Analysis &Estimation of QoS Parameters on LAN Fundamental technologies based on OPNET

Dr. Adnan Hussein Ali, HaeederMuntherNoman, Dr.Ali AbdulwahhabAbdulrazzaq
Middle Technical University,Baghdad,Iraq/Technical Instructors Training Institute

ABSTRACT

The performance assessment of a networkcan becentered on fixed parameters like throughput and delay and others. The technology performancesdeal withauser's number or nodes in addition toconfirmed generation parameters. Thepurposes of this workis toestimate and explore the performances ofthroughput concentrated on traffic received,downloaded objects and pages as well as delay& loadbased on most basic technologies: Ethernet besides FDDI. By simulating two scenarios, first one contain 10 nodes with the other of 20 nodes. The effect of numerous network configurations on created scenarios were examined with a network simulator OPNET. The concluded diagrams ofthe Ethernet throughput be greater than at FDDIdue to their abilities for filtering errorsand to avoid collisions,while FDDI load anddelay which experienced atthese networkscan be consideredless than Ethernetifan equalnodes number could be utilized.At last, the effect of the downloaded objects and pages for Ethernet network with10 & 20 nodes are explained and proves as greater than that for 10 &20 nodes for FDDI networks.

Keywords: Ethernet, FDDI , QoS parameters (throughput , delay, load), OPNET.

1- INTRODUCTION

Networks can be wired or Wireless connection, theyhave been grown-up like weed over the past few decades provided that stepsfor the paths of networksaccess resources. Thus, it is animated for havingperfect and a consistentcommon platform to assist networks. Networkwith a wired connection provides a protected and faster ways of connectivity. Thewired Ethernet's performancesarewith a high sensitivityfor the sum of operators, loadcontribution, and alink of transmission,whereas wireless connections are also identical sensitivity to the users, loadofferingin addition to physical characteristics, data bit rate, size of packets and so on[1].

2.1 Ethernet Technology

Ethernet is a technology for local area whichdeals withflexibility, fairlyinexpensive, practically fast, in addition tobe considered very common technology utilized inbest applications [2]. Ethernet was initiallyadvanced by Digitallyequipment's Corporation (DEC), Xerox , and Intel with aconsistent by IEEE group as an 802.3. It was intendedto be a 'broadcast' systems, which means, the station may be transmit message to another oneat whatever time. The response is came only from a station that a message was sent. Atechnologyof commonEthernet containmany types, like a thick wire represented by 10 Base-5, thin wire signified by10 Base-2, Ethernet over UTP denoted by10 Base- T, Ethernet over Optical fiber for 10 Base-FL, finally 100 base-T among others[3]. The Totalforms of Ethernet utilize a protocol of Media Access Control (MAC) titled CSMA/CD for controllingeach devices may beused for transmitting data to any network, beside ifthese systemsmay do so [4].

2.2 FDDI

The FDDI identified for Fiber Distributed Data Interface which requires a 100-Mbps token-passing, dual-ring LANutilizingopticalfiber cable. It is commonlyapplied as one of backbone technologies forhigher speedingdue to itsbacking for greatbandwidthsas well aslarger distances compared with copper [5].

FDDI utilizes an architectureof dualring using trafficsfor each ring to flowatreverse directions which known as acounterrotating. The dualring consisting of primary ringin addition to secondary. Throughthe standardoperations, the primary ring can be utilized for transmitting data, with a secondary rests idle. Thepurposing ofprimary of the dual ring is for providing agreater reliability and

strength. Figure 1 explains the rotating counter of FDDI primary and secondaryrings.

