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Enhancement In The efficiency Of Telecom System Parameters in Cloud Computing With SDN Controlled Environment

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ABSTRACT: The orignation of cloud computing has revolutionized the field of computing in term of shared network resources.It has provided new oppertunities for different enterprises to compete in the modern days era to provide the shared network resourses amont different end nodes (Host Networks) by using virtualization techniques.On the other hands the modern days cloud computing has completely over thrown the culture of private data centers by saving extra cost and infratracture hazards with better options for end nodes (Host Networks) to select target enterprises (network resource providers) depending upon their network resorce requirements and applications.On contarary of all above textuar represented above in the favour cloud computing have three important issues to be mentioned as (1) Security (2) data load managing in data centers virtually shared among the different end networks (3) Throughput and Efficiency.All above mentioned issues requires a centerlized controller as mentoned in this research article namely SDN(Software Defined Networking),with centerilized control and separate control plan and data plan which can enhance the system parameters (Bandwidth,throughput,end to end delay and etc).This research article inroduces a noval approch by indroducing DLBA(Dynamic load balancing algorithum) technique to enhance bandwidth by load balancing among different data residencial devices groupped in data cenetrs.The results showed that the efficiency of shared network resource cloud computing get boasted under the influenced of DLBA with SDN controlled environment.

KEY WORDS: SDN, Cloud Computing, End nodes, DLBA(Dynamic load balancing algorithm), Bandwidth.

I. INTRODUCTION:

With the disclosure of modern day research of cloud computing, the field of computing and networking are revolutionized. Now with expansion in computing model, the customers can easily select any cloud provider having resemblance to their application demands within minutes without developing their own data centres and facing upfront payments. In to provide elastic growth the cloud provider with network virtualization techniques have make available several servers, connected to tens of thousands of switches to handle application requests of different users[1].

The Cloud customers are given small size resource from the entire capacity of server, in this way a single server can handle multiple customers with the help of different virtualization techniques. These cloud customers are considered as VM (virtual Machines) [2].These VMs communicates to the others and the internet through the number of switches and routers in the data centres. DCN (Data centre networks) is developed to manage the traffic among different VM's. In the legacy networks each network switch has its own control logic and individually processes the requests coming from different VM's so this creates a severe problem in traffic handling in the data centres. There will be a greater probability that the data centre with this fragile and legacy approach could create larger end to end delay less efficiency and in balance among the servers grouped in the data centers.so this requires a more centralized and revolutionized approach to solve the in balance in the traffic in data centres and enhance the system quality parameters (Bandwidth, throughput, end to end delay and etc.).

The answer to all above facts is the SDN (software defined networking) which has three main layers (1) Application layer (2) control layer (3) Data Layer. SDN is one of the modern programming techniques that have separated the control layer from the data layer. Control layer is the brain of SDN which tells the switches routers (Data traveling devices) how to handle the requests from the users by modulation their routing tables. The Modulation of the routing table of data traveling devices by the control layer is actually done by the controllers (the pox, open day light etc.) of SDN through the guidance provided by the application layer, which is in the direct vicinity of network administrator. The application layer communicates with the control layer through north bond and the control layer communicates with the data layer through south bond. With Reference to case study mentioned in [3-4] SDN showed 53% more efficiency in term of bandwidth in presence of high congestion network with 256 servers as compare to Legacy Network.

This article is organised as followed: **Section (II)** includes literature review in terms of Cloud-Computing, Data Centre Networks (DCN) and SDN (Software Define Networking) architecture. **Section (III)** includes the methodology adopted to obtain the results in term of enhancement in the system parameters (bandwidth, throughputs, end to end delay and etc.). **Section (IV)** contains the results of system parameters. **Section (V)** concludes the research article.

II. LITERATURE REVIEW:

In this section we have discussed the relation among Cloud-Computing, DSN and SDN for obtaining better system quality parameters.

A-Cloud-Computing:

The cloud comp consists of three important services to be provided among the requested customers.(1) software based service (SBS) (2) Platform Based Services (PBS) (3) infrastructure Based Services (IBS).The SPS provides the complete liberty to the cloud customers in term of any program running on the cloud like email services ,scheduler services, social networking services etc.

The PBS allows the application developers to get help from the layer plat from of the cloud and develop the application according to their will, by using both features of PBS and SBS. The IBS provides the cloud customer's access to the virtual machine servers to handle their requests. In the light of all above three services that could create severe traffic in balance and results in degradation of network quality parameters. This requires more centralised approach to overlook all above mentioned services.

