CAREER EPISODE 3

ANALYSIS OF CLOUD NETWORKING

3.1 INTRODUCTION

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Location	Gandhinagar, India
Sub/Sem	Project- III, 8th
Chronology	Feb 2021- April 2021
Supervisor	Hitesh Patel
Role	Leader

3.2 BACKGROUND

3.2.1

Data management and processing on virtual platforms are made possible by "cloud networking," which is the orchestration and connectivity of computer resources across internet-based infrastructures. Traditional networking relies on physical hardware, whereas cloud networking utilizes virtual, scalable environments that can be accessed and managed online. It enables quick provisioning and on-demand availability over the network of shared pools of reconfigurable resources. Scalability, affordability, and the flexibility of accessing resources from virtually anywhere are just a few benefits of this technique. It is possible to use public, private, or hybrid cloud networking, each of which offers a different amount of security, control, and scalability. While it offers many advantages, particularly in multi-cloud installations, it also creates management, security, and compliance challenges. Utilizing and managing cloud networking requires striking a balance between these benefits and challenges in order to enhance business operations and procedures.

The key goal of this project was to analyze the network's cloud computing. A literature review was conducted to investigate network performance evaluations and cloud computing security concerns. The project's many components, such as servers, routers, IP clouds, and software, were chosen with care. The OPNET software environment was used to create network models that covered a range of implementations, including single IP cloud topologies, various firewall configurations, and variable server counts. These network models were then put through network simulations, and the results were carefully scrutinized. The project's findings were developed using the simulations' outputs. These initiatives contributed to the project's overall goals by providing a thorough grasp of network performance and security issues in cloud computing.

3.2.2 OBJECTIVES

The foremost objective of the endeavor was to evaluate cloud networking with its different numbers server numbers and firewalls.

- To enhance network performances with data in cloud computing.
- To reduce the risks and challenges associated with cloud computing security.

3.2.3 WORK'S NATURE

I took part in meetings and discussions to make sure the project was going according to schedule I also added to the project report by offering my opinions and suggestions based on the examination of the simulation's outcomes. I conducted literature studies on cloud computing and did different component selections. I created different network models with varying server numbers, and cloud and firewall conditions. I concentrated on examining the network's operations using several matrices. I simulated the system and deduced conclusions from the analysis conducted. I monitored all the project activities to make sure they were done on time.

3.2.4 HIERARCHY

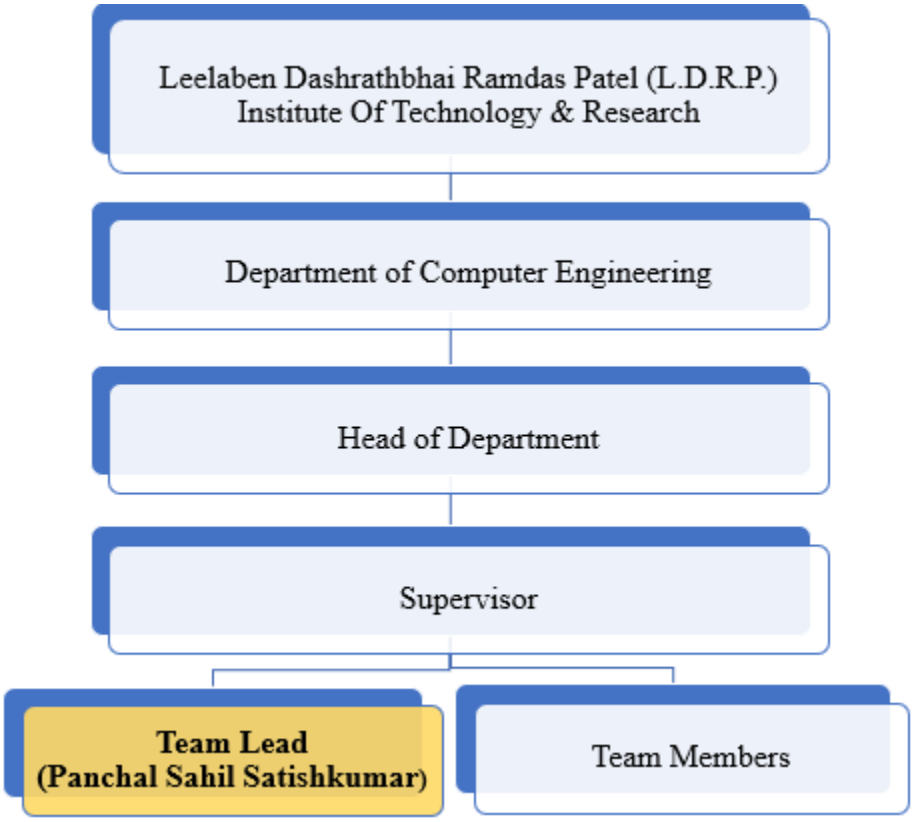

Figure 1: Hierarchy

3.2.5 OBLIGATIONS

- To implement an investigation on network performance evaluations and security issues with cloud computing.

- To choose various components and software and consider different network models.
- To design network models with various configurations mainly single IP cloud and with different firewall conditions and server numbers in OPNET.
- To make a network model with different IP cloud and different server numbers in OPNET.
- To run network simulations and examine the outcomes to give a project conclusion.

3.3 PEAs

3.3.1

I gathered knowledge on a numerous journals and articles on cloud computing systems and their security concerns and challenges before starting my research. Through the analysis of various case studies and the discussion of potential drawbacks and advantages from the perspectives of users, developers, and security engineers, I was able to understand better about the cloud computing idea. I examined the security specifications needed to achieve the Service Level Agreement (SLA) goals for isolation, data recovery, and data locations. I investigated the serious security problems brought up by the cloud computing, such as payment security, sensitive data privacy, and data integrity. I studied the numerous dangers as well as challenges linked with cloud computing security, such as unauthorized access, data loss, & breaches. I looked at the amount of exploration on cloud computing designs and the metrics employed to gauge their effectiveness. I learned about the value of network performance evaluation in cloud computing and the necessity of a perfect cloud network system. The corpus of prior articles was then examined in order to determine the research gap and the need for additional research in this area. I also acquired information on OPNET which could be a potential modeling and simulating software for the project.

3.3.2

I started choosing the many parts after accumulating the project concepts. I decided to make my project model and simulation using OPNET software. I selected a server to act as the core component for hosting applications and storing data. To effectively handle data traffic and guarantee precise packet routing, I chose a router. I decided to use an IP cloud to mimic internet communication for smooth network connectivity. I made the choice to build up my LAN using a 100BaseT configuration which was renowned for its ability to carry data at a rapid rate, in order to emulate contemporary network architectures. I selected a firewall to reduce unauthorized access or any attack on the network model. I selected networking clouds to store and manage data and information in the system. I selected nodes for the data to smoothly transfer from one end devices to another end device. I selected profile definitions for the devices and traffic patterns considering how accurate they should be in the real world where Applications that simulate different network services and interactions were also defined by me. I decided to combine these elements to produce a thorough and trustworthy network simulation model.

