IEC Blueprint of Akraino Edge Stack and Related Work

Aug 19, 2019

AKRAINO EDGE STACK

Agenda

- Edge Computing & Akraino of LF
- IEC Introduction
- IEC Reference Stack
- IEC Types
- IEC Status & CI
- Future Work

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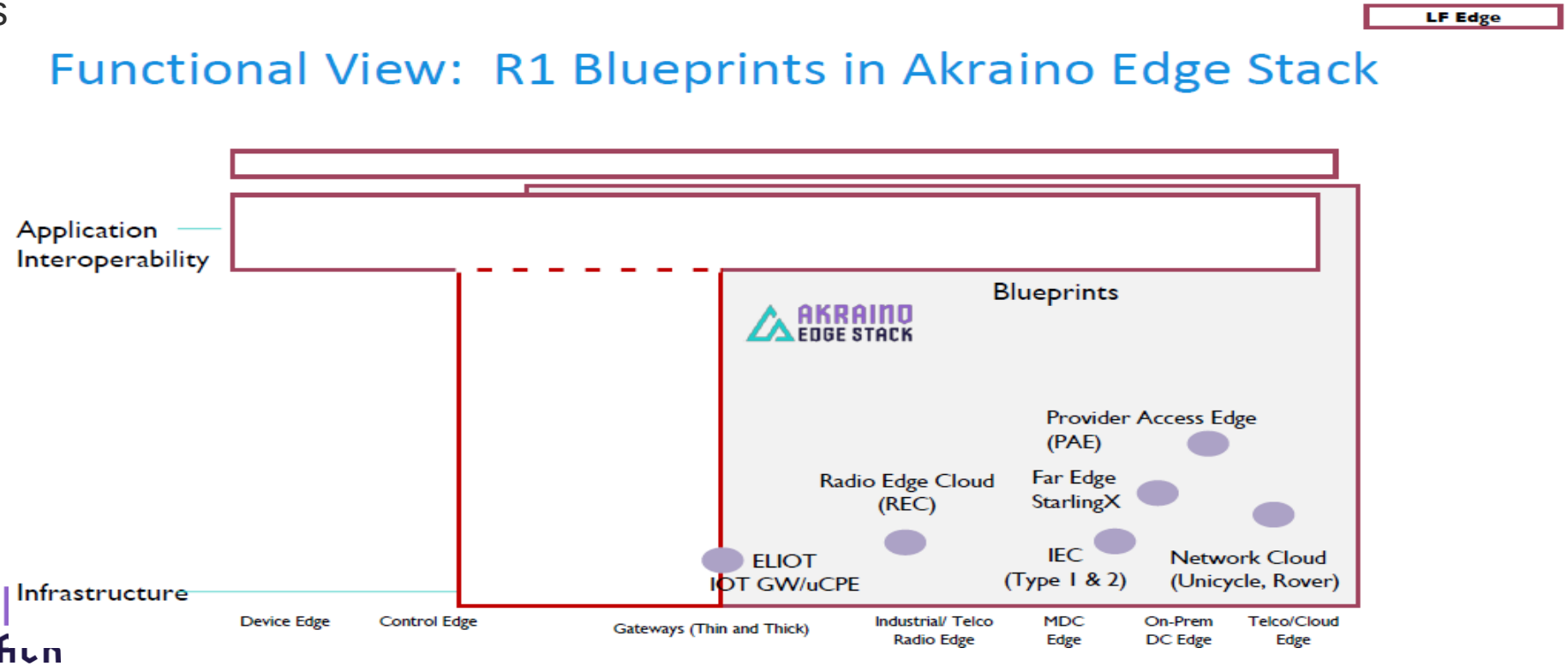
LF Akraino

- The Akraino community was proud to announce the availability of release 1 on June 6th. The community experienced a rapid growth within a year, in terms of membership and community activities. Akraino received broader contributions from 60% of the LF Edge 60+ members and other developers across the globe in R1.
- Akraino community came up with a brilliant way to solve this integration challenge with the Blueprint model. Akraino community will be the sole supplier of the Blueprints to LF Edge projects and intent to address



Why Akraino Edge Stack?