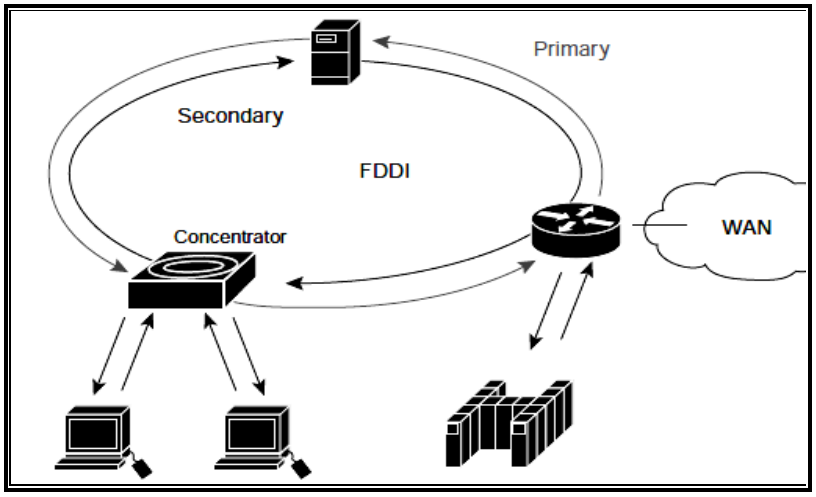

Fig. 1 FDDI primary and secondary rings with rotating counter.

There are three topologiescan be applied by FDDI: Ring, Star and Tree. All of themmay be sharedfor a large and strong network (up to 400 nodes or more) with severalbenefits overanyother networkswhereasto avoid their disadvantages [6]. Four types of cablesmay be utilized with FDDI:first, Multimode OpticalFiber Cable which can be covered a distance to about 2km, second, Singlemode OpticalFiber Cable which covering distance round to 10 km, IBM Category 1 STP that has a distance of maximum of 100m, and Set 5 UTPthat an FDDI utilizes couple rings used for tolerances fault and can operates for connectingevery nodes or may beemployerswithin a network. Any rings can transmitted data with an opposite direction for other one. Commonly, a primary ring transmitsa data whereasa secondary ring may be idle. If a break is found in the ring, thus a primary ring will beencircledfor the secondary onewith nodes or else users that adjacentfor break therefore bypass the faultsso thatoutcomeswithacompleteor unbroken rings [7]. Also, a couple rings may be utilized for transmittingdata simultaneously to enhancementsspeed of anetwork withmaximum distance doubleof 100m[8].

3. Network Simulation Performances:

A two models of network, the Ethernetas well as FDDI are simulatedbased on anassistance of OPNET IT modeler,Guru Academic Edition 17.5. A simulation methodology utilizes a simulator of OPNET for modeling the network. OPNET considers confident simulator for communication system established by OPNET technology [9]. Both scenarios have been simulatedwith two various scenarios,afirst scenario with 10 nodes, whereasa second scenario with 20 nodes beingassessed. The conceptaccompanied with using two different types of scenarios istocreateenhancedconsequencestoa network by compared the traffic's analyses in addition toDownloaded objectsand pages. Different metrics are compared like load, throughput, and delay with these two different scenarios,a results ofthem are associatedwith graphs as seen in the figures (2, 3, 4, 5).

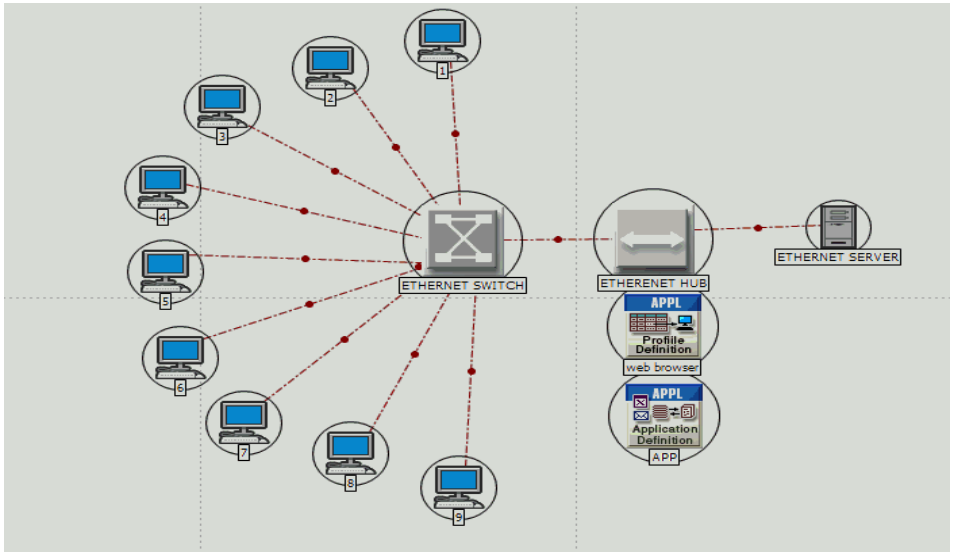

Fig 2:Ethernet Scenario 1 Network for 10 Nodes.

