FD.io/VPP OVS DPDK

An Comparison of Fd.io and OVS/DPDK

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Fd.io

ERICSSON
CISCO
intel
HUAWEI
6WIND
NXP
BROCADE
redhat.
PROJECT CALICO
SUPPORTED BY METASWITCH
PLUMgrid
MESOSPHERE
INOCYBE
OPENDAYLIGHT DISTRIBUTION
COMCAST
CAVIUM NETWORKS

Fd.io Introduction

- **Community**
  - Open Source Project
  - Linux Foundation
  - Open Governance Model
  - Active and Growing Community
- **Licensing**
  - Apache 2.0
- **History**
  - Internal of Cisco product: vRouter v9000 ACL products
  - Code dump: Cisco January 2016

- **Projects**
  - VPP - Core Engine
  - CSIT
  - NSH/SFC
  - ONE -- Overlays, LISP
  - Honeycomb
  - VPP Sandbox -- Bootstrapping hosting
  - More to Come

Fd.io

Full Layer 2 and Layer 3 Functionality

IP
- Complete IPv4 and IPv6 Stacks
- GRE, vxLAN, IPSEC, DHCP
- Neighbor Discovery, Router Advertisement
- Segment Routing
- MAP/LW46
- ARP Termination and Proxy ARP
- ...

MPLS
- MPLS over Ethernet with Deep label stacks

Layer 2
- Vlans -- single and double
- Mac Learning
- Flooding
- Input ACLs
- ...

Counters for Everything

Input Checks
- TTL, Header Checksum
- ARP

VPP Architecture -- How VPP Works

Packet Vector is Input to DPDK

Nodes on Graph Pipeline Process Packets According to Registered Dependencies

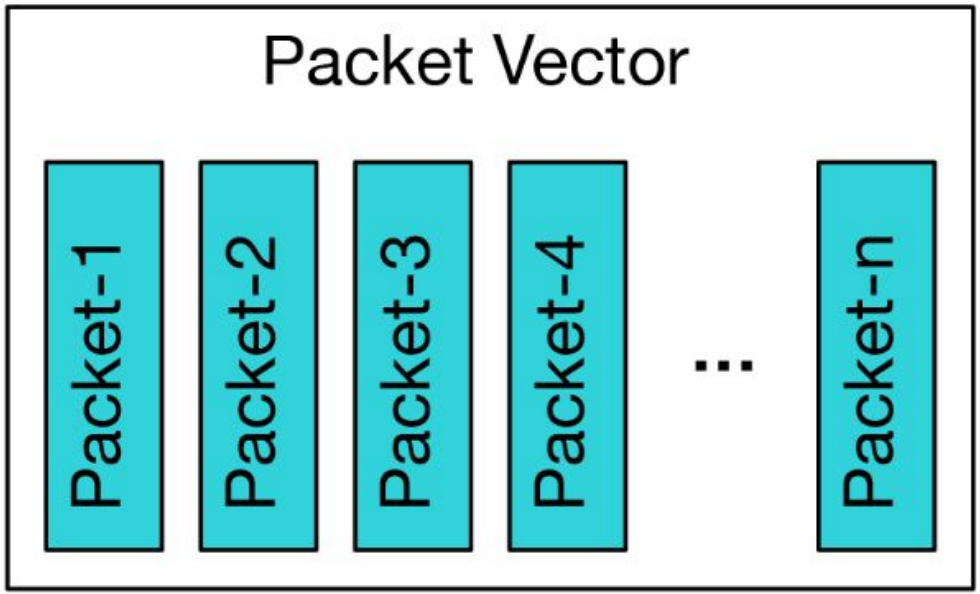
Additional Plugins can be Introduced to Create New Nodes

Examples:

VxLAN - NSH VTEP

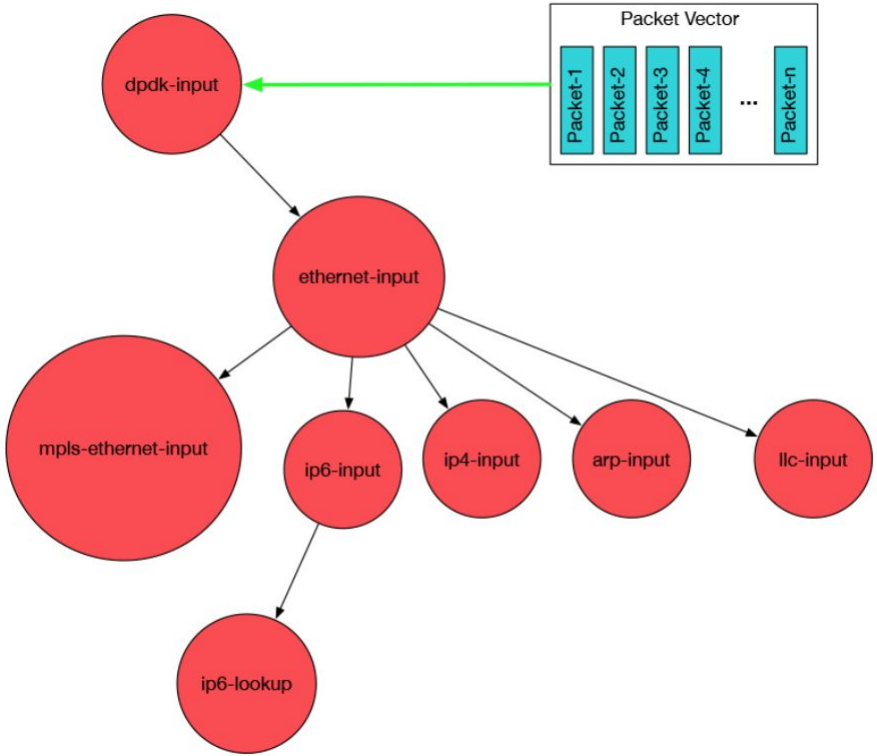
Fd.io (VPP) Architecture

VPP reads the largest available vector of packets from the network IO layer.



