Back-End Design And Development On Rekaruang Application With Microservices Architecture

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Abstract
One of the basic human needs is a house. One aspect considered when building a home is interior design. However, today, many people do not care about the importance of interior design in human psychology, which may cause a problem for interior designers, especially in getting their service users. Therefore, this study will discuss solutions to overcome the issues of interior designers and interior designer service users through the development of the Rekaruang startup. This research focuses on planning and building the back-end, which will later be implemented in the Rekaruang Application. The back-end development will use a microservices architecture with the waterfall method as a guide for development. The services formed are user service, master data service, consultation service, transaction service, and chat service. The created services are represented in the form of API endpoints which are then tested with unit testing and load testing types to determine the performance of microservices. The test results using unit testing show that of the 34 test cases tested, all test cases can be declared victorious. Furthermore, this study only tested three endpoints for load testing because they were considered to have a long execution time. The total number of users that microservices can handle is 216 at the same time. The test results can be said to be good because the projection of Rekaruang users in the first year is only 40 users, consisting of 20 interior designers and 20 clients.

Keywords— Interior Designer, Microservices, Waterfall Model, Rekaruang

1. INTRODUCTION

Interior design can create a functional, comfortable, and beautiful life and fulfills the material, spiritual, and needs of its users by considering the nature of the building, the environment, the use of materials, and the principles of architectural design [1]. From this statement, it can be stated that the house is one of the primary needs in domestic life. Based on the results of interviews with five practitioners or interior designer professionals, most of the users of interior designer services are newly married people and business people. Based on Susenas in Figure 1, the age trend at first family in Indonesia in 2016 was 27.5 years for men and 23 years for women. From these data, the researchers determined the age of the interior designer service users to be in that age range.
Figure 1. Trends in Age of First Marriage in Indonesia [2]

Young people in Indonesia have more interest in becoming entrepreneurs, both in the culinary, IT, and other fields. The World Economic Forum stated that 35.5% of Indonesian youth want to become entrepreneurs in the future, as shown in Figure 2. Based on interviews with interior designer users (clients), interior design is an investment value that provides many long-term benefits. A good interior design will support employee performance or customer satisfaction to get maximum results related to their business in terms of finance and business continuity.

Figure 2. Percentage of Southeast Asian Youth Who Want to Become Entrepreneurs [3]
Based on the OPUS of the Indonesian Creative Economy Agency, the GDP growth rate of the interior design sub-sector in 2016 increased by 5.98% with a GDP value of Rp. 1,484.7 B compared to 2015 with a GDP value of Rp. 1,354 M. In addition to the increasing GDP growth rate, the reality on the ground shows that there are still interior designers who have difficulty getting clients. Based on the interviews with five interior designers, the main problem they mentioned was the difficulty of getting clients.

Based on the description above, researchers will conduct research that develops a platform called Rekaruang. Rekaruang is a platform that bridges the needs of clients as building owners with interior designers. Rekaruang's target users are interior designers, entrepreneurs, and people at the age of getting married. To be a solution for building owners and interior designers, the establishment of the Rekaruang platform will focus on user needs, especially in overcoming the problems of the interior design purchasing process and the publication of interior designer portfolios.

The application development architecture is needed as a guide for developers to build the Rekaruang application. The researcher chose to use the microservices architecture for application development from the back-end side of the Rekaruang application. With a microservices architecture, application development will be faster, easier to understand, and easy to maintain [4]. In addition, in developing microservices, researchers chose to use the waterfall model as a system development life cycle. The waterfall model has a steady flow from phase to phase, making it easy to use [5]. With the waterfall model, development costs become more efficient. The waterfall model can be the proper system development life cycle for the early stages of development in establishing the Rekaruang platform.

2. METHODOLOGY

This research will use the waterfall model development method. The waterfall model is a linear SDLC model, the flow from phase to phase decreases steadily, so it is easy to use [5]. There are five phases in which these phases will support the development of microservices in this research, namely requirements analysis, system design, implementation, testing, and deployment.

In the requirements analysis stage, a detailed collection of user needs, data, and information collection are carried out by interviewing the target user of Rekaruang. The data collection results will be analyzed by identifying user needs, business aspects, and application design needs. At the system design stage, the identification of system requirements and the design of the microservices design will be carried out. In this research, the design stage produces use case diagrams, activity diagrams, entity-relationship diagrams, deployment diagrams, and microservices architecture. Furthermore, at the implementation stage, microservices are created following the microservices design that has been made previously. The creation of microservices will use the JavaScript programming language.

