

# The New Open "Edge"

IOT+Telecom+Cloud+Enterprise+Industrial

 LF EDGE

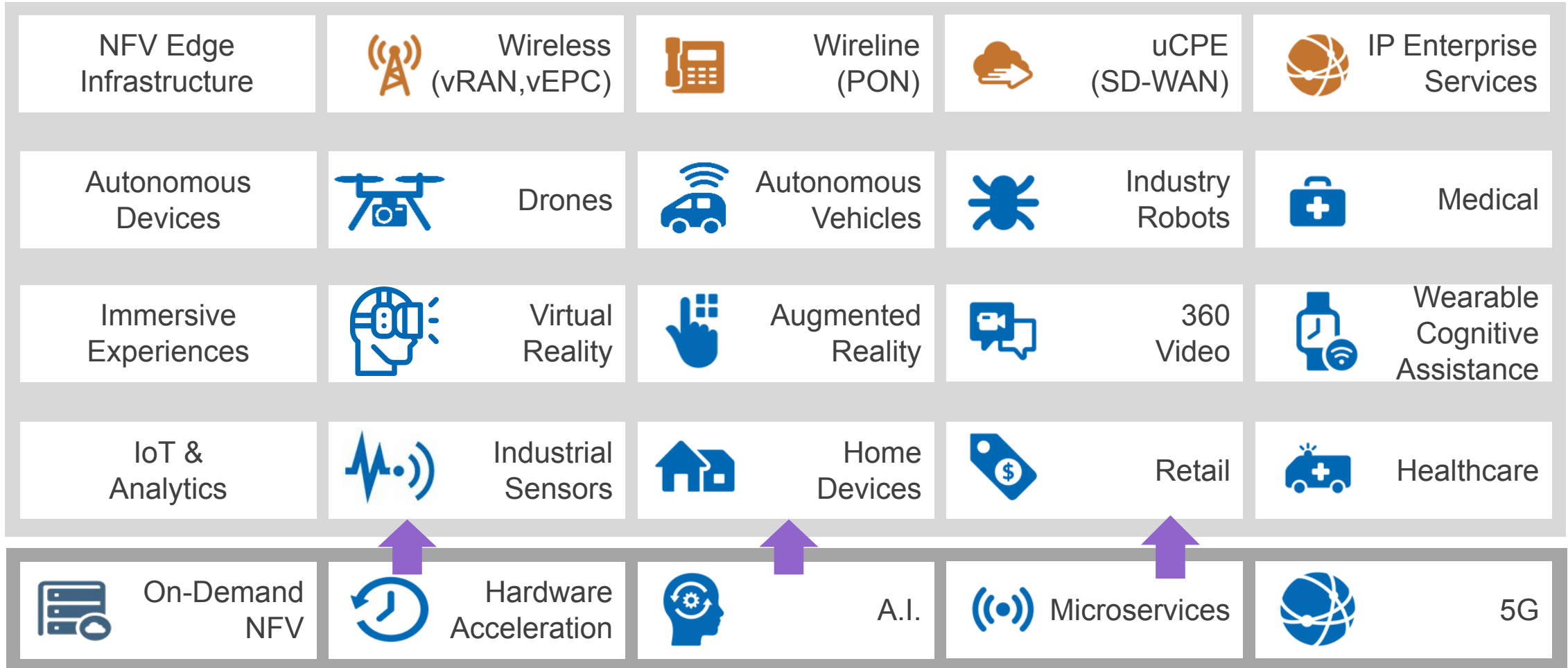
June 2021

 THE **LINUX** FOUNDATION

# Why Edge

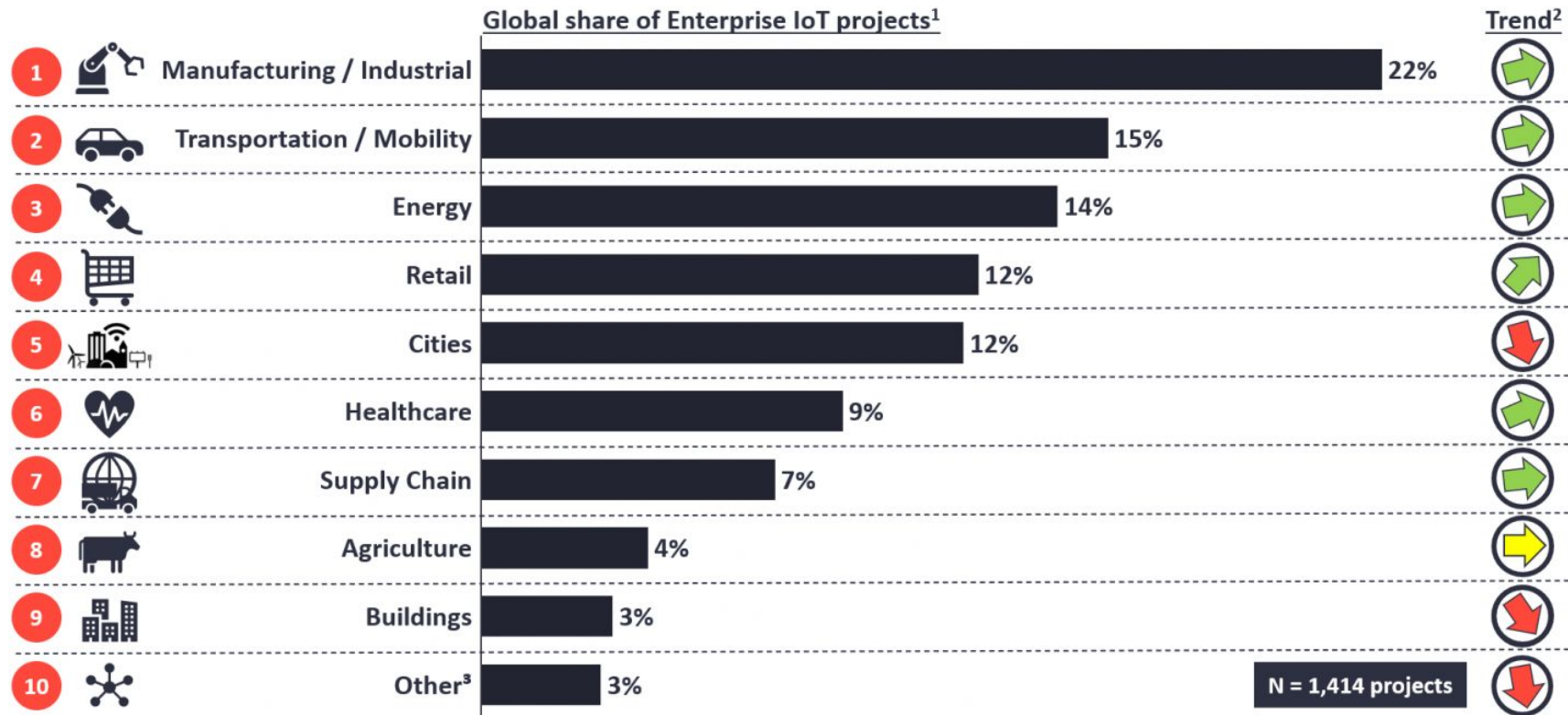
# Emerging Edge Applications & Convergence of Technologies

are demanding & fueling lower latency + accelerated processing



# IOT Killer apps 2020

## Top 10 IoT Application areas 2020



Note: 1. Based on 1,414 publically known IoT projects (not including consumer IoT projects eg smart home, wearables, etc.) 2. Trend based on relative comparison with % of projects in the 2018 IoT Analytics IoT project list e.g., a downward arrow means the relative share of all projects has declined, not the overall number of projects. 3. Other includes IoT projects from Enterprise & Finance sectors. Source: IoT Analytics Research - July 2020

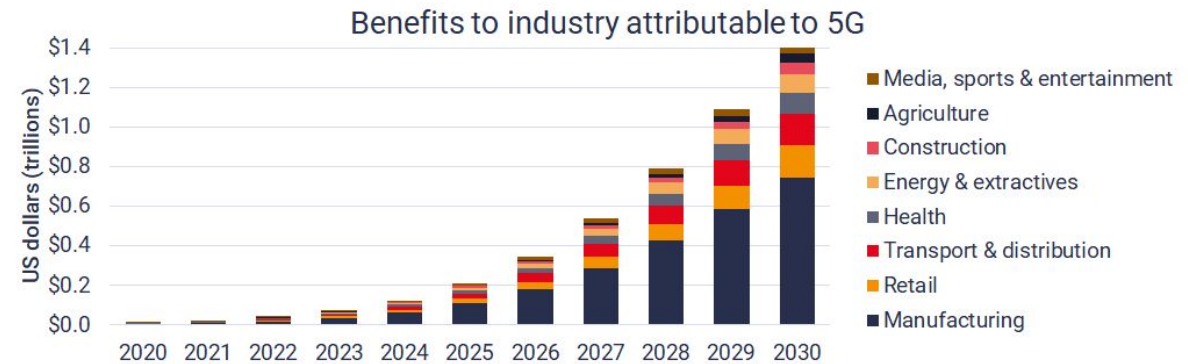
# 5G and Edge Critical in the Next Battle, a new normal!

## Edge is 4X the Size\* of Cloud Market !

“As businesses and governments establish their own new normal, **5G and Edge computing** will be necessary to deliver the automation, performance and cognitive insight required by many industries—including manufacturing, healthcare, energy and utilities, among others. Telecom operators will need to embrace open ecosystems to externalize innovation and accelerate new services.”

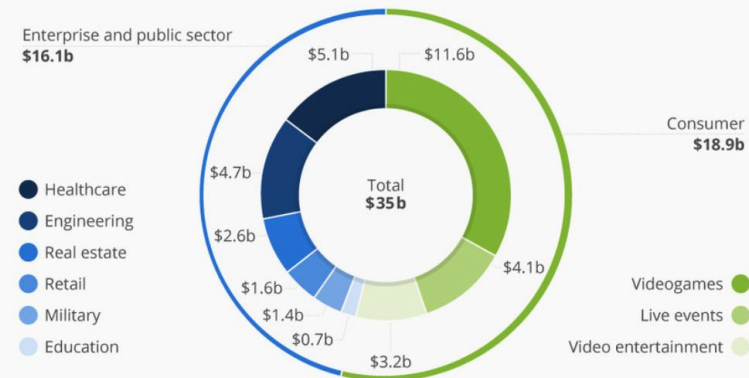


<http://www.chetansharma.com/publications/edge-internet-economy/>



### The Diverse Potential of VR & AR Applications

Predicted market size of VR/AR software for different use cases in 2025\*



\* Base case scenario  
Source: Goldman Sachs Global Investment Research

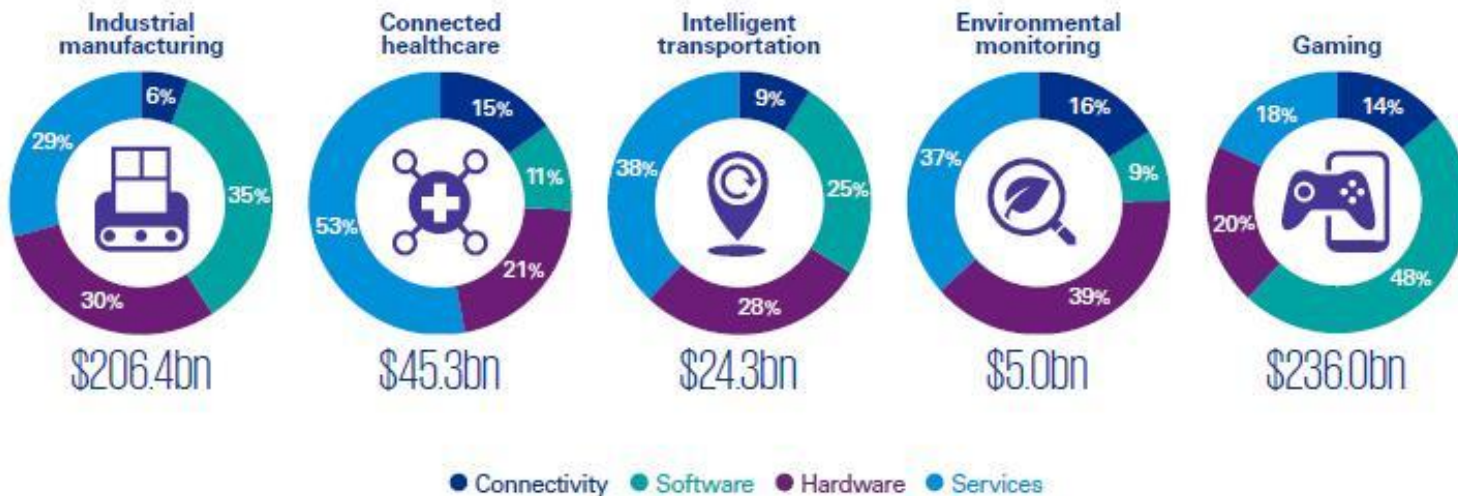
statista

How VR and AR will be used in 2025

Image: Statista

# Top 5 Edge Markets - KPMG

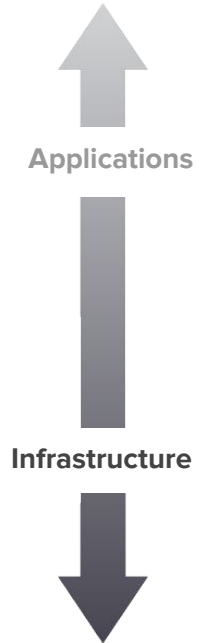
The US\$517bn 5G+Edge ecosystem across just five industries