3.3.3

After nomination of component, I initiated the network modeling with 1 IP cloud and 1 server model without a firewall. I connected a single server to Router1 directly in my early network model. Then, using Router1 as the data exchange gateway, I built a link to an IP cloud. Following that, I connected the IP cloud to Router2 and Router3. After that, I linked Router3 to LAN 2, and Router2 to LAN 1. With the server at its center, this architecture gave me the freedom to design a simple network architecture for data transfer. In order to enable seamless communication and data exchange between devices in LAN 1 and LAN 2, I coupled Router2 and Router3 to act as intermediaries efficiently channeling traffic between the server and the corresponding LANs. Then I also added profile definition and application to the network. Similarly, I made a connection network using a firewall in place of router 1. Next, I also made a network model with 2 servers and one cloud by connecting router 6 to server0 and router 7 to server 1 which was connected to the IP cloud and eventually to LAN 3 via router 4 and LAN 4 via router 5. I first designed the system without firewall and proceeded to add a firewall to the later design replacing node 6 and node 7 with firewall 2 and firewall 3.

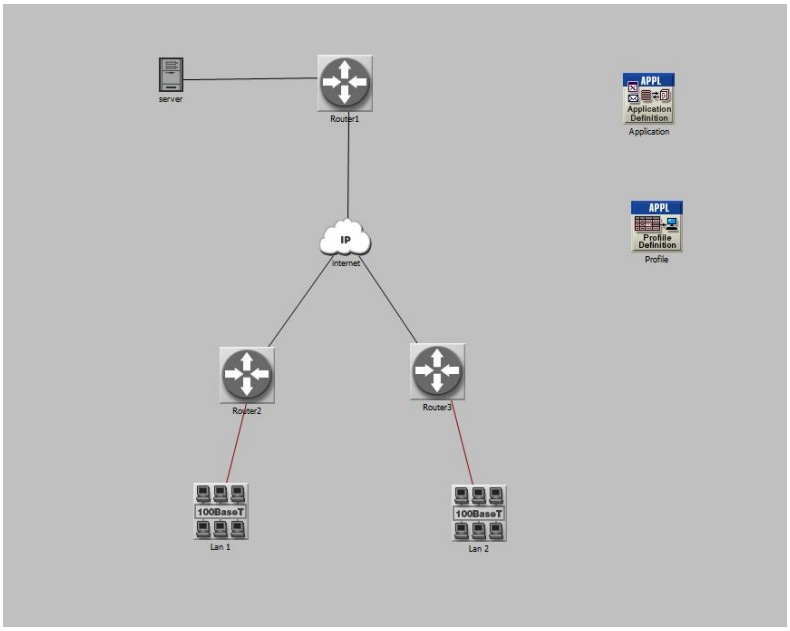

Figure 2: 1 IP cloud and 1 server model without firewall

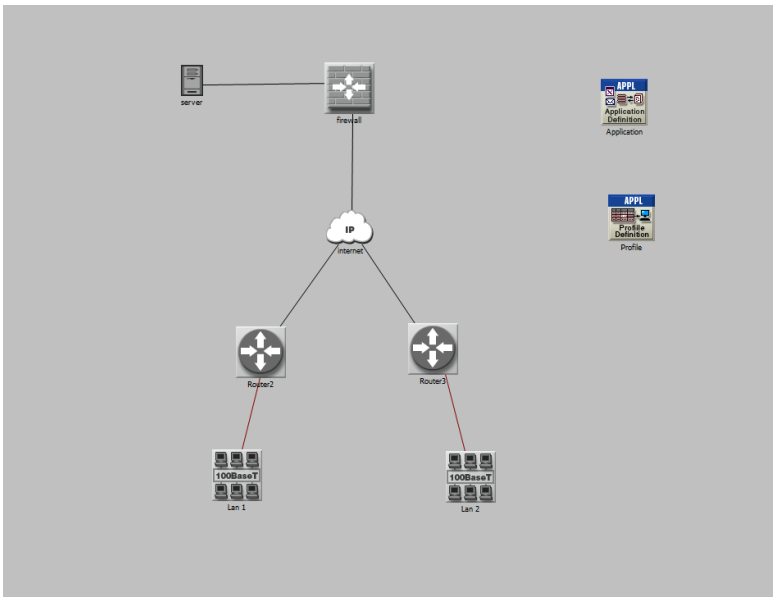

Figure 3: 1 IP cloud and 1 server model with firewall

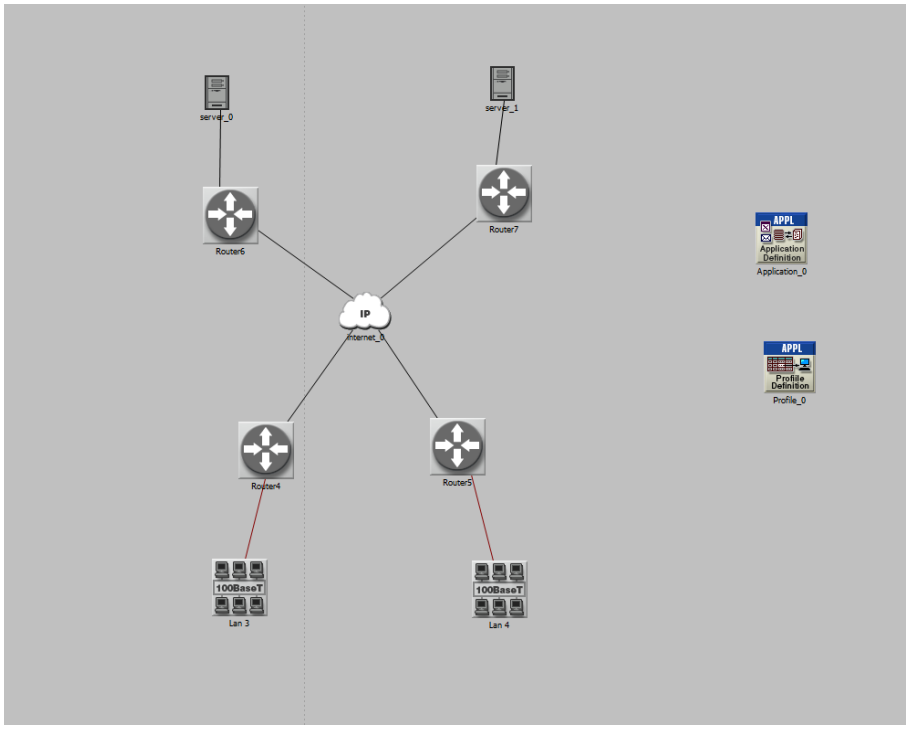

Figure 4: 1 IP cloud and 2 servers in model without firewall

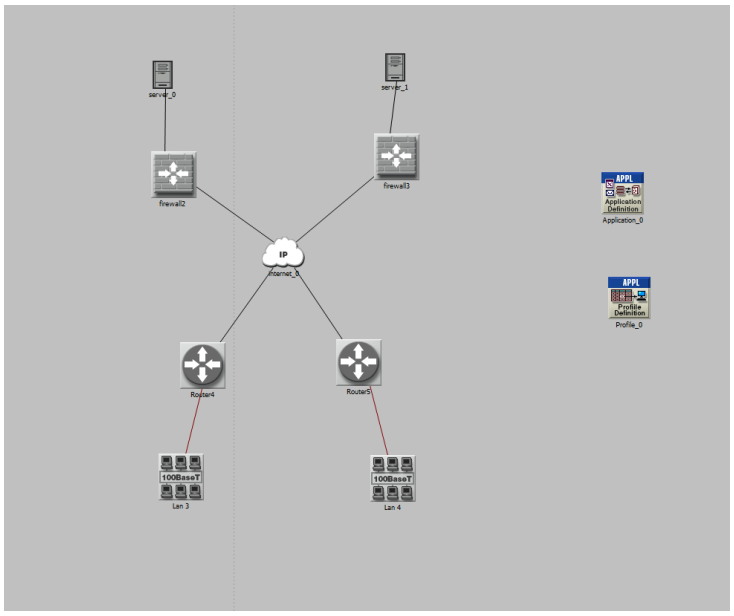

Fig5: 1 IP cloud and 2 server model with firewall

3.3.4

Next, I initiated modeling of other network designs. I made the network model with three IP clouds named node0, node1, and node2. I connected three other routers to these clouds. I connected node9, 10, and 11 with node 1, nodes 6,7, and 8 with node 2, and nodes 3,4, and 5 with node 0. I then proceeded to connect each of these nodes with 2 LANs and a server. I connected servers 18,19, and 20 to nodes 5, 8, and, 9 and the rest nodes were connected to LANs. Similarly, I created a similar design with additional firewalls named node21, node 23, and node 25 to Ip cloud 1, 2, and 0 respectively, each of these firewalls were also connected to their respective servers.

