CLOUD TECHNOLOGY AND PERFORMANCE IMPROVEMENT WITH INTSERV OVER DIFFSERV FOR CLOUD COMPUTING

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***Abstract*— Cloud computing, bright venture of today and tomorrow, is rising based on the idea of the use of online information, software and hardware. Cloud computing provides users three different kinds of service models; infrastructure services, platform services and software services; which are in the run all together as requested and meets the needs of users. Benefits of cloud computing include increased security, monitoring and maintenance of the technical infrastructure by the provider, cost-savings, efficient use of resources, high flexibility, accessibility and device independence. This paper describes the cloud computing technology with its features and advantages in business life. Traffic of a medium-sized company is examined in two different scenarios; LAN network and cloud computing network; and compared according to ftp, email, HTTP traffics using OPNET. In second part of the study, DiffServ and IntServ quality of service terms are studied over cloud computing model. A new approach is studied in order to improve the performance of cloud computing network in a medium sized company by combining IntServ and DiffServ in same network model. This model serves an improvement in business applications using cloud computing technology.**

Keywords—Cloud Computing;Cloud Computing Service Models; OPNET; Cloud Computing QoS parameters; DiffServ; IntServ

I. INTRODUCTION

Especially lately information technology and social media internet sites often include articles about the benefits of cloud computing and their products. If we simply define the Cloud Computing; It is only accessible architecture to the data, applications or services without any extra software, hardware or service infrastructure, which regardless of location [1].

According to the U.S. National Institute of Standards and Technology (NIST); "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" [2].

Cloud computing brings us a new platform to realize data sharing which is done previously on web services such as social networking sites, file sharing portals by moving them to another dimension to be accessed anytime, anywhere. In this way, the world has shrunk even further, personal or corporate information has become much easier to achieve.

Cloud computing is not just about sharing the data at hand, but also the common use of infrastructure services or hardware sharing brought us the biggest advantage of cloud technology. In this way, by providing remote access to an infrastructure service, it is possible to have more efficient infrastructure resources available. In addition, users find the software they need already installed on the internet that are ready for use. By this way, they save thousands of dollars by depending on the amount they use and pay the appropriate amounts.

Cloud computing will be a leading structure for technologies and adaption of cloud structure to our daily usage with maximum benefits is the main goal. Almost every major corporation in the IT industry have researches and developments on this subject. For this reason, the aim of this study is to show the effective usage of cloud computing technology in business and daily usage rather than standard network infrastructure. The lack of research on active usage of cloud computing on business life is motivated us to work on this subject. More researches on cloud computing will cause improvement in performance, security, scalability, issues and development of applications compatible with cloud.

There were several papers and general introductions to cloud computing, which bring an overview of the field but yet there is not an enough research on business or daily usage of cloud computing. It is obvious that a survey in such a fast moving field will soon be out of date, but such a survey like this would provide a good base for the Cloud Computing to set new work and that it can be useful as a resource for researchers new in this area. Another thing that is wished to be accomplished with this paper is not only a definite picture of what the cloud does well and a brief overview of it, but also a short survey on usage in real life, its performance and improvement of performance.

Today, emergence of the real-time applications demands more resources. The main challenge is to maximize the resource utilization by QoS mechanisms. The contribution of this work is to analyse QoS performance metrics such as end-to-end delay, delay variation, throughput, packet loss and queuing delay for real-time applications such as video and voice conferencing, e-mail traffic, FTP download in cloud computing networks. In the next generation Internet, there will be more demand for real-time applications and multicast services. In order to meet the requirements, Integrated Services (IntServ) and Differentiated Services (DiffServ) have been combined. The study explores the behaviour of cloud

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model reply to various QoS metrics against different network scenarios.

In this paper we discuss the main parts of cloud computing, deployments and advantages for building clouds. Research in this field appeared to be split into two parts. One investigates the performance comparison between standard network and cloud network. Second one is to try to improve efficiency of cloud network by using DiffServ/IntServ combination in a newly proposed hybrid model.

This paper is structured as follows: Section 2 outlines the work done in this area; Section 3, 4 discusses deployment of cloud computing; Section 5 outlines the advantages that brings with cloud computing; Section 6 expresses the quality of service in cloud computing; Section 7 continues with design implementation and simulates the models; finally Section 8 concludes the review by summing up the research entire paper.

II. RELATED WORK

Several researches have been concentrated separately on Cloud Computing network performance and Quality of Service over the last decade. But there are fewer researches on the effects of Cloud Computing on QoS Following papers in particular were considered.

