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Study and Analysis of Software Defined Networking (SDN) using Open Source Tools and Techniques

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ABSTRACT

In the widespread of digital society the traditional IP networks are believed to be complex and hard to manage. It is also bit tough to use the policies in configuring the networks that is to reconfigure the faults, changes and all. This type will be really consuming too much of time and thereby it requires more spending in case of generating virtual machines, migration and network configuration. To overcome these challenges, flexible, agile, efficient and scalable software defined networks is needed. Software defined Networking (SDN) is the emerging networking archetype that will be useful for current communication networks. This research paper speaks on the basic performance of Mininet which is the first system that will provide the easy and quick way to evaluate and prototype the SDN protocols.

Keywords: IP network, Software Defined Networking, Mininet, Abstraction, Configuration, Design.

1. INTRODUCTION

In the present state, the routers and switches are the main part of technology that makes the sharing of information through digital packets all around the world by the distributed control and transport network. One can use low-level and often vendor-specific commands to execute the high-level network policies and network operators which will configure each network device. There are three planes of functionality in the computer networks: The data, Control and the management planes (Fig.1.)

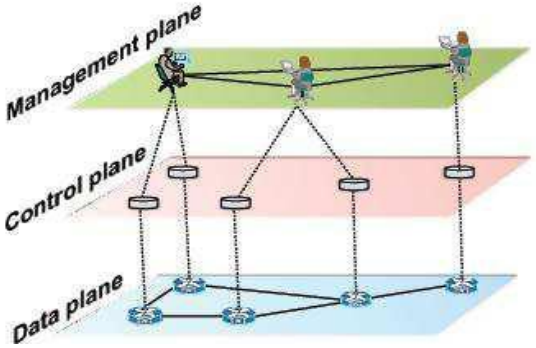

Fig.1 Layered view of networking functionality

Efficient forwarding of data is done by the networking devices connected with data plane. The forwarding tables are populated by the control plane which represents all the protocols of the data plane elements. Software devices like SNMP-based tools which are used to remotely supervise and build up the control functionality.

2. PROBLEM STATEMENT

The improvement of technology will be more in the upcoming days. Virtualization in computing is the major innovation in it industries and the importance of storage has also improved. In the existing system, the control and the data planes are closely coupled and that are embedded in the same networking devices. It can be seen in Fig.2

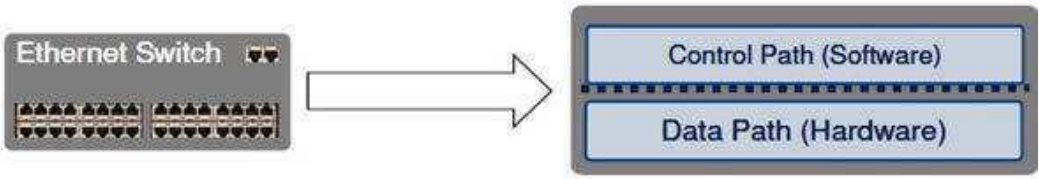

Fig 2 Traditional Networks

In the traditional type of configuration, many steps are needed by an IT administrator just to add or remove a device. This type of configuration is also time-consuming and error-prone. So, the organizations have to encounter security break, non-compliance with allegation.

2.1 STATUS QUO IN NETWORKING

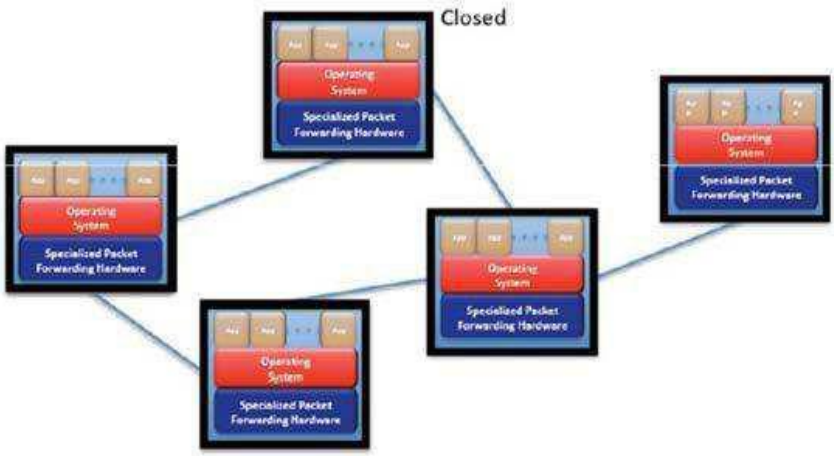

Fig.3 Closed Boxes and fully distributed protocols

Average types of organization possess different variety of equipments from different vendors. (Fig.3.) So, to configure all these device types a wide spread knowledge is needed. This traditional architecture even complicates the network segmentation where all the devices from different vendors will incorporate within their network in a safe, systematic and structured method. There is no evident reason for giving them access to all network components. Rather the 'administrative hassle' makes network segmentation a multifaceted process and rapidly leads to network clutter. To conclude, new perspectives on the management of network have to be introduced to overcome the traditional networking limitations.

