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Service-aware Adaptive Link Load Balancing Mechanism for Software-Defined Networking

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ABSTRACT

A Service-Oriented Load Balancing Mechanism for Software-Defined Networking is proposed to resolve the problems of network load imbalance and the scalability in control plane. The main research works includes: Firstly, a load balancing model is proposed for distributed controllers. In the model, the flow-requests information among the switches is used as the basic unit of the controller, all controllers publish respective the total of the flow-requests periodically and flow-requests deviation mean is introduced to aware load status for controllers. On this basis, a load balancing algorithm is proposed based on load-aware. This algorithm uses flow-requests information allocation strategy, taking into account the current load and propagation delay of idle controllers and allocating partial the flow-request information of the overload controller to the idle controller with the minimum of flow-requests deviation and propagation delay. In order to avoid inconsistency of the network status caused by performing load balancing algorithm at the same, each controller maintains a flow-request deviation the mean table and the overload controller performs the load balancing algorithm based on the magnitude of the value in the table. Secondly, service-aware adaptive link load balancing mechanism is designed which can aware the service types using the northbound interface and monitor the state of the network periodically. Adaptive link load balancing algorithm is proposed and the link weight is introduced based on QoS-aware, which measures the comprehensive quality of link through acquiring real-time QoS parameters. So the mechanism can select the path of the best link quality in the current to forward data, reduce the imbalance of the load distribution in the network. Meanwhile for different service types, dynamic QoS routing optimization strategy is proposed further. It adopts the Lagrange relaxation technique to compute a path which meets the QoS constraint. Experimental results show that the proposed mechanism can effectively balance the network traffic, the average utilization of link bandwidth up to 79%, and achieve QoS guarantee for different services.

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1. Introduction

The international academic community for the future development of the Internet and new technology research, explore and test work in large scale, the world has also begun large-scale construction of the future research of the Internet architecture and the future network test platform, such as the United States GENI^[1], European FIRE^[2], Japan JGN2plus, South Korea's K-GENI^[3] and China's SOFIA^[4] etc. The new design and deployment of future Internet architecture focuses on network architecture and network router^[5], there are two kinds of evolutionary and revolutionary idea^[6], the former does not change the existing

network structure, only to the shortcomings of the current network architecture for incremental improvements, such as RSVP protocol, CIDR protocol and Mobile IP protocol etc. The latter should completely abandon the existing architecture, redesign new network architecture of current network development needs, fundamentally solve the problem, such as SDN^[7] (Soft-Defined Networking) and NDN are the product of revolutionary ideas. Software defined network is a revolutionary new network architecture proposed by Stanford University. When the controller fails, the SDN network can not make the corresponding forwarding path for the data stream, so the whole network will be collapsed. Therefore, the

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