The authors in [20] state the current state of the affair with respect to quality of services in the cloud computing environment. The paper also describes the key challenging areas of how resources are allocated to clients and what the roles of cloud providers are. Finally, the authors observe how the performance can be increased by improving various components in a scalable way with low cost, better performance and QoS.

The authors in [21] highlight DiffServ based QoS analysis in a wired IP network with a more realistic enterprise modelling and presents simulation results of a few statistics. Four different applications are used in this work such as FTP, Database, Voice over IP (VoIP) and Video Conferencing (VC). Two major queuing disciplines are examined, which are 'Priority Queuing' and 'Weighted Fair Queuing' for packet identification under Differentiated Services Code Point (DSCP).

In [18], the authors were focused on the enhancements of mapping between IntServ and DiffServ as a solution to provide a more scalable and efficient end-to-end QoS architecture in a radio access network. They observed that IntServ over DiffServ interoperation model had shown noticeable improvements with respect to the two mechanisms when used alone and provided satisfactory QoS guarantees even in an extreme congestion situation.

The objective of [17] is to quantitatively demonstrate the QoS guarantees that can be obtained by end applications when IntServ is run over DiffServ. They authors used goodput, drop ratio and non-conformant ratio of packets from the different services and the queue size of DiffServ router to determine the QoS obtained by packets belonging to different traffic classes.

The authors in [22] demonstrate mapping the IntServ Controlled Load Service into the DiffServ Expedited Forwarding "Per Hop Behavior". The proposed approach has been implemented under the Linux Operating System.

The work in [23] states the efficiency of IntServ and DiffServ. The IntServ architecture provides an end-to-end QoS guarantee on a per-flow basis. The DiffServ architecture, on the other hand, provides a QoS guarantee designed to aggregate flows and is more scalable for in backbone networks. The writer proposes an integrated environment in which local access networks provide IntServ, while backbone networks provide DiffServ. Issues concerning how to map service classes between these two types of networks and how to provide multicast services are discussed, and possible solutions are proposed.

III. CLOUD COMPUTING SERVICE MODELS

A. *Infrastructure as a Service –IaaS:*

Inside cloud computing infrastructure, the bottom layer of the stack is used to refer these services. In this model, users configure the CPU, storage, network memory, and other essential information resources. Users are able to install the operating system and applications that they desire. Although management and control of the infrastructure is not on customer, only some operations on operating system level and network components (Firewall, etc.) can be managed by the customer [4]. Amazon's EC2 service can be shown as an example of this service model.

B. *Platform as a Service –PaaS:*

Platform is offered as a service in this model. Users are able to install their self-developed applications or provided applications on cloud service. Except the user's own established application, there is no control and management on the components on platform infrastructure by the user [4]. Google App. Engine service can be shown as an example of this service model.

C. *Software as a Service –SaaS*

In this model, the service provider's applications running on a cloud infrastructure, is made available to users. Applications can be accessed through any device with an Internet connection by web browser, without any limitation as to time and location. Users do not have any control or management capabilities on components such as network, server, storage devices or operating systems. However, the application settings can be configured and specified by the user [4]. Email accounts can be shown as an example to this service model.

IV. DEPLOYMENT OF CLOUD MODELS

There are different types of clouds available, each with different benefits and drawbacks.

A. *Public Cloud*

Global cloud applications, storage, and other resources will be offered by a service provider to public users. These services are accessible for free or users are charged according to a pay-per-use model. As an example, Microsoft and Google operate their own infrastructure and only provide access via the Internet [5].

B. *Private Cloud*

The cloud service is generated within the company servers. Private cloud is just a single run organization as a cloud infrastructure and managed by the built-in or third-party and hosted internally or externally [6]. The private cloud may at any other place as may be in institution's own building.

C. *Community Cloud*

A community cloud is a collaborative effort in which infrastructure is shared between several organizations from a specific community with common concerns (security, compliance etc.), whether managed internally or by a third-party and hosted internally or externally [1]. Community members have access to applications and data. As an example, by using a community cloud computing, State agencies can meet their needs on a joint cloud [6].

D. Hybrid Cloud

Hybrid uses both private and public cloud due to a company's data security and such reasons. Hybrid cloud is a combination of two or more clouds, which are different, separate clouds but they are interconnected to each other [6]. On the private part of the hybrid cloud, critical applications can be found. Public part of the hybrid cloud owns the applications where security concerns are less [3]. Inside Hybrid clouds, in-house applications shall be flexible, secure [7]. Businesses use their private cloud in their normal company activities; in case of a sudden increase of capacity, they meet their high peak load requirements from public cloud [3].