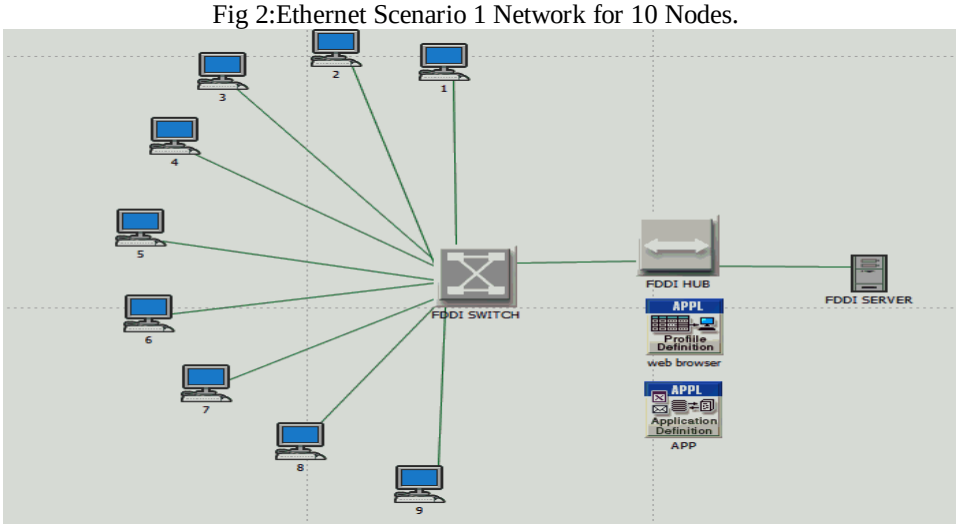

Fig3:FDDI Scenario 1 Network for 10 Nodes

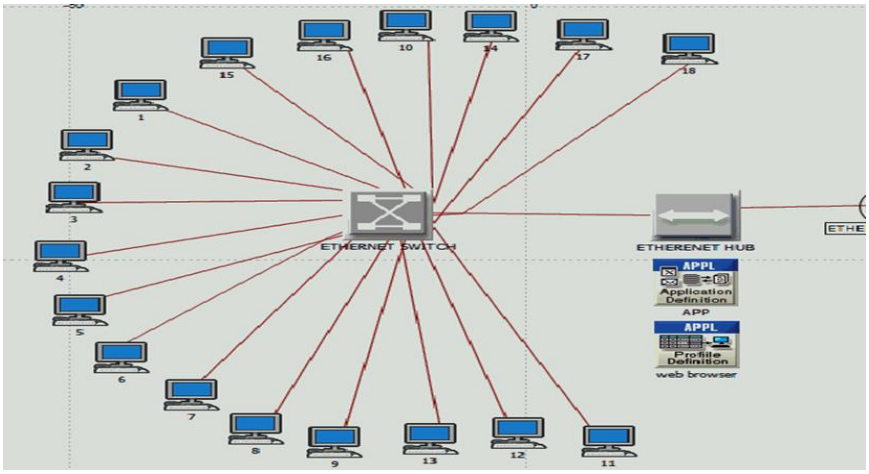

Fig.4: Ethernet Scenario 2Network for 20 Nodes.

