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PERFORMANCE MEASUREMENT FOR DISTRIBUTED SYSTEMS USING 2TA AND 3TA BASED ON OPNET PRINCIPLES

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ABSTRACT:
This paper presents a comparative study of two designs and analysis: Two Tier Architecture (2TA) and Three Tier Architecture (3TA). By using Optimized Network Engineering Tool (OPNET) modeler network-efficiency is done evaluation. OPNET, a professional simulation tool, is relied on to check the system with many clients from networks for both 2TA and 3TA. The outcomes demonstrate that 3TA is more capable than 2TA in term of data assessment is done utilizing OPNET modeler, which gives a convenient and easy-to-utilize platform for simulating extensive criterion networks. So, it will give more achievement when extended with many clients from networks with eight or sixteen clients. The models are utilized to study how the performance of the network is influenced by the different design decisions that are made to upgrade the system. This paper likewise examines ways in which the OPNET modules have been produced so that students could learn computer network concepts, and not exactly how to use OPNET software.

KEYWORDS: Network, distribute, OPNET, Simulation, Design, 2TA, 3TA.

1. INTRODUCTION

Network simulators have developed in development since them introductory showed as performance, establishment and expectation apparatuses. Simulators are usually utilized as network management apparatuses, for which packet level analysis is not generally employed (Fras, Mohorko, & Cucej, 2010; Li & Lin, 2005). In spite of this, more studies are needed to build up rules for researchers so that they may choose and customize simulator to suite fine-grained packet level analysis (Currier, 1999; Heidemann, Mills, & Kumar, 2001). The breach of credibility that studies based on simulation devices need to handle which is one motivation behind this paper. The simplicity and facility that simulators give in assessing "radical" changes in a network environment cannot be ignored. There are impressive number of simulation tools in the market that have main characteristics such as exactness, speed, ease of use, and monetary expense (Lucio, Paredes-Farrera, Jammeh, Fleury, & Reed, 2003). It concentrates on the accuracy of the simulation in comparison to a real network for packet level investigation. OPNET (Optimized Network Engineering Tools) is a comprehensive programming environment for demonstrating, simulating, and analyzing the performance of communications networks (define the Internet) (L.Peterson & S.Davie, 2008). Recent articles (Qaqos, Zeebaree, & Hussan, 2018; "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Service Layer Requirements to integrate NGN Services and IPTV Doc. Nb. TS 181 016 Ver. 3.3.1Ref. RTS/TISPAN-01059-NGN-R3,ITU-T, 2009.,") have described how it has been utilized as a part of education and research. Features of it include object-oriented editors that mirror the structure of genuine networks, and support for most network type and technologies. OPNET has become the business standard tool for designing networks and assessing network performance under different test conditions. Thus, students will profit from introduction of this product. Configuring network models with OPNET requires many steps, and this can be overpowered for new users. Then student performs investigations on the essential model. The following stride involves adjustments of the fundamental network model and investigations of the modified networks. Along these lines the students can focus on learning computer network concepts, and gradually be acquainted to learning the stage on how to build network models with it. We introduce the modeling approach to another issue of assessing the execution of measure for distributed network systems (Praveen Balda & Garg, 2015; Salah & Alkhoraidly, 2006). Our objective is to build up a simulation environment that would empower such an assessment. So, this is an introductory project. OPNET simulators have developed in development since they initially appeared as execution, administration and expectation tools. Simulators are normally utilized as network administration tools for which packet level investigation is not commonly employed. However, more studies are needed to build up rules for researchers so that they may select and customize a simulator to suit fine-grained parcel level analysis (Currier, 1999; Heidemann et al., 2001). The ability to simulate computer networks wireless enhances the teaching of computer networks concepts (K., 2009; Salah & Alkhoraidly, 2006). Information and communication technology (ICT) is most beneficial for the business sector (Praveen Balda & Garg, 2015).distribution networks as one of strategic (Rusu, Huang, & Rizvi, 2008).

The issue and motivation for displaying design/analysis systems was talked and proposed an OPNET model for evaluating measure in distributed network. System how effectively in the lessening of vital factors, for example process-devoured -time, overhead-effort, expended -cost, diminishing the issues of combination traffic. In this paper our contribution are essential for organizations if we need to utilizing from a little office or big approximate, The results show that 3TA is more competent than 2TA in term of information evaluation is

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done utilizing OPNET modeler, which gives advantageous and easy-to-utilize platform for simulating extensive criterion systems.