V. Advantages of Cloud Computing

With the transition to cloud computing, institutions can provide a more secure infrastructure that can be monitored by specialists, cost-efficient systems, efficient use of sources, high degree of flexibility and high performance any time needed [2]. Moreover, it brings features like remote teleconference and meeting services for companies with multiple offices, ability to manage contact lists, projects, and personal documents and reach up-to-date documents regardless of where you are [8].

A. Scalability

In the presence of fast growing computer technology, systems have to be updated frequently, in order to stay up to date. In cloud systems, instead of purchasing new devices, it is possible to buy a third party CPU cycle or an external storage device [9]. Since cost depends on the consumption, purchase of new equipment is more costly. If the company thinks the current system does not fulfill needs or more than necessary, service provider can be contacted to revise the needs and lower down unnecessary items [9].

B. Security

Security is enhanced by data centralization. With the help of improved security-focused resources, active and passive cryptography, strong ID authentication, cryptography and secure algorithms, effective security services are provided [10]. Security is much more superior to traditional systems because service providers are able to allocate resources for security problems instead of customers [11]. In addition if multiple redundant areas are to be used, security will be improved. Our data in different data center locations will be accessible in case of any emergency status by their backup [12].

C. Performance

Service providing companies are trying to meet the needs of business life with the help of latest technological hardware and higher bandwidths. In order to prevent the system from connection failure or overload, extra routes and load balancing techniques are being used for nonstop service [13]. When needed, performance increase in user activities is also provided. Effective use of resources, distribution and instant performance monitoring are useful for multiple user systems and especially for companies [1].

D. Flexibility

It is not essential to connect to any platform so as to access cloud services. Location of service providers are not considered in cloud technology. Service can be provided at anytime and in anywhere as long as there is an internet connection. It is able to be used in any device or operating system like Windows, Mac, and iPhone/iPad, Blackberry, Windows Mobile or Android [12].

VI. Quality of Service in Cloud Computing

Quality of service is the ability to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance. QoS criteria are numerous and are highly dependent of the application, such as throughput, delay, jitter, loss rate [13]. In our research we implement two main services; IntServ and DiffServ into our network model.

In our work, we propose a new model that leads to a proposal to combine the DiffServ and IntServ, using the IntServ control mechanism at the edge of the network and DiffServ within the core network in order to gather efficiency in cloud computing.

A. Differentiated Service (DiffServ)

DiffServ is a computer networking architecture that specifies a simple, scalable mechanism for classifying and managing network traffic and providing quality of service (QoS) on modern IP networks [14]. DiffServ is used for various critical applications and for providing end-to-end QoS. The traffic is classified based on priority. After that traffic is forwarded using per-hop behavior (PHB) mechanisms. This mechanism allows traffic with similar service characteristics to be transmitted with similar traffic guarantees across multiple networks [15]. Expedited Forwarding (EF), Assured Forwarding (AF) and best-effort (BE) are widely used in DiffServ approaches.

1) Expedited Forwarding (EF)

The Expedited Forwarding (EF) model is used to provide resources to latency (delay) sensitive real-time, interactive traffic. The EF service provides a low loss, low latency, low jitter, assured bandwidth, end-to-end service [16].

2) Assured Forwarding (AF)

The assured forwarding (AF) model is used to provide priority values to different data applications. This service provides reliable services for customers even during network congestion. Classification and policing are done at the edge routers of the DiffServ network. In-profile packets should be forwarded with high probability. However, out-of-profile packets are delivered with lower priority than the in-profile packets [17].

3) Best-Effort (BE)

This is the default service of DiffServ, and it is also name default Per-Hob-Behaviour (PBH). It does not guarantee any bandwidth to customers, users can only get the available bandwidth. Packets are queued and transmitted when buffers are available but they are dropped when resources are over committed [17].

B. Integrated Service (IntServ)

IntServ provides services on a per flow basis where a flow is a packet stream with common source address, destination address. Because of routing delays and congestion losses, real-time applications are not feasible on the current best-effort

Internet. Video conferencing, video broadcasting, and audio conferencing applications need guaranteed bandwidth to provide acceptable quality. To support these service requirements it has been necessary to modify the Internet infrastructure to provide control over end-to-end packet delay and bandwidth administration [18]. Resource Reservation Protocol (RSVP) is widely used and Guaranteed Service, Controlled-Load Service are the most preferable classes of RSVP inside integrated services.

