Performance Considerations When Deploying Open Source NFV
Networking Myths Debunked

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6WIND: Performance Software Experts

- Headquartered in France with a global presence in the US, China, Korea and Japan
- Primary business is infrastructure software for networking
- Combines software expertise with historical experience in telecom
- Products are used both by Network Operators and OEM vendors
- VC-backed company with Cisco as an investor

High Performance Software For Cost-Effective Virtual Networking
Performance Enables a Cost-Effective Transition to NFV

High Performance Specialized Hardware

Deliver Required Performance to Standard Servers

Bring Performance To Virtual Networking
Open Source NFV: Virtual Networking Performance Problems

- **Application Throughput**
  - Standard OS Virtio driver bottlenecks
  - Legacy networking software doesn’t scale on standard servers

- **Hypervisor Scaling**
  - 10/40/100 Gig Ethernet
  - Virtual switch bottleneck
Standard Linux: Pros and Cons

**Pros: Features and Compatibility**
- Includes all virtual switching and networking features on heterogeneous NICs
- Supported by OpenStack, OpenDaylight, etc.

**Cons: Throughput / Performance**
- Linux networking performance doesn’t scale (Virtual Switch and Application)
- Host / Guest communication bottleneck
SR-IOV Breaks Virtualization

**Pros: Throughput**
- Bypasses hypervisor, curing throughput bottlenecks

**Cons: Lose all hypervisor features**
- Hardware dependent
  - Virtualization is broken
  - VNF migration?
- Only fixes performance at the hypervisor level
Data Plane Development Kit (DPDK): Preserve Performance And Hardware Compatibility

DPDK is:
- Set of libraries and drivers for high performance packet processing in Linux user space
- Low overhead, run-to-completion model
- Can be used in the hypervisor domain and for applications
- Built with open standards in mind, compatible with all major hardware vendors

DPDK is not:
- DPDK is not a networking stack
- DPDK does not provide functions such as Layer 3 forwarding, IPsec, firewalling, etc.
Data Plane Libraries and Optimized NIC Drivers in Linux User Space

DPDK Libraries
- Buffer Mgmt
- Queue/Ring Functions
- Packet Flow Classification
- NIC Poll Mode Drivers
- Etc.

Environment Abstraction Layer

Linux Kernel

App

User Space
dpdk.org: Knowledge Base and Online Community For DPDK Applications

- Open source project launched by 6WIND in April 2013; BSD licensed project

- THE open source framework for high performance packet processing
  - Initially for x86 CPU and Intel NICs
  - Now available for IBM Power 8, EZchip TILE-Gx and ARM CPUs
  - And for Cesnet, Chelsio, Emulex, Cisco, Mellanox, Netronome, QLogic, (Amazon soon) NICs

- A vibrant community
  - More than 3 million page visits since the project launch
  - More than 30,000 visitors per month, growing

- More than 20 projects use dpdk.org including OpenDayLight, OPNFV, OVS-DPDK, FD.io / VPP, Rump, dpdk-nginx...
Open Source Networking Stacks That Use DPDK: Two Examples

OVS

DPDK

DPDK

DATA PLANE DEVELOPMENT KIT
A high performance data plane stack is additional software separated from the Linux networking stack

Interface to control plane has to be adapted and validated

DPDK stack including configuration has to be integrated with network management

Control Plane uses Linux stack APIs

Management tools including OpenStack, SDN Controller, SNMP… integrate Linux stack management

How to benefit from DPDK performance without impacting system integration?
Linux Synchronization Architecture

Data Plane

- Data Plane Modules
- Shared Memory
- Protocol Tables
- Statistics

Data Plane Statistics

Linux Networking Stack

Data Plane Configuration

Linux Kernel

iptables
iproute2

Quagga

OpenFlow

OpenStack

HAPROXY

NGINX

DPDK

Debian
Fedora
Red Hat
Ubuntu
Use Case: Scalable IPsec Aggregation for Remote Users

Leverage NFV Infrastructure

Eliminate The Performance Gap From Commodity Hardware To Reap Cost Benefits
Solution: Accelerating IPsec Software on COTS Servers

DPDK-based
High performance data plane stack (IPsec):
Bare Metal or VM
Synchronized with Linux for reusing StrongSwan (IKE) control plane

DPDK-based (physical NIC)
Dedicated high performance data plane stack (OVS)
Synchronized with Linux for OpenStack

App
VM

Virtual Switch
Hypervisor

Bare Metal

OpenStack
Scalable Virtual IPsec Aggregation

Save Costs

- Ownership costs drastically lowered
- Improved ROI on infrastructure costs

Use spare cores

- To serve more users with more bandwidth
- To integrate IPsec with added value services on the same server

Scenario 1
- 2 Gbps
- <500 Kbps per user
- No spare cores
- Linux IPsec
- Linux OVS
- 5,000 IPsec Tunnels
- 10G Wirespeed

Scenario 2
- 6 Gbps
- 1.2 Mbps per user
- No spare cores
- Linux OVS
- 2 Mbps per user
- @ 10 Gbps

Scenario 3
- 10 Gbps
- 2 Mbps per user
- 8 spare cores out of 12
- Clear Traffic
- 10G Wirespeed

Encrypted Traffic @ 10 Gbps
Fast, Open, Unlocked NFV Architecture

DPDK-based (virtual NIC)
High performance data plane stack
Synchronized with Linux for reusing control plane and management

DPDK-based (physical NIC)
High performance data plane stack (OVS + L3...)
Virtualization friendly
Synchronized with Linux for OpenStack, SDN controller...
Thank You