B-Data Centre Network (DCN):

The data centres consists of data residential devices that are connected with each another through network wired/wireless links to network switches (core, aggregate, edge). The servers in the data centre grouped in a rack and are connected to one or more edge switches. The Edge switches are connected to aggregate switches. The Aggregate switches are connected to multiple core switches. The DCN architecture is made up of three layer topology with servers and edge switches in layer 1 ,aggregate switch in layer 2 and core switches in layer 3.The different DCN architecture are shown in figure#1 (a,b,c,d). In article [5] the suggested flat tree topology (as shown in figure 1b) having similar hierarchy to Clos network [6] ensure high available network as compare to legacy hierarchy topology 2N-tree.

In flat tree topology there are multiple links available for the core switches to the aggregate switches as compare to 2N-tree arrangement. In research Article [7] the proposed technique involves less number of switches making network more efficient in terms of cost with edge switches acting as both lower tier and upper tier switches (as shown in figure 1c).

In research article [8] the author discussed the performance and technical issues in three tier topology and proved that hierarchical arrangement create more problem in term of load management (the proposed model is shown in figure 1d).

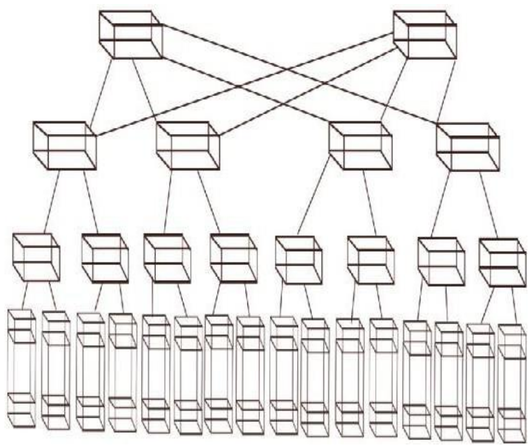


Figure 1(a): 2N-Tree Topology

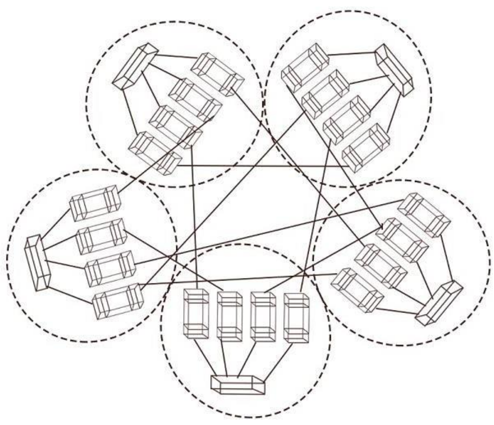


Figure 1(d): DCell

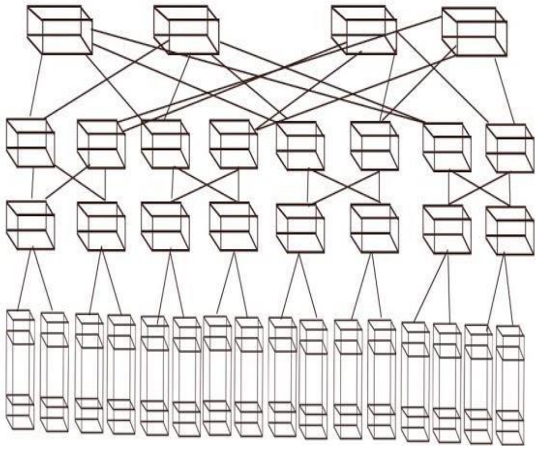


Figure 1(b): Fat Tree Topology