1) RSVP

The Resource Reservation Protocol (RSVP) is designed to reserve resources across a network for an integrated services Internet. RSVP can be used by either hosts or routers to request specific levels of quality of service (QoS) for application data transmission. RSVP defines how applications place reservations and how they can release the reserved resources once the need for them has ended. RSVP requests resources for simplex flows, one direction from sender to one or more receivers [19].

a) Controlled-Load Service

Controlled-Load Service (CLS) supports applications that are highly sensitive to overload connections. CLS provides the same QoS under heavy loads as under unloaded conditions [24].

b) Guaranteed Service

Guaranteed Service (GS) is accepted as a "real-time applications" with light delay requirements. Assured level of bandwidth, guaranteed throughput, guaranteed maximum limited delay and no queuing loss are the features of GS [24].

C. Queuing Disciplines

Queuing discipline prioritizes the network traffic passing through the interfaces. Each router must implement some queuing discipline that governs how packets are buffered while waiting to be transmitted. Examples of the common queuing disciplines are first-in first-out (FIFO) queuing, priority queuing (PQ), random early detection (RED), weighted random early detection (WRED) and weighted-fair queuing (WFQ). In this study; WFQ, RED and WRED will be included into simulations.

1) Weighted Fair Queuing (WFQ)

WFQ gives each queue a weight with different bandwidth requirements. In WFQ, the traffic is forwarded on the basis of the weight assigned to the assured queue. The weight is determined according to the QoS parameters, such as service rate or delay.

2) Random Early Detection (RED)

The idea of RED is to start packet discarding before the queues are full so that congestion is prevented. By this way network arrange its transmitting rate just before congestion happens. It keeps track of the average queue size and discards packets when the average queue size reaches to threshold [26].

Inside WRED, only a single average queue is provided for all incoming packets. A single queue may have several different queue thresholds. Each queue threshold is assigned to an assured traffic class [26].

D. IntServ-DiffServ Mapping

The main idea behind combining these two service model is to gain the benefits of IntServ mechanism at the edge of the network and DiffServ within the cloud network. IntServ is per-flow based and it is relies on the RSVP protocol; it provides QoS guarantees, but it has some scalability problems. On the other hand, DiffServ is based on flow aggregates: it allows an efficient implementation inside the cloud network, but it does not provide real service guarantees. The mapping is realized on the border router in DiffServ/IntServ zones [17]. In Fig. 1, it is seen that working principle of cloud zone is defined as DiffServ while the working principle of Intranets are IntServ.

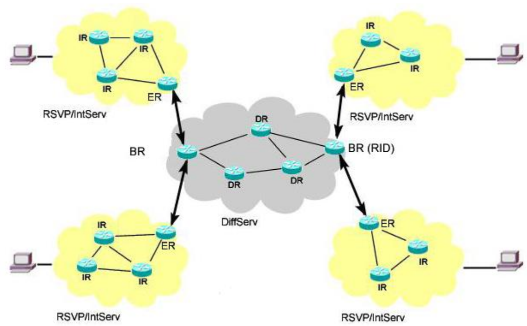

Figure 1 – DiffServ/IntServ Zones

The mapping is realized according to mapping fuction. The mechanism inside IntServ (Best Effort, Guaranteed Service, and Controlled-Load Service) should be mapped into DiffServ (Best-Effort, Expedited Forwarding, and Assured Forwarding) in order to fulfill the interoperability. In our study, the fallowing steps will be tried out to combine two services [18].

- Appropriate Per-Hop Behavior is selected for the requested service.
- Appropriate ruling should be configured in border routers inside DiffServ zone.
- Transfer of parameters from IntServ to DiffServ field.

The proposed mapping in cloud network is stated in table 1for this study.

Table 1 – DiffServ/IntServ Mapping

Intserv	DiffServ	Queue Discp.
GS	EF	WFQ
CLS	AF	WRED

GS generally preferred in applications requiring high data volume. It provides limited traffic delays and guarantees traffic without loss. For this reason, EF is an appropriate match for GS with features like low latency, guaranteed high data volume and limited delay. For VOIP, video, audio inside cloud traffics, combination of these services will be efficient.

CLS does not support strict guaranteed service; the working principle is more like best effort service. The data transmitted on the network is transmitted with minimum interruption. The features of CLS are very close to AF inside DiffServ. AF provides different priorities to various data flows. It is used in ignorable packet loss conditions and traffics without congestion.

VII. Design and Implementation

Based on the above described advantages of cloud technology, a remote multiple office company will be created and simulated on both LAN network and cloud network in order to observe the performance of the network in this section. In the second part, by combining IntServ and DiffServ in a cloud network, performance improvement will be measured.

General impression has been reached with the performance measurement criteria considering the different usage scenarios for groups of 8-hour daily office work in accordance with the traffic density of the simulation results.