The Akraino Edge Stack community delivers fully integrated, “ready and proven” Edge Stacks

Multiple Opensource but no integrated solution to address Edge use cases

Before
Akraino Edge Stack

Real use case driven & Architecture Agnostic

Edge Use Case Driven

Development of features to support fully functional Edge Solution.

Integration of Multiple Opensource Software

Fully Integrated Edge Stack

Production Readiness

Multiple Validations with declarative stack

Standardize Edge Features and APIs

Compliant and Secure

Vendor Support Eco-system

Suppliers and Users upfront collaboration

Akraino Blueprints

After
Akraino Edge Stack

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Akraino Blueprints - Incubation Projects

Note: Company shown is company requested the Blueprint creation. Further contributions comes from the community (many). See the Akraino Wiki for the full details.

IOT & Far Edge Use Cases

NOKIA

Micro MEC
Can be installed on light poles, vehicles, etc…
Target Industry: Smart City, Far Edge Cloud

HUAWEI

Edge Light & IoT
uCPE use cases, IoT appliances
Target Industry: Manufacturing & Customer Premise

intel

Time Critical Edge Compute
IoT use cases, appliances
Target Industry: Manufacturing, IoT & Safety

arm

Integrated Edge Cloud
IoT use cases, appliances
Target Industry: Remote Edge Locations

Telco Use Cases

AT&T NOKIA

Radio Edge Cloud
Cloud appliance to address ORAN RIC requirements
Target Industry: Telco – Radio Edge

AT&T NOKIA

SDN Enabled Broadband Access
Virtual broadband access – higher bandwidth, symmetric version of GPON
Target Industry: Telco – Access

AT&T

Network Cloud
Telco 5G use cases and beyond
Target Industry: Telco – 5G and generic use cases. Airship Based

JUNIPER NETWORKS

Tungsten Fabric Integration
Enhancement to NC blueprint to support Contrail Tungsten Fabric

Other Use Cases

ERICSSON

OVS-DPDK Integration
Enhancement to NC blueprint to support OVS-DPDK

arm

ARM Servers/Appliance
Enhancement to NC blueprint to support ARM Servers & Appliances

redhat

Kubernetes Native Infrastructure
Focused on Native Container workloads
Target Industry: Industrial Automation

WIND RIVER STARLINGX

StarlingX Edge Cloud
Addresses Industrial Edge Usecases
Target Industry: Far Edge Automation

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Connected Car
Connected Car use case

Tencent 腾讯

LF Edge - Founding projects
Bringing several Edge verticals and domains under one umbrella

- Akraino Edge Stack is creating an open source software stack that supports high-availability cloud services optimized for edge computing systems and applications;
- EdgeX Foundry is focused on building a common open framework for IoT edge computing.
- Home Edge Project, seed code contributed by Samsung Electronics, is a new project that concentrates on driving and enabling a robust, reliable, and intelligent home edge computing framework, platform and ecosystem running on a variety of devices in our daily lives.
- Open Glossary of Edge Computing provides a concise collection of terms related to the field of edge computing.
- Project EVE (Edge Virtualization Engine), contributed by ZEDEDA, will create an open and agnostic standard edge architecture that accommodates complex and diverse on- and off-prem hardware, network and application selections.

Platinum Members:

arm AT&T DELL EMC ERICSSON Hewlett Packard Enterprise HUAWEI IBM
intel inwinSTACK JUNIPER NETWORKS MobiledgeX NETSIA NOKIA
NTT Qualcomm Radisys redhat SAMSUNG SEAGATE
Tencent 腾讯 WIND wipro ZEDEDA
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60 + Members already

Emerging Technologies in IOT and Networks

are demanding lower latency and accelerated processing at the edge

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

Edge computing

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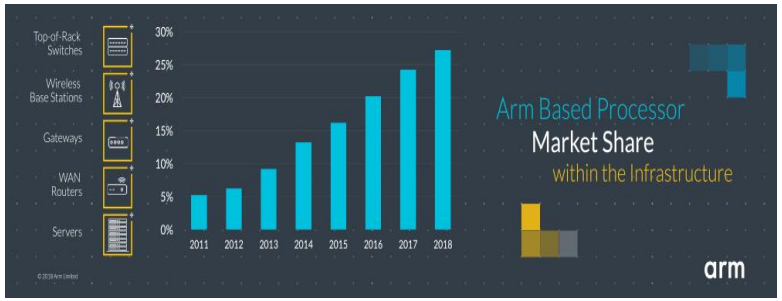
Akraino Blueprints and Arm's Involvement

