



SDN: Software Defined Networking

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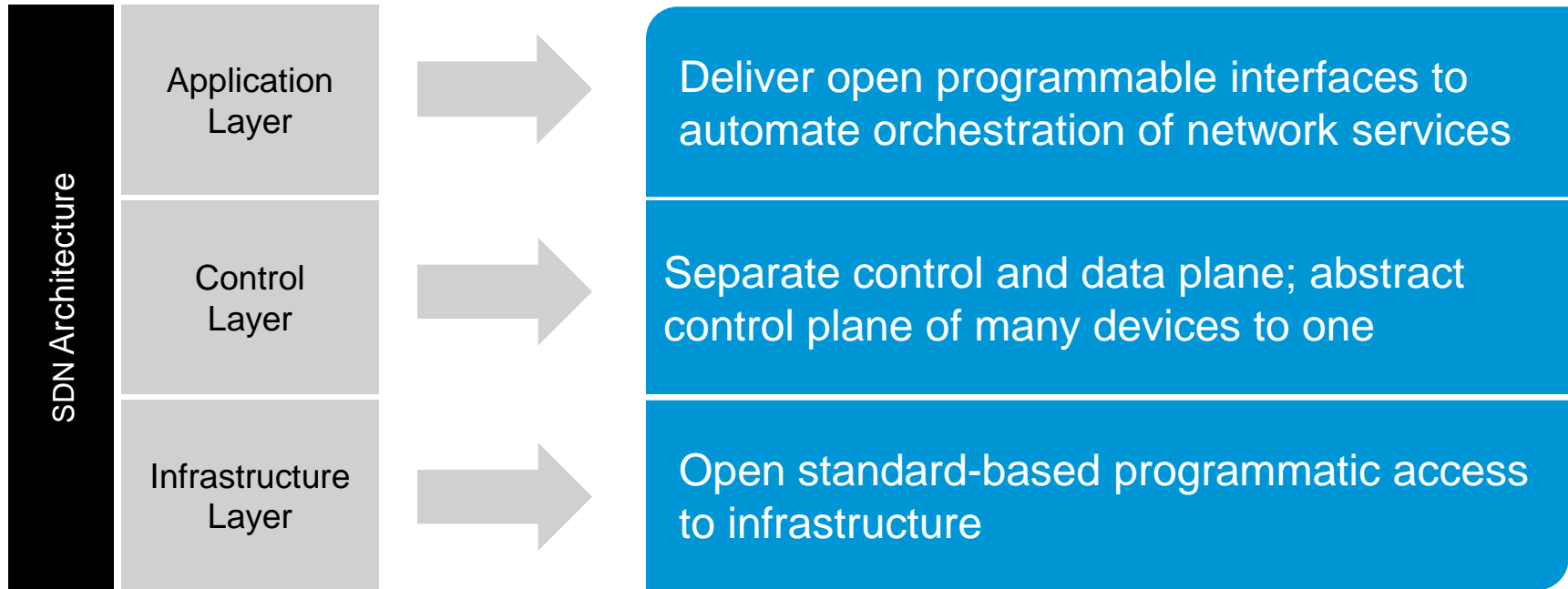
Open Networking Foundation on SDN

... In the SDN architecture, the control and data planes are decoupled, network intelligence and state are logically centralized and the underlying network infrastructure is abstracted from the applications ...