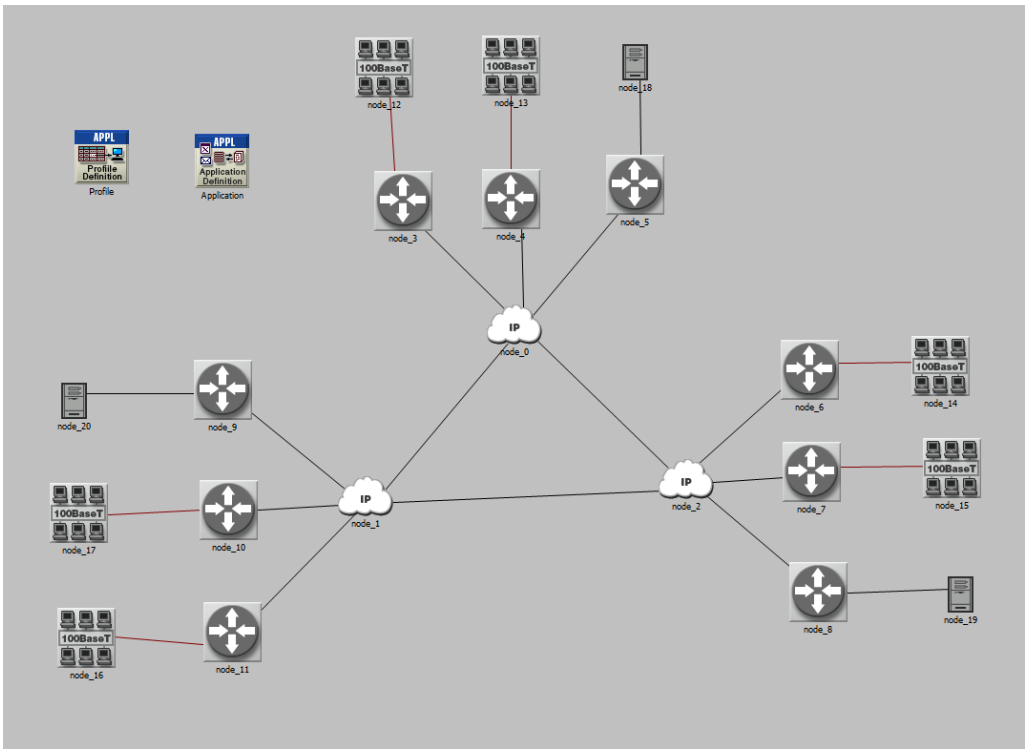

Fig6: Single server and multiple IP cloud without firewall

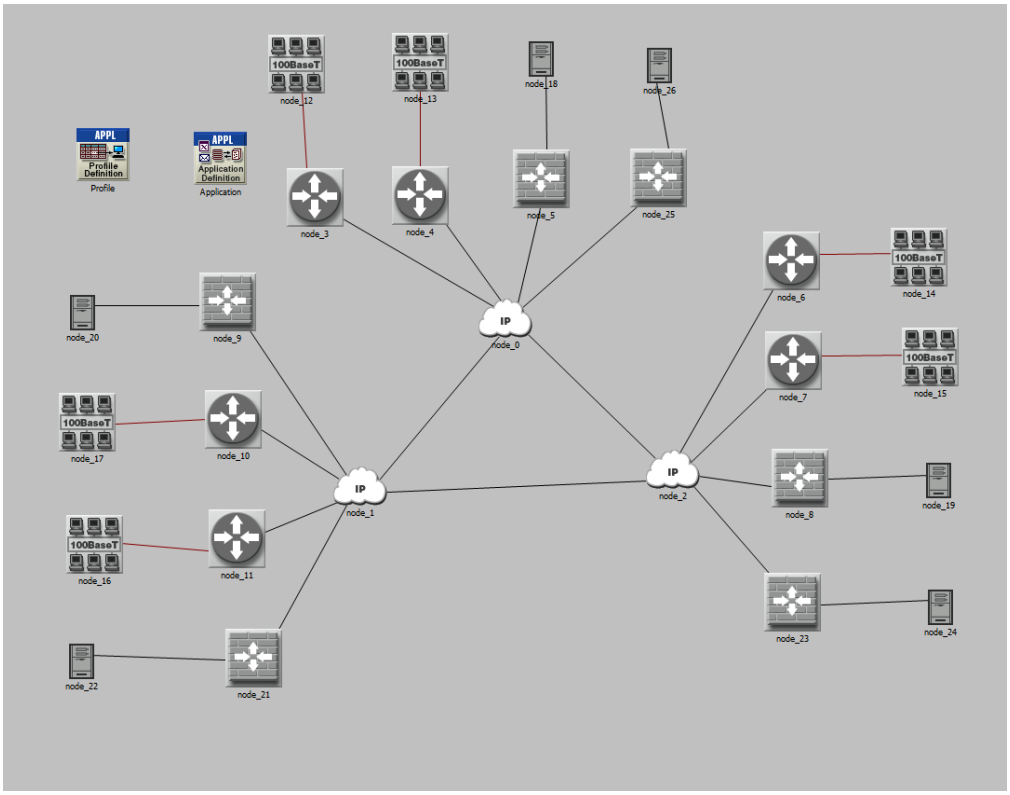

Fig7: Multiple IP cloud and Multiple server network model with firewall

3.3.5

I looked at the results of my network simulation experiments and found that in the "with firewall" situation, the different IP cloud with 1 server and 1 IP cloud and 1 server configurations had faster query response times for the database application. I noticed this was because of the low packet latency in the router. I discovered that in these setups both incoming and outgoing traffic was more productive. I found that the server load stayed constant during all of the situations proving that while the firewall did add some packet delay, it had little to no effect on the server load especially when employing a single server with cloud. I saw that several clouds with a 1-server model performed better in terms of email application's response time of download. However, with time, I found that numerous clouds with multiple servers performed better in terms of traffic delivered and received. In the instance of the HTTP application, I discovered that multiple clouds with a single-server model had shorter response times, but I discovered that multiple clouds with multiple servers had faster networks. I found that the numerous clouds with a single server had a lesser server load indicating greater performance. I discovered that the performance was generally better than the firewall scenario for both the HTTP and database applications in the "firewall with blocking web access" scenario. I saw that a single server running many clouds continued to function effectively. I was unable to locate any pertinent graphs for the email application in this situation, though. I saw notable improvements in the response time of database query, a response time of HTTP page, and received HTTP traffic in the without firewall case. I found that removing the firewall sped up data transmission and decreased response times. I discovered that using multiple clouds and servers produced the best results.

