



## Lighting on Software Defined Networking

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**Abstract**—Software Defined Networking (SDN), now categorized as network efficient technology because it can support the dynamic nature of the functions of the networks and it is making operating cost lower, because of simplify the hardware and software. It is also simplify the management. Unfortunately well understanding for the computer science students about SDN concepts in general is still weak regards to the overlapping concepts of networks in general. This article gives general light about SDN from different angels like what is SDN, why SDN, architecture, framework, models, application, opportunities, trends, benefits and challenges this article aims to illustrate and give good theoretical conception about the SDN.

**Keywords**—SDN; Framework; Models; Opportunities; Application; Trends; Architecture; Challenges; Use Cases.

### I. INTRODUCTION

Highly skilled and talented people who are experts are being required for Network configuration and installation and many different network elements. Due to the complexity of interaction between network nodes e.g. switches, routers, etc. A system-based movement is required to encircle the elements of model. However, with the current programming interfaces of today's networking equipment's is difficult to gain success. While accumulating further, one can know that the operational cost regarding provision and management of large multivendor networks which are covering large number of technologies has been raised in the recent era and the largest trend of revenues for operations has been decreased. Followed with the increment in the lack of human resources and increasing costs of real state, a new model should be formulated to support the network management and provision of services across multiple domains [1, 2, 3].

Cisco has enabled the organizations to increase their speed for application exploitation and delivery with the help of Software Defined Networking (SDN), it reduced the IT costs by formulating such policy to mechanize the workflow. (SDN) technology has reformed the phenomena by providing cloud architectures that can mechanized the delivery of on-demand applications at large scale. SDN has enhanced the benefits regarding data center virtualization, has decreased the cost by flexing resources, utilizing and reducing the cost related to the infrastructure and overhead. The reasons of accomplishments the business objectives behind SDN are, it manages the services related to networking and applications into a centralized form and provision of such platform that can mechanize the provision and configuration of the entire infrastructure. That provide results into a more modernized infrastructure that can deliver new services and can render new applications within a minute rather than consuming days and weeks like past. (SDN) provides speed and quickness for delivering the business applications and services, that's why SDN has got a platform where it can handle the most demanding networking needs of today and tomorrow [4].

### II. SDN HISTORY

AT&T's GeoPlex was one of the first SDN projects the development is still in progress since 96, in 98 new network operating system designed by Medovich then in 2000 WebSprocket released VMFoundry. Later the research engineers of Ericsson's advanced network saw in urgent need to design feature of the upcoming generation and this lead to the first step to architect and build the first commercial soft switch. Development process is still in progress in tow thousand and three the Content Delivery Control Network developed by Zac Carman & Bob Burke. Two thousand and four SDN expounded by Avaya using Shortest Path bridging and OpenStack as an automated campus, that works on services delivery by remove the provisioning which is manually work from it and make the automation extending to the end devises directly form data center [5, 6, 7].

The concept of (SDN) has gained the advantage in last 10 years. Actually, thinking about the SDN has been growing since one thousand nine hundred and ninety six, followed by the demand to provide network nodes with a management of user controlled. There are different groups industry and researches, which are being involved in the implementation phase. These groups includes: IPSILON they purposed General Switch Protocol in 1996, The Tempest they proposed a framework for a network which will be safe, resource based and programmable in 1998, Internet Engineering Task Force (IETF) they proposed about forwarding and control element separation in 2000, Path Computation Element in 2004. Most recently, a group called Ethan (2007) and Open Flow (2008) have implemented the SDN closer to the reality [1].

### III. WHAT IS SDN, HOW IT WORKS, WHY SDN AND BENEFITS

“The physical separation of the network control plane from the forwarding plane, and where control plane controls several devices” [8].

“Software-defined networking (SDN) is a new approach to designing, building, and managing networks that separates the network’s control (brains) and forwarding (muscle) planes to better optimize each”[9].

