

# Performance Analysis of Proxmox and Virtualbox with Overhead and Linearity Parameters to Support Server Administration Practice

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## ABSTRACT

In the informatics and computer engineering education study program, there is a computer network administration course. One of the competencies in that course is server administration. Server administration practices require virtual servers that have good performance to support server administration practices. The previous students used VirtualBox in server administration practice. The use of VirtualBox is felt to be lacking in terms of performance. Therefore, it takes a virtual server that has better performance than VirtualBox. Researchers used a Proxmox virtual server to compare its performance with VirtualBox. The performance test uses overhead and linearity parameters. The results showed that when testing the performance of overhead and linearity parameters, proxmox was able to run ten virtual machines according to the research scenario. While in VirtualBox, you are only able to run three virtual machines. The overhead on proxmox is 8.3 to 15.1 seconds. While the overhead on virtualbox is higher than that on proxmox, which is 84.2 to 155.8 seconds, The graph of overhead values on Proxmox is also more stable and constant than that on VirtualBox. As for the linearity on proxmox, the value is 85.3 to 858.64 seconds. While the linearity in VirtualBox is 241.07 to 2247.15 seconds, The graph of linearity values on Proxmox also experienced a more stable increase than VirtualBox. The conclusion of this research is that the performance of proxmox with parameters for overhead and linearity is better than that of virtualbox in supporting server administration practices.

**Keywords:** Linearity, Overhead, Proxmox, Virtualbox

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## 1. INTRODUCTION

In the Informatics and Computer Engineering Education Study Program, FKIP UNS, there are several courses, one of which is Computer Network Administration, a course broadcast in semester 3. In these courses, students in the learning process are equipped with knowledge and skills. Knowledge is obtained through learning the theories given by the educator, and skills are obtained through the students' practical activities during the learning process. One of the competencies in the course is server administration.

In server administration practicum learning, it will not be completed in one face-to-face lecture. It is conceivable, if there are only a few computers, to do a server administration practicum using computers and cable networks that have been set up as servers and networks according to the server administration learning scenario. Then other courses that will use computer devices and wired networks will not be able to use them because they will interfere with the configuration that has been made in such a way according to the server administration learning scenario.

The capabilities of computers today are very high, ranging from speed, storage capacity, memory capacity, and increasing processor capabilities. In addition, we also developed a capability called computer virtualization. Using virtual technology and appropriate software, a virtual network environment can be created according to the actual system (Dobrilovic, D., Jevtic, V., & Odadic, 2012). Virtualization allows the creation of several virtual computers with different operating systems on one physical machine. These virtual computers can be servers, workstations, or network units (Dobrilovic, D., Jevtic, V., & Odadic, 2012).

Current server administration practices already use server virtualization technology in the form of VirtualBox. VirtualBox is an open-source virtualization application that allows users to run one or more operating systems in one virtual machine while running Windows (Sidiq, 2013). The use of VirtualBox on the same computer or laptop causes problems, namely inadequate computer or laptop performance so that VirtualBox runs slowly, so the teaching and learning process will be hampered. This is because during server administration practice, it is required to open more than two operating systems on one student's laptop, one as a server and one as a client. Therefore, a virtualization technology that has better performance than VirtualBox is needed so that server administration practices run smoothly. According to (Arfriandi, 2012), Proxmox has good performance when compared to other virtualizations that can run Windows.

So in this study, researchers chose Proxmox as a server virtualization technology to compare its performance with VirtualBox. Due to his limitations, the researcher examined the performance of proxmox and virtualbox with two parameters, namely overhead and linearity. The tests carried out are CPU usage and file transfer time. This research focuses on analyzing the performance of proxmox and virtualbox. It is hoped that with the performance analysis on proxmox and virtualbox, it can be seen which server virtualization technology has better performance that can be used to support server administration practices.

## 2. RESEARCH METHOD

This research method begins with several stages of research, namely the preparation stage, design stage, implementation stage, and reporting stage.

### 2.1. PREPARATION

In this stage, a work plan is prepared to address the problems that will arise, including the hardware and software requirements used to support the creation of a virtual server architecture model.