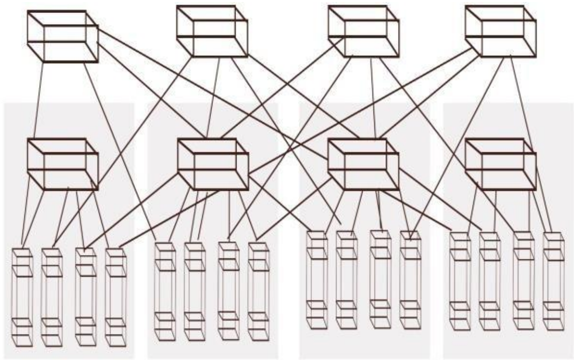


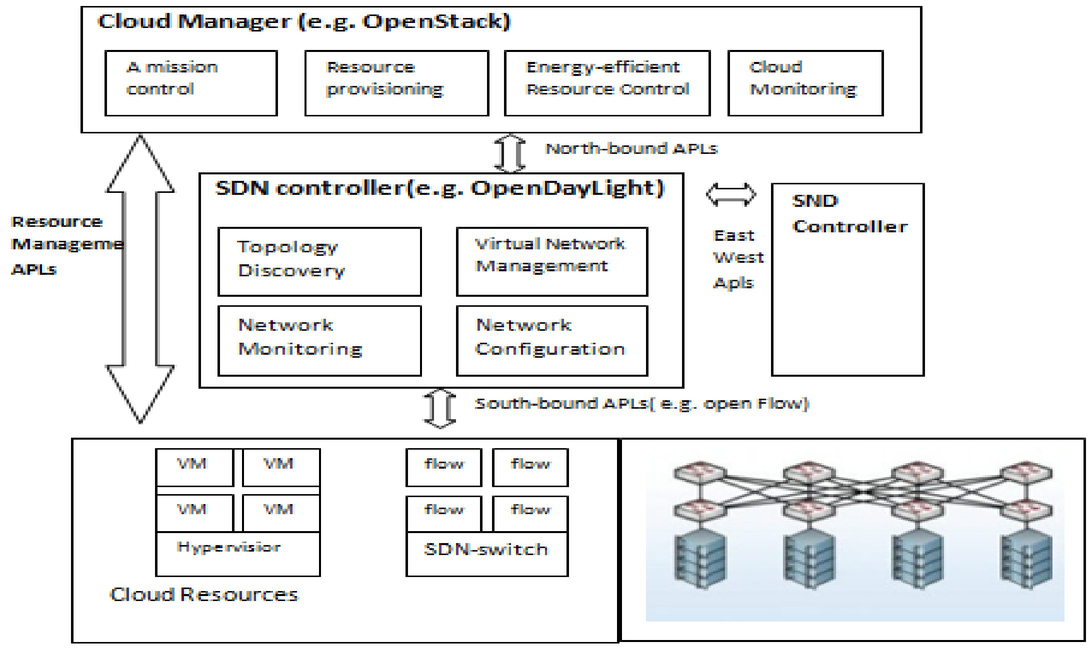
Figure 1(c): BCube

Figure#1: Topology commonly used for arrangement of severs and switches in data centres

C-SDN Cloud Architecture:

The abstract view of architecture of SDN controlled cloud-computing is shown in figure#2.The following architecture is also discussed in literature [9,10,11,12]. The SDN cloud architecture is divided in three main categories (1) Cloud Manager commonly called open stack to create the private cloud (2) SDN Controller (3) Cloud Resources. The cloud manager, manage the resources of entire cloud. The responsibilities of cloud manager includes provision of VM creation, allowing access to the cloud customers to access cloud services, energy efficient resource control and monitoring of cloud in the light of feedback given by the SDN controller. The open stack is [13] an open source software to build private cloud.

The SDN controller has two important tasks (1) by using south bounds it controls the flow of network switches underline the network. (2) By using North bound it give information to the open stack about the flows in each network switch and perform load balancing among different servers bounded in rank in data centres. Cloud resources consists of two important portions (1) VM based host (2) Network infrastructure.VM based host are the provisions granted by the cloud manager to access the cloud resources by running different virtualization software techniques. The network infrastructure uses the end users and the switches which are managed and handled by the SDN controller.

