ONAP4K8s (EMCO), OVN4NFV-K8s and SD-EWAN
Open Source Projects that Akraino/ICN family integrate and some cases developing as feature projects

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What is ICN?

- A reference architecture/integration initiative targeting Telco edge, On-Prem Edge computing use cases
- Approved (incubation phase) as a ‘blueprint’ family within the Akraino project (LF)
- ICN Family has two blue prints
  - Multi-server Integrated Cloud Native NFV/App stack
  - Private LTE/5G
  - (Proposal) Multi tenancy security cloud native stack
- ICN Family has 16 Partners – Ranging from Telco, Enterprises and SIs
- Intel-optimized ingredients include: OpenNESS, EdgeX, SRIOV, QAT, CSI/Optane, K8s HPA, etc.
Traditional Cloud Native frameworks
For Enterprise applications

Traditionally
- Number of K8s clusters are small
- K8s Cluster installation/upgrades are mostly done independently in each location.
- Deployment of applications on K8s clusters is also done independently.
- K8s clusters are used for normal applications
- Network and security functions are deployed outside of K8s clusters as physical appliances or virtual appliances

Today K8s Clusters are not meant for Network functions and Telcos. Need for Telco grade platform.
Let us see the needs
Need: High performance applications
Low latency, Deterministic performance & high throughput

High performance applications requirement
- Dedicate cores
- Core affinity
- L3 Cache allocation
- NUMA aware placement
- Dedicating Memory bandwidth

Intel ICN solution
- OpenNESS platform micro-services
  - CMK for core affinity/dedication.
  - Topology manager for NUMA aware placement
  - KPI aware scheduling
  - RDT configuration
Need: Cloud Native network functions
Resource constrained Edges, Data plane NF (such as UPF, firewall, RAN) support
Separate Management Interface

Network function requirements
- **SRIOV-NIC support**
- **Multiple CNIs**
- **Multiple virtual networks**
- **Provider network support**
- **Service function chaining**
- **Some cases, attaching GPU and FPGA based accelerators.**
- **Platform feature exposure**

Akraino ICN solution:
- **OpenNESS Network Services**
  - SRIOV-NIC device plugin/CNI
  - FPGA Device service.
  - Multus for Multiple CNI support
  - NFD
- **OVN4NFV-K8s Network Controller:**
  - For Multiple virtual networks, Provider networks & Service function chaining

[GitHub Link](https://github.com/opnfv/ovn4nfv)
How does NFV based deployment with Cloud Native network functions look like? (Taking SDWAN with security NFs as an example)
Need: Support for Large number of Edges
Simplify cluster life cycle management

Large number of Edge Cluster
- Install, upgrade/patch and terminate are complex operations

Intel ICN solution
- Infrastructure orchestration (infra-local-controller) based on ClusterAPI, Metal3 and Ironic.

ICN Infra local controllers: https://gerrit.akraino.org/r/admin/repos/icn
Need: Geo-Distributed Application (Such as 5GRAN, 5GC) Life Cycle management
For geo-distributed applications across multiple K8s clusters

Operator / Subscriber

Deploy & Manage Apps - EMCO

Onboard | Deploy | Visibility

Distributed Application deployment and visibility
- Simplify
- Geo distribution

Intel ICN solution:
- EMCO
  - Onboarding of composite applications
  - Deployment intent
  - Configure ISTIO and security of edges automatically
  - Comprehensive visibility across clusters

https://github.com/onap/multicloud-k8s
Need: Secure Overlay
For connecting edge locations security for inter application traffic

Unique Edge challenges (No public IP, Less bandwidth links, Prone to DDOS attacks) and the need for overlay

Intel ICN solution:
- SD-EWAN
- OpenWrt based
- CNF
- Cloud native configuration
- Traffic Hub for traffic sanitization
- Controller Hub to create security and WAN policies dynamically
- FW+NAT+DPI+IPSEC+SLB
- ISTIO/Envoy based Application overlay
  - Automation of ISTIO (Ingress, egress & SC) across edges for microservice connectivity

https://gerrit.akraino.org/r/gitweb?p=icn/sdwan.git
Need: Analytics
For collecting statistics and making them available for analysis & closed loops

Local collection agents
Local inferencing and closed loop
Centralized metrics collection
Training
Model Reps
Policy based Analytics
Rule Synchronizer

Akraino ICN solution:
• Distributed AI Analytics
  • CollectD, Prometheus
  • Grafana
  • M3DB for central collection
  • Spark & TF for training
  • Kafka for distribution
  • Minio for storage

- Flexibility to deploy various pieces at various locations.

https://gerrit.akraino.org/r/admin/repos/icn/daaas
Need: Common CNF middleware as Sidecars
(Yet to be done)

Need:
Make Telco specific logic as common infrastructure logic
- Control to DevOps/DevSecOps
- Increase productivity of CNF developers
- Automate the addition of sidecars (Example: Via EMCO) at the time of deployment

Note: Some operations can only be done as POD

ICN goals:
- Identify common blocks across CNFs for various market segments.
- Make them as sidecars
- Few that can be started with are:
  - Linux namespace specific metrics exporter (NodeExporter) as sidecar
  - Tuning
  - Monitoring (Tamper detection, scanning)
MICN
Integrated Platform combining all components together