Hardware requirements in this study include personal computers (PCs), monitors, keyboards, mice, unshielded twisted pair (UTP) cables, RJ-45 connectors, network cards, switches, stopwatches, and calculators. The PC specifications used are processors that have hardware virtualization capabilities. The processor used in this research is the Intel Core i3.

The native server used is Debian version 7.0. Then the server is installed with the FTP server application. The virtual server uses Proxmox and VirtualBox with an FTP server application and the addition of several virtual machines.

### 2.2. DESIGN

At this stage, the design of the proxmox and virtualbox server virtualization systems is carried out according to the preparations that have been made. Between the client and server connected via a switch or hub, physically, the virtual server looks like a unit, so it looks as if it looks like one server.

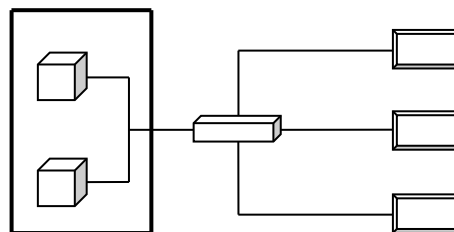


Figure 1. Virtual Server System Design

### 2.3. DEVELOPMENT

At this stage, the design of the proxmox and virtualbox server virtualization systems is carried out according to the results of the design analysis. All server configuration is done at this stage.

### 2.4. TESTING

At this stage, performance testing is carried out. The tests carried out are overhead and linearity tests. The scenarios are showed in Table 1 and Table 2.

Table 1. Overhead Testing Scenario

Scenario	Testing
FTP server virtual machine	Overhead
Added 1 virtual machine without application	Overhead
Added 1 virtual machine without application	Overhead
Added 1 virtual machine without application	Overhead
Added 1 virtual machine without application	Overhead
Added 1 virtual machine without application	Overhead
Added 1 virtual machine without application	Overhead
Added 1 virtual machine without application	Overhead
Added 1 virtual machine without application	Overhead
Added 1 virtual machine without application	Overhead
Added 1 virtual machine without application	Overhead

Table 2. Linearity Testing Scenario

Scenario	Testing
Mesin virtual FTP server	Linearity
Added 1 FTP server to the same	Linearity
Added 1 FTP server to the same	Linearity
Added 1 FTP server to the same	Linearity
Added 1 FTP server to the same	Linearity
Added 1 FTP server to the same	Linearity
Added 1 FTP server to the same	Linearity
Added 1 FTP server to the same	Linearity
Added 1 FTP server to the same	Linearity
Added 1 FTP server to the same	Linearity
Added 1 FTP server to the same	Linearity

## 2.5. REPORTING

At this stage, a report on the results of data collection is carried out through observations as well as conclusions to determine the performance of proxmox and virtualbox with overhead and linearity parameters to support server administration practices.

Evaluation of virtualization overhead is done by comparing the execution time of applications running on a physical machine ( $T_a$ ) with the same application running on a virtual machine ( $T_{av}$ ) (Adji, T. B., Nggilu, F. S., & Sumaryono, 2013). Virtualization overhead is calculated using Formula (1).

$$Ov = T_{av} - T_a \quad (1)$$

With,  $Ov$  : Overhead (sec)  
 $T_{av}$  : Application execution time on the virtual server (sec)  
 $T_a$  : Application execution time on the native server (sec)

If the application takes time ( $T_{av}$ ) when running on a virtual machine, when the application is run concurrently on  $n$  virtual machines, the maximum application execution time ( $T_{max}$ ) (Rahma, Fayruz; Adji, Teguh Bharata; Widyawan, 2013) is showed in Formula (2).

$$T_{max} = Ov + T_{av} \times n \quad (2)$$

With,  $T_{max}$  : Maximum app execution time (sec)  
 $Ov$  : Overhead (sec)  
 $T_{av}$  : Application execution time on the virtual server (sec)  
 $n$  : Number of virtual machines

The data that has been obtained will be presented in graphical form so that it will be easy to analyze and then draw conclusions from the research.

## 3. RESULT AND ANALYSIS

The results of the study include CPU usage and file transfer times on Proxmox and VirtualBox during testing. During the analysis, the performance analysis of proxmox and virtualbox is carried out using the formula.