A. Scenario Design

1) Standard Network Infrastructure (LAN Model)

Scenario creation is implemented in OPNET Modeler 14.5. Fig. 2 shows us the normal network infrastructure for multiple office company. This company includes 1 head office (Istanbul) and 2 remote offices (Ankara, Budapest). In this topology, PPP_DS3 links are used between offices and 10BaseT LAN connections are used inside offices.

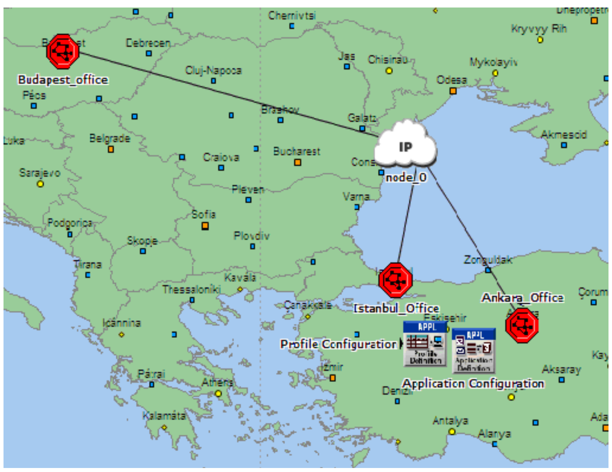

Figure 2 – Standard Network Infrastructure (LAN Model)

Fig. 3 expresses us the design of head office. Head office consists of 3 servers (Ftp, Email, and Web) and has 3 floors with offices. Remote offices include manager and researcher groups same as head office and 3 floors as head office.

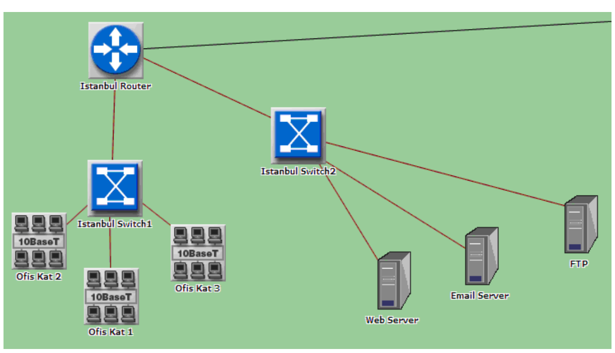

Figure 3 – Head Office

2) Cloud Network Infrastructure

Fig. 4 shows us the network infrastructure of same company designed with cloud computing technology. In this topology, PPP_DS3 links are used between offices and 10BaseT LAN connections are used inside offices.

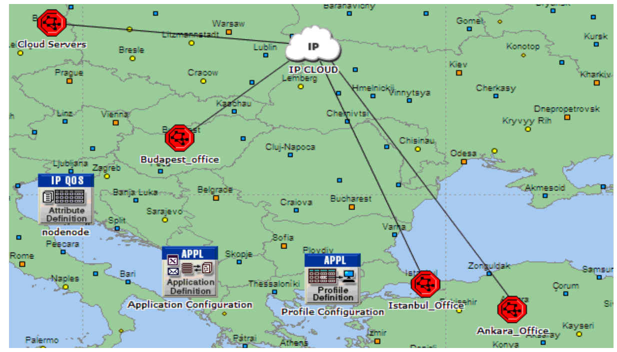

Figure 4 – Cloud Model

As opposed to other scenario, servers are located inside remote cloud service provider's server farms instead of inside company zone in this cloud model scenario. Fig. 5 shows the design of the headquarters for us in this scenario. Remote offices design stay same as previous model.

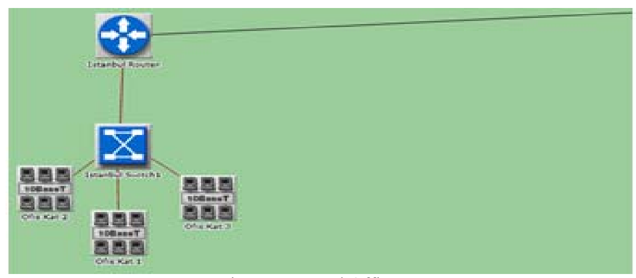

Figure 5 – Head Office

3) Proposed IntServ over DiffServ on Cloud Network

Fig. 6 shows us the IntServ over DiffServ model implemented on cloud network subnet. As it seen in the Fig. 6, IP cloud subnet is designed again. There is a DiffServ zone contains DiffServ routers and outside of that zone the conversion to IntServ is done on border routers. Black lines pass through the routers represent the border routers. The cloud server router, Istanbul router, Ankara Router and Budapest Router is configured with IntServ features.