VPP then processes the vector of packets through a Packet Processing graph.

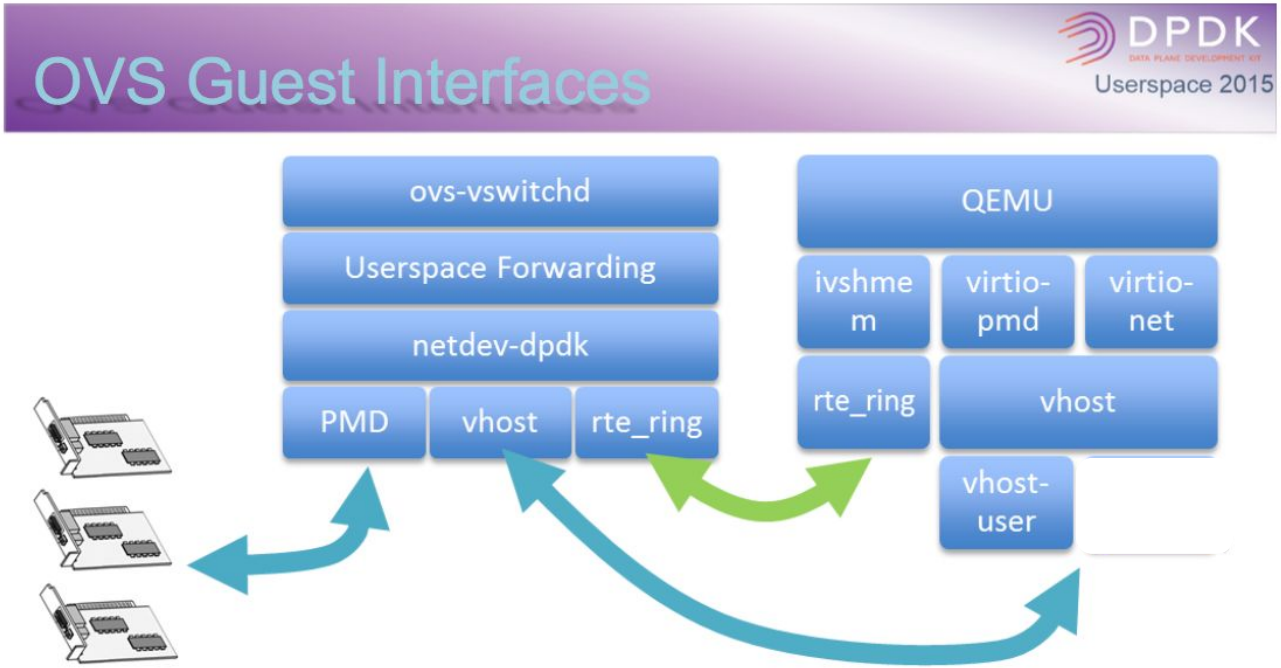
Fd.io (VPP) Architecture



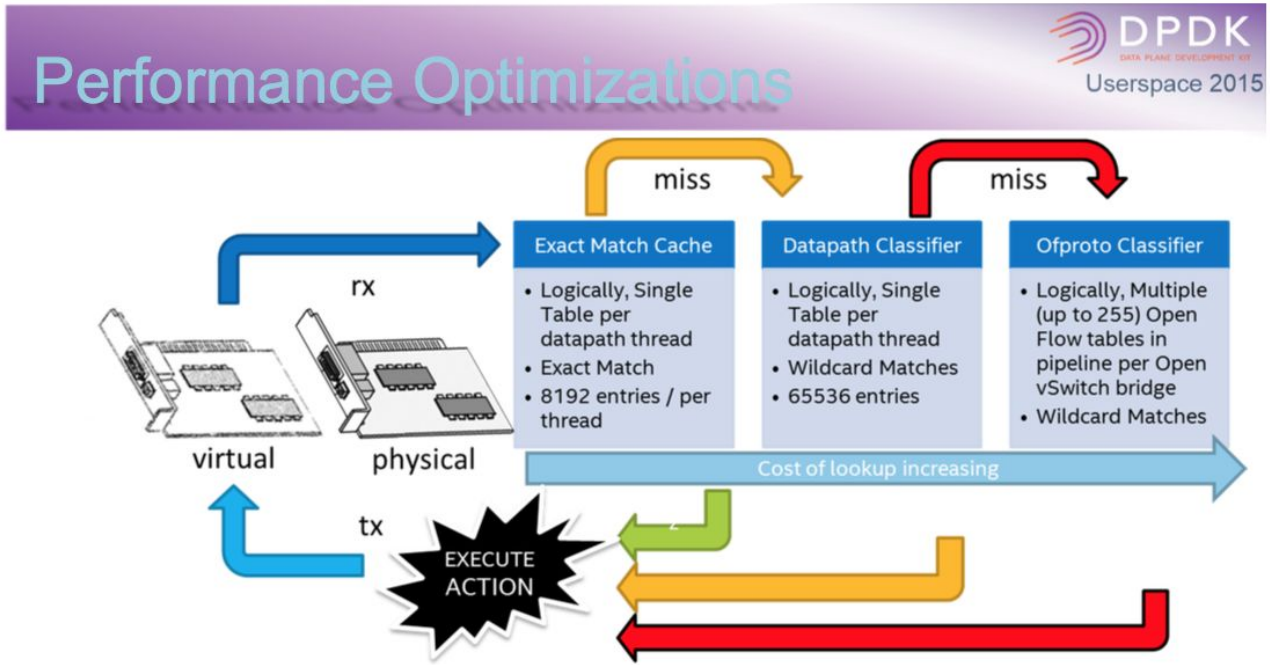
Fd.io (VPP) Architecture

Open vSwitch Architecture

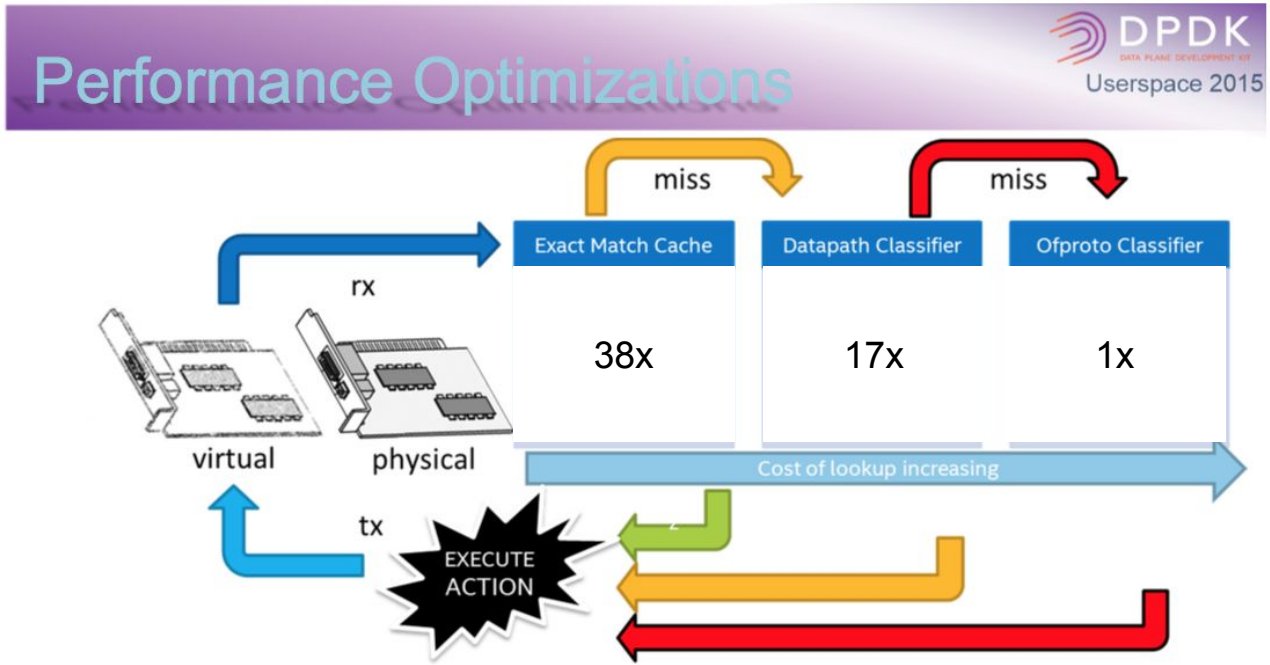
