Accelerating NFV with VMware's Enhanced Networking Stack (ENS) and Intel's Poll Mode Drivers (PMD)

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**Problem Statement**

- NFV has stringent performance requirements.
  - High packet rate for small packets
  - Low packet loss and latency

- Need to improve vSphere networking stack to support NFV applications
  - Using DPDK in a VM is not enough.
  - Remove performance bottleneck in current networking stack
    - Vmxnet3 virtual device, virtual switching, and the physical driver

- We propose new **Enhanced Networking Stack (ENS)** for vSphere with **Intel poll mode physical driver**.
Solutions: Intel – VMWare Collaboration

Intel provided Poll Mode Drivers (ENS compliant)
New ENS Driver Development Kit
New ENS DataPath to VM

I'm polling…
Flow Cache
NUMA-Awareness
Dedicated / Pinned Cores

VM

Hugepages
Vmxnet3 PMD
DPDK VNF

VMxnet3 device for ENS

ENS vSwitch

ixgben-ens PMD
i40en-ens PMD

10G
40G

vSphere Kernel

DPDK Learnings integrated
VMware Enhanced Networking Stack (ENS)

- New and faster vSphere networking stack targeted for NFV applications
  - DPDK techniques employed
  - New vmxnet3 virtual device backend
  - New poll-mode physical device drivers
  - Faster switching using flow cache
- Deliver improved performance while supporting vSphere features
  - DRS, HA, vMotion
- Integrated with NSX
- Openstack (VIO) support through Neutron plugin
ENS Design Choices for Improved and Deterministic Performance

- Dedicated CPU allocation to system thread and polling
- NUMA-aware placement of VM and system threads
- NUMA-aware allocation with large pages
- Simplified packet representation
- Use of flow cache
- Lockless datapath
- Vmxnet3 optimizations
- SSE instructions faster packet processing
Initial ENS Poll Mode Drivers from Intel
- IXGBEN-ENS
- I40EN-ENS

Initial Features
- Receive/Transmit routines
- Link Set/Get
- Per Queue statistics
- IPv4 TCP/UDP Checksum
- Multiqueue filtering
- Device reset
ENS Performance

- **3-5x** improvement in packet rate over the existing vSphere networking stack
  - Performance scales with the number of system threads

- Acceptable packet loss

- Low jitter and latency
Thank You