Performance Evaluation of Virtual and Physical Router in Optical Networks

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Abstract—In this Paper a Linux based Pc is converted to a virtual router and is compared with the physical router with respect to their Performance parameters.Here we use four Linux operating hosts where the operating system is Ubuntu. First system and fourth system is considered as server and client hosts respectively. The second and the third are converted to routers. A process called "Router virtualization" is carried out here, i.e., converting a Pc to a router is called "virtualization" and the host is called "virtual router". Similarly we then configure a "Physical router"(cisco router) and send the multimedia data from source to destination. After getting the results, we compare the throughput of both the routers and evaluate the performance of both with respect to delay, packet loss and low bit rate. Also time is calculated for the packets to reach at the client side from server for both the routers. The physical media used here is the optical fiber cable.

Now a days long distance broadcasting of data are more prone to errors and there exists many data packet losses in network management. The main aim of the project includes improving the lifetime of network, Qos, provide increase in bandwidth, and avoid packet loss.

IndexTerms—Network Virtualization, virtual router, physical router,Performance Measurement.

Fig1: Virtual router.

I.INTRODUCTION

In today's network management, there is a great demand for communication. Future networks should produce a great reliability,good Qos(quality of service) and applications, and should give good access over network to the user. Routers have more demand in today's common network. It is used in small offices, large IT industries,and routers are used toconnect to an Internet service provider where more number of routers serve to manage data communication from a remote network.Routers are network devices that literally decides how to send data to a network area.By checkingthe arrival data, the router can provide the destination address for the data. The way to meet these requirements is to virtualize routers. Virtualization is a process where a Linux based pc is converted to a router by issuing necessary commands in the terminal prompt of the operating system, which is called a virtual router. There exists two types of router, 1)virtual router 2)physical router. Physical router is a cisco router, i.e. a hardware device related to networking.
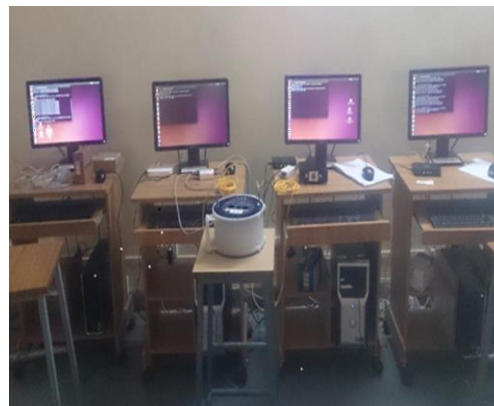
II. SCOPE AND MOTIVATION

Today in computer networks mutual information of data takes Place rapidly.Transfer of data can be through different physical media types such as Ethernet Lan cables whose data transfer rate is 10Mbps to 100Mbps. Such type of network is referred to as LAN(Local area networks). But one thing to notice is more amount of data loss occurs at the receiving end. also the routers what we use in big industries, companies, and many Engineering institute are Physical routers which is too cost expensive . But everywhere it is not possible to use the physical routers. So inorder to overcome all above stated problems, we go for a physical media such as a optical fiber cable which is more efficient than a Lan cable.Also we convert a host system to router so as to achieve the necessary requirements.The motivation of the project is to show that virtual routers can also compete with physical router and show thatvirtualrouters can also compete with physical router and show the same functionality as latter.

III. LINUX(OPERATING SYSTEM) VIRTUAL ROUTER

A virtual router is a router where a Linux operating pc is converted to a virtual router by issuing a command in the terminal prompt of the operating system. A router routes data accordingly in the form of packets thereby facilitating the communication.Here multiple routers serve this part to user.