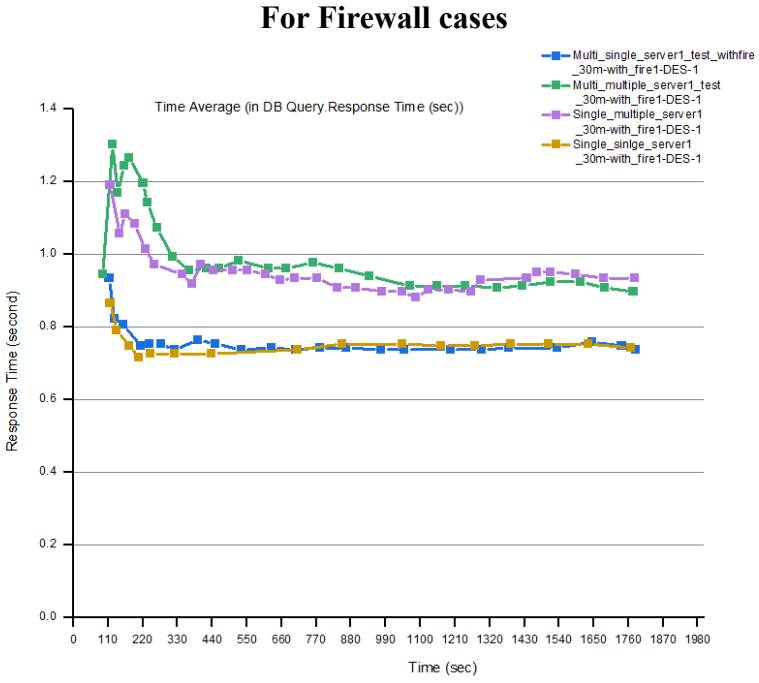

Fig8: Response time of DB query

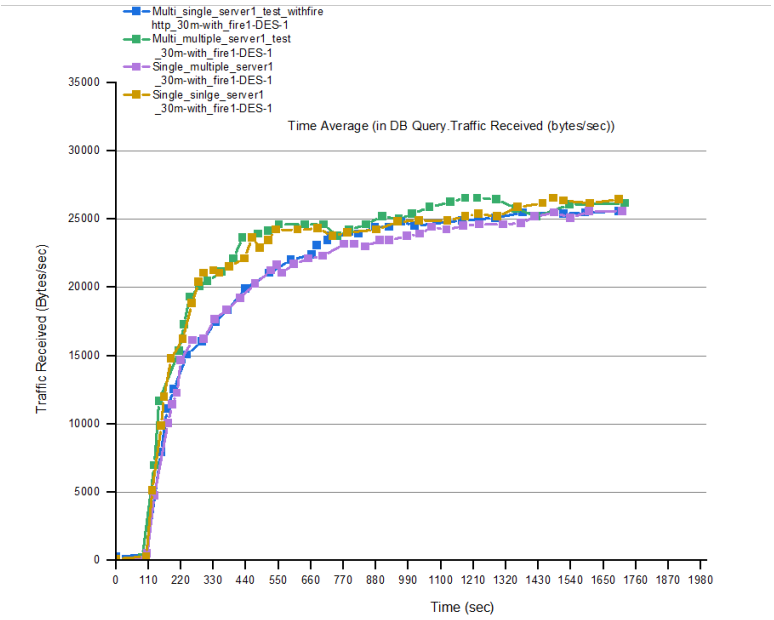

Fig9: Received Traffic

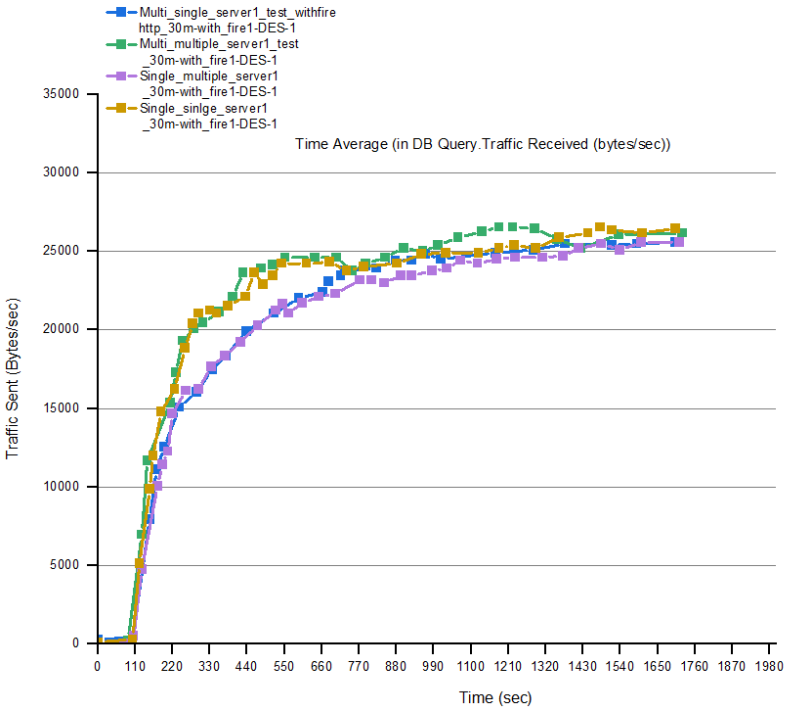

Fig10: Sent Traffic DB query

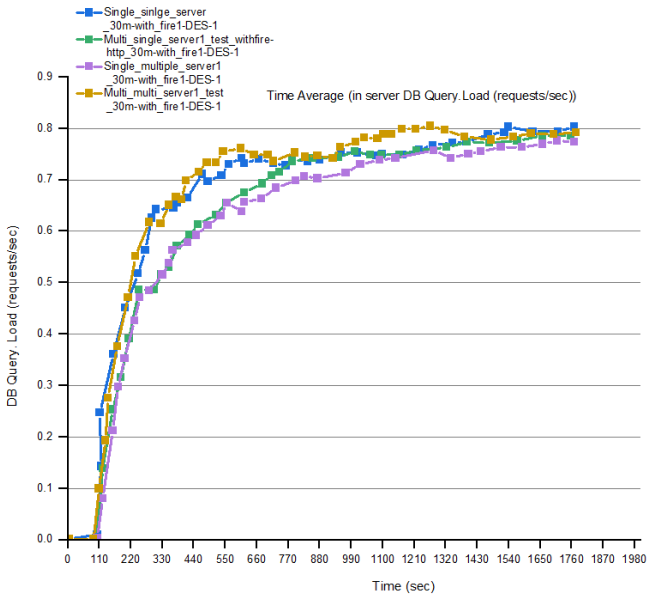

Fig11: DB query load

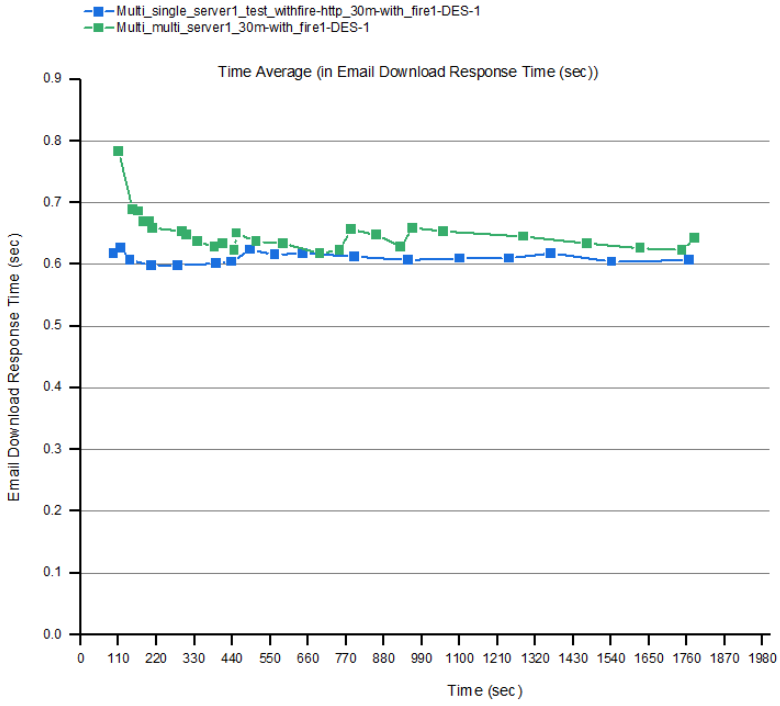

Fig12: Email download response time

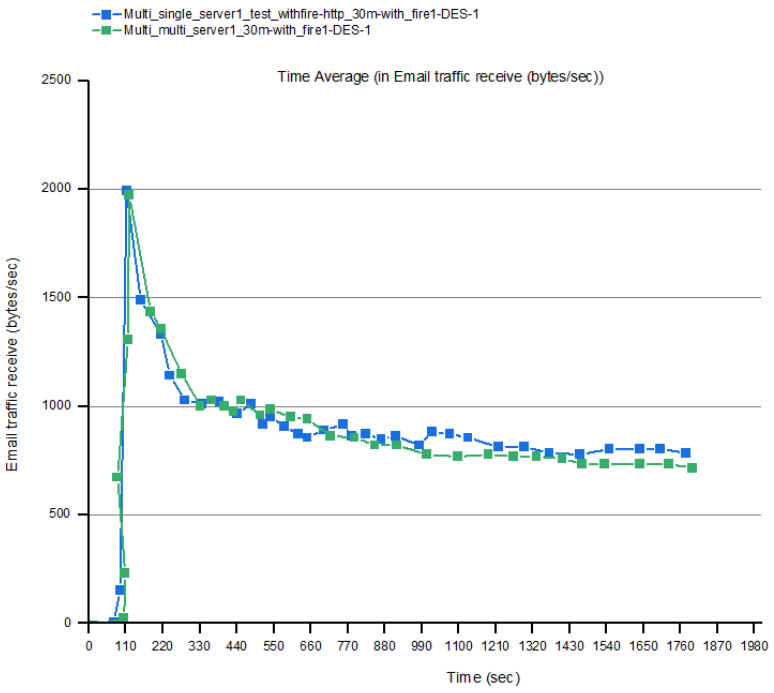

Fig13: Received email traffic

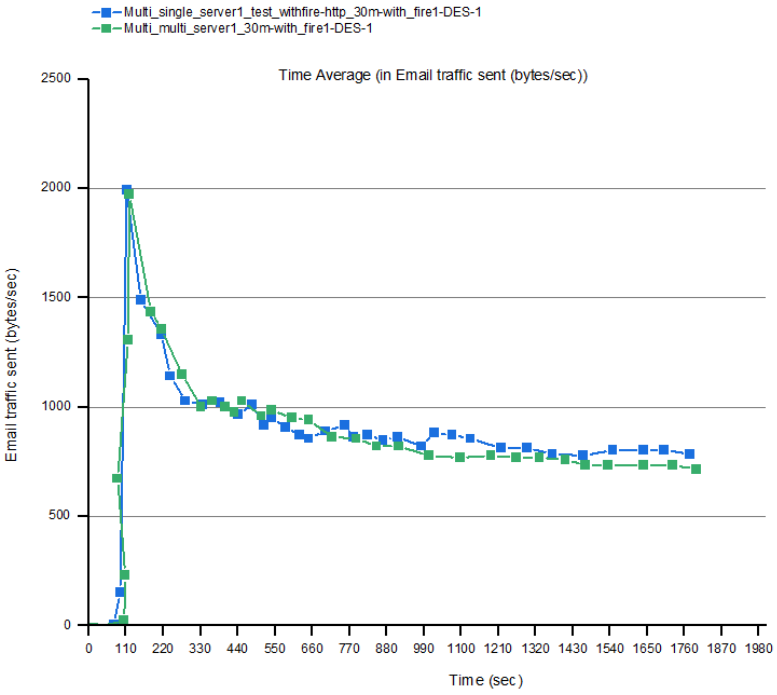

Fig14: Sent email traffic

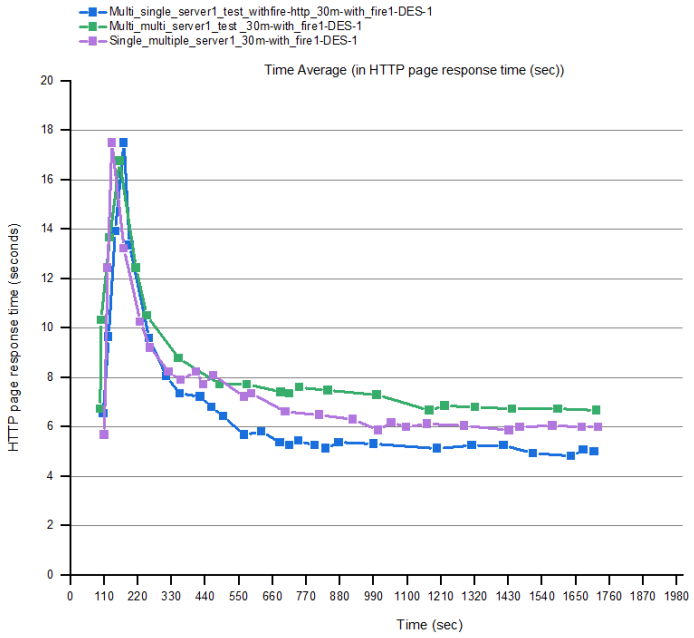

Fig15: Response time for Http page

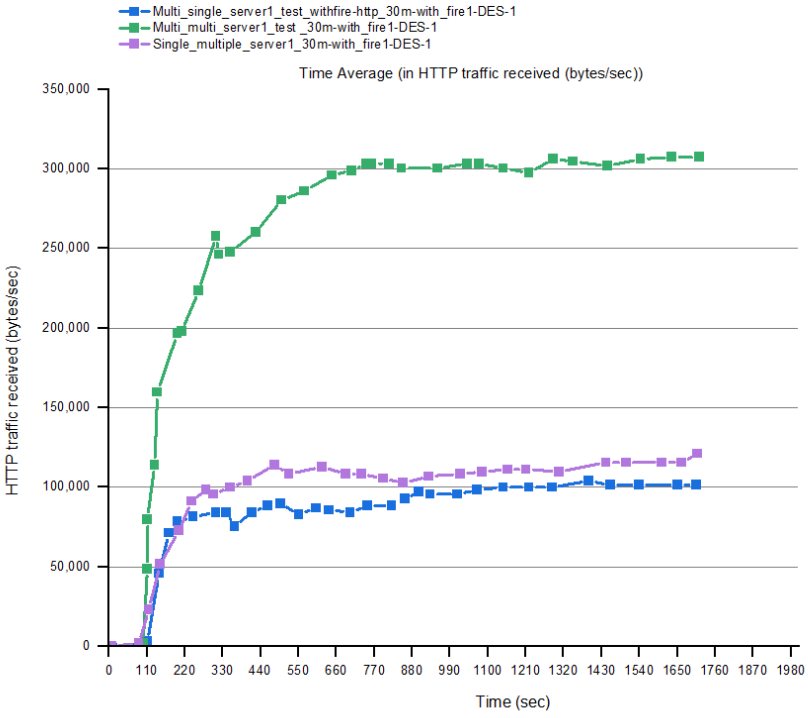

Fig16: Received Http traffic

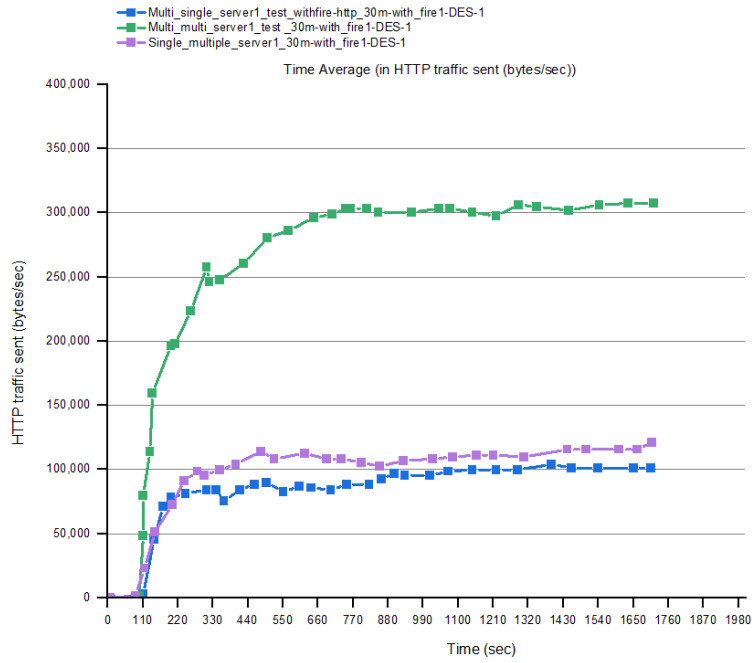

Fig17: Sent Http traffic

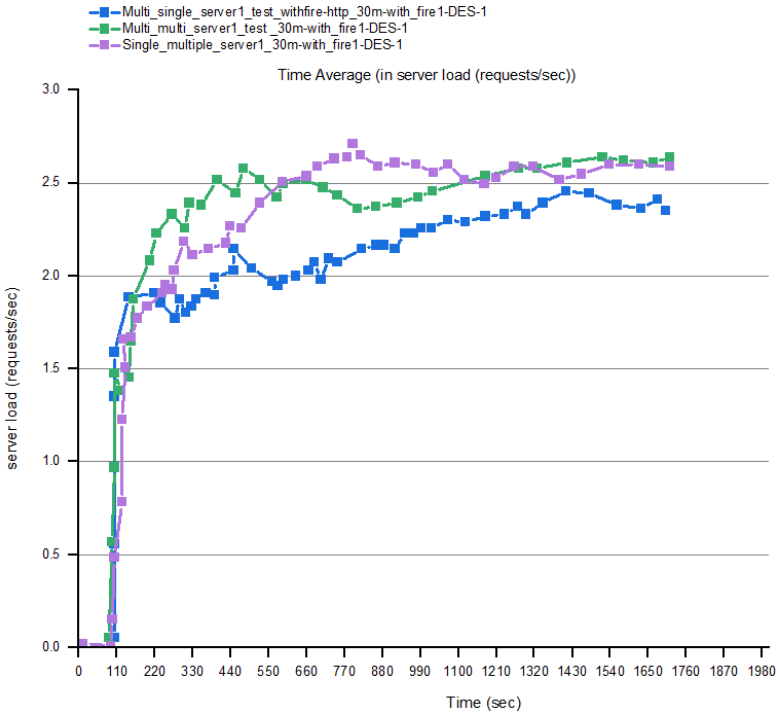

Fig18: Server load

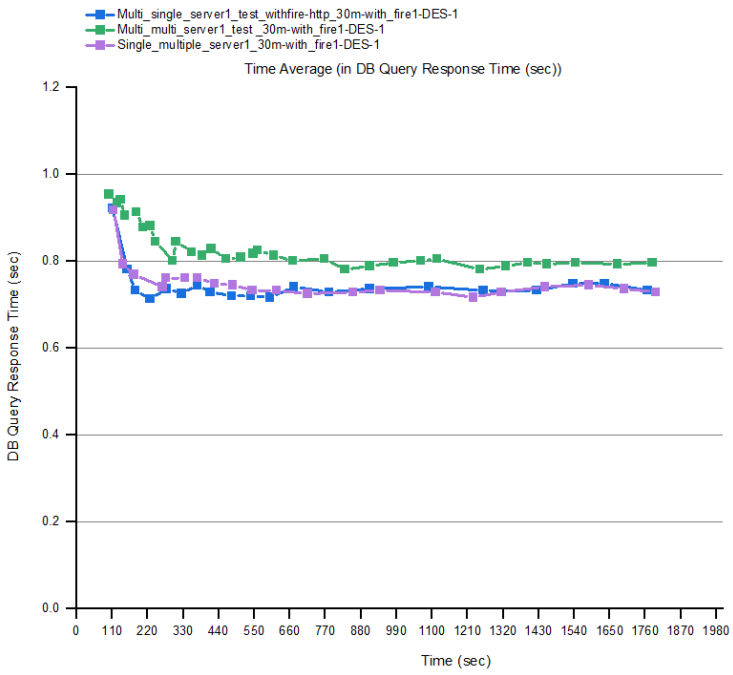

Fig19: Response time of DB queries

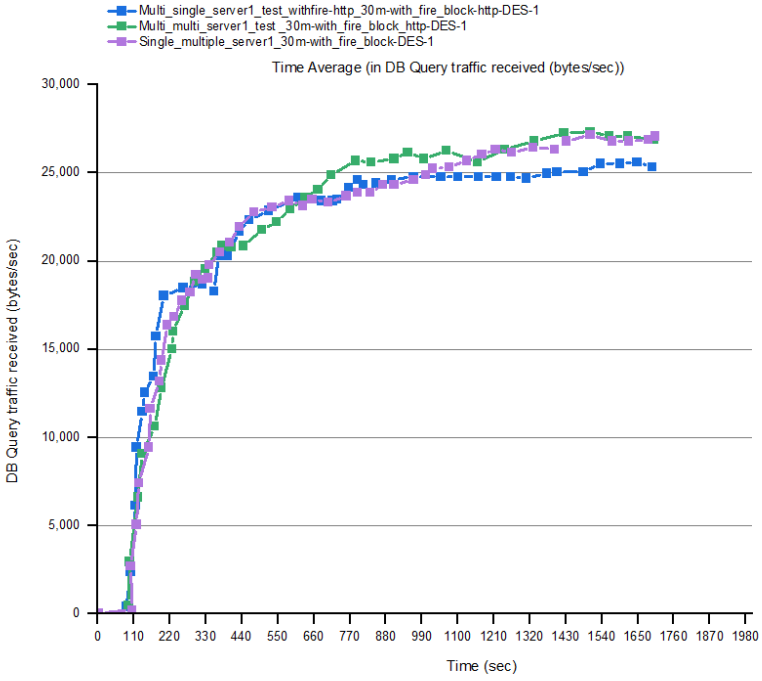

Fig20: Traffic received DB queries

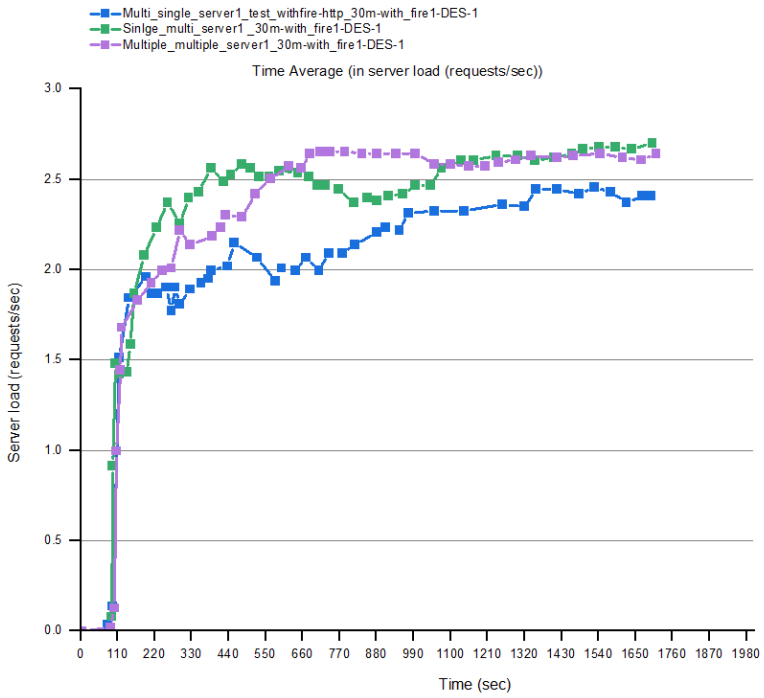

Fig21: Server load

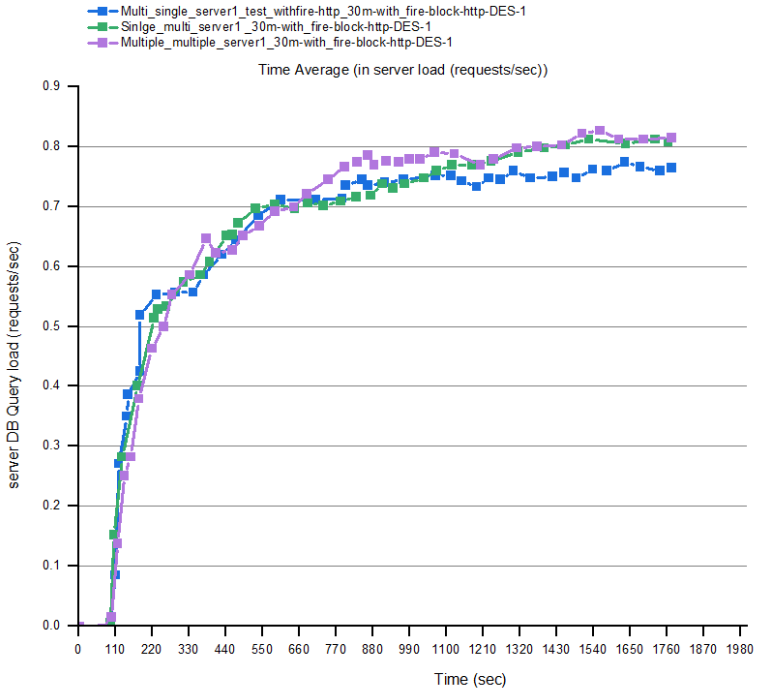

Fig22: Server DB queries load

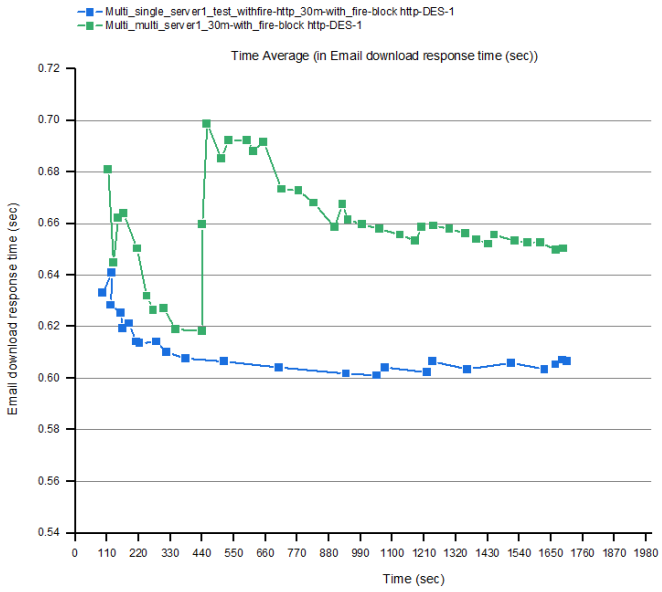