Open vSwitch Architecture



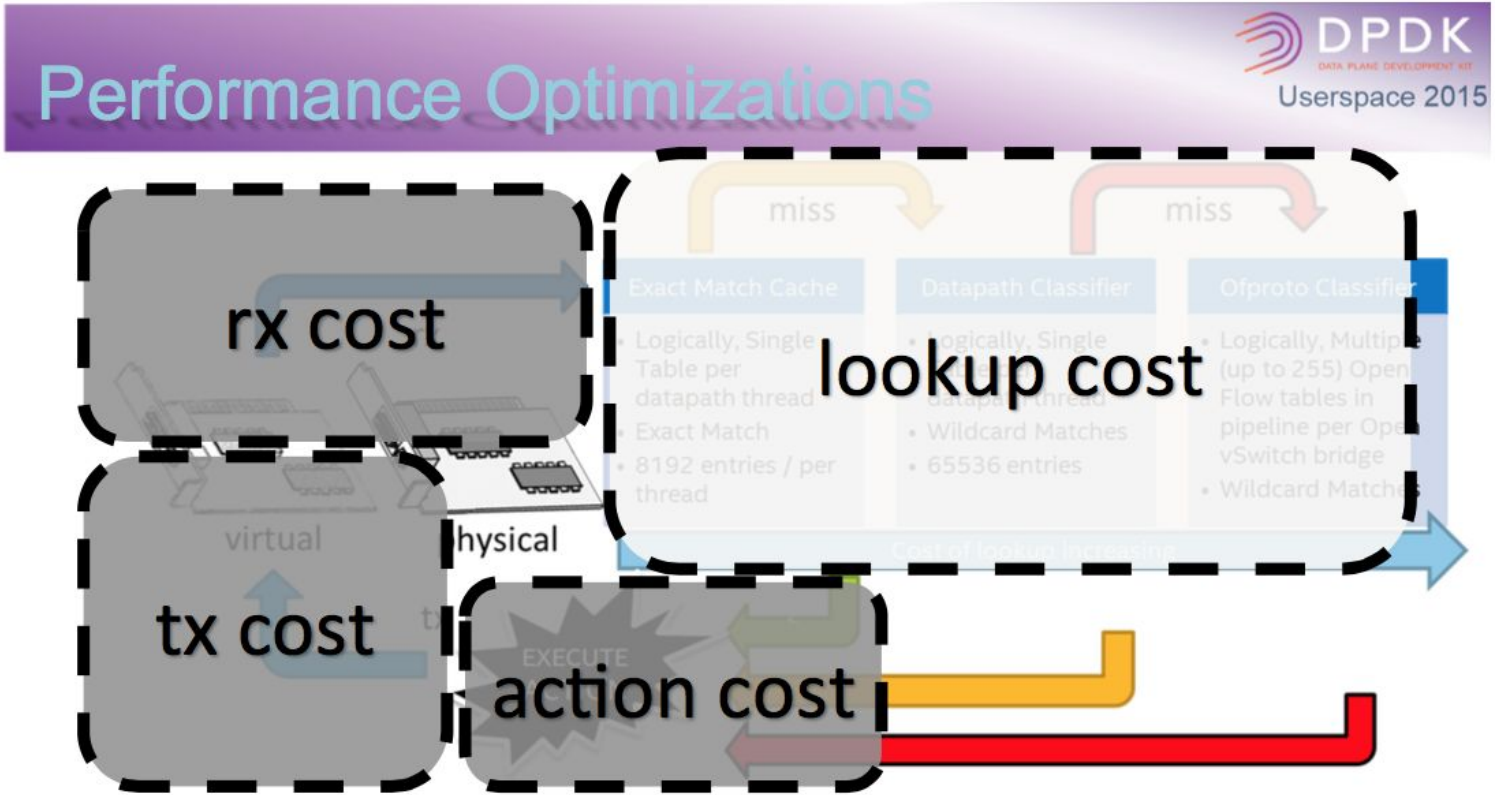
Open vSwitch Acceleration



Open vSwitch Acceleration



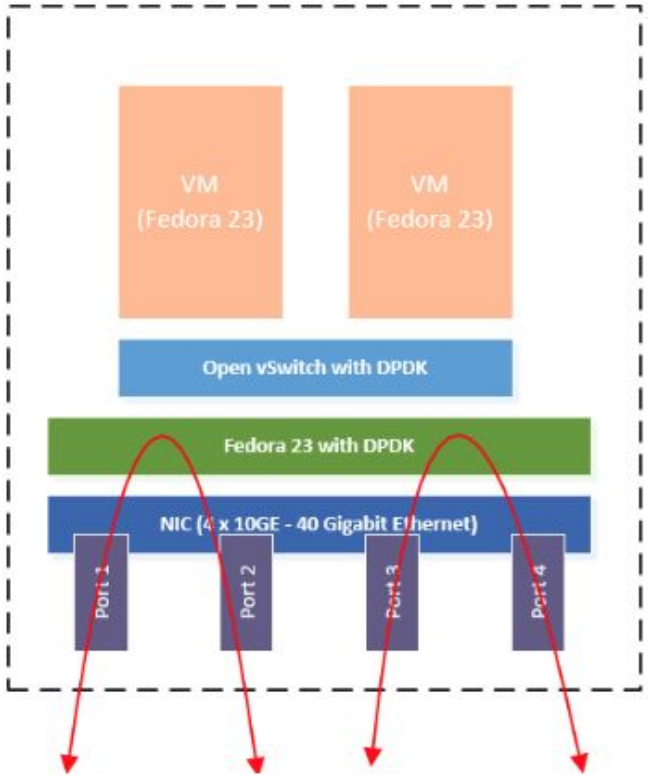
Open vSwitch Acceleration

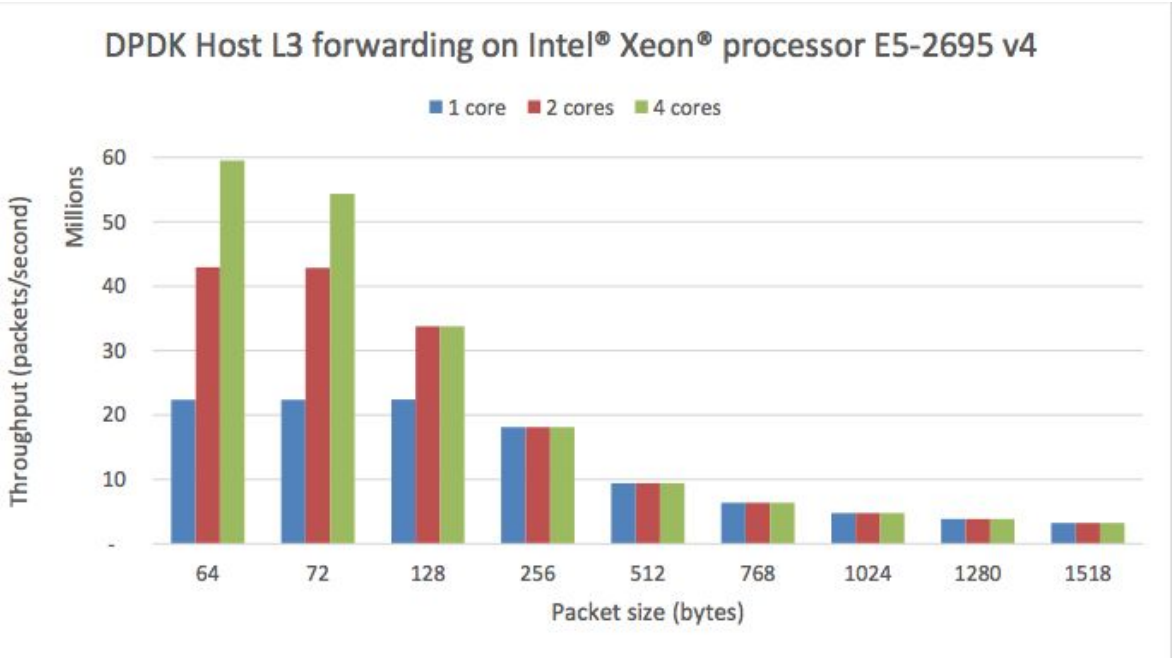


Challenge of Comparing Performance

- Perception that that VPP “Fixes” OVS/DPDK Scalability Problem.
- Need Real World Use Cases
  - Open Stack Deployments of Both to Compare
  - The hope is that OPNFV/Vsperf will compare
  - Fds vs ovs/dpdk
- As TOR VPP May Scale Better
  - But Deployed in Compute Node or Hosting NFVs?