### 3.1. RESULT

#### 3.1.1. OVERHEAD TESTING

Proxmox's CPU usage is more stable with every addition of a virtual machine without an application when compared to VirtualBox, which has a very significant increase. Proxmox CPU usage has changed, but not significantly. Meanwhile, proxmox CPU usage when adding virtual machines is more efficient than virtualbox CPU usage.

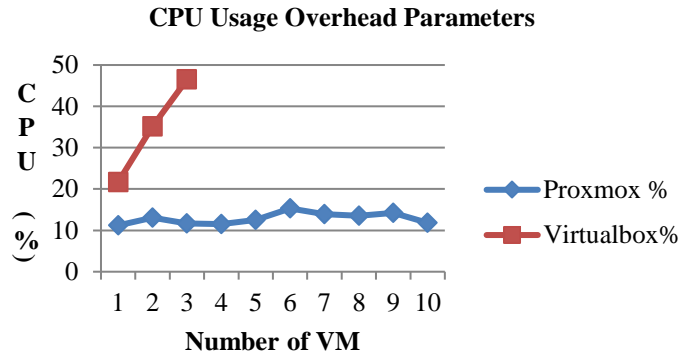


Figure 2. CPU Usage Overhead Parameters

Transfer times on Proxmox are more stable every time a virtual machine is added without an application than on VirtualBox. On proxmox, there may be fluctuations at some point, but not significantly. While in virtualbox, the transfer time significantly increases. While the transfer time on Proxmox when adding virtual machines is faster than the transfer time on VirtualBox.

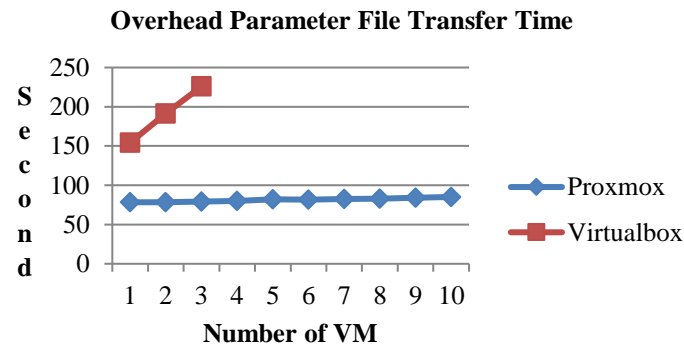


Figure 3. Overhead Parameter File Transfer Time

#### 3.1.2. LINEARITY TESTING

CPU usage on Proxmox increases every time the FTP server is added. CPU usage on Proxmox with the addition of ten FTP servers is almost as high as CPU usage on VirtualBox when adding a second FTP server. While CPU usage on VirtualBox has increased significantly more than on Proxmox.

From these results, it is known that CPU usage on Proxmox and VirtualBox has increased with each additional workload.

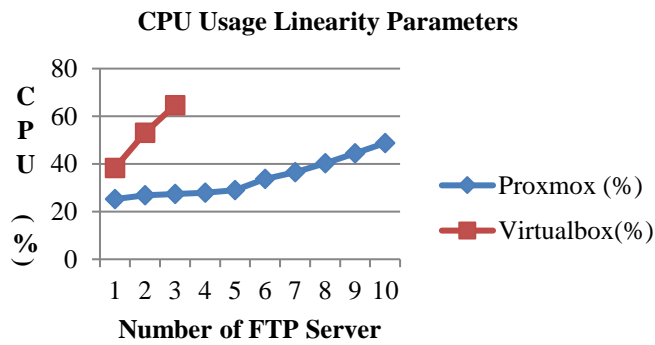


Figure 4. CPU Usage Linearity Parameters

Transfer time on Proxmox increases fairly consistently every time an FTP server is added to VirtualBox. It was noted that until the addition of ten FTP servers, the increase in transfer time on Proxmox was still constant. Meanwhile, the transfer time on VirtualBox has increased significantly compared to Proxmox. For example, when adding a second FTP server to VirtualBox, the increase is very significant.

This proves that the transfer time on Proxmox and VirtualBox increases with every additional performance load.