The paper is organized as follows. Section II gives an overview of the developed model and presents its key components and functionalities. In Section III and IV, simulation setup is introduced and the outcomes obtained with the OPNET modeler are discussed. In Section V, the paper is concluded with few remarks on future work.

2. LITERATURE REVIEW

In the research work (Bagus, 2012) led in 2011, OPNET was utilized for designing a network simulation for Mosul University. The system configuration was tried by adding 3 applications (File Transfer Protocol, Hyper Text Transfer Protocol, and Voice over Internet Protocol). Their results demonstrated that the suggested model produced a constructive efficacy on scheming. The research work (Hammoudi, 2011) directed in 2011, demonstrated the infrastructure of PC network for Tarumanagara University for supporting diverse academic and administrative actions. The built infrastructure covered completely parts of the building and the floor levels and dealing with the focused-on system. The authors in (Ammar O. Hasan & Rashid, 2017) talk their experiences with lab and classroom projects utilizing OPNET in undergrad networking courses, for example Data Communications and Networking, TCP/IP and Internet Technologies etc. The research work (STRAKA, 2010) in 2017 is depended on OPNET for developing a computer network simulation for Salahaddin University-Erbil measuring HTTP (Hyper Text Transfer Protocol) service values.

3. RESEARCH METHODOLOGY

Each electronic system needs of both software and hardware parts. It is preferred to have two different types of computers. The servers-side computers must be more powerful than clients-side ones (but if the client hosts are powerful too, it is not a problem). Therefore, it is important to describe all software and applications utilized for designing the proposed system. In addition, required hardware features for the proposed system must be depicted. The system is implemented utilizing hosts with various features in order to give applications that are more practical and to be more close to the genuine situation. OPNET modeling and simulation flow diagram is shown in Fig. 1.

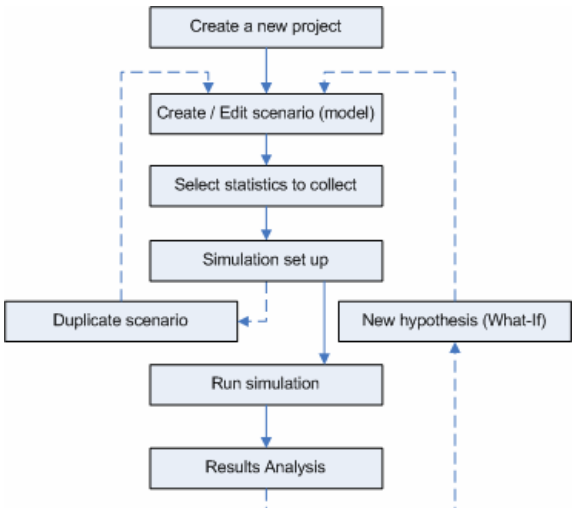


Figure 1. How do work scenarios

A. *Required Software for Windows-7*

- Operating System: Windows-7
- Applications: OPNET Modeler
- Web Browser: HTTP server and Database server (STRAKA, 2010).

Web communication environment consists of following elements (JIA, 2005):

1. Servers: Continually running programs that serve information to the web.
2. Clients: Web browsers that allow users to access the web.
3. Protocols: Database and hypertext transfer protocol (http)
4. Networks: Connected devices to a local area network and a wide area network with the form of Internet.

B. *Architectures Diagram*

Some of the modern design models of the software Application (Manual) is illustrated in Fig. 2. and Fig. 3.

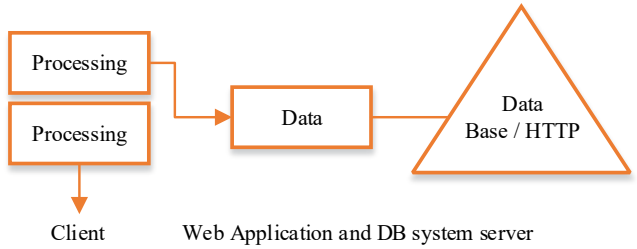


Figure 2. Two tier architecture

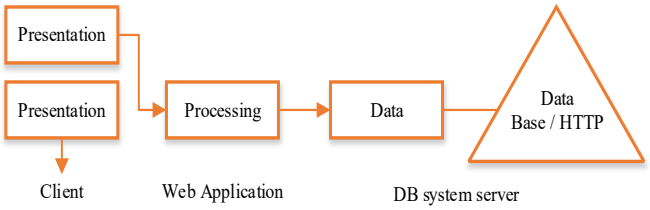


Figure 3. Three tier architecture

Each of structures shown in Figs. 2 and 3 has its specific features. In the structure of Fig. 2., there is one server-host used for both of web-applications and database system, while the structure of in Fig. 3. Includes two hosts for the servers-side, which one of them is specified for the web-application and the other for database system. Splitting the servers-side provides more security to the system. The focused point of this proposed system is to determine the performance of different organizations of network. The performance measures include Total-Network-Delay (TND), Server Delay (SD) and Server-Load (SL).

