A comprehensive survey on Software Defined Networking

Sweety Sehgal
Department of Computer Science and Engineering
Lovely Professional University, Phagwara, Punjab, India

Amandeep Kaur Sandhu
Department of Computer Science and Engineering
Lovely Professional University, Phagwara, Punjab, India

Abstract: Internet has changed our ways of communication to the extent that has become our primary medium of everyday communication. There has been a dramatic growth of multimedia applications. Even though, there is no guarantee of Quality of Service to users. The users face a lot of problems in the form of delays and failures while accessing the internet. Solution to these problems is Software Defined Networking (SDN). This paper gives a complete description of SDN, applications, structure and issues faced.

Keywords: Software Defined Networking (SDN), Principles, architecture, Issues and Applications of SDN.

INTRODUCTION
From last few years the use of internet has increased rapidly. The traditional network faces a lot of problems to cope with the increasing demands of the users. The network environment consists of number of equipment's such as routers, switches, server load balancers, firewalls, network address translators, intrusion detection systems and many more. The network administrator has to individually configure the devices through configuration devices. It became a big problem when the network in large. The major drawbacks faced by tradition network are increased complexity, unable to manage traffic, vendor dependency, inability to cope with different domains, inability to scale. This led researchers to think on a model that can overcome all the problems of current network. The model named as “Software Defined Network” is the solution to all the problems related to the traditional network. The basic idea of Software defined Network (SDN) is to move the intelligence out and make it logically centralized. SDN approach separate the control plane from the data plane. The control plane is logically centralized. The goal to logically centralize the control plane is to give the global view of whole network environment. This feature of globalization of network easy the network administrator to look at the network and take the decisions. In short, we can say Software Defined Network paradigm is an emerging technology in the field of networks which will give deal with the current problems being faced in the network world.

Rest of the paper is organized as: section 2 discusses the need of SDN. Background of SDN is summarized in Section 3. In section 4 models, architecture of SDN, basic principles and features is discussed. In section 5, Challenges and issues are outlined. And at last paper is concluded.

NEED OF SDN
Today’s network is expanding day by day to meet the needs of application users and the business users. It is becoming huge every day. The network support number of services varying from simple text messages to multimedia services. Several users opt number of services. This increase complexity and create traffic in the network. As a result, things get messy and become hard to be managed. Time taken to provision network services to new applications, unlike other parts of IT, making changes to network is still a manual process. When an application is rolled out the administrator have to manually reconfigure device on network command line interface. Manual configuration adds hours and sometimes days to accomplish this task. The dynamic changes to network cannot be done to accommodate new applications. Today’s network is very complex. The visibility is limited to implement universal changes that expand from user to applications. The solution to all these problems is SDN.
Traditional Network: The traditional network is static in nature, slow to change and dedicated to single services. The current network has data plane and control plane both contained within simple physical system. The job of data plane is to handle packets in line based of information stored in tables. Execution of instruction in data plane originates in control plane. The control plane is sometimes referred to as the network node brain. Network uses control plane to communicate with other nodes in network. So, control plane handles the complexity. The control plane determine how individual packets should be handled and push this information down to fastest path in data plane. In traditional network the flow of data is managed and controlled by the networking devices i.e. routers and switches. The traditional network architecture is static in nature. Users don’t have freedom to control the packets. The data plane has to carry the packets physically node to node following certain protocols, the control plane contains logic that the devices are using to forward the packets. After comes the management plane that act as the administrator. The network administrator is management plane here. Now the administrator has to keep track of whole network. As discussed above more the complex network more difficult it will be for administrator to manage and control the network.

The answer to all the problems is the Software Defined Network. SDN takes a complicated network and separates the control plane from data plane. And gives a network that is simple. Addition to, gives visibility to real time responses. We can bring in programmability to dynamically change how network response to business needs.