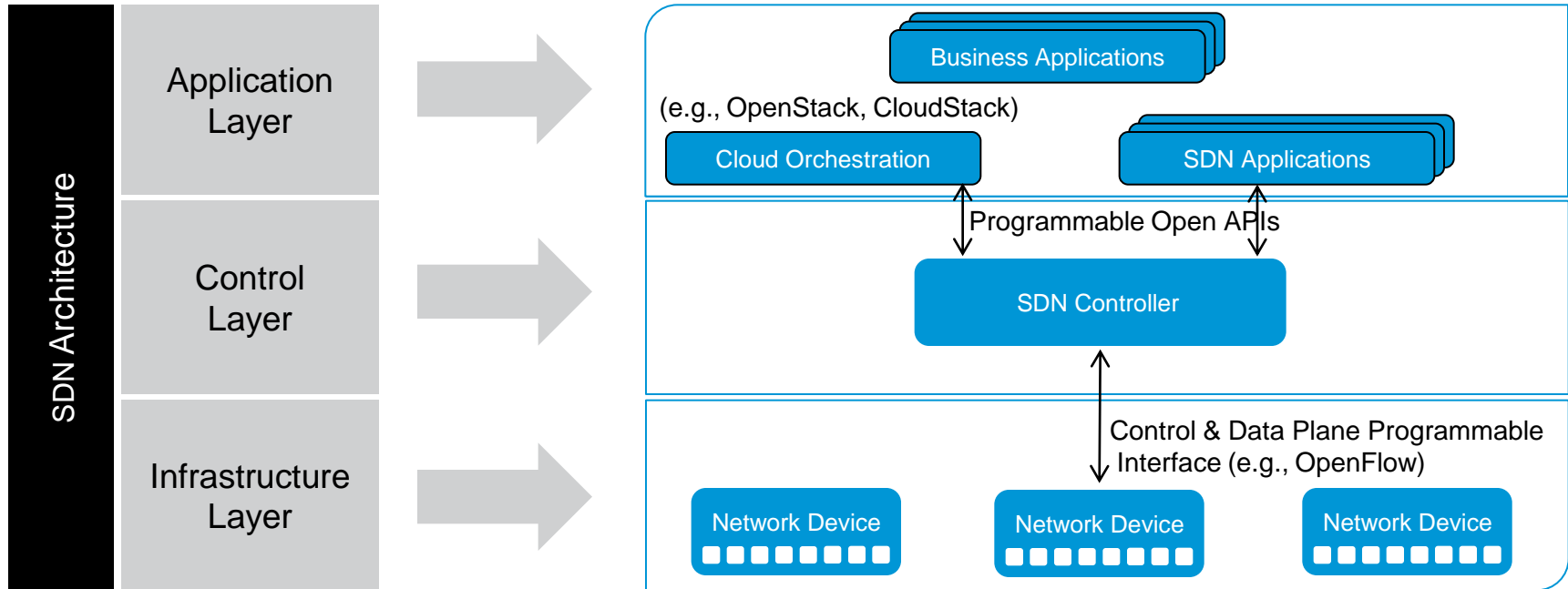
SDN Architecture

Ability to Apply Business Logic to Network Behavior in Dynamic Fashion



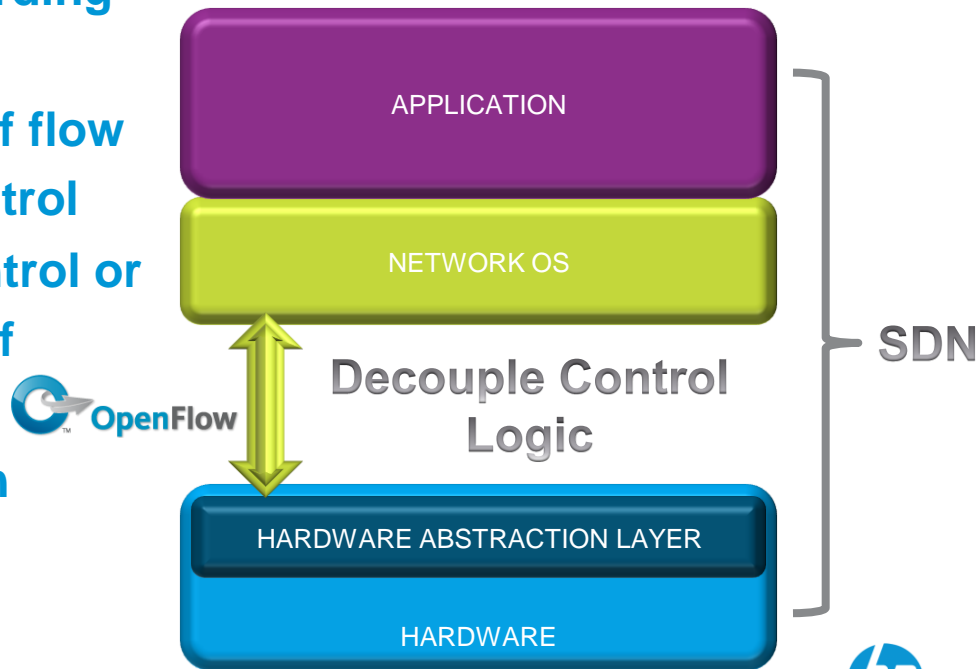
SDN Architecture

Ability to Apply Business Logic to Network Behavior in Dynamic Fashion

