Dedicated, Operated

Stage 1: At Large Projects
- Baetyl, Open Horizon, Secure Device Onboard

Stage 2: Growth Projects
- EVE, Fledge, Home Edge, State of the Edge

Stage 3: Impact Projects
- Akraino, EdgeX Foundry

Distributed Devices and Systems
- Smartphones, PCs, ruggedized IoT gateways and servers in accessible to semi-secure areas
- Servers in secure on-prem data centers, MDCs

User Edge
- Dedicated, Operated

Service Provider Edge
- Shared, XaaS

LOCATIONS
- Access Edge
- Regional Edge

Last Mile Networks
- Access Networks
- Aggregation Hubs/COs
- Server-based compute at Telco Network and Edge Exchange Sites
- Server-based compute at Regional Telco and Direct Peering Sites
- Servers in traditional cloud data centers

MCU-based devices
- Embedded compute

Infrastructure

Research and Reports

Applications
LF Edge - the end to end context
Deployment ready Open Source - use cases
Akraino Release 4: Now available

Akraino Release 4 Enables Kubernetes Across Multiple Edges, Integrates across O-RAN, Magma, and More

- 7 New Akraino R4 Blueprints (total of 25+)
- Akraino is Kubernetes-ready with K8s-enabled blueprints across 4 different edge segments (Industrial IOT, ML, Telco, and Public Cloud)
- New and updated blueprints also target ML, Connected Car, Telco Edge, Enterprise, AI, and more

SAN FRANCISCO – February 25, 2021 – LF Edge, an umbrella organization within the Linux Foundation that creates an open, interoperable framework for edge computing independent of hardware, silicon, cloud, or operating system, today announced the availability of Akraino Release 4 (“Akraino R4”). Akraino’s fourth release enables additional blueprints that support various deployments of Kubernetes across the edge, from Industrial IoT, to Public Cloud, Telco, and Machine Learning (ML).
**Applications**
- Distributed Devices and Systems
- Buildings / Factories / Smart Homes

**Infrastructure**
- MCU-based devices
- Embedded compute
- Smartphones, PCs, ruggedized IoT gateways and servers in accessible to semi-secure areas
- Servers in secure on-prem data centers, MDCs

**LOCATIONS**
- Access Edge
- Aggregation Hubs/COs
- Regional Data Centers
- Centralized Data Centers

**User Edge**
- Dedicated, Operated

**Service Provider Edge**
- Shared, XaaS

**Akraino R4 Blueprints**
- IOT – Predictive Maintenance
- IEC - Type 1
- ELIOT IOT GW/uCPE
- Micro-MEC

**Last Mile Networks**
- Server-based compute at Telco Network and Edge Exchange Sites
- Server-based compute at Regional Telco and Direct Peering Sites
- Servers in traditional cloud data centers

**KubeEdge**
- Public Cloud Edge Interface

**Blueprints**
- R4 Blueprints (New)
- R1/R2/R3 enhanced Blueprints
- 5G MEC – Cloud Gaming
- 5G MEC – Enterprise
- The AI Edge – Security, Autonomous Vehicle, Federated Learning
- ICN Private 5G
- Network Cloud Family
- Telco Appliance -Radio Edge
- Connected Vehicle
- IEC - Type 2-S
- KNI Provider Access Edge (PAE) & Industrial Edge
- R4 Blueprints (New)
- R1/R2/R3 enhanced Blueprints

**Applications**
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**Infrastructure**
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**LOCATIONS**
- Access Edge
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**User Edge**
- Dedicated, Operated

**Service Provider Edge**
- Shared, XaaS
Akraino: Delivering a Fully Functional Edge Solutions
Unifying multiple industry sectors of edge across disciplines, including IoT, Enterprise, Telecom, and Cloud