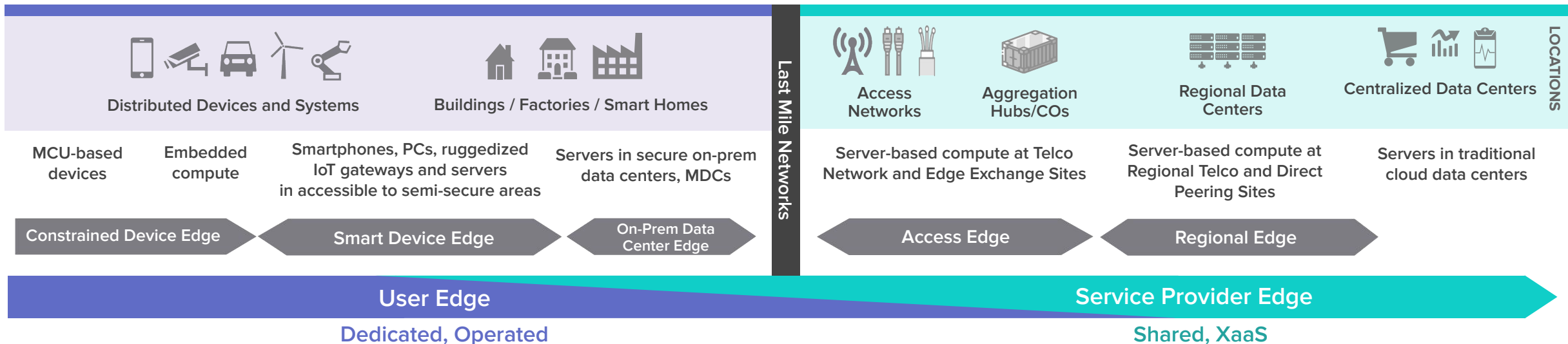
1. Industrial Manufacturing
2. Energy (Oil & Gas, Utilities)
3. Commerce/Retail
4. Homes (including B2B2C use cases)
5. Automotive
6. Fleet/Transportation
7. Logistics
8. Building Automation
9. Cities and Government
10. Healthcare

# Defining the Edge

# Unified Edge Framework

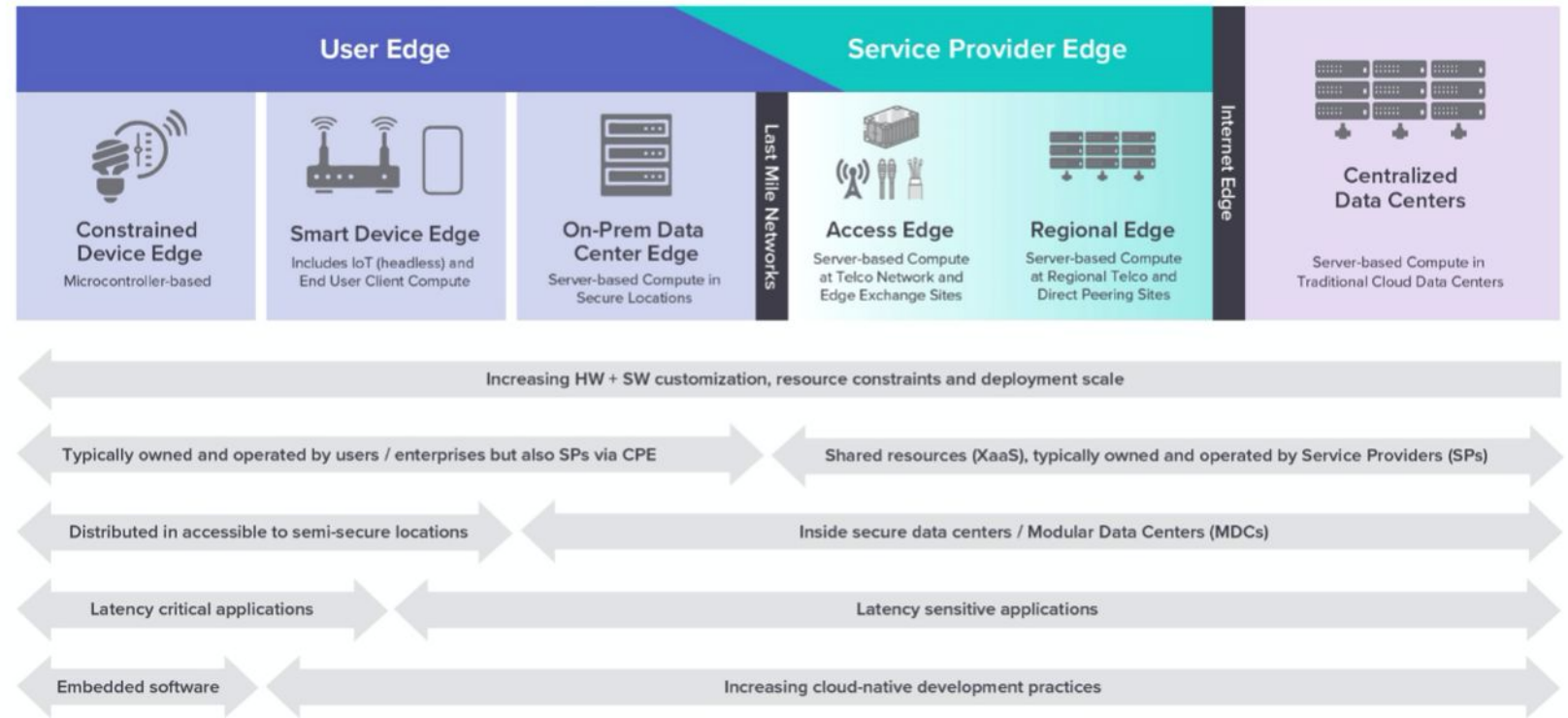
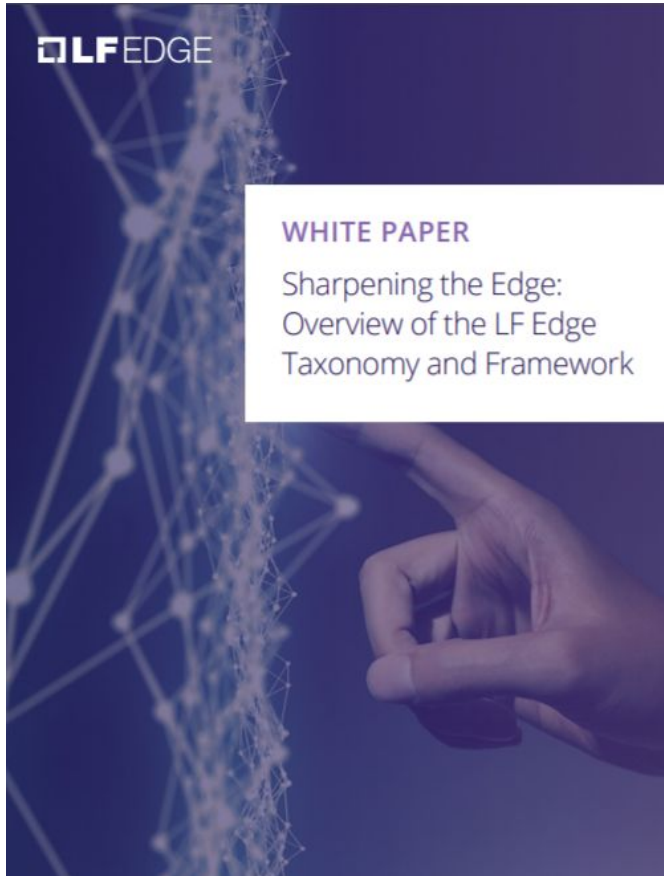


- ✓ Proximity (compute & storage)
- ✓ Responsiveness (5-20ms latency)
- ✓ Mobility



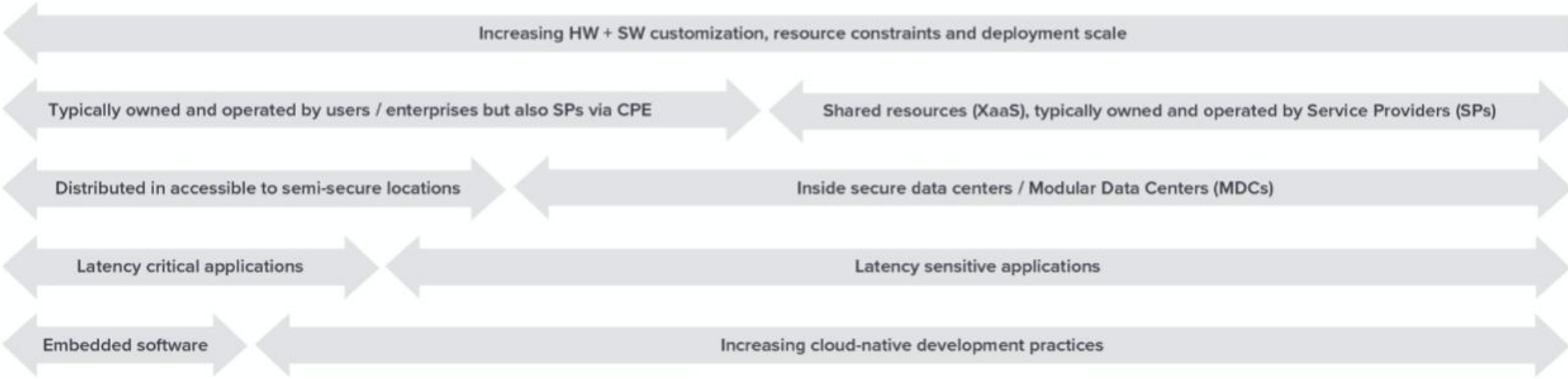
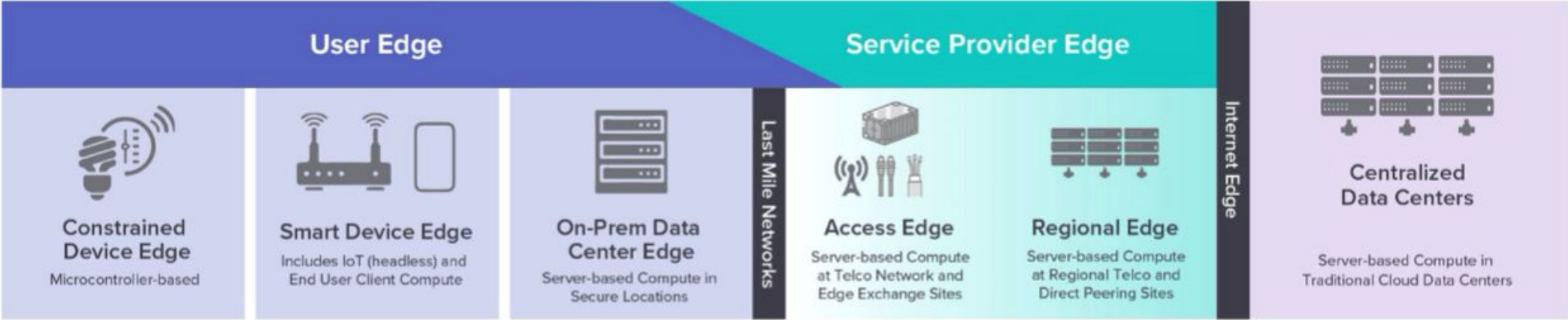