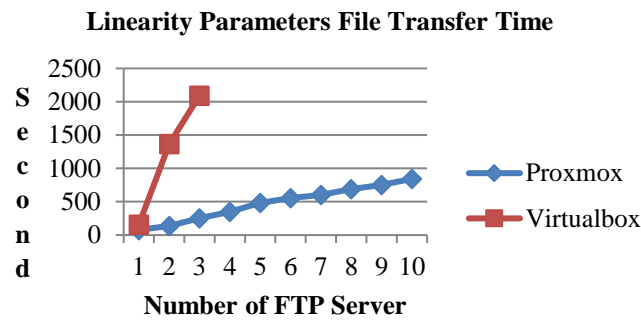


Figure 5. Linearity Parameters File Transfer Time

### 3.2. ANALYSIS

#### 3.2.1. OVERHEAD ANALYSIS

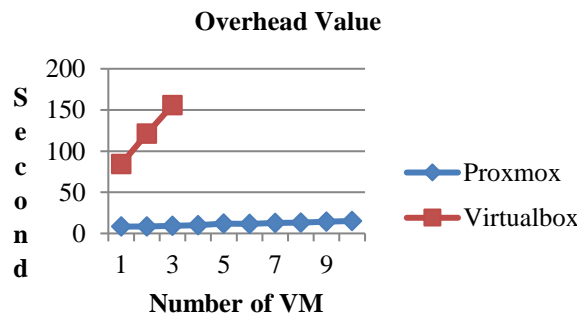


Figure 6. Overhead Value

In the graph above, it is known that for every additional virtual machine without an application, the overhead of proxmox is quite constant compared to virtualbox. There may only be some points found to be

fluctuating but not significant. It is known that the overhead on Proxmox for each additional virtual machine without an application is in the range of 8.3–15.1 seconds.

Meanwhile, the virtualbox overhead for each additional virtual machine has increased significantly since the addition of the first virtual machine. VirtualBox is only capable of running three virtual machines simultaneously. Overhead on VirtualBox for each additional virtual machine without an application ranges from 84.2 to 155.8 seconds.

While the overhead of proxmox is smaller than that of virtualbox. The difference between the proxmox and virtualbox overhead values is very significant, ranging from 75.9 to 146.5 seconds.

### 3.2.2. Linearity Analysis

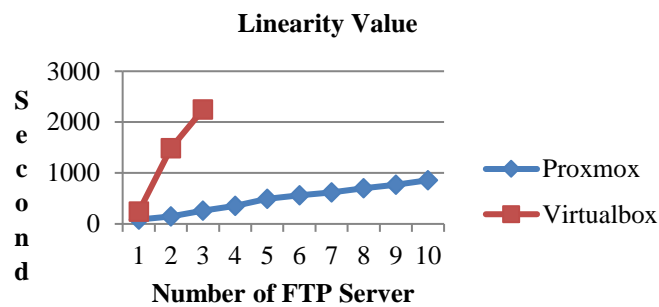


Figure 7. Linearity Value

Based on the table above, it can be seen that the linearity in proxmox for each additional FTP server ranges from 85.3 to 858.64 seconds.

While VirtualBox is only able to run three FTP servers simultaneously. The linearity in virtualbox is such that for each additional FTP server, the value ranges from 241.07 to 2247.15 seconds.

In the graph above, it is known that for every additional FTP server, proxmox linearity is more stable than virtualbox. There may only be some points found to be fluctuating but not significant. Meanwhile, virtualbox linearity increased significantly when the second FTP server was added.

## 4. CONCLUSION

The conclusion of the study is that proxmox can support server administration practices as seen from the performance of overhead and linearity parameters. In terms of the results of the analysis, which show the overhead and linearity parameters are better than those of VirtualBox.

Among them, the overhead on Proxmox is lower than that on VirtualBox. The proxmox overhead value ranges from 8.3 to 15.1 seconds, while the virtualbox overhead value ranges from 84.2 to 155.8 seconds. Then, on the graph of the overhead, the overhead on Proxmox is more stable than virtualBox every time you add a virtual machine without an application.

In the graph of linearity values, the linearity of proxmox is better than that of virtualbox, as indicated by the transfer time having a tendency to increase, which is more stable and constant than virtualbox every time an FTP server is added and is given the same load. Proxmox linearity: when adding the first FTP server, the value is 85.3 seconds; until it can run the tenth FTP server, the value is 858.64 seconds. During the virtualbox linearity, the value is 241.07 seconds when the first FTP server is added, until it is only able to run three FTP servers, but the value is up to 2247.15 seconds.

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