• Ever since its launch in 2018, Akraino continues to gain community support for innovative creation of deployable Edge solutions with work going in more than 30+ Blueprints.
• Akraino blueprints are now globally adopted in commercial solutions to address several edge use cases.
• Akraino hosts sophisticated community and multiple user labs to speed the edge innovation.
• Akraino delivered fully functional new Blueprints for deployment in R3 to address edge use cases such as 5G MEC, AI Edge, Cloud Gaming at Edge, Android in Cloud, Micro-MEC and Hardware acceleration at the edge.
• Created framework for defining and standardizing APIs across stacks, via upstream/downstream collaboration and published a whitepaper.
• Akraino introduced tools for automated Blueprint Validations, security tools for Blueprint Hardening and Edge API’s in collaboration with LF Edge projects.
• Akraino community has participated in several industry industry outreach events that featured participation to foster collaboration and engagement on edge projects across the entire ecosystem.
Robust Community Contribution

Deployable and fully functional edge stack for use cases across IIoT, Telco 5G Core & vRAN, uCPE, Provider Access Edge, SDWAN, Edge Media Processing, and Carrier Edge Media Processing

✔ 40+ companies are engaged across the globe
✔ 80% of LF Edge Premier Members are active in Akraino
Robust Cross-Industry Contribution- 2020 (full year)

Deployable and fully functional edge stack for use cases across IIoT, Telco 5G Core & vRAN, uCPE, SDWAN, Connected Vehicle, AR/VR, Edge Media Processing, and Carrier Edge Media Processing

Commits Percentage By Organization

- Huawei Technologie...
- Red Hat
- ENEA Software AB
- Intel Corporation
- Intel
- AT&T Services, Inc.
- Nokia
- ARM
- The Linux Foundation
- Tencent Holdings Li...
- Other

Lines Changed Percentage By Organization

- China Mobile Comm...
- Huawei Technologie...
- AT&T Services, Inc.
- ARM
- Intel Corporation
- Intel
- Red Hat
- ENEA Software AB
- Individual
- Equinix
- Other

Top 10 Orgs
Intel Corporation
AT&T Services, Inc.
The Linux Foundation
Nokia
China Mobile
Red Hat
Tencent
Arm
ENEA Software AB
Huawei
ERICSSON

242 Unique Contributors
From 70 Organizations
What is an Akraino Blueprint?

Community Integrated, tested, deployable, end to end Edge Stack

- Benefits:
  - Low Cost
  - Large Scale
  - Zero Touch Provisioning
  - Industry Adoption
  - OCP Whitebox/OEM H/W

Since launch in 2018, Akraino continues to gain community support for collaboration and validation with 30+ blueprints
Public Cloud Edge Interface (PCEI)

BP Family: Public Cloud Edge Interface

**Purpose/Features:**
The purpose of Public Cloud Edge Interface (PCEI) Blueprint is to specify a set of open APIs and orchestration functionalities for enabling Multi-Domain Inter-working across functional domains that provide Edge capabilities/applications and require close cooperation between the Mobile Edge, the Public Cloud Core and Edge, the 3rd-Party Edge functions as well as the underlying infrastructure such as Data Centers, Compute hardware and Networks.

**Use cases & Applications**
- Edge Multi-Cloud Orchestrator (EMCO) - PCEI Enabler
- Deployment of Azure IoT Edge Cloud Native PCE App
  - Using Azure IoT Edge Helm Charts provided by Microsoft
- Deployment of AWS Green Grass Core PCE App
  - Using AWS GGC Helm Charts provided by Akraino PCEI BP
- Deployment of PCEI Location API App
  - Using PCEI Location API Helm Charts provided by Akraino PCEI BP
- PCEI Location API Implementation based on ETSI MEC Location API Spec
- Simulated IoT Client Code for end-to-end validation of Azure IoT Edge
- Azure IoT Edge Custom Software Module Code for end-to-end validation of Azure IoT Edge

**Target Industry:** IoT, Developers, Operators, Clouds, DCs, Interconnection
Predictive Maintenance with a Thermal Imaging Camera, vibration sensors, etc.

