability in a long term and the dissemination of scientific work data. However, data collection from various source publications (i.e., e-journals, e-theses, e-book etc.), are needed to be integrated into a repository system. In this paper has been presented a database integration model from a collection of publications or e-journals such as journals and proceedings into the repository system. A web service integration model has been implemented with Simple Object Access Protocol (SOAP) services, Web Service Definition Language (WSDL), Universal Description, Discovery, and Integration (UDDI), and NuSOAP (SOAP written in PHP language library). The results of this study indicated that the database of e-journals and proceedings on http://e-journals.unmul.ac.id is capable to be integrated into the repository system http://repository.unmul.ac.id which is an open access system.**

Keywords **– Web service, SOAP, WSDL, UDDI, NuSOAP, repository, e-journals.**

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1. Introduction

Since, the existence of the Director General of Higher Education Regulation, Ministry of Research, Technology and Higher Education, Republic of Indonesia No. 152/E/T/2012 relating to the requirement to publish scientific papers for graduates (bachelor, master and doctoral) degrees, so it is expected that Indonesian publications will increase. Therefore, several strengthening programs are launched, including publication of scientific papers within the globally indexed e.g., Scopus and Web of Science, increasing the quantity of journals, and collecting scientific papers throughout Indonesia.

According to the Directorate General of Research and Development Strengthening, Ministry of Research, Technology and Higher Education, Republic of Indonesia stated that Indonesian scientific publications indexed by Scopus as of April 6, 2018 were 5,125. It is also supported by 37 journals indexed Scopus and 1,682 journals indexed national accredited. In fact, the number of journals required by Indonesian academics is around 7.817 journals [1]. Afterwards, the next program is to document digital scientific papers [2]. This aims at ensuring the availability of authentic and reliable and also dynamic archives [3].

In this paper, a digital scientific papers collection storage is universities concern. Therefore, well-organized and digitally-based scientific papers storage, called institutional repositories (IR), is required for every University [4]. Researcher [5] also confirmed that IR was an important part of infrastructure in delivering the results of researchers' dissemination. Therefore, the IR as a storage for scientific papers has developed to (a) provide infrastructure for preservation of digital content; (b) reduce obstacles to document distribution; (c) create a centralized digital storefront for research, teaching, and knowledge; and (d) facilitate wider distribution. Moreover, [7], [8] stated that the IR benefits also include (a) expanding the scope of knowledge sharing; (b) increasing information investment and content management systems (CMS); and the availability of more flexible ways to communicate knowledge. The researchers agreed that technology

plays an important role in delivering the results of researchers' dissemination.

Furthermore, a strategy in developing IR is very necessary thus the scientific papers collection can be maximized. The availability of good collections also plays a role in increasing the visibility, prestige, access and diversity of knowledge of scientific papers collected and maintained by higher education institutions such as informing the public about an expertise of a lecturer [8]. Therefore, the IR development as a scientific papers collection is very important in order to record the scientific work of a lecturer, researcher and student within the University [9].

Generally, universities have built a scientific papers collecting system. Numerous technological developments of digital-based scientific papers collections have continued to be progressed. Researchers [7] have recorded repositories of Universities in Nigeria. These repositories have been used by researchers to communicate the research results. However, there are still technical constraints in its application, for instance the repository software feature that does not support database interoperability due to the large number of scientific works stored. Similarly, [5] have built an institutional repository (IR) named DRUGG (Digital Repository of the University of Ljubljana, Faculty of Civil and Geodetic Engineering - UL FGG) since 2011. This IR has been utilized by the academic community but also has obstacles in technical infrastructure, personnel and similar collaboration systems. Furthermore, [10] has been verified the implementation of IR digital preservation policies at the Brazilian Federal University. Researchers have taken a sample of 26 IRs from the Federal University of Brazil registered with OpenDOAR, which represents 68 % of repositories. The results have shown that the technical domain has become a major concern in improving repository data.

In other words, the IR developing obstacle especially at the University is database interoperability [11]. This is due to many digital-based scientific works published by researchers, lecturers and students are stored in various places [12]. Moreover, numerous scientific works such as journals and proceedings are stored in a separate digital system [13]. Consequently, an integrated and easily accessible scientific works storing system for academics is very necessary [14].