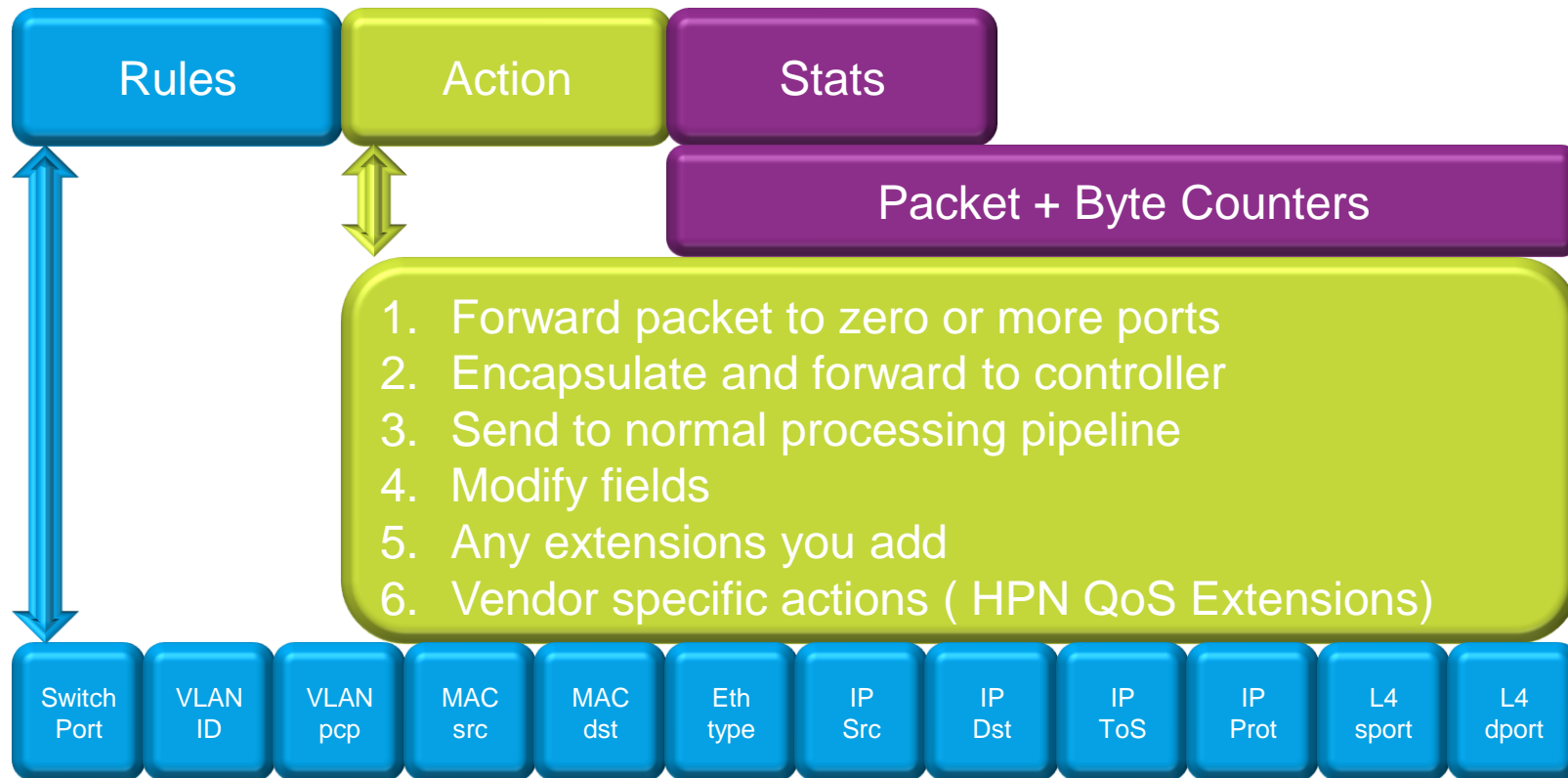


OpenFlow Protocol Overview

- OpenFlow is a protocol specification defining an API to the switch forwarding plane
- It enables selective centralization of flow control with variable grain flow control
- A controller can use this API to control or