Optimizing Libraries’ Content Findability Using Simple Object Access Protocol (SOAP) With Multi-Tier Architecture

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Abstract. The aim of this paper is to describe a developed application of Simple Object Access Protocol (SOAP) as a model for improving libraries’ digital content findability on the library web. The study applies XML text-based protocol tools in the collection of data about libraries’ visibility performance in the search results of the book. Model from the integrated Web Service Document Language (WSDL) and Universal Description, Discovery and Integration (UDDI) are applied to analyse SOAP as element within the system. The results showed that the developed application of SOAP with multi-tier architecture can help people simply access the website in the library server Gorontalo Province and support access to digital collections, subscription databases, and library catalogs in each library in Regency or City in Gorontalo Province.

1. Introduction
The demand of advanced methods of search and information retrieval in the library was growth rapid due to the amount of data available in electronic libraries. In each “modern” library is a clear demand for fine-tuning the performance of information retrieval systems. Like in other library, the demand of advance search and information retrieval become one important need of library in Province Gorontalo, Indonesia.

Nowadays all districts / cities in Gorontalo province already has a library area. Books Data access in each library area has been equipped with an application. For the local library on the Gorontalo city and Gorontalo Regency already have an online system and four (4) Other districts still use offline system so that people are required to come to the library to be able to access the data of the book. This is less than optimal because, if the book is sought does not exist in the library, the people will be disadvantaged in terms of time, cost, and energy.

The solutions of this problem that can be done by build a website for each regional library in the district / city, but it is not as flexible because the public are required to access any local library website to find the desired book. Another solution is to build a unified information system and web-based centralized at the provincial library, but it would violate the responsibility and authority data processing library resources that should be in the respective local library.
Various studies have been done to address the above issues instead build the applications that allow users to search the collections at each library work together with technology grid data [1], but the applications built conduct a search using the facility server computers in the library provinces to find data in each of the library district / city, when the server computer has a problem, it will interfere with the search data.

Based on the description problems above, the research was conducted to develop a system using web services technologies (SOAP protocol) with a multi-tier architecture. SOAP protocol is placed in the respective local library, because SOAP is a text-based protocol that is used to wrap the data and information within the framework of XML documents used in the Internet network. SOAP defines a common message format for communication between applications, running on top of the HTTP protocol (SOAP over HTTP) [2]. Architectural applications on each server using a local library multi-tier architecture in which applications in the server is divided into several units, called tier, each of which can be run on different computers. These units communicate with each other via a LAN (Local Area Network) or via the Internet. The simplest form of a multi-tier application is a three-tier model [3].

The purpose of this research is to build a model system based on the SOAP protocol on Multi-Tier architecture to optimize the flexibility of accessing information and library resources. To achieve these objectives, the methods used in this study are the research and development, with the phases: Data collection, literature studies, and system architecture development, testing system architecture and system architecture improvements.

2. Material and method.

2.1. Simple Object Access Protocol (SOAP)

SOAP is a file sending or receiving messages formatted XML, SOAP is a text-based protocol that is used to wrap the data and information within the framework of XML documents used in the Internet network. SOAP defines a common message format for communication between applications running on top of the HTTP protocol (SOAP over HTTP) [2]. SOAP specifies clearly how to encode an HTTP header and an XML file so that program on a computer can call a program on another computer and sends responses. SOAP is a lightweight protocol for exchange of information shown on the scope of decentralized structures and distributed. Figure 1 shows the basic structure without the SOAP header elements.

```
<Envelope xmlns:tns="http://schemas.xmlsoap.org/soap/envelope/">
  <Body>
    <Add xmlns="http://example.com/Add"><x>2</x><y>3</y></Add>
  </Body>
</Envelope>
```

Figure 1. Examples of simple SOAP message

2.2. Web Service Document Language (WSDL)

WSDL is an XML based language that provides a model to describe web services, usually combined usage by using SOAP and XML web services and then provide the network, which was developed by IBM, Ariba and Microsoft [4].

WSDL is an XML format published to explain the web service. WSDL defines:

a. Messages (both abstract and concrete) that are sent to and from the web service.
b. Digital collections of messages (port type, interface).
c. How port type specified wire protocol used.
d. Where the service is placed.

By using an XML grammar, WSDL defines web service with elements of the concept of representation of the WSDL document shown in Figure 2.

![Figure 2](image-url)
2.3. Universal Description, Discovery and Integration (UDDI)

UDDI is a directory WSDL web services that provides publications, search and recovery of the global registry, which is a block up enables an organization or user doing a search service and transaction data quickly with other organizations using open standards [5]. UDDI interaction shown in Figure 3.

![Figure 3. UDDI Interaction [5].](image)

2.4. Multi-tier

Multi-Tier Application is an application which is divided into several units, called tier, where can run on different computers. These units communicate with each other via a LAN (Local Area Network) or via the Internet. The simplest form of a multi-tier application is a three-tier models. Based on this model, the application is divided into three parts [3]:

1. **Client Application (front-tier)**
   a unit used by the user application.

