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Research Article

Optimized Load Balancing Using Adaptive Algorithm In Cloud Computing With Round Robin Technique

Shalvi Agarwal[1*], Rajeev Kaushik[2], Sudhir Dawra[3],

[1*,2,3]Deptt. of Computer Science & Engineering, R.D. Engineering College, Ghaziabad, India
[3]Deptt. of Computer Science & Engineering, Inderprastha Engineering College, Ghaziabad, India

***Corresponding Author:** Shalvi Agarwal
Email: shalviaug@gmail.com

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ABSTRACT

Developments in the field of computer networks have been carried out by several groups. However, there are still a lot of wrong problems one is the server load. For this reason, a system will be implemented Load Balancing with the aim of overcoming the server load which is not in accordance with its capacity and to optimize server load before and after the implementation of the Round robin Algorithm Load Balancing system on the cloud servers. The method used is the comparative method, namely researches that compares and analyze two or more symptoms, compare least connection algorithm as the previous algorithm with Round robin algorithm. Load Balancing Testing with both algorithms using a software called Httperf. Httperf displays the value according to parameters. The parameters used are Throughput, Response Time, Error and CPU Utilization. The test results show that load balancing with the algorithm round robin is more effective to handle server load than algorithm. The previous one was Least Connection. It is proven that in each respondent's assessment of the load balancing system. Test rating throughput obtained a percentage of 81.11% with good criteria, testing response time obtained a percentage of 81.78% with good criteria, testing error obtained a percentage of 84.67% with very good criteria, and cpu utilization testing obtained a percentage of 82% with good criteria.

Keywords- Httperf, CPU utilization, Round robin

1. INTRODUCTION

The existence of communication network technology allows two entities to be connected to each other. This allows computers to be associated to every one further via a communication group. With the increasing alacrity of delivery that current communication technologies can make, this has allowed computers to share resources, such as CPU, memory and storage media, to provide applications that are superior to a single system [1]. This is also driven by the problems to be solved which have become more complex and on a larger scale to be worked on by a single computer. One of the applications that take advantage of the advances in communication network technology is grid computing and cluster computing. Network computing is a structure of computing that occupies numerous machines that are typically heterogeneous and spread over different geographic locations. Meanwhile, cluster computing is a computation that involves many computers located in one place. Cluster computing is one of the constituent components of grid computing [2-4]. In cluster computing, the terms server, node, client, job and task are known. A task is a computational unit which is usually a program that cannot be broken down into small processes. Job is a computational activity that consists of one or several tasks [2-4]. Clients are entities that create jobs, servers are entities that distribute jobs and nodes are entities that perform computational tasks [2-4]. When receiving a job, there is a possibility that the computers in the parallel computing system experience an unbalanced load. This unbalanced system load condition can reduce the Quality of Service (QoS), so a load balancing method is needed. In cluster computing, there is a term load balancing policy. Policy load balancing in cluster computing can be categorized into four, namely static, dynamic, hybrid and adaptive methods [5-8]. Static policies consider the state of systems and applications statically and pertain this in sequence into pronouncement production. The foremost improvement of static policy is mediocre transparency because assessment creation has been through prior to the job is given [5-8]. Dynamic policies work by moving jobs from an overloaded computer to a lesser computer. The hybrid method is a load balancing method that combines static methods and dynamic methods. Meanwhile, the adaptive method is a method that adaptively adjusts the portion of the task using the latest information from the system and a certain threshold value. Adaptive policy for load balancing problems has been done a lot of research.

1.1. IDENTIFICATION OF PROBLEM

From the facts on the background, several can be identified problems, including:

1. Internet users increase along with the number of devices that continues increases, so that server performance is required to increase as well.
2. Servers that have high performance have a good price high, so it is necessary to find a solution to create a server with services high but minimal costs.

1.2. FORMULATION OF THE PROBLEM

Based on this background, it can formulate problems which exist, namely:

1. How to deal with the server load in Cloud Computing that is not in accordance with the capacity?
2. How to optimize the server load before and after application of the Round robin Load Balancing Algorithm system on Cloud servers?

2. PROPOSED METHODOLOGY

2.1. SYSTEM REQUIREMENTS ANALYSIS

In making this final thesis, using a qualitative approach, namely investigate that be determined to recognize the incident knowledgeable by research topic such as performance, perceptions, inspiration, actions and others. The qualitative research method in this study uses comparative research. However, comparative research is a study that compares and analyzes two or more symptoms. The comparison in this study is to compare the round robin algorithm with least connection.