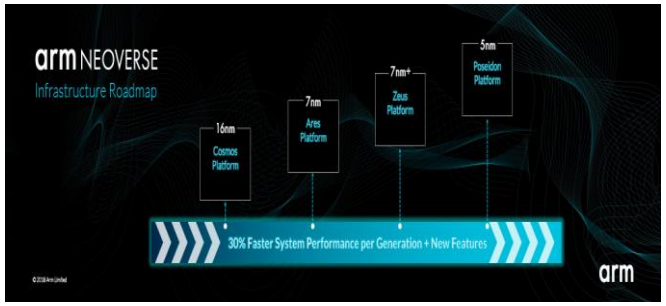
- 20+ blueprint projects proposed in Akraino
- Arm proposed and is leading Integrated Edge Cloud (IEC) as PTL
  - IEC Type 1: small deployment
  - IEC Type 2: medium deployment
- Arm is participating the following as committers
  - SDN Enabled Broadband Access (SEBA)
  - Radio Edge Cloud (REC)
  - Edge Light & IoT (ELIOT)
  - Micro MEC
- Arm is also discussing feature projects with partners in Akraino

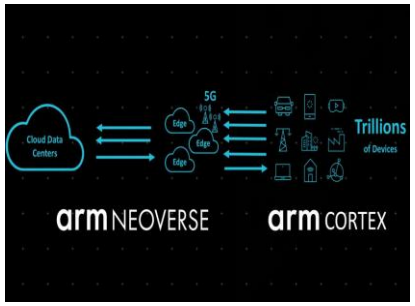
Blueprint Family	Blueprint Species Name	Submitter	Release Target
Network Cloud	SDN Enabled Broadband Access (SEBA)	AT&T	R1
	Serverless	AT&T	R1
	Unicycle Blueprint (SR-IOV)	AT&T	R1
	Rover Blueprint	AT&T	R2
	Real Time Edge Media Processing	Radisys	R1
	Network Cloud and TF Integration	Juniper	R1
	OVS-DPDK Unicycle (Dell)	Ericsson	R1
Integrated Edge Cloud	IEC Type 1: small deployment	Arm	R1
	IEC Type 2: medium deployment	Arm	R1
	IEC Type 4: AR/VR Oriented Edge Stack	HTC, Arm	R2
	IEC Type 3: Autonomous vehicles as the edge(Proposal)	DiDi, Arm	R2
	IEC Type 5: AI on the edge(Proposal)	Baidu, Arm	R2
Edge Light & IoT	ELIoT 2: LW Edge	Huawei	R1
	SD-WAN	Huawei	R1
Kubernetes Native Infrastructure for Edge	Provider Access Edge	Red Hat	R1
	Industrial Edge	Red Hat	R1
Micro MEC	Micro MEC Type 1,2,3	Nokia	R2
Radio Edge Cloud	Radio Edge Cloud	Nokia	R1
Far Edge Cloud	Starling X Far Edge Distributed Cloud	WindRiver	R1
Time Critical Edge Compute	Time Critical Edge Compute	Intel	R1

IEC Introduction

- IEC (Integrated Edge Cloud) is a platform that enables new functionalities and business models on the network edge. It targets telco applications and medium deployment of Edge Cloud. In this release it is based on Kubernetes and Calico and installation is automated with the foundation building and the focus on SEBA use-case.
- Edge use case to address
  - Telco/enterprise Edge cloud – for example, MEC or branch office data center…
  - Telco/enterprise remote edge locations – edge platform with limited resources, for example, SD-WAN, IoT gateway…







