Talk - AT&T Blueprint for a Successful Edge Cloud

Tuesday, March 27 • 4:45pm - 5:35pm

Akraino Project Overview

Arpit Joshipura – Linux Foundation, Head of Networking
Kandan Kathirvel – AT&T, Director, Cloud Strategy & Architecture
Topics

› The Announcement
› Why Edge is a key to next generation services
› Edge Use cases & Akreino Edge Stack in context of Open Source Landscape
› Project Overview – Scope, goals and details
Why Edge?
Emerging Technologies in IOT and Networks are demanding lower latency and accelerated processing at the edge.

<table>
<thead>
<tr>
<th>Emerging Technology Enablers</th>
<th>NFV Edge Infrastructure</th>
<th>Autonomous Devices</th>
<th>Immersive Experiences</th>
<th>IOT &amp; Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-demand NFV</td>
<td>Wireless (vRAN, vEPC..)</td>
<td>Drones</td>
<td>Virtual Reality</td>
<td>Industrial Sensors</td>
</tr>
<tr>
<td>Hardware Acceleration</td>
<td>Wireline (PON, ..)</td>
<td>Autonomous vehicles</td>
<td>Augmented Reality</td>
<td>Home Devices</td>
</tr>
<tr>
<td>A.I.</td>
<td>uCPE (SD-WAN..)</td>
<td>Industry Robots</td>
<td>360 Video</td>
<td>Retail</td>
</tr>
<tr>
<td>Microservices</td>
<td>IP Enterprise services</td>
<td>Medical</td>
<td>Wearable Cognitive Assistance</td>
<td>Healthcare</td>
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</tbody>
</table>

Emerging Technology Enablers:
- On-demand NFV
- Hardware Acceleration
- A.I.
- Microservices
- 5G
New Edge Requires End-to-End Automation & Interworking

Services
- Cloud Services
- Residential Services
- Enterprise Services
- IOT Services
- AI Services

Software & Automation
- Cloud Automation
- Network Automation
- IOT Automation

Infrastructure
- Data Centers
- Carrier Network
- Cloud Network
- Enterprise Software Defined Data Centers (SDDC)
- Service Providers
- Public/Hybrid Cloud Service Providers
- Web Service Providers
- MSO/CableCo

THE LINUX FOUNDATION
Edge Enables New Business Ecosystem & Cost Savings

Users
[Enterprises, …]

New Services
Open Source-Based

Application Developers

New Edge Applications
Global Opensource Collaboration

Public Cloud Provider

New Cloud Services
More Footprint
ROI – New offerings to existing customer base

Suppliers

Infrastructure (H/W, ..)
Support as a Service
Extended Portfolio

Telco Operator

Edge Processing - Reduced Backhaul Traffic
NFV Infrastructure (5G, etc.)
Edge Services (Public Edge Cloud, API, Analytics, ……)

The Linux Foundation Internal Use Only
Edge Use Cases & Akraino Edge Stack in Context of Open Source Landscape
Use Case 1: Operator's Owned Network Edge
Optimal Zone For Edge Placement

- **Customer Devices**: Mobile, AR/VR end user, Drones, Autonomous Vehicles, Enterprises, Home, Smart Cities, Small Enterprises, Stadiums, Public buildings

- **Customer Premises**: Home, Smart Cities, Small Enterprises, Stadiums, Public buildings

- **Access Methods**: 5G, LTE, Wifi, Wireline

- **Telco Network Edge**: Tower, Central Offices, Other Telco real estates (wire centers…)

- **Device**: ~2 ms
- **Last mile network**: <5 ms
- **Access**: 1-3 ms
- **Edge computing**: ~5-20 ms

- **Not Optimal**

- **Optimal Edge Zone**: Telco Operated

- **Burst Capacity**

- **Backbone**: Centralized Cloud, Public Clouds

- **Backbone**: Non-accelerated processing ~5-50 ms

- **Source**: AT&T

- **Estimates**

- **Millions**
- **Thousands**
- **Tens**
Use Case 2: IOT Driving the New Edge for Enterprise
Retail, Transportation, Healthcare...

