

# LF Edge Akraino Project Presentation

Tina Tsou, Oleg Berzin

LF Edge Akraino TSC Chair & Co-Chair

December 10th, 2021



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### 2. LF Edge Akraino Contact for future inquiries and information



# 1.1. LF Edge Akraino Project Overview

## -20 < Blueprints (aka Integration Projects), BPs Proposals & Development Projects

- set of Open Infrastructures & Application Blueprints (BPs)

- Coordination & Co-operation with Multiple Upstream Open Source Communities/SDOs as:

- Airship,

- LFN Anuket

- OpenStack,

- ONAP,

- ETSI MEC,

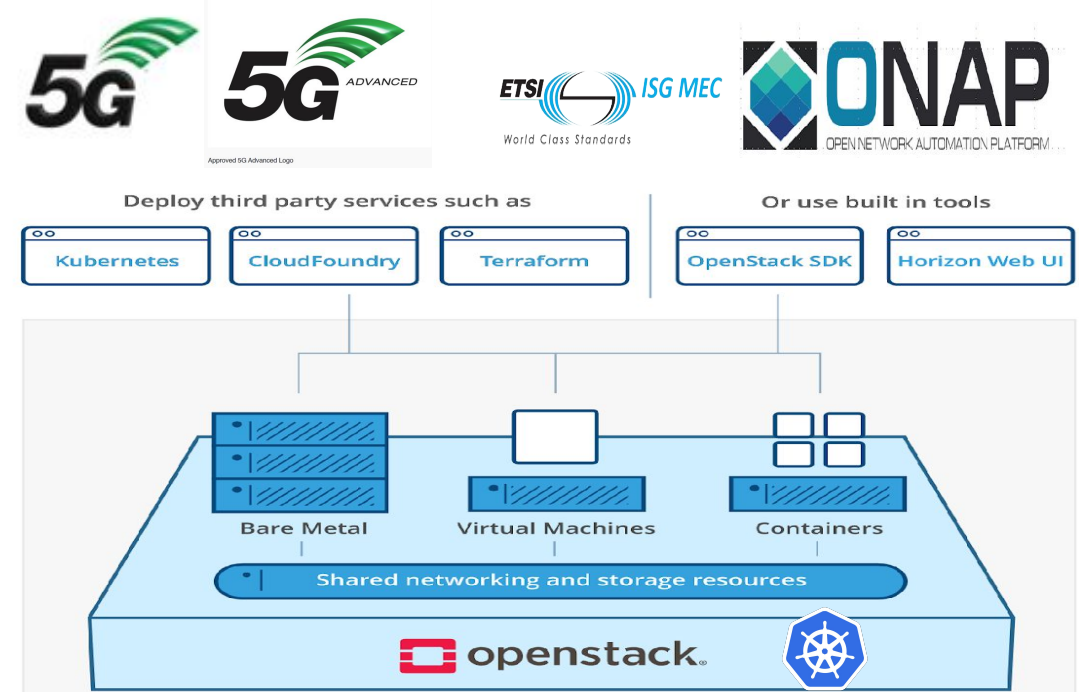
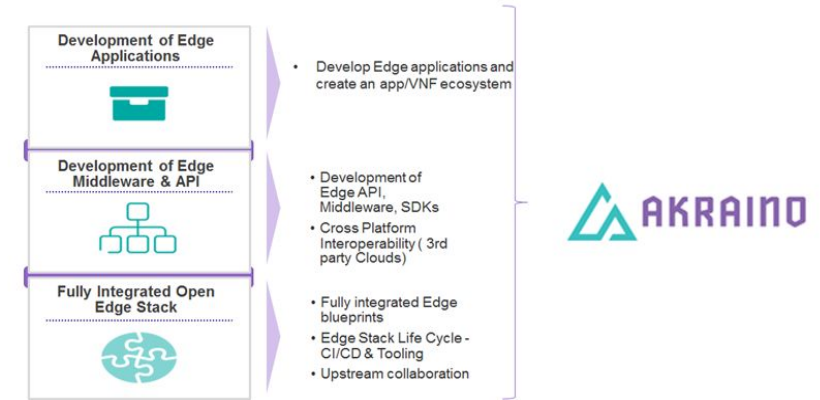
- GSMA,

- TIP,



- O-RAN

What is Akraino? Everything About Edge – Akraino is the Edge Project



Objective: To deliver a fully integrated stack

## 1.1.1 LF Edge Akraino Project Overview: LF Edge TAC Stage 3 Project

### - LF Edge Stages - Definitions & Expectations

Every Foundation Project has an associated Maturity Level, as voted on under the approved Project Lifecycle Document (PLD) Process.

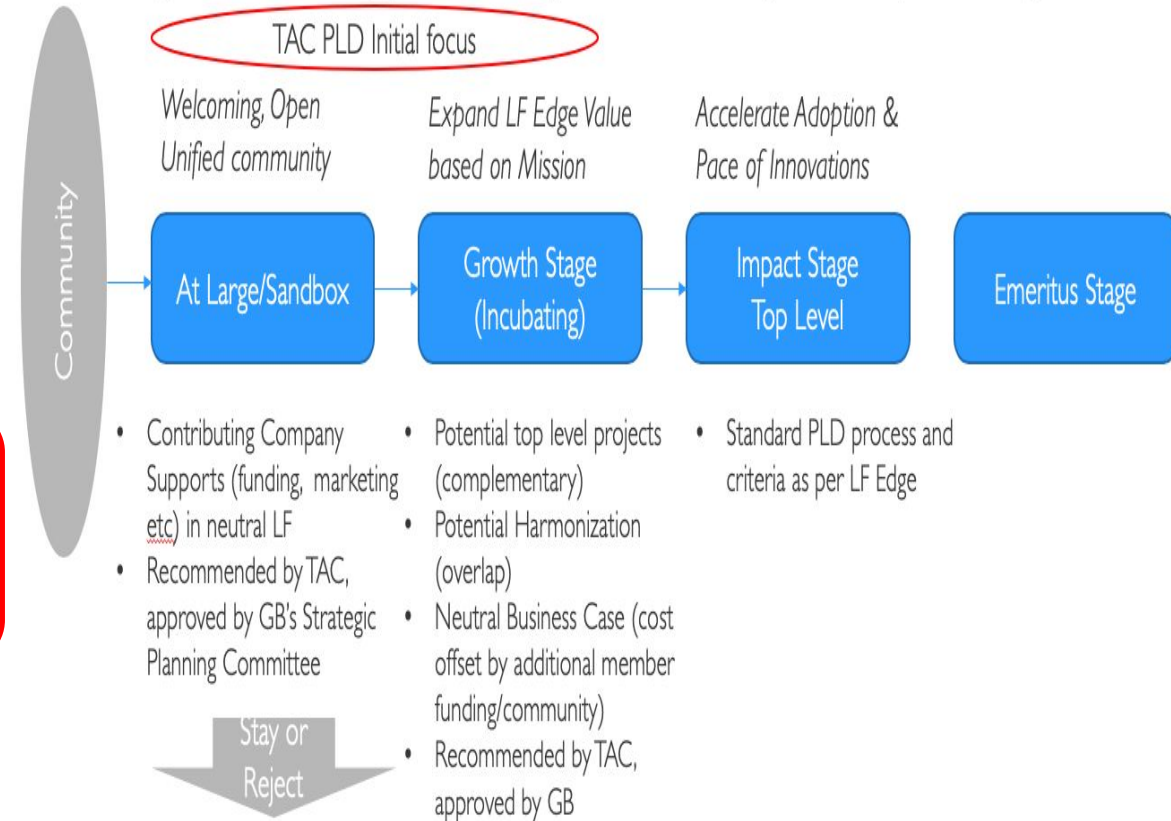
- Projects of all maturities have access to Foundation Resources.

### - Stage 3: Impact Stage ('Top-Level') Definition

- Projects that have reached their Growth Goals and are now on a Self-sustaining Cycle of Development, Maintenance, and Long-term Support.

Impact Stage projects are widely used in Production Environments and have Large, Well-established Project Communities with a number of Contributors from at least two (2) Organizations.

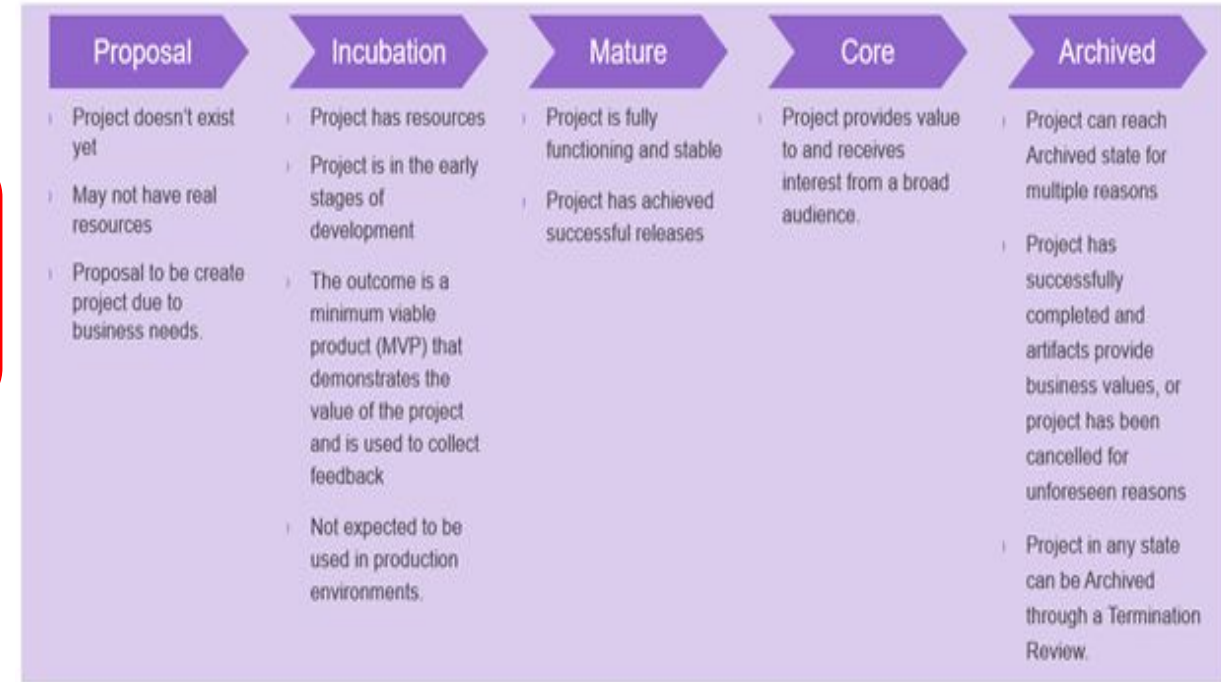
Following a balanced approach – open/welcoming but scope managed





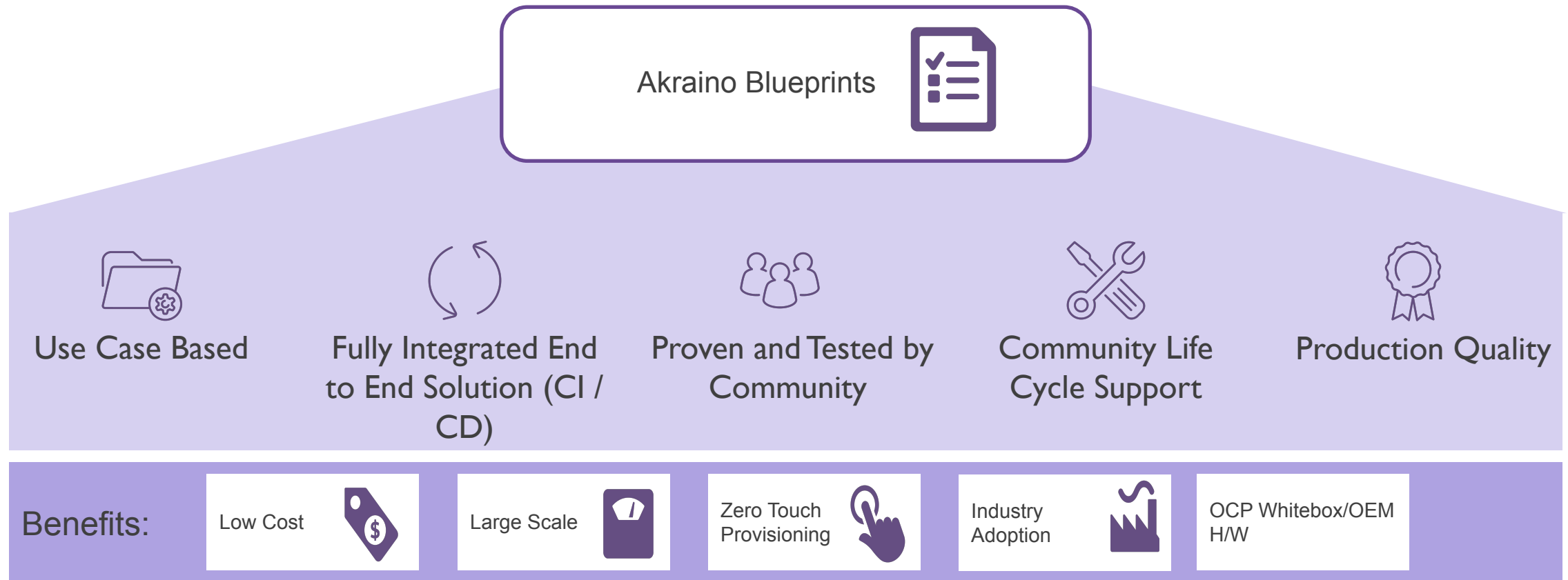
## 1.1.2 Akraino Project (Blueprint) Lifecycle States and Reviews phases