# Taxonomy whitepaper



<https://www.lfedge.org/resources/publication-download/>

# The Edge Taxonomy - Explained

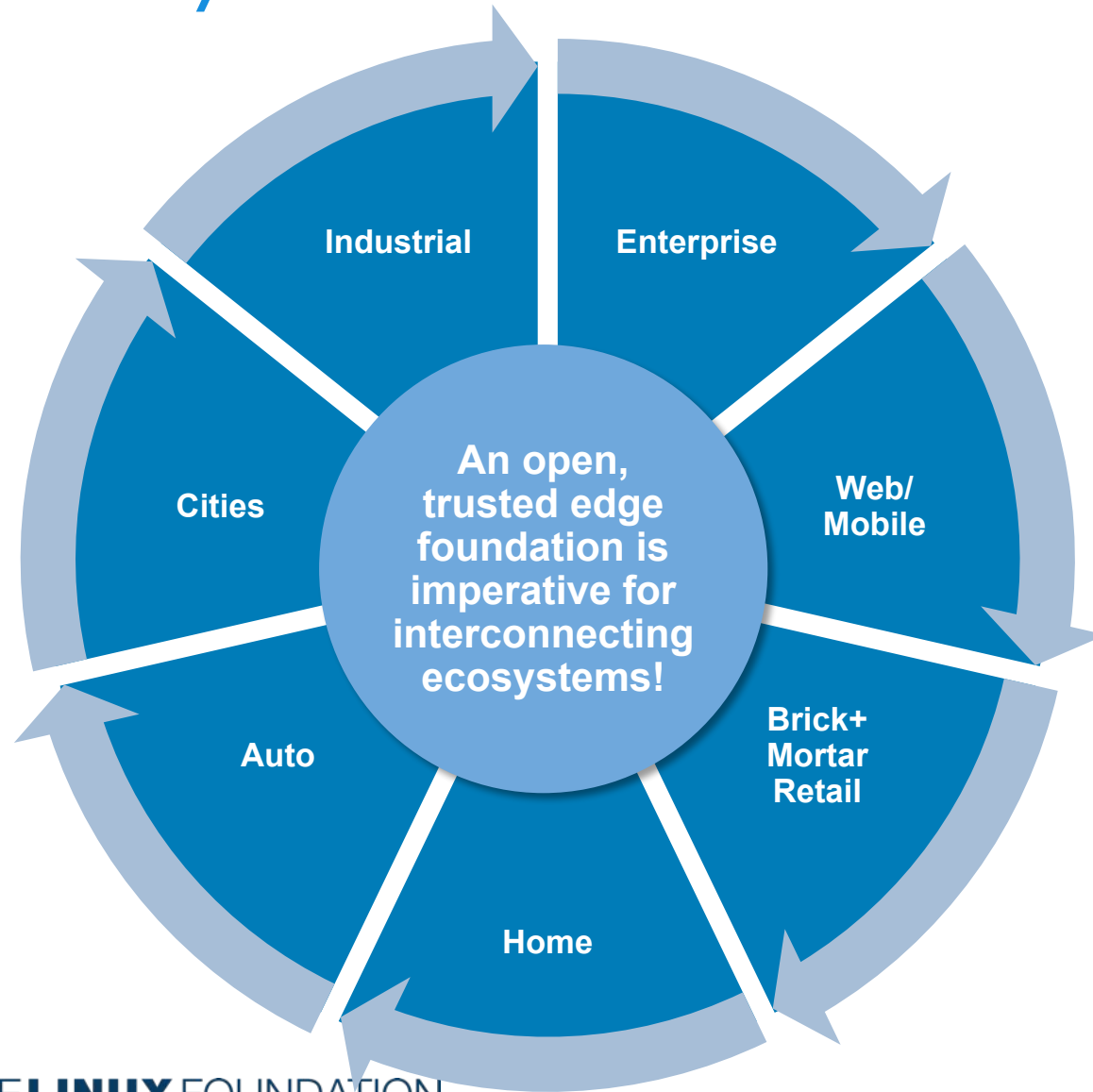


Source: LF Edge June 2020 Taxonomy White Paper

# Introducing LF Edge

 THE **LINUX** FOUNDATION

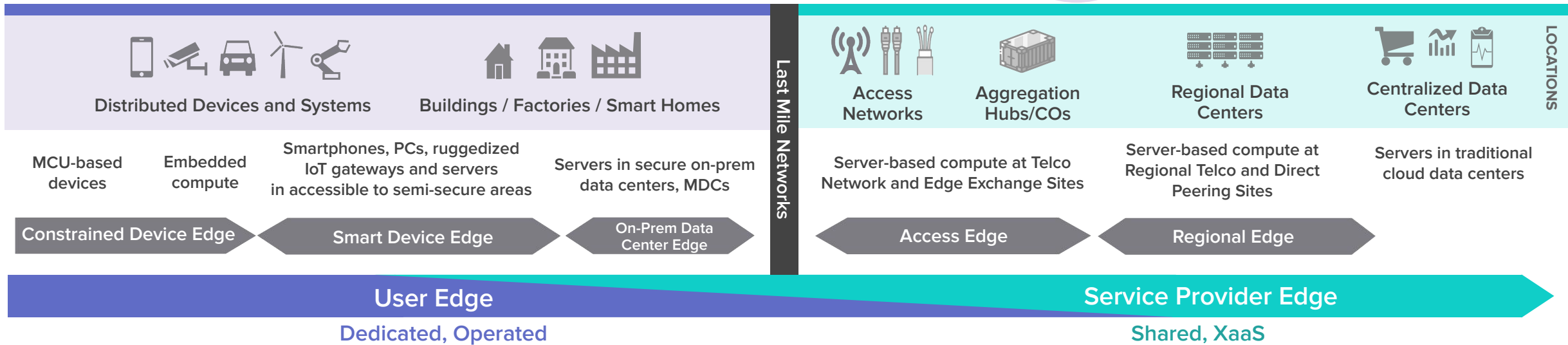
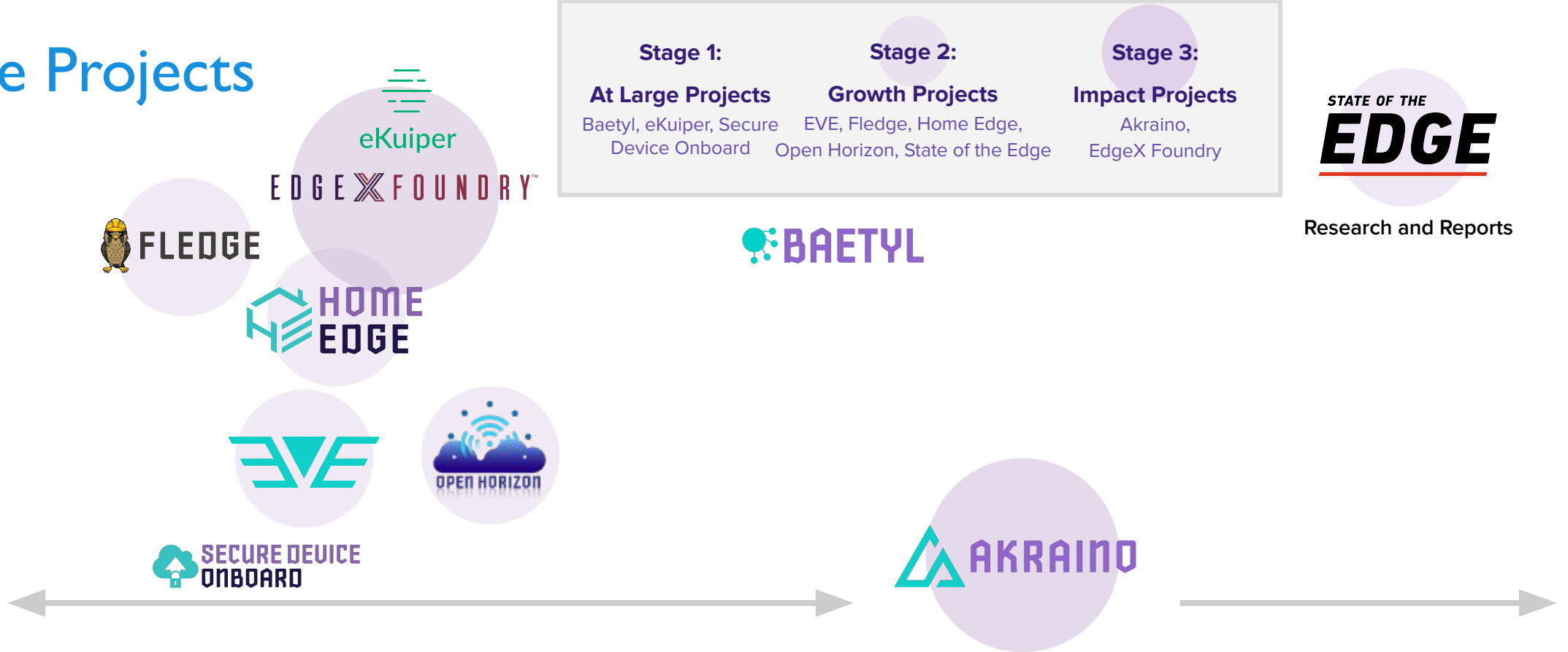
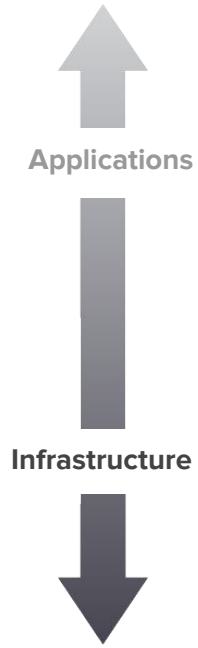
# The Holy Grail – B2B2X Across Interconnected Ecosystems



**B2X2X innovation is the ultimate opportunity for digital transformation.**

**Getting here requires an open edge foundation...**

# LF Edge Projects



# Vertical Market Adoption of End to End Open Source Software

## OPEN NETWORKING, EDGE AND IOT MARKET ADOPTION



Industrial  
Manufacturing



Energy (Oil,  
Gas Utilities)



