Networking Optimization in Edge Computing
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Agenda

- Why Edge Computing?
- What is Edge Computing?
- StarlingX based on OpenStack for Edge
- Challenges
- Regional Controller
- OVS-DPDK and SR-IOV
- Other Enhancements in OpenStack Neutron
- Containerized Network
# Emerging Technologies in IoT & Networks

## NFV Edge Infrastructure
- Wireless (vRAN,vEPC)
- Wireline (PON)
- uCPE (SD-WAN)
- IP Enterprise Services

## Autonomous Devices
- Drones
- Autonomous Vehicles
- Industry Robots
- Medical

## Immersive Experiences
- Virtual Reality
- Augmented Reality
- 360 Video
- Wearable Cognitive Assistance

## IoT & Analytics
- Industrial Sensors
- Home Devices
- Retail
- Healthcare

## On-Demand NFV
- Hardware Acceleration
- A.I.
- Microservices
- 5G
Why Edge Computing?

Emerging technologies are demanding lower latency and accelerated processing at the edge.

**Edge Cloud**
Performs data processing at the edge of the network, near data sources.

**Central Cloud**
Highly centralized computing resources of cloud service providers.

Latency Comparison:
- **Low Latency** (Edge Cloud): < 20ms
- **High Latency** (Central Cloud): ~25 – 200ms

**Optimal**
- Edge Cloud

**Not Optimal**
- Central Cloud

Technologies:
- NFV Edge Infrastructure
- Autonomous Devices
- Immersive Experiences
- Industrial IOT
What is Edge Computing?

- Extensions Beyond Cloud Computing and Data Centers
- Close to Users and Data Sources, Edge Sides
- Converged Platform of Networks, Compute, Storage and Applications
- Real-Time, Optimized, Data Localization, Intelligence, Security and Privacy
- High Performance and Low Latency
- Large-Scale but Small-Size
- Zero Touch Provisioning and Automation, Remote Management, Autonomous Devices
- Self-Healing, Easy Upgrading, and Long Life Power Supplier
High Level Structure of StarlingX for Edge

Upstream Projects
- Kubernetes
- Ceph
- ovsdpdk
- CentOS
- OpenStack

Integration Project
- Host Management
- Configuration Management
- Service Management
- Fault Management
- Software Management
- Infrastructure Orchestration
StarlingX Architecture Details

Control Node

- Virtualization Infrastructure Manager (VIM)
  - Infrastructure Orchestration
  - Configuration Management
  - Fault Management
- Service Management

Compute Nodes

- Neutron Agent
- Nova Compute
- ovsdpdk
- SRIOV networking
- KVM – Real time

Storage Node

- Carrier Grade Storage Cluster
- Centralized, Local, or SAN

OSS/BSS

Service Orchestration (i.e. ONAP)

- Edge Applications
  - VM IOT
  - VM CPE
  - K8S Others

Edge Applications

- Linux
- KVM

StarlingX Edge Node(s)
High Level Challenges in OpenStack for Edge

- Scalability of the Controller
- Wide Area Network limitations
- Security Management
- Maintainability
- Fault Tolerance
ONAP based Service Orchestration and Deployment

Support for both OpenStack edges and Kubernetes edges
Support for Kubernetes edges that manage both VM and container VNFs
Fabric control to manage switch
OVS-DPDK and SR-IOV

Neutron Agents → vhost-user → OVS-DPDK → VF1, VF2, VF2 → SRIOV

- VNF NonDP
- VNF NonDP
- VNF DP
- VNF DP
- VNF DP
- VNF High DP
- VNF High DP

- OAM
- Ethernet Port

Show 2 Physical Ports
Show 1 VF to OVS-DPDK
2 VFs to VNFs.

OAM on a separate physical port.
OVS-DPDK and SR-IOV
Port Mirroring with SR-IOV VFd

https://blueprints.launchpad.net/neutron/+spec/port-mirroring-sriov-vf
Other Neutron Enhancements

- OVS-DPDK support in Helm
- Segment Range Management of Self-service Networks
- Provider Network Management
- Rescheduling of DHCP Servers and Routers
- Fault Management
- OVS support for Networking VLAN Transparency
- VLAN Trunk
- OVS-DPDK firewall driver enhancement
- Security Group
Containerized OpenStack Network

- Management network would be for platform services only and isolated from the cluster
- OpenStack services exposed on cluster network via an K8S ingress controller
- NFV-VIM APIs need to be accessible from both the OAM and cluster networks
- Platform services need access to several OpenStack APIs
- Ceph service need access from cluster network
Thank you!

- For More Information, Please Visit [www.akraino.org](http://www.akraino.org) and [www.starlingx.io](http://www.starlingx.io)

- Call For Join!!!
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