- Five (5) states that Projects goes through.
- A Project Lifecycle may **extend across** Multiple Projects and Akraino Releases.
- The Procedure of moving from one(1) State to the next one is **independent from the Akraino Release Lifecycle** and the pace depends on each individual Project.
- In order to effectively review Project progress, **four (4) Reviews** are built-in to the Project Lifecycle, namely,
  1. Proposal,
  2. Incubation,
  3. Mature,
  4. Core
  5. Archived



# What is an Akraino Blueprint?

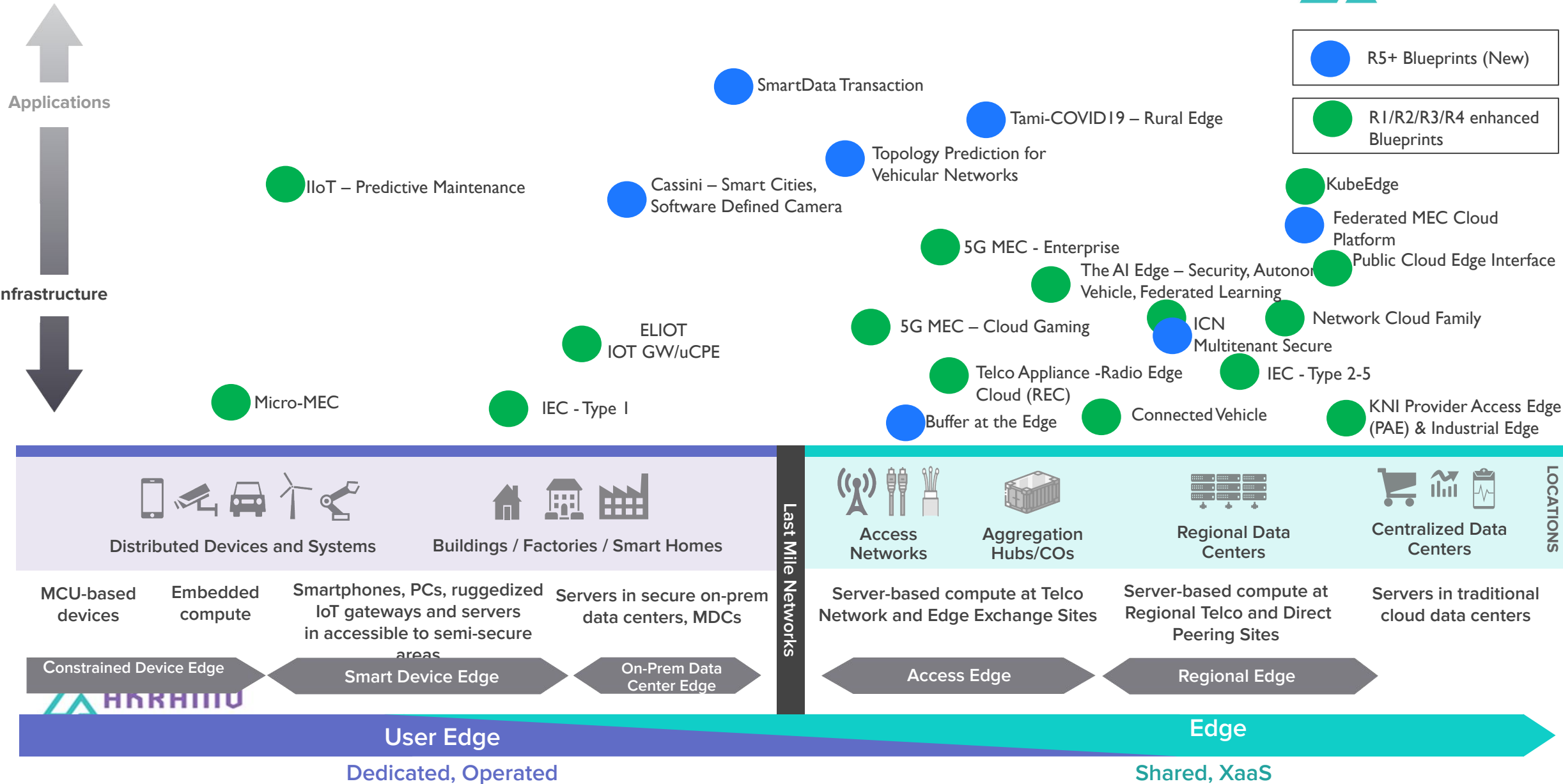
**Community Integrated, tested, deployable, end to end Edge Stack**



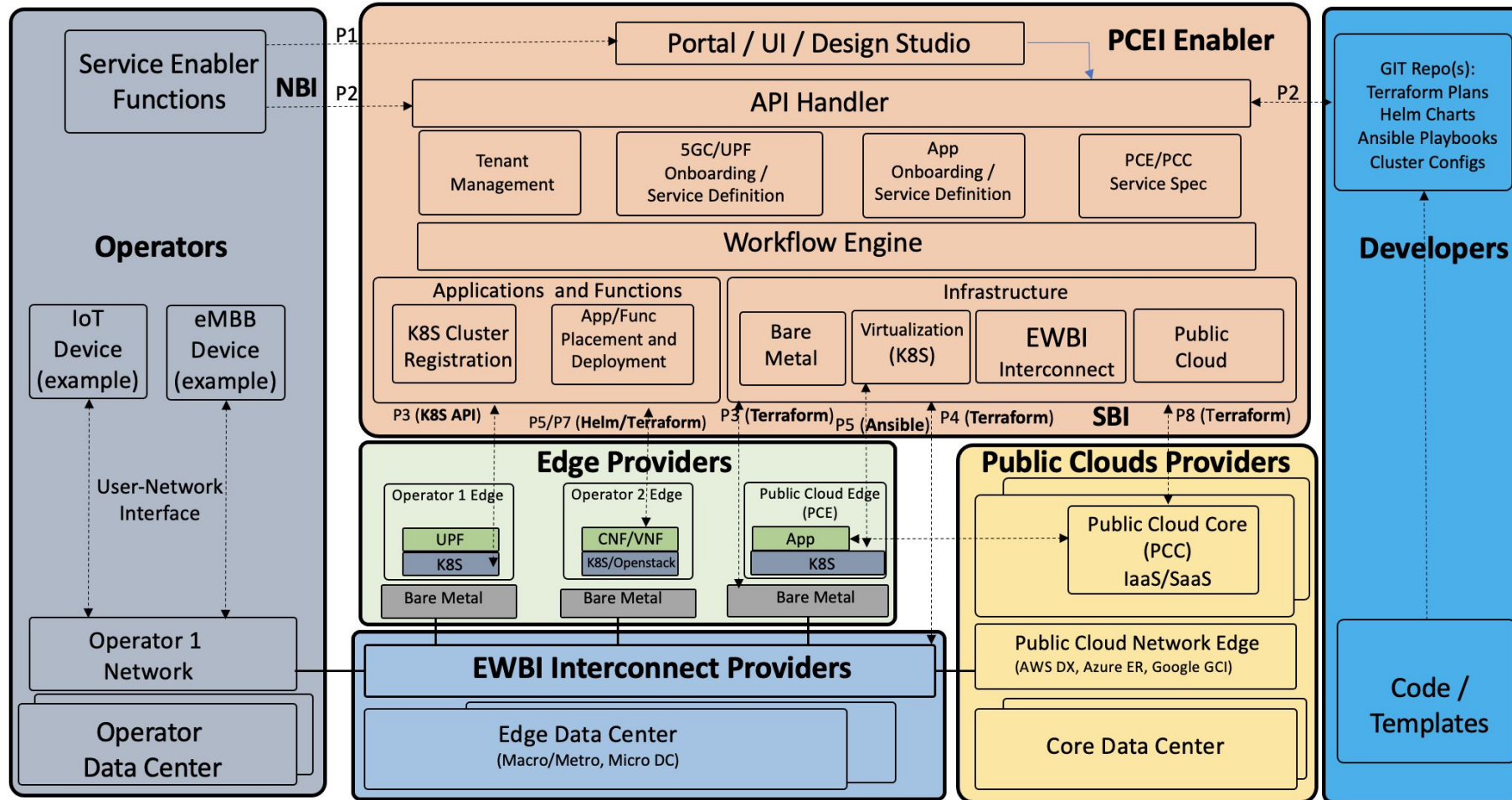
Since launch in 2018, Akraino continues to gain community support for collaboration and validation with 30+ blueprints



# 1.1.3 LF Edge Akraino Project Overview - R5+ BPs



# PCEI Release 5 Overview



- ❑ NBI APIs
  - ❑ GIT Integration
  - ❑ Dynamic Edge Cluster Registration
  - ❑ Dynamic App Helm Chart Onboarding
  - ❑ Automatic creation of Service Instance in EMCO and deployment of Apps
  - ❑ Automatic Terraform Plan Execution
- ❑ Integrated Terraform Plan Executor
  - ❑ Azure (PCC)
  - ❑ AWS (PCC)
  - ❑ Equinix Fabric (Interconnect)
  - ❑ Equinix Metal (Bare Metal Cloud)
  - ❑ Openstack (3PE)
- ❑ Equinix Fabric Interconnect
- ❑ Multi-Public Cloud Core (PCC) Orchestration
- ❑ Kubernetes Edge
- ❑ Openstack Edge
- ❑ Cloud Native 5G UPF Deployment



# 1.1. 4 LF Edge Akraino Project Analytics - Commits by Contributors and Companies - 1

[All Projects](#) > [Linux Foundation Edge](#) > [Akraino \(beta\)](#) > [Technical Trends](#) > [Summary](#)

Copy Short URL

Jump To Sections Within This Page :

Source Control

Select Time Range ( Last 90 Days )

SOURCE CONTROL

Commits

Go To Overview

40.26K

Lines Of Code Changed

49

Commits

10

Contributors

1

No Of Sub Projects

5

Repositories

Top 10 Contributors By Commits

NAME	LINES OF CODE	COMMITTS	%
Todd Malsbary	13.44K	25	33.39%
Kuralamudhan R...	7.08K	11	17.60%
Eric Ball	144	5	0.36%
ashgit301	40	2	0.10%
Le Yao	2.34K	2	5.80%
Trevor Tao	4	1	0.01%
Anil Shashikumar...	8	1	0.02%
Andrew Grimberg	24	1	0.06%
polaniap	8.83K	1	21.94%

Top 10 Organizations By Commits

49

Commits

Intel Corporation

The Linux Foundation

Unknown

OpenDaylight Project, Inc.

