

- Hardware Abstraction Layer Specification mapping OpenFlow 1.3.1 pipeline to StrataXGS[®] Network Switch Architecture.
- Enables OpenFlow 1.3.1-compliant programmability for StrataXGS Network Switch-based platforms.
- Leverages Open Networking Foundation (ONF) Forwarding Abstractions Working Group proposal of negotiated abstractions.
- Scalable OpenFlow switch pipeline utilizing both SRAM-based hash tables and TCAMs.
- Improves Latency and Throughput of Flows due to reduced dependency on controller.
- OpenFlow 1.3.1 support enabled on existing and widely deployed StrataXGS Switch Silicon.
- Enables OEMs and ODMs to offer OpenFlow 1.3.1 support on their deployed platforms via a software upgrade.
- Portable across various network switch devices in the StrataXGS and StrataDNX architectures.
- Rich API library allowing for integration with OpenFlow 1.3.1 agent software and implementation of popular software-defined networking use cases.
- Enables popular software-defined networking use cases like Virtual Tenant Networks, Network Virtualization, Traffic Engineering, and Service Chaining.

OF-DPA	
✓	Data Center
✓	Service Provider
✓	Enterprise

OPENFLOW SOFTWARE

OF-DPA

OpenFlow 1.3.1 Switch Pipeline Specification and Software

OVERVIEW

Broadcom's OpenFlow Data Plane Abstraction (OF-DPA) software enables development and deployment of scalable and high performance OpenFlow-based SDN applications on widely deployed Broadcom network switch-based systems. OF-DPA is compliant with the Open Networking Foundation (ONF) OpenFlow 1.3.1 specification. OF-DPA defines and implements a hardware abstraction layer that maps the feature-rich and industry-leading StrataXGS switch architecture to the OpenFlow 1.3.1 switch and pipeline.

The OF-DPA specification and API are openly published and provided with turnkey reference implementation on ODM and OCP-compliant switches to enable a community and academia-based development ecosystem. Any OpenFlow 1.3.1-compliant controller and agent can be integrated with OF-DPA to enable popular SDN use cases such as Virtual Tenant Networks, Network Virtualization, Traffic Engineering, and Service Chaining.

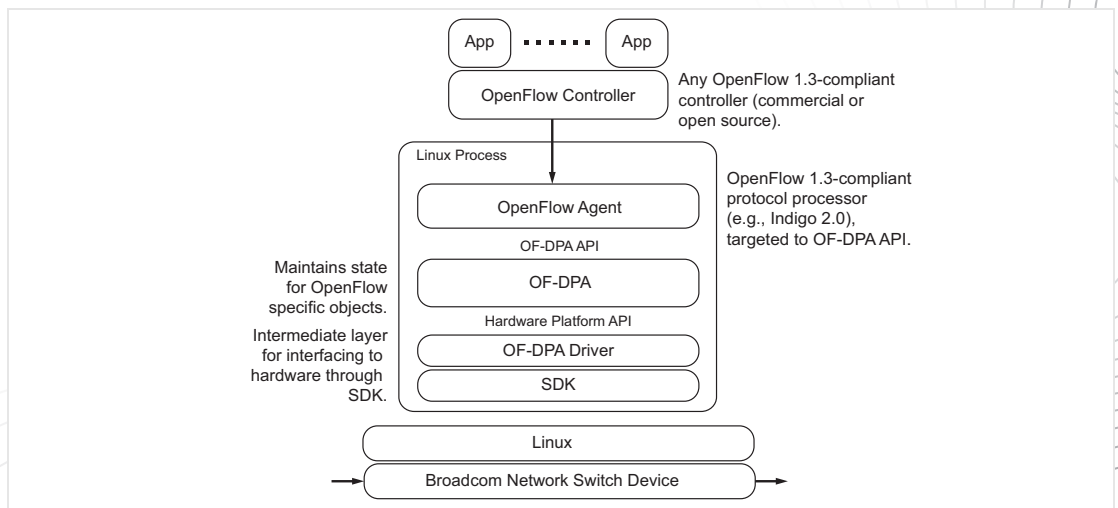
OF-DPA Software is available as a full-source package to OEMs and ODMs for development of full-featured OpenFlow switches. It is also available as an openly published Community Development Package on [GitHub](#). This package has the OF-DPA API header files and an Application Development Kit containing example code showing API usage, API guide and reference manual, and architecture specification—all released under Apache 2.0 license.

