Production-ready SDN with OpenFlow 1.3

OpenFlow is the industry’s only standards-based protocol to implement SDN

What is OpenFlow?

OpenFlow provides programmatic access to the data plane. It does this by providing a forwarding abstraction and a wire protocol that is used to communicate with an SDN controller. Development of OpenFlow began in 2007, led by Stanford University in collaboration with HP, and its 1.0 release was published in 2009. The standardization of OpenFlow transitioned from the academic community to the Open Networking Foundation (ONF) in 2011. HP, one of the ONF’s founding members, and the other 90+ member companies, have driven the development of OpenFlow through three major iterations. This paper outlines how OpenFlow 1.3 enables production-ready SDN, and why this matters to you.

Essential enhancements for production networks

The OpenFlow 1.3 specification was released by the ONF in September 2012 with the goal of enabling widespread adoption. This milestone release boasts significant enhancements to capabilities for enabling production deployments, including enhancements from previous 1.1 and 1.2 specifications that were not widely implemented by equipment vendors. Let’s evaluate some of the key features that are required for production-ready SDN.

OpenFlow 1.1

Multiple tables
OpenFlow 1.0 originally supported a single logical table for implementing flow rules. This limited the full utilization of hardware ASIC capabilities. With multiple tables, OpenFlow can now take advantage of the unique characteristics of each hardware table to increase performance and scalability.

Groups
With the addition of groups, OpenFlow can create group of ports, similar to link aggregation in legacy networks. This can be used for multipathing or redundancy.

MPLS and VLAN tag support
OpenFlow originally supported VLANs in a limited fashion. With this enhancement OpenFlow now has robust support for VLANs, QinQ, and MPLS tags. These capabilities provide additional flexibility in programming the forwarding plane with rules that can match against more information contained in Ethernet packets.

Virtual ports
Virtual ports extend OpenFlow beyond physical ports. The concept of virtual ports, or logical ports, enables OpenFlow to be used across LAGs or tunnels. This enables OpenFlow to be used to implement network virtualization for multi-tenancy at scale.

Controller connection failure
On losing connection with the controller, OpenFlow 1.0 offered an emergency flow cache which, in practice, was difficult to implement. The latest version of the specification adds two simpler modes to deal with the loss of connectivity with the controller. In fail secure mode, the switch continues operating in OpenFlow mode until it reconnects to a controller. In fail standalone mode the switch reverts to using normal processing (Ethernet switching).
OpenFlow 1.2

**Extensible match support**
OpenFlow 1.2 enables a flexible expression of match criteria and the inclusion of new match fields by replacing the static fixed length match structure with a new TLV-based structure called OpenFlow Extensible Match (OXM), which dramatically increases flexibility.

**Basic IPv6 support**
OpenFlow 1.2 provides basic support for IPv6 using the OXM.

**Controller role-change mechanism**
This is a simple mechanism that allows the switch to be aware of a controller’s role, allowing failover from a primary to a secondary controller, for example.

OpenFlow 1.3

**Expanded IPv6 support**
The IPv6 support in OpenFlow 1.3 has been expanded to cover IPv6 extension headers using the OXM.

**Per-flow meters**
OpenFlow 1.3 brings support for per-flow meters. These can be attached to flow entries and can measure and control the rate of packets. One of the main applications of per-flow meters is to rate limit packets sent to the controller.

Provider Backbone Bridging tagging
OpenFlow now supports matches and actions for Provider Backbone Bridging tags. This allows an OpenFlow network to be multi-tenant aware.

Tunnel-ID metadata
The tunnel-ID metadata is a new OXM field that exposes the OpenFlow processing pipeline to metadata from a logical tunnel port. This metadata can be used to specify encapsulation and decapsulation of packets.

How to get started
With the release and commercialization of OpenFlow 1.3 on several HP switch platforms, you can now start deploying production SDN-ready infrastructure and begin the journey to software-defined networking. HP has outlined key steps to help you embark on your journey.

Now is the time to get started with SDN and HP makes it easy with its broad support for OpenFlow via free software upgrades. HP is the first company to offer OpenFlow 1.3 support on a mainstream platform—the HP 5900 Series—and HP customers using OpenFlow 1.0 today can upgrade to 1.3, as it is made available across the portfolio with no additional licensing or costs.

Learn more at hp.com/networking

Figure 1. Getting started with SDN

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OpenFlow version history

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