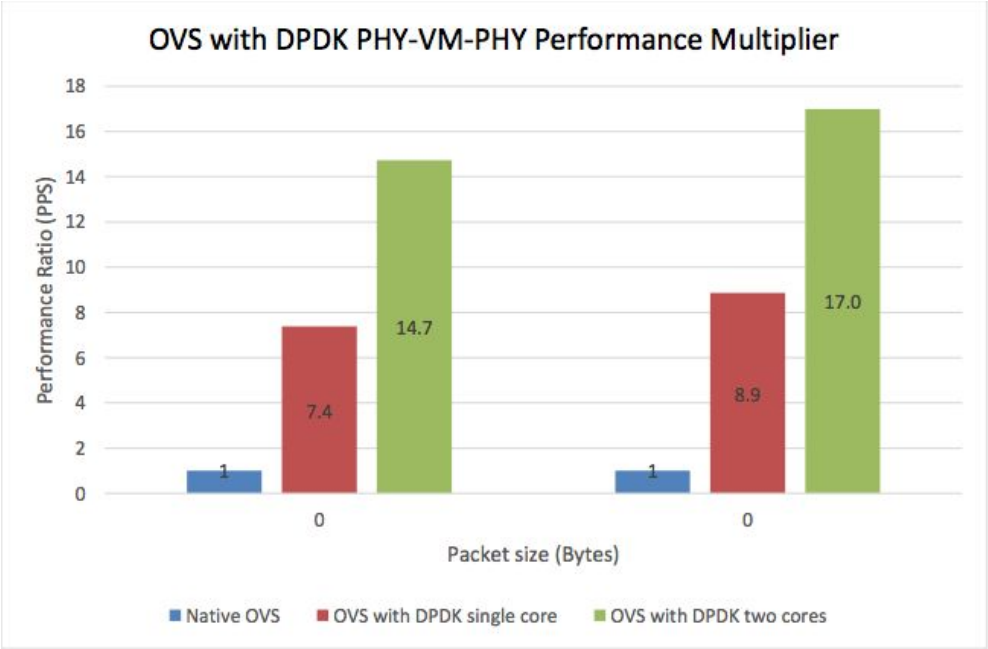
Raw DPDK Performance





Intel® Open Network Platform Release 2.1 Performance Test Report

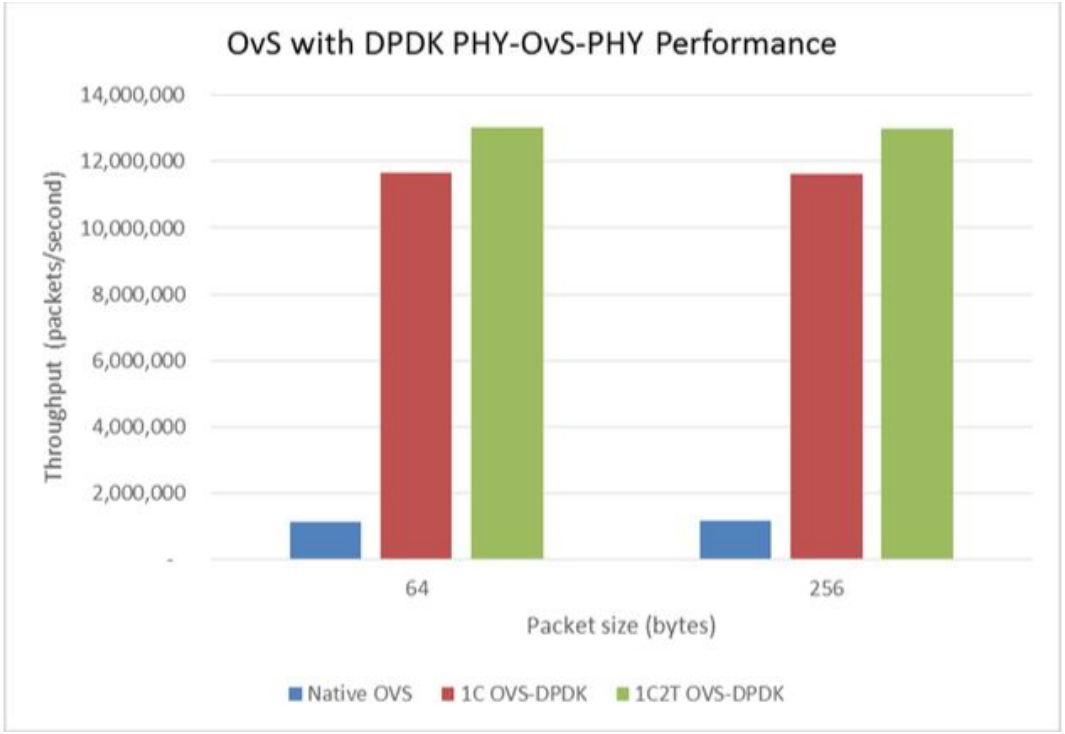
Open vSwitch Performance w/DPDK



DPDK Can Scale OVS performance significantly particularly when multiple cores are used.

Intel® Open Network Platform Release 2.1 Performance Test Report

