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Brief Summary of Software Defined Network: Past, Now, and Future

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Abstract

With the growing demand for information, it has a strategic importance for the future of sustainable development how to create a safe and robust network system to ensure the security of important information. Intrusion detection technology can proactively react against intrusion behavior and adjust its strategies in time. So it provides an effective means for network security to minimize or avoid loss when network system is attacked. It is an important part of network security system. When using Software Defined Network to deal with several complicated network problems, people now find the difficulties existed in SDN. However, SDN would still be the top priority to most users, since it can not only lift up responding capability of Internet towards specific application and business requirement, but also decrease running time and cost. Before applying Software Defined Network, we have to understand how it works, and why the situation will become so complicated to utilize Software Defined Network.

Keywords

SDN, Difficulty, Complexity, Functionality, Future.

1. Introduction

"As computer network grow larger and more complex, there is a need for a new simple kind of approach to configure them. SDN has emerged as promising network architecture. It takes the control plane away from the individual nodes and centralize the network control by utilizing a flow based traffic management". [1] A failed ***"big promise"*** of SDN in the real world is pointed out and is intended to be solved. Overall, several drawbacks exist in three large areas (the centralized calculation of network paths, flow-based forwarding, and network progammability), followed by useful instructions and suggestions towards those problems. It is impossible for this new technology to be entirely perfect just like an Internet with best routs and cheapest cost. The key ideas behind Software Defined Networking are the separation of control and data plane, centralization of network policies and programmability of the networks. Software Defined Networking also claims to solve the perplexing network management issues with some related technologies.[2]

2. Centralized calculation network paths

In centralized calculation network paths, the distributed control planes are one of the most complex components of networks. In fact, the entire network is designed around the operation of routing protocols, including the following topics:"Splitting up failure domains through information hiding, Managing complex policies through communities, tags, and metrics, Choosing topologies based on fast convergence characteristics, and The interaction of multiple distributed control planes running on a single network**".** In order to supporting complicated distributed control plane processing and data processing, network equipments have to be extremely large and expensive. Therefore, if a

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controller can be used instead of a distributed control plane, we can largely reduce the complexity of the forwarding device by using a lightweight, inexpensive, and small forwarding device, thus using a less configured available white box device. However, due to the relationship between centralized computation and reactive control plane, many unknown problems may occur if centralized controller method was simplified.Control Path Management is an important component in the Distributed SDN Controller, and plays a key role in Software Defined Networking (SDN). Testbed simulations are done with an implementation of several controllers are deployed to improve the scalability and reliability of the control plane framework by employed network clustering into several subdomains with separate controllers. This paper investigates the deployment of distributed SDN controller but logically centralized systems for decouples control plane using Distributed Traffic Engineering mechanism. The results obtained show that the proposed mechanism can achieve controller load balancing with better performance.[3]

3. Difficulty in simplifying SDN control plane

In centralized control and reactive forwarding, the SDN control plane should be moved to the reactive control plane. This design will take away a great number of forwarding states from arbitrary device, but it may cause many negative effects. Specifically, moving to reactive control plane will increase total amount of lag between first packets in the stream being transmitted, while the reactive control plane suffers from these changes for a broader reason. Moreover, in a large sense, the equipment, already establishing connection, will witnesses a disconnection between the real and perceived state, named network instability. If the disconnection is larger, the whole network will become more unstable. More importantly, as discussed earlier, distributed control planes are extremely complicated and demand numerous configuration to deploy, while distributed control planes can be simpler by replacing every part with small number of programmers in a place where the code can be easily manipulated and customized to suit a specific environment. However, SDN was not initially designed for distributed architectures and could not handle a huge amount of data coming from a large network.[4] This method is unlikely to come true, for it violates the basic concept of a solid state system (which must contain at least two controllers instead of mere one controller). Anyway, a distributed control plane must allow controllers communicate with each other. “Although SDN offers flexibility, it has design flaws with regard to network security. To support the ongoing use of SDN, these flaws must be fixed using an integrated approach to improve overall network security”. [5]

4. Stream-based forwarding

The routing protocol is designed to be accessible so that the forwarding information is based only on the target address. However, to eliminate denial access, forward traffic based much more than destination address are more likely to be used. On the other hand, stream-based forwarding also has some problems: in a large network, the amount of control surface state required to forward each flow is unreasonable. In addition, the operational costs of this idea will be enormous, and the utilization of this forwarding based traffic will be limited in many aspects.

5. Capability of being programmed

Last but not least, SDN promises network programmability, which consists of three distinct parts---dynamic provisioning and dynamic interaction between applications and the network. For large networks, they are difficult to be configured, monitored, and troubleshooted. If a unified interface enters every vendor's platform, the peak of network operation will occur. However, in the real market, suppliers are impossible to maximize their profits, and they always try to make their products different, which is the opposite of this new concept. In addition, vendors want to get higher returns from vertical integration solutions, but vertical builds thrive on a single well-integrated vendor. These two issues may limit the SDN interface in a small range and the lowest common denominator. In addition, a tension around automatic configuration introduces brittleness into unintended operating cycles. In

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addition, the combination of dynamic provisioning and dynamic policies often results in API (application programming interface).

6. Short overlook of future development

One of the core properties of Software Defined Networking (SDN) is the ability for third parties to develop network applications. This introduces increased potential for innovation in networking from performance-enhanced to energy-efficient designs.[6]Due to various uses of SDN, the future application of SDN is very prosperous and SDN can be used in many problematic fields. However, the problems of centralized controller, scale and speed may interrupt the balance of SDN of the world consumption to some extent. As a result, it is better to apply mixed-mode approach in data center structures of all sizes. In addition, "Bandwidth optimization, intelligent routing, special policies, and other uses seem to be the most practical approaches." we provide a tutorial of 5G network slicing technology enablers including SDN, NFV, MEC, cloud/Fog computing, network hypervisors, virtual machines & containers. [7] Therefore, in the foreseeable future, distributed control planes and SDN (programmable layer on top of distributed control planes) will continue to be used.

7. Conclusion

SDN is a strategy rather than a product and could be a destination to perform certain tasks. Although SDN can be applied in many fields, due to the above problems, the current achievements of SDN have not fully succeeded, which can be further improved in the future. In general, Software Defined Network (SDN) is a new network architecture that uses a centralized controller to control data flow at the data level. This new approach makes network management easier and less costs. The progress of cloud computing technology has promoted the development of cloud management tools, such us OpenStack, one of the representation of cloud management tools. It uses the network component Neutron (formerly Quantum) to provide network virtualized services, allowing tenants to create and manage virtual networks, and provides a standardized plug-in architecture for connecting SDN controllers. However, the scalability of Neutron has not been perfect, which is unable to satisfy the dynamic characteristics of the virtualized environment, and the control over network resources is limited. SDN can actually provide additional functions for Neutron, such as centralized control, seamless network, multi-tenant and network scalability.

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