BP Family: IoT Workloads at the Smart Device Edge

Features:
- LF Edge’s Project EVE-OS to provide remote management, Zero Trust security (physical and software)
- LF Edge’s Fledge as an IIoT framework for sensors, historians, DCS, PLC’s, and SCADA systems and connectivity to public or private clouds
- Remote monitoring and updating of applications, without bricking the device
- AI Models, real time data capture, and cleansing at the device edge
- Sample application that can be customized to meet many different Use Cases

Use cases & Applications
- Predictive Maintenance
- Hazards monitoring (People detection in hazardous area)
The AI Edge: Federated ML Application at Edge

BP Family: AI Edge

Purpose

To provide a Federated Learning Platform that trains Machine Learning algorithm across edge devices without them sharing the data that make up the models.

Features

- FATE first unsupervised learning algorithm: Hetero KMeans
- Add Data Split module: splitting data into train, validate, and test sets inside FATE modeling workflow
- Add Data Statistic module: compute min/max, mean, median, skewness, kurtosis, coefficient of variance, percentile, etc.
- Add PSI module for computing population stability index

Landing Applications of The AI Edge: Federated ML application at edge

Target Industry: Driverless cars, Warehouse
KubeEdge Edge Service

BP Family: KubeEdge

Purpose:
- First Release will focus on the ML inference offloading Use Case

Features:
- KubeEdge managed Application deployment and life cycle management
- ML offloading to Edge server
- Cloud(training), Edge (Inference), Device collaboration

Target Industry: Smart road, Cold chain logistics, Smart building, etc.
Purpose/Features:

- Managing edge computing clusters from a central management hub by using Advanced Cluster Manager
- GititOps based application deployment with ArgoCD
- Cloud Native CI/CD Pipelines with Tekton
- Event streaming from edge to core with Kafka AMQ Streams and Mirror Maker
- Machine learning as a data scientist with Jupyter Notebook.

Use cases & Applications

- Machine inference-based anomaly detection

Target Industry: Manufacturing
The AI Edge: Intelligent Vehicle-Infrastructure Cooperation System (I-VICS)

**BP Family: AI Edge**

**Purpose/Features:**

- Autonomous Valet Parking

**Use cases & Applications:**

- Starting and testing the behavior planner
- Starting and testing the global planner
- Initializing the NDT localizer
- Running the EKF filter for localization
- Trajectory Following

**Target Industry: Autonomous Vehicles**
Private LTE/5G ICN

BP Family: ICN

Purpose/Features:
Creating a EPC/5G “in a box” to enable enterprises and operators to deploy LTE/5G
Uses OSS such as free5GC/Magma

Target Industry: Manufacturing, Retail, Farming, Mining
Enterprise Application on Light weight 5G Telco Edge (EALTEdge)

BP Family: 5G MEC/Slice

Purpose/Features:
Provides a complete ecosystem for enterprise applications on light weight 5G Telco Edge. Can be leveraged by Telco operators to provide edge computing capability to its enterprise users. Overall objective of this blueprint is to provide the following main features.

R4 Improvements
- Leverage EdgeGallery to add application/MEC Edge Orchestrator, Dev Platform, Dev and Tenant Portals
- Built a sample ROBO

Use cases:
**ROBO (Remote office Branch office):** Due to limited resource and disaster prone of ROBO sites, edge native storage, Backup and restore on lightweight telco edge is supported. Smart retail with automatic shelf management on ROBO sites is developed and integrated.

**Machine Vision on Campus Networks:** Centralized processing using wireless cameras, real-time response for detection/feedback; provide shared GPU

Target Industry: Telco operators
5G/MEC Slice System to Support Cloud Gaming, HD Video & Live Broadcast

BP Family: 5G MEC/Slice

Purpose/Features:
The 5G MEC BP consists of two network elements. One is the edge connector which is deployed in the cloud to enable traffic offloading, subscribe edge slice and implement application lifecycle management etc. The other is the edge gateway which is deployed close to the 4G/5G network to perform traffic steering, Local DNS service and traffic management etc.

Use cases & Applications
- Cloud Gaming
- HD Video
- Live Broadcasting
- Small deployment targeting MEC in access sites or enterprise
- Medium deployment targeting MEC in central offices

Target Industry: Gaming, Video, Broadcast
Micro Multi-access Edge Computing (MEC)

BP Family: uMEC

Purpose/Features:
Enables new functionalities & business models on network edge. Benefits include better latencies for end users; less load on network, since more data can be processed locally; and better security and privacy, since sensitive data need not be transferred to a centralized location.

