Empowering container-based NFV with VPP on Arm servers

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Background

• Recent trends: Container-based platforms for OPNFV
• Containerized OpenStack or Kubernetes as VIM
• OPNFV Euphrates release delivers Kubernetes integration
• OPNFV projects: **Container4NFV, Auto, Clover**...
• SFO17 presentation on “Containerized VNFs...
Container-based NFV Architecture

Container-based NFVi on Arm servers

Micro Service Micro Service Micro Service Micro Service
Kubernetes Node Pod Pod

Kubernetes Node Pod Pod

CNI

DPDK/ SRIOV Flannel vhost user DPDK/ SRIOV Flannel vhost user

Kubernetes Node

Master

API SERVER SCHEDULE CONTROLLER MANAGER

ONAP

C-VNFM

VNFM

OpenStack

Arm servers

Ref: Container4NFV Architecture

Kubernetes as VIM
Flannel/SRIOV/vhost user CNI plugins integrated
SRIOV CNI: enable VF passthrough
Vhost-user CNI: enable VPP-based container networking
FD.io/VPP (Vector Packet Processing)

- User Space software platform providing switch/router functionalities
- Aiming to run on commodity CPUs
- Cisco developed it from 2002 and open sourced it in FD.io (Linux Foundation) on Feb 2016
- Leverage DPDK, XDP, netmap... as fast I/O
- Batch packet processing - more efficient iCache utilization
- Packet processing graph: modular, flexible, and extensible
- **Fast, scalable** and **deterministic**
  - 14+ Mpps per core, tested to 1TB
  - Scalable FIB: supporting millions of entries
Why VPP

• Container networking requirements for NFV
  High performance on packet processing
  High scalability
  High flexibility

What VPP provides

High performance
Abundant interfaces: ssvm, virtio/vhost, af_packet, tap, memif...
Abundant features for control and management
VPP for Container Networking with AF_Packet interface

Container A

send()

FIFO
TCP
IP (routin g)
device

Layer 2 (ether)

Layer 3 (IPv4,6)

Overlays (VXL AN)

ACL/Policy

VPP

Container B

recv()

FIFO
TCP
IP (routin g)
device

User Space

Pros:
Support Linux kernel stack which is required by most applications with performance higher than Flannel

Cons:
Performance is lower than vhost-user/memif interface
VPP for Container Networking with Virtio-Vhost Interface

CONTAINER

DPDK

DPDK APP

ETHDEV

virtio-user

vhost-user adapter

vhost

Data Path 1

Data Path 2

host

VPP-DPDK

VxLAN Overlay

CONTAINER

DPDK

DPDK APP

ETHDEV

virtio-user

vhost-user adapter

vhost

CONTAINER

DPDK

DPDK APP

ETHDEV

virtio-user

vhost-user adapter

vhost
Vhost-user CNI for Kubernetes

- Vhost-user server socket(interface) is created in VPP
- After adding the vhost user CNI path, the virtio-user interface is used as a virtual device of DPDK
What We Have Done

• Enabled VPP release/17.10 on Arm64 servers
• Integrated VPP with Kubernetes for inter-container communication with virtio/vhost-user interfaces on Arm servers
• Enhanced vhost-user CNI for Kubernetes with VPP
• Enabling VPP-based use cases for OPNFV Container4NFV project
Next Steps (provisional)

• Continue VPP enablement and performance tuning on Arm servers
• Performance benchmarking with VSperf on Arm servers
• VPP integration (CI/CD enablement) in OPNFV Gambia release (Nov 2018)
• Enable and integrate other VPP based CNI solutions (memif, …)
• Enable more VPP-based use cases (microservices and SFC) for NFVi
• Integrate VPP-based NFV solutions with orchestration software (ONAP)
Nginx as CDN Use Case (provisional)

ONAP/Kubernetes

VPP-DPDK

CONTAINER

CONTAINER

CONTAINER

VNF

Nginx

TCP stack

FlowCac

Content Delivery Service

Data Flow

Flannel/Cali

co

VxLAN Overlay

Client

VPP-DPDK

arm
Thank You
Danke
Merci
謝謝
ありがとうございます
Gracias
Kiitos
감사합니다
धन्यवाद
תודה