Several universities have built the IR system including Universitas Mulawarman (http://repository.unmul.ac.id). However, this system still has disadvantages, such as not being integrated with journals and proceedings collection system called e-journals (http://e-journals.unmul.ac.id) and also the library system (http://perpustakaan.unmul.ac.id). Therefore, integrated data collection system is needed in order to increase availability and accelerate larger and more complex systems development. Furthermore, it is expected that this system would be a reference for readers e.g., researchers, lecturers, and students in pursuing scientific references [15]. The main purpose of this paper is to build and integrate e-journals and repository database. Hence, storing and searching scientific papers collection are expected to provide convenience for readers. This paper consists of four sections. An introduction that contains the background problem and related previous research in Section 1. Section 2, research methodology that explain the web service work process. Section 3, results and discussion that explains the findings of the experiment. Conclusions are presented in the last section.

2. Methodology

Web service is a service to integrate Web-based applications using open standards such as eXtensible Markup Language (XML), Simple Object Access Protocol (SOAP), Web Service Definition Language (WSDL) and Universal Description, Discovery, and Integration (UDDI) through the internet protocol backbone [16]. XML is used to mark data, SOAP is used to transfer data, WSDL is used to describe available services and UDDI is used to list available services [13]. The benefits of a web service include dealing with the data exchange from several platforms [17]. Meanwhile, the web service architecture can be seen in Figure 1 [18], [19].

Layer 1: The internet protocol standard used as a transportation of Hyper Text Transfer Protocol (HTTP) and Transmission Control Protocol / Internet Protocol (TCP/IP). HTTP is a term given to a protocol and is used to send documents from the WWW (World Wide Web). In other words, HTTP is a network protocol for collaborating hypermedia information systems [20]. Layer 2: SOAP is XML based and used for information exchange between a groups of services. In this paper has been used SOAP, which is a combination of HTTP and XML as a protocol for information exchange with decentralization and distribution. SOAP uses the HTTP protocol as a means of transporting data written in XML format. It exchanges data on different platforms, operating systems and software. SOAP manages how requests and responses from a web service work [21]. Then, XML is used to describe data in a web service. Thus, XML functions as communication between applications, data integration, and communication of external applications with the outside. Therefore, with XML standardization, different applications can easily

communicate between one another. Layer 3: WSDL is used to describe the service attributes. WSDL is an XML-based language used to define web services and describe how to access them. Its function is to automate the mechanism of business-to-business communication in web services through internet protocol [22]. Layer 4: UDDI is the central directory for service descriptions. UDDI states that a registry service for web services allocating to advertise the existence system. UDDI is a framework that defines an XML-based registry where an organization can upload information about the services they provide. The XML-based registry contains the services organizations' names and descriptions it provides [6]. Meanwhile, the web service architecture can be seen in Figure 1.

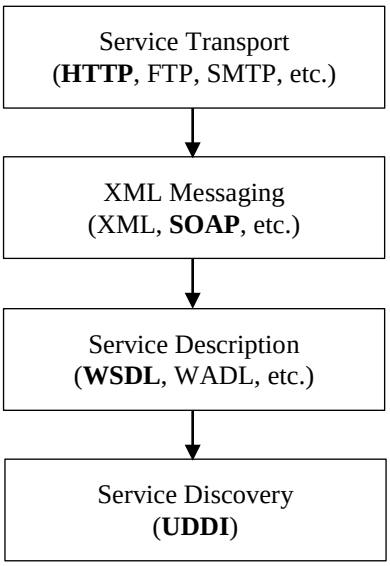

Figure 1. Web service architecture

3. Results and Discussion

3.1. Database Replicated Design

In this paper has been prepared the one master into many slave replication model, where the journal server site is a master and e-journals and repository sites are slaves. The database management system (DBMS), for replication by using MySQL, has been implemented. The integrated replication process between e-journals and repository systems can be illustrated in Figure 2.

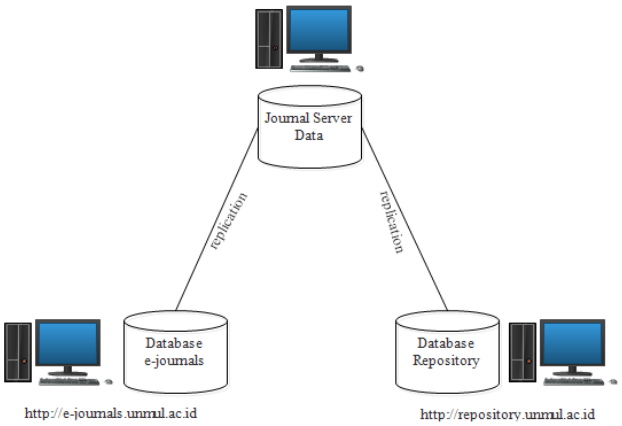

Figure 2. Database e-journals and repository replicated schema

3.2. Database Fragmentation Design

In this experiment, the database of vertical fragmentation scheme has been implemented. Then, the database has been divided into columns and rows stored in different database systems (e-journals and repositories). Afterward, the web service for data retrieval has been completed. Next, database fragmentation design can be viewed in Figure 3.