Arm Limited

[All Projects](#) > [Linux Foundation Edge](#) > [Akraino \(beta\)](#) > [Technical Trends](#) > [Summary](#)

Copy Short URL

Jump To Sections Within This Page :

Source Control

Select Time Range ( Last 90 Days )

PULL REQUESTS / CHANGESETS

Gerrit

GitHub

Go To Overview

76

Changesets

0

Time To Merge

27

Open Changesets

9.3 days

Time To First Review

160

Approved Changesets

Top 10 Contributors By Changesets

NAME	CHANGESETS	%
Todd Malsbary	48	63.16%
Kuralamudhan Ra...	11	14.47%
ashvin.p-REDACTE...	5	6.58%
Le Yao	2	2.63%
Patryk Strusiewicz...	2	2.63%
Andrew Grimberg	1	1.32%
Anil Shashikumar ...	1	1.32%
Asif Mehmood	1	1.32%
Eric Ball	1	1.32%

Top 10 Organizations By Changesets

76

Changesets

Intel Corporation

Unknown

The Linux Foundation

Mobica Ltd

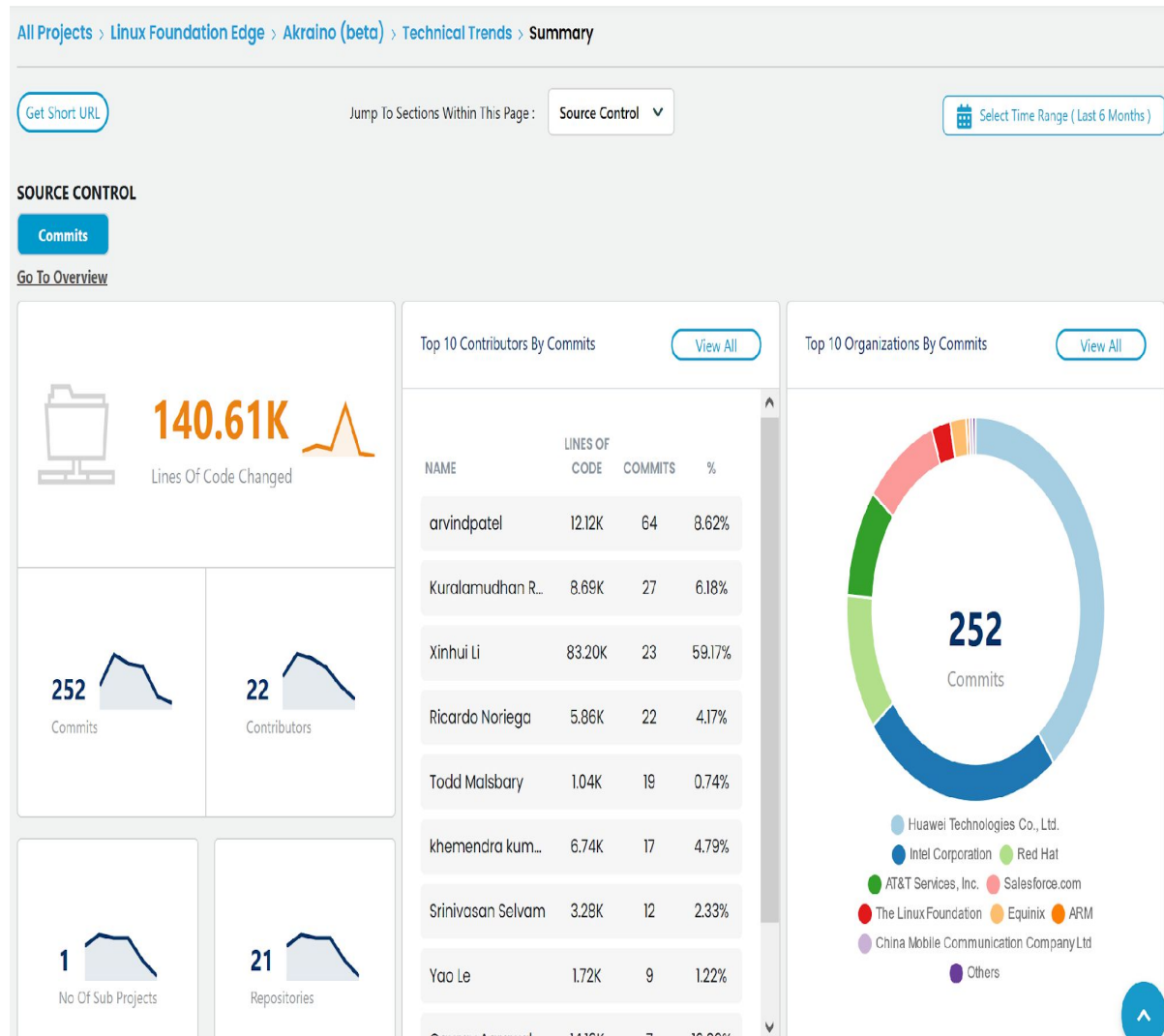
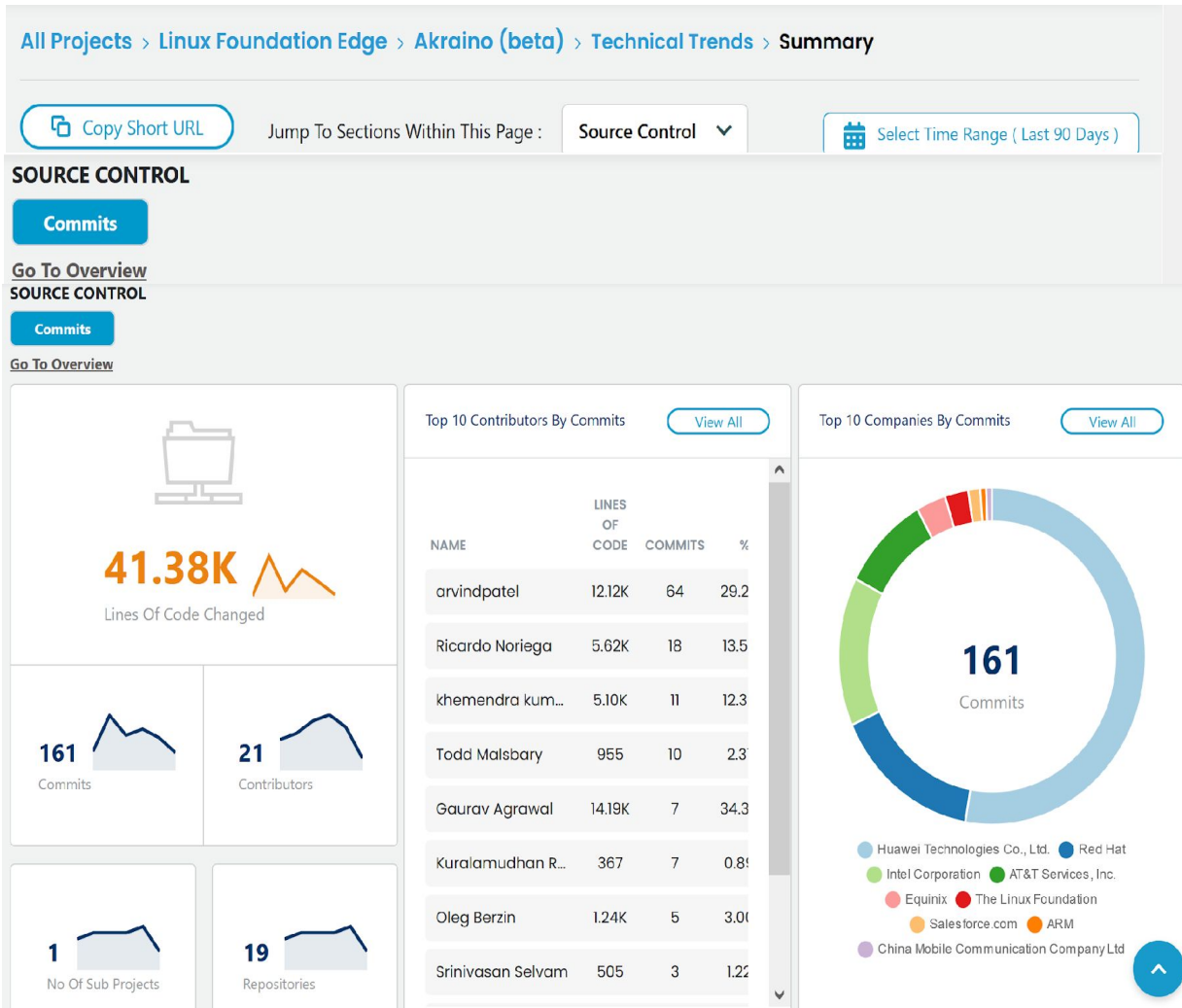
Jeju National University

OpenDaylight Project, Inc.





# 1.1.4 LF Edge Akraino Project Analytics - Commits by Contributors and Companies - 2



## 1.1.5 Akraino Project TSC Sub-committees



Platser ▾

Frågor



Akraino

### Akraino TSC Sub-Committees

#### ▼ Subcommittees

- API Sub-committee
- CI, Blueprint Validation Lab sub-committee
- Documentation Sub-committee
- Outreach Sub-committee
- Process, Project review and recommend, documentation sub-committee
- Security Sub-committee
- Technical Community Sub-committee
- Upstream & Downstream Sub-committee
- TAC
- TAC Level Activities



# The State of Enterprise Open Source

A Red Hat® Report

**In a stand-out finding of interest to our Telco Customers, 95% of respondents from the Telecommunications Industry report using Open Source.**

The high-level takeaway of the report is that: "using Open Source SW across all Industries is no longer principally about making best use of IT Budgets.

*Lower Cost of Ownership has fallen off the top spot and now sits in sixth (6th) position.*

**Today, the Strategic Benefits of using Open Source are valued more, including:**

## Top benefits of using enterprise open source

1. Higher quality software **35%**
2. Access to latest innovations **33%**
3. Better security **30%**
4. Ability to safely leverage open source technologies **30%**

### Top benefits of using enterprise open source

#### U.S.

**35%**

Higher quality software

**33%**

Access to latest innovations

**32%**

Ability to safely leverage open source technologies

#### EMEA

**35%**

Higher quality software

**33%**

Access to latest innovations

**31%**

Better security

#### APAC

**38%**

Higher quality software

**33%**

Access to latest innovations

**30%**

Trusted by smartest software engineers

**30%**

Ability to safely leverage open source technologies

#### LATAM

**35%**

Better security

**34%**

Higher quality software

**32%**

Ability to safely leverage open source technologies

# Akraino Edge Stack Security Sub-Committee

September 24, 2021

Daniil Egranov  
Security Sub-Committee Co-Chair, Akraino

Randy Stricklin  
Security Sub-Committee Chair, Akraino



# Akraino Security Team 2021 Accomplishments

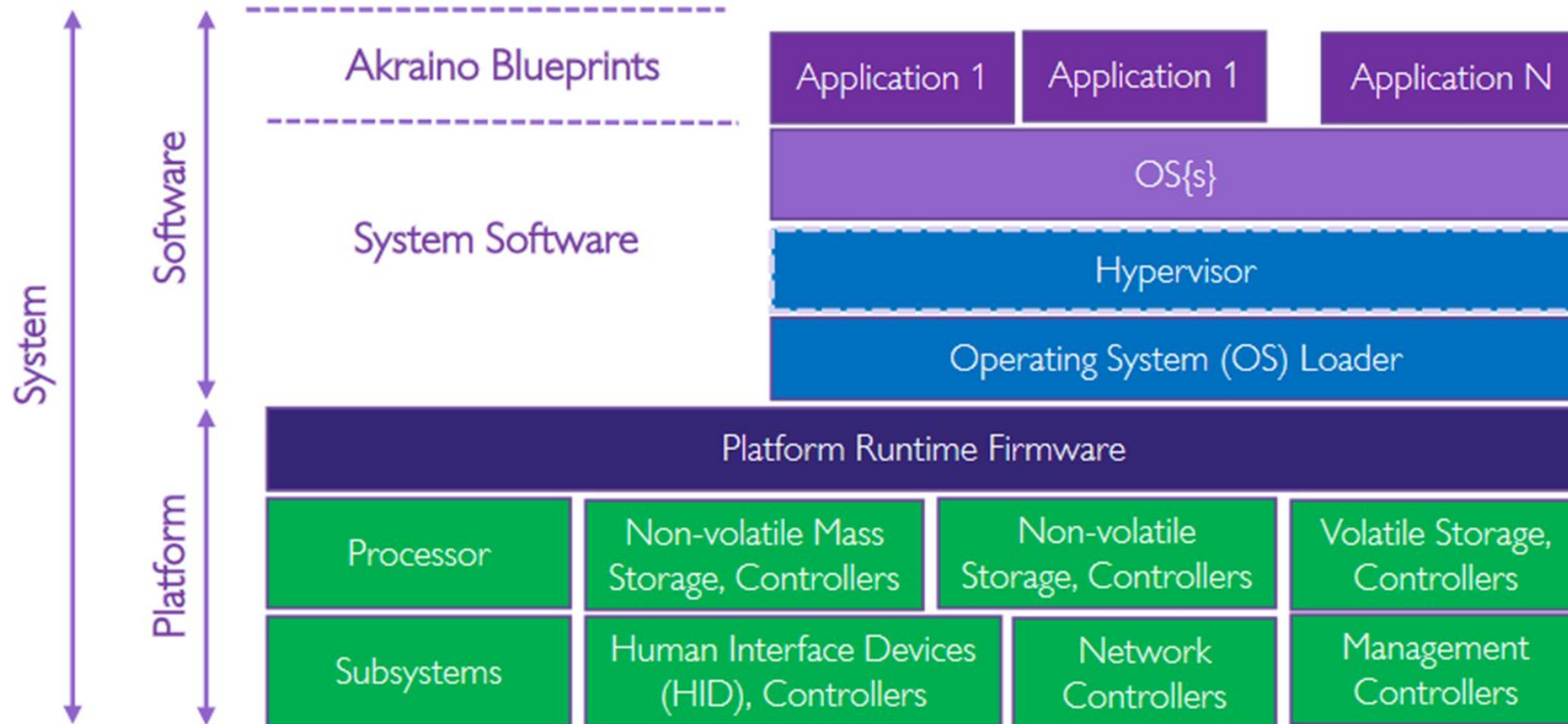
- › Automated Lynis, Vuls and Kube-Hunter Log Output Pass/Fail Analysis
- › Lynis – Reviewed Required Tests
  - › Formalized and Documented Lynis Incubation vs Maturity Requirements
- › Platform Security for Akraino Blueprints
  - › Arm
  - › x86
- › Release 4 and 5 Blueprint Reviews



# Akraino Security Team Future Plans

- › Develop Minimum OS Version Support Document
  - › Ubuntu, CentOS, RHEL CoreOS, Debian
- › Develop Minimum Security Tool Version Support Document
  - › Lynis, Vuls, Kube-Hunter, and OVAL (Vuls) database
- › BluVal (Blueprint Validation):
  - › Integrate Automated Lynis, Vuls and Kube-Hunter Pass/Fail
  - › Enforce minimum versions of Vuls, Lynis and Kube-Hunter
- › Version 1.0 Platform Security Whitepaper
- › Investigate using LFX Security

# What is Platform Security?



# Akraino Platform Security Objectives

- Maintain the integrity of the platform layer and provide a safe execution environment for the Akraino software stack.
- Define secure boot environments based on the platform HW Root-of-Trust.
- Provide protection of key platform assets.
- Provide a foundation for attesting the platform's state of security.
- Provide requirements for securely updating the platform firmware.