Cloud Automation
Network Automation
IOT Automation

Enterprises
Public buildings

“SOUTHBOUND” DEVICES, SENSORS AND ACTUATORS
Akraino Interfaces With Adjacent Projects in Space

- **Zero Touch Edge Cloud Automation**
- **Container Orchestration Multi-cloud portability**
- **IIOT Framework at Edge**
- **Open source software for creating private and public clouds.**
- **AI Framework Across Projects Networking Analytics/Automation**
- **Disaggregated Networking Whitebox Operating Systems**

**Acumos AI**

**DANOS**

**OpenStack**

**Kubernetes**
Typical Project Interfaces - Examples

North Bound API
(to app store, app developers or upper layers)

End Device Interfaces

Project

South Bound API
(to lower layers of the stack)

ONAP.AI

New Edge Apps

South Bound (Cloud Stacks, Infra)
Akraino is Complimentary to Standards, Reference Architectures and Reference Implementations

Providers, Users, Developers

Fully integrated Edge Platform

Inputs

Integrate

Ref Standards

(IOT, Gateway & Cloud Ref Arch)

Providers, Users, Developers

Cloud Layer

VNF Orchestration Layer

IoT

AI

Source: AT&T
Akraino Overview – Scope, Goals and Details

High-Availability Cloud Services Optimized for Edge Computing Systems and Applications
Akraino Community Scope – Everything About the Edge Platform

Innovate | Integrate | Support Lifecycle

- Edge User / Developer Experience
- Edge / MEC Developer APIs
- Edge Platform Innovation (Cloud, NFV, Apps, …)
- Edge Open Source Platform Integration & Development to Enable Edge Application
- Edge Hardware Selection and Certification

Source: AT&T
The New Edge Requirements for Akraino Project

Akraino Edge Stack is the first open source collaborative community project exclusively focused on integrated distributed cloud edge platform.

**Edge Challenges**

- **Large Scale**
  - >1000 Locations

- **Need Simple Operations**
  - Zero-touch provisioning
  - Zero-touch operations
  - Zero-touch lifecycle

- **Low Cost**
  - Start-up, Build, Run

- **Multiple Edge Use Cases**
  - Faster innovation but with right integration

**Solution**

Akraino Edge Stack integrates multiple open sources to supply holistic Edge Platform, Edge Application, and Developer APIs ecosystem.
Akraino Edge Stack – Key Principles

**Design**

- Finite set of configurations – reduce complexity
- Cloud native applications – design application to be optimized from the beginning
- Simplified security – secure platform and services while not being a burden
- Autonomous, turn-key solution for service enablement – enable rapid introduction
- Platform, VNF and application assessment and gating – assess whether the application is fit to run at the edge (e.g., latency sensitiveness, code quality)

**Build**

- Low startup cost – space, power, capital but scalable and evolvable
- Low latency placement and processing – support the edge drivers
- Plug and play modular architecture – building blocks using multiple cloud management technologies

**Operate**

- Zero touch provisioning, operations and lifecycle – reduce OpEx
- Automated maturity measurement – operations, designs and services
- Software abstraction based homogeneity – hide any hardware differences via software
- Common platform and service orchestration – ONAP
Akraino Edge Stack Community Goals

- **Faster Edge Innovation**
  Focused group facilitating faster innovation

- **Vendor Ecosystem**
  Upfront certifications of H/W stacks

- **User Experience Is Key**
  Address both operational and user use cases

- **Seamless Edge Cloud Interoperability**
  Standard to interoperate between multiple Edge Cloud

- **Host End to End Stack**
  End to end integrated solution with demonstrable use cases

- **Support Production-Ready Code**
  No oops! Security by design, support full lifecycle

- **Innovate Edge Technologies**
  Everything about Edge (e.g., Hardware Acceleration, Smart NIC based SDN, etc.)

