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Intelligent Network Bandwidth Allocation using SDN (Software Defined Networking)

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Abstract **- SDN (Software Defined Networking) is a new approach to computer networking where control over the network is removed from the hardware devices and placed in a software or program called the controller. The goal of SDN is to take the control from networking devices i.e. routers and switches and put this network control on an intelligent program or application.**

One major problem that can be solved by SDN is internet or network bandwidth allocation. The purpose of this research paper is to discuss how SDN can achieve dynamic bandwidth allocation. The paper will consider how the network intelligence introduced by SDN can automatically allocate network bandwidth to the application that needs it.

Internet or network bandwidth allocation can be a major problem since every application requires to be allocated beforehand. Further, since this allocation does not change dynamically, this bandwidth can remain unused during idle times since the application is not using it yet it remains allocated to it. To solve this problem, the intelligence of SDN can be exploited to ensure that internet or network bandwidth is allocated dynamically to applications that need it. SDN takes the network management functions from the network devices to an application that can be used to intelligently manipulate & control the network without the need to do this in devices such as switches and routers. With this functionality, one can optimize internet or network bandwidth such that it is allocated dynamically to applications that need it the most.

Keywords: SDN (Software Defined Networking); Network bandwidth allocation; Dynamic bandwidth allocation.

INTRODUCTION

Recently everyone noted that there is a continuous improvement in speed of the internet backbone where the data transfer rate reached 10 to 100 Gigabits per second with the aid of giant servers and the emergence of cloud computing have solved the problem of storing and processing partly of massive data, while the problem of internet addresses has been ended with the beginning of relying on internet addresses of (IPv6), but remained one of the problems that everyone wants to have a solution by depending on a robust, secure and simple infrastructure with low cost and easy to deal with and solving problems that occur which cannot be achieved with the current situation. As a real network hardware if it offers what you need , the high cost make you think more than once before executing your steps .

SDN (Software Defined Networking) is a new approach to computer networking where control over the network is removed from the hardware devices and placed in a software or program called the controller *(Barker 1)*. Traditionally, when a data packet arrives at a network device such as a switch or router, the rules that are built into the device instruct the switch where to send the packet. The packets going through the same path are then sent in the same direction and along the same path. The goal of SDN is to take the control from networking devices i.e. routers and switches and put this network control on an intelligent program or application.

One major problem that can be solved by SDN is internet or network bandwidth allocation. In modern networks, different applications use certain bandwidth amounts which must be allocated and provisioned. The bandwidth required for any application has to be allocated beforehand and such bandwidth cannot be redirected or dynamically reallocated for use by other applications during idle times – the bandwidth is dedicated to that application *(Barker 1)*. With SDN, bandwidth can be allocated dynamically according to the needs of applications. The purpose of this research paper is to discuss how SDN can achieve dynamic bandwidth allocation. The paper will consider how the network intelligence introduced by SDN can automatically allocate network bandwidth to the application that needs it.

Software Defined Networking (SDN)

SDN takes the lower level functionality that is traditionally left to devices such as switches and routers and places it on an application. Through this application, the network administrators can now design or shape how the network traffic will flow from a centralized location without having to do it in the devices. Once the new instructions are developed in the application, they can now be communicated down to the devices without having to enter commands in the network devices *(Duffy 1)*.

The network administrator can now change the rules of any network device from this application. Here, administrators can block traffic, prioritize and de-prioritize traffic. This allows the network engineers to manage traffic in a more efficient manner by taking the control from the devices to an application *(Azodolmolky 39).*

Hereby researching for alternative solutions , specifically within the scope of the concept of the Network Overlay ,today our focus will be on a recent technology known as Software-Defined Networking (SDN). SDN is a new next-generation of infrastructure in the network architecture because it is doing what we cannot do with the traditional hardware. To be more understood, we will explain what is happening in traditional hardware that we use now, where this router contains two foundations, master and slave or the mind and the body or Control Plane and Data Plane or Network Topology and Network Control. The function of the first part is summarized that it is responsible for decision-making and process of routing and data traffic to somewhere . Part II is responsible for executing all the decisions taken by the first part as shown in figure 1.1 below:

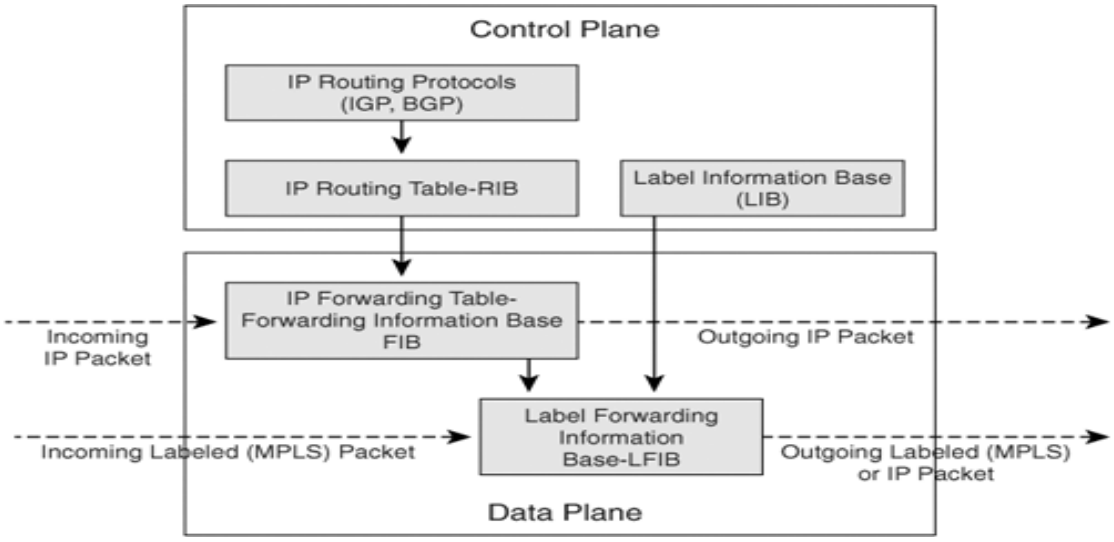

Figure 1.1 Control plane and data plane.

Figure 1.2 Illustrates the current hardware structure for router or switch.

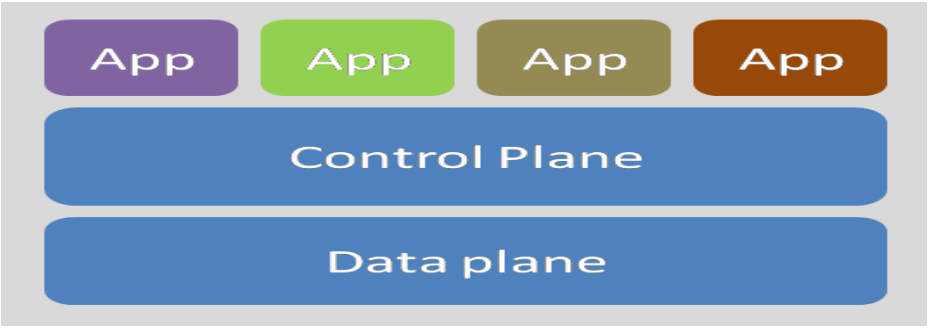

Figure 1.2

While this figure 1.3 illustrates how the current hardware infrastructure works whether for router or switch.