# Use Cases

- Secure Boot with Disk Encryption
- Secure Supply Chain
- Platform Integrity and Trust

- 
- Future: Confidential Computing



# ETSI MEC Update of the collaborations with OpenSource, with special focus on LF Edge Akraino

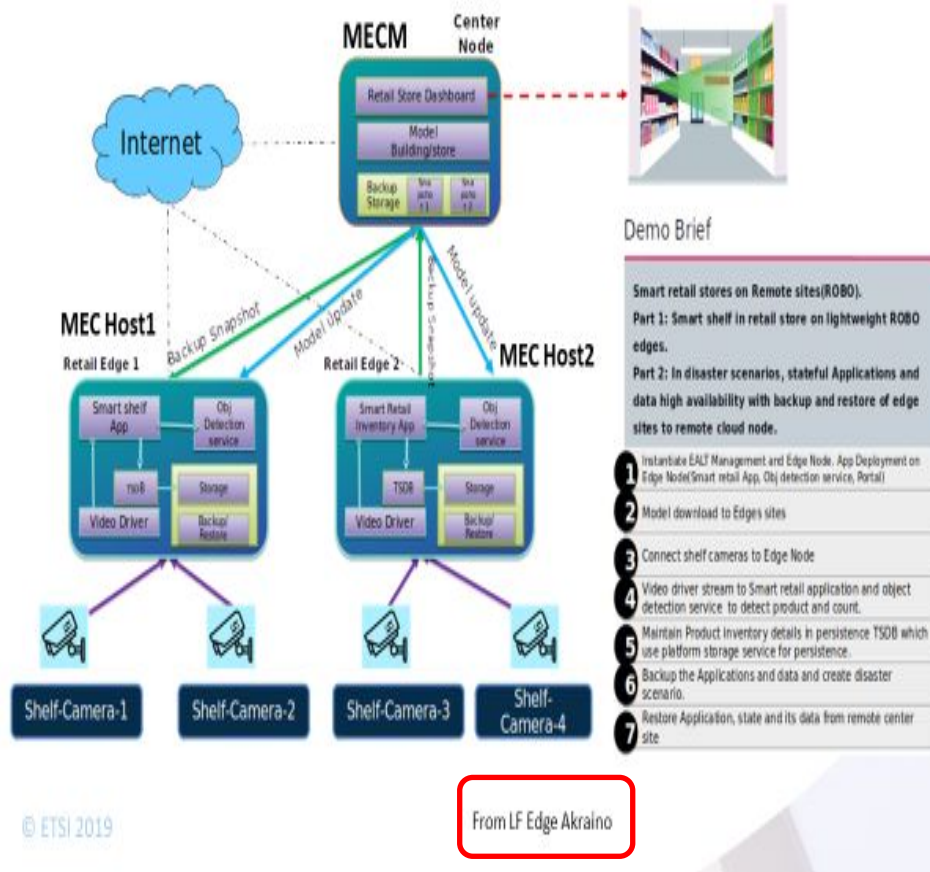
Presented by: **Jane Shen,**  
**VP of Technology Strategy, Mavenir**  
**Technical Expert, ETSI MEC ISG**

© ETSI 2021

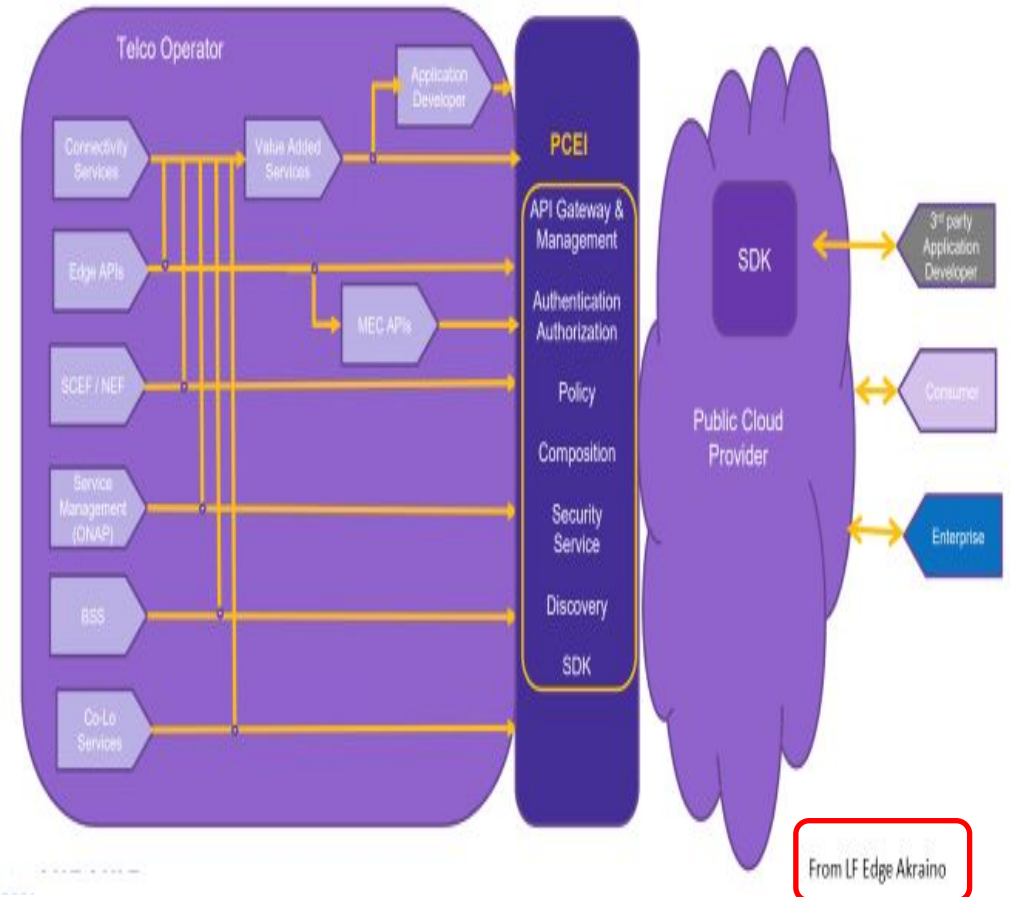
15.11.2021



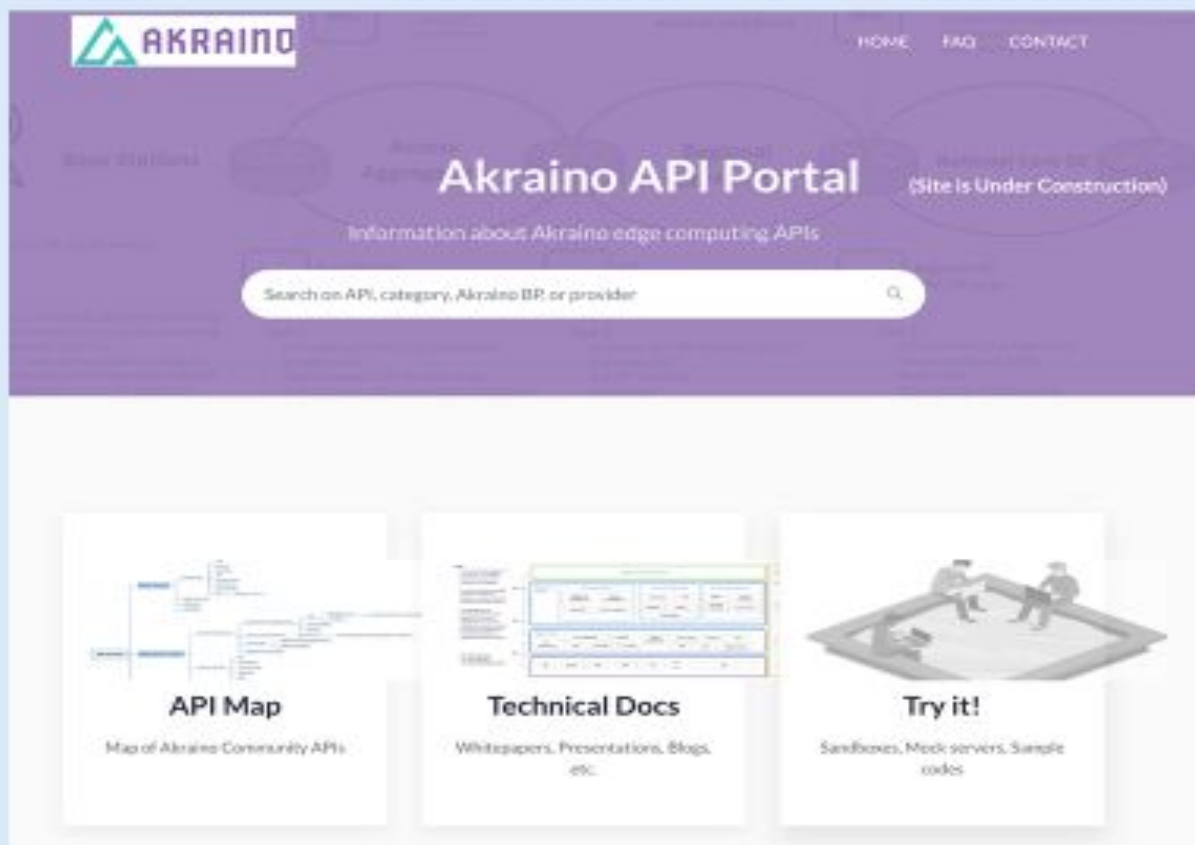
## Enterprise Application on Lightweight 5G Telco Edge Use Case