C. *Evaluation Parameters*

The evaluation parameters utilized in performance network are as follows:

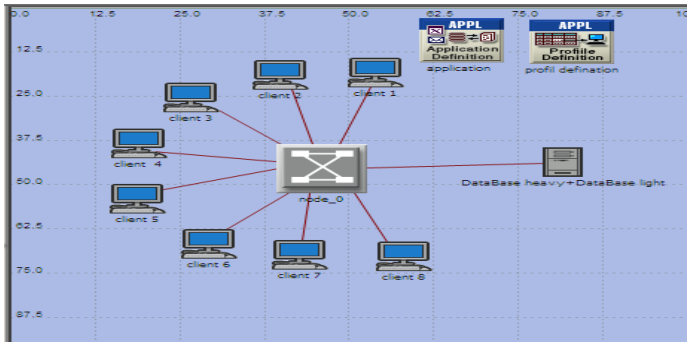
- **Load:** It represents all control packets sent by the nodes in the network for finding and keeping up the server during the emulation. Loading capacity can be utilized to compare the scalability and efficiency as well as the ability to configure network congestion in various networks. Server protocols with extensive loading capacity have more probability of packet collision and delay.
- **Average delay:** This parameter refers average lag time of the packet going from the source node to the goal node. It consists of

the buffer delay in the server finding process, the transmission delay in the MAC layer and the transmission time.

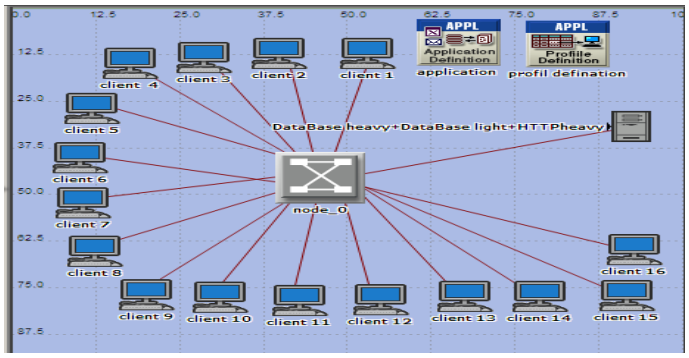
4. RESULTS AND DISCUSSIONS

There are two main parts of the assessment. Firstly, the similar scenarios are applied for 2TA. Then, scenario is applied for 3TA. Both of scenarios utilize eight and sixteen clients and Windows 7. The consumed-time and the data flow for the general network and the server(s) are resolved.

Results obtained from evaluation-scenarios using OPNET tool are as follows.



(A)



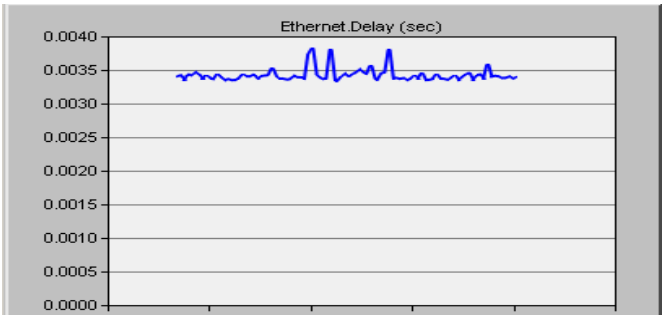
(B)

Figure 4. Two tier architecture (A) utilizing 8 clients. (B) Utilizing 16 clients

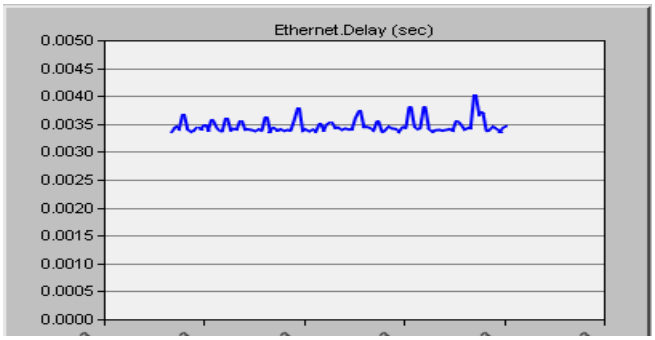
TND, SD and SL are considered here that are related to the system performance measurements. From Table I, Fig. 5 and Fig. 6, it is clear that general delay of the network is more than that of the server-host (which are typical and expected outcomes). In general, server load can be noticed obviously because both of web application program and database system are put in one server-host (for 2TA).