selectively modify the forwarding of traffic flows in the network
- It is a standard defined by the Open Networking Foundation (ONF)



OpenFlow 1.0 Table



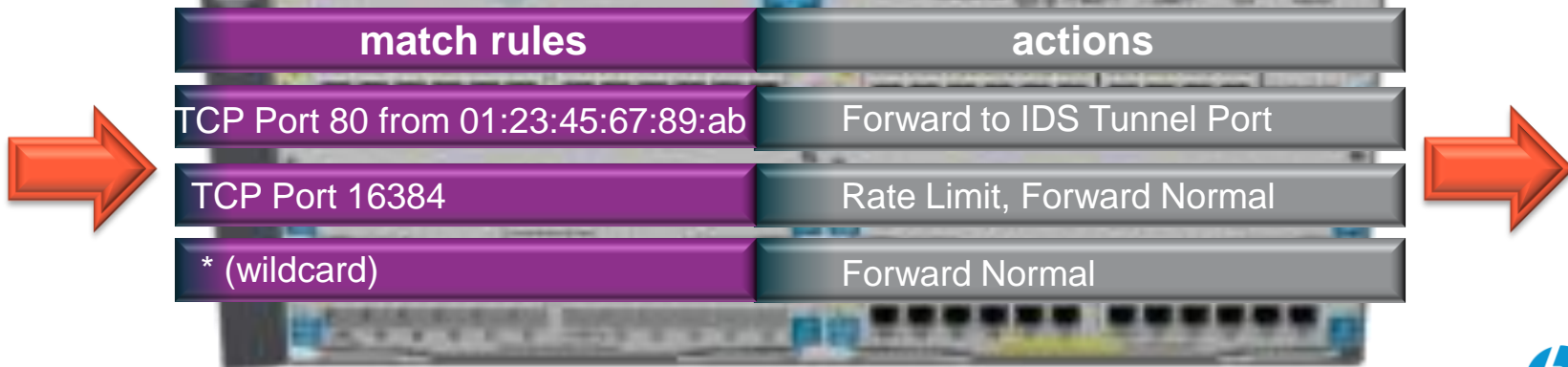
OpenFlow Switch Flow Table Example

Both fine and coarse
grain flow control
possible.