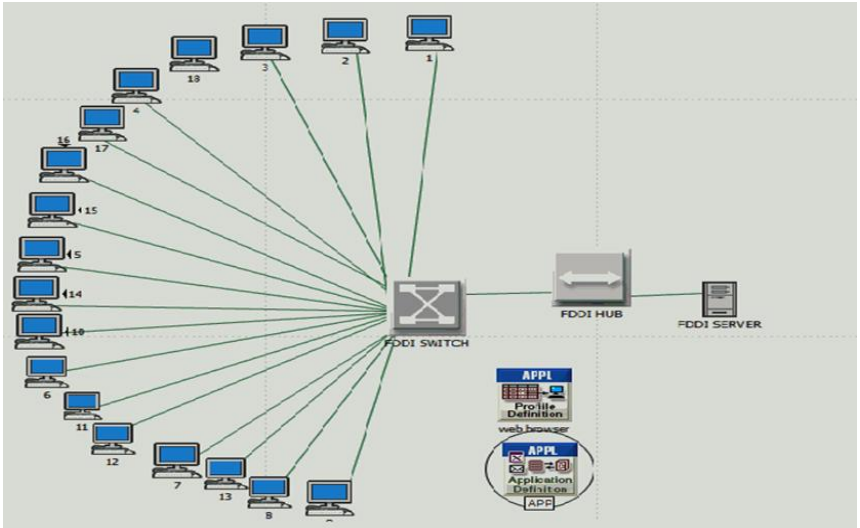

Fig.5: FDDI Scenario 2 Network for 20 Nodes.

Ethernet scenario

A first scenario, Ethernet model issimulated with connecting10 nodes to aessential switch type (Ethernet16_ switch) by used 100 BaseT link. This link would be utilized to confirm designing of Ethernet 100-Mbps thatprovides a fast speed equal to100mbps, the supporting ofa switch to use up to 16 interfaces, with a data rate of 100 mbps and duplex link.The Ethernet 16_ switch is used for performingintelligent functionssuch as filters and preventing collisionsif the information could bepass along with nodes. Theused parameters for generating traffics and packets for an Ethernet model can be seen intable 1.

Table 1: Ethernet Traffic Generation Parameters

Start time (seconds)	Constant (1.0)
ON State Time	Exponential (100.0)
OFF State Time	Exponential (0.0)
Interarrival Time	Exponential (0.02)

FDDI scenario

According tothe same first scenario, FDDI scenariocan beformedby employing10 nodes with a center connectionof(Fddi 16_layer_switch)by an FDDI link. A usage of FDDI link is forconnectinganyoperator to a switch of 16ports to procedure an FDDI ring's connection at 100mbps.

Table 2: FDDI Traffic Generation Parameters.

Start time (seconds)	Constant (1.0)
ON State Time	Exponential (100.0)
OFF State Time	Exponential (0.0)
Interarrival Time	Exponential (0.02)
Packet Size	Exponential (1024)

4.1 Result analysis for throughput

Athroughput of the network can be defined as the average amount of the effective message transfer over the channel of communication [10]. It can be measured with bits/seconds (bit/s or bps) as well aswith data packets/second or packets per times slot.

It can be perceivedfrom figures (6, 7, 8, 9) that a throughput or traffic received for FDDI be 2.4 packets/sec and for Etherert is 1.2 packets/sec in

addition the throughput (traffic sent) for FDDI is 9 packets/sec and for Etherert is 5 packets/sec that means the throuhput for FDDI is more than ethenret for 10 nodes, as node increases from 10 node to 20 node then the throuhput (traffic received and traffic sent) for ethernet is more than FDDI. That'sdenotewith FDDI, whenfurther trafficsare generating, the amount of collisions will be increased and consequently the throughput islowered. The Throughput could be high at Ethernet due to a technology of CSMA/CD beapplied for filtering and preventing collisions.