## Public Cloud Edge Interfacing (PCEI) Blueprint Projects



# An API Portal For Edge Developers



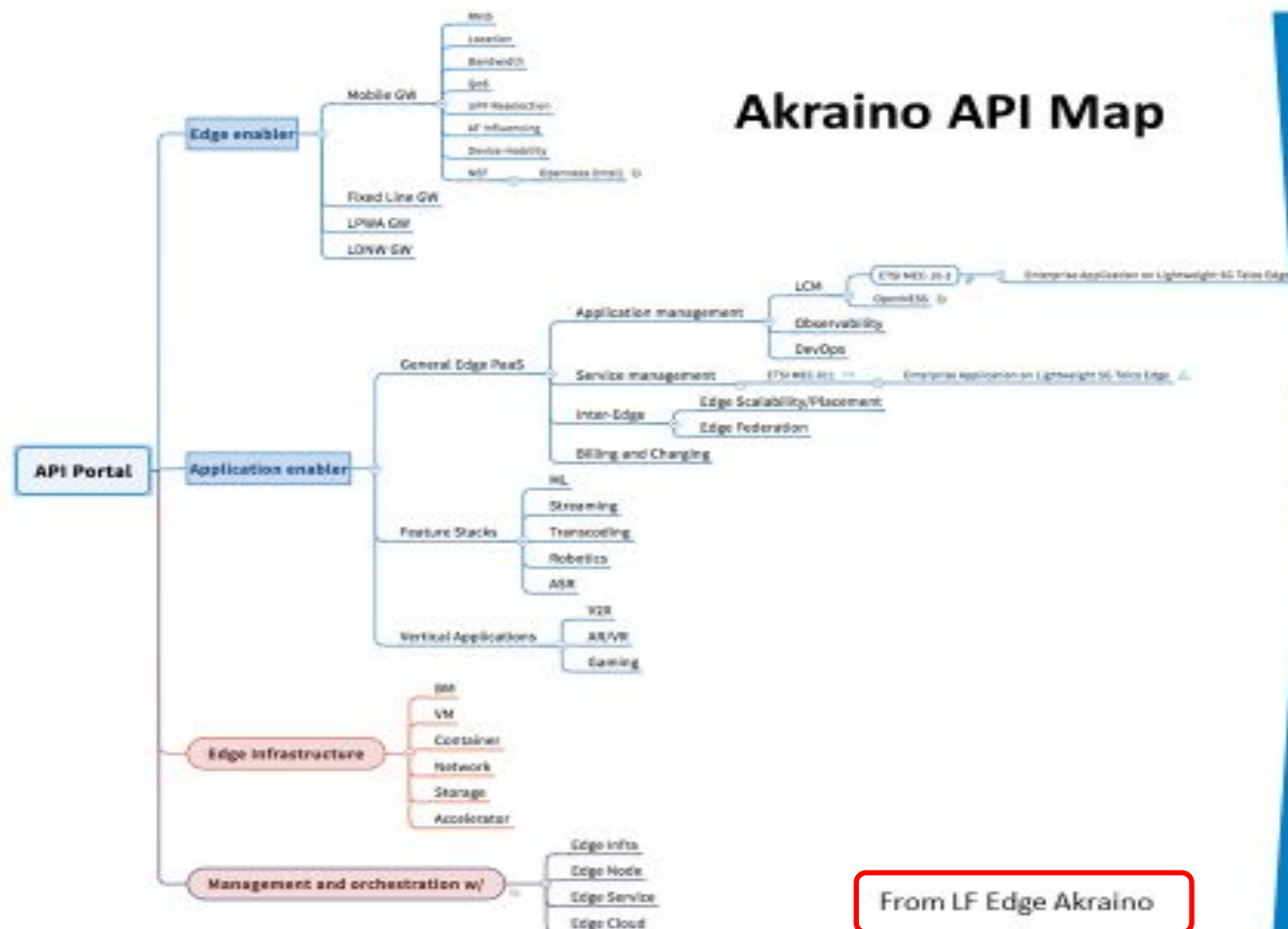
- An API info hub of Akraino projects
- Cross reference with other relevant API information sites, e.g. ETSI MEC wiki, [forge.etsi.org](https://forge.etsi.org) etc.
- Highlight API offerings from Akraino projects

<https://apiportal.Akraino.org>

From LF Edge Akraino

© ETSI 2021

# An API Map For Akraino Project APIs



## ETSI MEC DECODE

Summarized by Walter Featherstone

Group Spec (GS)	GS Version	Service Name	apiName
MEC-010-2	2.1.1	Application lifecycle, rules & req management (Mm1 & Mm3)	app_pkgm
			app_lcm
	2.1.3		granting
			app_pkgm
			app_lcm
MEC-011	2.1.1		granting
	2.1.1	Platform Application Enablement (Mpi)	mp1
			mec_app_support
			mec_service_mgmt
	2.1.2		mec_app_support
MEC-012	1.1.1	RNIS	mec_service_mgmt
	2.1.1		rni
MEC-013	1.1.1	Location Service	rni
	2.1.1		location
MEC-014	1.1.1	UE Identity Service	location
MEC-015	1.1.1	Bandwidth Management (BWM) service and Multi-access Traffic Steering (MTS) service	ui
	2.1.1		bwm
	2.1.1		bwm
MEC-016	1.1.1	UE App (Mtx2)	mts
			mts
			mts
	2.2.1		mts
MEC-021	2.1.1	Device App (Mtx2)	mts2
			dev_app
MEC-028	2.1.1	App Mobility Service (Interface)	amsi
MEC-029	2.1.1	WLAN Access Information Service	wis
MEC-029	2.1.1	Fixed Access Information Service	fai
MEC-030	2.1.1	V2X Information Service	vis
MEC-033	2.0.2	IoT API	iot



12



# IoT Platforms Competitive Landscape & Database 2020

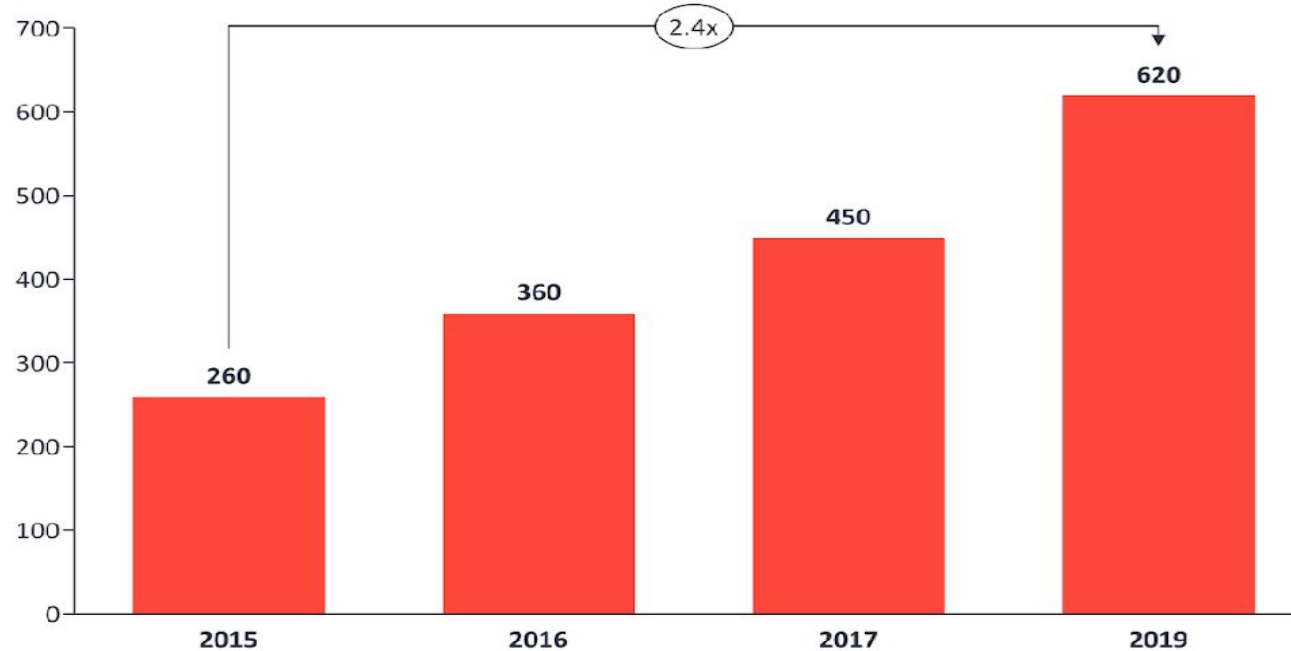
Database of 600+ IoT Platforms

Insights that empower you to understand IoT markets



## Number of publicly known "IoT Platforms" (2015-2019)

Number of publicly known "IoT Platforms" (IoT Analytics Research)



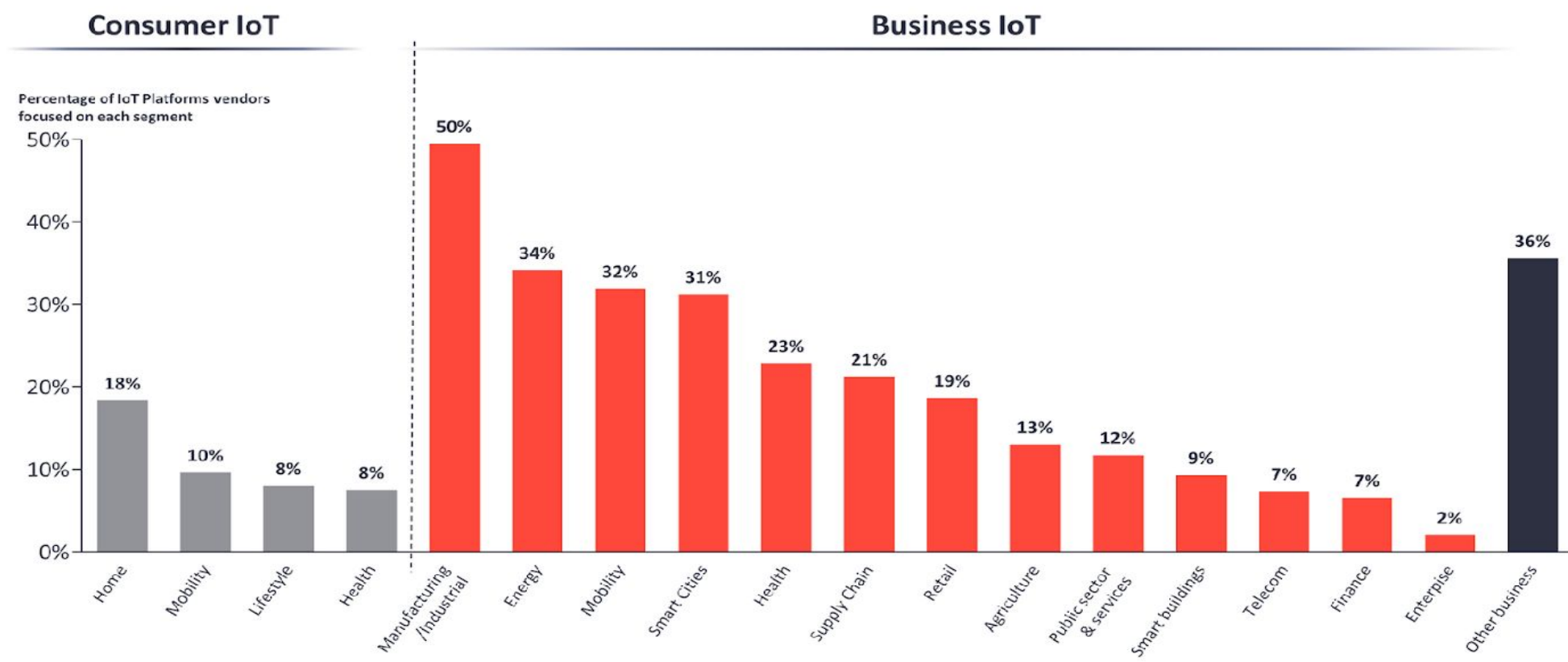
Source(s): IoT Analytics Research

## 40+ example providers



Copyright © 2019 by www.iot-analytics.com All rights reserved

# Number of Identified IoT Platforms – By industry (Dec 2019)



**Note:** Percentages do not add up to 100% as most companies focus on several segments **Source:** IoT Analytics 2020 List of IoT Platform Companies, n=620



# 1.1.5.1 Akraino IoT Area - 1

<https://wiki.akraino.org/display/AK/IoT+Area>

1

2

3

4

AKRAINO

Platser

Personer

Frågor

Kalendrar

Skapa

...

▼ Akraino Integration Projects (Blueprints)

▼ Approved blueprints

- Al/ML and AR/VR applications at Edge
- Edge Video Processing
- Integrated Edge Cloud (IEC) Blueprint Family
- Kubernetes-Native Infrastructure (KNI) Blueprint I
- MicroMEC
- Network Cloud Blueprint Family
- StarlingX Far Edge Distributed Cloud
- Telco Appliance Blueprint Family
- Time-Critical Edge Compute
- Integrated Cloud Native NFV/App stack family (S
- The AI Edge Blueprint Family
- 5G MEC System Blueprint Family
- Public Cloud Edge Interface (PCEI) Blueprint Fami
- KubeEdge Edge Service Blueprint

▼ IoT Area

- ELIOT: Edge Lightweight and IoT Blueprint Fam
- IIoT at the Smart Device Edge (family)
- oneM2M IoT Service Layer (SL) Platform
- Project Cassini - IoT and Infrastructure Edge Bli

Platsverktyg

«

Dashboard / ... / Approved blueprints

Redigera

Spara till senare

Bevakar

Dela

...

## IoT Area

Skapad av Tina Tsou, senast ändrad av Ike Alisson den sep 07, 2021

### Blueprint Families

- ELIOT: Edge Lightweight and IoT Blueprint Family
- IIoT at the Smart Device Edge (family)
- oneM2M IoT Service Layer (SL) Platform
- Project Cassini - IoT and Infrastructure Edge Blueprint Family

### Security

PARSEC, the opensource CNCF project has been adopted for edge deployments as it offers a common API that abstracts secure roots of trust which are required to protect devices outside of the datacenter. This enables the cloud native principle of being able to freely move your applications from one platform to another while maintaining level of security that was not possible in the past.

Building on this abstraction, PARSEC can mediate access to hardware security primitives and create isolated key stores for a multi-tenancy environment.

Starting your project with the right platform for security will accelerate your deployments and scale.

Come read about Parsec at: <https://parallaxsecond.github.io/parsec-book>

And talk to the experts during our weekly community calls (see github).