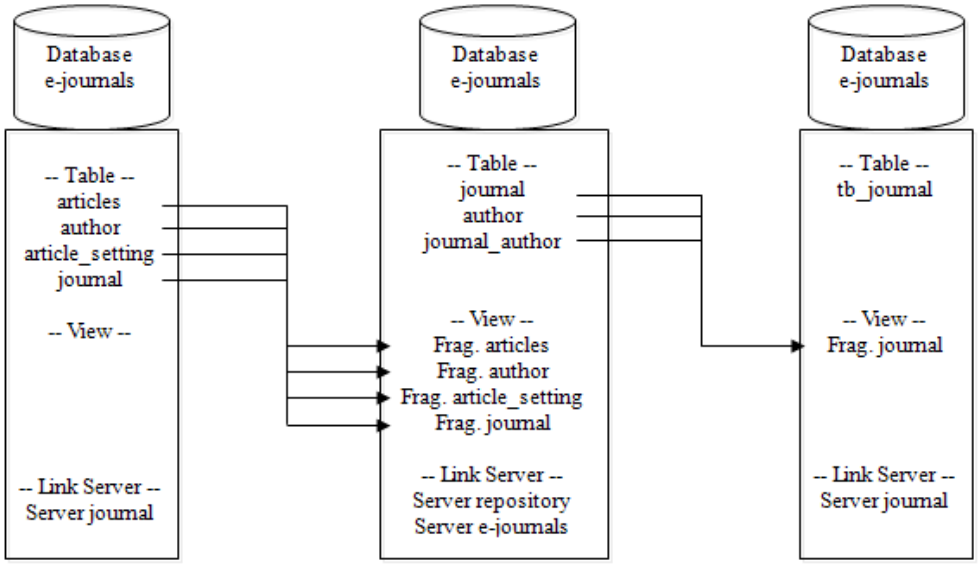

Figure 3. Database fragmentation design

Afterwards, the database design has been saved in the MySQL DBMS with the name ddb_jurnal. Meanwhile, the database design using Linux, Apache, MySQL, and PHP (LAMP) applications with the 192.168.22.102 server has been implemented. Then, the database model can be viewed in Figure 4.

