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In coorporation with :

THE UNIVERSITY OF KITAKYUSHU

3rd ICETD 2014

The Third International Conference On Engineering And Technology Development

28 -29 October2014
Bandar Lampung University (UBL)
Lampung, Indonesia

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PREFACE

The Activities of the International Conference is in line and very appropriate with the vision and mission of Bandar Lampung University (UBL) to promote training and education as well as research in these areas.

On behalf of the Second International Conference on Engineering and Technology Development (3rd ICETD 2014) organizing committee, we are very pleased with the very good response especially from the keynote speaker and from the participans. It is noteworthy to point out that about 80 technical papers were received for this conference.

The participants of the conference come from many well known universities, among others : University Kebangsaan Malaysia – Malaysia, IEEE – Indonesia, Institut Teknologi sepuluh November – Indonesia, Surya Institute – Indonesia, International Islamic University – Malaysia, STMIK Mitra Lampung – lampung, Bandung Institut of Technology – Bandung, Lecture of The Malahayati University, B2TP – BPPT Researcher – lampung, University of Kitakyushu – Japan, Gadjah Mada University – Indonesia, Universitas Malahayati – Lampung, Lampung University – lampung,

I would like to express my deepest gratitude to the International Advisory Board members, sponsor and also to all keynote speakers and all participants. I am also gratefull to all organizing committee and all of the reviewers who contribute to the high standard of the conference. Also I would like to express my deepest gratitude to the Rector of Bandar Lampung University (UBL) who give us endless support to these activities, so that the conference can be administrated on time

Bandar Lampung, 22 October 2014

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Virtualization Technology for Optimizing Server Resource Usage

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Abstract— Data and information needs for large organizations rely heavily on information technology infrastructure support. One of the necessary supporting components is the availability of a sufficient number of servers to increase data center. The huge costs required to increase the number of server units. Virtualization technology can be the perfect solution to resolve these problems. However, due to the high cost of a license, causing an open source-based virtualization used as the main option, namely Proxmox. The application virtualization based Proxmox, can maximize the use of resources, because the function of 3 units of physical servers can be enabled simultaneously on 1 physical server unit. The presence of live migration feature of Proxmox, allowing to move a virtual machine from one physical server to another physical server when maintenance underway. This change can take place without stopping services running on virtual machine.

Keywords— virtualization, resources, server, Proxmox, live migration

I. INTRODUCTION

UPT-Teknologi dan Komunikasi Pendidikan (UPT-TKP) is a technical services unit of Education Department of Riau Province which has the task to develop information and communication technology in education. Currently, UPT-TKP has 3 units of servers. This condition is not sufficient to serve the needs of the data and information. Overall, according to the network design that has been made, the UPT-TKP must have at least 7 units of servers. The function of each of these servers are to be a proxy server, cloud storage server, firewall server, web server, application servers for the learning contents, database server and server monitoring system.

Due to current conditions, there are only 3 units existing server then turned off some of its features. As a result, resource usage of the servers are not optimal. This condition is very influential to the performance of UPT-TKP. Procurement of new servers with a heavy price can not be avoided, while there is a very limited budget. Operational funds for the maintenance of these servers are also expensive. The current electrical power capability could potentially be a complicated issue when adding servers is done. All of these servers require high electrical power during operation. Power supply capability UPT-TKP will not be able to meet the needs of all the servers.

This resource limitations can be overcome by virtualization technology, so the server function optimally. Virtualization utilizes existing space on a physical device to be used and make it as if the other units of physical devices. Server units in large numbers, can be incorporated usefulness and performed by 2 or 3 units of servers. It is very efficient. In addition to saving costs, virtualization can also improve the efficiency of the use of server resources.

There is a wide range of products that offer virtualization. Proxmox is one of them. Proxmox has licensed under the GPL v2, which means it's open source and free. In addition, Proxmox also has live migration features. This feature allows to move a virtual machine from one physical server to another physical server when maintenance takes place[2].

In this study, Proxmox will be tested as a virtual server on UPT-TKP Education Department of Riau Province.