The providers of (SDN) offers a distributive scope of testing structures, essentially the SDN technique standardize the control of the systems by making the partition in control rationale and off-gadget PC assets. All SDN models have diverse adaptations of SDN controller and also southbound APIs and northbound APIs [9]:

- 1- Controllers: It is categorized as network brain and it provide a centralized view of the overall network; it is also allow the administrator of the network to dictate to the underlying systems as example the routers and the switches.
- 2- Southbound APIs: southbound APIs is used by SDN to relay the information to the switches and routers below.
- 3- Northbound APIs: northbound APIs is used by SDN to make communication with the logic of business and the applications and this make deploying of services and traffic shaping to be easy programmed by the administrator.

At times individuals’ synonymies the Open Flow with SDN; however, in actuality Open Flow is just a solitary component in the general SDN structural engineering plan. Open Flow categorized as standard, which is open for interchanges convention that empowers the association between control plane and sending plane. It ought to be pointed that Open Flow is by all account not the only convention accessible of utilized as a part of the improvement of SDN [9]. Traditional networks has gone to their limits due to the social media, mobile devices and cloud computing. Lot of benefits has been given from innovation in virtualization and mechanization, but these remunerated benefits are controlled by the restrictions in the network. Now administrators can twist the compute and storage in minutes rather than consuming weeks on manual network operations. SDN has revolutionize the data centers by giving ways of flexibility to control the network so that it can work more like the unacknowledged versions of the storage and security today. These benefits “Reduce Capex, Reduce Opex, Deliver Agility and Flexibility and Enable Innovation” are provided by SDN [1, 2, 9].

#### **IV. SDN ARCHITECTURE CONCEPT, COMPONENTS AND FRAMEWORK**

Software-Defined Networking (SDN) has become the promising architecture, which is vibrant, convenient, less cost consuming, flexible, adaptable, and perfect for the high transmission capacity energetic nature of today’s applications. System control get decoupled by this engineering structural, system control got empowering by the sending capacities to be a wind up also it is absorbed for the administrator of the system [10].

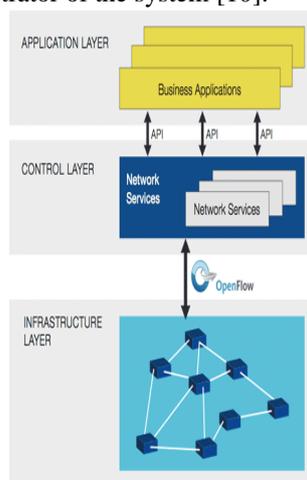


Fig. 1 SDN Framework

- 1- Directly Programmable: The forwarding functions making decoupled so that is why called directly programmable [11].
- 2- Agile: The wide traffic flow of the network can be adjust dynamically by the administrator to just meeting the changing needs that is because abstracting for the control from forwarding [11].
- 3- Centrally Managed: The intelligence of the Network centralized logically in software SDN controllers that make the network global view maintained, and appears as a single logical switch for the engines policy & applications [11].
- 4- Programmatically Configured: Network manager can setup, secure, manage and make optimization for the resources of the network fast, because of SDN programs are automated write themselves [11].
- 5- The Open Standards-Based & Vendor-Neutral: network design and operation be simple now that is refer to SDN because SDN operating instructions are provided by the controllers of SDN instead of the protocols and the multiple, Vendor-Specific devices [11].

The communication data networks consist of End-Users’ device or hosts the interconnect by the network infrastructure, which is shared by switching elements and hosts like routers, and communication links that carrying data between the hosts. Routers are closed systems also switches referred as closed systems that is mean deployment in production will be quite hard to be evolve in the current infrastructure of the network. The development of the Software defined network was to enable the simple programmatic control of the network data path and to facilitate Innovation. Easier deployment of new protocols and applications, now possible because the separation of forwarding hardware from the control logic [12, 13]. That is mean network now reduced to simple forwarding hardware and decision making network controller as illustrated in figure 2.