Fig22: Response time for email download in the case of firewall web access

No firewall cases

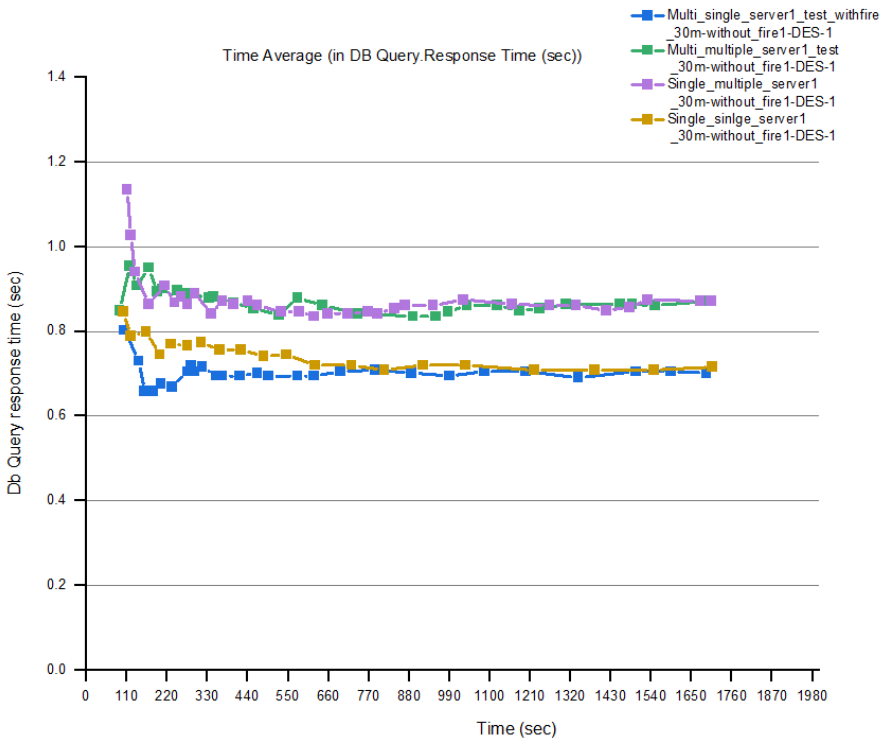

Fig23: response time in DB query

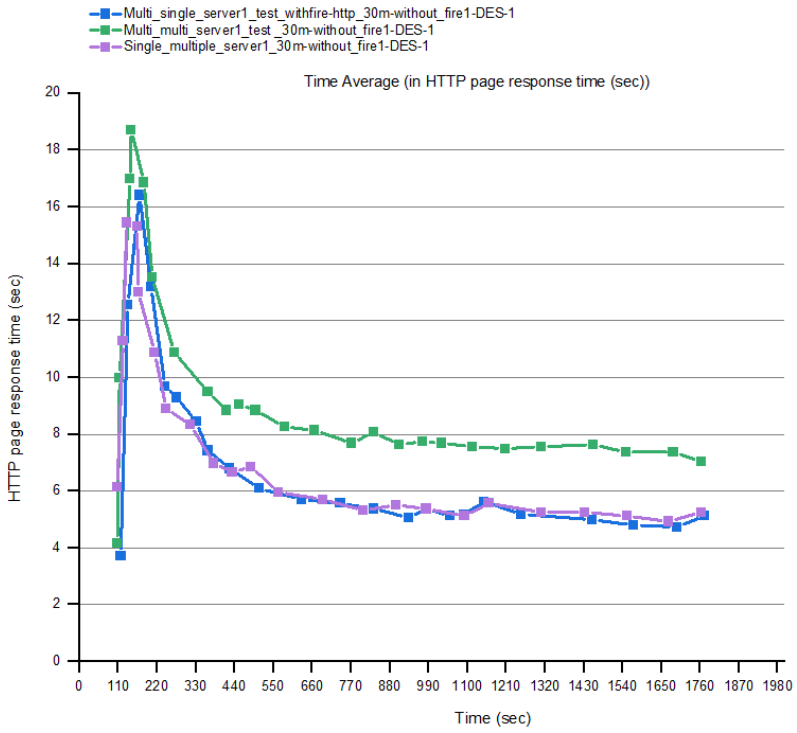

Fig25:Response time for Http page

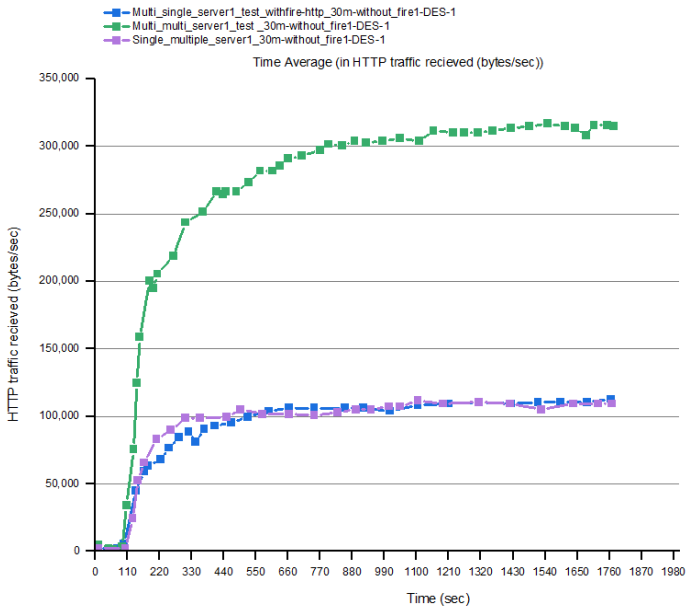

Fig24:Received Http traffic

3.4 TECHNICAL ISSUE AND SOLUTION

In the course of my investigation, I came into a technical issue with application configuration in the context of cloud networking. I discovered that the setup of applications within the cloud network such as databases, email servers, and web servers, was not optimized for effective performance. As a result, I got the network performance was negatively impacted by longer response times, more traffic congestion, and erratic server loads. I found the main reason for this issue was my failure to properly tune and optimize program parameters in the cloud environment. I observed there were performance bottlenecks and lost efficiency as a result of my inadequate resource allocation. The results of the experiment, where I saw slower reaction times and ineffective traffic