- **Use Existing Open Source**
  Maximize the use of existing industry investments but allow additional innovation

- **Develop Features**
  Develop missing features in the existing open source technologies to meet the needs of edge computing (blueprint/code development/version control)

- **Upstream Code**
  Upstream the code (the existing open source) and maintain the code (components belongs to this community)

- **VNF Test & Certification**
  Certify edge VNFs upfront
## Technology Scope for Akraino

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>Single Pane of Glass Control</td>
<td>Single view management of edge resources across 10,000+ sites</td>
</tr>
<tr>
<td>Edge IaaS/PaaS</td>
<td>Wide variety of Edge applications</td>
</tr>
<tr>
<td>Thin local Control Plane</td>
<td>Explore multiple ways to reduce local box or data center control plane footprint e.g., run control/data plane mixed with security measures, run in network switches, etc.</td>
</tr>
<tr>
<td>Central/Regional VIM</td>
<td>Alternative to Thin local Control Plane. Remote orchestration of edge compute resources (thin control, agent only at the edge)</td>
</tr>
<tr>
<td>Central/Regional ONAP</td>
<td>Enhance ONAP to support Edge scale</td>
</tr>
<tr>
<td>Edge user/Developer APIs</td>
<td>Provider agnostic Edge APIs</td>
</tr>
<tr>
<td>Edge Capabilities</td>
<td>Analytics, etc.</td>
</tr>
<tr>
<td>Cloud Native VNFs</td>
<td>Container/Microservices based VNFs</td>
</tr>
<tr>
<td>Edge Hardware</td>
<td>Edge Hardware Standards, Solution and Integration</td>
</tr>
</tbody>
</table>
Multiple Sub Projects Drive One Akraino Edge Platform

- API
- Tools (Ops.)
- Integration (CI/CD)
- Orchestration
- Hardware

User/Admin Documentation & Training for Holistic Edge Stack

Multiple Sub Projects Drives One Platform
# Akraino Edge Stack – Technology Enablers & Building Blocks

**Fit to Run at Edge | Integrate | Support Scale & Lifecycle**

<table>
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<tr>
<th>APIs</th>
<th>Edge APIs</th>
<th>Edge Cloud(s) Integration APIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applications &amp; VNFs</td>
<td>Any Edge Applications</td>
<td></td>
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<tr>
<td>Intelligence</td>
<td>Acumos</td>
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<tr>
<td>Operational tools</td>
<td>Logging, Monitoring, Alerting, Security</td>
<td></td>
</tr>
<tr>
<td>Access Methods</td>
<td>5G, LTE, Wireline, WiFi</td>
<td></td>
</tr>
<tr>
<td>NFV &amp; Domain Specific Orchestrator</td>
<td>ONAP, App Specific</td>
<td></td>
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<tr>
<td>Infra Orchestration</td>
<td>OpenStack, SDS (Ceph), Container (Docker,..), Kubernetes</td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>SR-IOV, OVS-DPDK, Simple SDN, CNIL, White box Switches</td>
<td></td>
</tr>
<tr>
<td>Operating System</td>
<td>Linux Flavor, Thin Linux</td>
<td></td>
</tr>
<tr>
<td>Edge Hardware</td>
<td>Open Compute, Small Form Factor, OEM Servers, uCPE, Acceleration (GPU, FPGA,..)</td>
<td></td>
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</tbody>
</table>

Platform Life Cycle Management Tools (Helm, Armada, Promenade……………….)

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[Image: Akraino Edge Stack – Technology Enablers & Building Blocks]
Akraino: Summary of Overall Approach

Goals:
- Scalable, flexible platform suitable for CSP, Edge, IoT, and Fog use cases
- Support for VM, container, and bare metal workloads
- Product-grade code
- Zero-touch provisioning and operations

Ingredients:
- OpenStack core
- Kubernetes / Docker
- Ceph
- ONAP
- Hypervisor projects

Approach:
- Collaborate with broad industry support under open governance
- Work with existing communities, upstreaming enhancements and fixes
- Drive scale and support new industries

Benefits:
- Ease of deployment
- Ability to provision and update
- Secure
- Lower TCO
FAQ

Question 1: How do I join this community?
Answer: You can further inquire about the Akraino community by connecting with The Linux Foundation via the form on Akraino.org

Question 2: Who can join this community?
Answer: Anyone interested in edge, whether that’s a telco, cloud provider, supplier, developer; you name it!

Question 3: How can I contribute code?
Answer: The Akraino Edge Stack community, now forming, anticipates releasing project code in the second quarter of 2018. We gladly accept code contribution following the launch after second quarter of 2018.

Question 4: Who is contributing the initial code to Akraino?
Answer: To seed the new project, AT&T, Intel and other early members are contributing code designed for carrier-scale edge computing applications running in virtual machines and containers to support reliability and performance requirements.