2.2 AIM OF THE RESEARCH

The aim of the research is to facilitate the innovation in network, to have fast upgrades, to use standard open interface in layered architecture, to make the programmability more flexible, to use other software applications for the ease of customization and integration, to show about programming and configuring a network, to have more

accessibility for the software by which it can easily developed by more vendors, to have independent innovation in each layer and finally to research using non-bulky and non-expensive equipment.

3. PROPOSED SYSTEM

Software-Defined Networking (SDN) has newly reignited the interest of network researchers for programmable networks. This also opens the attention of the networking community through the innovative and simplified process of managing and designing networks to establish the current way if approach. High level of complexity is involved in the managing and designing of computer networks which becomes a daunting task. This will help to know how the programming languages can be used to reprogram computers which will perform numerous tasks without any continuous modification in the hardware platform.

SDN is a fairly new model of a programmable network that changes the way that networks are managed and designed by implementing a concept that decouples the control from the data plane (Fig.4.). A software guide application is related as the controller that has an overview of the whole network which is also accountable for the final decision. The hardware (routers, switches etc.) is merely responsible for forwarding packets into their destination like a set of packet-handling rules under proper controller's instructions.

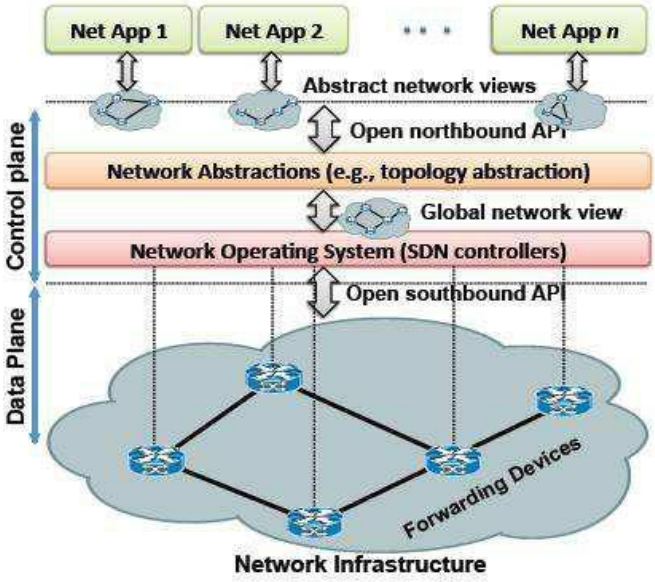

Fig.4 SDN Architecture and its fundamental abstractions.

The important tool of research in computer science and Information technology is Abstractions. There are three types of abstractions: Forwarding abstraction, distribution abstraction and specification. The abstraction which allows the network program, to forward any behaviour with the hiding details of any underlying hardware is forwarding abstraction. The distribution abstraction makes the distributed control problem into one by shielding SDN application from various distributed state. Finally, the specification should allow a network application to articulate the preferred network without being accountable for implementing that behaviour.

4. RESULTS AND DISCUSSION

4.1 Single Topology

A single topology having 16 numbers of hosts is designed in Mininet using CLI command as

"$ sudo mn --topo = single,16"

On an execution of above command for OpenFlow-enabled single topology in command prompt, a Mininet console will create a single OpenFlow-enabled network topology having 16 hosts connected with a single OpenFlow-enabled switch (Fig.5).

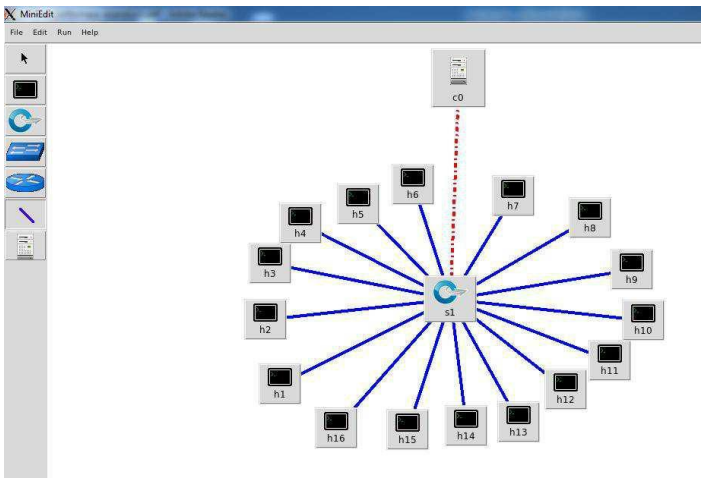

Fig.5 Shows OpenFlow-based Single Topology having 16 hosts.

