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A Study on Application and Tools in Software Defined Network

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Abstract: *Software defined network (SDN) has the power to facilitate current network improvement and make the network as a programmable, pluggable component infrastructure. Most of the papers represent implementation part of SDN projects is biggest challenges for the researches. Even many researchers are developing SDN based application. The main few challenges for developing SDN based applications are scalability, accuracy and efficiency. This paper outlines the key highlights of SDN, challenges and factors which affects SDN platforms. Then discuss various applications of SDN where traditional network not supported for its entire task and explained different simulation tools that helps to implement SDN projects.*

Keywords: *SDN; Tools; SDN application.*

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I. INTRODUCTION

Software-defined networking is networking technology which separates the software (control logic) from the hardware (forwarding device) of network component rather than the traditional networking concept. In SDN, the controller in logical layer controls the entire architecture, which can be replaced by a centralized virtualized controller that configures all network components. SDN provides a better efficiency and flexibility to industry so it can adapt particular networking application at any time.

SDN is a new concept to design, build and operate how current networks work. SDN is mainly software-based architecture which helps the network administrator and cloud providers to easily manage their networking equipment. The Open Networking Foundation helps the future network architecture SDN to dynamically manage and adapt the present complex application and as well as provides cost effective.

The key highlights of SDN are [10]

- SDN is almost growing in almost all recent trends like cloud center, IoT, Big data, etc and design, manage or use in all these areas.
- SDN is a disruption to current networking concept. SDN is a hybrid approach which is used with existing networking assets to give more benefits to organizations.
- In beginning stage, end users suffer to adopt SDN approach. But SDN implement hybrid approach which holds trails that gives the best way to approach the SDN opportunity.

The following figure 1 (a) and (b) shows the traditional router versus SDN router [1] .

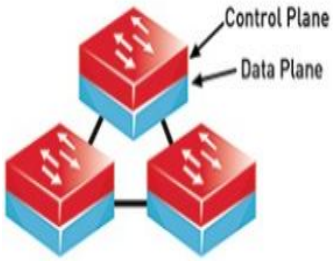

Figure 1 : (a) Traditional router

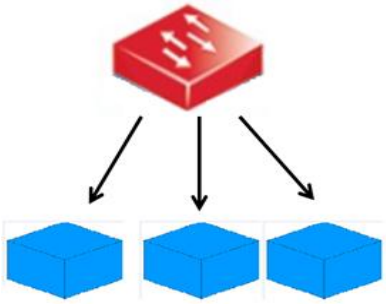

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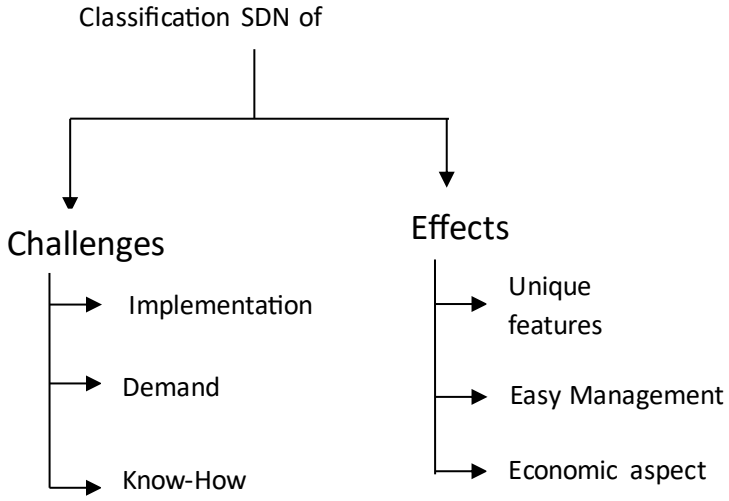
Figure 1 : (b) SDN Router

II. CLASSIFICATION OF SDN LITERATURE

Many review of literatures identified that need of SDN is concerned with big challenges and effects.



The main challenging factors of SDN are implementing SDN over traditional network, end-users demand to solve security issues and how to manage the untrained existing staff [3].Further the above category shows the effects is unique feature of SDN, where attribute like decouple logic part of software from hardware, the centralized view of the entire network. Next, SDN provides easy maintenance and deployment of the network when compared to traditional network. Economic aspect is the last and important effects, such as how efficiently cost can be utilized or reduced.

III. SDN-ENABLED CLOUD COMPUTING

SDN based Cloud provider [5] deploy their data centres for different purposes, and researchers consider various objectives such as Energy Efficiency, Performance, Virtualization and Security.

The most common objective of SDN based cloud service is energy efficiency. Here, the energy represents electricity, which can be used large amount universally. Researchers have to consider some energy saving approaches. Mainly the more energy consumed in data centre depends on networking devices, server's utilization level and cooling system.