The testing stage is testing the microservices that have been created. The testing carried out includes unit testing and load testing. Unit testing is one of the tests included in the White Box testing method [6]. Unit testing can be used to test the functionality of microservices [7]. Unit testing is carried out to know that every code unit in microservices can run well. At the same time, load testing is used to determine the performance of microservices. When all tests perform the excellent result, the microservices are ready to publish at the deployment stage. Once published, the development of website applications can consume the microservices.

3. RESULT AND EXPLANATION

3.1 Requirement Analysis

3.1.1 Identification of User Needs

The main actors of the Rekaruang business are interior designers and clients as users of interior designer services. Researchers conducted interviews with five interior designers and five clients to get effective results in identifying user needs. Based on the interview results, a Minimum Viable Product (MVP) was formed, which will be made in this study, namely the consultation process and design order process.

3.1.2 Business Process

A business process is a set of connected activities that turn input into an output, a product or service that provides value to users [8]. Minimum Viable Product (MVP) at Rekaruang is a consulting service and design ordering service. Each of these services has a business process that contains a set of interrelated activities to achieve the benefits owned by the Rekaruang application.

The consulting business process begins with the client entering the design criteria and building conditions in a consultation form. The system will provide the designer with the relevant design criteria, and building conditions entered previously. Next, the client chooses a designer. In choosing a designer, the client can consider the designer's portfolio. Then, the designer will confirm the consultation request. After that, the client needs to make a payment according to the designer's consultation price. If approved, the system will automatically create a chat room. Next, the consultation process can be carried out by clients and interior designers. If the consultation is complete, the interior designer or client can end the consultation. However, if the consultation is not finished yet and the consultation time has expired, the system will end the consultation automatically. Clients need to provide ratings and reviews for interior designers based on client satisfaction during the consultation process.

The design order business process starts with the client filling out the design order form provided by the system. If the client chooses the pitching method, the client will immediately have to choose the desired interior designer. However, if the client selects the bidding method, the interior designer will provide an offer first, then the client will choose an interior designer who has made an offer. The interior designer will create a work plan that contains details of design and prices. If the client approves the work design provided by the designer, then the client can make a payment. But if not, then the client can choose another designer. After that, the interior designer will design the design according to the client's needs. When the designer has finished creating, the designer will make a progress report to the client. Furthermore, the client will see the results of the designer's work and are allowed to provide minor revisions that the interior designer will correct at a later stage. When the design phase is complete, the client will receive a design in 2D and 3D from the interior designer.

3.1.3 Business Worthed

The feasibility analysis uses NVP and PBP, IRR, and Net B/C calculations based on several aspects, including market, marketing, technical and technological, organizational and management, legal and legal, and financial aspects [9]. The results of the PBP calculation obtained a number of 2.54, and the results of the NPV calculation obtained a number of Rp. 445,177,175. The Rekaruang business can be said to be feasible because of the NPV value > 0. The results of the IRR calculation get a figure of 64%, so the Rekaruang business can be said to be feasible because of the IRR > 1. The results of the Net B/C calculation get a figure of 1.09, so the Rekaruang business can be said to be feasible because the Net B/C > 1.
3.1 Design

3.2.1 Use Case Diagram

Use case diagrams can describe actors and functional or use cases found in Rekaruang applications in general.

Figure 3 shows that the Rekaruang system has several functionalities accompanied by relations to actors. These relations describe the functionality that actors can use. Interior designers can use several functionalities, including providing consulting, designer registration, managing portfolios, providing designs, and authentication. Interior designers who have authenticated can manage profiles and view transaction history, but it is not mandatory.

Building owners (clients) can use several functionalities of the Rekaruang application, including finding designers, ordering designs, consulting, and authentication. Like designers, clients who have used the authentication function can also manage profiles and view transaction history, which is optional. Building owners who want to use the consultancy function and design order must use the procedure to make payments.
3.2.2 Activity Diagram

Activity diagrams are helpful to make it easier for researchers to understand the process flow and interactions in functional Rekaruang applications. Activity Diagrams are formed as many as functional ones contained in the Rekaruang application described in the use case diagram.

3.2.3 Entity Relationship Diagram

ERD will provide an overview of the dependency relationships between entities in the Rekaruang system database, which is quite complex. In this study, the concept of The Database Cluster Pattern will be applied. This concept forms a database by separating the schema for each service in the application [10]. There are four database schemas, including user schema, master data schema, consultation schema, and transaction schema.

Figure 4 is one example of the scheme created.