2.2 SOFTWARE COMPONENTS

The software used in this research is as follows the following:

- **Operating system**

The operating system used as the load balance is RHEL Server 6.5. Meanwhile, as a virtual server using the RHEL 6.0 operating system. And for client computers using the Windows Desktop 7 operating system.

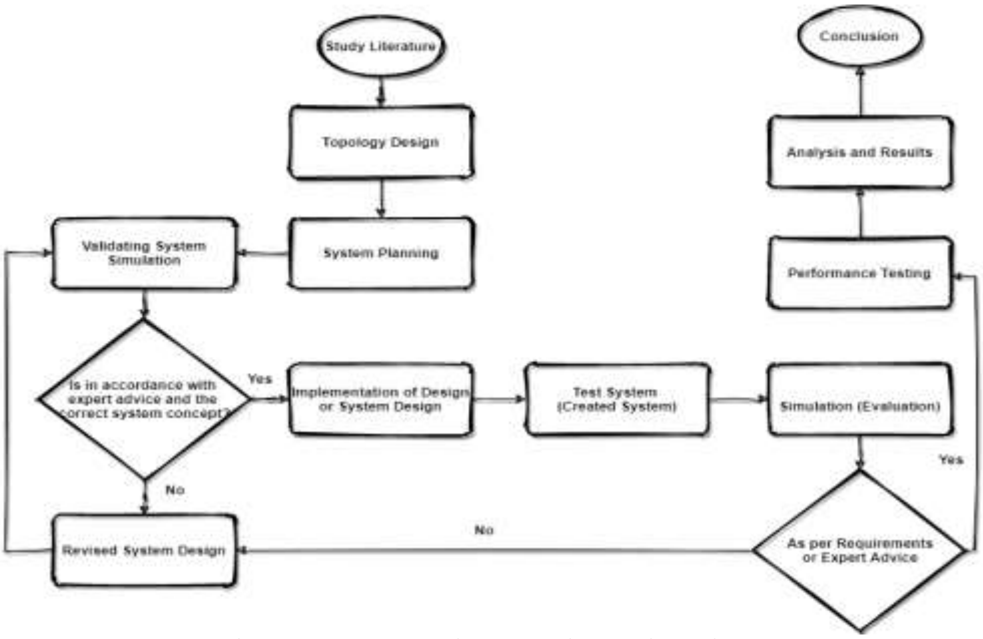
Study Literature
Topology Design
System Planning
Validating System Simulation
Is in accordance with expert advice and the correct system concept?
Yes
No
Implementation of Design or System Design
Test System (Created System)
Simulation (Evaluation)
Revised System Design
No
As per Requirements or Expert Advice
Yes
Performance Testing
Analysis and Results
Conclusion

Figure 1: Research Procedure Flowchart

The explanation of each stage system in the flowchart above is as follows:

- **System Design**

The network design used for the experiment uses a simple local network as shown in the following figure:

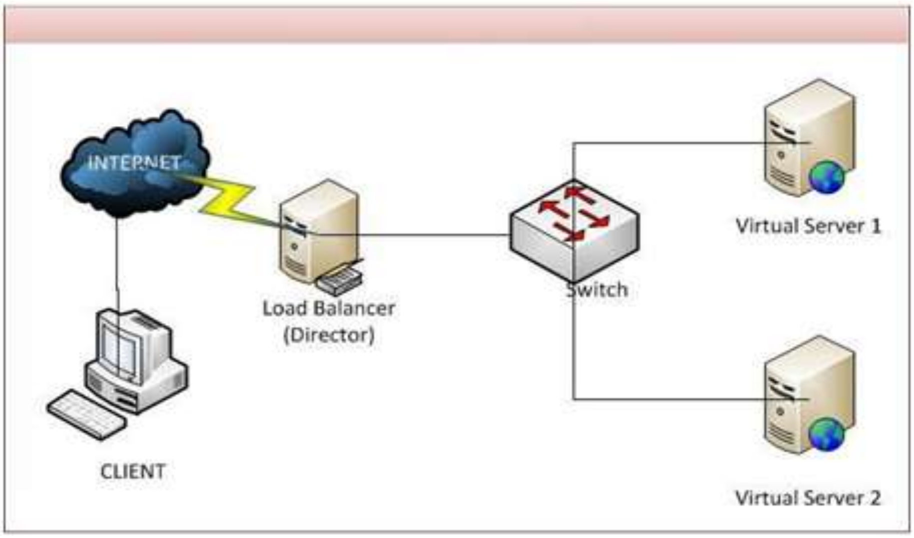

Figure 2: Scenarios 1 and 2 with 2 Virtual Servers

Figure 2 is an experimental scenario using 2 virtual servers connected to the Director (Load Balancer). Each virtual server runs apache and has a load balance using the server director. On this load balance runs the IPvsadm software which experiments to replace the load balance algorithm. Experiments were carried out with 2 algorithms, namely Least connection and Round robin with 10 trials each with a predetermined request.

- **Implementation**

System Kernel Linux Director: System operation Linux that use the kernel version below:-
Linux Kernel 2.4.28 doesn't support Linux virtual server yet, so patching is needed by compiling the kernel, but in this final project the author uses a kernel that supports Linux virtual server, but needs to activate the virtual server modules in the kernel using modprobe.
1.echo ipvs dh >> /etc/modules echo ipvs ftp >> /etc/modules echo ipavs>> /etc/modules echo ipavsalc>> /etc/modules echo ipavsarr>> /etc/modules
modprobeipavsadhmodprobeaipavsaftpamodprobeaipavsamodprobeipavsalcamodprobeipavsarr
Whereas for kernels that do not yet support the Linux virtual server, compilation must be done by taking the kernel source from the kernel.org site or scheme can use the Synaptic Package Manager tool. After all the preparations are complete, then recompile the linux kernel. To recompile the kernel, the packages used for compilation are needed, namely:
kernel-packager
libnucrses5-devr
# yum install kernel-packagellibncurses5-dev

After the above packages are installed, the kernel compilation is ready to do. The next steps for compiling the kernel are:-
a)Go to the /usr/src directory and extract the existing kernel-2.6.x sources.
# tar –jxvfalinux-2.6.x.tar.bz2a
b)Enter the ipvs patch in the /usr/src directory and extract the patch.
# tara-zxvfaipvs-1.1.7.tar.gza

c) Enter the linux-2.6.x directory as a result of the extraction that has been done, and do the kernel patching.
# cd / linux-2.6.x
#patchr-pqr<../ipvs-1.1.7/linuxkernel_ksyms_c.diffr
# patchr-pqr<../ipvs-1.1.7/linuxnet_netsyms_c.diffr
If the forwarding service from the real-server you want is direct routing, then add the kernel patching:
# patchr-pqr<../ipvs-1.1.7/contrib/patches/hidden-2.6.xpre10-1.diffr

d) Configure the kernel.
# makermenuconfigrorrmakerxconfigr
e)Enter the initial kernel configuration menu.
f)Enter the networking options menu.
g)Activate the features that support LVS, namely:
# cd /linux-2.6.xr
# patchr-pqr<../ipvs-1.1.7/linuxkernel_ksyms_c.diffr
# patchr-pqr<../ipvs-1.1.7/linuxnet_netsyms_c.diff

```
# patchr-pqr<../ipvs-1.1.7/contrib/patches/hidden-2.6.xpre10-1.diffr
# makermenuconfigrorrmakerxconfig
Networking options --->
Network packet filtering (replaces ipchains) <m> IP: tunneling
```

2.3 RESEARCH PARAMETERS

Based on observations and evaluations from several previous sources, research on load balancing with the Round robin algorithm will be carried out using the LVS Direct Routing method with the help of Httperf software so that the parameters to be calculated are Throughput, response time, error and CPU Utilization. According to Mulay& Jain, (2013) in measuring load balancing the parameters used include:

•Throughput is the amount of data received in units of time.
•Response Time is the time it takes to complete one request and send it back to the client.
•Error are a number of requests that the web server has not responded to.
•CPU Utilization is the amount of resources needed to carry out a computerized process.