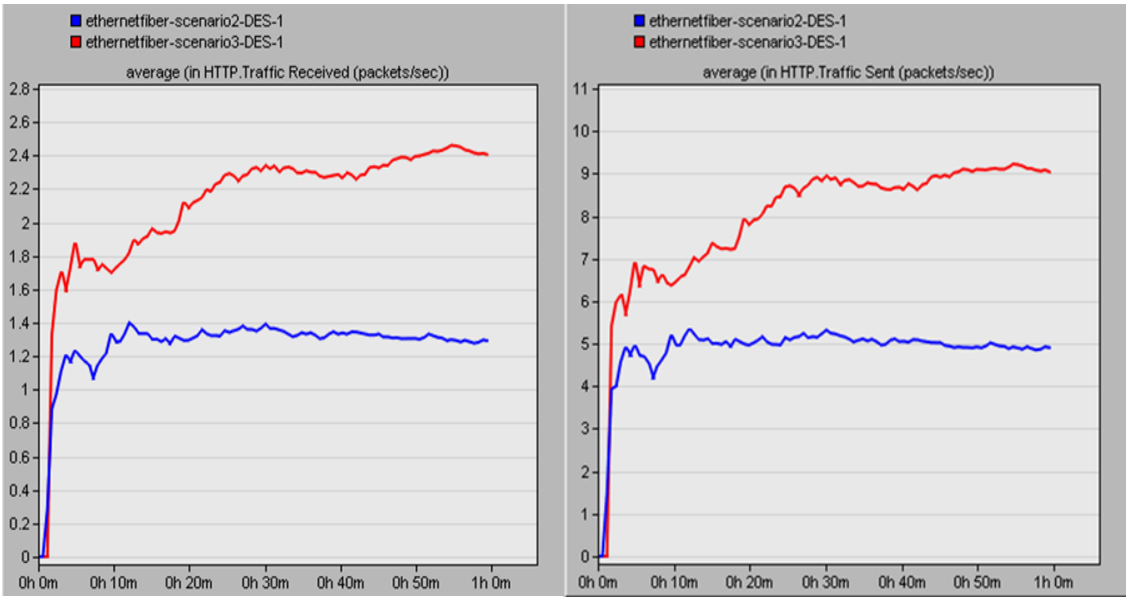

Fig.6 : average throughpt(traffic received)Fig. 7 : average throughpt(traffic sent) for 10 nodes (scenario 1)

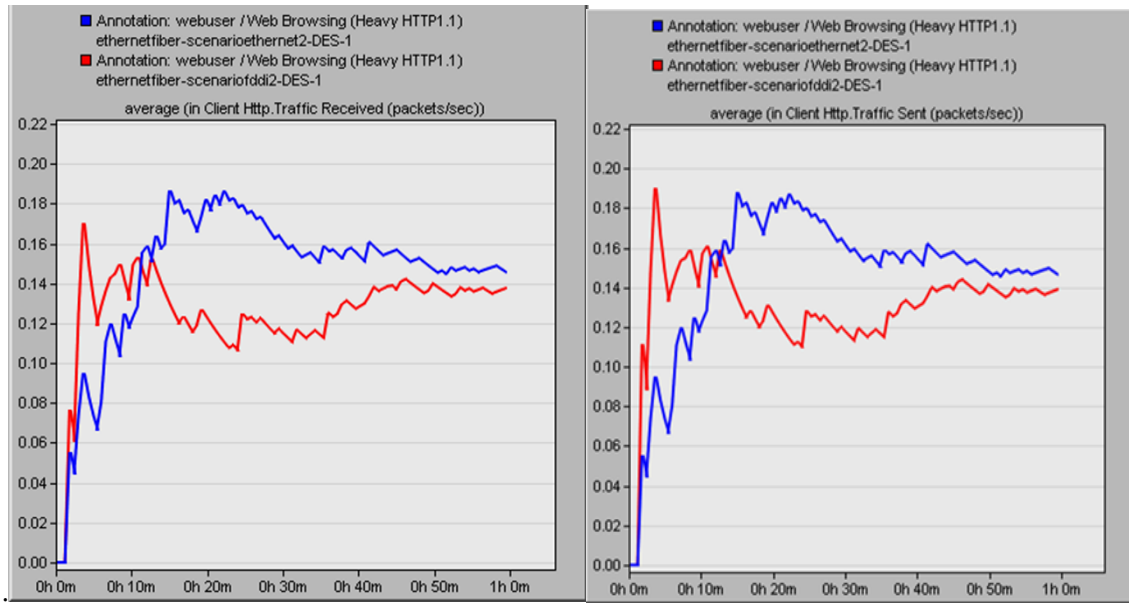

Fig.8 : average throughpt(traffic received) **Fig. 9** : average throughpt(traffic sent) for 20 nodes (scenario 2)