TABLE I. TOTAL-NETWORK-DELAY AND SERVER-LOAD FOR 2TA

No. of. Clients	Total Network Delay (sec.)	Server Delay (sec.)	Server Load (Bits/sec.)
8	0.0038	0.0048	1800000
16	0.0038	0.0048	3000000



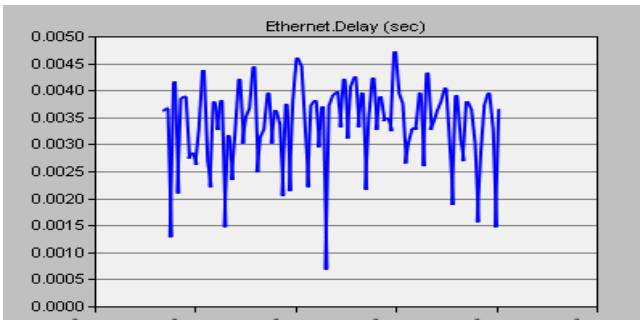
(A)



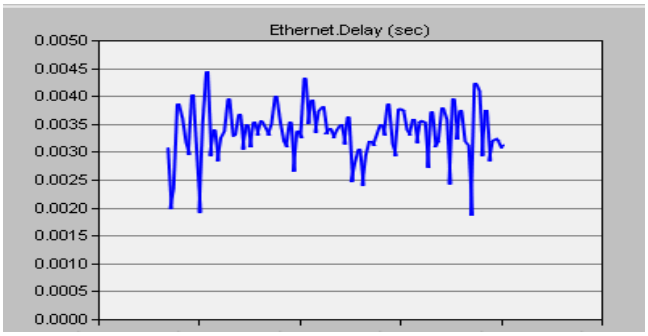
(B)

Figure 5. Total-Network-Delay comparison of the two evaluation-scenarios for (A 8 clients, B 16 clients) 2TA

These figures A and B illustration 8 clients for figure A and 16 clients for figure B used Ethernet delay by form two tiers Architecture.



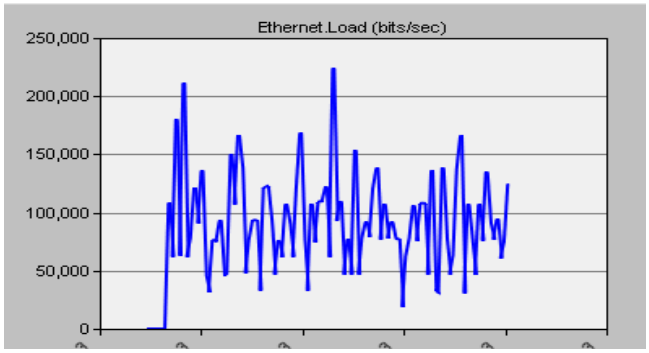
(A)



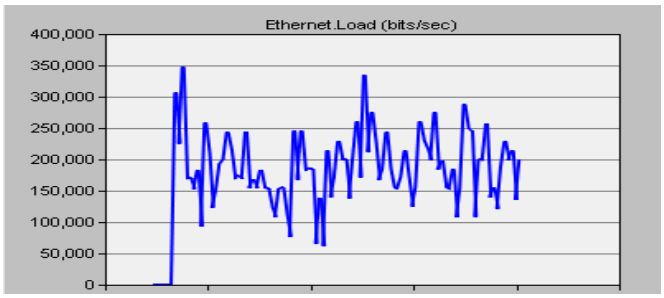
(B)

Figure 6. HTTP-Server-Delay comparison of the two evaluations -scenarios for (A 8 clients B 16 clients) 3TA

These figures A and B illustration 8 clients for figure A and 16 clients for figure B used Ethernet delay and HTTP-server by form three tiers Architecture, these curves difference with curves figure five.

