



SIMPLIFIED SOFTWARE DEFINED NETWORKING (SDN) WITH ALCATEL-LUCENT OMNISWITCH OPENFLOW API MODE

APPLICATION NOTE

INTRODUCTION

The virtualization of enterprise computing resources has changed the way network architects design enterprise networks. Efforts to manage the dynamic nature of these virtual environments and maximize a network's ability to support business critical applications have led to the adoption of Software Defined Networking (SDN). An SDN framework bridges the gap between the network world and a virtualized computing world with standard Application Programming Interfaces (APIs) that enable the interaction of applications with the network. It offers a way for the requirements of applications to influence and even direct network infrastructure operations.

The OpenFlow™ protocol standard is widely used in SDN-enabled networks to allow SDN controllers to direct the flow of network traffic. It provides direct access to and manipulation of the forwarding plane of network devices, such as switches and routers, over a network. This includes both physical devices and virtual switches. In this way, it allows the path of network packets through network switches to be determined by software running on multiple routers.

In a typical OpenFlow operation of Local Area Network (LAN) switches, all traffic received on the switches' ports is managed by an assigned controller. However, there is a big drawback to this approach. Large networks that rely on OpenFlow controllers require a high level of computing power to enable the controller to handle all necessary control plane operations.

Alcatel-Lucent Enterprise has implemented OpenFlow capabilities in most of its current OmniSwitch™ LAN switches. With OpenFlow, network architects can use these switches to design, build and manage an SDN-based network. In addition, Alcatel-Lucent OmniSwitch LAN switches offer an OpenFlow API Mode, which allows an enterprise network to benefit from SDN and OpenFlow without the need for a high level of computing power.

OMNISWITCH OPENFLOW API MODE

Many enterprises have a traditional network, but would like to use an SDN approach to enhance or improve one or more aspects of the network's operation. The OpenFlow API Mode offered by an OmniSwitch OpenFlow agent — the software that communicates with a controller — has been built for this purpose.

When enabled, the OpenFlow API Mode connects to a single OpenFlow controller that can insert flows into the normal packet forwarding logic and alter the treatment of frames to suit higher level application requirements it has received. These flows are essentially Access Control List (ACL) entries that provide the controller with a variety of ways to modify the handling of packets to match flow requirements. The available actions include packet redirection, quality of service (QoS) adjustment, drop, or modification. Packets that do not match flow requirements are forwarded based on normal OmniSwitch configuration and forwarding processes.

The OmniSwitch OpenFlow API Mode uses a standard OpenFlow protocol mechanism that dictates normal packet forwarding processes for a packet that does not match flow requirements. Compatible controllers can monitor and modify the network as needed without having to manage the entire network operation. The OpenFlow API Mode also supports normal OpenFlow controller and agent actions, such as topology discovery, statistics, and packet relay between an OpenFlow controller and agent.

Normal OpenFlow operation requires explicit configuration for each port to assign the OpenFlow controller. The OmniSwitch OpenFlow API Mode can operate on all switch ports with minimal configuration and can be configured at the switch level. The OpenFlow API Mode controller can then access all ports not configured for normal Openflow control.

PRACTICAL EXAMPLES

The OmniSwitch OpenFlow API Mode is ideal for many applications. With OpenFlow API Mode, a compatible controller can communicate with an OmniSwitch to learn the topology of the network, and it can use external rules or information from other sources to make decisions about how to modify the flow of traffic in the network. The inputs to the controller can be from requirements established by administrators or critical applications. Given the actions available to controllers, the OmniSwitch with OpenFlow API Mode can enable network functions such as:

- **ACL policy distribution:** The OpenFlow controller will program a set of ACL rules into the needed devices in the network.
- **On demand Switch Port Analyzer (SPAN):** The controller can insert flows anywhere in the network to forward the traffic from a port on an OmniSwitch device to a network analyzer.
- **Real-time network protection:** If the network is using sampled flow (sFlow) or similar network sampling tools, the analyzer can trigger event reactions by updating an OpenFlow controller to filter or redirect suspect traffic through the API mode, wherever it is detected in the network.
- **Real-time network optimization:** As conditions change in the network, such as the initiation of a high priority file transfer, a controller can react by inserting flows to ensure that the specific transfer receives the necessary QoS or is redirected on the most optimal path.
- **'Elephant flow' load balancing:** An OpenFlow controller can monitor the flows and use of specific network links and can redirect 'elephant' flows to alternate paths so that those links are not congested, resulting in unnecessary frame loss.
- **Wireless LAN (WLAN) controller bypass:** A WLAN controller can detect the initiation of a high bandwidth flow between two wireless clients and can inform the OpenFlow controller to redirect that particular flow along a shorter path so that the WLAN controller can be excluded from high bandwidth flows.

BENEFITS

OpenFlow API mode on the Alcatel-Lucent OmniSwitch enables network architects to optimize and even protect their networks for their critical applications. It can be used in many ways to dynamically enhance the operation of an enterprise network while retaining normal functions. This mode of working provides many benefits, including:

- The traditional network with OmniSwitch remains operational with or without the OpenFlow controller.
- Lower computing resources are needed to manage the SDN functionality in a network.
- Modern applications can take advantage of SDN without network architects converting the entire network to OpenFlow control only.
- Network statistics can be interpreted and flows can be fed back to the OmniSwitch to optimize traffic.