Apart from this a virtual router also functions like a physical router, i.e it also has a routing table, routing protocols, packet filtering rules, management interfaces. There may be several virtual routers that work on the same network topology that shares the required resources.
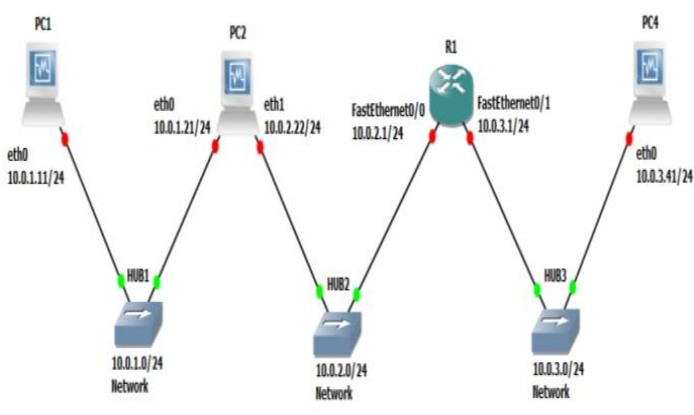

Fig 2: network topology

Fig 2.1 depicts Network topology of 4 Linux based pcs and a physical router. The above description shows fig 2.1 where 4 pcs are connected between 3 hubs or switches and a physical router. Here the information data is first sent through the server(pc1) system to client(pc4) system via the router(r1).The multimedia data (text,mp3 or mp4) is sent from server system to client system via the routers. before that it is streamed in VLC media player and data packets are analyzed in the wire shark packet analyzer and respective I/O graphs and wire shark packet summary are noted and throughput is calculated.
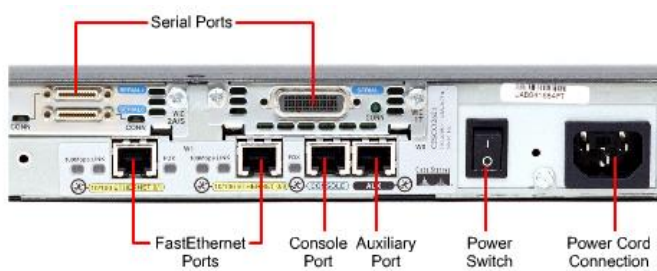
IV.PHYSICAL ROUTER

Fig3:Physical router

The fig3.1shows a physical(cisco router). A physical router is a cisco hardware device that route literally data around the network. Here the cisco device model type is cisco1905 Serial Integrated Services Router (ISR)*.It delivers highly secure data, mobility, and application services.The primary features of this device includes:
A physical routerhas 2 integrated 10/100/1000 Ethernet ports. It is a 1 Integrated Serial WAN interface module. It is a multifunction device and easily interfaced to switch, hub or Pc.It has a Integrated threat control inbuilt, and Cisco IOS Content Filtering.Identity management with authentication, It is well authorization resources and public key infrastructure. It has fully integrated power distribution to modules whichsupports 802.3af Power to Ethernet.It provides Security to network management.

V.PHYSICAL HARDWARE ROUTER VERSUS VIRTUAL ROUTERS

A router may be either a Physical device or a pc system that may be connected between at least two networks. All common Linux operating systems provide the ability toact as routers as the part of their functionality. Physicalrouters provide greater performance levels than virtual-routers, but they have a major disadvantage that their manufacturing and design cost is high. However, they are more flexible in the network.

The physical routers advantages are listed below:

Physical routers are typically faster than virtual routersGenerally physical routers are found to be more reliable than virtual-routersIt is more flexible in efficiency than virtual based routingsolutions

The disadvantages of physical routers are as below:

They are more expensive than virtual routers.Usually physical routers are integrated with additional or a required software .It often requires a user to acquire sometechnical skills and it also acknowledges to managethem.Also a very limited number of users can get access to it.

A routes feature enhances its different type of functions. A basic router function is to then forward data between two same network types. Arouter that is more advanced can act asa gateway between two networks, for ex between a system and a switch for authentication purposes.

VI. PERFORMANCE EVALUATION RESULTS

The data packets are captured by a data packet analyzer called wire shark.Wireshark is called as a GUI network protocol analyzer. It lets user to interactively browse the data packet from a real time network or from a previously saved capture file. Wireshark's capture file format is the format used by transmission control protocol dumpand various other tools.