Commerce &  
Retail



Home



Automotive



Fleet &  
Transportation



Logistics



Building  
Automation



Cities &  
Government



Healthcare



### ENTERPRISE NETWORKING

1. Private Networks 5G/LTE
2. Workloads across Multi-clouds
3. End to end visibility and monitoring



### SERVICE PROVIDERS

1. Built on end to end open source 5G & edge
2. Developing countries with 5G and edge
3. Global connectivity



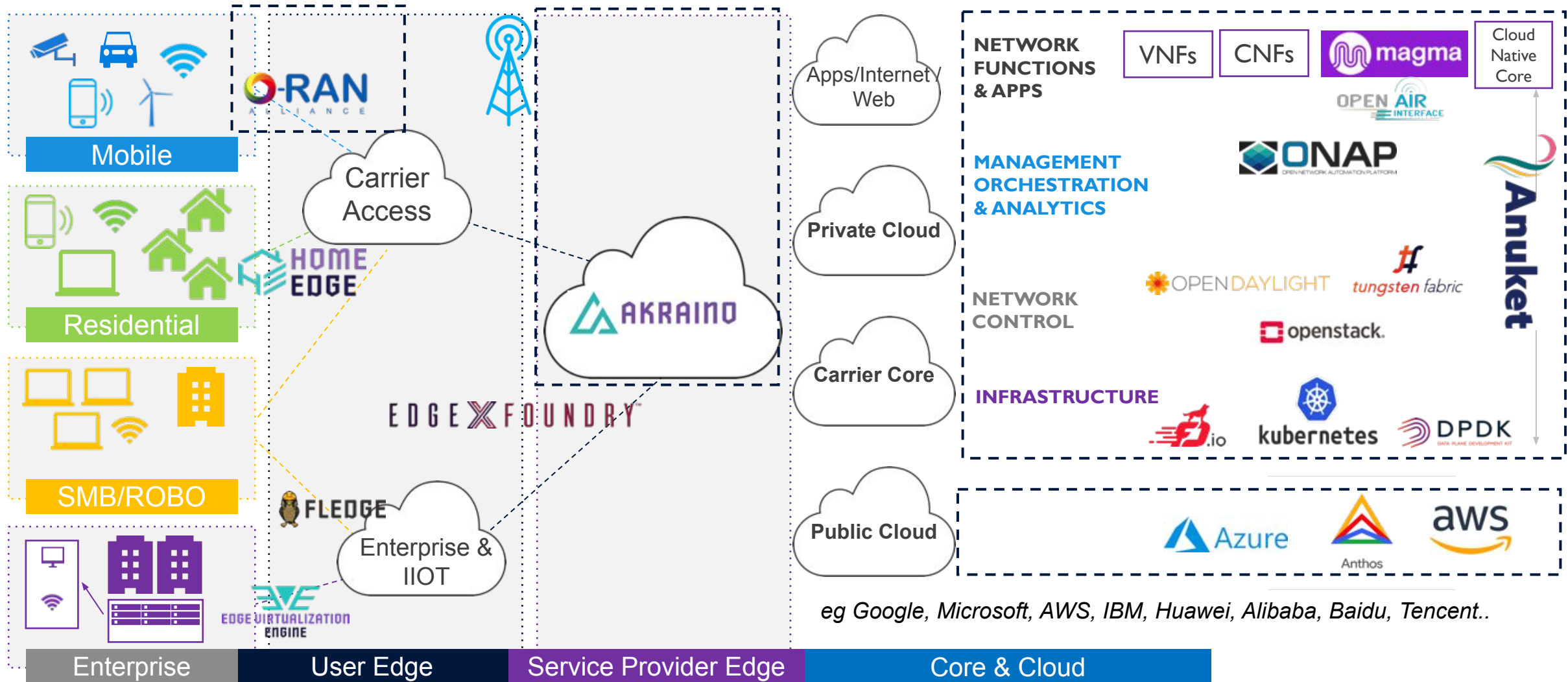
### END USERS GOVERNMENT

1. Built on Open Source projects
2. 5G Super Blueprints
3. Unified Cloud, Enterprise, Telco

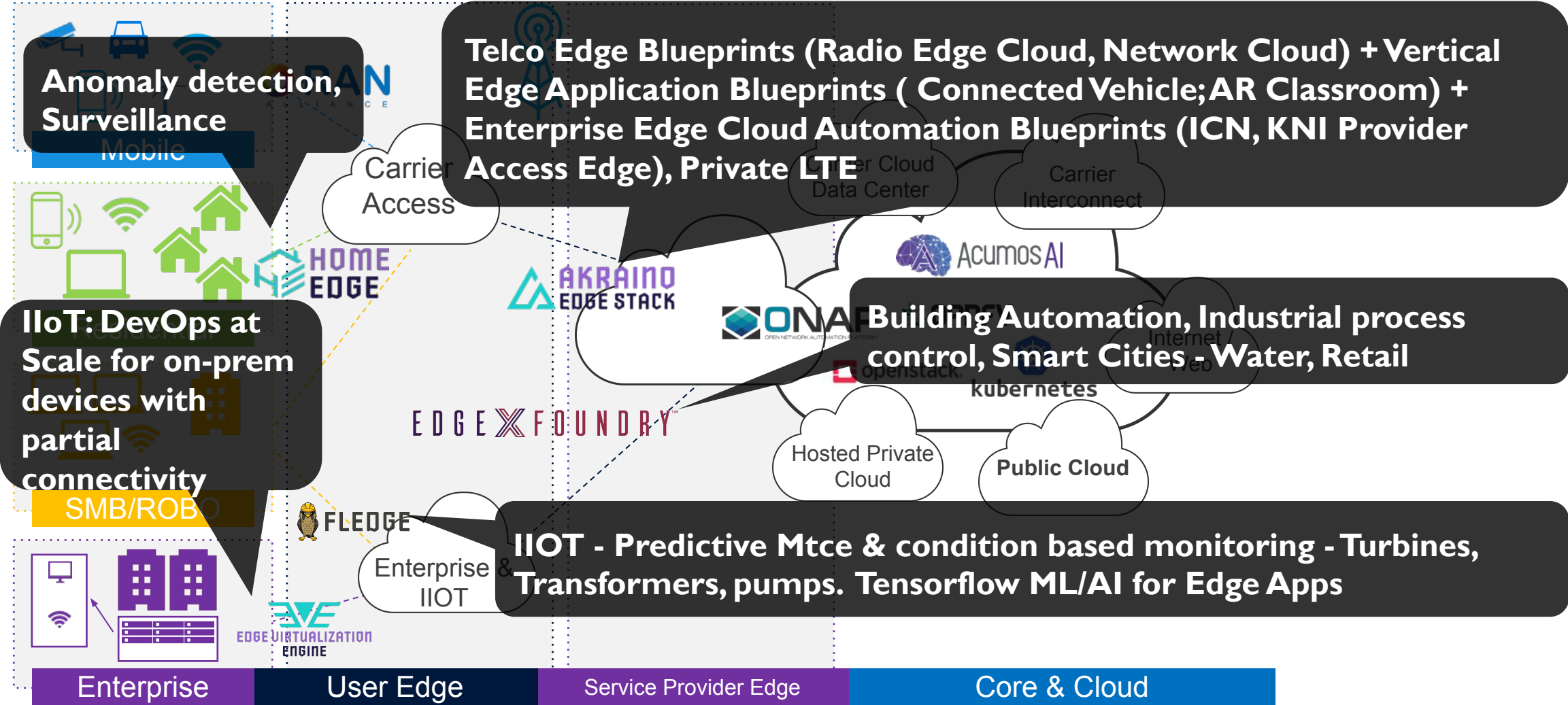
## BUILT ON END TO END OPEN SOURCE PROJECTS



# End to End Open Source Software Collaboration



# LF Edge - Deployment ready Open Source Edge - use cases





# LF Edge Summary

*Vision: Our software & projects enable rapid productization of Edge platforms by leveraging end user input to drive and supply the necessary building blocks (and/or frameworks, reference solutions) to facilitate integration and interoperability for Edge Computing across Telecom Service Providers, Cloud Providers, IOT & Enterprises*

## Projects

### IMPACT - STAGE 3



### GROWTH - STAGE 2



### AT LARGE - STAGE 1



## Premier Members



# LF Edge Accelerating Community Collaboration



**25+%**

New Member  
Y/Y increase



**80%**

New Projects increase  
SOTE, Open Horizon, SDO...



**25+**

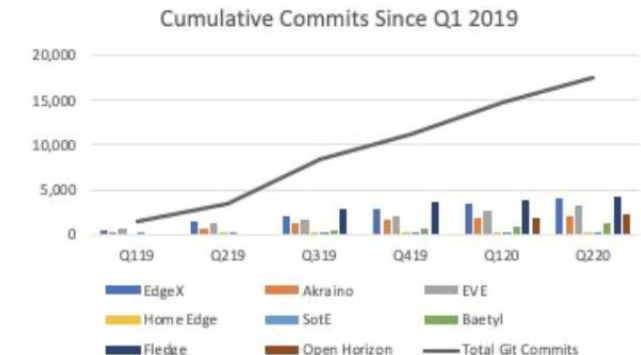
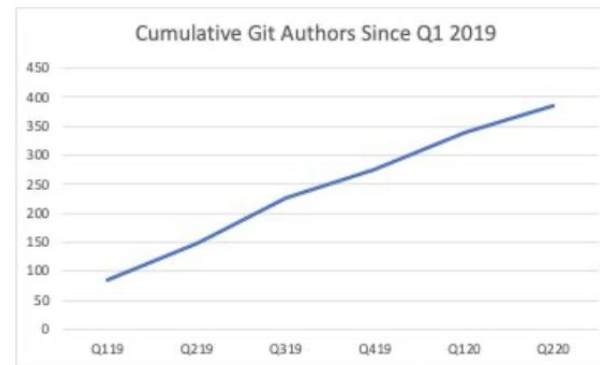
Global Deployments &  
Commercial Products



**6M+ /30+**

EdgeX Downloads and Akraino  
Blueprints in development

**160% Growth in Developers Y/Y, 4X Commits Y/Y**



**15800 global mentions since launch**

Participation from Service Providers (Telco, Cloud, Cable), IOT, Enterprise ecosystem with a goal of Unifying Edge Frameworks & Life cycle mgmt

# LF Edge: Unifying Open Source Edge IoT, Telco, Cloud, Enterprise

## The Linux Foundation Launches New LF Edge to Establish a Unified Open Source Framework for the Edge

*More than 60 global founding members across enterprise, IoT, telecom and cloud collaborate on open source framework for edge computing and future of IoT*

**SAN FRANCISCO, January 24, 2019** – [The Linux Foundation](#), the nonprofit organization enabling mass innovation through open source, today announced the launch of LF Edge, an umbrella organization to establish an open, interoperable framework for edge computing independent of hardware, silicon, cloud, or operating system. LF Edge is initially comprised of five projects that will support emerging edge applications in the area of non-traditional video and connected things that require lower latency, faster processing and mobility.

LF Edge includes **Akaino Edge Stack, EdgeX Foundry, and Open Glossary of Edge Computing**, formerly stand-alone projects at The Linux Foundation and new projects **EVE (Edge Virtualization Engine), Home Edge**.

Jan  
2019

## LF Edge Momentum continues with Project EVE seed code, project demonstrations at IOT World and new members

- *IOT OnPrem Edge Virtualization Engine seed code contributed by Zedada to LF Edge*
- *Four new members join existing community of 70+ LF Edge organizations*
- *LF Edge on Display at IoT World, with Akraino Edge Stack, EdgeX Foundry and Project EVE demonstrations*

**SANTA CLARA, Calif. – IoT World – May 14, 2019** – [LF Edge](#), an umbrella organization within the Linux Foundation that aims to establish an open, interoperable framework for edge computing independent of hardware, silicon, cloud, or operating system, today announced continued project momentum. [Project Edge Virtualization Engine \(EVE\)](#) receives initial seed code from LF Edge founding member [ZEDEDA](#), as the community showcases a range of edge/IoT application demonstrations, from connected cars to wind turbines, on-site at IoT World.

May  
2019

## Akraino Edge Stack Issues Premier Release, Sets Framework to Enable 5G, IoT Edge Application Ecosystem

- *Inaugural release unifies multiple sectors of the edge across disciplines, including IoT, Enterprise, Telecom, and Cloud*
- *Delivers tested and validated deployment-ready blueprints*
- *Creates framework for defining and standardizing APIs across stacks, via upstream/downstream collaboration*

**SAN FRANCISCO – June 6, 2019** – [LF Edge](#), an umbrella organization within the [Linux Foundation](#) that aims to establish an open, interoperable framework for edge computing independent of hardware, silicon, cloud, or operating system, today announced the availability of [Akraino Edge Stack](#) Release 1 (“Akraino R1”). Created via broad community collaboration, Akraino’s premiere release unlocks the power of intelligent edge with deployable, self-certified blueprints for a diverse set of edge use cases.

June  
2019

## EdgeX Foundry Announces Production Ready Release Providing Open Platform for IoT Edge Computing to a Growing Global Ecosystem

- *Enables IoT digital transformation for Enterprise, Industrial, Retail and Consumer*
- *Supports complementary products and services from global open ecosystem including commercial support, training and customer pilot programs*
- *Deployed in many end user projects; EdgeX also collaborates with IIC on AI testbeds and is the foundation for the Open Retail Initiative (ORI)*

**SAN FRANCISCO – July 11, 2019** – [EdgeX Foundry](#), a project under the [LF Edge](#) umbrella organization within the [Linux Foundation](#) that aims to establish an open, interoperable framework for edge IoT computing independent of hardware, silicon, application cloud, or operating system, today announced the availability of its “Edinburgh” release.

July  
2019

# LF Edge New Announcements

## LF Edge Expands Ecosystem with Open Horizon, adds seven New Members and reaches critical deployment milestones

**SAN FRANCISCO, CA – April 30, 2020 –** [LF Edge](#), an umbrella organization under [The Linux Foundation](#) that aims to establish an open, interoperable framework for edge computing independent of hardware, silicon, cloud, or operating system, today announced continued project momentum with the addition a new project and several technical milestones.

April  
2020

Welcome new members **CloudBrink, Federated Wireless, Kaloom, Ori Industries, Tensor Networks, VoerEIR** and **ITRI**

# 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).

# 2021 State of the Edge Report

- Aspects of Edge Studied
  - › Community Standardization of Edge Terminology
  - › Market Size / Growth: A use case driven market forecast of the growth and value of edge infrastructure through 2028.
  - › Critical Infrastructure: Edge data centers, wireless towers & cable head ends, traditional interconnection, and service providers.
  - › Edge Hardware: Key trends, processor platforms, open hardware, virtual networking and storage.
  - › Networks & Networking: The networking ecosystem, SD-WAN, edge exchanges, and the wireless edge.
  - › Software at the Edge: The “new edge” stack, code at the edge, orchestration, serverless, hyperconverged, and marketplaces.

## STATE OF THE **EDGE**



[Download Today](#)

Reset Filters

- Grouping: N/A
- Sort By: N/A
- Category: N/A
- LF Edge Relation: Any
- License: Any
- Organization: Any
- Headquarters Location: Any

**Example filters:**  
Open source cards by age  
Apache-2.0 landscape  
Cards in categories  
Cards by stars  
Group by location  
Cards by MCap/Funding

Download as CSV



The LF Edge landscape (png, pdf) is dynamically generated from a community-supported Github account. It is modeled after the **5NCP** landscape and based on the same open source code.