Use cases:
- Fixed installation as part of 5G NR base stations; enables new services that leverage especially low latency, such as AR/VR
- As an extension of the previous, the “Smart City” deployments have additional functions such as weather stations, cameras, displays, or drone charging stations. The control software for these functions would run on the uMEC
- In an Industry 4.0 use case set, the uMEC is deployed as part of a 5G network and would provide a platform for running services for the factory floor
- In a train, the uMEC can collect and store surveillance camera data for later uploading
AI Edge: School/Education Video Security Monitoring

BP Family: AI Edge

Target Industry: Education, Home

Purpose/Features:
Focuses on establishing an open source MEC platform combined with AI capacities at the Edge; can be used for safety, security, and surveillance sectors as well as Intelligent Vehicle-Infrastructure Cooperation Systems.

Use cases:
- Hierarchical cluster management
- Duplex channel between cloud center and edge cluster
- Kubernetes native support
- Accurate routing of messages between clusters
- Support both x86 and arm64
IEC Type 3: Arm-Enabled Android Cloud Applications

BP Family: IEC

Purpose/Features:
Supports Android applications and services running on Arm-enabled cloud architectures with GPU/vGPU EC management. Arm-based cloud games need basic “cloud” features, such as flexibility and broad availability, which this blueprint provides.

R4:
- Android application environment based on Robox
- GPU Support

Use cases:
- **Android Cloud Games**: compress the rendering of game scenes into video and audio streams on the edge Android platform. Then edge cloud server transmits the compressed game pictures to the players’ game terminals through a 5G network, and obtains the players’ input instructions to realize interaction. End to end latency better =< 20ms.
- **AR/VR Android Applications**
IEC Type 5: SmartNIC

Target Industry: Telco and other carriers

Purpose/Features:
IEC Type 5 is focused on SmartNIC, which can accelerate network performance and provide more management convenience. In general, the architecture consists of two layers: IaaS (IEC), SmartNIC layer. But in R4, we have two simple layers: Host Layer, SmartNIC Layer.

Use cases:
- **CT based OVS-DPDK offload into SmartNic**: accelerates network performance, saves computing resources and providing security managements.
- **Part of the UPF and VPC functions**, like load balancing, forwarding, dpi, etc offloaded into SmartNIC to enhance the performance of UPF that will be deployed in carrier’s edge cloud datacenters.
Akraino R4 Connected Vehicle Blueprint

Connected Vehicle

**Purpose/Features:**
Establish OSS edge MEC platform for customized v2x application development. Tested on BM, VM and containers.

**Use cases:**
- **Smarter Navigation:** Real-time traffic info, reduced latency - minutes to seconds.
- **Reduce traffic violation:** Alerts drivers to local traffic laws.
- **Cooperative vehicle and infrastructure system:** Identifies potential risks not be seen by driver.

Target Industry: Transportation, Auto, Enterprise, IOT, Telecom
Akraino R2 Integrated Edge Cloud

IEC Type 4: AR/VR Oriented Edge Stack

Purpose/Features:
- Architecture consists of three layers: IaaS (IEC), PaaS (Tars), SaaS (AR/VR Application)

Use cases:
- (now available) **Virtual classroom**: Simulates virtual classroom, improves online education experiences
- (in progress) **Operation Guidance**: Predicts next step for operations (e.g., assembling Lego blocks, cooking sandwiches, etc)
- (in progress) **Sports Live**: Augments/simulates sports live, providing immersive watching experience
- (in progress) **Gaming**: Augments/simulates game scenario, provides immersive game world

Target Industry: Entertainment, Gaming, Cloud
Akraino R4 Integrated Cloud Native

Integrated Cloud Native (ICN)

**ICN Infrastructure**

- **Edge location #100**
  - Infra local Controller
  - K8s cluster #100.1
    - Master
    - Worker Nodes
  - Multi Scheduler Site (ONAP/K8S)

- **Edge location #101**
  - K8s cluster #101.3
    - Compute
    - Master Node
    - Worker Node
  - Network
  - Compute
  - Storage

