

Exploring the Next Generation Network Architecture based on SDN

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Abstract—This paper has studied the definition, characteristics and basic structure of SDN with the method of literature analysis and analogy analysis, analyzed the development trend of the next generation of SDN network structure from different aspects, including the way to realize the SDN, some of the problems that SDN will encounter with the development, and gave the corresponding solutions.

Keywords-SDN;networkstructure;cloud;ipv6

I. SDN' DEFINITION

SDN is a new type of network architecture, and its design concept is to separate the control plane and data network forwarding plane, thus to realize programmable control of the underlying hardware by a software platform with centralized controller, to realize the flexible deployment of the cyber source with demand[1]. The essence of SDN is to let the user / application can fully control the behavior of the network by software programming, to make the network software-oriented, and then make the network agile. The difference between them as shown in figure 1

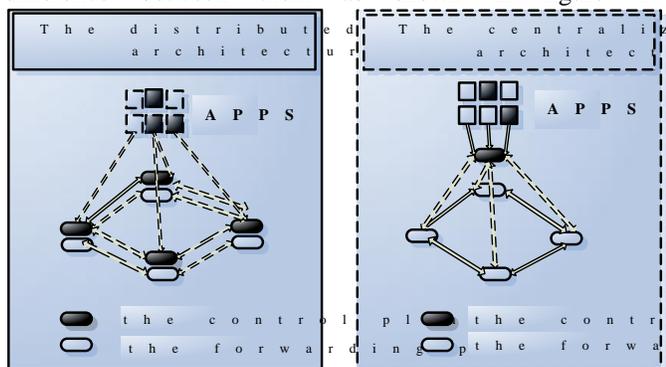


Figure 1.

II. THE ARCHITECTURE OF SDN

The architecture of the SDN from the top to the bottom mainly is divided into SDN application layer, controller, the physical layer, upward interface, downward interface[2].

A. SDN application layer

Like the thinking of the human brain to command limbs, SDN application layer programs the underlying device with the programming interface provided by the control layer, to open the right of the network control to users to develop the variety of business applications and to realize the rich and colorful business innovation.

B. the controllers

Like the human brain to control each action of the human body, the controllers centralizedly manages all the network equipments and supposes the whole network as a resources pool to flexibly and dynamically allocate the resource , according to the different needs of customers and the global network topology. The SDN controller has a global view of the whole network: to the lower layer, to communicate with it by basic network and standard protocols; to the upper layer, to provide the control ability of cyber sources to the application layer by opening interface.

C. the physical layer

Like all the organs of the human body to do some actions under the brain control, the physical layer is the layer of hardware equipments, focusing on the physical forwarding of pure data and business, and concerning about the security communication of the control layer. The processing performance of the physical layer must be high, so as to realize the high speed data forwarding.

D. The North interface

Like brain waves to be responsible for the up transmission of signal driver, North interface is the interface to open application to the upper business through the controller, and the purpose is to make the business application can easily call the underlying cyber source and

ability, which directly services business application. The design of North interface requires close connection with the business application needs and has the feature of variety.

E. The south interface

Like the human body nerves to be responsible for the transmit of signal to each organ of the body, the South interface is the transmission channel of the physical equipments and the controller signals, and all the related state of the equipments, data flow tables, and control instructions are needed to convey through the south interface of the SDN, to realize the management of the equipments,

The relationship between them as shown in figure 2

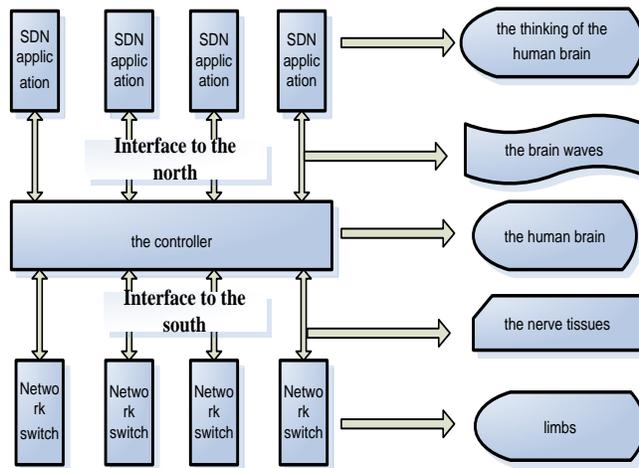


Figure 2.

III. THE VALUE OF SDN

SDN is a kind of innovative reform, which has solved some inevitable problems in the traditional networks, including lack of flexibility, the slow response speed of demand changes, the incapability of realizing the network's virtualization and the high cost, etc. Under the structure of nowadays' network, the network operators and companies can't provide new business quickly, for they can only realize it by waiting for the agreement of the facility providers and the standard organization, and bringing the new function into the professional running environment. Obviously, this is a very long waiting process, or the market has changed tremendously after the recent networks really have this new function[3].

The appearance of SDN has changed the current situation. The network operators and companies can easily decide the network function by the software written by them. SDN enables them to have more initiative in the aspects of flexibility, agility, and virtualization. SDN can help the network operators and companies to provide new services by ordinary software at any time. Through the integration of network control function by the OpenFlow transmitting instruction set, the network can be virtualized, and be regarded as a kind of logical resource, but not the material resource to be controlled and managed.

IV. THE ANTICIPATION OF SDN'S DEVELOPMENT TREND

A. SDN will reform the data center of the next generation.

The network between the data centers has the characters of large flow, strong suddenness and strong periodicity, which requires the network to have the ability of multi path transmission, balanced loading, broadband network service based on requirement, green and energy saving, centralized management and control. The network drawn in SDN can gather the flow requirement between the data centers by deploying unified controllers, thus carrying out the unified computing and dispatch, implementing the broad band's flexible distribution on demand, and optimizing the network to the greatest degree, improving the resource utilization rate[4].