FEATURES

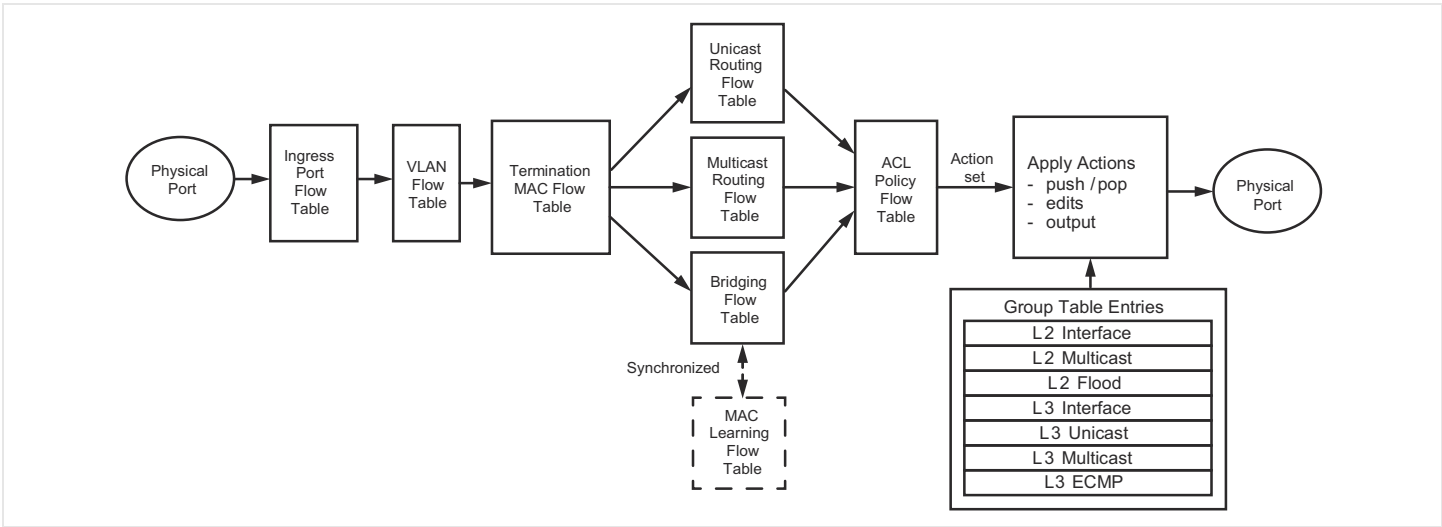
- Full-featured L2 bridging and L3 routing support.
- VXLAN Gateway support to enable isolated tenant forwarding domains.
- Wide-match Policy ACL support with actions such as redirect, drop, classify, mark, header field rewrite, etc.
- Vendor extensions where necessary, like Source Learning, where MAC learning flow table is synchronized with Bridging flow table and configuring logical ports.
- Maintenance of an OpenFlow object database with counters, timers, etc.
- Support for the following API classes: Initialization, Flow and Group table operations, Port, Queue, Packet Send and Receive, Event notifications, etc.
- Openly published Community Development Package with API header files and an Application Development Kit released under Apache 2.0 license.

BENEFITS

- Enables scalable, multi-table OF 1.3.1 implementations at wirespeed on systems based on widely deployed Broadcom network switch-based systems with software upgrade.
- Open specification and API enables community-based development and academia research.
- Enables OpenFlow 1.3.1 agent integration or implementation on Broadcom network switch-based systems.
- Accelerates migration to, and deployment of, OpenFlow 1.3.1 Switches.



OF-DPA Component Layering



Abstract Switch Pipeline for Bridging and Routing

DESCRIPTION

OF-DPA is a software component that provides a hardware adaption layer between an OpenFlow agent and Broadcom network switch devices. It is layered above the Broadcom SDK which, in turn, provides the lower-level driver for configuring, programming, and controlling the Broadcom network switch devices. The OF-DPA API presents a specialized hardware abstraction layer (HAL) that allows programming Broadcom network switch devices using OpenFlow abstractions. However, it relies on other software layers to process OpenFlow protocol messages (that is, an OpenFlow agent is required in order to create a complete OpenFlow switch using OF-DPA). To complete the picture, an OpenFlow Controller is required to field an OpenFlow deployment using OF-DPA enabled switches. [OF-DPA Component Layering on page 1](#) shows the relationship of OF-DPA with the other OpenFlow system components.

The OF-DPA Abstract Switch, as defined in the OF-DPA 1.0 specification, represents a

specialized instance of an OpenFlow 1.3 Abstract Switch. OF-DPA OpenFlow objects are programming points for Broadcom network switch devices. These include flow tables with action sets, group table entries, logical and physical ports, meter tables, and queues. OF-DPA manages hardware resources and states on behalf of OpenFlow. In addition, OF-DPA supports OpenFlow specific state such as aggregate counters and flow entry expiration

[Abstract Switch Pipeline for Bridging and Routing](#) shows the OF-DPA abstract switch pipeline for enabling L2 bridging + L3 routing. OF-DPA flow tables accommodate specific types of flow entries with associated semantic rules, including constraints such as which match fields are available, which instructions and actions are supported, how priorities can be assigned to flow entries, which flow tables entries can go to next, etc. The flow tables fully conform to the OpenFlow 1.3.1 specification. OF-DPA provides API calls to support interrogating tables for capabilities including supported match fields, actions, instructions, etc. They also include status properties such as current resource usage.

TARGET APPLICATIONS

- Virtual tenant networks: Create isolated virtual tenant networks using VLANs and header field rewrites.
- Network Virtualization: Create VXLAN overlays for tenant isolation by configuring logical ports and tunnel endpoints.
- Traffic Engineering: Implement Layer 3 ECMP CLOS networks and engineer elephant flows using Policy ACL flow table to dramatically increase application performance.
- Service Chaining: Transparently switch packets through a sequence of network functions or appliances by redirecting flows using Policy ACL Flow Table.
- Network Monitoring: Keep track of the network paths by collecting flow statistics with a full view of the network topology



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ABOUT BROADCOM

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