IEC Blueprint of Akraino Edge Stack and Related Work

Aug 19, 2019
Agenda

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

Functional View: R1 Blueprints in Akraino Edge Stack
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

After Akraino Edge Stack

Akraino Blueprints
### Akraino Blueprints - Incubation Projects

#### IOT & Far Edge Use Cases

<table>
<thead>
<tr>
<th>Company</th>
<th>Use Case</th>
<th>Target Industry</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nokia</td>
<td>Micro MEC</td>
<td></td>
<td>Can be installed on light poles, vehicles, etc… Target Industry: Smart City, Far Edge Cloud</td>
</tr>
<tr>
<td>Huawei</td>
<td>Edge Light &amp; IoT</td>
<td></td>
<td>uCPE use cases, IoT appliances Target Industry: Manufacturing &amp; Customer Premise</td>
</tr>
<tr>
<td>Intel</td>
<td>Time Critical Edge Compute</td>
<td></td>
<td>IoT use cases, appliances Target Industry: Manufacturing, IoT &amp; Safety</td>
</tr>
<tr>
<td>Arm</td>
<td>Integrated Edge Cloud</td>
<td></td>
<td>IoT use cases, appliances Target Industry: Remote Edge Locations</td>
</tr>
</tbody>
</table>

#### Telco Use Cases

<table>
<thead>
<tr>
<th>Company</th>
<th>Use Case</th>
<th>Target Industry</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>Radio Edge Cloud</td>
<td></td>
<td>Cloud appliance to address ORAN RIC requirements Target Industry: Telco – Radio Edge</td>
</tr>
<tr>
<td>Nokia</td>
<td>SDN Enabled Broadband Access</td>
<td></td>
<td>Virtual broadband access – higher bandwidth, symmetric version of GPON Target Industry: Telco – 5G and generic use cases. Airship Based</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>Network Cloud</td>
<td></td>
<td>Telco 5G use cases and beyond Target Industry: Telco – 5G and generic use cases. Airship Based</td>
</tr>
<tr>
<td>Juniper</td>
<td>Tungsten Fabric Integration</td>
<td></td>
<td>Enhancement to NC blueprint to support Contrail Tungsten Fabric</td>
</tr>
</tbody>
</table>

#### Other Use Cases

<table>
<thead>
<tr>
<th>Company</th>
<th>Use Case</th>
<th>Target Industry</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ericsson</td>
<td>OVS-DPDK Integration</td>
<td></td>
<td>Enhancement to NC blueprint to support OVS-DPDK</td>
</tr>
<tr>
<td>Arm</td>
<td>ARM Servers/Appliance</td>
<td></td>
<td>Enhancement to NC blueprint to support ARM Servers &amp; Appliances</td>
</tr>
<tr>
<td>Red Hat</td>
<td>Kubernetes Native Infrastructure</td>
<td></td>
<td>Focused on Native Container workloads Target Industry: Industrial</td>
</tr>
<tr>
<td>Wind River</td>
<td>StarlingX Edge Cloud</td>
<td></td>
<td>Addresses Industrial Edge Use cases Target Industry: Far Edge Automation</td>
</tr>
</tbody>
</table>

**Connected Car**

Connected Car use case

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Note: Company shown is company requested the Blueprint creation. Further contributions come from the community (many). See the Akraino Wiki for full details.
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
- Inwin Stack
- Juniper
- MobiledgeX
- Netsia
- NOKIA
- NTT
- Qualcomm
- Radisys
- Red Hat
- Samsung
- Tencent
- Wipro
- Wind
- ZEDEDA

60 + Members already
Emerging Technologies in IOT and Networks are demanding lower latency and accelerated processing at the edge.

<table>
<thead>
<tr>
<th>NFV Edge Infrastructure</th>
<th>Wireless (vRAN,vEPC)</th>
<th>Wireline (PON)</th>
<th>uCPE (SD-WAN)</th>
<th>IP Enterprise Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomous Devices</td>
<td>Drones</td>
<td>Autonomous Vehicles</td>
<td>Industry Robots</td>
<td>Medical</td>
</tr>
<tr>
<td>Immersive Experiences</td>
<td>Virtual Reality</td>
<td>Augmented Reality</td>
<td>360 Video</td>
<td>Wearable Cognitive Assistance</td>
</tr>
<tr>
<td>IoT &amp; Analytics</td>
<td>Industrial Sensors</td>
<td>Home Devices</td>
<td>Retail</td>
<td>Healthcare</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On-Demand NFV, Hardware Acceleration, A.I., Microservices, 5G

Edge computing
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

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

1. Telco/enterprise Edge cloud – for example, MEC or branch office data center…
2. Telco/enterprise remote edge locations – edge platform with limited resources, for example, SD-WAN, IoT gateway…

Announcing Arm Neoverse
IEC Reference Stack

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

- 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
An IEC Type 1 sample platform with small devices, SEBA use case is enabled on this system with a k8s cluster.

**Use Case Attributes**

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

**Use Case**

- **SEBA**: SDN-Enabled Broadband Access
- **R-CORD**: Residential Central Office Re-Architected as Datacenter
- **VOLTHA**: virtual CPE hardware abstraction
- **ONOS**: Open Network Operating System
- **Arm-based Platform**
  - Edge devices and customized Edge platforms
  - Virtualized NFV
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 jumpserver [https://jenkins.akraino.org/view/iec/](https://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.
IEC Type 2

Features

- 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.

<table>
<thead>
<tr>
<th>Typical Platform Software</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Ubuntu16.04/18.04</td>
</tr>
<tr>
<td>docker</td>
<td>18.06.1-ce</td>
</tr>
<tr>
<td>Kubernetes</td>
<td>v1.13.0</td>
</tr>
<tr>
<td>calico</td>
<td>v3.3.2</td>
</tr>
<tr>
<td>etcd</td>
<td>v3.3.9</td>
</tr>
</tbody>
</table>

Typical Platform Software

Ampere eMAG 64bit Arm Server

Marvell Thunderx2 arm server
IEC Type 1,2 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
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
For More Information, Please Visit www.akraino.org

谢谢！Thank You!