II. THEORY

Virtualization refers to technologies designed to provide a layer of abstraction between computer hardware systems and the software running on them. Server virtualization is the use of software that allows the hardware to run multiple operating systems and services at the same time, while the virtual server is software that enables the use of a lot of hardware to run the system in an integrated manner [1].

Proxmox is a Linux distribution based on Debian (64 bits) that carries OpenVZ and KVM. Proxmox allows to perform centralized management of many physical servers. Proxmox consists of a minimum of one master and several nodes (at least one master and one node) [3].

III. ANALYSIS SYSTEM

Currently, the UPT-TKP has 3 units of physical servers. Where, the third server functions as proxy server, web server, and application server for learning content. All servers are located in a private network. Each of these has a different network to the client computer.

UPT-TKP has 3 internet lines with a total bandwidth of 10 Mbps, which is managed by firewalls and routers belonging to UPT-TKP. All three lanes of the internet has its own distribution channels and usability. Astinet service lines from Telkom, destined for the internet client and proxy server. PUSTEKOM internet line destined for a web server, and SPEEDY as a network backup for client. All three lanes are separated by using VLAN (Virtual Local Arean Network). In addition, the UPT-TKP also has a VPN-IP network that is connected to the 12 districts/cities in Riau province and has a metro Ethernet network that is connected to the Education Department of Riau Province. Details of the existing network topology currently in UPT-TKP can be seen in Figure 1.