4.2 Analysis resultsof delay

The delay scheme for FDDI in secs can be appearedat Fig10, within a red color and with a blue color for Ethernet. It'snoticedthat FDDI delay at 10 nodescan have lower value, about 0.0026 secs as matchedwith Ethernet delay which is about 0.0secs,if the nodes is increased from 10 nodes to 20 nodes the delay in FDDI is equal 0.003 secsifrelated to Ethernet'sdelay (0.092 secs)as shown in fig11. An indication gives that,the FDDI speed runs at highcompared with Ethernet. A result

furthermoreproves that FDDI will bebetteratchallenging applications represented bya requirementfortransferringa large data amounts within a short time amounts. In spite ofdeliveries of data cannot be promisewhen collisionsarerestricted to be happened.

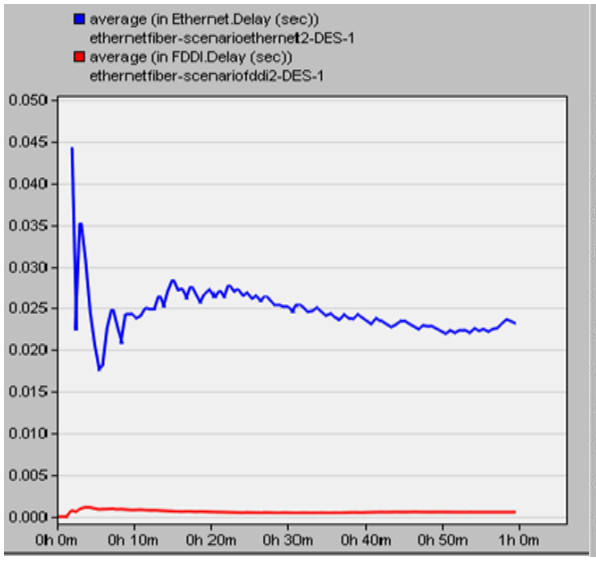

Fig.10 : scenario 1 average 10 nodes delay

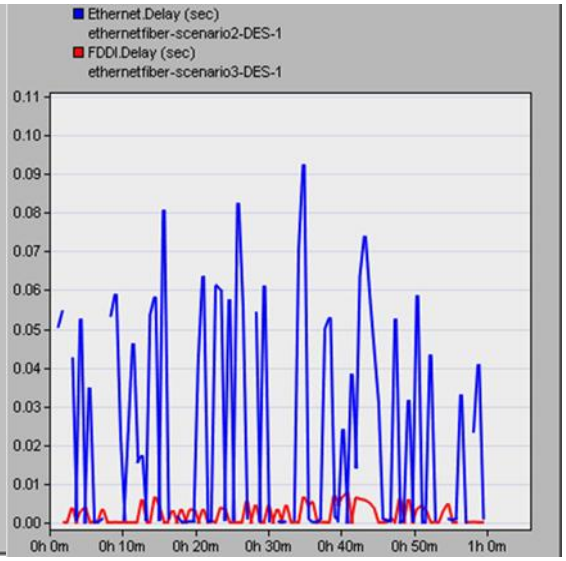

Fig.11:scenario 2average20 nodes delay

4.3 Result analysis for load:

A load for FDDI and Ethernet (packets/sec)can be seenat fig. 12within red color and blue color respectively. Again FDDI load at 10 nodes is lowered than Ethernet(2.26 packets/sec as compared to 5.2 packets/sec).However with nodesare increased (10 nodes to 20), the FDDI load equals 2.5 packets/secand Ethernet load matches 5.7 packets/sec as presentedin fig13. This specifies theoperation ofEthernet load will be highas related to the FDDI.