4.2 Linear Topology

A linear topology having 16 hosts is designed in Mininet using CLI command as:

"$ sudo mn --topo = linear,16"

On an execution of above command for linear topology in command prompt, a Mininet console will create an OpenFlow-enabled linear topology with 16 hosts (Fig.6).

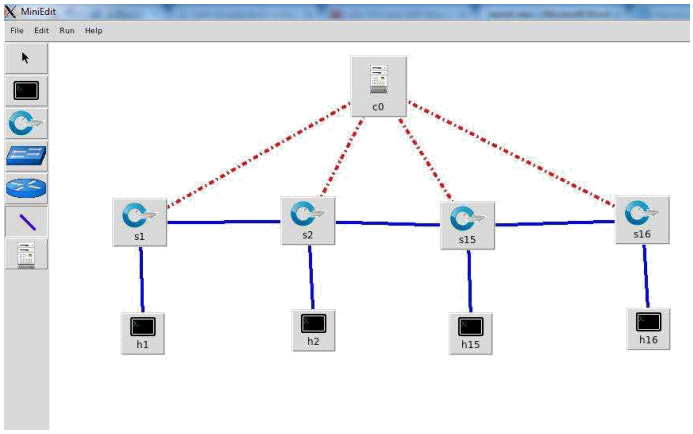

Fig. 6 Shows OpenFlow-based Linear Topology having 16 hosts.

4.3 Tree Topology

A tree topology having 16 hosts is designed in command prompt CLI using following command:

"$ sudo mn--topo = tree, depth=2, fanout=4"

In the above given CLI command to create tree topology, a command syntax define depth and fanout. Here, depth indicates the number of levels of switches and fanout indicates the number of output ports available to connect switches or hosts (Fig.7).

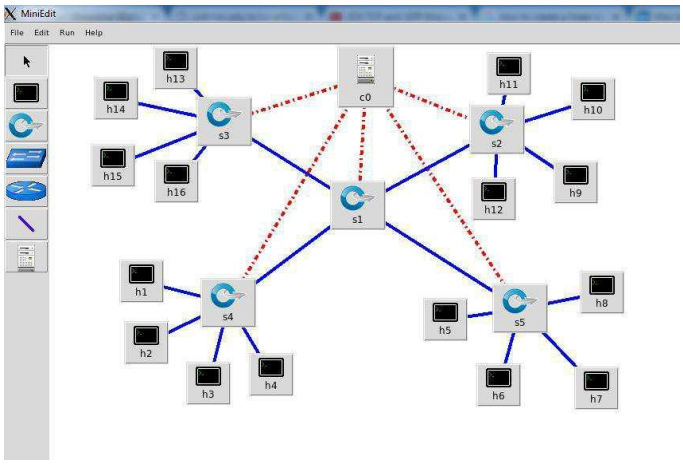

Fig. 7 Shows OpenFlow-based Tree Topology having 16 hosts.

5. BASIC PERFORMANCE EVALUATION ON MININET

Performance analysis for the three topologies as discussed above is done for a topological designed network of 16 hosts. Bandwidth utilization for all three Open Flow topologies is tabulated below,

Network Topologies	Single	Linear	Tree
Number of OpenFlow Controllers	1	1	1
Number of Open flow enabled switches	1	16	5
Number of Hosts	16	16	16
Maximum TCP Bandwidth (Gbps)	13.8	11.2	13.7

Table 1 Bandwidth Utilization for basic Open Flow topologies

6. CONCLUSION

Compare this new paradigm with traditional networks and discussing how academy and industry helped shape software-defined networking. Following a bottom-up approach, Provided an in-depth overview of eight fundamental facets of the SDN problem. Various Simulation and emulation tools were analysed and identified the suitable tool (Mininet) for Software Defined Networking (SDN). Basic simple topology created for the single similar network and it is simulated using mininet graphical user interface. Basic UDP and TCP transmission performance throughput evaluation is plotted. Connection between the hosts also verified. SDN has successfully managed to give the way towards a future generation networking, seeding an innovative research and development environment, supporting advances in several areas: evolution of scalability switch and controller platform design, promotion of security and dependability and performance of devices and architectures.

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