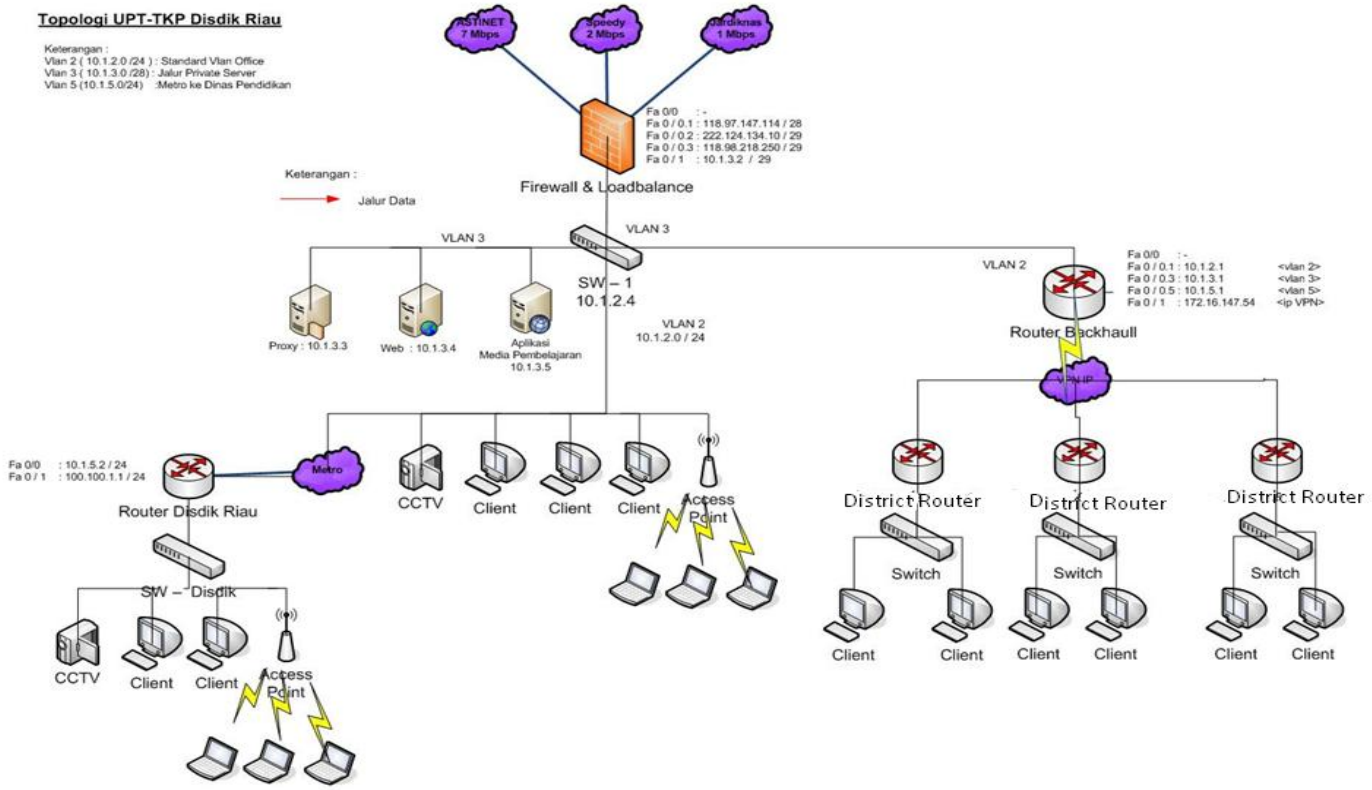

Fig. 1 Network Topology of UPT-TKP Riau

The main problems faced by the UPT-TKP Riau Province is the lack of availability of servers. The servers is currently owned, not enough to meet the needs of the main duties and functions of UPT-TKP Riau Province. Overall, the UPT-TKP must have a minimum of 7 units of servers. Required of their role as a proxy server, cloud storage servers, firewall servers, web servers, application servers for learning media content, database servers and server monitoring system. Currently, only 3 units available servers. Some server functions had to be stopped. It would greatly hamper the performance of UPT-TKP.

In the later stages of identification, if it is available 7 server unit, and must be operated simultaneously, the power supply UPT-TKP will not be able to fulfill. Furthermore, observations of the efficiency of resource usage on the 3 units existing server, is also done. Observations were made using the software PRTG Network Monitor is installed into a computer. Their role is to observe and record the activity resource running on the servers. The observed resource is CPU usage, memory usage, and network traffic.

The observation of these resources is shown in the form of graphs and tables which have been recorded by the software: PRTG Network Monitor. The results of observations are shown in Table I as follows:

TABLE I
OBSERVATIONS OF SERVER RESOURCES

No	*Server*	CPU	Memory	Network
1	*Web Server Real*	1 %	26 %	131 kbit/s
2	*Aplikasi Server Real*	0,30 %	38 %	131 kbit/s
3	*Proxy Server Real*	0,03 %	36 %	35 kbit/s

IV. RESOLUTION

Solutions to problems faced by the UPT-TKP, is to build a server-based virtualization system that can run seventh Proxmox server functionality into the 3 physical servers. Later, 1 unit of physical servers will accommodate 3 virtual servers, and 2 units remaining physical servers each will accommodate two virtual servers. These three physical servers that will connect with Proxmox VE Cluster, making it easier to manage. After that, tests will be conducted using the optimal level of the server virtualization. There is one unit of a computer (PC) additional function as a file server for testing against the use of live migration feature. This feature allows the removal of virtual servers from one physical server to another physical server without experiencing downtime. While the file server will be installed using the operating system FreeBSD-based FreeNAS.

There was no significant change in shape between the old network topology design with the new one. Only the private network servers that are changing due in virtualization. There is the addition of a new IP address for the virtual servers and the addition of a subnet. Previously used for the 6 hosts, changed to 14 hosts, due to the increase of virtual servers. Later, the server UPT-TKP previous scene consists of 3 units, increased to 7 units after virtualized. The addition here is not adding servers in physical form but only the addition of the virtual server. Those 7 servers will function as a proxy server, cloud storage servers, firewall servers, web servers, application servers for learning media content, database servers and server monitoring system. Furthermore, there is the addition of 1 unit of computer (PC) which functioned as a NAS (Network Attacher Storage) File Server while to test live migration. Detailed plan of the network topology after the implementation of virtualization can be seen in Figure 2.