2.4 DATA ANALYSIS TECHNIQUE

Analysis of data obtained from the study includes a system feasibility test and observation tables from the results of system testing carried out by the following techniques:

- **Feasibility Analysis**

The analysis technique used to calculate data from each aspect consists of the Throughput, Response Time, Error, and CPU Utilization tests. The calculations used to process the data from the instrument are the calculation of the average value and the calculation of the percentage score for each aspect:
1)Calculating the response value of each aspect or sub variable.
2)Recap value
3)Calculate the average value
4)Calculate the percentage using the percentage formula as the following:

$$P = \frac{n}{N} * 100\% \; (eq. 3.1)$$

Information:
P = Percentage (%)
n = Empiric score (score obtained)
N = Ideal score for each question item

5)Determine the criteria level with the following steps:
a.Determine the highest percentage number with the formula:

$$\frac{Obtained\ Score}{Maximum\ Score} * 100\% = \frac{5}{5} * 100\% = 100\%$$

b.Determine the lowest percentage number with the formula:

$$\frac{Obtained\ Score}{Maximum\ Score} * 100\% = \frac{1}{5} * 100\% = 20\%$$

To find out the criterion level, the score obtained (in%) of the percentage calculation results are consulted with the criteria table.

1. Determine the range (largest data-smallest data), namely 100-20 = 80
2. Determine the assessment interval, namely 4 (very good, good, good enough, not good, not good)
3. Determine the width of the interval by dividing the range by the assessment interval, namely 80/5 = 16

Table 1: Interval of Qualitative Score Categorization

NO.	PERCENTAGEE	CRITERIAE
1	184% <ESCOREE ≤ 1100%	VERYEGOOD
2	168% <ESCOREE ≤ 184%	GOODE
3	152% <ESCOREE ≤ 168%	PRETTYEGOOD
4	136% <ESCOREE ≤ 152%	NOTEGOOD
5	120% <ESCOREE ≤ 136%	NOTEGOOD

In the analysis of observations, there are several aspects that must be considered, namely the value that appears on the HTTF. Research is carried out to see the changes in the value that will appear, from this value the average will be sought according to the parameters used and the number of requests. After recording the results of the treatment, the results will be compared and graphed according to the algorithm under study.

3. RESULTS AND DISCUSSION

3.1. RESULT ANALYSIS

The following is an explanation of the process that occurs in LVS (Linux Virtual Server) with the implementation of Direct Routing and how to get test data to compare algorithms before Round robin and after Round robin. The following is an example of taking test values from a load balancing system using the Round robin method.

3.2. THROUGHPUT PARAMETER ANALYSIS

The throughput parameter in this study represents the number of requests that can be responded to by the web server at one time. This parameter is calculated in units of Kb / second. The greater the value of this parameter, the better the performance of the web server.

Figure 3 shows the amount of throughput using the least connection algorithm. Changes in the amount of throughput produced are not very significant.

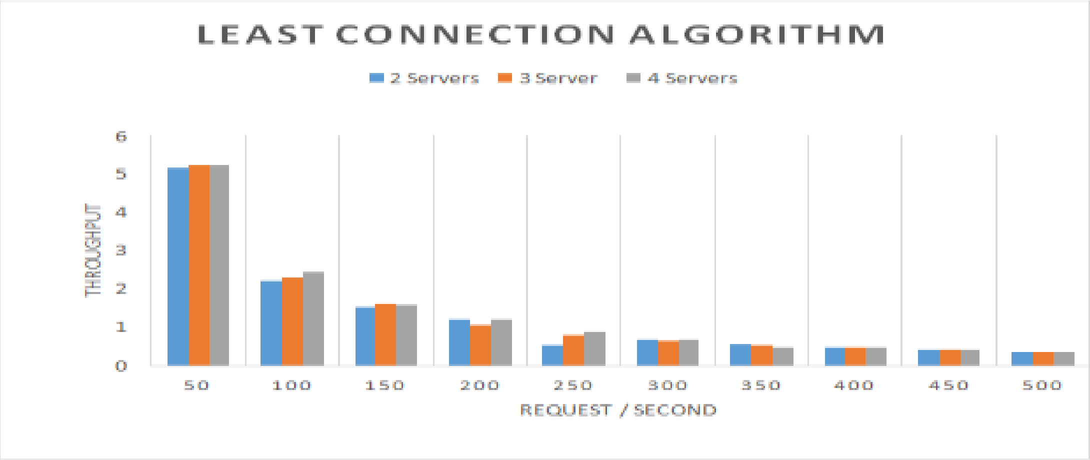

Figure 3: Throughput Graph of the Least Connection Algorithm

Figure 4 shows the throughput of the study using the Round robin algorithm. The resulting change in the amount of throughput is not very significant. This can be seen from the throughput comparison graph in Figure 4, where the resulting graph tends to be down and stable.