- **OSS/BSS**
- **CI/CD workflows**

**Deploy & Manage Apps - EMCO**
- **Onboard**
- **Deploy**
- **DAAS**

**SD-EWAN Automation**

**Distributed Applications**
- **SD-EWAN CNF**
- **DAAS**
  - OpenNESS Platform Svcs
  - OVN-for-NFV
  - OpenNESS Network Svcs

**Linux**

**Private Cloud K8s cluster**

**Public Cloud K8s Cluster**

**Edge K8s Cluster**

**Possibly in hundreds**

**SD-EWAN traffic Hub**

**Infrastructure Orchestrator**

**Internet**
ICN Recipe

- **ICN is an excellent starting point for Cloud native Telco grade PaaS**
- **But with modular extensions and services that can be built upon in Telco, Enterprise and IOT uses cases**
- **ICN is complete End2End platform – All SW and HW necessary for Edge Service Providers and Telcos that require deployment of CNFs, VNFs, CNAs and all working together.**

ICN BPs
Integrated Cloud Native Edge SW platforms for Enterprises, IoT and Telco markets

ICN is complete End2End platform – All SW and HW necessary for Edge Service Providers and Telcos that require deployment of CNFs, VNFs, CNAs and all working together.

**Cloud Native industry Open Source projects**
- K8s
- ISTIO
- Prometheus
- Virtlet/Kubevirt
- CollectD
- Envoy
- Ceph/Rook
- FluentD

**OpenNESS toolkit**
- MEC type service discovery
- Topology, CPU Manager, NFD
- OpenVINO
- platform device plugins
- CNIs (Multus, SRIOV-NIC, OVS-DPDK)

**Integration Validation Platforms with XEON-SP, OS**
Use cases (uCPE, 5G RAN, 5GC, AI, Vision)

**Distributed AI Analytics Stack**
- DAAS

**Multi Edge/Cloud Orchestrator – EMCO**
- Cloud Native Edge WAN function SD-EWAN
- Infrastructure Orchestration : BPA

**OVN based CNI : OVN-for-K8s-NFV**

**ICN Recipe**

Digital Edge Cloud
- ICN BPs
  - ICN is complete End2End platform – All SW and HW necessary for Edge Service Providers and Telcos that require deployment of CNFs, VNFs, CNAs and all working together.
ICN Current Status and Roadmap
(Subject to resources availability – Get Involved 😊)

**Q4, 2019**
- 1st release
- Local infrastructure controller
- Integration of OVN-for-K8s-NFV, OpenNESS platform and network services.
- VNF, CNF support
- Integration with EMCO
- Ubuntu OS

**Q2, 2020**
- SD-EWAN CNF support
- SD-EWAN to replace external load balancer
- SD-EWAN K8s based configuration
- More test cases
- VM based K8s support
- Higher integration with EMCO

**Q4, 2020**
- Traffic Hub integration
- EMCO v2 API integration with SD-EWAN
- SFC chaining
- DCM support in EMCO in ICN
- SDEWAN and IPSec Controller, SDEWAN HUB
- CentOS support
- OVN based Network Policy in OVN4NFV-k8s
- OVN based Cluster IP LB (Instead of IPVS)

**Yet to be planned**
- Optimization with Intel IA Accelerators (QAT, AES-NI) in SDEWAN
- Cluster API
- Global Infrastructure Orchestration support
- Common CNF Middleware as sidecars
- technical debt
- Others...
Q&A
How the Secure Overlay For connecting edge locations security for inter application traffic works?

SD-EWAN

- Open WRT based SE-DWAN CNFS
- Cloud Native based SD-EWAN controller and IPSec controller
- Zero touch automation
- Solution to all Edge Challenges identified
- Centralization controller for configuration
- Traffic Hub for sanitization

Advantages

- No changes to application Micro services and configuring Edges
- Supporting both green field and brownfield requirements
- Work with third party SD-WAN VNFs (future roadmap)

Refer

Repo: https://gerrit.akraino.org/r/admin/repos/icn/sdwan
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NFV based deployment with Cloud Native network functions requirements

K8S Cluster

K8S Master

resident 1 Applications (Micro-Services)

PCD POD POD

resident 2 Applications (Micro-Services)

POD POD POD

Ingress (L7 LB)

Default Virtual network (OVN)

Provider network 1 (OVN using L2 breakout, OVN LB on L2 Switch)

Provider network 2 (OVN)

SLB

NGFW

SDWAN CNF

EXT Router

Internet

Corp networks

M1

M2

M3

Hardware (Multiple Nodes)

Dynamic virtual Networks

Provider networks

Multiple interfaces

Network function chaining

Network function load balancing

Feature Reqmts

Dynamic virtual Networks

Provider networks

Multiple interfaces

Network function chaining

Network function load balancing

Implementation Consideration

No changes to NFs

No changes to Apps

Configuration via operators

OVN based SRIOV Overlays

Smart NIC friendly & AF_XDP for packet processing NFs

OVN4NFV: https://gerrit.opnfv.org/gerrit/admin/repos/ovn4nfv-k8s-plugin