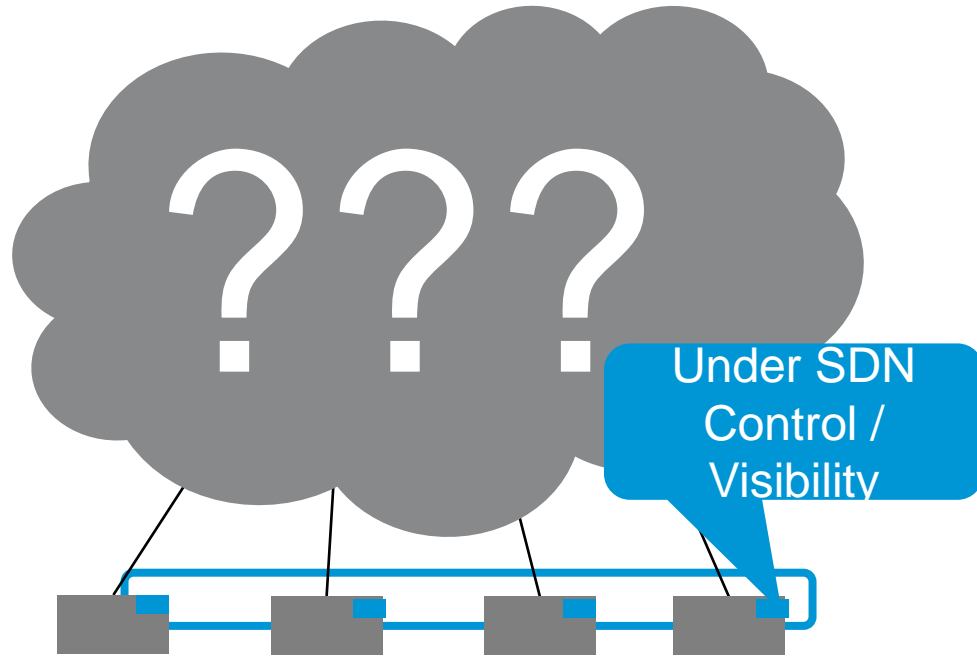


CONTROLLER

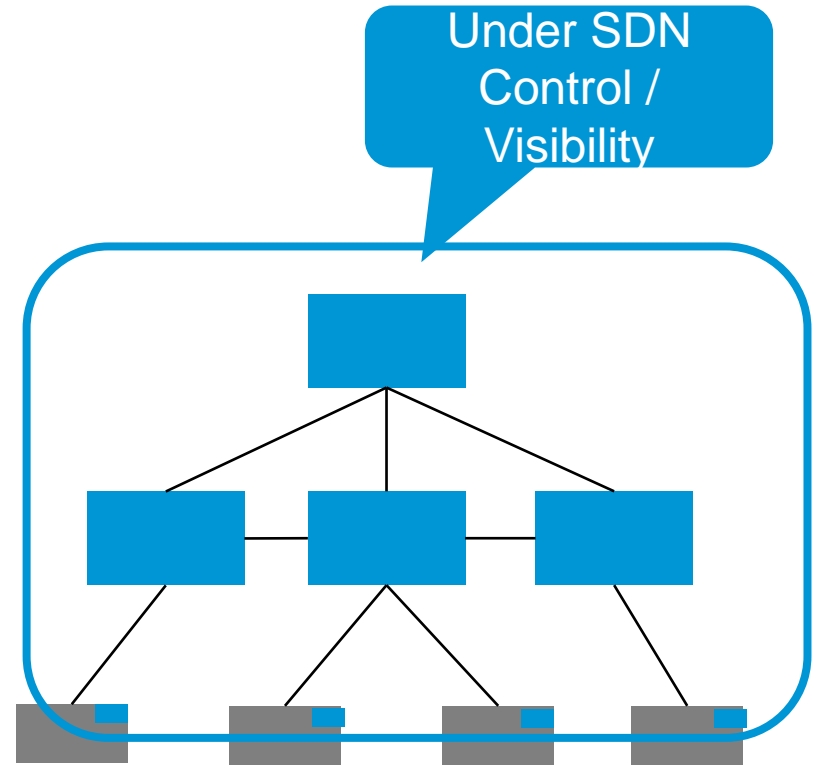
SWITCH



Overlay vs Full SDN



Virtual Server with vSwitches



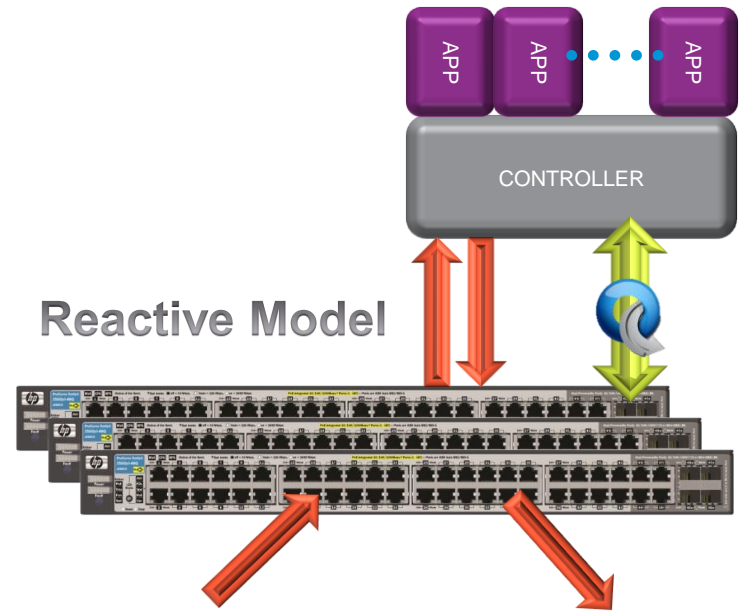
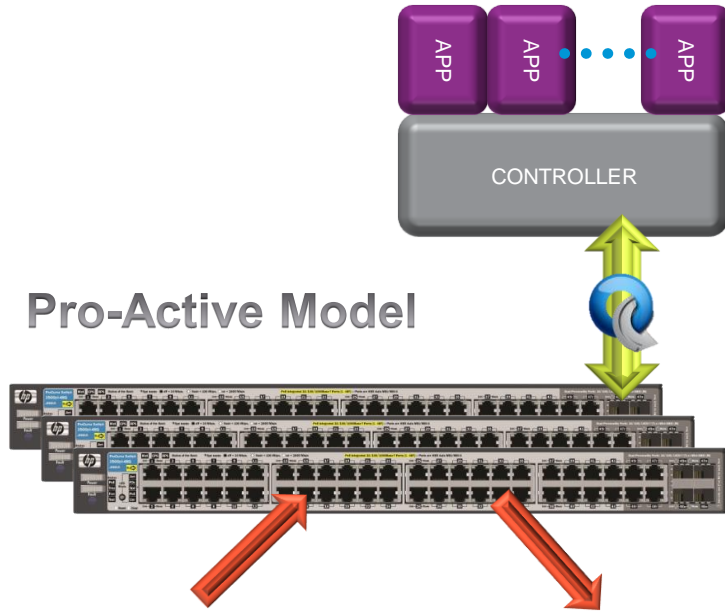
Virtual Server with vSwitches

Hybrid OpenFlow Switch

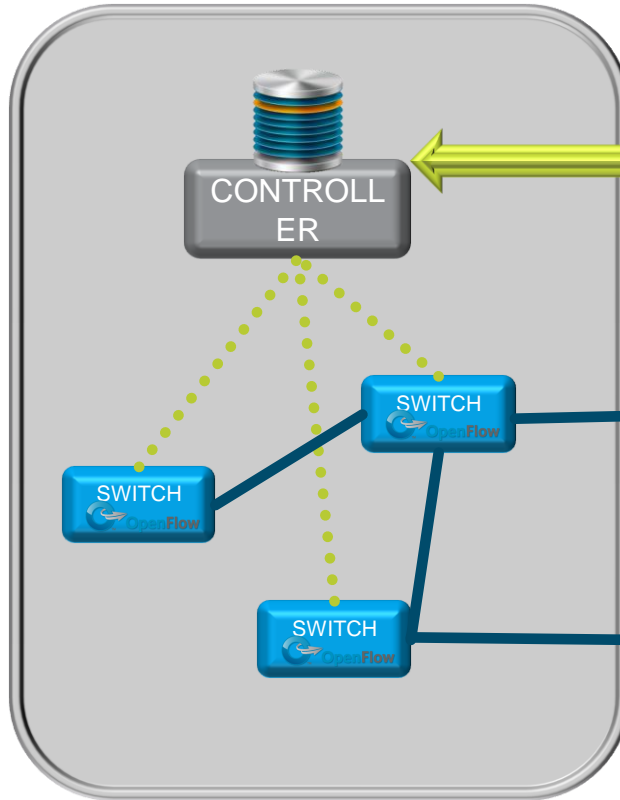
- **Ships-in-the-Night**
- **Operates as Two Independent Switches**
- **Two Forwarding Tables (FIBs)**
 - Traditional FIB – Source Mac Address and Routing Protocol Information
 - OpenFlow FIB – OpenFlow
- **Traffic Separation through OpenFlow Instances**
 - Configuration Commands are Applied Per-Instance