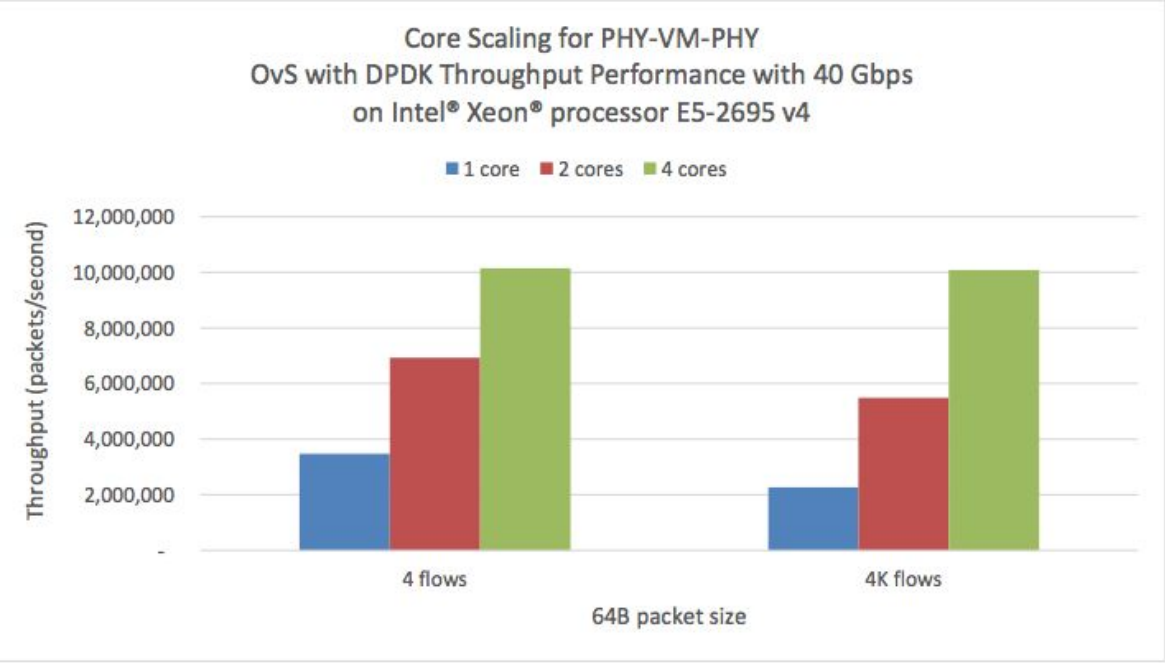
Open vSwitch Performance



DPDK Can Accelerate OVS Well with Small Packet Sizes.

Intel® Open Network Platform Release 2.1 Performance Test Report

Open vSwitch Performance



When passed through VM with vhost-user, DPDK/OVS may scale OK with simple forwarding with relatively small number of flows.