2. **Application server (middle-tier)**
   This unit provides to services can be used by the client application to accessing data. This unit is the liaison between the client applications to the database server

3. **Database server (back tier)**
   This unit is responsible for managing data storage. Usually a RDBMS, for the database server, use existing database server. So only need to create a client application and server application. In a multi-tier application is more complex, may require more than one application server unit. For example, it takes a special unit to deal with security issues (security), or as a bridge to connect with a variety of database server or multiple platforms. Figure 4 shows the architecture of Multi-Tier
3. Result and Discussion

3.1. Design System

Use Case Diagram showing the interaction between the Use-Case and 5 Actor ie Member, Admin / Operator, inspectors and procurement committee, head of the library and BPKAD. Interaction between actors on the system shown in Figure 5.

![Multi Tier Architecture](image1)

**Figure 4.** Multi Tier Architecture [3]

1. Members have several authorized access to the system is logged, borrowed the book, looking for a book, and return the book.
2. Operator / admin has all the powers that exist in member and coupled to the input data input member and a guest book.

![Use case diagram](image2)

**Figure 5.** Use case diagram for the interaction of the actors involved in the system
3. The committee of inspectors and procurement of books have the right access to the system is logged on, enter the data book, a distributor of data input and validation of the list of books to be purchased / messages.

4. Head libraries have authorized access to the system is logged and view all reports (for example: report lending, the report returns, reports and statements fines procurement of books).

5. The Board of Finance and Asset Management (BPKAD) equal authority at the head of the library. However, in view of the report is restricted only to see reports of procurement / books

3.2. Model communication between the library in general
Communication between the Libraries using the approach of two-way data exchange architecture, which searches every book, by one of the libraries is done in all local libraries connected to each other. Figure 6 shows the relationship between library, where every library can communicate with others using web services technologies (SOAP protocol). Request process from the library will be given to the regional library, then the library is intended will give response to whether a specific book is available or not. The result of this response is then displayed in the client application from a library looking for the book data.

Figure 6. Communication between the library architecture in general

3.3. Model communication between the library in detail
The process of request and response of the architecture described in Figure 6 and will be described in detail in Figure 7, where the user (user) at a local library that wants to find a book then the first time the application searches for the book in the local library server where the user is visiting. If a book that you're not finding the library server where users visit the server will direct the search process in other areas of the library server. Search results will then be displayed by the client application. Step-by-step of process finding books are as follows:

1. Users come to the local library to find a book that will be read / borrowed by accessing computer
2. The computer that accessed acts as the computer running the client application
3. Computer looking for a book on a computer server in the library
4. If the book you are looking for does not exist then the client application will access the WSDL of each local library server computers
5. The search results are displayed on the computer, in the form of books and library areas that provide the book.
3.4. Multi-tier model of each library

Architectural design applications available in each regional library using a multi-tier architecture approach, where the top level is the level of application that is accessed by the user in the respective library. The middle level is an application used for accessing database, so that the client application does not access the database directly. The application uses the SOAP protocol is this level, so that each Library can use the database with a variety of platforms and database management is the responsibility of each it. The lowest level is the database level. Architectural design created by researchers is in the respective level using a computer to the development of the future can be done easily, for example, where will be made the application at the middle level, the admin does not need to existing security level database, because the application only needs to be installed on the computer in medium level and vice versa (in case of changes to the database it will not interfere with the arrangement / setting that has been done in the middle level).
3.5. Application Mobile

3.5.1. Book search Application.

Book search applications function to make it easier for visitors to make a book search. This application will display books searchable in library server in each area. The search results are displayed based on the layout where the book. Entry book title or author or publisher name to be searched and then click the blue search button. Display book search results shown in Figure 9.
3.5.2. Application Transaction Loan and Refund
The process of borrowing and returning books to be done in a library that provides the desired book. This application allows library members to conduct lending transactions as long as it is in the library that provides the book (as when performed in other libraries, the application of borrowing in a state of the recording button is disabled), so also for the return of books. Applications at any library can only be used to see the books available in the library (instead of borrowing and the return). Figure 10 shows the application view of borrowing and repayment.

![Display applications borrowing / returning book](image)

Figure 10. Display applications borrowing / returning book

4. Conclusion
Based on the results of research conducted at the office of the regional library and the discussion that has been described previously, we can conclude several things:

1. Some libraries respective areas rely on manual systems in service procurement of books, borrow and return books, so that related data library management still kept manually, so the need for a policy in utilizing IT as part of their local library for easy management of service users / members and sharing resources in the respective library.

2. Results of the design of the new library management system using object-oriented design approach resulting in the development / manufacturing of application should be using object oriented programming

With multi-tier architecture and application server using SOAP protocol, the communication and exchange of information resources between different areas of the library client application platform is easy then to optimize the application of multi-tier architecture, each regional library should provide 3 (three) servers.
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