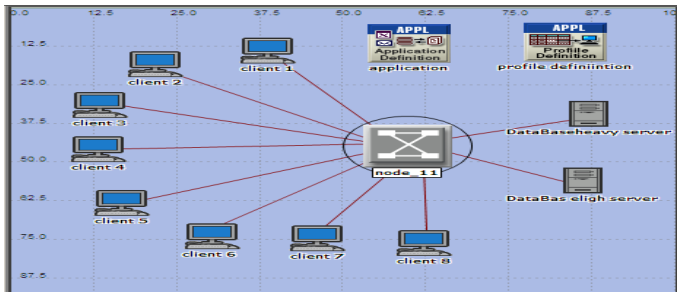


(A)

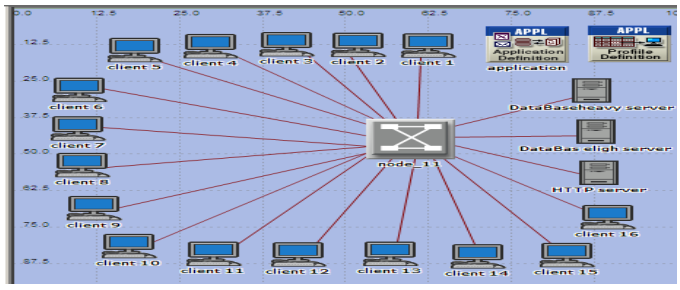


(B)

Figure 7. Server-Load comparison of the two evaluation-scenarios for (A 8 clients, B 16 clients) 2TA



(A)

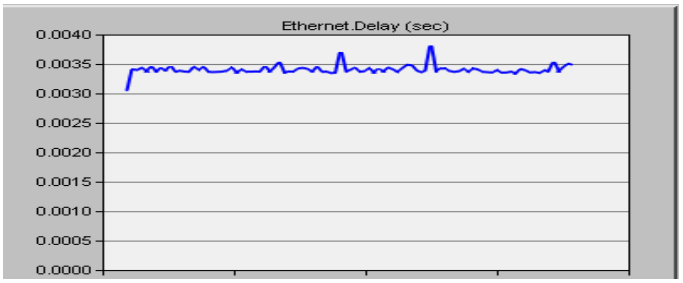


(B)

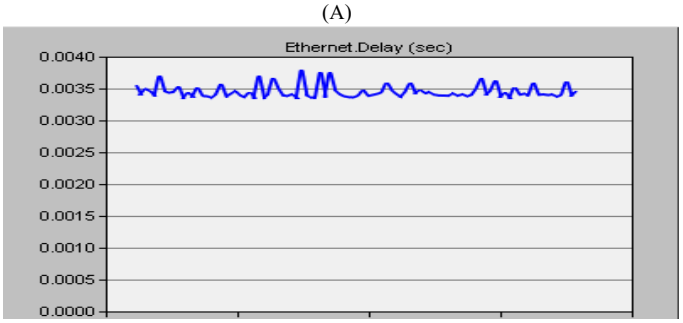
Figure 8. Three tier architecture (A) utilizing 8 clients. (B) Utilizing 16 clients

TABLE II. TOTAL-NETWORK-DELAY AND SERVER-LOAD FOR (A 8 CLIENTS B 16 CLIENTS) 3TA

No. Of Clients	Total Network Delay (sec.)	Server Delay (sec.)	Server Load (Bits/sec.)
8	0.0038	0.0048	100000
16	0.0039	0.0049	200000

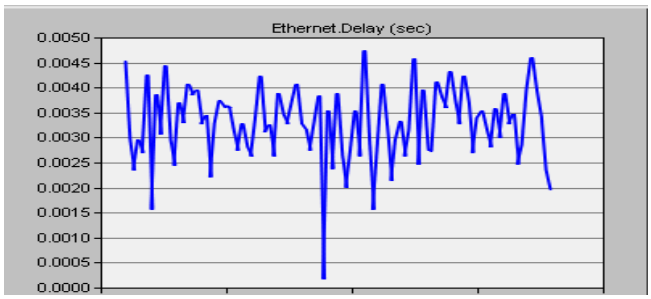


(A)

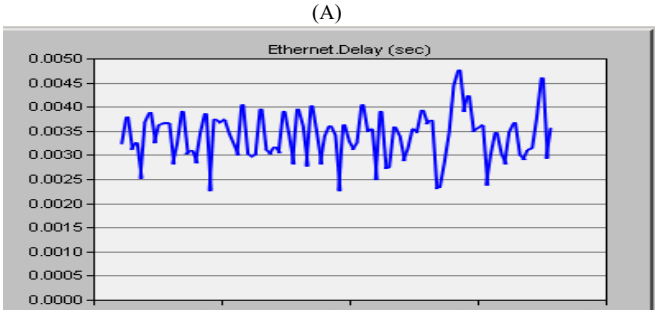


(B)