If you would like to contribute, please open a pull request with projects in the edge ecosystem. Please note all images submitted must be true SVG files, include a URL to the company's site, and a Crunchbase link. Please open a pull request to correct any issues. Greyed logos are not open source. Last Updated: 2021-01-01 20:39:09Z

You are viewing 183 cards with a total of 105,149 stars, market cap of \$9.9T and funding of \$5.25B.

landscape.lfedge.org

Navigation: Landscape | Card Mode | Tweet 2 | 80%

Categories:

- ORG
- Traffic Routing
- Communication Service Provider
- CDN & Distributed Caches
- Edge PaaS
- IoT Focused
- Security
- Networking
- Monitoring
- Provisioning
- Virtualization
- IAAS
- Physical
- Other
- Core Silicon (CPU / PLC)
- Accelerators (GPU / FPGA / TPU)
- Edge OEMs
- Wireless
- Wireline
- Real Estate / Land
- Traditional
- Non Traditional
- Towers
- Municipal Right of Way (Essential)
- Services / System Integrators
- Premier
- General
- Associate

Hardware

LF Edge Member Company

# Premier Members





# General Members



# Associate Members and Liaisons



# LF Edge: Key Takeaways

1. Harmonizing Open Source Edge Communities across IOT, Enterprise, Cloud & Telecom
2. Keeping LF Edge Open & Interoperable with
  - › Hardware, Silicon, Cloud, OS, Protocol independence
  - › Bringing the best of telecom, cloud and enterprise – location, latency & mobility
  - › In collaboration with Consortia/SDO (IIC, AECC, OEC, ETSI)
3. Hosted by the Linux Foundation similar to other Open Source Communities like CNCF (Kubernetes), LF Networking (ONAP) and many more.

# Get Involved in the LF Edge Technical Communities

- › Participation in LF Edge Projects is open to all
- › Getting involved in the technical communities is the best way to learn
  - › **Step 1:** Get a Linux Foundation ID Here:  
<https://identity.linuxfoundation.org/>
  - › **Step 2:** Visit LF Edge Wiki (<https://wiki.lfedge.org/>)
  - › **Step 3:** Join workflows for the projects and working groups, subscribe to mailing lists, ask questions, contribute!



## Way to participate

- › Attend project meetings
- › Attend developer events
- › Join approved projects
- › Propose a project
- › Write documentation
- › Contribute use cases
- › Analyze requirements
- › Define tests / processes
- › Review and submit code patches
- › Build upstream relationships
- › Contribute upstream code
- › Provide feedback through VSFG
- › Host and staff a community lab
- › Answer questions
- › Give a talk / training
- › Create a demo
- › Evangelize LFE and its projects

# What is the new way of supporting our community?

## The Linux Foundation initiatives

- › ONES NA in Fall (Sept 28-29)
- › Training - Free Training and discounted courses
- › (New) projects in Multiple areas to help move OSS forward

### LF EDGE

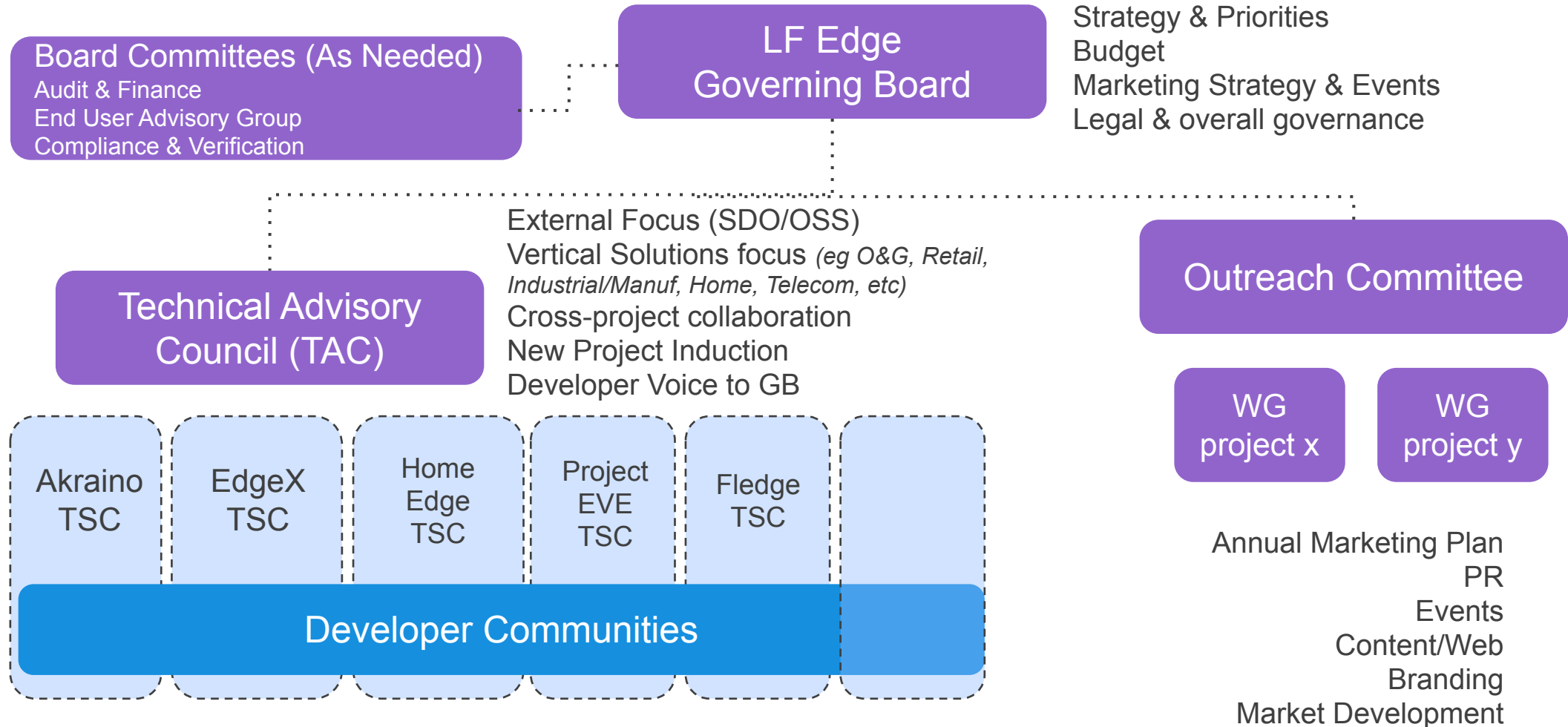
- › Project-specific Webinar Series  
Two webinars (200+ participation)
- › EdgeX Virtual Hackathon (138 registrants)
- › Edge training

<https://www.lfedge.org/2020/04/16/how-open-source-is-driving-5g-edge-ai-and-iot/>

# LF Edge Membership

 THE **LINUX** FOUNDATION

# LF Edge Governance



# LF Edge Membership Structure, broad base – lower dues

## Summary

1. Premier Member, Annual cost for LF Edge \$50,000 (similar to Akraino)
2. Simplified EdgeX general category to match LF levels
3. Dues for existing projects will be credited towards LF Edge or any LF projects.

Level	Not Yet LF Member	Already LF Member
<b>Premier</b>	\$70,000	\$50,000
<b>General</b>	\$45,000 (USD) 5,000 and above \$30,000 (USD) From 500 to 4,999 \$20,000 (USD) From 100 to 499 \$7,500 (USD) Up to 99	\$25,000 (USD) 5,000 and above \$15,000 (USD) From 500 to 4,999 \$10,000 (USD) From 100 to 499 \$2,500 (USD) Up to 99

*LF Edge membership also requires companies to corporate members of The Linux Foundation (similar to Akraino and EdgeX Foundry).  
A discount of \$5,000 to \$20,000 is available for existing Linux Foundation members who join LF Edge.*

# LF Edge Membership – the benefits

## Premier

### **Influence Strategic Direction of LF Edge & its projects (as a Voting GB member)**

- › Budget Influence/approval, how and where the project spends money.
- › Direct Influence on messaging, developer events, training
- › Influence the marketing, messaging, and positioning to best represent the project for your uses
- › **Marketing Committee Voting Seat**

### **Direct Interaction with Leadership – within LF and across peers**

- › Premium access to the project ED/VP to understand business goals
- › Premium access to the Operations staff. IT, Marketing, Operations, Leadership
- › Participate in any Cross project strategy discussions on harmonization and future direction of Edge
- › LF Leadership support to Keynote member events, participate in outreach (eg roadshows, events, conference meet ups etc..)

### **Technical and Roadmap Direction Influence (through the technical community)**

- › **TAC (Technical Advisory Council) voting seat**
- › Find like-minded companies/developers to build a coalition to get an idea accepted and prioritized by the community
- › Aid the developers in actions they can take to improve their standing, position, and influence in the community., etc.

### **Brand Momentum – ability to show Leadership in Open Source which drives end user adoption and talent.**

- › Open Source Brand Affinity, prove to your customers that you are a leader in the project, hire talented software engineers

## General

### **Learning and Engaging to create the largest Open Source Edge shared technology roadmap**

- › Work together across company lines and industries
- › Participate in elected board seat process

### **Marketing & Thought Leadership**

- › Logo on the website once your membership has been announced. LF will support with quotes on Press releases related to the project
- › Marketing Committee comprised of a representative from each Member company. General Members may appoint a representative as an observer of the Marketing Committee meetings on a non-voting basis. The objective of this Committee is shaping the marketing direction for edge. The Linux Foundation will do the heavy lifting, so this is more to oversee and shape the discussion/direction with the other Members for the Marketing efforts. This person can also funnel all Marketing information back to your organization so that the key stakeholders are in the loop.
- › Participate in our hosted projects and attend our events, meetups, and roadshows

### **Technical Steering Committee & Technical Community**

- › TSC meetings are open to the public and we encourage all members of the technical community to participate in the discussion moving forward.



# How Members Engage: LF Edge Marketing and PR

Co-promotion of project related updates, releases, and news via LF Edge social media accounts

Attend Outreach Committee meetings and participate in LF Edge driven marketing and outreach activities

Publish use cases, case studies, white papers, and deployment insights

Marketing and PR support for demos at meetups and events

Host vendor neutral content via LF Edge blog site

Get support for artwork, web site, content creation, etc., related to LF Edge and its projects

Be featured in the LF Edge Member Spotlight series

Coordination at events – speaking proposals, booth attendance, demos, etc.

Volunteer for planning initiatives such as developing annual marketing plan, preparing for major event, etc.

Identify LF Edge speaking opportunities in your region and help secure speakers from the LF Edge community

Help secure user stories about LF Edge based deployments.

Participate on the LF Edge Speakers Bureau

# How Members Engage: LF Edge Technical Projects

**Participate in the development efforts:  
Review and submit code patches, report bugs, request new features, etc.**

[Attend developer events for LF Edge projects](#)

**Contribute to documentation**

[Provide your testing and deployment feedback via appropriate project channels](#)

[Join the projects' mailing lists and participate in the discussions](#)

[Start a local User Group Meetup](#)

[Join the LF Edge Technical Advisory Council \(TAC\) calls and subscribe to the TAC mailing list](#)

[Contribute to the Open Glossary of Edge Computing](#)

# How Members Engage: Technical Advisory Council (TAC)

<p><b>Support TAC leadership in inviting speakers</b></p>	<p><u><a href="#">Attend TAC Bi-weekly calls, participate in the discussion, volunteer</a></u></p>	<p><b>Share success stories, opportunities and challenges with the broader technical community to seek input from peers</b></p>	<p><b>Identify opportunities for collaboration on common interests and initiatives</b></p>
<p><b>Support technical leadership for harmonization efforts with other open source communities within and beyond LF Edge</b></p>	<p><b>Support TAC in hosting and sponsors intra-project and inter-project in-person developer events for LF Edge projects</b></p>	<p><u><a href="#">Support TAC in evaluating new projects for inclusion in LF Edge</a></u></p>	<p><b>Support TAC Chair who works with the Governing Board to highlight the Projects' collective opportunities and any resource needs</b></p>

Join Us!

Contact Mike Woster, [mwoster@linuxfoundation.org](mailto:mwoster@linuxfoundation.org)

LF Edge, bringing Edge initiatives together

IOT+Telecom+Cloud+Enterprise

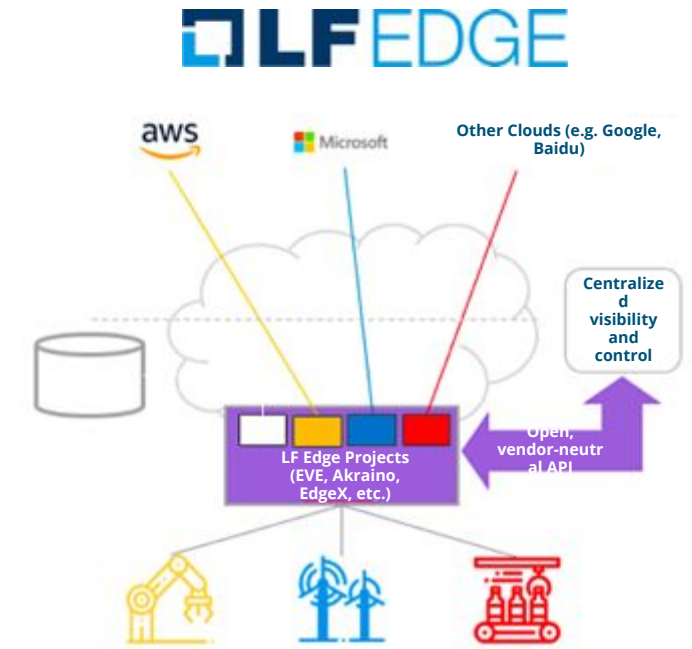
 THE **LINUX** FOUNDATION

# LF Edge Projects

 THE **LINUX** FOUNDATION

# Unified Edge Interoperability - key architectural tenets

1. Abstract data, apps and domain knowledge from underlying infrastructure
  - Invest in data ingestion, security, and M&O tools that are consistent regardless of use case
2. Untether data from cloud services as close as possible to the edge source
  - An open edge supports all future permutations of edge to cloud data flow without risk of lock-in
3. Extend cloud-native principles wherever possible
  - Plan for CI/CD, while also recognizing technical tradeoffs (e.g. constrained hardware, time critical applications) and need for OT/IT cultural evolution



# LF Edge – umbrella for Edge Projects

## STAGE 3: IMPACT PROJECTS



Aims to create an open source software stack that supports high-availability cloud services optimized for edge computing systems and applications.