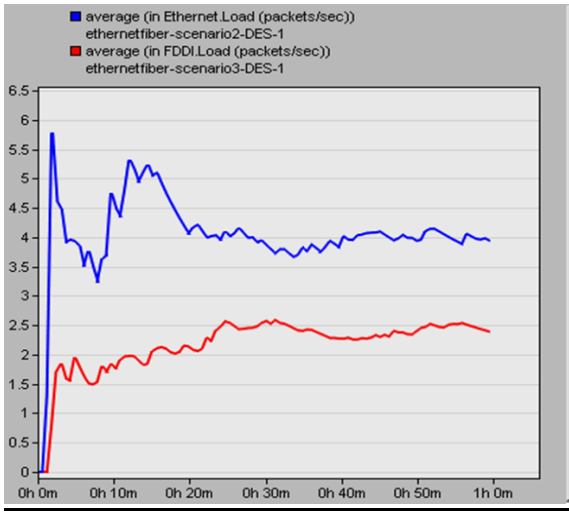

Fig.**12**: 10 nodes (scenario 1)average load

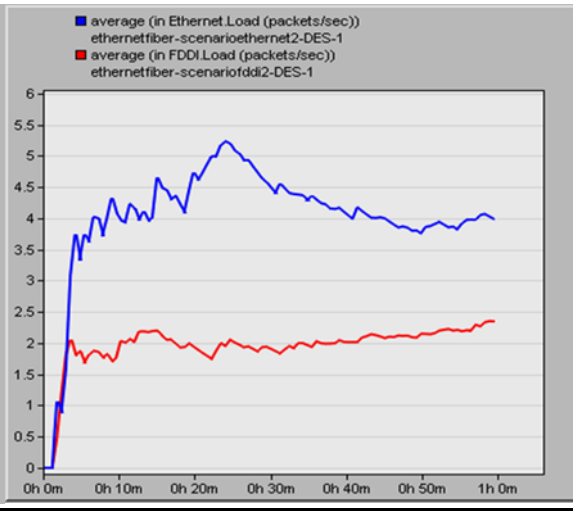

Fig.**13**: 20 nodes (scenario 2)average load

4.4 Downloaded objects and pages

Downloaded objects between Ethernet and FDDI for 10 and 20 nodes can be seen after simulating them for two scenarios , first the effect of downloaded objects can be seen in fig. 14, and a results show that the downloaded objects for Ethernet network with 20 nodes is greater than that for 20 nodes for FDDI network with same connection for network with 10 nodes for Ethernet network and FDDI network respectively.

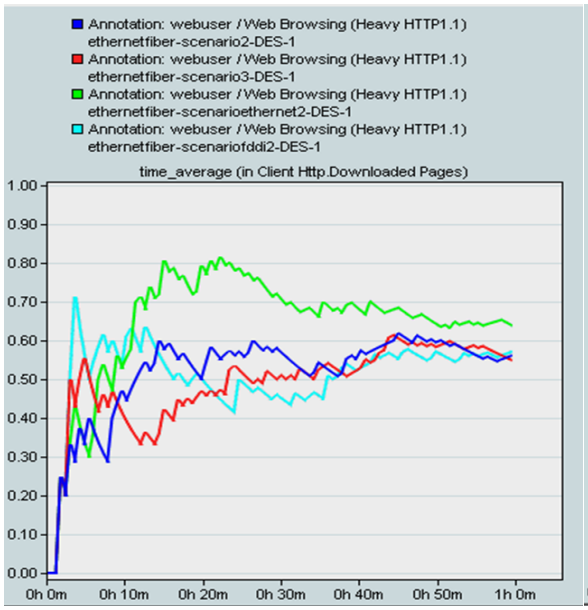

Fig. 14 Downloaded objects network model between Ethernet and FDDI for 10 & 20 nodes

