OVS, DPDK and Software Dataplane Acceleration

OVS Fall Conference
November 17th, 2015
Who are we?

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Open vSwitch with DPDK

User space

Openflow Processing

Kernel space

Netlink

Megaflow Cache

Microflow Cache

User space

Openflow Processing

Megaflow Cache

Microflow Cache
OVS Architectural Evolution

Compute Node: User Space
- OpenDaylight
  - ovsdb
  - OpenFlow
- ovsdb server
- ovs-vswitchd
- ofproto
- dpif-linux (Kernel Space Forwarding – Control Only)
- dpif-netdev (User Space Forwarding)
- openvswitch.ko

netdev
- netdev_vport
  - Overlays
- netdev_linux
  - sockets
- netdev-dpdk
  - DPDK librte_vhost
  - DPDK librte_ring
  - DPDK librte_eth

Compute Node: Kernel Space
- VNF
- Virtio
- Qemu
- VNF
- Virtio
- Qemu
- Ivshmem
- DPDK
- Qemu

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The Netdev Interface Makes it Possible

• Transparency of Data Plane
• Netdev – API Between Data Plane and OVS
  • Generic network device API independent from data plane implementation.
  • Similar to network driver interface in BSD
  • Netdev Abstracts forwarding of packets in data plane
• Conceptually like any Network device driver
  • With Start, Stop, Private Data Area, Queue Management
• Struct netdev Holds the interface Specific Function Pointers
  • Includes the generic part followed by private part for use by driver.
  • Constructur for netdev provider
  • Dpdk Creates dpdk personality of struct netdev
    • Multiple rx queues Managed by OVS
Open vSwitch with DPDK

- DPDK – Data Plane Development Kit
  - About 4 Years Old
  - First Integrated with OVS from 2013
  - Fast Packet Forwarding
  - Poll Mode Drivers
  - Uses Commodity Hardware
  - Multiple Threads and Cores
  - Up to 12X Speed Improvement for small packets
  - Over 15mpps Forwarding
    - Small Packets

- Disadvantages WRT Linux Kernel
  - Linux Data Plane Has
    - Complete TCP/IP Stack
    - 20 years of development
    - Rich Debugging Options
      - Promiscuous IFs
    - Access to Wide Variety of Network IF’s and VF’s
    - Tunnels and Endpoints
Open vSwitch with DPDK User Perspective

- Who Uses OVS/DPDK
  - Open vSwitch
  - Open Stack/Neutron via ODL Plugin and OVS
  - OVS CLI Tools
  - Programmers - Application Developers of
    - Other Packet consumers, DPI, Classifiers
    - Infrastructure – Routers, Firewalls, Services
    - Other Packet consumers, DPI, Classifiers

- Typical Scenario
  - NF’s in VMs or Containers
    - Service Function Chaining
  - Real World Performance
    - Challenge: DPDK Gains Over Wide Variety of Use Cases
Open vSwitch with DPDK Usability Story

• In the Beginning: My user Story starts in 2013
  • Inspired by Intel presentation of DPDK at ONS 2013
• Developing Network Threat Analyzer
  • Integrated Open vSwitch
  • Traffic shaping, threat blocking and mitigation
• Requirement: 10Gb without Adding $10K to $20K on custom HW Switch Fabric.
  • DPDK is the Answer?
  • How to prove the OVS/DPDK Claim?
• Started with DPDK 1.7.1 and OVS 2.3

• Scary: poor integration --Not integrated with OVS
  • Compilation issues, conflicting APIs. ABIs, OVS Versions
  • Three Confusing Forks:
    1. DPDK.org
    2. DPI Fork with custom API
    3. 01.org
• Came Together with DPDK 1.8
  • Integrated: Master Branch OVS
  • I Ran DPDK on guest with VirtIO/VMXnet3 saw 2.5X perf gain
  • Developed App using DPDK-ring to feed DPI

• Now: DPDK 2.1 with OVS: Much improved!
Improving Open vSwitch with DPDK

- Is DPDK really still Experimental?
  - Is it time for this patch?

---  a/INSTALL.DPDK.md
+++ a/INSTALL.DPDK.md
@@ -5,8 +5,8 @@
Open vSwitch can use Intel® DPDK lib to operate entirely in Userspace. This file explains how to install and use Open vSwitch in such a mode.