Or join us on the CNCF slack channel: <https://cloud-native.slack.com>

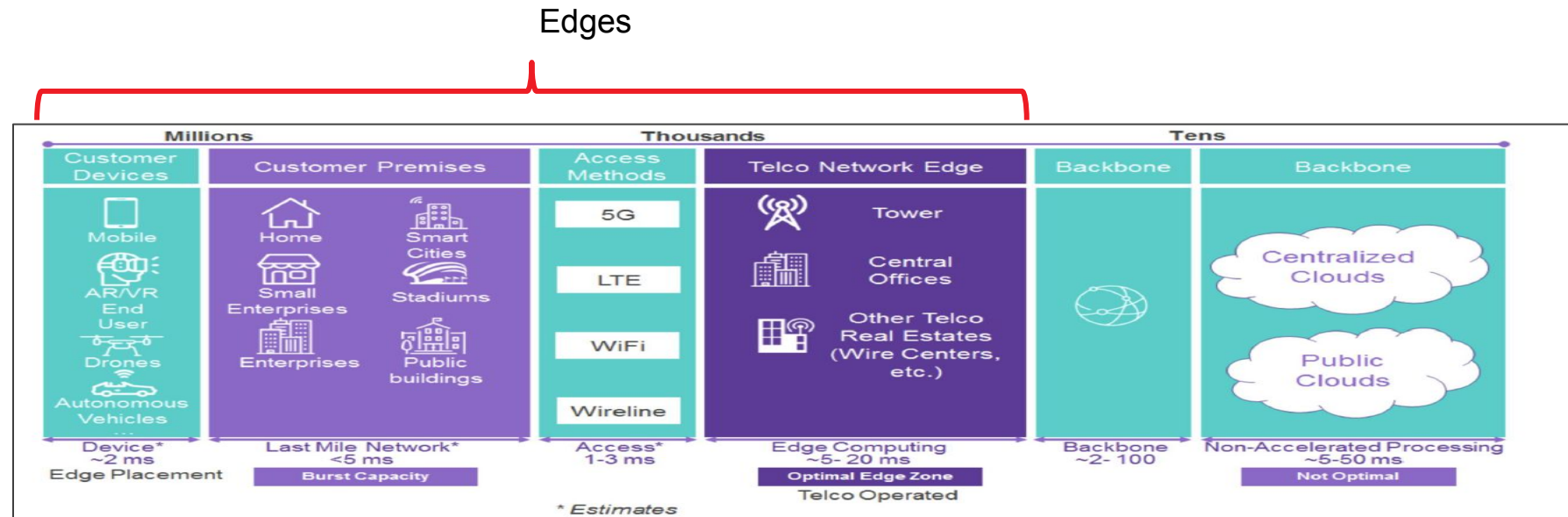
# ELIOT – Overview

ELIOT is project under Akraio approved blueprint family. It intends to develop a fully integrated edge network infrastructure and running edge computing applications on lightweight Edge Nodes.

ELIOT targets on making the edge node a lightweight software stack which can be deployed on resource constraint edge devices like IOT-Gateway and uCPE, by leveraging lightweight OS, container running environment and container orchestration applications.

## ELIOT BP family target 2 use case:

- IoT gateway
- SD-WAN, WAN edge, uCPE



ELIOT target edge

## Akraino Blueprint: Smart Cities

The purpose of Smart Cities blueprint is to provide edge computing platform base on Arm Soc, Improve deployment flexibility and security in the edge computing. The high-level relationship between the functional domains is shown in the figure below:

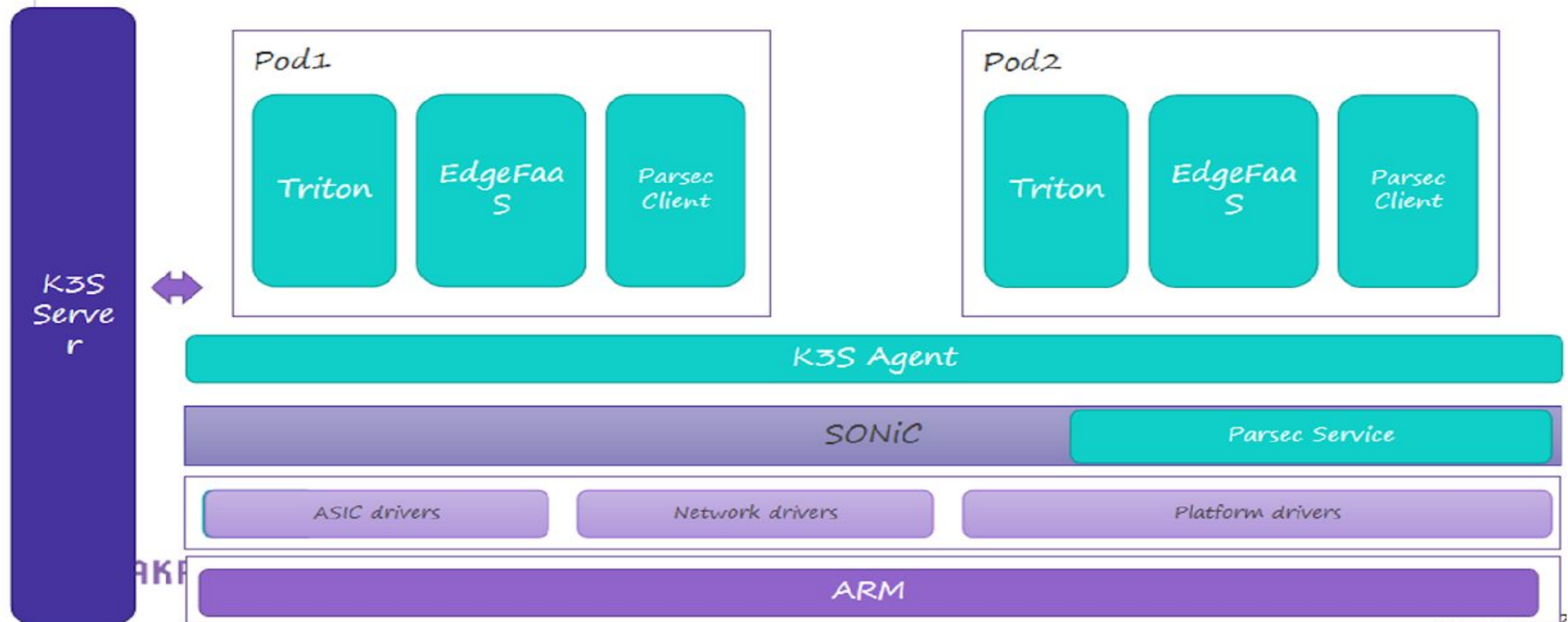


Figure 1. Smart Cities Functional Domains.



## 1.1.5.1 Akraino IoT Area - 2

› 5G MEC System Blueprint Family

› Public Cloud Edge Interface (PCEI) Blueprint Family

› KubeEdge Edge Service Blueprint

3

▾ IoT Area

› ELIOT: Edge Lightweight and IoT Blueprint Family

› IIoT at the Smart Device Edge (family)

4

▾ **oneM2M IoT Service Layer (SL) Platform**

- 3GPP 5G HMTC (High Performance Machine Type Communication) SST (S)
- oneM2M Cloud Vendor Independent & ETSI MEC support
- oneM2M IoT SL and AI/ML use
- oneM2M IoT SL and CIM NGSI-LD (Context Information Management Ne
- oneM2M IoT SL Architecture
- oneM2M IoT SL Common Service Functions (CSFs) (applied to all IoT Dor
- oneM2M IoT SL pre-integrated with 5G (3GPP) Specifications for cloT & S
- oneM2M IoT SL Release Roadmap
- oneM2M Semantic enablement and ASD (Advanced Semantic Discovery)
- oneM2M Test Suite Structure (TSS) and Test Purposes
- oneM2M Use Cases (UCs) and SAREF (Smart Applications REference) Oni

5

- OPC UA Standard IEC 62 541 for Open Platform Communication Unified .

› Project Cassini - IoT and Infrastructure Edge Blueprint Family

› Tami COVID-19 Blueprint Family

Sök



Dashboard / ... / IoT Area

✎ Redigera

★ Sparad feller senare

👁 Bevakar

🔗 Dela



# oneM2M IoT Service Layer (SL) Platform

Skapad av Ike Alisson, senast ändrad den sep 04, 2021

## oneM2M Overview

The oneM2M Global Organization creates Technical Specifications (TSs) to ensure that Machine-to-Machine (M2M) Communications can effectively operate on a Worldwide scale.

Seven (7) of the World's leading Information and Communications Technology (ICT) Standards Development Organizations (SDOs) launched in July 2012 a new Global Organization to ensure the most efficient Deployment of Machine-to-Machine (M2M) Communications Systems.

The new organization, called [oneM2M](#), develops specifications to ensure the Global Functionality of M2M—allowing a range of Industries to effectively take advantage of the benefits of this emerging Technology.

The seven (7) majors ICT SDO founders of oneM2M are:

- The European Telecommunications Standards Institute (ETSI) , Europe
- The Association of Radio Industries and Businesses (ARIB), Japan
- The Telecommunication Technology Committee (TTC), Japan
- The Alliance for Telecommunications Industry Solutions (ATIS), USA
- The Telecommunications Industry Association (TIA), USA
- The China Communications Standards Association (CCSA), China
- The Telecommunications Technology Association (TTA), Korea

The members of the organization are devoted to developing Technical Specifications and Reports to ensure M2M Devices can successfully communicate on a Global scale.

The oneM2M Standardization work is split in five (5) WG:



## 1.1.5.1 Akraino IoT Area - 3

AKRAINO

Platser ▾

Personer

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Kalendrar

Skapa

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Sök

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2

▼ oneM2M IoT Service Layer (SL) Platform

- 3GPP 5G HMTc (High Performance Machine Type C
- oneM2M Cloud Vendor Independent & ETSI MEC s
- oneM2M IoT SL and AI/ML use
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- oneM2M IoT SL Release Roadmap
- oneM2M Semantic enablement and ASD (Advance
- oneM2M Test Suite Structure (TSS) and Test Purpo:
- oneM2M Use Cases (UCs) and SAREF (Smart Appli
- 5 • **OPC UA Standard IEC 62 541 for Open Platform**
- › Project Cassini - IoT and Infrastructure Edge Blueprin
- › Tami COVID-19 Blueprint Family
- › Automotive Area
- › Blueprint Proposals

› Akraino Feature Projects (a.k.a Development Project)

- Point of Delivery (POD)

› Technical Steering Committee (TSC)

› Shared Community Lab



› Meeting notes





› Shared links

› File lists

Platsverktyg

«

Dashboard / ... / oneM2M IoT Service Layer (SL) Platform  

 Redigera  Spara till senare  Bevakar  Dela ...

# OPC UA Standard IEC 62 541 for Open Platform Communication Unified Architecture

Skapad av Ike Alisson, senast ändrad den sep 04, 2021

OPC UA (Open Platform Communication Unified Architecture) provides the necessary infrastructure for interoperability across the Enterprise, from Machine-to-Machine (M2M), Machine-to-Enterprise (M2E) and everything in-between.

The OPC UA was initially released in 2006 - 2008 and has a very broad Market deployment footprint since then. OPC UA specifies a Platform independent Service-oriented Architecture, that integrates all the functionality of the individual OPC Classic Specifications into one (1) extensible Framework.

OPC UA specifications are stipulated in International Standard IEC 62 541 (<https://opcfoundation.org/news/opc-foundation-news/update-iec-62541-opc-ua-published/>).

The current version of the OPC UA specification is on 1.04 (22 November 2017). The new version of OPC UA has added Publish/Subscribe in addition to the Client/Server communications infrastructure.

The OPC UA Information Model is a so-called Full Mesh Network based on nodes. The OPC UA Architecture supports two (2) Protocols. This is visible to Application programmers only via changes to the URL. The binary protocol is [opc.tcp://Server](#) and [http://Server](#) is for Web Service. Otherwise OPC UA works completely transparent to the API.

After the initial release in 1996, the [OPC Foundation](#) was created to maintain the Standard. As OPC has been adopted beyond the field of Process Control, the [OPC Foundation](#) changed the name to Open Platform Communications in 2011. The change in name reflects the Applications of OPC Technology for Applications in [Building Automation](#), [Discrete Manufacturing](#), [Process Control](#) and many others. OPC has also grown beyond its original OLE ([Object Linking and Embedding](#)) implementation to include other Data transportation Technologies including [Microsoft's .NET Framework](#), [XML](#), and even the OPC Foundation's binary-encoded TCP format.

The OPC UA Multi-Layered approach accomplishes the original design specification goals of:


- **Functional equivalence:** all COM OPC Classic specifications are mapped to UA
- **Platform independence:** from an embedded micro-controller to cloud-based infrastructure
- **Secure:** encryption, authentication, and auditing
- **Extensible:** ability to add new features without affecting existing applications
- **Comprehensive information modeling:** for defining complex information

## Functional Equivalence

Building on the success of OPC Classic, OPC UA was designed to enhance and surpass the capabilities of the OPC Classic specifications. OPC UA is functionally equivalent to OPC Classic, yet capable of much more:



## 1.1.5.1 Akraino IoT Area - 6

Platser ▾ Personer Frågor Kalendrar Skapa ...