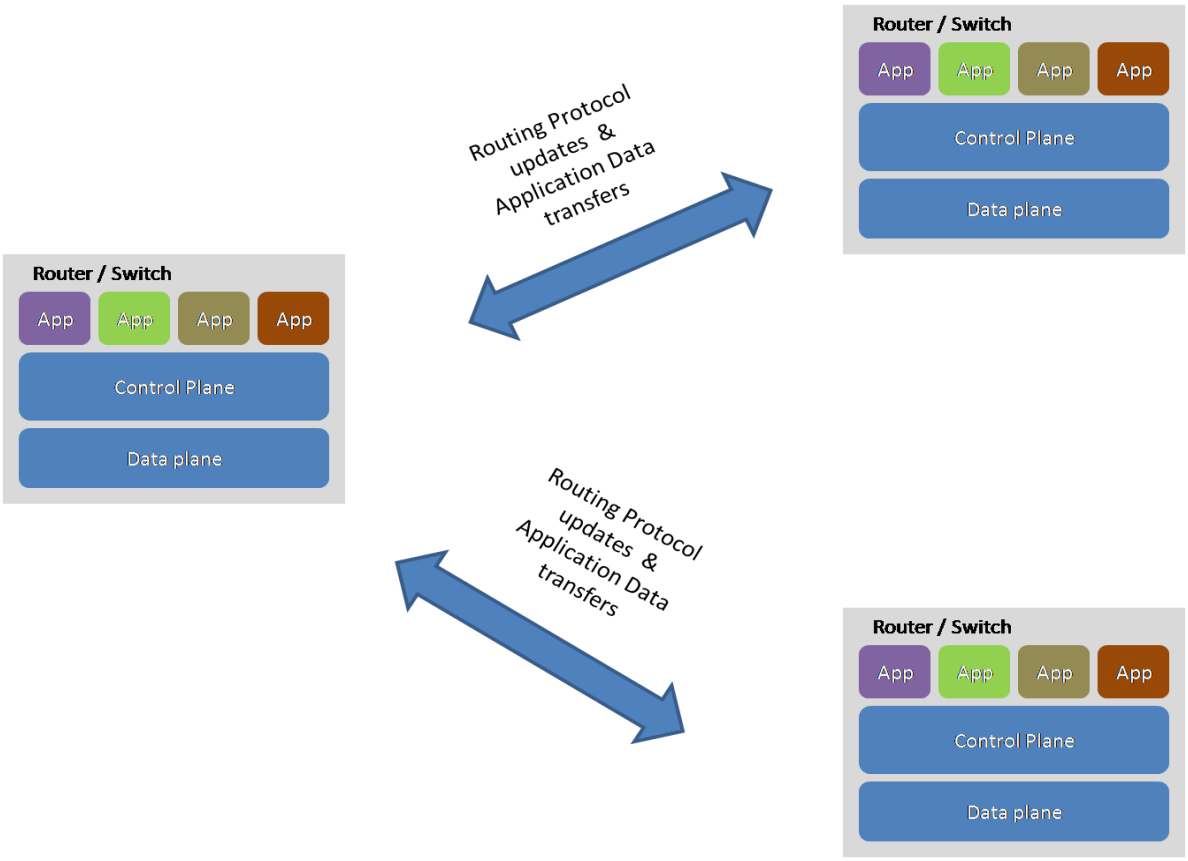

Figure 1.3

The new technique of SDN, will separate them and will put the first part on servers with high capabilities, the second part will remain on the usual hardware. This change will accelerate the network many times than the traditional way because all the loads will be on the servers .Graphical comparison between the Control Plane and Data plane, and some pictures explain the difference between the structure of the traditional hardware and the infrastructure of SDN. Here is the infrastructure work of the networks using SDN technology as shown in the figure below:

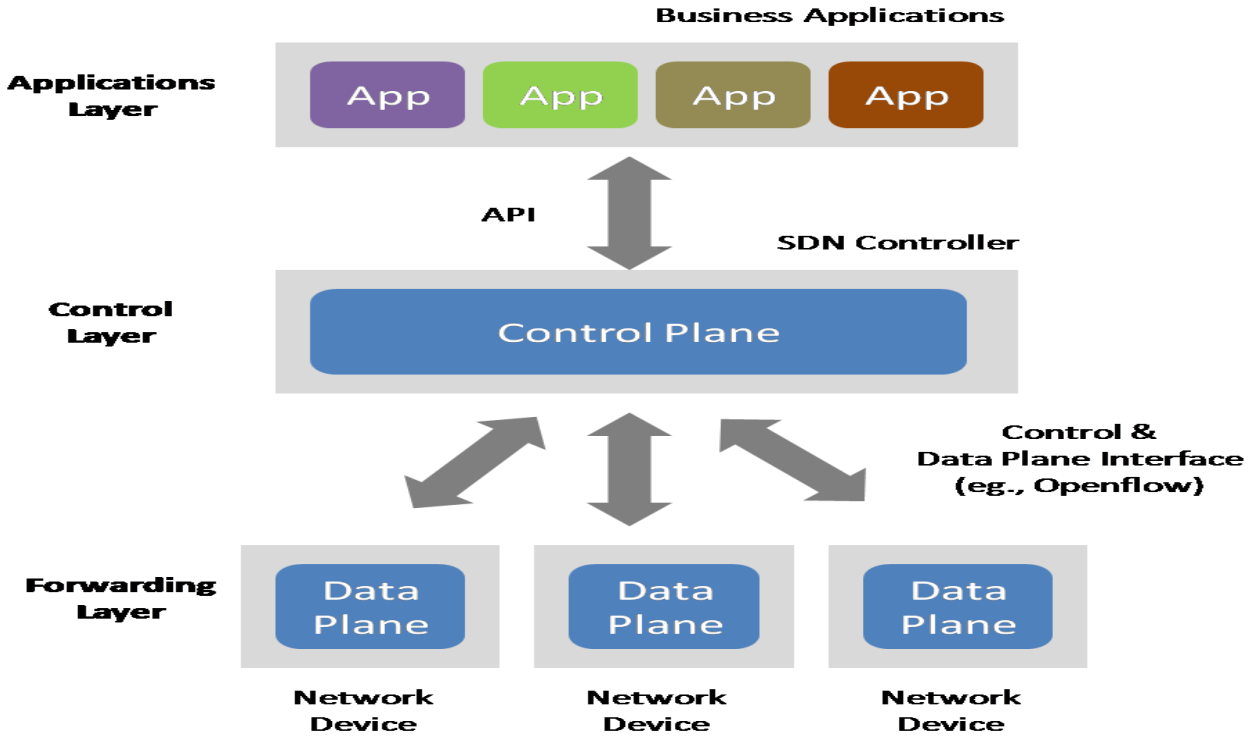

Figure 1.4 SDN technology infrastructure work

Network Intelligence and Dynamic Bandwidth allocation with SDN

One main advantage of SDN is the increase in network intelligence that can allow network professionals to achieve more functionality. For example, a network running on SDN can use the application to learn the bandwidth requirements of an application and allocate only what is required so that the rest is used by other applications *(Azodolmolky 116).* Modern applications that need to use internet or network bandwidth require this to be allocated and provisioned beforehand. This means that the application will have a certain amount of capacity allocated to it at all times. The bandwidth allocated cannot be changed dynamically according to the needs of the application.

Therefore, when the application is in an idle mode, the bandwidth allocated to it is idle but it cannot be used by another application. This leads to a situation where there is idle bandwidth that is not being utilized by an application which cannot be allocated dynamically to other applications. SDN introduces network intelligence such that network bandwidth can be allocated dynamically according to the needs of applications. If a certain application is idle, its bandwidth can be allocated to other applications that need it. This allows network engineers to manage the network in a more flexible and efficient manner *(Thomas and Ken 73).* Further, with this functionality, network engineers can increase the quality of service in their different applications since the network capacity is being allocated according to the needs of the different applications.

The SDN functionality can therefore lead to greater optimization of resources which would then lead to a reduction of the costs of running a network. In fact, companies can purchase less bandwidth because they can improve their efficiency in using reduced capacity *(Thomas and Ken 92).* Due to optimization of the use of bandwidth, the company can buy less bandwidth and optimize it with SDN in such a way that it is sufficient for the needs of the organization.

CONCLUSIONS

Internet or network bandwidth allocation can be a major problem since every application requires to be allocated beforehand. Further, since this allocation does not change dynamically, this bandwidth can remain unused during idle times since the application is not using it yet it remains allocated to it. To solve this problem, the intelligence of SDN can be exploited to ensure that internet or network bandwidth is allocated dynamically to applications that need it. SDN takes the network management functions from the network devices to an application that can be used to intelligently manipulate & control the network without the need to do this in devices such as switches and routers. With this functionality, one can optimize internet or network bandwidth such that it is allocated dynamically to applications that need it the most.

Now we will move on talking about some of the advantages of this technology at several points in short:
1 – Facility of implementing and enhancement of routing policies and designing and distribution of networks and traffic control of data related.
2 – Obtaining a higher performance from the current hardware and ease of control in this performance via the central control unit without needing to deal with traditional hardware components .
3 – Lowering in cost compared with hardware, such as routers , switches, they have closed structure, which would be impossible to develop or been integrated with other products as well as reduce the number of engineers who are saving time at work from four weeks to nine days only.

4 – Virtual networks and software will increase the rate of innovation on the network infrastructure , and this will lead to the emergence of new ideas, for example, developers can select applications within the network without affecting the performance of the network or other services .

5 – Not depending on a particular company's product so that allowing the existence of flexibility in the network because it will allow the administrator taking independent choices to choose the best elements within the network .

6 – This technique will allow the division of network resources and therefore it will sell models of new services within the network .

7 – Managing the network easily, for example, in our current situation what happens if we remove the router or switch from the network? If there will be no problem in contact or Loop because of the lack of this device, what might less be expected that there will be an overload on the rest of the hardware instead of the removed device , but this will vary with the new technology .

8 – Integration with MPLS and GMPLS.

9 – Existing of multiple processes and full support in the distribution of loads.
10 – Ability of applying a more accurate unified security policy than what we use in our current situation .

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