-The DPDK support of Open vSwitch is considered experimental.
-It has not been thoroughly tested.

This version of Open vSwitch should be built manually with `configure` and `make`.

- Issues with DPDK:
  - How to Improve?
  - Some Suggestions from Thread
    - Device management:
    - Udev/systemd – (Flavio Leitner)
      - Device creation, binding, destruction – handled by Host OS
Improving DPDK in Open vSwitch

• How About Debugging?
  • TcpDump like capability
  • Use “Mirroring” of packets to pmd/libpcap or libpcap-ng
• How About Test Frameworks for DPDK
  • Add CI for Data Plane Testing
• Vsperf Project in OPNFV
• Support Only One type of vhost device
  • Drop Vhost – Cuse
• Better Documentation
  • Recent Patch to INSTALL.DPDK.md
• Education About Optimization Cache and Numa
  • From lstopo to Optimum DPDK
• Device Management
  • Driverctl utility for Fedora
Tuning – Core Affinities

[Diagram showing the relationship between Core 0, VM, OS, virtual cores (VIRTUAL 0, VIRTUAL 1), physical cores (PHY 0, PHY 1), and OVS.]
Tuning – Core Affinities

```
# Set CPU affinity for Open_vSwitch
ovs-vsctl set Open_vSwitch . other_config:pmd-cpu-mask=2
```
Tuning – Core Affinities

```bash
ovs-vsctl set Open_vSwitch . other_config:pmd-cpu-mask=6
```
Tuning – Core Affinities

```
ovs-vsctl set Open_vSwitch . other_config:pmd-cpu-mask=1806
```
Tuning – Multiqueue

```
ovs-vsctl set Open_vSwitch .other_config:pmd-cpu-mask=781E
ovs-vsctl set Open_vSwitch .other_config:n-dpdk-rxqs=2
```
Usability Guides

• Instructions for setup
  

• Performance tuning
  
  https://github.com/openvswitch/ovs/blob/master/INSTALL.DPDK.md#performance-tuning

  https://download.01.org/packet-processing/ONPS1.5/Intel_ONP_Server_Release_1.5_Performance_Test_Report_Rev1_2.pdf
Availability: Distro Packages and Git

- ISV and OSV recognizing the progress of OVS with DPDK
- Centos7: 7.4: DPDK 2.1; 7.2: OVS 2.4
- Fedora: F23;F22 updates DPDK 2.0; F24: DPDK 2.1
- Fedora Copr repo for latest: https://copr.fedoraproject.org/coprs/pmatilai/dpdk/
- Red Hat OSP8...soon:
  - OVS/DPDK Integrated with Neutron
  - Ubuntu: 15.10: OVS with DPDK package
- OVSNFV OPNFV Project planning deployment in future OPNFV releases
  - https://01.org/packet-processing/intel%C2%AE-onp-servers
  - git clone http://dpdk.org/git/dpdk
  - git clone https://github.com/openvswitch/ovs.git
Conclusion

“It just works”
Conclusion

"It just works"
**OVS with DPDK Meetup**

**WED, NOV 18, 2015 AT 8:30 AM**

**OVS with DPDK Meetup**

DoubleTree by Hilton Hotel San Jose, San Jose, CA

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**Arrive**

8:30 - 9:00

**Usability Session**

Discuss the issues highlighted in ML post here and ways to improve usability


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**Mid morning break**

10:45 - 11:00

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**Features Session**

Discuss status of current and potential userspace features
e.g. vhost multiqueue, vhost-cuse, ivshmem, conn track, SFC, QoS etc.

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**Lunch**

12:30 - 1:30

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**Performance Session**

Discuss ways to increase performance
e.g. host-guest, guest-guest, tunneling, emc, dpcs etc.

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**Mid afternoon break**

2:30 - 2:45

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**Adoption/Community Session**

Discuss ways to grow community and adoption
e.g. Downstreaming, DPDK and QEMU community dependencies, further events

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**Open Mic/Wrap up**

3:45...

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**By: Kevin Traynor**

Discussion about OVS with DPDK, Usability, performance improvements, future features, testing, packaging etc.

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**WHEN**

Wednesday, November 18, 2015 from 8:30 AM to 5:00 PM (PST)

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https://www.eventbrite.com/e/ovs-with-dpdk-meetup-tickets-19216389739
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