- **Edge location #102**
  - K8s cluster #102.2
    - Compute
    - Master & Worker Node
  - Network
  - Compute
  - Storage

**Target Industry:** Telco, Cloud, Enterprise, IOT

**Purpose/Features:**
- Addresses overall challenges of edge deployments

**Use cases:**
- Zero Touch provisioning (ZTP) using BPA (Metal3, Ironic), BM provider (BMdeployment) and libvirt provider (KVM)
- Kubernetes Deployer (KuD) is being containerized - single solution deploys Multus, OVN, Flannel, accelerator plugins (SRIOV & QAT), NFD, OVN4NFV, EMCO; applications such as Edgex Foundary (IoT Framework), Containerized Firewall (cFW), and SDEWAN
- Enables nested k8s: K8s used to manage both under cloud (BM provider) & over cloud (k8s inside VM)
Purpose/Features:
- Addresses IOT & Universal CPE use case
- Targets IOT Appliances
- Very thin OS and Orchestration
- Full CI/CD deployment ready and verified
- Platform is ready to support different IOT Gateway use cases for Edge computing. Video Analytics is one of use case verified on this platform.

Updates in R2:
- Integrated EdgeX framework for IIOT
- Supported/verified on Tailored OS, Ubuntu and CentOS
- Single-click installation
- Portal for IOTgateway or uCPE with enabled features like application and platform management
- Enables community validation testing in CI for Hardware, OS and K8s layers.
- OPC-UA test enabled on ELIOT platform.
Akraino R2 Network Cloud & Tungsten Fabric

Network Cloud Powered by Tungsten Fabric

Purpose/Features:
- Implements the Network Cloud with Tungsten Fabric as an SDN Controller, supports CNI for K8s & Neutron plugin for OpenStack
- Enables telco operators to take control of infrastructure

Use cases:
- Supports telco grade applications and a wide variety of VNFs & CNFs
- Offers advanced networking features supported by Tungsten Fabric, such as service chaining, network policies, security, VRRP, route advertisement, flow management, etc.
- Enables deployment of multiple remote edge sites from a single regional controller
- Consolidates settings into a single input file that defines the edge site configuration
Akraino R2 Provider Access Edge

Kubernetes Native Infrastructure (KNI)

Purpose/Features:
- Leverage the best-practices and tools from the Kubernetes community to declaratively and consistently manage edge computing stacks from the infrastructure up to the workloads.
- Supports both containerized and VM-based applications.

Use Cases/Key Features for R2:
- Lightweight, self-managing clusters based on CoreOS and Kubernetes (OKD distro)
- Support for VMs (via KubeVirt) and containers on a common infrastructure
- Application lifecycle management using the Operator Framework
- Support for real-time workloads using CentOS-rt

Target Industry: Enterprise, IoT
Akraino 5G RAN Telecom Access Use Cases

**Purpose/Features:**

- Telco-grade edge cloud platform for near-real time container workloads.
- Open-source RAN Intelligent Controller (RIC)
- RIC enables telcos to deploy customizations, in the form of apps, that tailor cell network for specialized needs of customers’ own industries
- Automated CD pipeline testing the full software stack
- Integrated with Regional Controller (Akraino Feature Project) for “zero touch” deployment of REC to edge sites

**Target Industry:** Teleco 5G, Enterprise
Purpose/Features in R2:

- Enables hardware configuration and automated deployment of multiple edge sites from a remote Regional Controller
- Supports telco-grade applications and a wide variety of Virtual Network Functions (VNFs)
- Enables deployment of multiple remote edge sites from a single Regional Controller
- Consolidates settings into a single input file that defines the edge site configuration
- Supports single server (Rover) and multi-server (Unicycle) deployments
- Deploys Openstack using Airship Treasuremap release v1.3

Target Industry: Telco, Enterprise
Akraino R2 Network Cloud Blueprint

Network Cloud Blueprints: Unicycle with OVS-DPDK

Purpose/Features in R2:
- OVS-DPDK support into existing Network Cloud Unicycle Blueprint Family
- Joint community effort by Ericsson and AT&T
- Integration with Akraino feature project to add OVS-DPDK support to Airship distribution
- Based on Dell PowerEdge R740XD Servers to deploy kubernetes (undercloud) and containerized Openstack platform (overcloud) using Airship
- Network Cloud Edge use cases to support vRAN & 5G core Telco grade applications

Target Industry: Telco, Enterprise
Akraino R2 SEBA for Telco Appliance

SDN-Enabled Broadband Access (SEBA)

Purpose/Features:
- Provides an appliance tuned to support the ONF SDN-enabled Broadband Access (SEBA) platform.