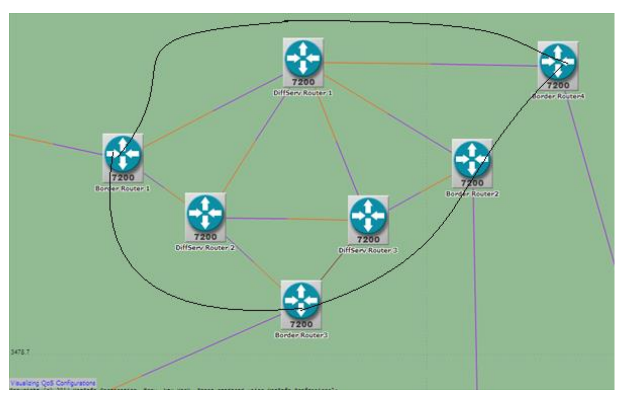

Figure 6 – IP Cloud Subnet with DiffServ Zone

Implementation of DiffServ/IntServ combination to cloud network is followed by configuration of devices. Routers inside company zones support Intserv while cloud zone supports Diffserv. Table 2 expresses the configuration profile of the routers.

Table 2 – IntServ/DiffServ Configuration

Device Name	**Qos Profile**	**QoS Mech.**	**Queue Discp.**
Istanbul Rtr	RSVP IntServ	CLS	WFQ
Budapest Rtr	RSVP IntServ	CLS	WFQ
Ankara Rtr	RSVP IntServ	CLS	WFQ
Cloud Server Rtr	RSVP IntServ	GS	WFQ
Brdr Rtr1/Cloud	DiffServ	EF	WFQ
Brdr Rtr2/Ist	DiffServ	AF	WRED
Brdr Rtr3/Bdpt	DiffServ	AF	WRED
Brdr Rtr4/Ank	DiffServ	AF	WRED
Core Rtr 1	DiffServ	Best Effort	RED
Core Rtr 2	DiffServ	Best Effort	RED
Core Rtr 3	DiffServ	Best Effort	RED

B. *Simulation Parameters*

Before starting the simulation, simulation parameters are examined. The users inside the offices are divided into two groups, managers and researchers in table 3. Inside one office, there are 10 manager users and 50 researcher users.

Table 3 – User Profiles

Application	Manager	Researcher
Email	Heavy	Low
VOIP	GSM	None
Web Browsing	Low	Heavy
File Transfer	Low	Heavy
Video Conf.	Heavy	None

Opnet traffic configuration of profiles parameters are defined for the researches in table 4 and for the managers in table 5. The simulation considered in parameter application start time, application duration and number of repetition which will create the daily office traffic.

Table 4 – Researches Opnet Parameters

Researchers	App. Start Time (s)	App. Duration (s)	Number of Repetition
FTP	Exponential (10)	Exponential (10600)	Unlimited
Email	No Offset	End of Sim.	Unlimited
HTTP	Uniform (0,500)	End of Sim.	Unlimited

Table 5 – Managers Opnet Parameters

Manager	App.Start Time(s)	App. Duration (s)	Number of Repetition
FTP	Constant(200)	End of Sim.	Unlimited
Email	No Offset	End of Sim.	Unlimited
HTTP	No Offset	End of Sim.	Unlimited
VOIP	Uniform (1000,2000)	End of Sim.	Uniform (0,5)
Video Conf.	Constant(1000)	End of Sim.	Uniform (0,5)

C. *Simulation*

1) *Comparision of Standard Model and Cloud Model*

These two scenarios were simulated based on real working hours (8 hours- 1 day) in order to observe the daily traffic and compare these models using OPNET modeler. E-mail traffic, web page response times, FTP download response time, Ethernet delay were used in order to carry out performance analysis.

In Fig. 7, we are able to see the FTP download response times of both models. Compared to the responses time, cloud model is much better than LAN model. Time dependent increase in download traffic causes slowdown in LAN model. On the other hand, cloud model show stable and better performance during the simulation period through its strong infrastructure.