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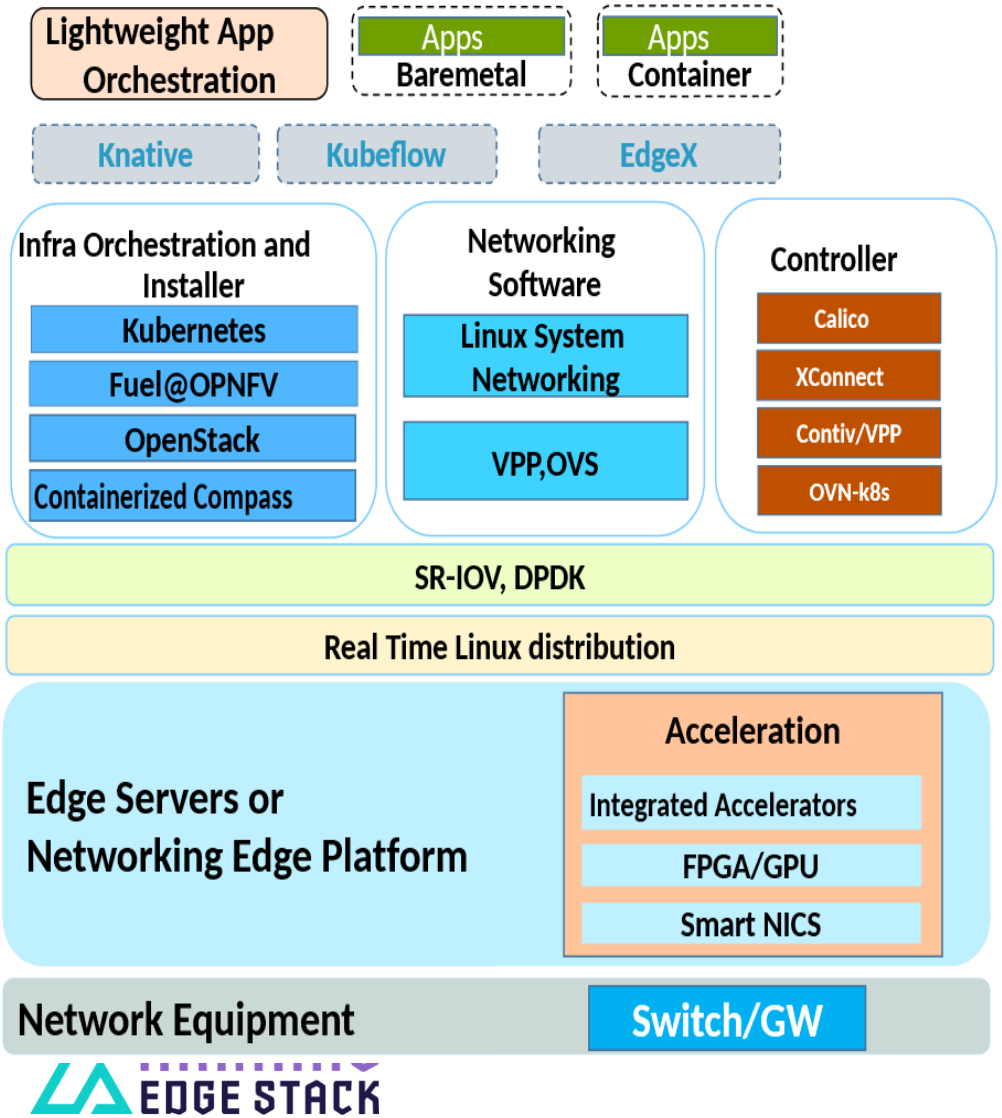
[Announcing Arm Neoverse]

IEC Reference Stack



Heterogeneous Architecture
- VM, container, bare metal
- Servers and customized Edge platforms
- Virtualized NFs and Physical NFs
- Accelerator interface