Highly flexible open source software framework that facilitates interoperability between heterogeneous devices and applications at the IoT Edge, along with a consistent foundation for security and manageability regardless of use case.

# LF Edge – New umbrella for Edge Projects

## STAGE 2: GROWTH PROJECTS



An open abstraction engine that simplifies the development, orchestration and security of cloud-native applications on distributed edge hardware. Supporting containers, VMs and unikernels, EVE provides a flexible foundation for Industrial and Enterprise IoT edge deployments with choice of hardware, applications and clouds.



Fledge is an open source framework and community for the Industrial Edge. Architected for rapid integration of any IIoT device, sensor or machine all using a common set of application, management and security REST APIs with existing industrial "brown field" systems and clouds.



Interoperable, flexible, and scalable edge computing services platform with a set of APIs that can also run with libraries and runtimes.



Open Horizon is a platform for managing the service software lifecycle of containerized workloads and related machine learning assets. It enables management of applications deployed to distributed webscale fleets of edge computing nodes and devices without requiring on-premise administrators.



# LF Edge – New umbrella for Edge Projects

STAGE 2: GROWTH PROJECTS continued



State of the Edge is an open source research and publishing project with an explicit goal of producing original research on edge computing, without vendor bias. The State of the Edge seeks to accelerate the edge computing industry by developing free, shareable research that can be used by all.

# LF Edge – New umbrella for Edge Projects

## STAGE I: AT LARGE PROJECTS



Baetyl offers a general-purpose platform for edge computing that manipulates different types of hardware facilities and device capabilities into a standardized container runtime environment and API, enabling efficient management of application, service, and data flow through a remote console both on cloud and on prem.



eKuiper is an edge lightweight IoT data analytics / streaming software implemented by Golang, and it can be run at all kinds of resource constrained edge devices. One goal of eKuiper is to migrate the cloud streaming software frameworks (such as Apache Spark, Apache Storm and Apache Flink) to edge side. eKuiper references these cloud streaming frameworks, and also considered special requirement of edge analytics, and introduced rule engine, which is based on Source, SQL (business logic) and Sink, rule engine is used for developing streaming applications at edge side.



Secure Device Onboard (SDO) is an automated “Zero-Touch” onboarding service.

# Stage 3: Impact Projects

# Project Summary: Akraino

## Stage 3-Impact, founding project



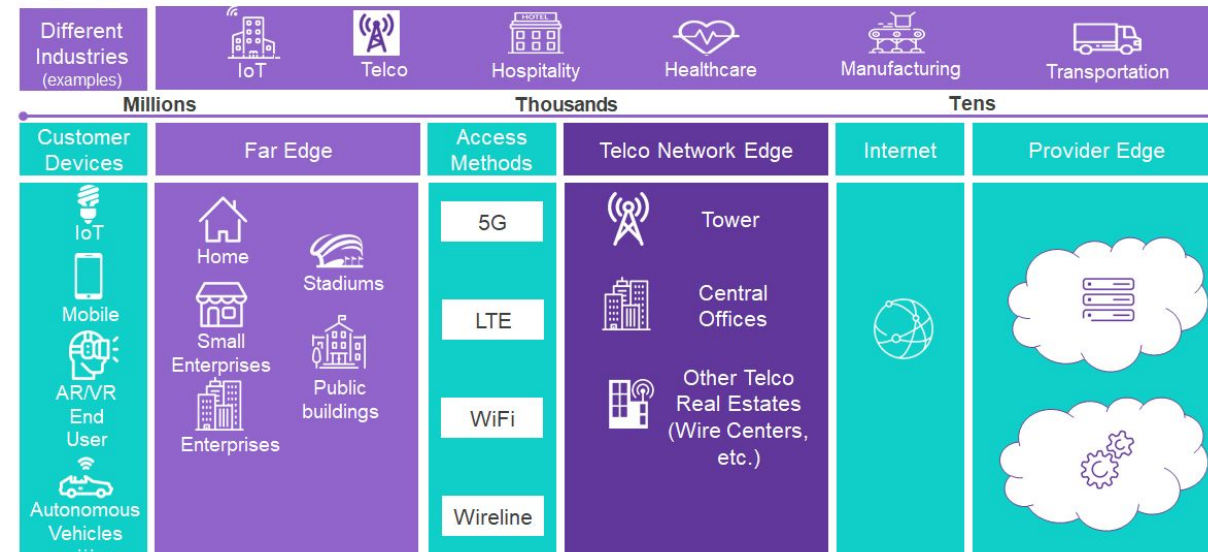
*Aims to create an open source software stack that supports high-availability cloud services optimized for edge computing systems and applications.*

### Top LF Edge Blueprints

- › Network Cloud & Radio Edge
- › 5G & MEC
- › Connected Vehicle
- › AI/ML and AR/VR Applications at the Edge
- › Automated Factory

### Technical Summary

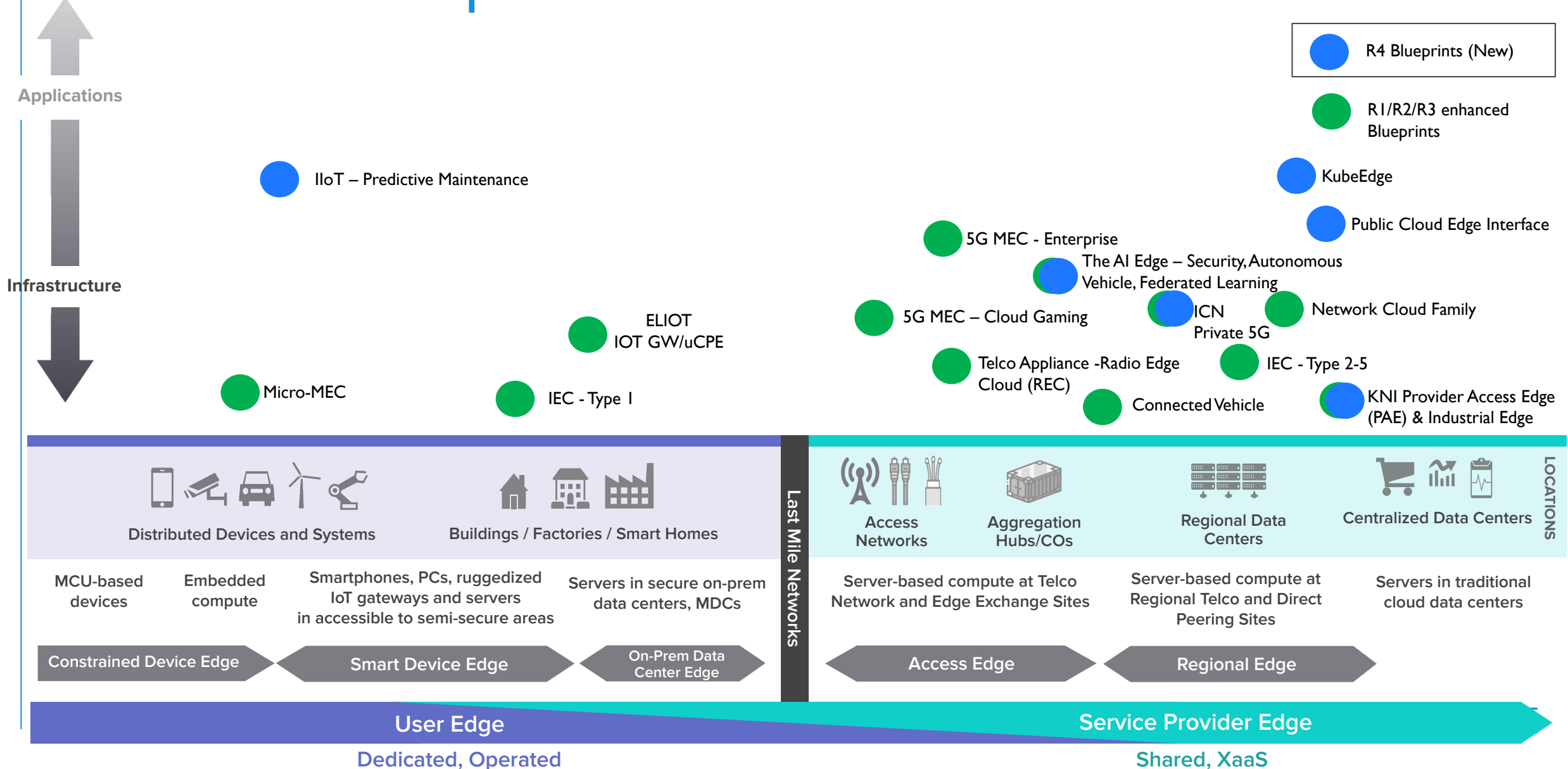
- › Finite set of configurations to reduce complexity
- › Cloud Native/Edge Native- optimized for the Edge in all of its forms
- › Autonomous, turn-key solutions for service enablement to enable rapid introduction
- › Low latency placement and processing to support edge drivers
- › Zero-touch provisioning, operations, and lifecycle (reduce on OpEx)



### Project Release Status (as of Q1 2020)

- › Current Release R4, 30+ Blueprints
- › Next release (Nov 2020)

# Akraino R4 Blueprints



# Project Summary: EdgeX Foundry

## Stage 3-Impact, founding project

*A highly flexible IOT open source software framework that facilitates integration and interoperability between heterogeneous devices and applications.*

## Top Use Cases

EdgeX provides a common set of horizontal capabilities to support use cases across any IOT vertical. Examples:

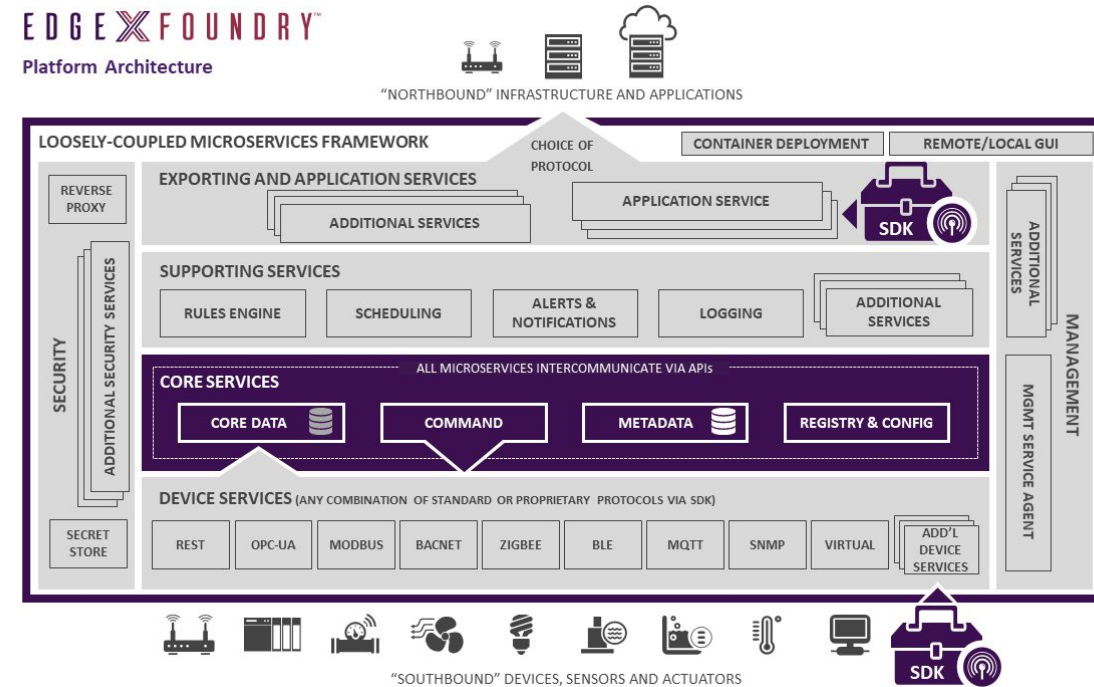
- › **Manufacturing** Remote monitoring of production equipment, get data from multiple sources and filter/transform it to react at edge before sending to the cloud for aggregation, analysis and to optimize production and maintenance.
- › **Retail** - the Open Retail Initiative (ORI) promotes the EdgeX framework in retail to ingest data from cameras (OpenVino), POS systems, RFID, etc and use it at the edge for use cases like Loss Prevention and Inventory Management.
- › **Building Automation**- Edge Control (control devices via a common API), use edge data to control building environment (HVAC, lighting, access). Connect to the cloud to optimize power consumption using ML.

