Paper Evaluation, B4: Experience with a Globally-Deployed Software Defined WAN

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1. Paper summary

The paper focuses on Google's WAN, B4, using Software Defined Networking (SDN) principles and OpenFlow to manage individual switches due to the expensive and inefficient WAN and the substantial bandwidth requirements. Using SDN architecture, it can simultaneously support standard routing protocols and centralized Traffic Engineering. The detailed approach for the SDN architecture is to logically separate to three layers, which are switch hardware layer for traffic forwarding only, site controller layer consisting Network Control Servers, and the global layer containing logically centralized applications. The authors adopted BGP and ISIS as the routing protocol between peers because of its isolation property and deploy routing and TE as independent services separately for easier development.

2. Top 3 contributions

1. The first paper to build B4 around Software Defined Networking and OpenFlow so that make it achieve the level of scale, fault tolerant, cost efficiency, and control required for today's network using traditional WAN architectures.

2. B4's centralized TE service make it possible for links to achieve near 100% utilization and realize balance capacity by splitting application flows among multiple paths.

3. The authors built their own hardware switches to solving the problem of no existing platform could support an SDN deployment. By moving most software functionality off, it can achieve fewer, larger switches yields management and software-scalability benefits.

3. Problems

1. In the hardware switches, OpenFlow Agent (OFA) is the bridge between OpenFlow's version of forwarding table entries and the switch silicon's packet processing pipelines. However, OFA supports only a subset of OpenFlow and it don't support configuration on VRF interfaces on the OFA switches.

2. To support both shortest-path routing and TE, multiple forwarding tables need to be supported. There are LPM table lookups for Routing/BGP protocol, the Access Control List (ACL) table lookups for TE, and the ECMP hashing. The routing process is too complicated and may cause long queue in the buffer.

3. It still faces the challenge that a TE session cannot be established caused by the control plane or software failures.