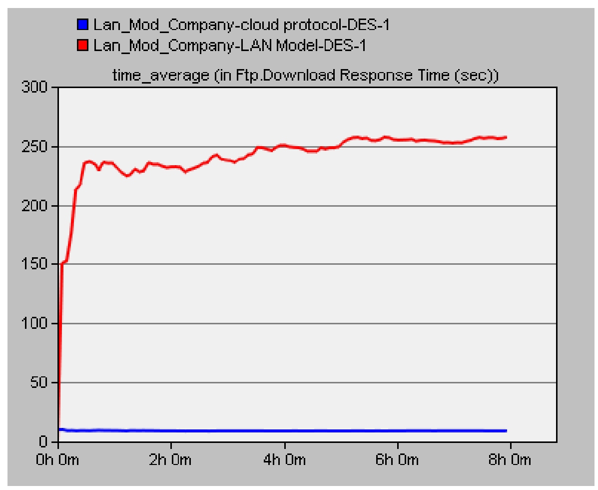

Figure 7 – FTP Download Response Time

Another comparison criteria in our simulation is HTTP page response time. Fig. 8 tells us the page response time is faster than LAN model. Inside LAN Model page response time increased with the simulation start time from 3 seconds to 6-7 seconds with the overload in the internet usage by the time. However in cloud model page response time stays constant close to 3 seconds and does not affected from internet usage due to dynamic resource allocation.

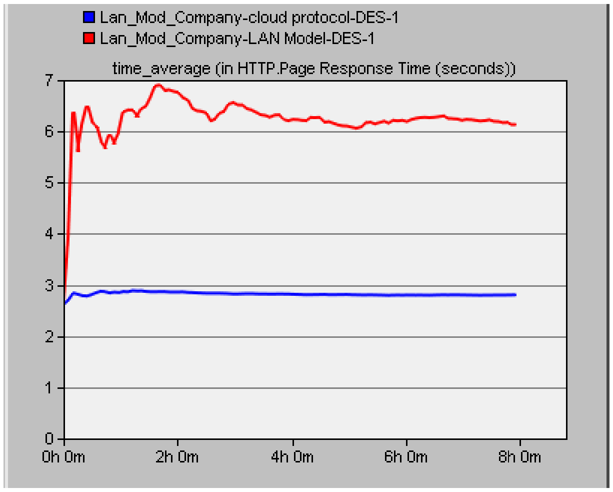

Figure 8 – HTTP Page Response Time

Fig. 9 shows us the email download response time of two models. It is easily seen that cloud model has much better performance than a LAN model. Increasing email traffic causes slowdown in LAN model by the time. Cloud model performance does not effect from any increasing traffic in this period.

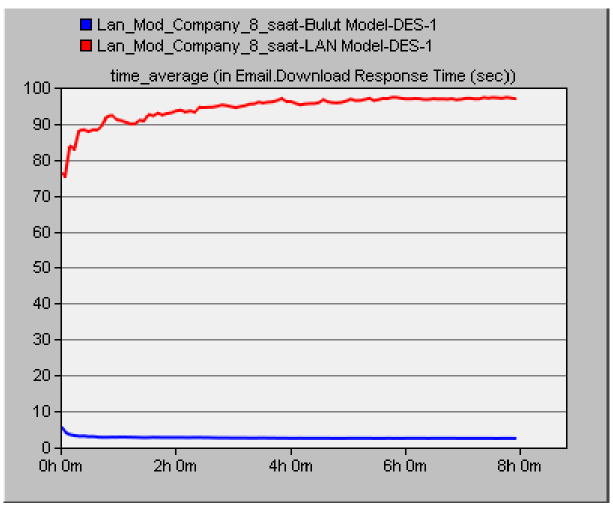

Figure 9 – E-mail Download Response Time

2) Performance Improvment of Cloud Model Using QoS

A new proposed Cloud network model is designed with a new DiffServ zone and existing routers from LAN models are configured according to IntServ profile. In our simulation; in order to combine QoS mechanisms; WFQ, RED and WRED is used to examine the effect of different queuing disciplines on packet delivery. Each router has some queuing discipline that governs how packets are buffered while waiting to be transmitted as expressed in table 2.

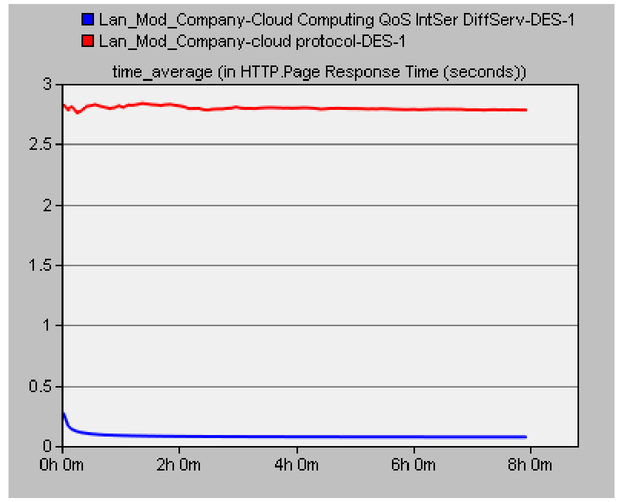

Figure 10 – HTTP Page Response Time with Qos Profiles

It is observed that with newly designed cloud topology in accordance with QoS profiles, performance improvement is gathered from the cloud model. As it is easily seen from Fig. 10, HTTP page response time highly decreases with the new configuration as well as email download response time.