3

IoT Area

ELIOT: Edge Lightweight and IoT Blueprint Family

IIoT at the Smart Device Edge (family)


4




oneM2M IoT Service Layer (SL) Platform


- 3GPP 5G HMTC (High Performance Machine Type Communication) SST (S)
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- oneM2M Use Cases (UCs) and SAREF (Smart Applications REference) Ont
- OPC UA Standard IEC 62 541 for Open Platform Communication Unified .

Project Cassini - IoT and Infrastructure Edge Blueprint Family

Tami COVID-19 Blueprint Family

Sök ? 2 

Dashboard / ... / IoT Area  Redigera ★ Sparad feller senare  Bevakar  Dela ...



oneM2M IoT Service Layer (SL) Platform

Skapad av Ike Alisson, senast ändrad den sep 04, 2021

### oneM2M Overview

The oneM2M Global Organization creates Technical Specifications (TSs) to ensure that Machine-to-Machine (M2M) Communications can effectively operate on a Worldwide scale.

Seven (7) of the World's leading Information and Communications Technology (ICT) Standards Development Organizations (SDOs) launched in July 2012 a new Global Organization to ensure the most efficient Deployment of Machine-to-Machine (M2M) Communications Systems.

The new organization, called [oneM2M](#), develops specifications to ensure the Global Functionality of M2M—allowing a range of Industries to effectively take advantage of the benefits of this emerging Technology.

The seven (7) majors ICT SDO founders of oneM2M are:

- The European Telecommunications Standards Institute (ETSI) , Europe
- The Association of Radio Industries and Businesses (ARIB), Japan
- The Telecommunication Technology Committee (TTC), Japan
- The Alliance for Telecommunications Industry Solutions (ATIS), USA
- The Telecommunications Industry Association (TIA), USA
- The China Communications Standards Association (CCSA), China
- The Telecommunications Technology Association (TTA), Korea

The members of the organization are devoted to developing Technical Specifications and Reports to ensure M2M Devices can successfully communicate on a Global scale.

The oneM2M Standardization work is split in five (5) WG:



## 1.1.5.1 Akraino IoT Area - 7

### IoT Area

› ELIOT: Edge Lightweight and IoT Blueprint Fam

› IIoT at the Smart Device Edge (family)

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### oneM2M IoT Service Layer (SL) Platform

- 3GPP 5G HMTc (High Performance Machine
- oneM2M Cloud Vendor Independent & ETSI
- oneM2M IoT SL and AI/ML use

- oneM2M IoT SL and CIM NGSI-LD (Context I
- oneM2M IoT SL Architecture
- oneM2M IoT SL Common Service Functions

- oneM2M IoT SL pre-integrated with 5G (3GP
- oneM2M IoT SL Release Roadmap
- oneM2M Semantic enablement and ASD (Ac
- oneM2M Test Suite Structure (TSS) and Test I
- oneM2M Use Cases (UCs) and SAREF (Smart
- OPC UA Standard IEC 62 541 for Open Platfc

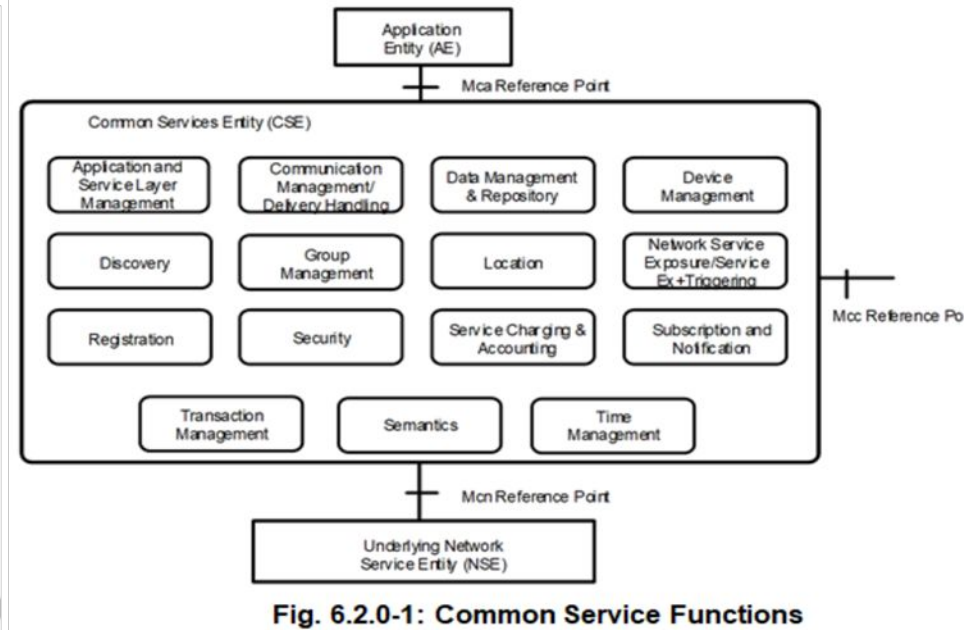
› Project Cassini - IoT and Infrastructure Edge Bl

› Tami COVID-19 Blueprint Family

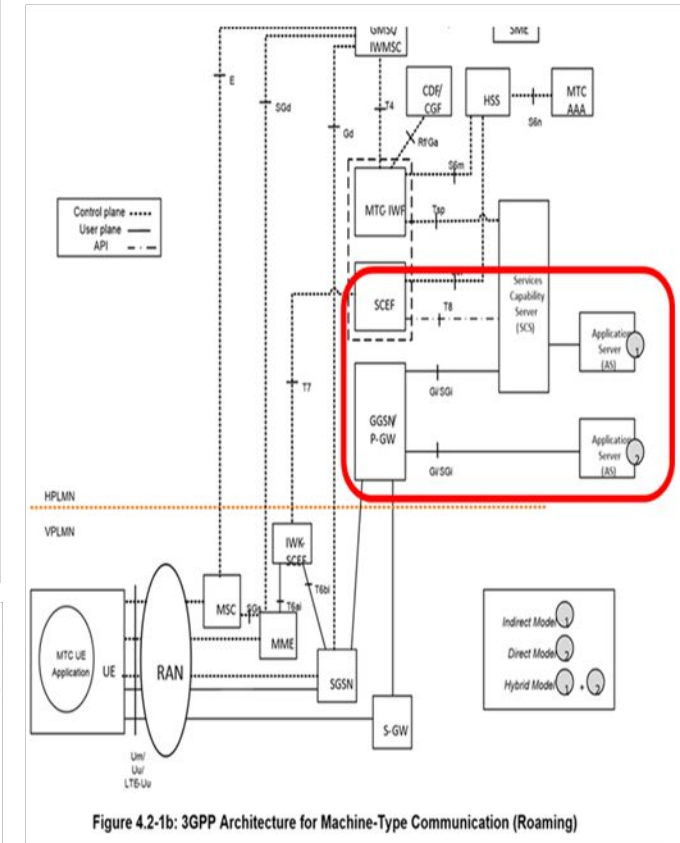
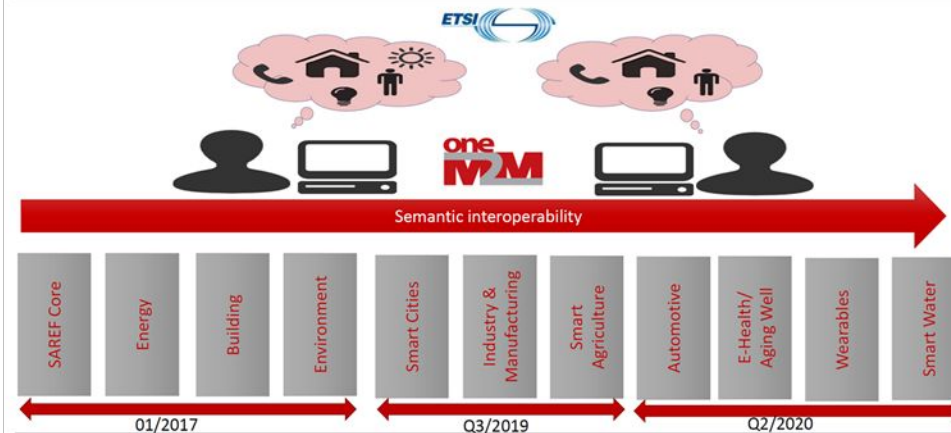
› Automotive Area

› Blueprint Proposals

› Akraino Feature Projects (a.k.a Development Project)



### SAREF and its extensions



Personal IoT Networks (PINs)

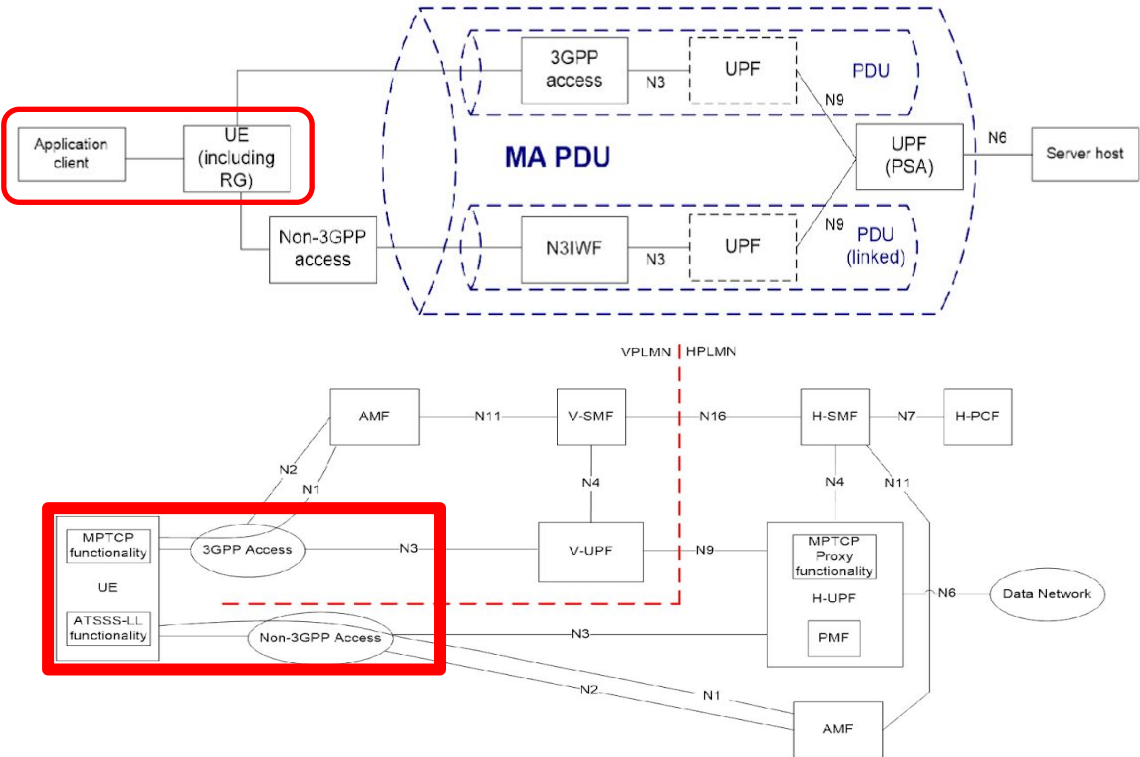
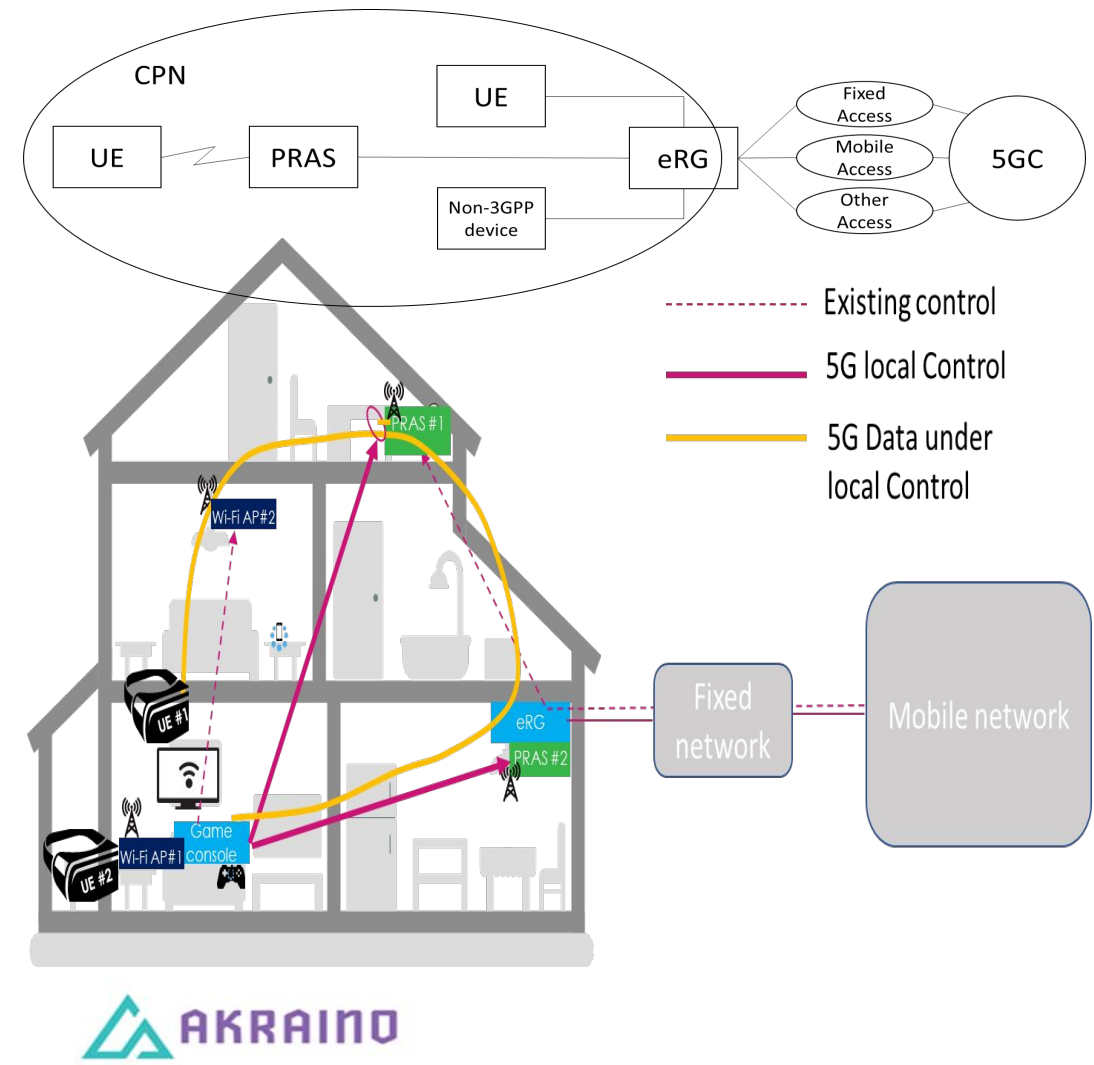


