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Network Traffic Scheduling Based on SDN in Cloud Data Center

Xin Cui[1, 2]*, Lianjun Zhao[1], Zhen Cheng[1]

[1]*College of Computer Science and Technology, Shandong University of Technology, Zibo 255000, China*
[2] *Institute of Network Technology, Beijing University of Posts and Telecommunications, Beijing 100876, China*

Abstract: In order to realize dynamic load balancing based on data stream level, SDN technology is applied to cloud data center, and based on SDN of the cloud center dynamic load equilibrium method. The method utilizes SDN Technology in the flow and task scheduling flexibility on the advantages of adoption OpenFlow Protocol on the service node traffic and load conditions real-time monitoring. When the system load imbalance occurs, the controller can be deployed in the global network resource load, through more accurate dynamic correction to ensure that the system in the long run the load will not be significantly tilted. Simulation experiments show that this method realizes and ensures that the load does not tilt for a long time, and can improve the system throughput.

Keywords: Software definition network, cloud data center, dynamic load balancing

I. INTRODUCTION

Cloud data center is accompanied by the development of cloud computing and the emergence of new data center, is a use of cloud computing technology to achieve multi-tenant sharing of computing, storage, network and security resources, and automatically provide all kinds of cloud computing on demand service data center architecture.It is through a unified cloud computing resource management and resource scheduling platform to provide real-time users flexible configuration, on-demand delivery, elastic retractable and massive according to the storage and processing of cloud business.Cloud data center segment generally uses a two-tier network structure, divided into core convergence layer, business access layer and service access layer, composed of access switches, down to connect various types of computing clusters, the traffic within the cluster control in the access layer, up with the core convergence layer exchange machine connection. Core convergence layer, mainly composed of core switches, firewall, load balancing, or other network service equipment next to or connected to the core switch. The aggregation layer is the core of traffic forwarding, which realizes the traffic forwarding of the external network and resource pool nodes and the traffic forwarding between the nodes within the node. But with cloud data increase the size of the center, the deployment of application systems increased, business needs are not overlap, network capacity has gradually become the cloud data center evolution bottleneck[1].

Therefore, the situation of the network device is not increased, how to make a more flexible and reasonable allocation of resources in the network is a key issue that needs to be solved urgently. At this point, the next generation of programmable networks, the SDN network architecture for the cloud center network resource management for a new solution.

II. SDN TECHNOLOGY

SDN is a new type of network architecture, which is adapted to cloud computing virtualization of the needs of the network after the development of virtualization, and its core thinking is through the decoupling of network equipment hardware and software, open to the user network can be compiled ability to achieve business and network decoupling. SDN implements a network resource pool and as a service provider, the release of the network flexibility, openness and creativity. Based on SDN to build cloud computing bearer network, can solve the cloud number according to the central network with the business, the calculation and storage of new technology adaptation problems, and provides architectural support for adapting new traffic models.

SDN's broadest definition points to the upper application of open resource interfaces,

To achieve the software programming control of various types of network architecture, the current gradually formed each technology, the technical schools of the maturity, applicability are different[2].

Corresponding author: cxsd2007@163.com

III. Cloud Data Center Network Logic Architecture

SDN technology based cloud data center network solution as a whole logical architecture is generally composed of management plane, control plane, data plane. Management plane composed of management modules, to achieve network abstraction, provide tenant network self-configuring self-service, while providing northbound API interface, can achieve a unified management platform of the tube.

Control plane, by the control module, to achieve network topology, network resources, network services, network virtualization to provide control functions[3].

Data plane, by the virtual switch, virtual router, and other related components, network virtualization to provide two-tier exchange, three-tier routing, border services and other functions. Can be deployed on demand.

Traffic engineering has been the hot topic of the Internet, which since the birth of SDN more prominent. SDN control plane intelligent processing features and centralized control mechanism for traffic engineering, especially data center traffic engineering provides a superior support platform. In distributed cloud data also flow engineering, both data also in the internal flow control, or data flow between the scheduling, SDN can provide a flexible solution.

In order to solve the problems encountered in traffic engineering, The use of SDN technology can quickly achieve centralized traffic engineering. The most common method is through the use of the current network resources and the use of the characteristics of the data flow for the data stream selection of the optimal forwarding path diameter, to ensure that the data is also low cost and efficient operation. Which is an urgent need to solve the problem is how effective identify the size of the data flow, especially in the data center.

IV. Implementation of Bandwidth Allocation Adjustment Module

In the actual environment, the bandwidth allocation adjustment module specific implementation method is: the use of Linux internal flow the synergistic effect of TC (Traffic Control) and Open vSwitch. Open vSwitch itself is not capable of rate limiting, but VM is and Open vSwitch phase in the cloud data center, the control of the virtual switch is more flexible and convenient. At the same time, because Open vSwitch can run as kernel state, so it can call the Linux TC function module, the virtual setting, limiting and adjustment of the sending rate of the machine. The following first describes the Linux flow control mechanism, and then outlined how it works with Open vSwitch.

In order to adapt to the rapid development of computer networks and the rapid growth of network data, and some network flow the demand for quality of service has increased in the new version of the Linux kernel network protocol QoS function, to achieve the guarantee of service quality. Linux is the most frequent use of the output direction of the flow control, and rarely use the input direction of the flow control.