## Technical Summary

- › Agnostic to: HW, OS, OT protocols, sensors and Cloud & Enterprise endpoint
- › Distributable set of microservices for scalability and fault tolerance
- › Enables autonomous operations and intelligence moving to the edge to address low latency decision making/actuation, bandwidth & storage, and remote ops

# EDGE X FOUNDRY™

EDGE X FOUNDRY™  
Platform Architecture



## Project Release Status (as of Q2 2020)

- › 4 Million downloads! Growing at 1 million a month!
- › Geneva (1.2) commercial deployment release
- › Next release Hanoi (1.3)- Oct 2020- Improved Security, better performance statistics, dynamic device provisioning/on boarding ...

# Stage 2: Growth Projects

# Project Summary: EVE

## Stage 2 - Growth, founding project

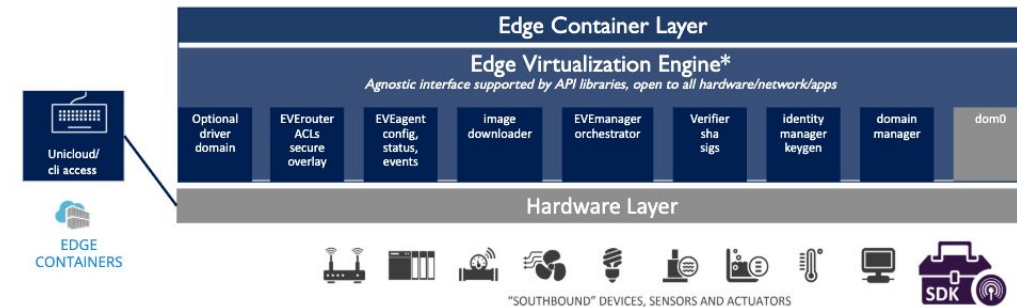
An open edge computing engine that simplifies the development, orchestration and security of cloud-native applications on distributed edge hardware. Supporting containers, VMs and unikernels, EVE provides a flexible foundation for Industrial and Enterprise IoT edge deployments with choice of hardware, applications and clouds.

## Top Use Cases

- › Consolidating a mix of container and VM-based workloads (e.g. for legacy apps) on the same IoT edge hardware
- › Deploying edge hardware to serve as secure network proxy for downstream IoT nodes and systems
- › Deploying out-of-band security and analytics apps leveraging a network SPAN port

## Technical Summary

- › Fully-featured bare metal orchestration foundation
- › Targeted at the IoT edge: x86/Arm nodes with 1GB+ memory up to small clusters
- › Supports VM, OCI/Docker and Unikernel app deployment models
- › Supports zero trust security with all key functions built on HW root of trust
- › Enables zero touch onboarding with no device username/password required
- › Supports rollback/forward updates
- › Enables IO port disablement, CPU/GPU assignment to apps, distributed firewall
- › Open orchestration API for use with console of choice



## Project Roadmap (as of Q1 2020)

- › Increase modularity to support more deployment options
- › Add support for Kubernetes via K3S and clustering
- › Add mesh networking capabilities
- › Continue to shrink the footprint of EVE in order to run on smaller and resource-constrained embedded edge devices



# Project Summary: Fledge

## Stage 2- Growth

*Fledge is an open source framework and community for the Industrial Edge. Architected for rapid integration of any IIoT device, sensor or machine all using a common set of application, management and security REST APIs with existing industrial "brown field" systems and clouds.*

## Top Use Cases

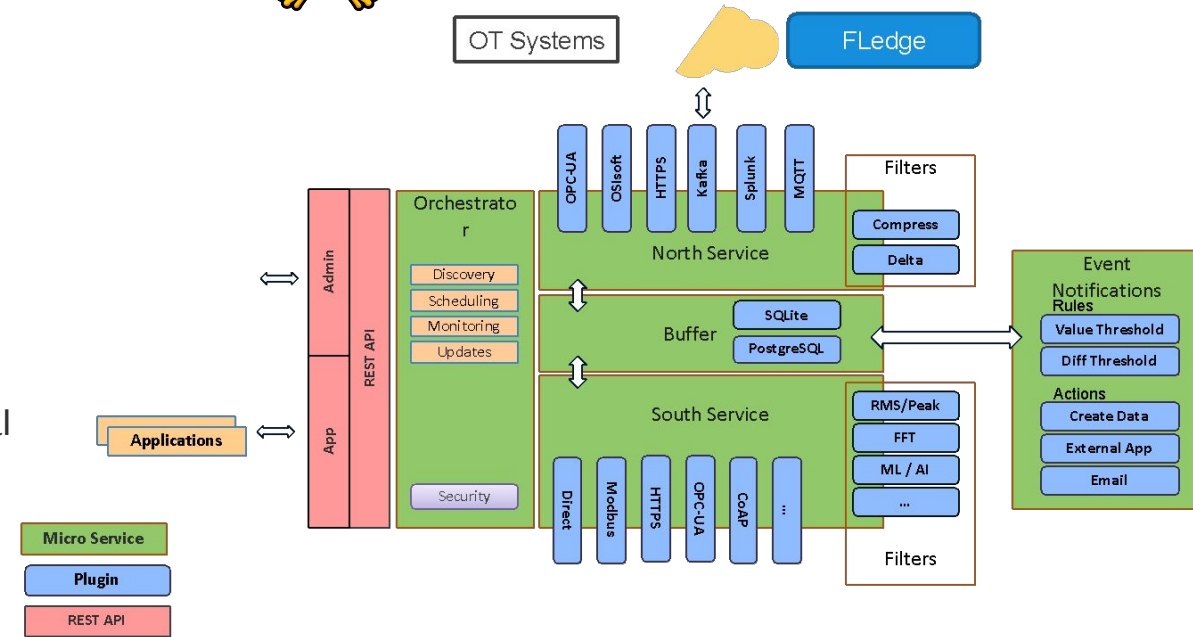
- › Eliminate route based monitoring and deploy modern condition based monitoring, predictive maintenance and situation awareness in industrial plants, mines and factories.
- › Integrate IIoT with existing OT systems (no data silos)
- › Edge based anomaly detection, machine learning and AI to determine machine state and/or part quality.

## Technical Summary

- › Pluggable microservices based architecture to rapidly connect any new or legacy machine, sensor or PLC using Python or C.
- › Easily build REST based applications and services that aggregate, buffer, transform, analyze and deliver machine data from sensors to any/all OT systems and clouds.
- › Consistent IIoT management and security APIs to scale up and out



# FLEDGE



## Project Release Status (as of Q1 2020)

- › Deployed in manufacturing, energy, water/waste water, and oil and gas operations since Q1 2019.
- › Release 1.8 March 30, 2020
  - › ML/AI Tensorflow Support
  - › Google Cloud North
  - › Vibration Data Management 8000khz
  - › New mgt/security API

# Project Summary: HomeEdge

## Stage 2- Growth, founding project



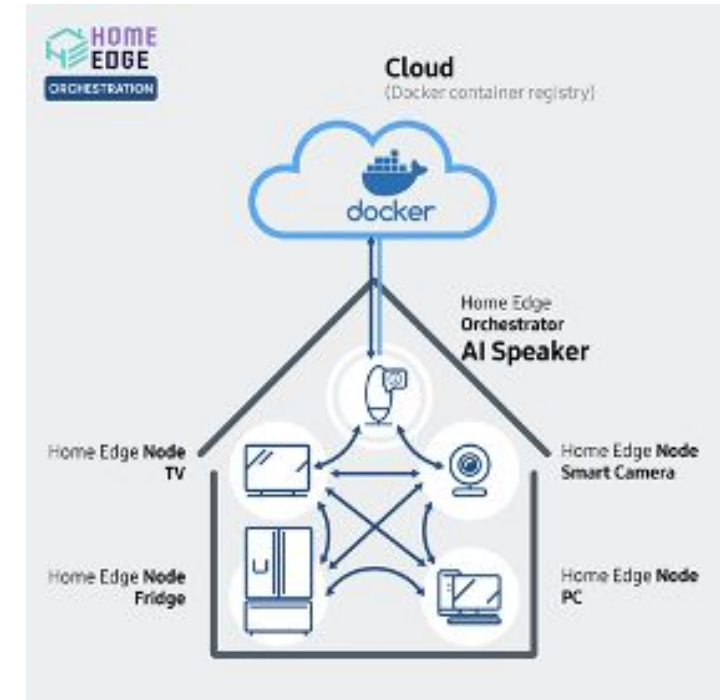
Concentrates on driving and enabling a robust, reliable and intelligent home edge computing open source framework and ecosystem running on a variety of devices at home. To accelerate the deployment of the edge computing services ecosystem successfully, the Home Edge Project provides users with an interoperable, flexible, and scalable edge computing services platform with a set of APIs that can also run with libraries and runtimes..

## Top Use Cases

- › Service offloading in a home environment when device doesn't have required capabilities
- › Distributed computing framework to maintain low latency and high data privacy

## Technical Summary

- › Device/Service Management : Device/Services which are in home network are discovered and managed based on their service capabilities.
- › Service Offloading : Low end devices request high end devices to perform computing on behalf of them using the scoring manager.
- › Scoring Manager : Helps to pick a right device to perform service



## Project Release Status (as of Q1 2020)

- › Baobab (Oct 2019) with Device/service discovery, Service offloading was released
- › Coconut (Oct 2020) is planned with VPN, Data Storage modules

# A Deeper look at key highlights, project Open Horizon

## LF Edge Expands Ecosystem with Open Horizon, adds seven New Members and reaches critical deployment milestones

SAN FRANCISCO, CA – April 30, 2020 – [LF Edge](#), an umbrella organization under [The Linux Foundation](#) that aims to establish an open, interoperable framework for edge computing independent of hardware, silicon, cloud, or operating system, today announced continued project momentum with the addition a new project and several technical milestones.

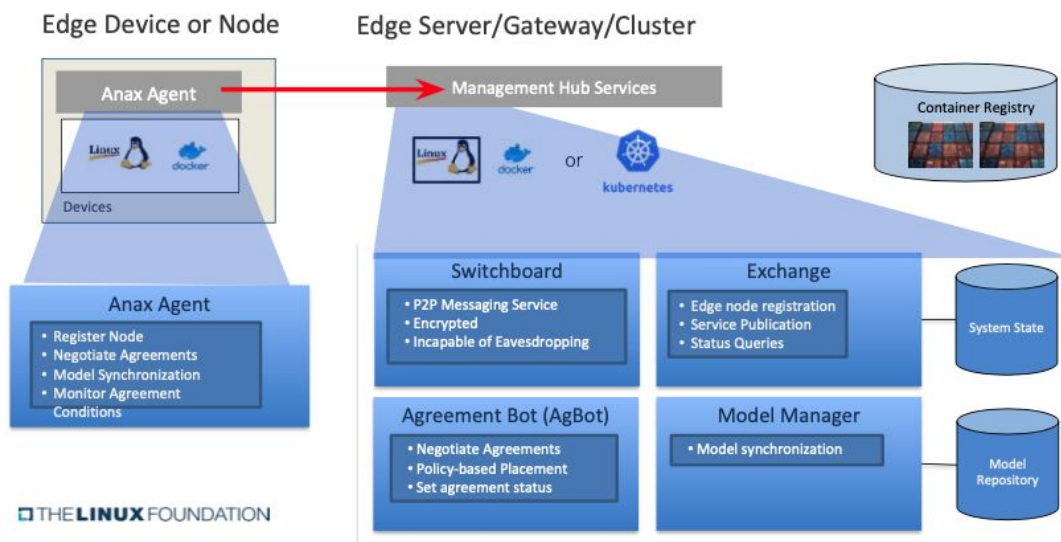


Seed contribution: IBM

Open Horizon is an application and metadata delivery and management platform.

- policy-based mechanism to securely and autonomously deliver containerized workloads to diverse edge compute nodes
- It allows workload and ML model management across fleets at hyperscale, from a single device to deployments of 10,000 nodes or greater, without requiring on-premise administration.