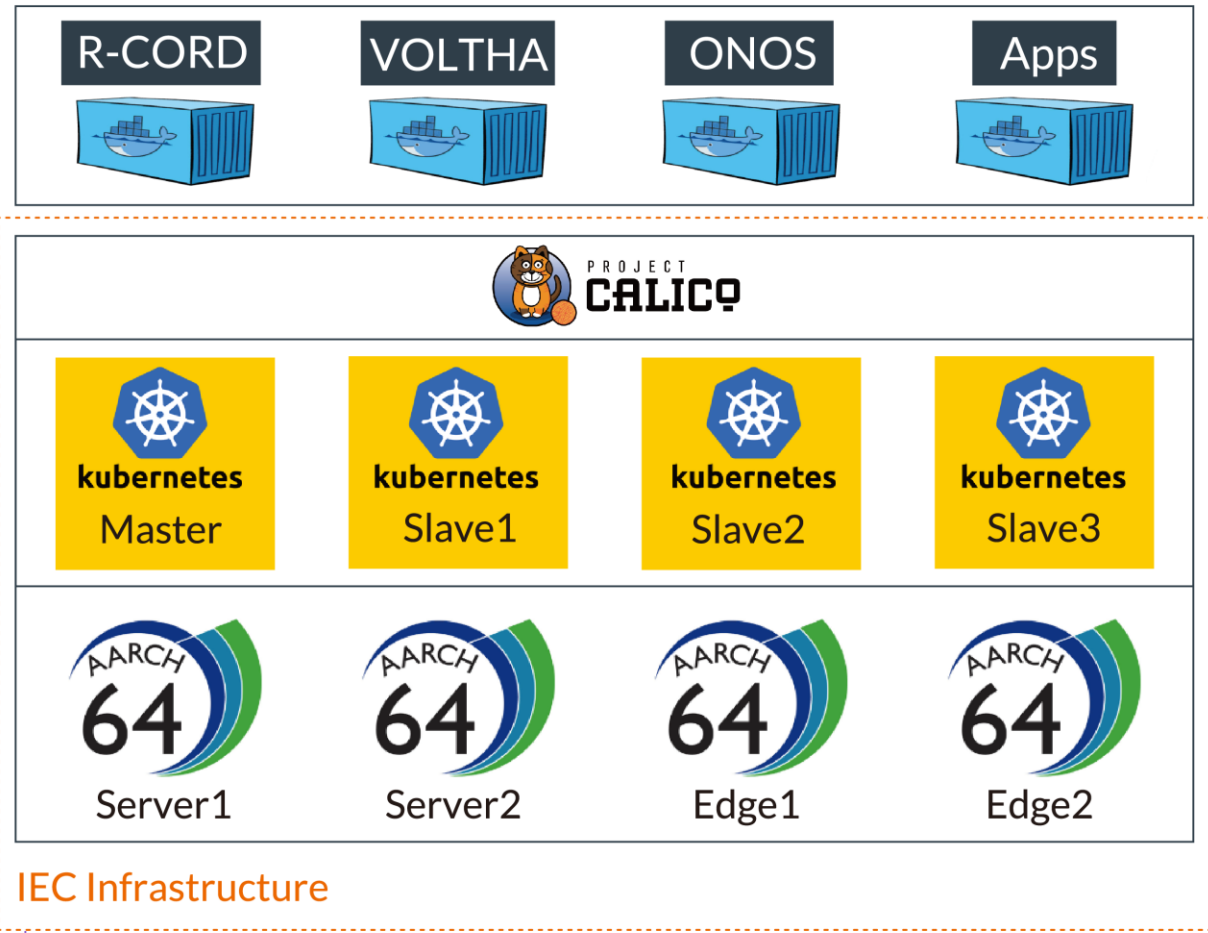
Resource constraints
- Kubernetes
- SDN Controller for K8s

HW Accelerations
- Integrated accelerators
- PCIe/CCIX attached accelerator (Smart NICs…)

IEC Wiki

- IEC Blueprints Installation Overview
- IEC CI/CD
- IEC Documentation
- IEC Engineering Plan
- IEC Gerrit
- IEC Hardware Requirement
- IEC Internal Verification and Validation Lab Setup
- IEC Jira
- IEC mailing list
- IEC Meetings
- IEC Type 1 for Integrated Edge Cloud (IEC) Blueprint Family
- IEC Type 2 for Integrated Edge Cloud (IEC) Blueprint Family
- IEC Type 4: AR/VR oriented Edge Stack for Integrated Edge Cloud (IEC) Blu...