Performance is also another important objective in SDN enabled cloud computing. The main cause of performance issue is due to congestion in network; as SDN has centralized control to monitor the entire network, it can be improved by altering the flow path and offering a delicate control across the entire SDN network. Performance of the network includes throughput, latency, resource availability and Quality of Service. To maximize the cloud provider benefits, host Virtual machines with scarce resources in a data centre.

Virtualization: SDN enabled cloud computing can improve the utilization of network resources efficiently by using virtualization technologies [2]. Network hypervisor is used to virtualize the SDN networks; as it helps to split the available resources such as switches, bandwidth, etc to multi-tenant of data centre.

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The main important objective of computer network is security. The two keys usage of SDN enabled cloud computing are: (1) providing security to networks where SDN is used and (2) protecting main components of SDN from threats or attack.

IV. SDN BASED APPLICATION MODELS

The SDN based cloud environment provides solution for the many new domains such as big data, cloud services, IoT, consumerization of ICT and data centres with different traffic patterns [4].

There are some specific applications models are getting benefit from SDN. The applications are web application, map-reduced model, streaming model and batch processing model. In this entire model, the traditional network was not support much in all its tasks. In web application model, user's expectation is latency and spontaneous response, which is crucial in traditional networking. The map-reduce model works divide-process-merge strategy which requires high network bandwidth and computing powers to complete the process. The streaming model produces continuous data which leads large data flow in networks. Streaming application includes audio streaming, video streaming and also Internet of things appliance. In these three applications need continuous network connection for transmission and acquire more attention. The next is batch processing model, process the collected jobs in some order and data may transfer between jobs [7]. For this transmission a constant and reliable connection required. It is more difficult to provide continuous bandwidth when comparing to latency and response time. SDN based network management for multi clouds may provide different approach.

V. TOOLS SUPPORT SDN PROJECTS

There are many tools that could help researchers to learn the network behaviour, perform experiments, and build new scheme to support different applications to emulate and/or simulate their SDN projects. Let us see some of the properties of currently available tools to support SDN platforms are :

Mininet, Estinet, NS3 and Trema.

A. Mininet

Mininet is a network emulator tool that supports to create a virtual network which consists of more host, switch, controller and communication link. Mininet is mainly dedicate for OpenFlow architecture. It is most popular since it is simple, available, and flexible to SDN platform. Mininet is open source software, which has its own built-in tools and use Python language scripts and command Line Interface to rapidly construct, modify test and share SDN applications.

B. EstiNet

EstiNet is a closed source software tool and it uses a distinct method to run and test the functionality and performance of Open Flow Controller. EstiNet combines the both advantages of emulation and simulation approaches. All Linux based application can implement using Estinet simulation tool. It also supports some of the controllers such as NOX, OpenDayLight, floodlight, POX, beacon, etc[8]. EstiNet has good simulation properties and in cloud service which referred to as Simulation as a Service..

C. NS-3

NS-3 supports OpenFlow protocol and its switches in simulator environment with some restrictions. It is mainly used for the beginners of open Flow [6] architecture and SDN concepts. The main drawbacks are (i) it assists Open Flow versions 0.8.9 and

(ii) it unable to run some real Open Flow controller (NOX, POX and Floodlight) without modify[9].

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D. Trema

Trema is an OpenFlow framework which gives freedom to the user or researcher to construct and configure controller for SDN in Languages like Ruby and C. The framework includes basic libraries and functionalities that are necessary to work as in interface to OpenFlow switches [8]. This platform supports to develop entire development process such as create, configure, test, debug and also helps to control, monitor and identify the problem of the system. The main reason for obscure this platform is not supports GUI and the use of the C and Ruby programming.

The following table shows the comparison of Mininet, Estinet and NS-3

TABLE I : Comparison of Mininet, Estinet and NS-3

Features	**TOOLS SUPPORT SDN PROJECTS**		
	Mininet	**Estinet**	**NS-3**
OpenFlow Specification Version	1.0.0	1.1.0/1.0.0	0.8.9
Support Emulation Mode	✓	✓	×
Support Simulation Mode	×	✓	✓
Operating System	OS X, Windows, Linux Distributions	Linux Fedora	Linux, OS X
Programming Languages	Phython	C/C++	C++
Support GUI	✓	✓	✓
Compatible with real controllers	✓	✓	

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VI. CONCLUSION

This paper gives a study on how the SDN helps with new domains, such as the IoT, cloud computing, Big Data, etc. SDN has impact on this recent areas functionality and show high efficiency and performance of its process where traditional network not support much in its entire task. At last, we have discussed some of the simulation or emulation tool that supports SDN environment.

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