Use cases:
Utilizes a reusable set of modules introduced by the Radio Edge Cloud (REC) from Akraino R1:
- Installation of host OS
- Configuration of network
- Installation/setup of Kubernetes cluster
- Installation/validation for SEBA components
- Utilization of reusable components of the “Telco Appliance” blueprint family
- Automated Continuous Deployment pipeline testing the software stack (bottom to top, from firmware up to but not including application)
- Integration with Regional Controller (Akraino Feature Project) for “zero touch” deployment of SEBA to edge sites

Target Industry: Telco
Akraino R2 Blueprint IOT & Remote Edge Use Cases

Integrated Edge Cloud Types 1 & 2

**Purpose/ Features:**
- Addresses IOT use cases
- Targets telco edge applications & medium edge cloud deployments with Arm
- Based on Kubernetes and Calico
- Automated installation, integrated with SDN-Enabled Broadband Access (SEBA) use case

**Updates in R2:**
- Supports both single node deployment and a 3-node deployment
- Deployment is automated in CI
- The SEBA (on Arm) use-case is integrated with the IEC platform
- Uses project Calico as main container networking solution
- Running environment deployment with multiple VMs
- PONSim installation support
- SEBA-charts submodule update, multi-arch etcd yaml files, etc.

**Target Industry:** Telco, IoT, Enterprise
Akraino Commercial updates

POC & Deployment

- SmartNic: In R4 provides the POD environment for ByteDance, realized the offload of CT based OVS-DPDK for SmartNic, to increase the throughput of edge network VPC and provides the security management needs.
- Android: In R3, used ANBOX to deploy a containerized Android system on an Arm-based server and conducted initial functional tests. Cooperated with ByteDance and Mozhuiyun respectively to provide private Lab environment, implement CI/CD environment deployment in the private lab;
- PCEI: transplant ETSI MEC location APIs and will verify them in China Mobile private lab in China.

Community Contribution Focus

- SmartNic: Focus on offloading network functions, improving network throughput and enhancing management of network card resources.
- Android: Focus on the virtual deployment of Android cloud native applications on the Arm edge cloud.
- PCEI: Focus on providing 5G core network functions to public cloud, improve the ETSI MEC APIs and build a unique API enabler between Telco and Cloud.

Lab resource: China Mobile provides MEC POD environment in Beijing for multiple BPs. 5G resources and accesses are under coordinating.

Public Cloud Edge Interface (PCEI) Blueprint

PCEI blueprint pursues development of multi-domain interworking capabilities to enable Mobile Operators, Public Clouds Core and Edge Compute providers as well as 3rd-Party Edge Compute providers utilizing distributed data center infrastructure, interconnection and edge services for mobile edge cloud use cases such as Mobile Hybrid/Multi-Cloud, Multi-MEC access.
- Joined PCEI blueprint as Project Technical Lead
- Proposed PCEI Reference Architecture
- Participated in the development of first PCEI feature based on OMA Zonal Presence API / ETSI MEC Location API
- Lead development and implementation of PCEI for Akraino Release 4 demonstrating EMCO orchestrator and deployments of Public Cloud Edge apps from Azure and AWS

KubeEdge Edge Service Blueprint

- This blueprint family showcases an end-to-end solution for edge services with KubeEdge centered edge stack. The first release will focus on the ML inference offloading use case.
  - Initiated blueprint project
  - Proposed the Architecture
  - Contributing to the development of end-to-end lab validation environment

- Contributed to ELIOT: Edge Lightweight and IoT Blueprint Family project
Akraino Commercial updates

- **Open Source ONAP software company** focusing on 5G/edge computing application automation
- New ONAP integration in the Akraino Private LTE/5G Blueprint
- Successfully completed 12 ONAP engagements
- Aarna Networks ONAP Distribution 4.0 (El Alto) available
- Recently joined PAWR, 5G Open Innovation Lab to drive 5G use cases with ONAP
- Number#1 Instructor led ONAP training provider

Enabled Arm architecture based hardware and software support for multiple blueprint families. These include several blueprints that share a similar set of use cases, software, and continuous integration and deployment.