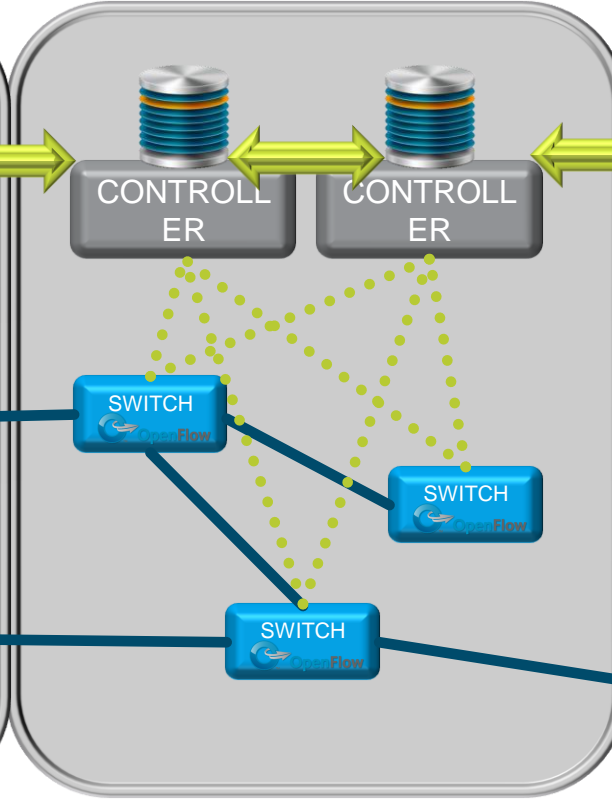
Pro-Active and/or Reactive Flow Table



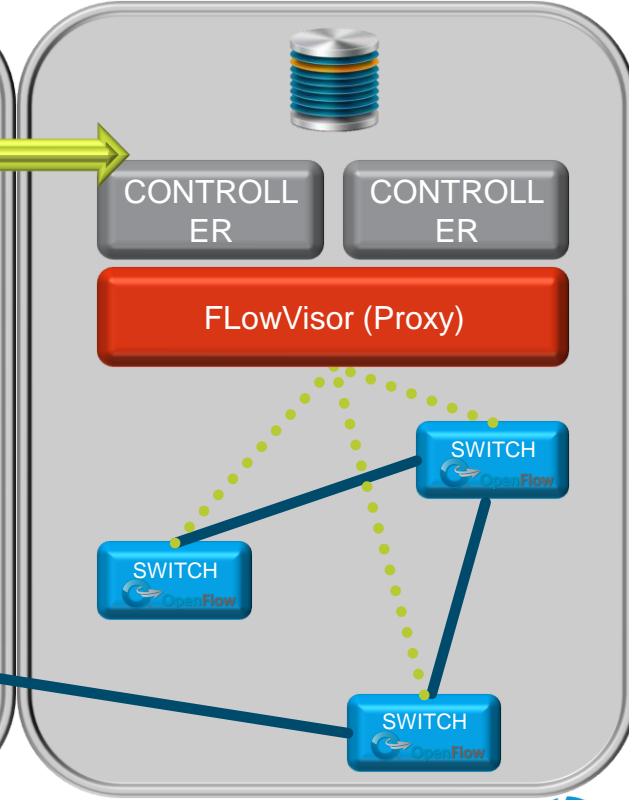
Centralized



Distributed



Parallel Control



Debunking SDN Myths

A Software-defined Network is Not

**Only Implementing
Network Functions in
Software or on
Virtual Machine**

**Only Programmable
Proprietary APIs for
Network Device or
Management System**

**The End of
Hardware
Innovation**



SDN uses for the Data Center

- 1. Slicing the network (multitenant private, public and hybrid cloud), flexible network configs creating custom topologies (2 tier, 3 tiers)**
- 2. Stretching the network. Extend LANs across racks in DC or interDC**
- 3. Automation & Orchestration. (NW, Compute, Storage, L2/3 & L4/7 service insertion)**
- 4. Visibility and troubleshooting – tap aggregation**