Intel® Open Network Platform Release 2.1 Performance Test Report

OVS and FD.IO Similarities

- **DPDK based**
- **Implemented in Software on Commodity Processors**
  - **Intel, ARM, Power 8**
- **Deployable in Compute node of Open Stack**
- **Host to VM uses vhost-user**
- **Container Support is through kernel via TAP**
  - **Limitations of Kernel Networking**
  - **Will User Space Netlink Be Faster**
    - **Security Issues**

Architecture: Apples vs Oranges

Open vSwitch

- Open Flow Protocol matches and actions
  - Fast Path -- Linux Kernel Module
  - Fast Path -- Accelerated by DPDK
- Fast Path Exact Match Cache -- Fastest
- About 8K matches using linear search
- Misses go to Slower MiniFlow Match -- Slower
- Misses then go to OFP Match Slowest

FD.IO/VPP

- VPP fd.io
- Graph based vector Processing Engine
- Consumes vector of input packets
- Extensible via plugins
  - Synchronized for parallel operation
- Multiple nodes
  - Optimized for parallelism
  - Hardware like -- Use branch prediction.

DPDK

Open vSwitch Control Plane FD.IO/VPP

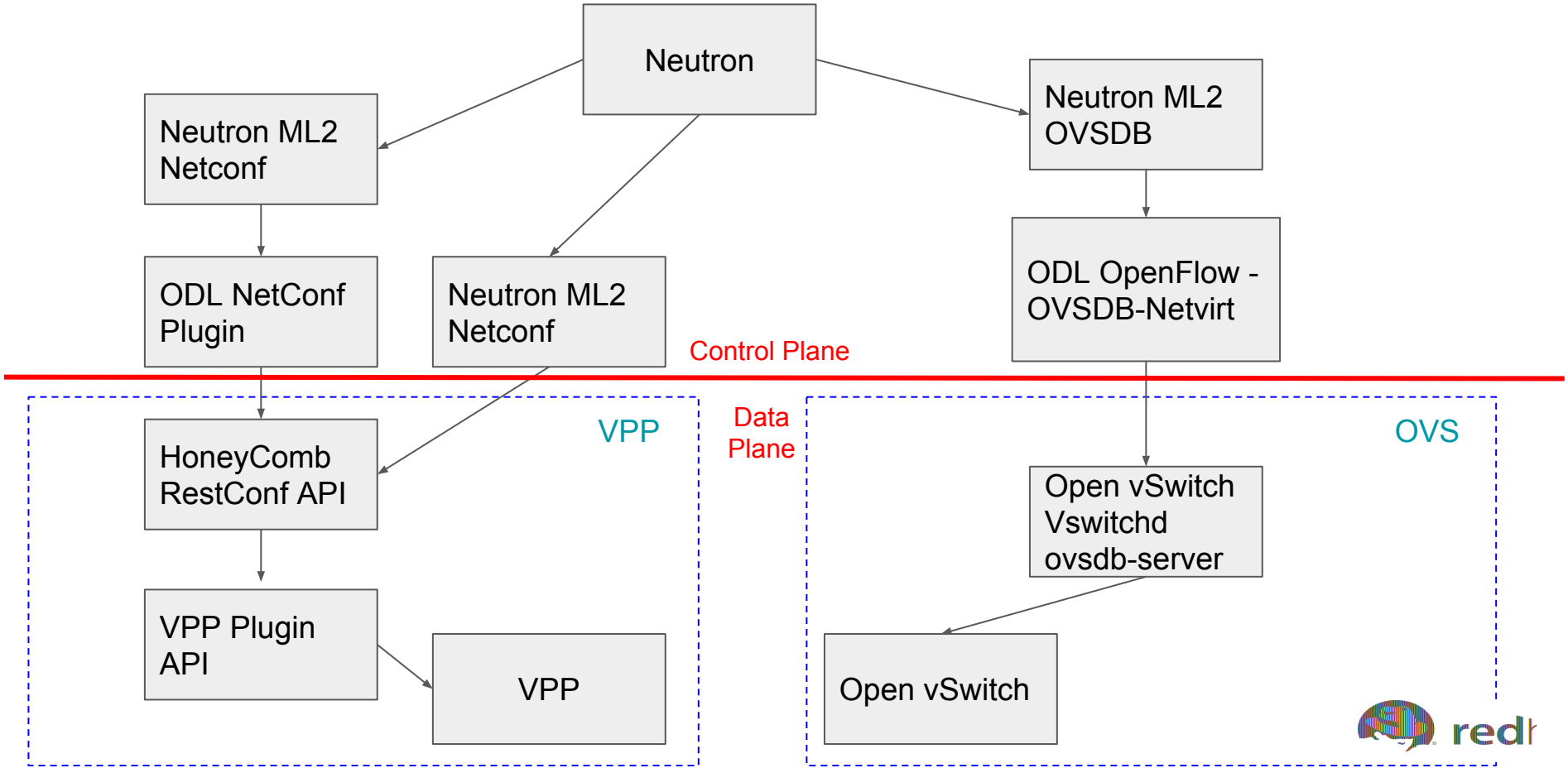
Two control plane protocols

- **Open Flow Protocol**
  - **Matches and Actions**
  - **44 Packet Match Fields Plus Metadata**
  - **CLI**
    - **ovs-ofctl**
- **OVSDB Protocol**
  - **Ports, Bridges, Tunnels, Config**
  - **Highly configurable**
  - **CLI**
    - **ovs-vsctl**

VPP Control Plane

- **Basic VPP has**
  - **CLI API**
  - **Restconf IF**
- **Extensible via plugins**
  - **Each Plugin has has**
    - **CLI API**
    - **Restconf IF**
- **Includes complete IPv4 and IPv6 stack**
  - **Other vRouter Features**
    - **CLI API**
    - **Restconf IF**