Figure 4.2.10-3: Roaming with Home-routed architecture for ATSSS support (UE registered to different PLMNs)

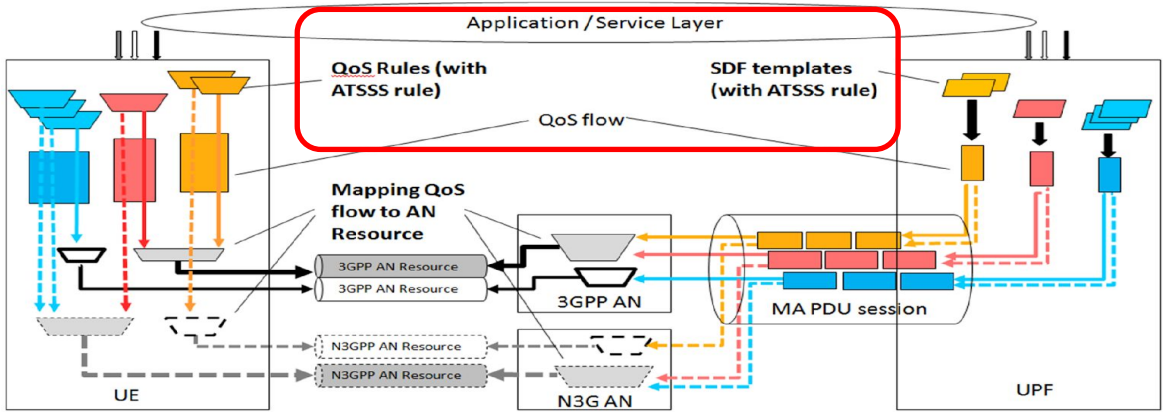


Figure 6.3.1.2-1: The traffic splitting based on the QoS rule (with ATSSS rule)

## 3GPP RAN Rel-16 progress and Rel-17 potential work areas

July 18, 2019

<https://www.3gpp.org/news-events/2058-ran-rel-16-progress-and-rel-17-potential-work-areas>

### Slide 7

## ***Release 16 progressing towards completion***

### 5G V2X

- Targeting advanced use cases beyond LTE V2X

### Industrial IoT and URLLC enhancements

- Adding 5G NR capabilities for full wired Ethernet replacement in factories: Time Sensitive networking, etc... with high reliability

### 5G NR operation in unlicensed bands

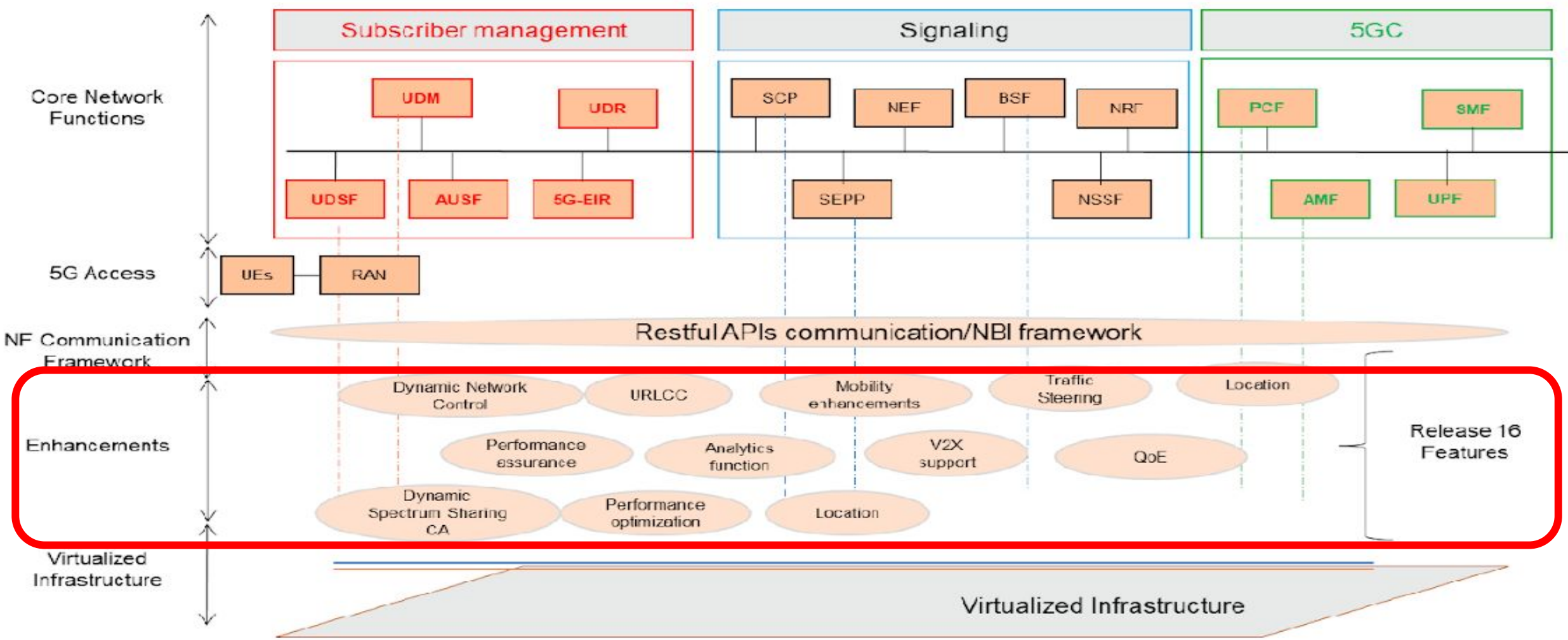
- Includes both Licensed Assisted Access (LAA), as well as Standalone Unlicensed operation

### System improvements and enhancements

- Positioning
- MIMO enhancements
- Power Consumption improvements



## 1.1.5.1 Akraino IoT Area - 10



**Figure 2-6: Release 16 5G features and enhancements supporting verticals**



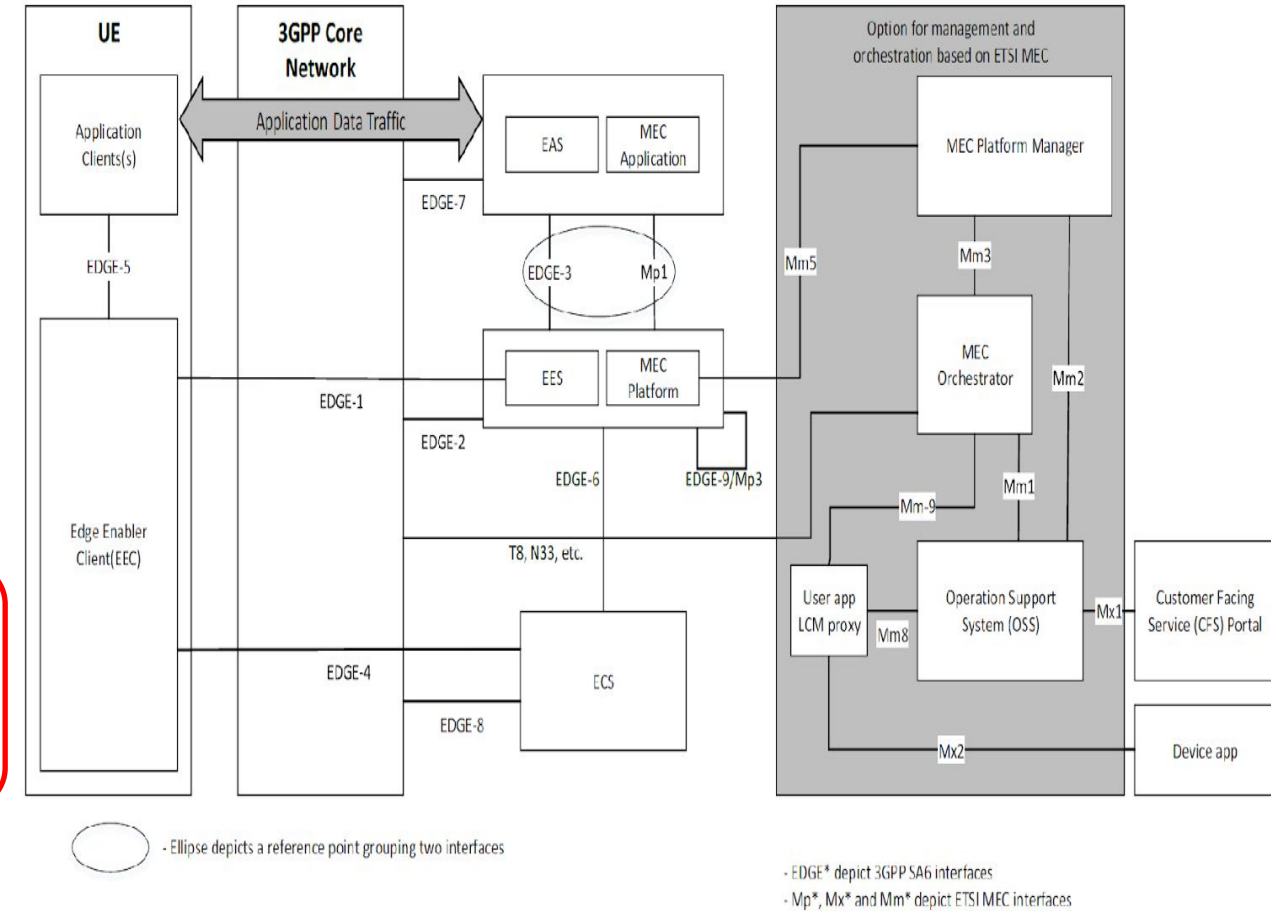
**Operator Platform Telco Edge Requirements  
Version 1.0  
29 June 2021**

*This is a Non-binding Permanent Reference Document of the GSMA*

The OPG believes that, for Operators to develop a Federated Edge Computing Platform such as the OP, Requirements must be enforceable in Contracts by a Published Set of Standards.

To this end, the OPG proposes selecting ETSI ISG MEC and 3GPP to provide a Standard Reference for an Edge Service End to End (E2E) definition.

We note that 3GPP EDGEAPP Architecture and ETSI ISG MEC Architecture could complement each other in a way that is acceptable to OPG:



**Figure 14: Relationship between ETSI ISG-MEC and 3GPP EDGEAPP architectures**