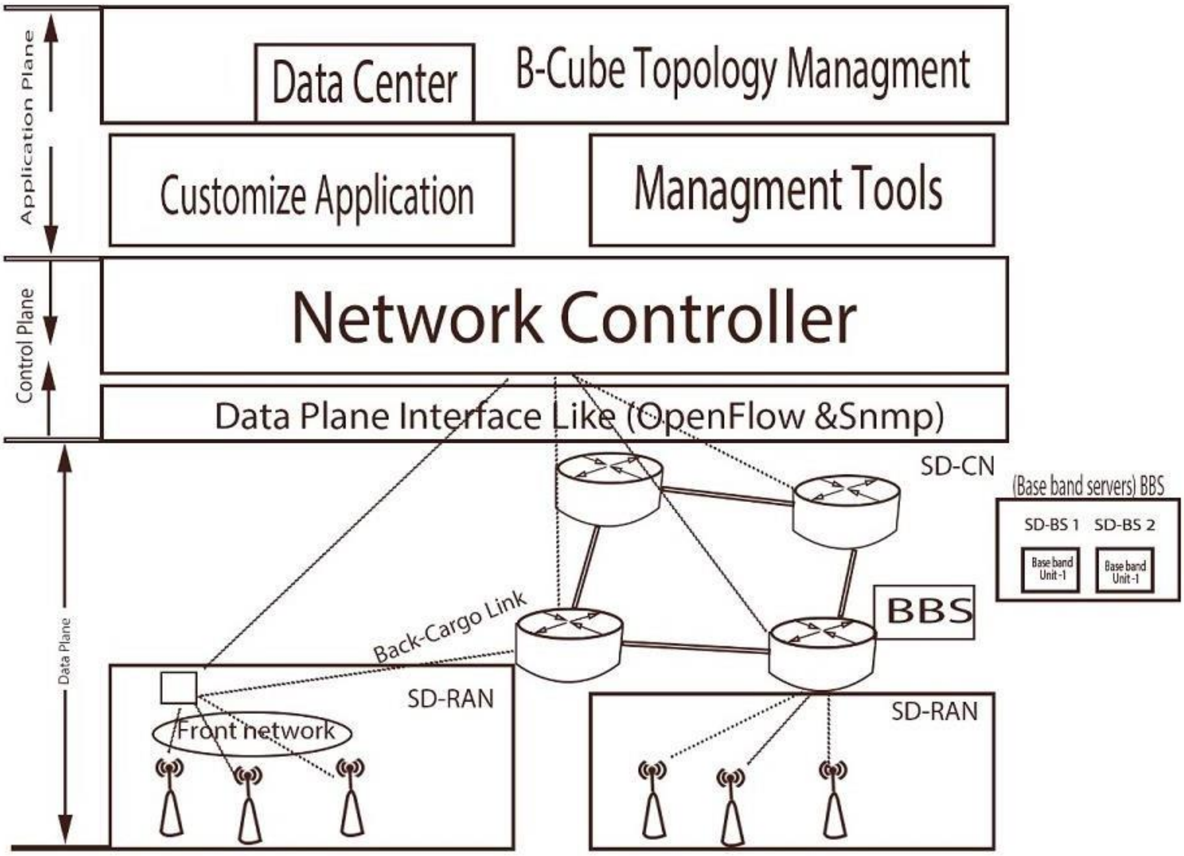


Figure#2: SDN Cloud Architecture

In article [14] the author presented the cloud computing architecture in SDN environment with multiple controllers to handle data traffic in data centres. In research article[15]the author proposed a scheme in which updated policies are sent to the controller with the help of SLA(service line agreement) .To manage the cloud according to the given policy and this result in the simplified user define simple cloud-controller model. In the research article [16] the author proposed a technique in which open stack was used to manage resources in distributed cloud data centres.

III. METHODOLOGY & EXPERIMENT SETUP:

The proposed framework is shown in figure #3.The framework consist of three planes namely (1) application plane (2) control plan (3) data plan.
The data plan consists of complete network infrastructure in which it consists of two stacks of SD-RAN (Software Defined Radio Access network), each SD-RAN contains N end users and BSS (Base Band servers). There is one SD-CN (Software Defined Core Network) which consists of network switches to route the data/request from different SD-RAN users under the flow guidance provided by the controller of SDN. The SDN controller used in this simulation performed on Mini-Net is POX. The POX controller is responsible for transferring the instruction from application layer to network layer through south bound. The application layer in the proposed model is sub divided into two portions. In portion (a) it consists of basic applications that include the tasks to be handled by the controller and SLA provided by the user to manage the network at will with the help of SDN controller. In the portion (b) includes the task of load managing/resource management of data centres by load balancing among different servers providing access to the VM as mentioned in figure#2.



Figure#3: Block diagram of proposed model of SDN based Cloud-Computing

In this research article, the proposed model consists of three HTTP servers which are sharing resources of cloud computing among N clients arranged in SD-RAN stacks. The I-Perf and J-Perf along with Apache-Bench utilities are used to find the network parameters (Bandwidth, Throughput, End to End delay and etc.) with and without SDN controller and results are shown in section IV.

IV. RESULTS AND DISCUSSIONS:

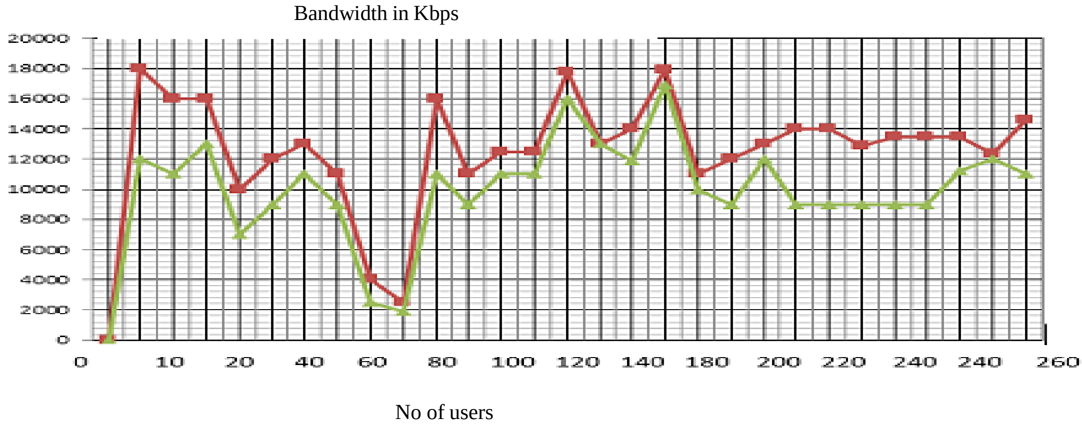


Figure IV: Comparison of available bandwidth of server 1 with Legacy approach and SDN controlled environment