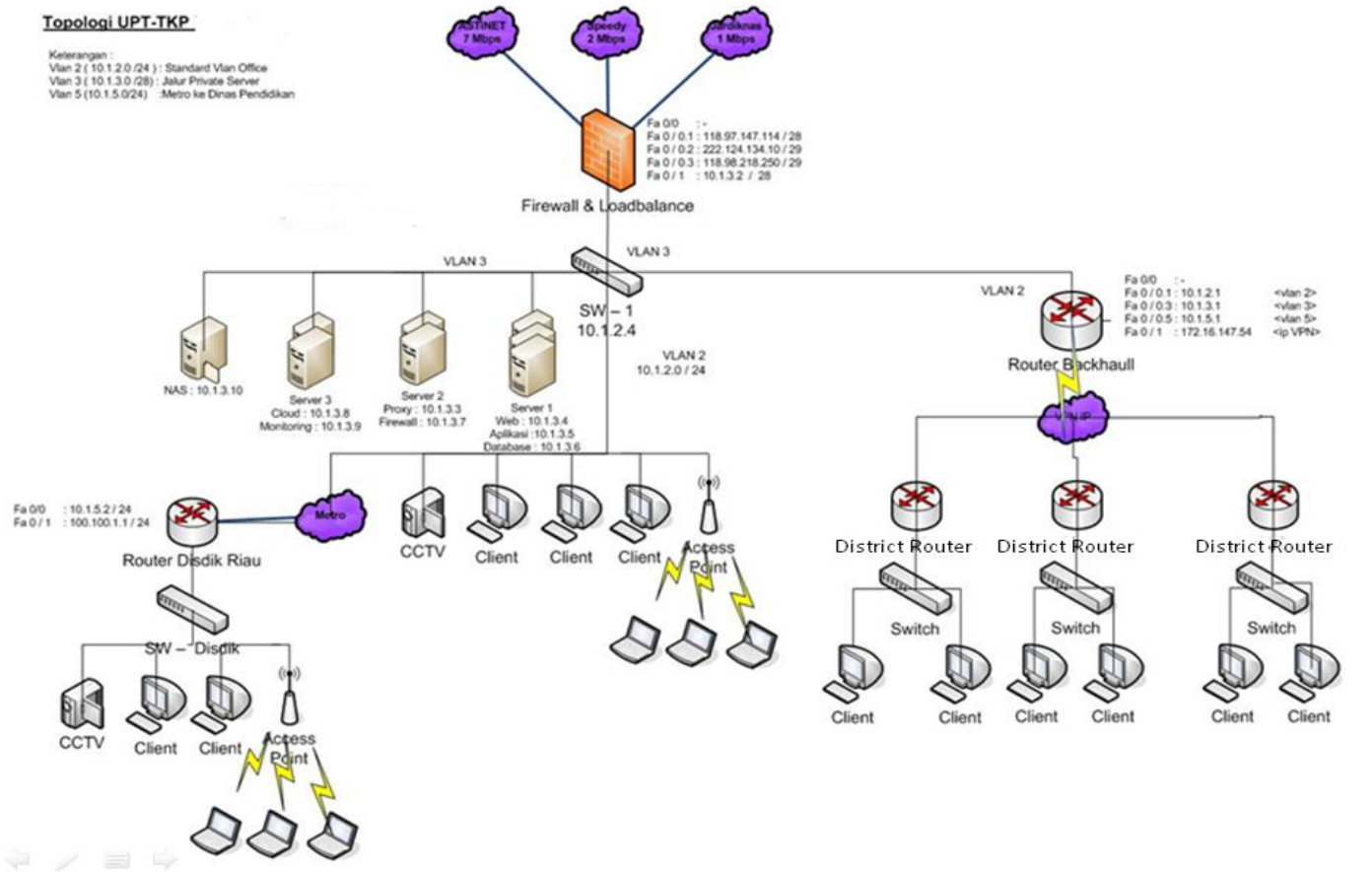

Fig. 2 The network topology after the implementation of virtualization

Server virtualization is done using Proxmox. All three available servers, each of which will be installed Proxmox, and performed the virtual server configuration. All servers will be configured in order for the inter-connected with Proxmox VE Cluster. It is intended to be easy in managing virtualization and live migration.