In the figure 2 it is clear that the control plane is separate and is centralized. Now the network administrator need not to access every node individually. Instead, he has a global view of whole network and can easily maintain and configure the nodes.
MODEL OF SDN

Number of Models were introduced by the researchers. Some of them are given as:

**Network Virtualization Model**: [1] The most important goal of network virtualization is to get rid of restrictions on LAN partitioning that resides in Ethernet Virtual LAN standards and solve the issues like scalability & multicasting in the network architectures. **Evolutionary Model**: [1] Evolutionary model objective is to maximize software control within the boundaries of network topologies. **Open Flow Model**: model on which he SDN work is the Open Flow model.

STRUCTURE OF SDN

Architecture of SDN consists of three planes- Application Plane, Control Plane and Data Plane. The complete architecture is divided into four key interfaces. These interfaces are given as:

![Architecture of Software Defined Network](image)

- **Northbound-API**: The applications running on the top of the network use this interface to link with SDN network. No standard protocol is available for this interface.

- **Southbound-API**: This API create link between the control plane and the data plane. OpenFlow is most common protocol used in this Interface.

- **Eastbound-API**: Communication between the non SDN network and the SDN control is done by this interface. This interface act as and translator between SDN and Non-SDN devices.

Westbound-API: Different network domains and the SDN communicate using this Westbound-API. Information is exchanged via this interface. BGP is the standard protocol used in this API.

BASIC PRINCIPLES OF SDN
The software defined network work on the four basic principles. These are explained as below:
Separation of control-plane and data-plane: SDN basically works one the main principle of extracting the Control plane from the data plane.

Logically Centralized Control: This principle states that virtually centralize the control plane. This gives the Database Administrator a global access to whole of the Network. The DBA can easily find the errors by having the global view of the network.

Programmability: This gives and easy User-Friendly access to do configurations instead of manually configuring the devices. Coding is done on the control plane using Protocol Oblivious Forwarding (POF).

Open Interface: Traditional Network have the restriction of closed access. To fully achieve the features of a network this principle provides Open Interface. This leads to innovation and better problem solving.

ISSUES AND CHALLENGES IN SDN
The challenges that the SDN faces in its evolution are classified as:
1. Separation of Control plane and data plane: Since control plane is separated so an appropriate protocol should be chosen from available protocols and appropriate forwarding elements.
2. Open Interface: Maintenance of open interface can be a challenging because different vendors might send proprietary information on network via open interface. This might generate additional values if the things of same vendors are used which affect the performance and can may also lead to deadlock.
3. Logically Centralized Control: The understanding of logically centralization of controller challenging for network vitalization, scalability and depending on specific scenario.
4. Migration of current network to SDN: The migration of traditional network to the SDN technology is the biggest challenge in the development of SDN. Since many of the vendor devices may not be able to cope with the SDN devices. So, a lot of work is to be done in this area.
5. Maintenance of SND Controller: Because SDN controller is centralized is maintenance become more critical. If man controller fail whole network will collapse. As in traditional networks, if one networking device failed other device take control of the failed device to make smooth working of network environment.

APPLICATIONS OF SDN:
Support to Big-Data: Database perform thousands of queries at a time and are now real-time and distributed. Is has been suggested that volume of data will be increasing 10 times or even more in the coming years. The companies are moving to the concept of big data to manage their huge amount of data. The current network is not fitting to support these features of Big Data.
Solution to this problem is the SDN.
Internet of Things: The Internet of Things (IoT) is the most emerging topic in the field of IT. IoT works on heterogeneous domains. These different domains can be easily implemented in the SDN paradigm.
Service Provider –SDN: SDN also have an application in cross domain service innovation by proposed architecture of Service Provider-SDN.
In wireless and Optical Networks: SDN is also gaining popularity in the optical and wireless network. SDN enables high bandwidth, error correction, efficient traffic management, flexibility, data security and efficient resource utilization. Critical issues like traffic management are easily handled by SDN network.

**Network Virtualization:** SDN has contributed to network virtualization, which provides isolation, abstraction and shearing of resources in the network environment.

**CONCLUSION**

The Current network architecture is unable to cope with the increasing demands of application and business users. This paper gives a brief introduction about the limitations of traditional network. A better solution to deal with these problems is to switch the tradition network to Software defined Network. In this paper applications, issues and architecture of Software defined Network was given.

**REFERENCES**