QoS profiles have a big positive impact on email download response time in Fig. 11. Finally, FTP download response time decreases from 9 second to below 1 second with this new QoS profiles which is observed from Fig. 12.

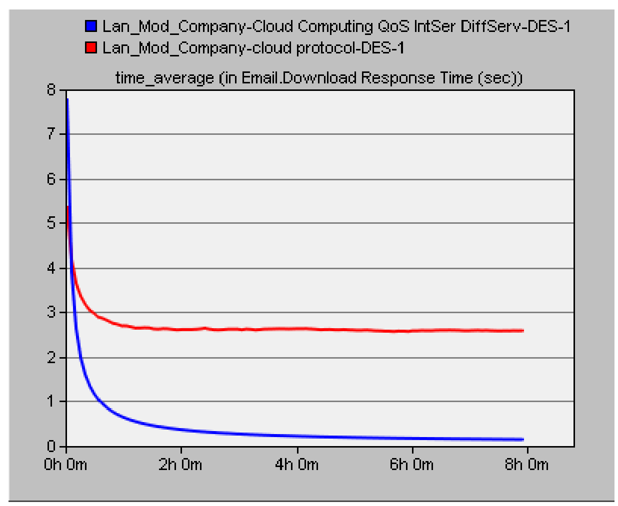

Figure 11 – Email Download Response Time with Qos Profiles

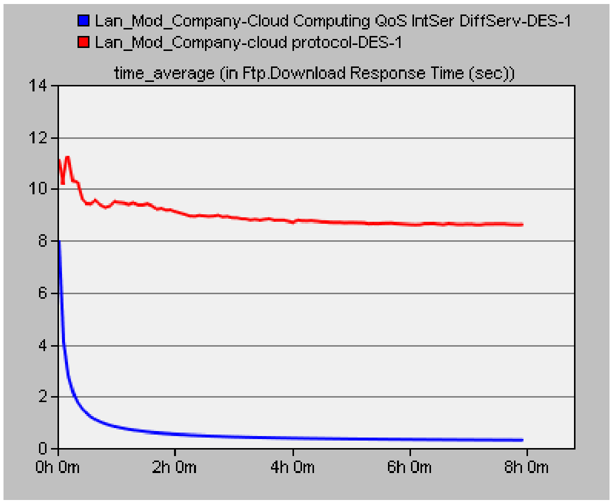

Figure 12 – FTP Download Response Time with Qos Profiles

The applied queuing disciplines are able to be used to control, which packets are transmitted and which packets are dropped. The queuing discipline also affects the latency experienced by a packet, by determining how long a packet waits to be transmitted. We are able to see the reflection of these features from the graphs above. Positive improvement is achieved with the newly proposed combination of IntServ over DiffServ into cloud topology.

VIII. Conclusion

Cloud computing allows all kind of user profiles to use same software, same database, same infrastructure at any time from any location that has internet connection. At the same time, complaints or satisfactions of clients are immediately detected and answered, as soon as possible. Thus, the quality and flexibility of the services can be provided and cost advantages can be obtained. With this application, it is possible to avoid waste of unnecessary performance, electricity use and labor. Savings can be reached on global scale.

In first part of the study, two network infrastructures are designed (Cloud and LAN model) and their performances are compared in HTTP, E-mail and FTP traffic. As a result, cloud model showed better performance in all three traffic type under specified conditions. In the second part, we evaluated the QoS that can be obtained when Integrated Services (IntServ) subnetworks are connected together using Differentiated Services (DiffServ) network. Results of different queuing for QoS management of IntServ/DiffServ networks, is reported.

With this work, assigning QoS profiles to the cloud model, performance improvement is gathered in cloud model in all three traffic conditions.

As a future work, it is possible to study on QoS mechanism and dynamic mapping of DiffServ/IntServ in order to improve performance of the cloud network and the studies can be implemented on big scale networks. Likewise, using other QoS profiles, different combinations and methods better performances can be reachable. The advantages of using cloud computing technology widely in business and daily life shall encourage researchers to spend time on cloud technology.

Referances

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