If the Proxmox VE Cluster configuration is completed, the next step are to install the operating system on the server and configure each of the seven servers to be able to function in 3 physical servers. The next stage is observed how the optimal usage of server resources when the virtualization is done. The study was conducted by observing the performance of all the

form of traffic server CPU usage, RAM, and Network Adapter for 15 days. After 15 days, the observations will be obtained in the form of graphs and tables use of server resources obtained from PRTG Network Monitor software.

After the results of the use of server resources obtained, then continue to do experiments to find out how much time it takes by Proxmox downtime to move a virtual server from one physical server, and to a second physical server or commonly called live migration. In order to perform live migration requires a file server operating system installed FreeNAS. FreeNAS is a linux distro that is specifically used as the operating system of a NAS based on FreeBSD is used for shared storage, which is a volume / partition the hard drive that is shared by the computer or server. In doing research on live migration techniques, considerations for test only by one virtual server being tested is due to limitations amounts of the device. It is highly recommended to use hardisk server type SAS-10,000RPM to use the 'NAS file server'. However, due to the limitations of the devices owned by UPT-TKP, that only has SATA hard drive-7,200RPM, then just one virtualization is tested to determine how much downtime is needed when a live migration is done.

To complete this research, it has been used 3 units of servers, and 1 unit of PC to test that function as a NAS file server. The entire hardwares specification used are as follows:

A. Server- 1:
- [1] Processor Intel Pentium Core Intel® Core™ i5-3470 Processor (3.2 Ghz, 6M Cache)
- [2] RAM 4 GB DDR3 PC-12800
- [3] VGA Card Intel® HD Graphics
- [4] LAN Card Gigabit Ethernet 10/100/1000 Mbps
- [5] Harddisk 1 TB SATA, 7200 RPM
- [6] DVD Rom Drive.

B. Server -2:
- [1] Processor Intel Xeon 3,2 Ghz
- [2] PC2-3200 DDR2 3 Gb
- [3] Networking HP NC7782
- [4] Storage Integrated Smart Array 6i 320 Gb
- [5] DVD Rom Drive.

C. Server -3:
- [1] Processor Intel Xeon Dual Core 1,6 Ghz with VT
- [2] PC2-3200 DDR2 2 Gb
- [3] Networking HP NC7782
- [4] Storage Integrated Smart Array 6i 250 Gb
- [5] DVD Rom Drive.

D. PC for file server NAS:
- [1] Processor Intel Xeon Quad Co re E5320 1,86 Ghz
- [2] PC2-5300 DDR2 1 Gb
- [3] LAN Card Intel Pro 1000 Mb
- [4] Harddisk 320 GB
- [5] DVD Rom Drive
- [6] Cable : UTP
- [7] Connector : to be connected to the cable RJ45
- [8] Switch hub : As a medium to connecting the three servers.

V. RESULT

The results of this research is divided into two parts, namely the applied virtualization and live migration.

5.1 Virtualization

The results of the research carried out by the observation virtualization for 15 days to load data server performance. Monitoring is performed continuously on 7 units of virtual servers that work, and 3 Proxmox server as a master server. The observation result in the form of tables and graphs recorded by PRTG Network Monitor software and presented as in Table III below.

TABLE II
RESULT OBSERVATION OF VIRTUALIZATION

No	*Server*	CPU	Memory	Network
1	*Web Server*	1 %	32 %	518 kbit/s
2	*Aplikasi Server*	1 %	25 %	7 kbit/s
3	*Database Server*	1 %	21 %	52 kbit/s
4	*Proxy Server*	4 %	57 %	252 kbit/s
5	*Firewall Server*	6 %	10 %	394 kbit/s
6	*Cloud Storage Server*	3 %	41 %	59 kbit/s
7	*Monitoring Server*	1 %	28 %	22 kbit/s
8	*Proxmox Server* 1	4 %	66 %	187 kbit/s
9	*Proxmox Server* 2	8 %	74 %	738 kbit/s
10	*Proxmox Server* 3	16 %	91 %	168 kbit/s

The next stage is to do a comparison between the server resource usage before and after virtualized. The comparison is done by comparing the results of the use of CPU resources, memory, and network usage between the web server before and after virtualized. Similarly, application servers, and proxy servers. The results of all these comparisons can be seen in Table III.