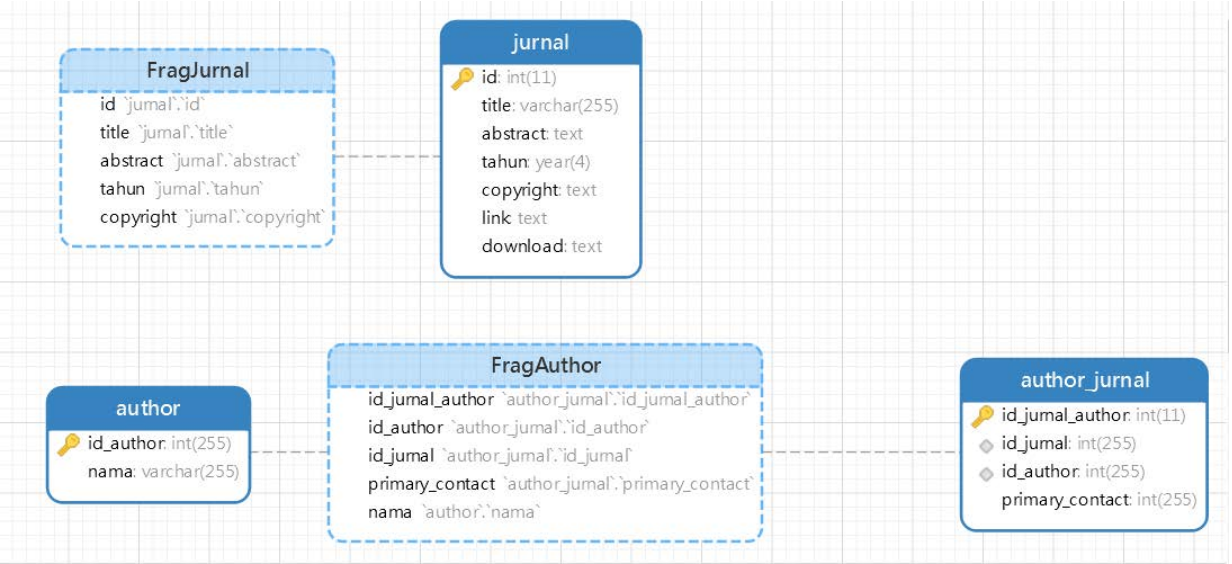

Figure 4. Database Model ddb_jurnal

3.3. Web Service Implementation

In this experiment, the distributing and accessing data interface on repository and e-journals have been constructed. Then, the SOAP server and client script can be seen in Figure 5. and Figure 6.

```
$server->register(
        "getJurnal",
        array('empty'=>"xsd:string"),
        array('output'=>"tns:dataJurnal"),
        "urn:JournalService",
        "urn:JournalService#getJurnal"
        );
$server->register("setJurnal",
       array("id"=>"xsd:string","author"=>"xsd:s
tring","title"=>"xsd:string","abstract"=>"xsd:str
ing","tahun"=>"xsd:string","copyright"=>"xsd:strin
g",'view'=>"xsd:string",'download'=>"xsd:string"
),
       array("output"=>"xsd:string"),
       "urn:JournalService",
       "urn:JournalService#setJurnal");
```

Figure 5. Script SOAP Server

Figure 5. shows that the SOAP server script has registered XML in the WSDL. Meanwhile, the getJurnal XML parameter contains blank input parameters and output in journal data. The, XML setJurnal contains parameters such as id_input, author, title, abstract, view and download using strings type data.

Figure 6. shows that service client script has getJurnal function with journal parameter which contains the XML getJurnal on WSDL urlDataGate scripts. However, the getJurnal function then automatically calls XML getJurnal. The setJurnal function contains the XML setJurnal on the urlDataGate WSLD which stores data in the master database functions.

```
public function getJurnal($jurnal){
        $client = new nusoap_client($this-
>urlDataGate);
        $client->soap_defencoding = 'UTF-8';
        $client->decode_utf8 = false;
        $data = $client-
>call('getJurnal',array('empty'=>"$jurnal"),"urn:
JournalService");
        $err=$client->getError();
        if($err) return $err;
        elseif($data!=null) return $data;
        else return false; }
public function
setJurnal($id,$author,$title,$abstract,$tahun,$co
pyright,$view,$download){
        $client = new nusoap_client($this-
>urlDataGate);
        $data = $client-
>call('setJurnal',array("id"=>"$id",

"author"=>$author,"title"=>$title,"abstract"=>"$a
bstract",

"tahun"=>"$tahun","copyright"=>"$copyright","view
"=>"$view",

"download"=>"$download"),"urn:JournalService");
        $err=$client->getError();
        if($err) return $err;
        elseif($data!=null)return $data;
        else return false;    }
```

Figure 6. Script Service client

In this experiment, proceeding of National Seminar on Computer Science and Information Technology (SAKTI) on e-journals data has been integrated to the repository database, Figure 7. and Figure 8.

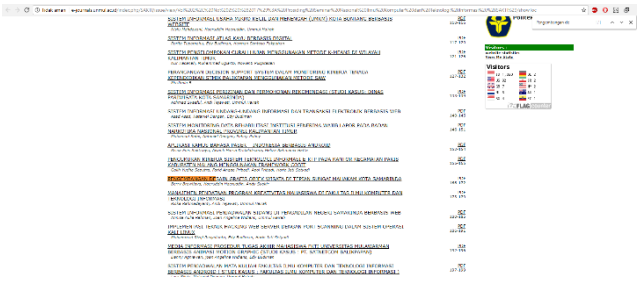

Figure 7. Proceeding in e-journals database

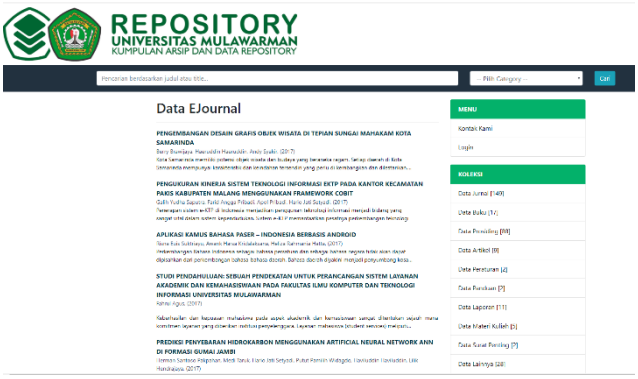

Figure 8. Result of integrated database

4. Conclusion

The database integrated between e-journals and repository systems by using SOAP web service have been presented. The e-journals systems are stand-alone journal management and publishing systems. Meanwhile, the repository system is a digital academic database collection (i.e., lecturers, researchers and students) in the Universitas Mulawarman. Afterwards, the integration process is carried out through replication and fragmentation of the master database to e-journals and repository systems. The experimental results have showed that database on e-journals systems is automatically integrated or stored in the repository system. Henceforward, increase of data availability and facilitating the development of a larger and more complex system of storing scientific works.

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