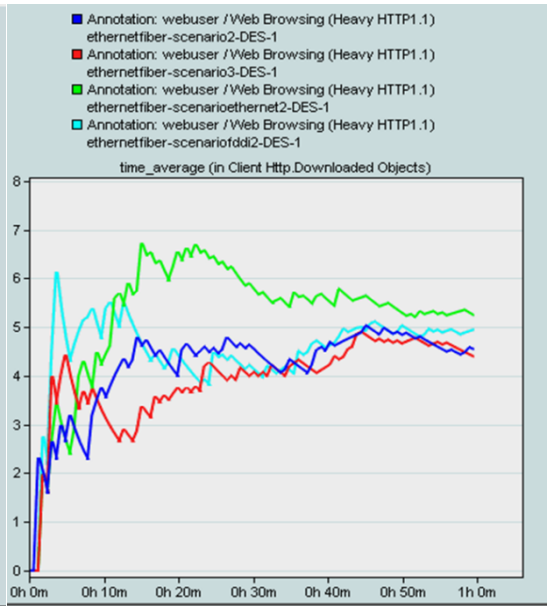

Fig. 15Downloaded pages network

Downloaded pages between FDDI and Ethernet for 10 nodes & 20 nodesafter simulating them for10 & 20 networks can be shown in fig. 15 which demonstrates the effect of downloaded pages and proves that, the downloaded pages for Ethernet network with 20 nodes is in max rate than that for 20 nodes for FDDI network and the same result for network with 10 nodes for Ethernet network and FDDI network respectively.

Conclusions

Different Network Scenariosconsideredin this researchobviouslyreliefsfor evaluating and investigatingthe behavior technologies for Ethernet as well as FDDI. Various parameters plusinfluences were applied and manyQoSobservations preparedwith metrics of throughput, load and delay. It can be clearly concluded that atechnology of Ethernet will be better if throughput maybe considered due totheir abilitiesfor filtering errorsin addition toavoid collisions. Nevertheless, FDDI can be consideredpreferable and appropriate at large network ifdelay settingfor considerations.On the other hand,the downloaded objects and pages for Ethernet network with10 & 20 nodes are greater than that for 10 &20 nodes for FDDI networks.Finally, the technology of FDDI be faster, the Ethernet parameter of throughput be higher with large networks.

References

[1]Ishu, G and K. Perminder. 2010. "Comparative throughput of Wi-Fi & Ethernet LANs using OPNET MODELER". *International Journal of Computer Applications*. 8(6):1-4. Available: http://www.maznets.com/tech/ethernet.htm.

[2] Chao, C. et al. 2001. "Backbone: FDDI, ATM or Gigabit Ethernet?" Available: http://www2.ensc.sfu.ca/~ljilja/ENSC833/Spring01/Projects/chen_liu_wang/backbone.pdf.

[3] Singh, A. 2011. "Throughput Analysis of Ethernet and FDDI using OPNET IT Guru Academic Edition 9.1". *Research Cell: An International Journal of Engineering Sciences*. 4(11):1-5. Available: http://ijoes.org/paper/SI2/46.pdf.

[4]Timothy, J. 2013. "The Fiber Distributed Data Interface (FDDI) - A new generation standard for Local Area Networks". Available: http://www.citeseerx.edu/.

[5] IkramUd Din, SaeedMahooz and Muhammad Adnan, "Performance evaluation of different EthernetLANs connected by Switches and Hubs," European Journal of Scientific Research, vol. 37, No 3, pp. 461-470, 2009.

[6] Singh, H. 2013. "Modelling, Evaluation and Analysis of Ring Topology for Computer Applications Using Simulation". *International Journal of Computer Science and Mobile Computing*. 2(1):1-3. Available: http://www.ijcsmc.com/docs/papers/january2013/V2I1201302.pdf.

[7]Pushparani, D. et al. 2005. "A New Analysis of System Utilization Performance for Ethernet Networking System. IEEE 802.11e EDGA". *IEEE Transactions on Comm*.

[8]Saad, M. 2006. "Performance Evaluation of Rapid Spanning Tree Protocol by Measurements and Simulation". Department of Telecommunications and Media Informatics, Budapest University of Technology and Economics.

[9] R.Kaparti, "OPNET IT Guru: A tool for networking education," REGIS University.

[10] Bhargava, N. et al. 2012. "Study of TCP Throughput on Network Simulator OPNET++ by using different Parameters". *Journal of Environmental Research and Development*. 7(2): 762-767.