In the above simulation diagram the red curve shows the behaviour of server 1 with SDN controlled environment under DLBA (Dynamic Load balance algorithm), While the green curve shows the behaviour of the server with legacy approach. In above figure it is clear as number of user increase (HTTP request) the available bandwidth reduces but with load sharing algorithm few HTTP request are forwarded to other servers to balance the load and available bandwidth is greater and available of server resource is also increased.

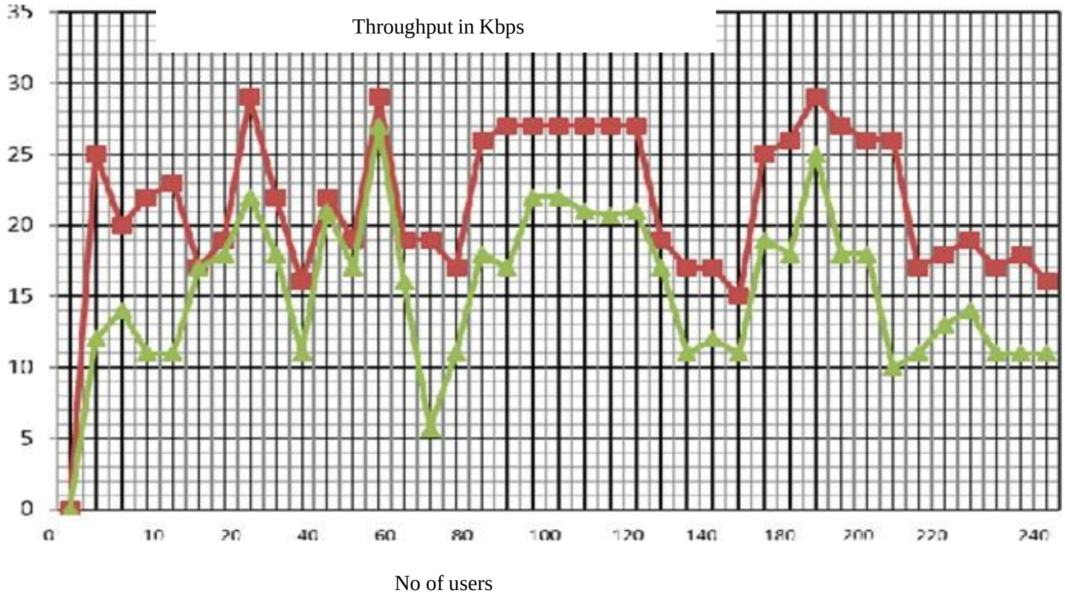


Figure V: Comparison of Throughput of server 1 with Legacy approach and SDN controlled environment

In the above simulation diagram the red curve shows the behaviour of server 1 with SDN controlled environment under DLBA (Dynamic Load balance algorithm), While the green curve shows the behaviour of the server with legacy approach. In above figure it is clear as number of user increase (HTTP request) the available bandwidth reduces and ability to handle request decrease so the throughput decreases but with load sharing algorithm few HTTP request are forwarded to other servers to balance the load and available bandwidth is greater and available of server resource is also increased, thereby increasing the ability of server to process mor ed.