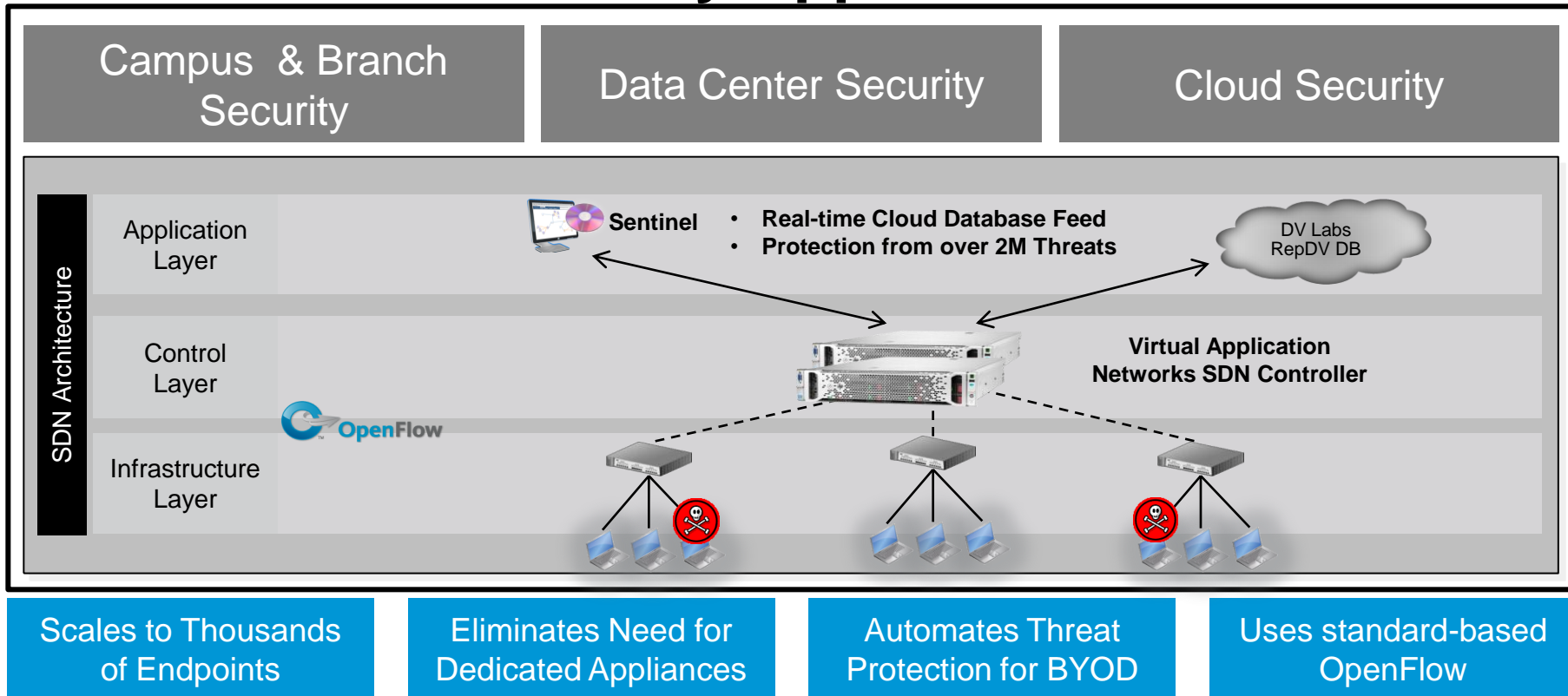


SDN uses for the SP

1. **Service chaining. L4/7 chain of function.**
2. **Dynamic WAN interconnect. Reroute dataflows to bypass bottlenecks (Google), dynamic flow rerouting (education space I2 research).**
3. **BW on demand. Programmatic interface for end user to request instant BW.**
4. **End to End Service Provisioning. SP DC all the way to mobile handsets with QoS, SLA.**



HBO: Sentinel Security Application Use Case



How do I start?

- 1. Several years incremental journey**
- 2. Select network equipment with support to OF**
- 3. Business use case where SDN can bring value
(Place in the network, goals, PoC)**
- 4. Get familiar with the technology and the ecosystem**



Thank you

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