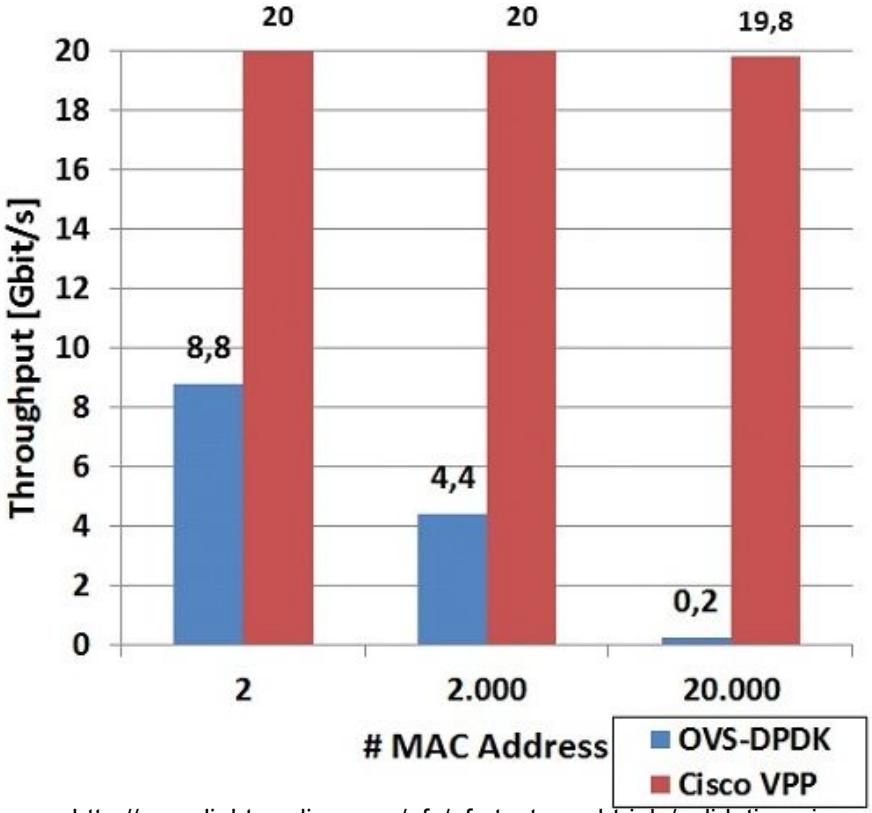
Control Plane Differences - Open Stack



Performance: Apples vs Oranges

Open vSwitch	FD.IO/VPP
Specified by Open Flow as "Switch" 1.0 - 1.5 **No one predicted NFV Cloud Use Case**	**Designed as vRouter** **Configured by IOS/CLI**
4 to 5 years of experience	**Super Configurable** **Statistics Everywhere**
Works Well with Conceptualized Networks	**Historical Use in Real World** **TOR Switch -- Infrastructure Router**
1+ Years with NFV Experience	**Now Utilized in Complex Multi-Use?** **Compute Node** **Host HyperVisor**
Observed Performance **Scaling May not be as Good:** **Deteriorates with many Flows**	**Not originally designed as "SDN" as defined by Open Flow**

VPP vs OVS Performance?



http://www.lightreading.com/nfv/nfv-tests-and-trials/validating-ciscos-nfv-infrastructure-pt-1/d/d-id/718684?page_number=8

- OVS may not scale well when the number of flows exceed 8192 due to size of EMC
- According to NEANTC testing, VPP scales close to linearly.
- Also, the VPP architecture may hold promise for accelerating vxLAN/NSH in the VTEP case for SFC.
- But...

Is testing on Number of MAC Addresses Sufficiently Realistic?

FD.io VPP OVS/DPDK Outlook

- VPP shows promise
  - Pipelined Approach
  - Well Suited for DPDK
- Dual Approach Possible
  - OVS in Control Plane
- FD.io: Alternative to OVS for some deployment scenarios

- Performance Validation
  - Real world scenarios: OpenStack
  - Via OPNFV FDS
  - Real World Use Cases
    - NFV
    - Open Stack - OPNFV Deployments
- vxLAN - NSH/SFC
  - Likely to be merged upstream sooner then OVS/DPDK

Open Stack Deployments

Open vSwitch

Upstream
- vHost multi-queue -- perf performances
- Container Acceleration
- DPDK Development
- DPDK “Usability”
- Get rid of “Experimental”
- vxLAN NSH and VTEP Acceptance

OPNFV and MidStream
- Deploy OVS/DPDK C Release
- Apex and Fuel Installers
- vxLAN NSH and VTEP
- Vsperf
- OVS4NFV - QoS Perf Req

FD.IO/VPP

Upstream
- vxLAN - NSH for Alternative to OVS
- HoneyComb Yang
- CSIT -- Continuous Testing Infrastructure

- Performance Validation
  - Container Performance

OPNFV and MidStream
- FDS - Fast Data Stacks
- Apex Installer
- “D” Release - Real World NFV Deployment
- Vsperf
- Security Groups Policy QoS

References and Credits

VPP fd.io

Open Source Project: fd.io

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Open vSwitch/DPDK performance

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