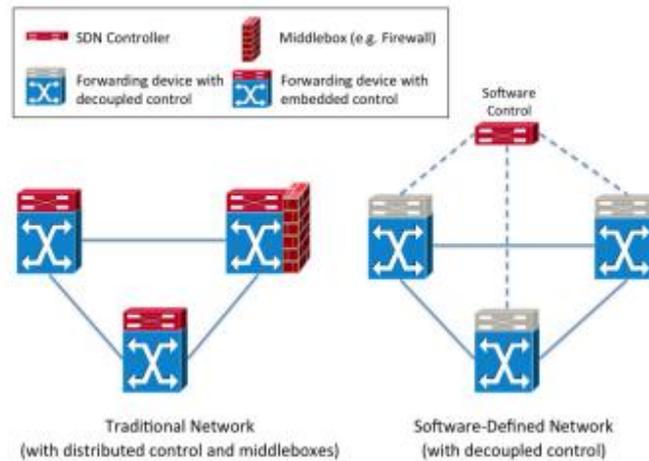


Fig. 2 SDN Architecture Decouples Control Logic

Architectural components of the SDN that are illustrated in figure 3 are: “SDN Application, SDN Controller, SDN DataPath, SDN Control to Data Plane Interface and SDN Northbound Interface” [11].

- 1- SDN Northbound Interface: “are interfaces between SDN Applications and SDN Controllers and typically provide abstract network views and enable direct expression of network behavior and requirements” [11].
- 2- SDN Control to Data Plane Interface: “is the interface defined between an SDN Controller and an SDN Datapath”.
- 3- SDN Datapath: “is a logical network device that exposes visibility and uncontented control over its advertised forwarding and data processing capabilities” [11].
- 4- SDN controller: “is a logically centralized entity in charge of (1) translating the requirements from the SDN Application layer down to the SDN Datapaths and (2) providing the SDN Applications with an abstract view of the network (which may include statistics and events)” [11].
- 5- SDN Application: “are programs that explicitly, directly, and programmatically communicate their network requirements and desired network behavior to the SDN Controller via a northbound interface (NBI)” [11].

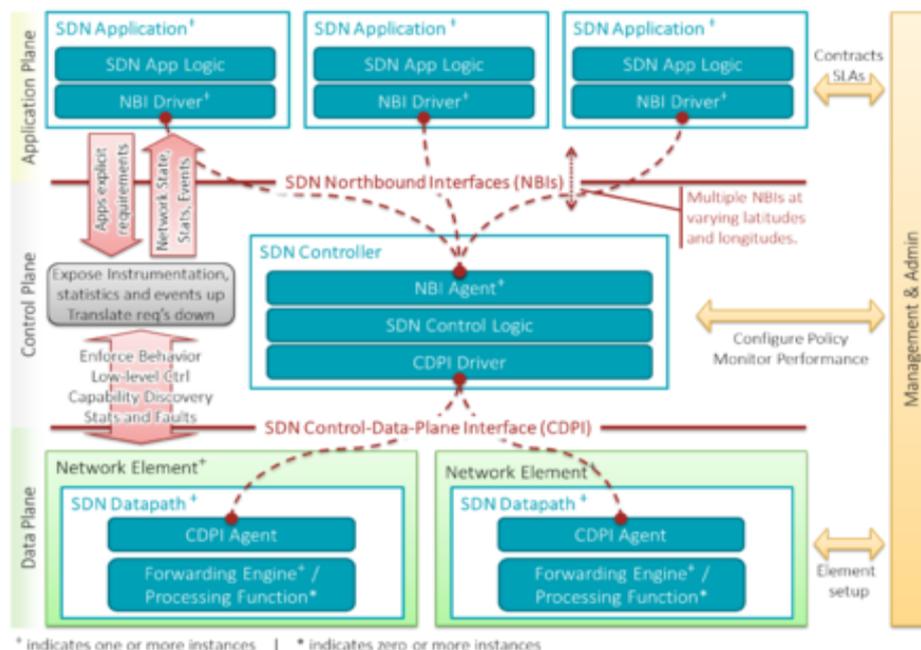


Fig. 3 SDN Architecture

## V. SDN MODELS

There has been a great discussion regarding SDN models for handling change and Open Flow models. There are three types of different definitions that can describe the SDN models with relation to the networks, which are based on Open Flow [14, 15].