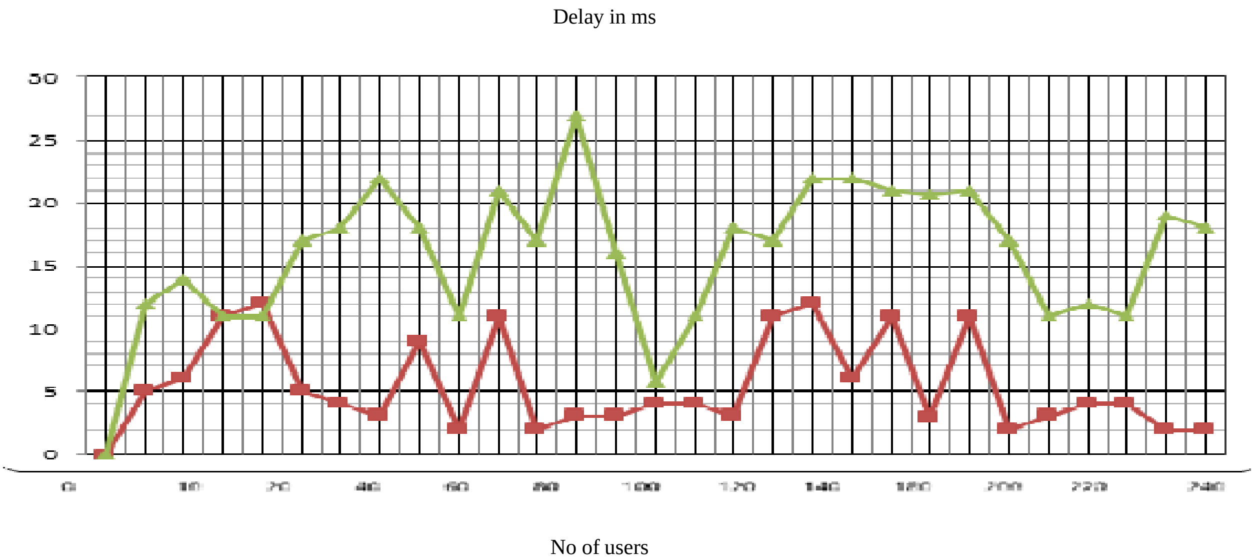


Figure VI Comparison of End-to-End Delay of server 1 with Legacy approach and SDN controlled environment

In the above simulation diagram the red curve shows the behaviour of server 1 with SDN controlled environment under DLBA (Dynamic Load balance algorithm), While the green curve shows the behaviour of the server with legacy approach. In above figure it is clear as number of user increase (HTTP request) the available bandwidth reduces and ability to handle request decrease so the throughput decreases and the queuing of request packets start increasing resulting in delay and packet loss. But with load sharing algorithm few HTTP request are forwarded to other servers to balance the load and available bandwidth is greater and available of server resource is also increased, thereby increasing the ability of server to process more request and throughput is increased and delay is also reduced.

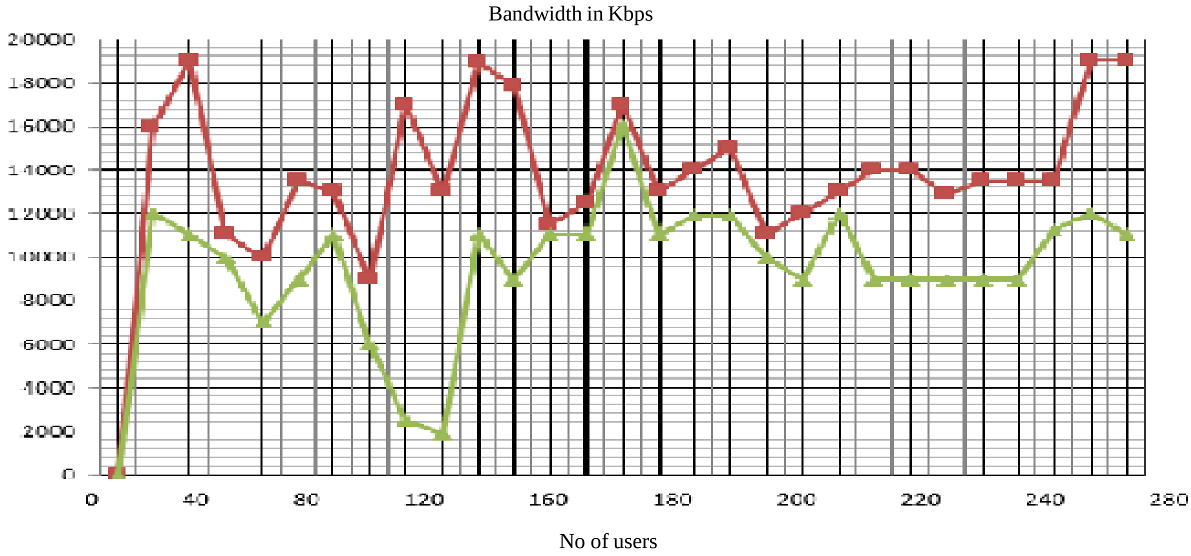


Figure VII: Comparison of available bandwidth of server 2 with Legacy approach and SDN controlled environment

In the above simulation diagram the red curve shows the behaviour of server 2 with SDN controlled environment under DLBA (Dynamic Load balance algorithm), While the green curve shows the behaviour of the server with legacy approach. In above figure it is clear as number of Load on the server 2 was initially less as more HTTP requests were present at the server 1 so that created traffic imbalance while with DLBA technique the load of server 1 is shared between server 2 and server 3 and though over all bandwidth of server 2 decreases but at the end the whole network is more proficient.

