Integration of digital library server with Service Oriented Architecture (SOA) based on cloud computing using proxmox server

Y Ariyanto¹, B Harijanto¹, A Setiawan², S Adhisuwignjo² and E Rohadi¹

¹ Information Technology Department, State Polytechnic of Malang, Malang, Indonesia
² Electrical Engineering Department, State Polytechnic of Malang, Malang, Indonesia

*yuri@polinema.ac.id

Abstract. With the advancement of computer virtualization technology, the use of cloud computing technology began to be scrutinized by researchers. With the existence of cloud computing technology can make computer virtualization on a server that is running. This can save the cost of providing information technology and operational infrastructure independently for each service that will be served. With this technology one physical machine is made into a shared resource that can be shared and used by several services at once. In this study made 4 servers using SLIMS7, digital libraries are virtual machines implemented in cloud computing servers with Proxmox servers. Database server digital library integration uses Service Oriented Architecture (SOA), by connecting to 4 virtual machine servers. Integration is carried out on the book data search system by entering keywords as book data searches that exist in each digital library server, with the results of displaying all book data on each digital library server according to the keywords. The conclusions of this study obtained after testing the system include the acquisition of a new model in the use of Service Oriented Architecture (SOA) to integrate the search for data books that exist in 4 digital library servers.

1. Introduction

Virtualization technology is a topic that began to be scrutinized by researchers. This is inseparable from the technology’s ability to reduce the cost of providing infrastructure, and operate independently for each service to be served. Through this technology, a service can be configured without affecting the configuration of other services, even on the same physical machine. With this technology, one physical machine is made into a shared resource that can be shared and used by several services at once. Each service can have its own operating system. Each service is placed in a container or container. Because, the operating system itself in each service, the configuration of each service does not affect each other [1].

Proxmox Virtual Environment (ProxmoxVE) is a virtual machine operating system that is widely used by users of virtualization technology. This is because, the operating system is open source, making it easier to modify and develop. ProxmoxVE is a Debian Linux derivative operating system with the RHEL kernel, which has been modified to be able to create, run, and manage virtual machines. ProxmoxVE supports two types of virtualization namely OpenVZ container based virtualization and full virtualization with KVM [2,3].
In this research, server virtualization is run using ProxmoxVE, by creating 4 digital library virtual machines on cloud computing servers. Where from the 4 digital library virtual machines, tested with system integration using Service Oriented Architecture (SOA), to find book data available on the digital library.

2. Literature review

2.1. Proxmox
Proxmox VE is an open source project, where Proxmox Server Solutions GmbH is the developer and manager [2]. Proxmox VE is a virtualization technology solution that is simple and easy to use in its implementation. All configurations can be done through a web browser, with the console display integrated to Virtual machines, integration and management into the Proxmox VE Cluster [4]. By using AJAX technology, it allows a more dynamic web console to appear, as well as secure access to all Virtual Machines through SSL encryption [3]. Virtualization technology uses KVM and OpenVZ, already in Proxmox VE in creating virtual machines [3,5-8].

2.2. Service Oriented Architecture (SOA)
Service Oriented Architecture (SOA) is an approach that makes application functions as a service [9], which is packaged as a component that can be used repeatedly and is independent, this will make it easier if there are changes or additional functions. SOA Lifecycle allows the placement of service capabilities through three stages, namely: requirements and analysis, design and development, and IT operation [10,11].

2.3. Senayan Library Management System (SLiMS)
Senayan, or the complete Senayan Library Management System (SLiMS), is a library management system, open source licensed under the GPL v3. The web application developed by a team from the Indonesian Ministry of National Education's Information and Public Relations Center was built using PHP, MySQL database, and Git version controllers. In 2009, Senayan won INAICTA 2009 for the open source category [12].

3. Methodology and system design

3.1. Methodology
In this research, using research methods in the following stages (1) analysis of system requirements is to collect various information about digital library integration (2) installation of software and hardware Proxmox (3) create a virtual machine and digital integration of SliMS library 7 scenario testing for network topology (4) VM database integration with SOA systems (5) evaluation of trial results based on testing scenarios.

3.2. System design
To implement digital library integration with SOA systems in cloud computing, a system design is shown in Figure 1.

![Figure 1. Cloud computing system design.](image)
In Figure 1, it is shown the implementation of a digital library integration system, by creating 4 digital virtual machine libraries that are implemented on cloud computing servers with Proxmox VE. Database integration between virtual machines is a system of service oriented architecture (SOA).

3.3. Hardware and software specification
At this stage, the requirements for computer hardware and software specifications, which are used to design and implement digital library system integration with SOA, based on cloud computing, are explained as follows:
- Processor AMD FX-6350 support features the number of cores 6, harddisk 2 TR, memory 8Gb.
- OS Proxmox VE used for implementation cloud computing server
- OS SliMS 7 user for implementation digital library

3.4. Digital library database integration
At this stage, the flow of the system is explained from the digital library system integration, using Service Oriented Architecture (SOA), shown in Figure 2.