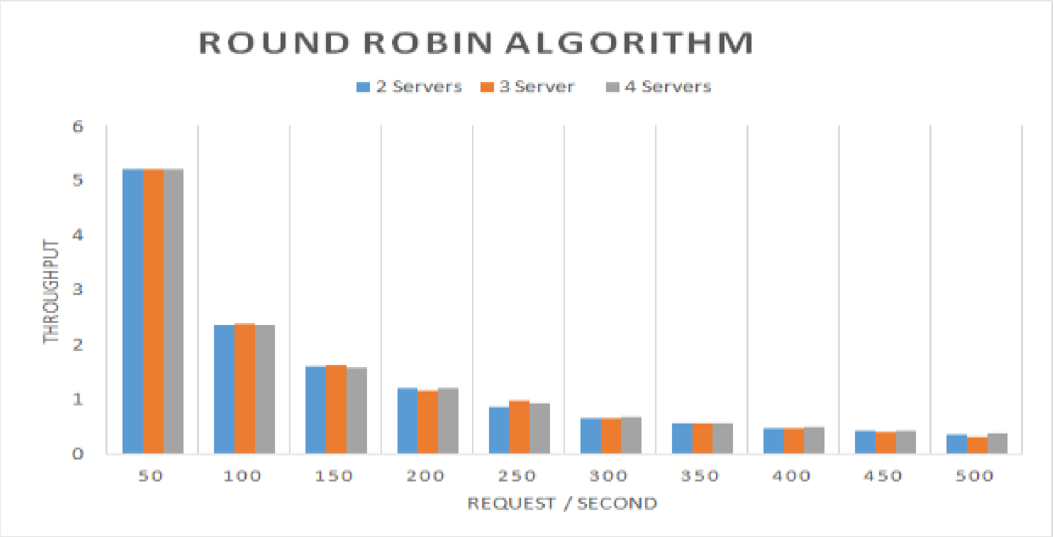

Figure 4: Throughput Graph of the Round Robin Algorithm

Figure 5 shows a comparison of the response time on the two algorithms that have been generated. The movement of the graph starts at 50 requests / second with a very low response time value, meaning that at 50 requests / second, the resulting response time is very good and fast.

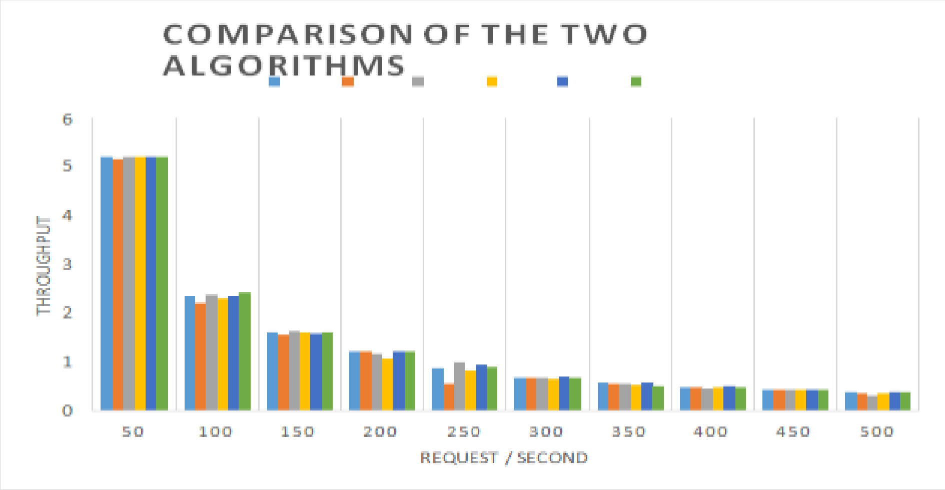

Figure 5: Two Algorithm Response Time Graph

3.2. ERROR PARAMETER ANALYSIS

The error parameter describes the number of errors that occur when the web server responds to requests from clients. Data from the observed error parameters are attached and presented in tabular form,

Figure 6 shows the number of errors in the Least connection algorithm. Just like the Round robin algorithm on requests for 50, 100, 150 and 200 requests / second, there were no errors. However, in this experiment the Round robin algorithm shows the average error value is smaller than the Least Connection algorithm.