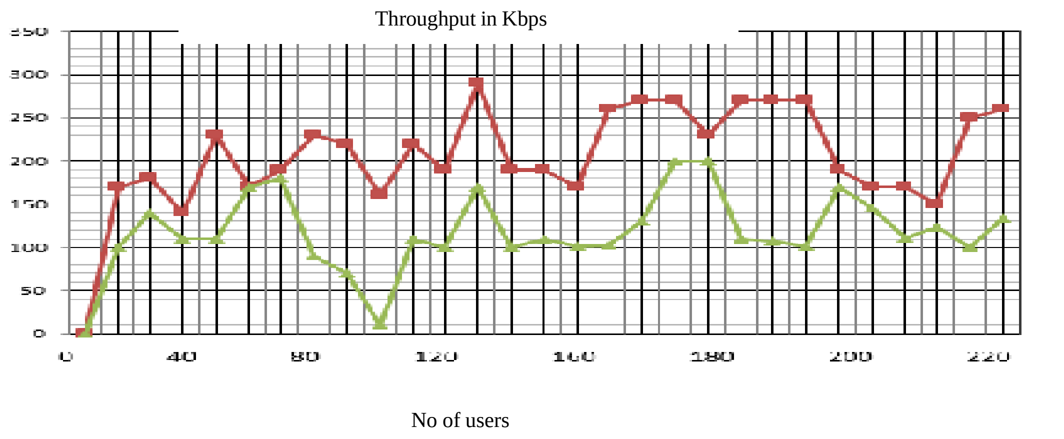


Figure VIII: Comparison of Throughput of server 2 with Legacy approach and SDN controlled environment

In the above simulation diagram the red curve shows the behaviour of server 2 with SDN controlled environment under DLBA (Dynamic Load balance algorithm), While the green curve shows the behaviour of the server with legacy approach. In above figure it is clear as number of Load on the server 2 was initially less as more HTTP requests were present at the server 1 so that created traffic imbalance while with DLBA technique the load of server 1 is shared between server 2 and server 3, So now more user request are handled by srever2 so the throughput increases.

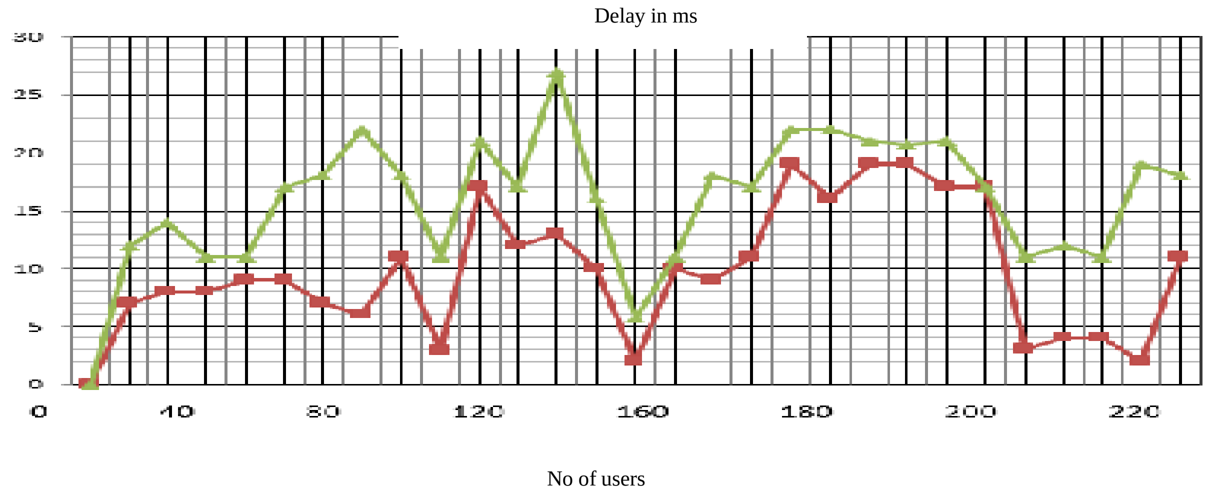


Figure IX Comparison of End-to-End Delay of server 2 with Legacy approach and SDN controlled environment

In the above simulation diagram the red curve shows the behaviour of server 2 with SDN controlled environment under DLBA (Dynamic Load balance algorithm), While the green curve shows the behaviour of the server with legacy approach. In above figure it is clear as number of Load on the server 2 was initially less as more HTTP requests were present at the server 1 so that created traffic imbalance while with DLBA technique the load of server 1 is shared between server 2 and server 3, So now more user request are handled by srever2 so the throughput increases and end to end delay as compared to the legacy network is less.