Use Case: SDN-Enabled Broadband Access(SEBA) on IEC



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ONF Open Networking Foundation

docker

kubernetes

- Small deployment of edge and cloud environment
- Support virtualized access at carrier network
- Lower latency for end users, less load on network
- Fully utilize the compute power of edge devices

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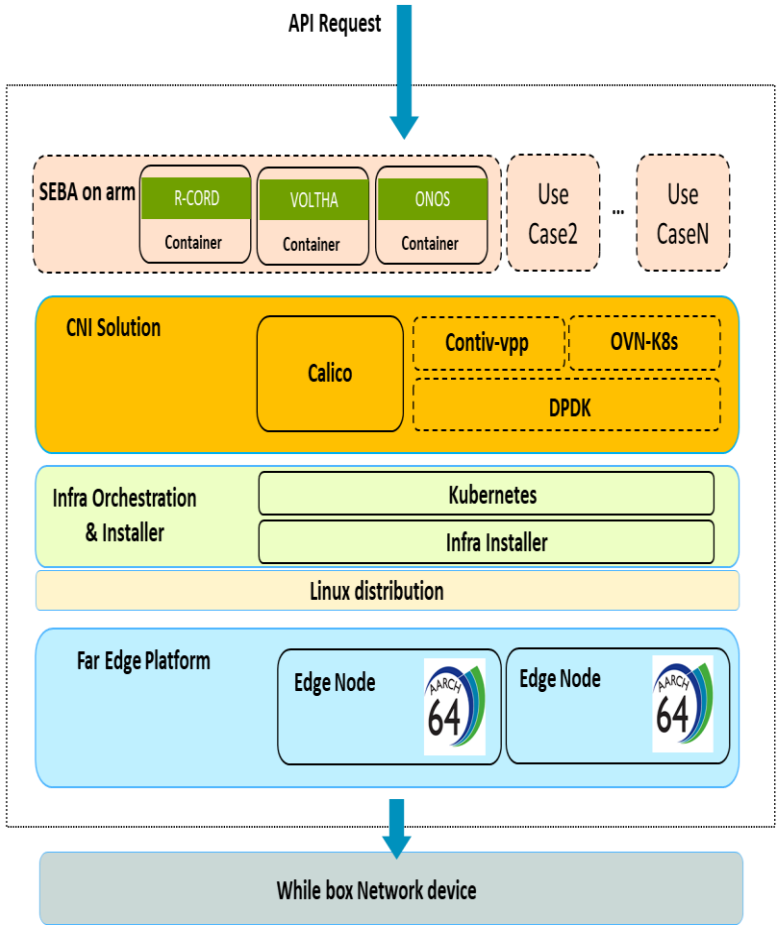
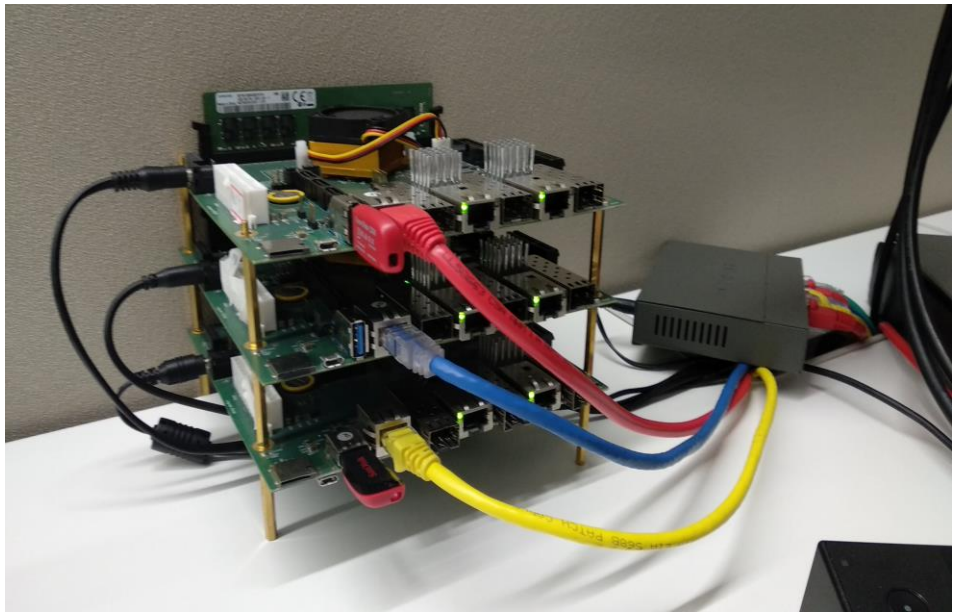
IEC Type 1