- Connected Vehicle Blueprint
- Edge Lightweight and IoT (ELIOT)
  - IoT Gateway Blueprint
  - SD-WAN/WAN Edge/uCPE Blueprint
- Integrated Edge Cloud - Type 1 - 5
- Telco Appliance
  - Radio Edge Cloud (REC)
  - SDN Enabled Broadband Access (SEBA)
- 5G MEC System
  - Ent Apps on Lightweight 5G Telco Edge
  - Slice System to Support Cloud Gaming, HD Video and Live Broadcasting
- Micro MEC
- AI Edge
  - School/Education Video Security Monitoring
  - Federated ML application at Edge
  - Intelligent Vehicle-Infra Coop System(I-VICS)
- Public Cloud Edge Interface
- IIoT

Predictive Maintenance with a FLIR Camera

POC & Deployment
AI Edge supports video security monitoring, classroom concentration analysis, factory safety production, kitchen hygiene monitoring, and also scenarios in Intelligent Vehicle Infrastructure Cooperation System. In R3, cooperated with Arm, Intel, and Huawei, set up a private lab environment, implemented CI/CD environment. More AI application for Arm architecture will be released in the future.

Community Contribution Focus
Focuses on establishing an MEC platform that combined with AI capacities at the Edge site. And it also could be used to enable the autonomous driving industry.
Akraino Commercial updates

As part of Akraino R4, Huawei is associated with following blueprints family:

**Enterprise Applications on Lightweight 5G Telco Edge**: BP intends to provide an ecosystem for enterprise application on light weight 5G Telco Edge which can be leveraged by Telecom operators to its enterprise users. BP having following salient features:

- Lightweight MEC Solution with reference to ETSI MEC Architecture.
- Developer Centric approach empowering developers to innovate & ship faster:
- Rich platform capabilities (Network, PaaS, aPaaS etc.) for Enterprise use cases.
- Autonomous Edge Sites

**Enterprise Lightweight IOT Blueprint family**: Contributing two Blueprints under this BP Family :
1. ELIOT IoT Gateway
2. ELIOT SD-WAN/WAN Edge/uCPE Blueprint

Develop an lightweight edge platform for Industrial IoT and SDWAN use cases.

Intel co-founded Akraino Edge Stack, continuously supported and contributed to the growth of the Edge ecosystem.

- Donated IA servers in Akraino Community Lab, plus supporting partners working on ICN and 5G MEC w/ Intel hosted PODs.
- Drove Integrated Cloud Native BP Family created SW Platforms for Enterprise, IoT and Telco markets, including MICN BP and Private 5G BP.
- Enabled Akraino R3 active community BPs with Intel architecture based hardware and software supported:
  - 5G MEC Slice System to Support Cloud Gaming, HD Video and Live Broadcasting BP
  - Connected Vehicle BP
  - Edge Lightweight and IoT (ELIOT) - ELIOT SD-WAN/WAN Edge/uCPE BP
  - Kubernetes Native Infrastructure (KNI) – Provider Access Edge BP
  - The AI Edge - School/Education Video Security Monitoring BP
  - The AI Edge: Intelligent Vehicle-Infrastructure Cooperation System(I-VICS)

• Juniper Network has been an active contributor in the Akraino community from the early days of its formation. They have been contributor for all three Akraino releases.

• Network Cloud with Tungsten Fabric Blueprint

This blueprint is part of release 3 which integrates Tungsten Fabric in Network Cloud. It integrates with Regional Controller to deploy edge sites that supports both Kubernetes as well OpenStack based workloads. Tungsten Fabric provides advanced networking SDN features to the edge sites.