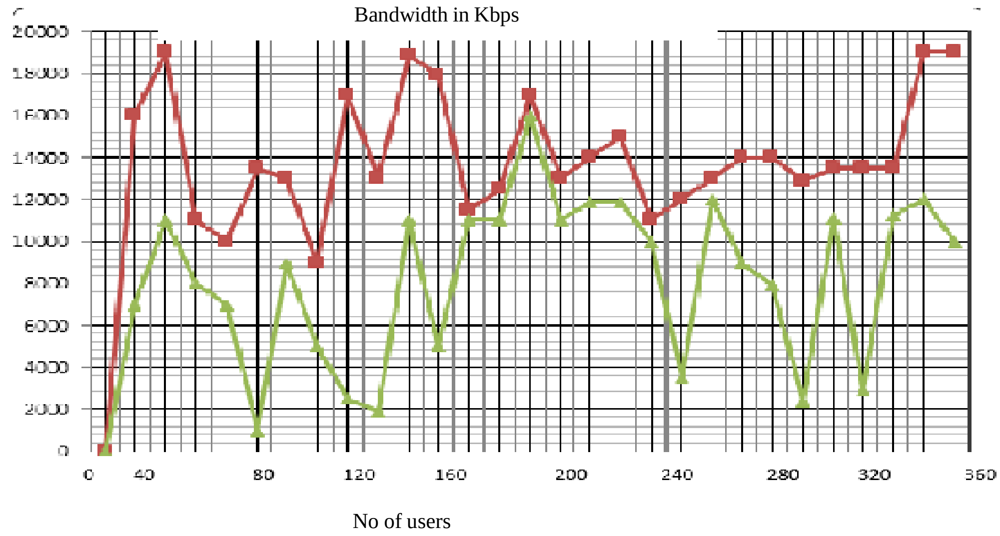
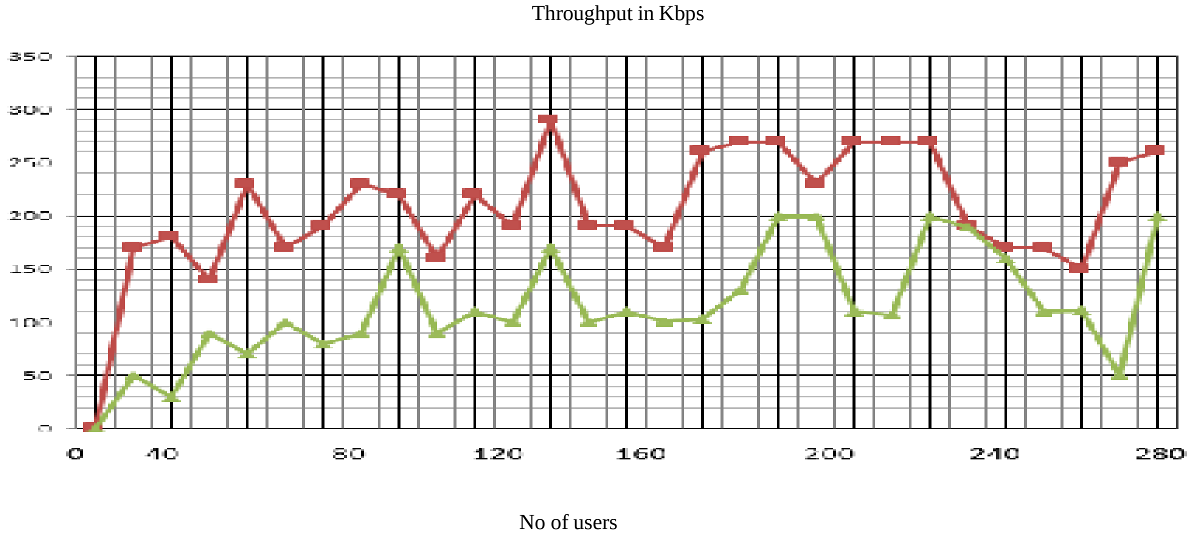


Figure X: Comparison of available bandwidth of server 3 with Legacy approach and SDN controlled environment

In the above simulation diagram the red curve shows the behaviour of server 3 with SDN controlled environment under DLBA (Dynamic Load balance algorithm), While the green curve shows the behaviour of the server with legacy approach. In above figure it is clear the bandwidth availability in the SDN control environment with DBLA is more as compared to legacy network.



In the above simulation diagram the red curve shows the behaviour of server 3 with SDN controlled

Figure XI: Comparison of Throughput of server 3 with Legacy approach and SDN controlled environment

V. CONCLUSION:

In this research article we have shown that efficiency of systems parameters increases with SDN controlled environment as compared to the legacy network. The Cloud-Computing with shared network resources along with SDN control environment can be very helpful in virtualization of large network. The deployment of DLBA techniques not only increases the bandwidth but throughput is also increased with less latency and end to end delay.

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