handling, made this issue clear. I came up with a resolution for this issue by tweaking the application parameters inside the cloud network. To boost performance, I upgraded packet handling, modified firewall policies, and streamlined resource allocation. Then I noticed that this method led to faster response times, less traffic jamming, and more stable server loads which in turn produced a more dependable and efficient cloud network architecture.

3.5 CREATIVE WORK

I considered different models for the cloud network analysis. I used different suitable components for the network model design which helped to enhance the network performance. I used firewall on the network model for implementing security measures to block out any harm or unauthorized access to the network

3.6 TEAM COORDINATION

I was a head of our team in ensuring that the project went as planned and that the team members collaborated successfully in my capacity as leader of the team for the initiative. I worked with the project participants to make sure that everyone understood their responsibilities and that the project was on pace to achieve its goals. Along with regularly updating the project supervisor on my progress, I also sought his advice and support when necessary. In order to guarantee that everyone on the team was involved in the project and that any issues or concerns were swiftly handled, I also facilitated project meetings and discussions. I motivated my teammates to finish the project on time. I was all ears to my teammates and served as a bridge between them and the supervisor.

3.7 CODES

I adhered to ISO/IEC code 27033-1:2009 for the implementation of network security measures in the endeavor.

3.8 PROJECT SUMMARY

3.8.1

The goal of this study project was to examine security issues with cloud computing systems and their effects which was completed in time. The potential dangers and benefits were clarified by a thorough assessment of the literature that included case studies and conversations from multiple

perspectives including those of customers, developers, and security engineers. As a result of careful component selection and network configuration using OPNET software, numerous network models were produced in the next step. These models covered single and multiple servers, single and multiple clouds, as well as situations with and without firewalls. Key results from simulations included faster query response times and effective traffic management for single-server multiple-cloud scenarios. Multiple clouds with a single server showed faster download response times in email applications, but multiple clouds with many servers were better at managing traffic. In certain cases, removing firewalls improved the efficiency of the network in a number of ways, which helped researchers fully comprehend the security implications of cloud computing.

3.8.2

I developed important research techniques by conducting in-depth literature reviews. I improved my technical skills by using OPNET software to model the network. I developed my analytical skills through reading simulation output. I gained more knowledge about cloud computing security. I enhanced and honed my communication and leadership skills through frequent meetings conducted during the project phase and my leading the team to a successful completion of the project.