B. SDN overturns the traditional network structure

SDN technology can be realized by API[5], which enables the program to control the network structure in the basic layer. SDN also paves the way for the enterprises to use the mixture cloud, provides the management and safety while applies the data center constructed by the third party providers and partners network together.

As the exploding of cloud computing and mobile network, the traditional network facilities and function combining system has become more and more complex, the speed is much slower; the running cost is also very high. In such a background, SDN has become an important technological star in the system of network virtualization.

SDN has three essential qualities. The first one is retransmission control separation. The second one is centralized control logically[6]. The final one is open API, enables the user to control the action on the network by software programming sufficiently. In the structure of SDN, the physical hardware is abstract, which can run independently on the virtualized machine and application on the network, thus realizing software's free control on the network hardware and flexible resource scheduling. SDN brings about innovation through features of flexibility, shortcut and virtualization, enables the network service providers to provide the network on requirement at any time, and simplifies the network operation. We can even say it overturns the traditional network structure.

C. SDN provides the solution plan for the mix cloud

The current situation of mix cloud network is that many elements in different areas should be linked together, and only gives out the responsive, elastic platform near the mix cloud computing customers' requirement. The applicable network service combines lots of net elements in many key areas, such as IP router, wireless and cable visit, integration of city and districts, package and light fiber core and many other areas. In most cases, it includes integrating many manufacturers' platforms. But in the current situation, the operators are restricted by its own support for many

services, and not being able to provide the required elasticity and response ability in the mix cloud computing.

In the structure, SDN approves the abstract definition of network service[7], covering too many different net elements widely. These elements can be described differently in the domain, such as the integration of city cable or the core of optical fiber. These abstract services run on the control panel, which exists between the bottom elements and the elements run above it.

In order to construct such a defined middle layer of network service, the operators can simplify and facilitating leading in new products into the process. Finally, the providers can overcome some key obstacles they confront, thus creating more attractive service for the mix cloud computing customers. They can also use SDN to realize more direct way, create service, and guarantee the delay, capacity, elasticity, safety or activating time, and adjust it to the requirement of mix computing customers. Returning back to the above mentioned experiment of MapReduce done by researchers in Microsoft in the mix cloud environment, the network design driven by SDN can help the operators solve the problem of delay and capacity.

D. *SDN will accelerate the commercialization of IPv6*

SDN is a late model of network architecture. By the control function and the separated of the device itself on the second and third layer of network device will makes the device more simple and convenient. Furthermore, the forwarding of the data of by Open Flow or similar agreement let the bottom equipment with the outflow of resources become more easy to control[8]. So that to lower these resources through a unified export assignment flows can greatly save the equipment cost, but also facilitate the network management personnel to the effective control of the network.

To increased IPv6 address terminal number mean greater routing tables and more complex queries. SDN can play an important role by its idea characterized with control, forwarding separated, centralized management.

Based on the SDN architecture, the device of NAT64[9] at the exit which is only responsible for transmit the data can greatly enhance the network forwarding capability while the corresponding control would be put in resource management platform of cloud computing. When the access of connection came in, the processing capacity could be increased through the controlling from the cloud computing resource management platform, the delivering of the the mapping table being responsible for cloud computing platform, the forwarding of NAT64 focusing on export by the device of NAT64[10]. Meanwhile, strategy with multiple devices forwarding can be avoided and also the problems of equipment maintenance can be exempted.

Especially the SDN with programmability and flexibility can realize the continuous optimization to network architecture by only upgrading related control software to realize the upgrade of more functions and applications to

make the network infrastructure to support both IPv6 application without being worry about the waste of resources.

E. *SDN does not deepen the threat to security*

traditional network. It is required more Advanced Method of User Identity Authentication and more flexible encryption than traditional way to ensure the traditional network security when the SDN is deployed. Meanwhile, SDN can cope with the challenges better than traditional network security due to its advantages of flexible application in centralized control by increasing the security key in the controller[11].

In terms of security, Extreme Network view can always make sure that the security layer is embedded into the operating system through our CLEAR-flow technology. By the point view of the monitoring and visualizing application from the SDN inside, the solutions of Extreme Networks XNV™ help to provide visibility and ensure that the strategies to specific application will always be observed whether the planed virtual machine location shift or not.

V. THE PROBLEMS IN THE PROCESS OF THE DEVELOPMENT IN SDN

The main problem for SDN is that SDN is still in the research stage of exploration and has not applied to commercial field. Currently[12], there is a lack of killer applications for SDN and the good SDN solutions can't be offered to deal with the problems raised by the customer, especially the application with the characteristics of the industry is in urgent need. Moreover, SDN is a late-model of network architecture which is characterized by its openness will caused a certain security hidden danger, especially server for operating network system is likely to become the target of an attack. Meanwhile there will be other problems for SDN such as no fixed criterion, lacking support from network equipment and practical experience on the SDN deployment. what is even more important is that SDN is a technology of revolutionary innovation, people take some time to adapt to new situations. Finally, it will bring the challenges to SDN for whether the supplier accept any type of controller to set up and keep the open software and switch or not.

VI. CONCLUSION

SDN is a late model of network architecture and will become a trend of network deployment, but the popularity of the SDN has no a obvious breakthrough within two to three years. SDN will coexist with traditional network architecture in the future for a long period of time. But one thing is for sure that SDN has become an important trend in the development of future network architecture and there will be an bright prospect of its market.

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