At the link layer, each packet is passed through the neighbor subsystem and then based on the queuing procedure of the output network device to determine whether to send through QoS, or directly call the network the card driver registers the send function to send the packet. In the case of QoS enabled, the packets to be sent are first queued into the QoS queue and then the live packet output soft interrupt, and finally in the packet output soft interrupt routine, from the QoS queue to obtain priority level of the highest packet, call the function of the packet output to the network device.

Traffic Control(TC), Linux system is under the open source software, integrated in the Linux kernel version, it can also and Linux kernel in a variety of racks structure work together. TC is mainly composed of three components: the queue rules, classes and filters. In the case of traffic control enabled, each network device, such as a network card, will be configured with at least one row team rules. When the data to be sent is output to the link layer, it is queued to the queue of the queuing rules, wait for the sending of the data to be sent, and the rest of the data must not be removed before transmission freed. At present TC has achieved a variety of queuing rules, including simple first-in first-out, CBQ(class-based queues) and HTB (hierarchical token bucket).

The class definition is closely related to the queuing rules in the queuing rules and can be distinguished by queuing rules sent data. In the queuing rules, the sent data can be allocated to different classes. For example, according to the hair send the priority of the data to classify. Queuing rules can have no class or multiple classes. A sort of row team rules can have multiple classes, which contain queuing rules.

The filters are often used to allocate sent data to the classification of queuing rules. A matching bar for a filter. The pieces may contain several pieces, which are matched according to the matching conditions and, if so, according to the queuing rules, only two

interfaces are provided team and team operations. The Enqueue interface checks the data to be sent according to the filtering rules and is filtered by the filter match the data stream into the matching class. If there is no matching filtering rule, you can pass the default filter to allocate. There are other queuing rules behind the classification, the whole structure is like a tree, with the outside interface is the root lined up rule.

In order to achieve the effective scheduling of network resources and flexible control, SDN controller design generally consider the following aspects. Network programming capabilities, network programming capabilities mainly refers to the controller can be applied to the upper application of the north interface, easy to write network applications to accelerate network innovation. Application developers can use the public API provided by the controller to develop web applications, conduct a network experiment. SDN proposed one of the purposes is to solve the rigid problem of TCP / IP network to accelerate network innovation, therefore, the network programming ability of the controller is an indispensable part of the controller. The network isolation ability, the current network application is developing continuously, and many new requirements are put forward for the network control. According to the center on the requirements of the way through virtualization, the physical network can be separated into a number of non-affect the part, so the network control equipment is bound to provide more granular control of the network to provide network isolation interface; reliability, because the SDN controller is the core part of the network, all the switches have to request routing decision to the controller, so the reliability of the controller is very important, once the controller occurs a single point of failure, the entire network will be paralyzed. On the one hand control, the need for the network of abnormal circumstances can be effectively handled to enhance the reliability of the network. On the other hand, need to study more controller of the collaborative backup mechanism, when a controller fails, you can control the function immediately transferred to the backup control scalability, with the network size continues to expand, the number of forwarding devices in the network rapid growth, a single controller of the performance may not be sufficient to deal with large-scale network events, and network control on the delay of demanding, so the need for control equipment scalable, can be used in large-scale network without failure[4].

V. Dynamic Traffic Scheduling Algorithm Flow

First, the OpenFlow controller will continuously monitor the health of the network through the sFlow collector, calculate the link utilization and the presence of elephant flows in the network. The controller will then decide which elephant streams should be re-scheduled at the same time topology of the network and the utilization of the link calculate a new feasible path. Finally, when the controller calculates a new route for the elephant stream, the controller will send an OpenFlow "flow_mod" message informing the switch to modify the flow table, and the switch routes the traffic to new route.

The controller updates the flow table entries in the switch in two ways. The first is that the controller sends the "ofpfc_add" to add a new flow entry to the flow table, but because the original flow table entry still exists, the new flow table entry is preferred level set higher. When the flow table matches, it will first match the high priority flow entry. When the low priority stream entry is long can not match the time, because the timeout does not delete, so as to achieve the purpose of updating the flow table.

Another way is to send message by the controller to modify the original flow entry of the switch. The Action field is modified to forward from the new port. The OpenFlow switch will receive the message. First in the switch flow table to find the matching flow table entries, if the match is successful, according to message modify the action field of the flow table entry, and if it is unsuccessful, add a new flow entry with the specified Action and matching fields[5].

IWe use the second way to re-route the elephant stream, because this approach is more conducive to the measurement of convection. The whole process, from the detection of the elephant flow to the calculation of the link utilization, then the controller dispatches the elephant stream to generate a new flow table entry and then to the last reroute is a complete control loop. The controller continually scans the elephant stream based on the measured feedback, the elephant reroute of the traffic also affects the network state, so the controller should run the traffic scheduling application to continuously schedule the traffic to improve the overall utilization of the network.

VI. Conclusion

With the increase in the size of the cloud data center, the cloud data center network asked has become increasingly prominent, the traditional network architecture has been unable to meet the cloud computing data, based on the SDN concept of the network, by decoupling the network equipment hardware and software, the release of the network flexibility, openness and innovation, to solve the

cloud data center in the development process encountered bottlenecks, to achieve the user traffic in the cloud data center flexible deployment and optimization, in improving the quality of service while also improving the user's service experience.

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