Empowering container-based NFV infrastructure with VPP on Arm servers

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Agenda

• Background
• Container-based NFV ecosystem
• VPP for container networking
• What we have done
• Next steps
Background
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 with Data Plane Acceleration (DPDK)”
Container-based NFV Architecture

- Kubernetes as VIM
- Flannel/SRIOV/vhost user CNI plugins integrated
- SRIOV CNI: enable VF passthrough
- Vhost-user CNI: enable VPP-based container networking

Ref: Container4NFV Architecture
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 (routing)
- device

VPP
- Overlays (VXLAN)
- ACL/Policy
- Layer 3 (IPv4,6)
- Layer 2 (ether)
- dpdk
- af_packet

Container B
- recv()
- FIFO
- TCP
- IP (routing)
- device

Kubernetes AF_Packet CNI?

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
How to Support DPDK APP in Container with VPP Efficiently and Dynamically

- Virtio/Vhost-user is a para-virtualization interface which could achieve quite promising performance compared with other native networking interface supported by VPP, such as af_packet.
- DPDK’s Vhost user for VPP is simple and easy use,
  - set dpdk’ section as “vdev eth_vhost0, iface=/tmp/sock0.sock” statically.
- Static DPDK vhost-user interface cannot support container orchestration engine, e.g., Kubernetes, dynamically.
- However, DPDK Virtio Driver Works with VPP native Vhost-user Driver which could be created on demand:
  - vpp# create vhost-user socket socket-file server.
Vhost-user CNI for Kubernetes

K8S POD

- 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
VPP Container Networking with Kubernetes

IP: 10.56.217.x
vppctl set int ip address VirtioUser0/0/0 10.56.217.xx/24

CONTAINER
DPDK
VPP
DPDK ETHDEV
virtio-user
vhost-user adapter
virtio

Kubernetes

IP: 10.56.217.y

CONTAINER
DPDK
VPP
DPDK ETHDEV
virtio-user
vhost-user adapter
virtio

Vhost-user cni plugin

Data Flow

Flannel

10GB E
VPP Container Networking with Kubernetes – cont.

• Configurations:
  • Vhost-user cni plugin would create the vhost user server socket port in /var/lib/cni/vhostuser/container_id
  • Vpp container(pod) would get its port IP and MAC configuration from /vhost-user-net-plugin by mounting to the host’s /var/lib/cni/vhostuser, add the virtio_user port info into /etc/vpp/startup.conf, for example:
    • vdev virtio_user0,path=/vhost-user-net-plugin/54d8c4ae5fc7550311097581f7ed8766f8ddaa3661b54bc0806517dce87819653/54d8c4ae5fc7-net1,mac=e6:63:69:59:15:47

• Vpp container(pod) mounts the needed hugepage information
• IP address is set on VirtioUser interface with VPP in container
  • vppctl set int ip address VirtioUser0/0/0 10.56.217.x/24
• VPP provides L3 connection to containers
What We Have Done

• Enabled VPP release/17.10 on Arm64 servers
• Integrated VPP with Kubernetes 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

VxLAN Overlay

CONTAINER
VNF
Nginx
FlowCache
TCP stack

CONTAINER
Content Delivery Service

CONTAINER
Client

Flannel/Calico

Data Flow In
Thank You
Danke
Merci
谢谢
ありがとうございます
Gracias
Kiitos
감사합니다
धन्यवाद
תודה