- SEBA: SDN-Enabled Broadband Access
- R-CORD: Residential Central Office Re-Architected as Datacenter
- VOLTHA: virtual OLT hardware abstraction
- ONOS: Open Network Operating System
- Arm-based Platform
  - Edge devices and customized Edge platforms
  - Virtualized NFs



An IEC Type 1 Sample Platform with small devices,
SEBA use case is enabled on this system with a k8s cluster

Use Case Attributes	Description
Use Case	Small deployment of edge end and cloud environment.
Blueprint proposed Name	IEC Type 1
Initial POD Cost (capex)	•The defining factor is power consumption < 50 W •The cost of the POD will depend on peripherals and case
Scale & Type	• A single-board computer that meets the power limit
Applications	IEC applications
Power and memory restrictions	•Less than 24 W for the SoC •Less than 16GB of memory
Infrastructure orchestration	ONAP Edge Automation/Kubernetes Edge Cloud orchestration
SDN	Calico container networking, or SR-IOV, OVS-DPDK or VPP-DPDK (Contiv/VPP)
Workload Type	•Containers
Additional Details	Submitter to provide additional use case details

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IEC Type 1

Features

- Platform works on aarch64 architecture, typically arm64 SoC with low power consumption;
- It supports both single node deployment and a 3-node deployment
- Deployment is can be automated from a jumpserverhttps://jenkins.akraino.org/view/iec/
- The SEBA on arm use-case is enabled and integrated with the IEC Type1 platform(Smallest SEBA itw?)
- The installation scripts which deploys Kubernetes cluster, Calico CNI, Helm/Tiller and related verifying Kubernetes applications/services with 1 master and 2 slave nodes. The scripts can be run from the jumpserver, or with manual installation from the servers on which it run. The installation methods is introduced in IEC Blueprints Installation Overview.
- Currently IEC uses
- project Calico as the main container networking solution which provides high performance, rich network policy, widely supported from Linux system and easy installation. In the future, Contiv/VPP or OVN-Kubernetes can be used as a high performance substitute since those 2 solutions can support DPDK enabled high speed interface access.

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IEC Type 2

Features

Typical Platform Software	Version
OS	Ubuntu16.04/18.04
docker	18.06.1-ce
Kubernetes	v1.13.0
calico	v3.3.2
etcd	v3.3.9