Figure 9. Total-Network-Delay comparison of the two evaluations (A 8 clients B 16 clients) -scenarios for 3TA

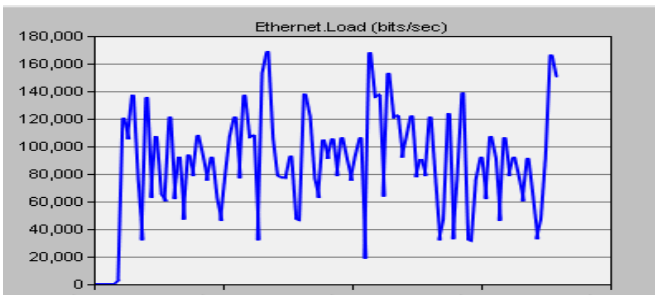


(A)

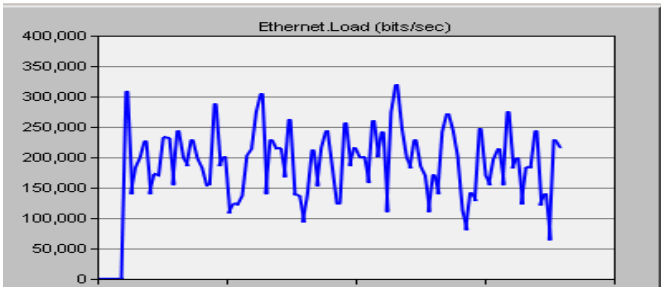


(B)

Figure 10. HTTP-Server-Delay comparison of the two evaluation-scenarios for (A 8 clients B 16clients) 3TA



(A)



(B)

Figure 11. HTTP-Server-Load comparison of the two evaluation-scenarios for (A 8 clients B 16 clients) 3TA

Fig. 7 outlines the impact of increasing number of clients on the amount of server load in term of (bit/sec). Subsequently, there is an instant proportion between number of client and server load. Fig. 8 represents the assessment-scenarios for 3TA utilizing eight and sixteen clients and OPNET tool. Table II represents Total-Network-Delay (TND), Server Delay (SD) and Server-Load (SL). Figs. 9, 10 and 11 represent TND, SD and SL comparisons of the two evaluation-scenarios for 3TA using OPNET tool. It can be appeared from Table II that the TND is greater with respect to those values of 2TA because of adding an extra server. Likewise, the SD values are less than those of 2TA because just http-server is considered (i.e. the delay of server that contains only the web application program). The http-server load will have higher load than that of 2TA because of the extra server in 3TA. The impact of these outcomes is outlined obviously in the plotted curves in Figs. 9, 10 and 11 that are extracted from Table II. Fig. 9 shows the impact of average values of TND for 3TA, and the differences can be taken note. Fig. 10 represents the average values of http-server-delay utilizing 8 and 16 clients. It is clear that there are no large differences among these values because just this server will face all received packets and the impact of communication between this server and database server can be ignored. The impact of increasing number of clients on the http-server is depicted in Fig. 11. This relation is instant proportion with increasing server load.

The overall evaluation of the proposed system shows that the 3TA is perfectly reliable with optimum results for both mentioned techniques. This section deals with two main parts. The first part deals with the comparison related to both architectures of the proposed system (2TA and 3TA) whereas the second part deals with the evaluation of the obtained results compared with those of previous works.

5. CONCLUSION AND FURTHER WORK

In this paper, the problem and motivation for modeling design/analysis networks was discussed and proposed an OPNET model for assessing measure in distributed network. System how effectively in the lessening of important factors, e.g. process-devoured -time, overhead-effort, expended -cost, reducing the issues of conjunction traffic, and even decreasing the side effects of environment causes depending on the obtained got from this system that demonstrated by evaluator programming called OPNET tools. The performance of the system utilizing 3TA was more precise than that of 2TA. As a result of utilizing two servers in 3TA, high security is provided by part both of application-server and DB-server. Adding to that, utilizing OPNET simulator as an expert assessment and designing tool and a vital performance assessment tool demonstrated the proficiency of 3TA than that of 2TA. Depending on the proposed system that has been designed, implemented and assessed. Also, thus, this office can be connected together to build an office. Designing and implementing human resources administration system is related to the administration part. Applying the details proposed by this system about extra services for example: operation rooms.

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