### Open Horizon Architecture



*Collaboration with*

- *EdgeX Foundry*
- *Glossary*
- *Home Edge*

# Project Summary: Open Horizon

## Stage I - At Large

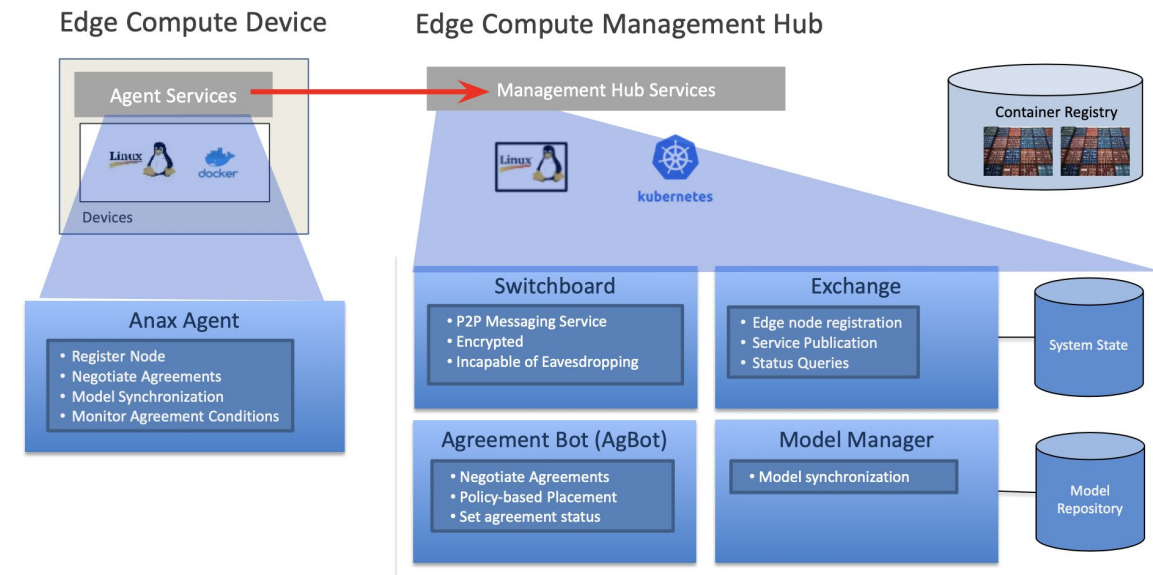
Open Horizon is a platform for managing the service software lifecycle of containerized workloads and related machine learning assets. It enables management of applications deployed to distributed hyperscale fleets of edge computing nodes and devices without requiring on-premise administrators.

### Top Use Cases

- › Management of ML models and containerized workloads on constrained devices

### Technical Summary

- › Provides a policy-based mechanism to securely deliver containerized workloads to edge compute nodes of varying sizes and capabilities and in various connected states.
- › Fully autonomous agent runs on every edge device to enable orchestration and manage the lifecycle of your containers
- › Autonomous Agreement Bots (agBots) monitor each edge node
- › Model Manager automatically syncs assets bi-directionally based on policy



### Project Release Status (as of Q22020)

- › Launched Q2 2020 with LF Edge and incubated with LF Edge's EdgeX

# Project Summary: State of the Edge

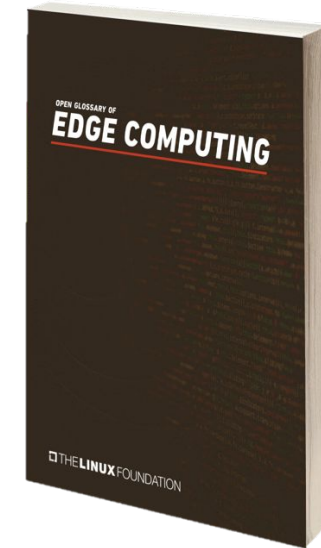
## Stage 2 - Growth

*State of the Edge is an open source research and publishing project with an explicit goal of producing original research on edge computing, without vendor bias. The State of the Edge seeks to accelerate the edge computing industry by developing free, shareable research that can be used by all. The SotE Project contains LF Edge's Glossary and Landscape projects.*

## Principles

- › The edge is a location, not a thing;
- › There are lots of edges, but the edge we care about today is the edge of the last mile network;
- › This edge has two sides: an infrastructure edge and a device edge;
- › Compute will exist on both sides, working in coordination with the centralized cloud

**STATE OF THE**  
**EDGE**



## Project Release Status (as of Q2020)

- › Moved under LF Edge April 2020

# Stage I: At Large Projects

# Project Summary: Baetyl

## Stage I-At Large



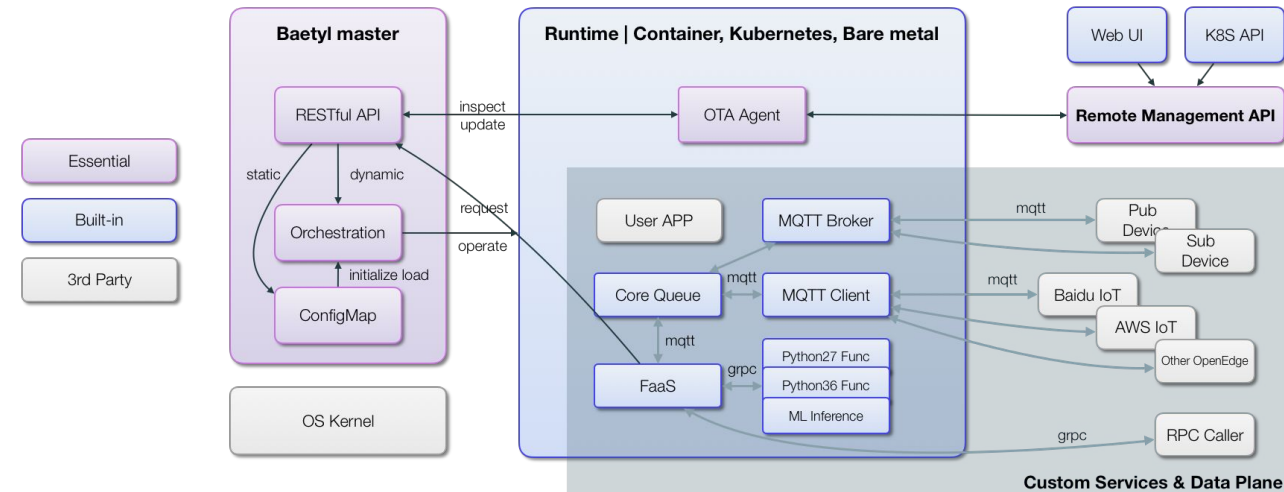
*Baetyl offers a general-purpose platform for edge computing that manipulates different types of hardware facilities and device capabilities into a standardized container runtime environment and API, enabling efficient management of application, service, and data flow through a remote console both on cloud and on prem.*

## Top Use Cases

- › Light, secure, and scalable edge applications
  - › On drone processing
- › AI/ML- Allows for processing at the edge, reducing latency
  - › Quality Inspection by AI via video images
- › Automated/Zero touch onboarding- remote management

## Technical Summary

- › Works with x86, arm, MIPS and OS agnostic
- › Services to speed development
  - › Video Ingress Service, ML Inference as a Service
- › For unstable Networks- has local persistence



## Project Release Status (as of Q1 2020)

- › Baetyl as a Container- Mid 2020
- › Remote Management- APIServer: Certification, application config & OTA Mid 2020
- ›

# Project Summary: eKuiper

## Stage I-At Large



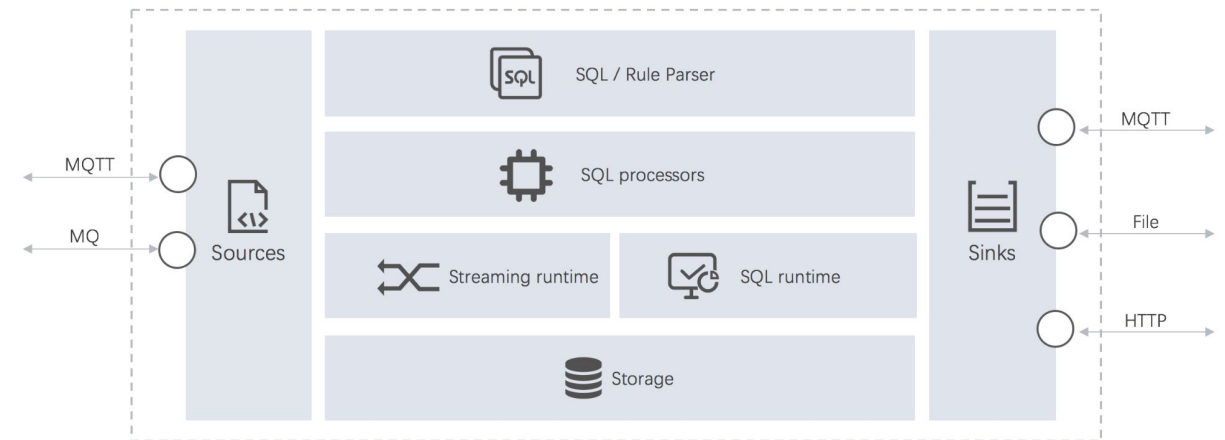
*eKuiper is an edge lightweight IoT data analytics / streaming software implemented by Golang, and it can be run at all kinds of resource constrained edge devices. One goal of eKuiper is to migrate the cloud streaming software frameworks (such as Apache Spark, Apache Storm and Apache Flink) to edge side. eKuiper introduced rule engine, which is based on Source, SQL (business logic) and Sink to develop streaming application at edge side.*

## Top Use Cases

- › IIoT: Real-time processing of production line data
- › Telematics: On-the-fly analysis of data from the car data bus
- › Smart city: Real-time analysis of data from various urban facilities

## Technical Summary

- › Lightweight: Core server package is only about 4.5M, initial memory footprint is about 10MB
- › Cross-platform
- › Data analysis support by SQL
- › Highly extensible
- › Management CLI, REST API and web based dashboard



## Project Release Status (as of Q22021)

- › Release 1.2.0 May 2021
  - › AI service func
  - › Table support
- › Release 1.3.0 July 2021
  - › Plugin system based on rpc



# Project Summary: Secure Device Onboard

## Stage I - At Large



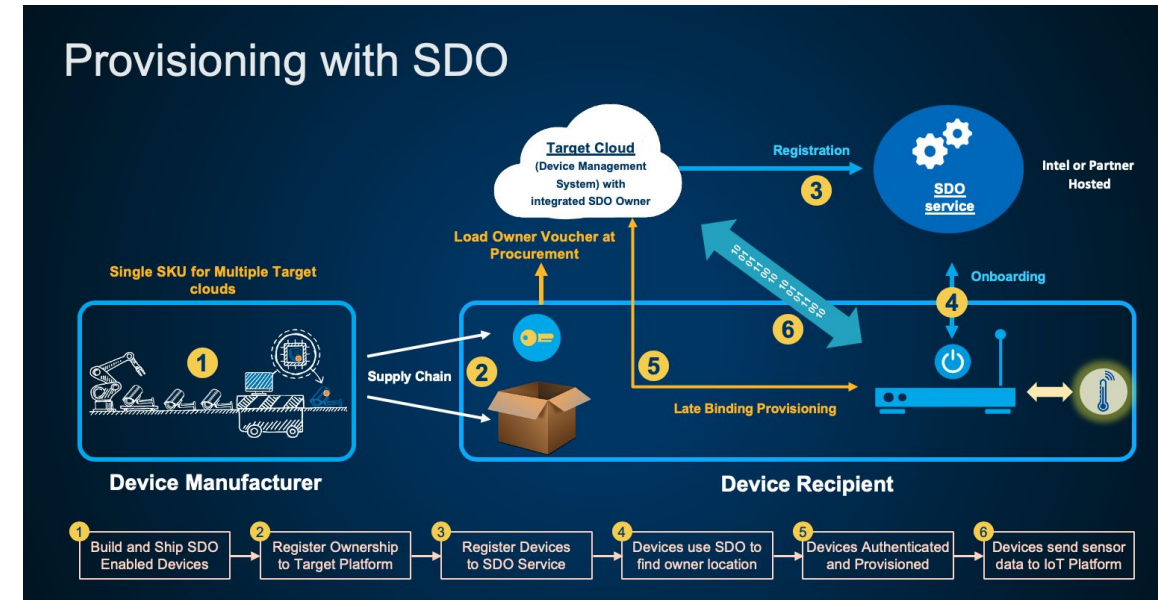
Secure Device Onboard (SDO) is an automated “Zero-Touch” onboarding service.

### Top Use Cases

- › Enables Build-to-Plan Model — ODMs can build identical IOT devices in high volume using a standardized manufacturing process.
- › SDO “Late Binding”— allows the device’s target platform to be selected “late” in the supply chain, at first power-on.
- › It’s Open – means its service & cloud independent.

### Technical Summary

- › Secure Device Onboard provides easier, faster, less expensive, and secure onboarding of devices. It expands TAM for IOT devices, and in turn accelerates the resulting ecosystem of data processing infrastructure.



### Project Release Status

Latest LF Edge Project, release 1.9 in progress

LF Edge  
([www.lfedge.org](http://www.lfedge.org))

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