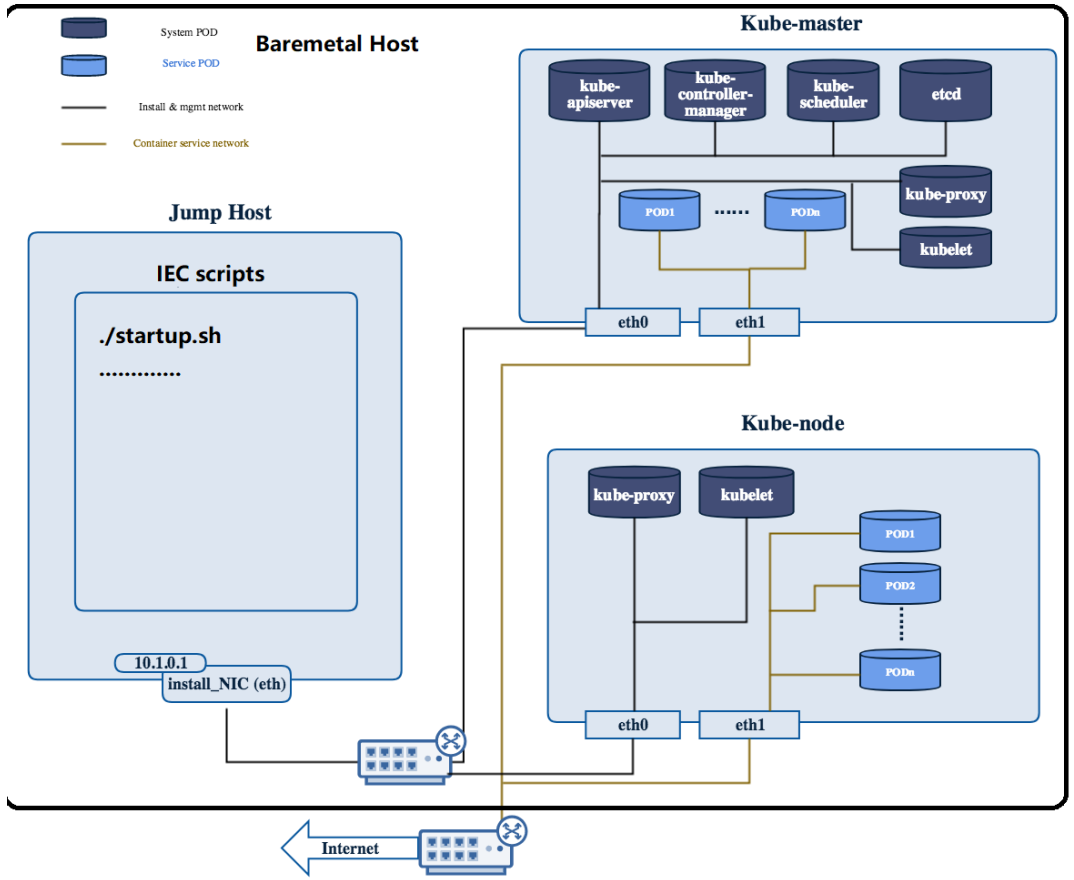
- Platform works both on x86_64 and aarch64 architectures
- It supports both single node deployment and a 3-node deployment
- Deployment is automated in CI with https://jenkins.akraino.org/view/iec/
- The SEBA (on arm) use-case is integrated with the IEC platform
- The IEC supported hardware are edge servers mainly based on arm64, such as Marvell ThunderX series, Ampere Arm64 servers; the desired network connections are above 10Gbit/s which may satisfy most current IEC applications requirement.
- The installation scripts which deploys Kubernetes cluster, Calico CNI, Helm/Tiller and related verifying Kubernetes applications/services with 1 master and 2 slave nodes. The scripts can be run from the jumpserver, or with manual installation from the servers on which it run. The installation methods is introduced in IEC Blueprints Installation Overview.
- Currently IEC uses project Calico as the main container networking solution which provides high performance, rich network policy, widely supported from Linux system and easy installation. In the future, Contiv/VPP and OVN-Kubernetes may be used as a high performance substitute since those 2 solutions can support DPDK enabled high speed interface access.
- IEC support Akraino CI/CD requests: IEC Daily jobs (scheduled to run recurrently) deploy IEC using one of the agreed installers; run testing suites; collect logs and publish them.

Ampere eMAG 64bit Arm Server

Marvell Thunderx2 arm server

IEC Type1,2 Status & CI

- Approved blueprint of Akraino Edge Stack Integration Projects(Blueprints)
- Code upstreamed to Akraino IEC repo: https://gerrit.akraino.org/r/admin/repos/iec
- Provide IEC foundation installation document and scripts
- SEBA use case have been enabled and integrated on IEC platform
- Setup Initial CI/CD environment: https://jenkins.akraino.org/view/iec/
- Weekly meeting
- IEC Wiki: https://wiki.akraino.org/display/AK/Integrated+Edge+Cloud+%28IEC%29+Blueprint+Family
- IEC Installation Guide: https://wiki.akraino.org/display/AK/IEC+Installation+Guide



Future Work(Provisional)

- Telco Appliance support enhancement(DamnNet, REC, uMEC);
- High performance data plane acceleration with DPDK, VPP(Contiv/VPP);
- Integrated Restful API to support management, deployment and control;
- More use cases, such as vCDN, edgeAI, TARs
- Other IEC Types support and integration
- KubeFlow, Kubeedge support

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For More Information, Please
Visit www.akraino.org

谢 谢!
Thank You!