![Diagram](image)

**Figure 2.** Flow of database integration system.

The process of searching for books that exist in digital library databases is shown in Figure 2. This process searches and matches book search keywords in each database stored in 4 digital libraries.

3.5. Implementation of database integration
At this stage, it is explained how to search for book keywords in the digital library database, shown in Figure 3.
Figure 3, shows how the program code, in searching books in digital library databases, where searches are carried out on 4 digital library servers in cloud computing, so that they get search results according to keywords.

4. Results and discussion

4.1. Testing digital library server integration

At this stage, testing and analysis is carried out on the integration of digital library servers in searching books according to keywords. Figure 4., shows how the book search results, based on the keywords entered in the digital library server, where system integration was successfully carried out, by displaying search results from 4 digital library servers.
During the process of searching books in a digital library server, the performance of a cloud computing server using Proxmox VE showed good performance results. In Figure 5, shows how the performance of cloud computing servers in terms of computer resource usage.

4.2. Analysis performance integration systems
Analysis of the process of testing the integration of digital library servers based on cloud computing on the search for books with keywords, shown in table 1.
Table 1. Analysis integration digital library.

| No | Digital Library Server | Integration Database Systems | Status          |
|----|-------------------------|-----------------------------|-----------------|
| 1  | Digilib Server 1        | Running                     | Data found      |
| 2  | Digilib Server 2        | Running                     | Data found      |
| 3  | Digilib Server 3        | Running                     | Data found      |
| 4  | Digilib Server 4        | Running                     | Data found      |

4.3. Analysis performance cloud computing server
Performance analysis of cloud computing servers with Proxmox VE, shown in the table 2.

Table 2. Analysis performance server cloud with proxmox VE.

| No | Virtual Machine | Memory Usage Virtual Machine | CPU Usage Virtual Machine |
|----|-----------------|------------------------------|---------------------------|
| 1  | Digilib Server 1 | 24.8%                        | 0.5%                      |
| 2  | Digilib Server 2 | 24.6%                        | 0.5%                      |
| 3  | Digilib Server 3 | 24.6%                        | 0.6%                      |
| 4  | Digilib Server 4 | 24.2%                        | 0.5%                      |

5. Conclusions
From the test results, it can be concluded, that the integration of 4 digital library servers in displaying book search results based on keywords was successfully performed. Implementation of cloud computing servers using a standard computer with 8GB of memory, can run well.

Acknowledgment
The authors would like to thank to Director State Polytechnic of Malang who have supported this research project.

References
[1] A Harijanto, Ariyanto B, Yur 2015 Design And Performance Analysis Of Server Virtualization Using The Proxmox Virtual Environment Simantec Journal 5
[2] Proxmox 2018 Server Solutions GmbH, Proxmox VE Features [Online] Retrieved https://www.proxmox.com/en/about. Access on 2019-02-10
[3] Yicheng Z, Feng D, Qingmeng Z, Yong D 2014 Cloud Storage And Search For Mass Spatio-Temporal Datathrough Proxmox Ve And Elasticsearch Cluster Proceedings of CCIS2014
[4] Qiu O Z, Yue Z 2012 Research on application of virtualization in network technology course Computer Science & Education (ICCSE), 2012 7th International Conference on IEEE, 357-359
[5] A Kovari, P Dukan 2012 KVM and OpenVZ virtualization based laaS Open Source Cloud Virtualization Platforms: OpenNode, Proxmox VE IEEE 10th Jubilee International Symposium on Intelligent Systems and Informatics
[6] Simon M C C 2014 Proxmox High Availability Ltd.ISBN 978-1-78398-089-5, pp. 4 (Packt Publishing).
[7] Algarni S A, Ikbal M R, Alroobaea R, Ghiduk A S and Nadeem F 2018 Performance Evaluation of Xen, KVM, and Proxmox Hypervisors International Journal of Open Source Software and Processes 9 2
[8] AL-Mukhtar M M and Mardan A A A 2014 Performance evaluation of private clouds Eucalyptus versus CloudStack International Journal of Advanced Computer Science and Applications 5(5) 108-117
[9] Barbará de Oliveira S, Balloni A J, Barbará de Oliveira and Todad F A 2012 Information and
Service-Oriented Architecture & Web Services: enabling integration and organizational agility CENTERIS.

[10] Shashwat A, Kumar D, 2017 A Service Identification Model For Service Oriented Architecture 3rd IEEE International Conference on "Computational Intelligence and Communication Technology" (IEEE-CICT)

[11] Ouda A H, Allison D S, and M A M Capretz 2010 Security Protocols In Service-Oriented Architecture IEEE 6th World Congress on Services.

[12] SLiMS (Senayan Library Management System) SLiMS Features [Online] Retrieved from: https://slims.web.id/web/pages/about/. 2019-02-15.