TABLE III
COMPARISON OF RESULTS

No	*Server*	CPU	Memory	Network
1	*Web Server Virtualisasi*	1 %	32 %	518 kbit/s
2	*Web Server Real*	1 %	26 %	131 kbit/s
3	*Aplikasi Server Virtualisasi*	1 %	25 %	7 kbit/s
4	*Aplikasi Server Real*	0,30 %	38 %	131 kbit/s
5	*Proxy Server Virtualisasi*	4 %	57 %	252 kbit/s
6	*Proxy Server Real*	0,03 %	36 %	35 kbit/s

Based on all the data that has been obtained, it can be seen that when using 1 servers function as the use of web servers to one physical server, create a lot of unused server resources. With the use of virtualization, more server resource usage can be maximized, because in addition to the financial saving to conduct purchases of new servers, also maximize the use of server resources. The use of virtualization, proven to be maximizing the use of server resources. One unit of the server that previously just for one function, can be maximized as much as 3 units of servers.

5.2 Live Migration

Experiments on the live migration is done by creating a virtual server in the server-3 installed Windows XP operating system, and a virtual file server is placed on the NAS File Server. The requirements to perform live migration, virtual file servers should be placed in a separate file server from Proxmox server. After the creation of virtual servers is completed, the next step is to enable live migration. Then observe the downtime required when performed live migration. Figure 3 below shows the results of the system log Proxmox when live migration is in progress.

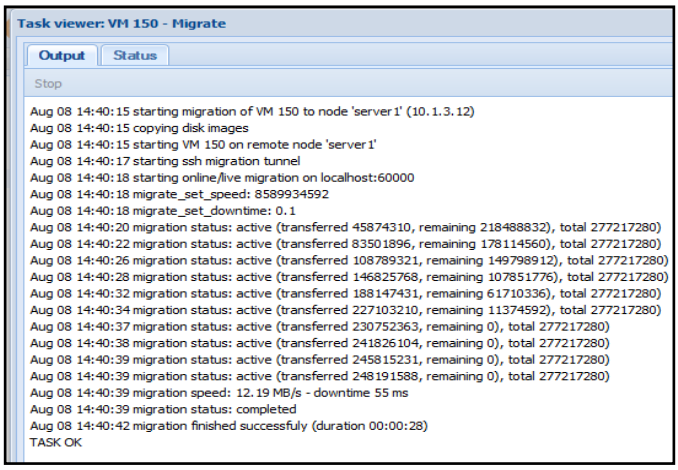

Fig. 3 Log System Proxmox

The data were obtained from the activation of the live migration feature as follows :

1. Ping results that showed a slowdown in the connection, initially ping time only takes 1ms and when live migration running, ping times increased to an average of 30ms.
2. Live migration process takes 30 seconds.
3. The downtime is 55ms.
4. Switching Speed to Virtual Server is 12 Mbps.

According to existing data, feature activation does not interfere with the performance of the live migration of virtual Windows XP is running, because of the rapid removal time and downtime is very small so it does not feel any downtime.

Based on the observations and the results obtained, it can be concluded that the live migration can be reliable, if the maintenance will be done on the server hardware that requires the server to shut down the service. With the removal of virtual server from server-1 to server-3, will be able to avoid the occurrence of service downtime. This does not make the client harmed because the process of moving a virtual server running very quickly.

VI. CONCLUTIONS

After studying, analyzing, and implementing server virtualization technology at UPT-TKP can be concluded as follows:

1. The application of virtualization in the UPT-TKP, cause it can provide data and information well, because the need for the availability of the server unit 7 as planned, its function can be replaced by 3 units available physical servers.
2. The use of server resources to be optimal, because the resource is left and not used, can be used to add a virtual server. This is due to the application of the 'one unit of server' to '1 server function' causing many server resources are not used, and server virtualization, utilizing the advantages of server resources to create multiple virtual servers, so the server resource usage would be optimal.
3. Features online transfer of the virtual server from 'server-1' to 'server-2' (live migration) can be relied upon when the 'server-1' will perform hardware maintenance. So there is no downtime virtual server that occurs when a physical server requires maintenance.
4. The use of server virtualization can reduce the cost of purchasing expensive new servers and server operating costs, because of the need 7 server unit can be met only by 3 units of physical servers virtualized into 7 units of servers.