![Entity Relationship Diagram](image)

Figure 4. Entity Relationship Diagram

3.2.4 Deployment Diagram

Deployment Diagrams illustrate the relationships between topologies and the resources required to deploy microservices. Deployment diagrams will also provide an overview of the connections between devices that the Rekaurang application will use.
3.2.5 Microservices Architecture

Microservice Architecture is a software architecture that aims to make software development more focused and structured. The Rekaruang application uses a microservices architecture software architecture formed by

Figure 6. The data transaction process requires a gateway to communicate between services (services) in the Rekaruang application. In this study, researchers used a restful application programming interface (API) to form services.
3.3 Implementation

The Rekaruang application uses two databases, including PostgreSQL, which stores the user schema, consultation scheme, transaction scheme, and master data scheme. The second database is a firebase database with a NoSQL concept to implement the chat feature in real-time. The Rekaruang application also requires available external services to make it easier for developers to implement payment features integrated with several banks and e-wallets.

The establishment of microservices will be adapted to the microservices architecture that uses restful APIs. The API that is formed has three types of methods, including GET, POST, and PUT. The base URL of the Rekaruang API is http://rekaruang.space/api/{URL_endpoint}. The formation of the API will use the AdonisJs framework, which produces 34 API endpoints. The payment features consulting services and design orders using external services, named Midtrans. The following is an example of an API endpoint generated in the user service.

![Microservices Architecture Diagram](image)

Figure 6. Microservices Architecture
Table 1. API Endpoints

<table>
<thead>
<tr>
<th>Code</th>
<th>API</th>
<th>Description</th>
<th>Method</th>
<th>Header</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.1</td>
<td>User Service</td>
<td></td>
<td></td>
<td></td>
<td>user/{ID}</td>
</tr>
<tr>
<td></td>
<td>Get User by ID</td>
<td>Retrieve user data based on ID as the parameter.</td>
<td>GET</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

3.4 Testing

3.4.1 Unit Testing

Testing with unit testing is helpful to measure the functionality of microservices by consuming APIs and verifying that the body and headers meet the expected expectations. As shown in Table 3.2, there is a Test Class, a function that will be tested. A Test Case is a condition that will be run as input to a process. The results of this test are valid if they are in line with expectations or invalid if they are not following the expected expectations.

Table 2. Unit Testing Result

<table>
<thead>
<tr>
<th>Code</th>
<th>Test Class</th>
<th>Test Case</th>
<th>Expected results</th>
<th>Results found</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.1</td>
<td>Displaying User Information</td>
<td>The user sees another user's information and has sent the user ID to the system.</td>
<td>The system sends user information data.</td>
<td>The system successfully sends user information data.</td>
<td>Success</td>
</tr>
</tbody>
</table>

3.4.2 Load Testing

Testing with load testing is intended to test the performance of microservices when consumed by considering the execution time and the number of users who make requests simultaneously at the same time. In this study, load testing was carried out only on three endpoints: login, store consultation form and upload design result. The primary endpoint for testing is the upload design result endpoint because this endpoint has the longest execution time caused by uploading 2D and 3D design documents. The researcher will be testing the other two endpoints to support the upload design result endpoint. The login endpoint for authentication and the store consultation form endpoint will be used to create consultation data. Load testing will be run by adding one user every second, with a maximum of 1000 users.
Figure 7. Total User Load Testing

After testing using a tool called Locust, from Figure 7, it can be seen that the endpoint being tested can be accessed by up to 216 users simultaneously. After more than 216, there will be an API call failure. Failures constantly occur after more than 216 users. In addition, the results of this test can still be said to be good because the projection of Rekaruang users in the first year is only 40 users, consisting of 20 interior designers and 20 clients.

3.5 Deployment

After the implementation and testing stages of microservices, the next process is to enter the deployment stage. The deployment stage is the stage for implementing microservices on the client-side by publishing microservices so that everyone can access them. The server used is Ubuntu version 20.04, with the webserver used, is Apache. The result of the deployment phase is a domain called http://rekaruang.space/api, which the public can access. With the publication of microservices, front-end developers can consume APIs.

4. CONCLUSION

This study's microservices design is based on the formed Minimum Viable Product (MVP), namely the consultation feature and the design ordering feature. From the MVP, the services formed are user service, master data service, consultation service, transaction service, and chat service. Using microservices as a back-end development architecture, Rekaruang as a startup still in the bootstrapping stage will facilitate the scalability process. In addition, microservices testing is carried out with two tests: unit testing and load testing. The test results using unit testing show that of the 34 test cases tested, all test cases can be declared victorious. So, it can be concluded that each unit of code generated can run well. Furthermore, this study only tested three endpoints for load testing because they were considered to have a long execution time. The total number of users that microservices can handle is 216 at the same time. The test results can be said to be good because the projection of Rekaruang users in the first year is only 40 users, consisting of 20 interior designers and 20 clients.
REFERENCES