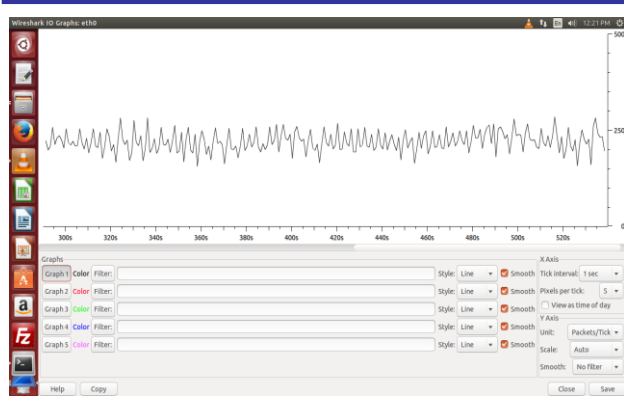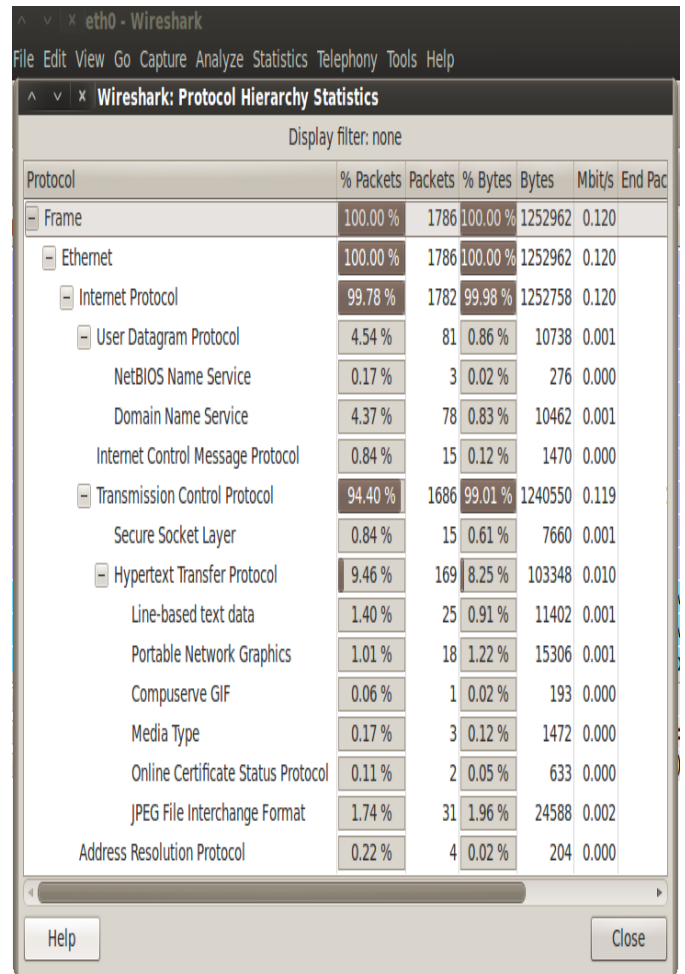Fig 4: wireshark I/O graphs of audio file

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Fig 5: wireshark I/O graphs of video file

Table 1
COMPARISION TABLE OF VIRTUAL AND PHYSICAL ROUTER
VIRTUAL ROUTER

MULTIMEDIA FILES	TIME TAKEN		AVERAGE PACKETS/SEC	
	Audio	Video	Audio	Video
Fiber optic cable(1km)	260	520	52166	1401204
Ethernet cable	3603080 sec		57411682	

PHYSICAL ROUTER

MULTIMEDIA FILES	TIME TAKEN		AVERAGE PACKETS/SEC	
	Audio	Video	Audio	Video
Ethernet cable	2800490		10.8832.73	

Fig:6 Wire shark Protocol Hierarchy statistics

The Parameters such as **Throughput, bandwidth, packet loss**, **RTT(Round trip time graph)**are calculated for both routers as below as follows:

- **Throughput** is calculated as follows and its denoted by Kbps (Kilobits per seconds).