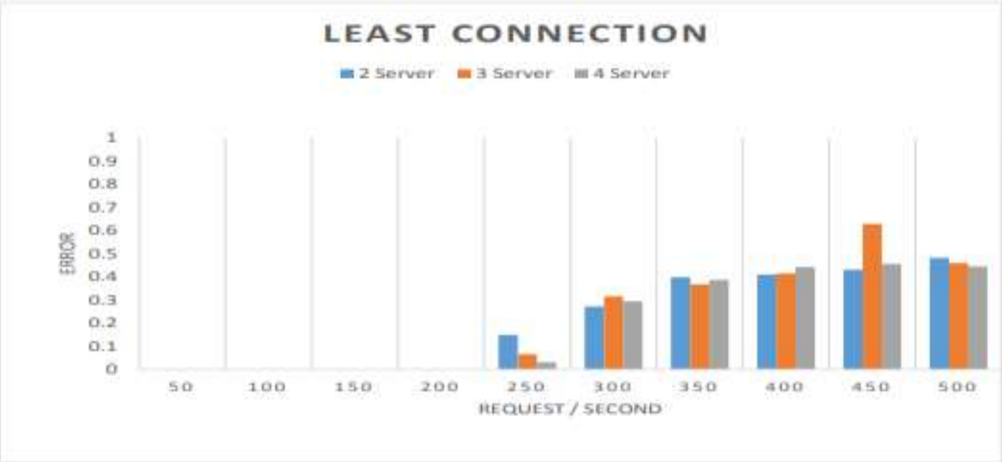

Figure 6: Least Connection Algorithm Error Graph

Figure 7 shows the number of errors that occur in the implementation of load balancing using the Round robin algorithm. Seems like on requests 50, 100, 150 and 200 requests / second there was no error. The error occurred starting at 250 requests / second.

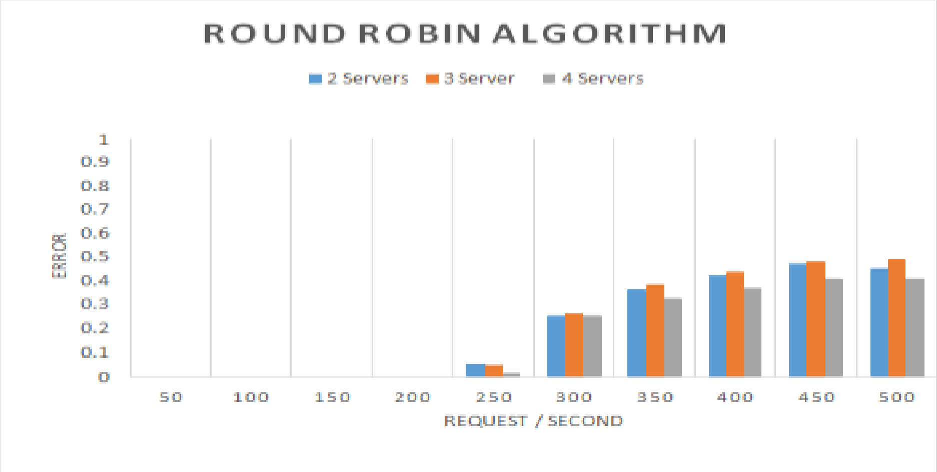

Figure 7: Graph of Round Robin Algorithm Error

4.CONCLUSIONS AND SUGGESTION

4.1. CONCLUSION

After conducting research on load balancing with Linux Virtual Server using the Round robin algorithm at Cloud by comparing the previous algorithm and comparing the performance between 2 servers, 3 servers and 4 servers, the following conclusions were drawn:

1. The implementation of load balancing with the round robin algorithm is more reliable in optimizing throughput, response time, CPU utilization, and reducing the number of errors from the web server. Meanwhile, using the previous algorithm, namely least connection, is more reliable in optimizing the response time of the web server.
2. The addition of the number of servers can increase the value of throughput, response time and reduce errors in the implementation of the load balancing system with the round robin algorithm, whereas the previous algorithm did not increase significantly.

4.2. SUGGESTION

In further research, research on load balancing with other algorithms can be developed by synchronizing database. Testing is done by considering the data flow that is on the database server. In addition, testing can be done using a type of web server application other than Apache as a comparison on the application side.

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