- 1- Reactive: Receptive models are largely for the most part connected with SDN and Open Flow. Receptive models are steady in nature while modifying and adaptable; it implies moment contrasts are shaped by current system conditions. That prompts the base of precariousness administration display in which there is highly progress in the area of machines that categorized as virtual.

Open Flow is utilized to constantly redesign the position and course of the system to every virtual machine. This model is not ascendable for any association and it is not CERN [14].

2- Proactive: Proactive models look forward for the issues in the system and attempt to determine them before they turn into a genuine issue, which will oblige some real responses. Proactive models can be in view of expanding misuse in particular parts of the system, demonstrating the sent potential bottlenecks. Rolling out sudden improvements to the directing of the information through the system before misuse gets to be too high that it can direct the potential issues identified with the execution [14].

3- Predictive: A Predictive approach for the most part uses a recorded foundation identified with the information in regards to the execution of the system to set the switches and streams intermittently. This methodology is less inconvenience making in light of the fact that it happens with less recurrence than a receptive model yet at the same time it permits inclines in the stream and information volume to advise suitable courses [14].

## **VI. OPPORTUNITIES, TRENDS AND CHALLENGES OF SDN**

Today SDN is the ICT industry topic, it is really help in adjust the structure of the network by the companies. Before SDN it was hard task to the networks for supporting the technologies like cloud computing and mobile service, today SDN make enhancement for the users' experience. SDN as it provides opportunities like Enhancing Efficiency of Campus Networks, Increasing Bandwidth Utilization in Wide Area Networks (WANs) and Customization for Specific Industries it is also face challenges such as Support for Smooth Transitions to SDN and adapting hardware for the deployment of SDN [16, 17]. These days campuses and data centers are in need for dynamic storage and dynamic computing, SND addressed the fact that conventional network is not suitable. The trends behind necessity for the new paradigm are: Consumerization of IT, Big Data, Rise of Cloud Services, Changing Traffic Patterns, Vendor Dependence and Inability to Scale [1].

## **VII. SDN APPLICATION AND USE CASES**

SDN offers multitude use cases for the organization such as enterprise campus cloud and data centers offer carrier and services provider. For carrier and services provider SDN provide demand bandwidth and for the cloud and data centers, the virtualization of the network for multi-tenants is an important use case as it offers better utilization of resources and faster turnaround times for creating a segregated network. SDN policies provides for the enterprise campus, experience monitoring of networks and experience access control for the network [18]. "An SDN application is a software program designed to perform a task in a software-defined networking (SDN) environment. SDN applications can replace and expand upon functions that are implemented through firmware in hardware devices in a conventional networking environment" [19, 20]. The cloud computing application are beneficiary of SDN which allow better services for these applications. SDN also enable security application and those are some use cases application (DDoS) Distributed Denial of Service detection and mitigation botnet and worm propagation. Influence the SDN controller by applying some algorithms. (Moving Target Defense (MTD)) is categorized as another kind of the applications that is related to the security. Scalability is highly require for the solution checking because large scale scenarios used to deploy SDN application. Comprehensive checks of possible programming errors during the SDN application development is highly require [21, 22].

## **VIII. CONCLUSIONS**

SDN help and shape in the future of the network, SDN comes to support the future dynamic nature of the network and to improve the network programmability. It provides a lot of solution, benefits and it is boon to cloud computing by its application. SDN still faces many challenges specially hardware and security challenges and if it not gain a traction it will to change to something else, right now with SDN I can call there is network revolution and SDN will gain momentum as vendors stake their claims and the advantages are realized.

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