• Juniper is also engaged with in the Akraino Private LTE/5G Blueprint
Akraino Commercial updates

- Worked on validating the O-RAN Near-Real Time Radio Intelligent Controller (RIC) in a live network, using the Akraino REC project.
- Promoted the emerging ETSI MEC ecosystem.
- The RAN Intelligent Controller Project utilized the NokiaAirframe Open Edge Server Hardware that is based on Open Compute Project Design. Open Edge provides Ultra-small footprint for easy installation at the network edge; an extended temperature range, robust seismic tolerance enabling deployment worldwide; and provides the performance and low latency required by Cloud RAN and MEC.
### POC & Deployment

- Connected Vehicle Blueprint can be flexibly deployed in physical machines, virtual machines, containers and other environments. TARS framework is an important open source component of Connected Vehicle Blueprint, which can efficiently complete the massive deployment and governance of micro-services.
- IEC Type 4 AR/VR applications, in general, the architecture consists of three layers: IaaS(IEC), PaaS(TARS), SaaS(AR/VR Application). TARS framework can efficiently complete the massive deployment and governance of micro-services, and make AR/VR applications deployed in physical machines, virtual machines, containers and other environments.
- 5G MEC/Slice system to support cloud gaming, HD video and live broadcasting; provides an edge connector and edge gateway to enable traffic offloading to edge applications, and supports application lifecycle management by using openNESS in R3. Means to subscribe edge slice, intelligent traffic management and enhanced local DNS will be provided in the future release.

### Community Contribution Focus

- Connected Vehicle Blueprint, focuses on Internet of Vehicles (IoV) application MEC platform, which helps the rapid landing of IoV applications.
- IEC Type 4 focuses on AR/VR applications running on edge.
- PCEI: Focus on use the 5G MEC open API provided by operator to support 5G MEC solution based on public cloud (i.e., ECM)

### Community Contribution Focus

- Connected Vehicle Blueprint, focuses on Internet of Vehicles (IoV) application MEC platform, which helps the rapid landing of IoV applications.
- IEC Type 4 focuses on AR/VR applications running on edge.
- PCEI: Focus on use the 5G MEC open API provided by operator to support 5G MEC solution based on public cloud (i.e., ECM)

### 1. POC & Deployment

The AI Edge: Federated ML application at edge provide Federated Learning Platform for data stored locally, improves accuracy in the edge computing. FedVision is provided in R3. More federated applications and quick validations will be provided in the future release.

### 2. FedVision

A machine learning engineering platform to support the development of federated learning powered computer vision applications.

### 3. Community Contribution Focus

Focuses on providing a federated learning platform which can be used in privacy protected and distributed edge applications such as vision, financial technology, Marketing Intelligence.

- Proof of Concept (PoC) completed for Akraino KNI R2 release on baremetal servers in 5G Lab.
- Proof of Concept (PoC) completed for Akraino KNI R3 release on virtual baremetal in 5G Lab.
- Implementing OpenAirInterface (OAI) use case on KNI R3.
- Showcasing Akraino and KNI blueprint to customers
Akraino Executive Summary

Akraino is an Edge project targeted to

› Address Telco, Cloud, Enterprise and Industrial IoT use cases

Akraino Mission:

1. Create end to end configuration for a particular Edge Use case which is complete, tested and production deployable meeting the use case characteristics {Integration Projects - Blueprints}.
   Production deployable means the blueprint has passed unit and integration testing and meets the blueprint’s use case characteristics.
2. Develop projects to support such end to end configuration. Leverage upstream community work as much as possible to avoid duplication. {Feature Projects}
3. Work with broader edge communities to standardize edge APIs {Upstream Open Source Community Coordination - For example, Socialization, so community tools and Blueprints can interoperate. This work can be a combination of an upstream collaboration and development within the Akraino community [i.e. a feature project]}
4. Encourage Vendors and other communities to validate Edge applications and VNFs on top of Akraino blueprints {Validation Project - ensures the working of a Blueprint}