Throughput=d/t in Kbps.

Where the d= Size of the file transmitted(mb).
t= Time in sec.
By collecting data from graph, it can be computed as given below as follows
For ex: Throughput=20mb/260sec
=76923Kbps

- **Bandwidth** can be calculated as follows:

The method of finding bandwidth is by selecting the menu items in Wire shark: **Statistics > Protocol Hierarchy.**

This screen will give us a breakdown of bandwidth by protocol. We observe the Mbits/sec column, which is found to be **0.119** in this case, The same is shown below in screenshot Of Wire shark **> Protocol Hierarchy**window and hence the Bandwidth is found to be 0.119 M bits/sec in this case of Example.

- **Packet Loss Calculation:**

The Packet Loss can be computed as shown below as follows:

Packet Loss = "(displayed packets/ packets)" * 100%

This is done by reading "displayed" and "packets" from the status bar. This is the way we get a percentage of lost packets for the whole trace.

For Ex: if displayed packets is 52166 and total number of packets is 52200, then Packet loss is found to be:

Packet Loss = (52166/52200)*100
=0.9993*100
=whole Packet trace% - 99% = 100%-99%=1%

Therefore Packet loss is found to be 1% in this case.

- **RTT(Round trip time graph) calculation:**

This parameter can be computed for both routers as follows: In Wireshark menu select Statistics -> TCP Stream Graph -> Round Trip Time Graph.

An interesting graph is the *round-trip-time* graph that shows the evolution of the round-trip-time in function of time. This graph can be used to check whether the round-trip-time remains stable or not. We can Observe that from a packet

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trace, wire shark can plot two *round-trip-time* graphs, Onewill be for the flow from the client to the server and the other one for which wireshark will plot the *round-trip-time* graph that corresponds to the selected packet in the top wire shark window.
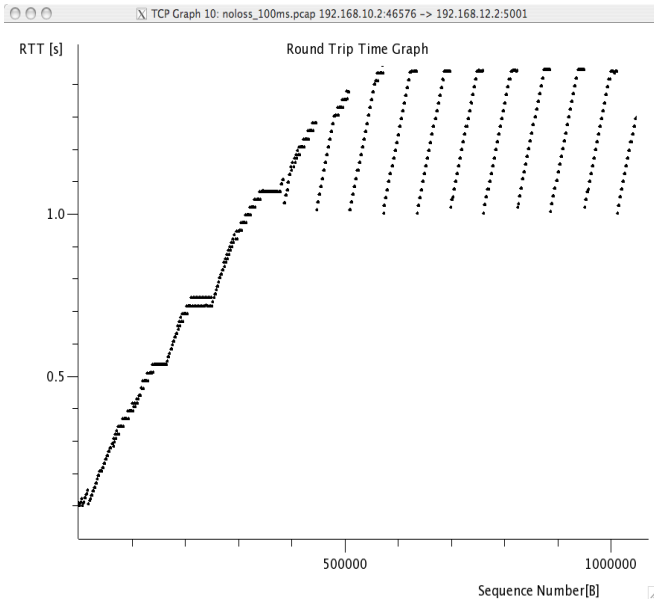

Fig 7:RTT(Round Time graph) screen shot

VII. CONCLUSION

With the continuous growth of the Internet user requires flexible network managementin new areas, functions and applications. A network for user should provide flexible output, and should provide a good quality of services and developments, and should be easy to manage andmaintain.One method to achieve this is to convert a physical system to a router which is called as a virtual router. Router virtualization converting multiple or more Pc's to virtual router depending on user requirements and the network design, in a way that allows each instance for the user to appear as a separate router device.

VIII. FUTURE SCOPE

In this proposed work is described by comparing both virtual and physical router in optical networks. Throughputs can also be computed by using different topologies.Also efficiency is calculated with respect to both physical medias such as Ethernet cable and optical fiber cable. Also the network management may be implemented wirelessly in future.

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