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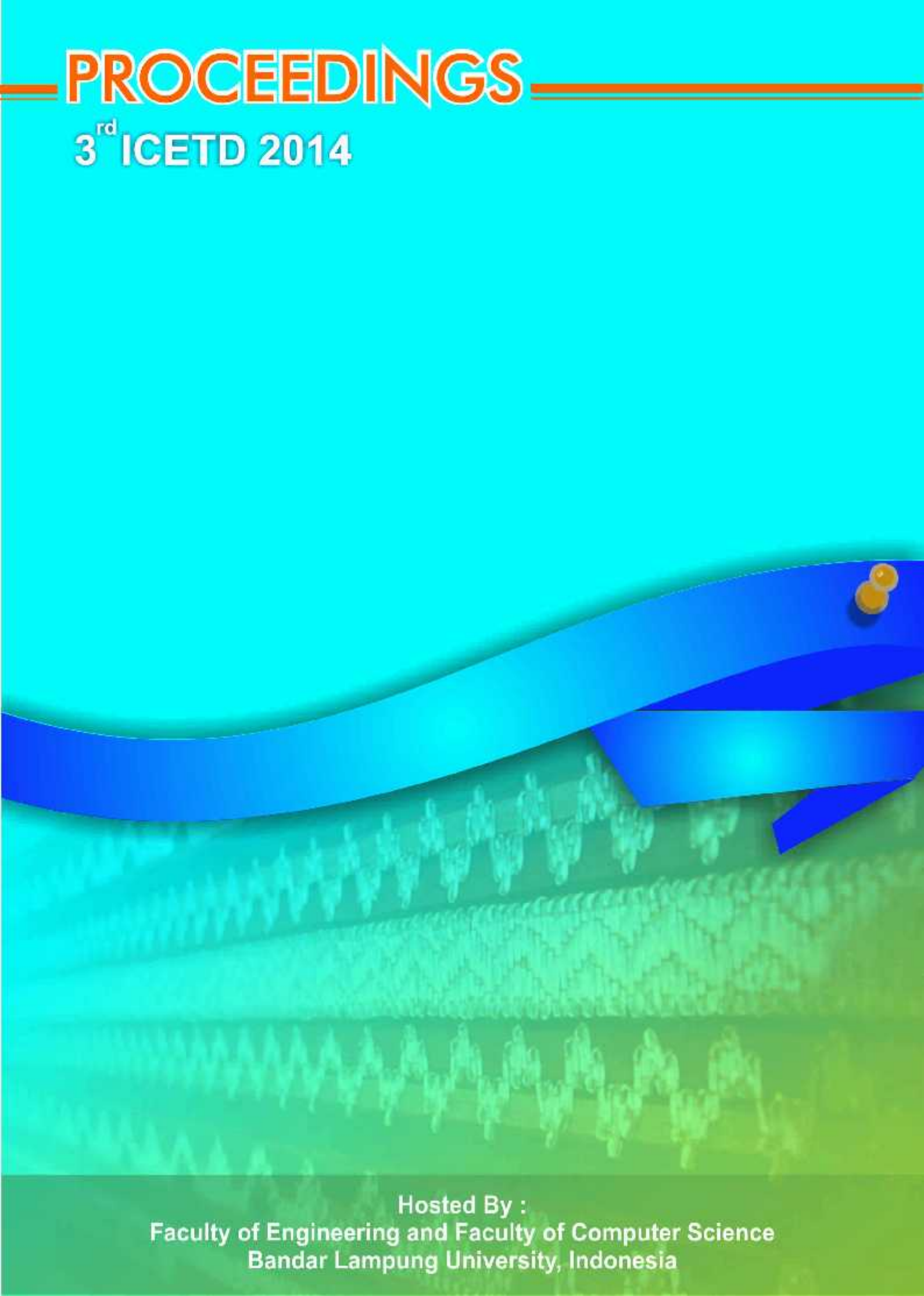

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