State of Open Source Networking and Edge - where are we heading?

2023 Edition

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GM, Networking, Edge/IOT, Energy

THE LINUX FOUNDATION

1. LF and ETSI - better together
2. Beyond OSS - Industry impacts
3. Next phase of collaboration

LF beyond Linux

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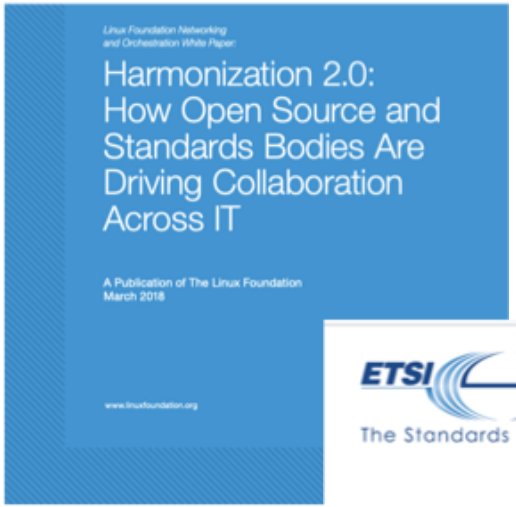
Long History of Collaboration: LF + ETSI



"Open Source & Open Standards:
Better Together"

ETSI
The Standards People

LF EDGE

ETSI / LINUX Foundation –
Edge Hackathon Final Pitch-off Competition

"Build your Edge Application with ETSI MEC APIs
and LF Edge Akraino Blueprints"

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EDGE COMPUTING WORLD

Harmonizing Open Source & Standards: A Case for 5G Slicing

3. ONAP Modelling

	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
SDO	Vertical Reqs	Product order	E2E Slice Mgt	E2E Slice Mgt – AN Mgt	E2E Slice Mgt – TN Mgt	E2E Slice Mgt – CN Mgt	AN Ctrl	TN Ctrl	CN Ctrl	AN/CN UP – TN UP
GSMA	NG.116									
TMF		TMF622 TMF641	IG1194 TMF664		TR255					
MEF										MEF 22.3.1
ETSI ZSM			ZSM003							
3GPP RAN							TS38.300			
3GPP SA2									TS23.501 TS23.502	
3GPP SAS			TS28.530	TS28.531		TS28.531				
IETF					design team			RFC8453		
CCSA			Y	Y	Y	Y	YD/T 3618-2019 YD/T 3619-2019	Y	YD/T 3615-2019 YD/T 3616-2019	Y
ONAP Impl.		Y	Y	Y	Y	Y				

Published Work In Progress Planned

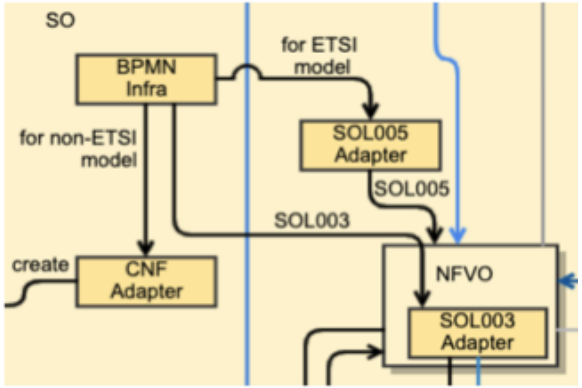
Figure 2 List of networking slicing related work progress of standard organization

3.4 ETSI

ETSI ZSM is positioned for cross-domain management automation use case requirements (ZSM001), reference architecture (ZSM002), and conducts in-depth research on the case of end-to-end slicing cross-domain management, and outputs the ZSM003 project document, which is based on the 3GPP slice management architecture, with reference to TMF open API for the north bound interface, and gives how the wireless, transmission, core network and other management domains cooperate with ZSM cross-domain management to achieve end-to-end slice management processes.

ONAP / ETSI collaboration

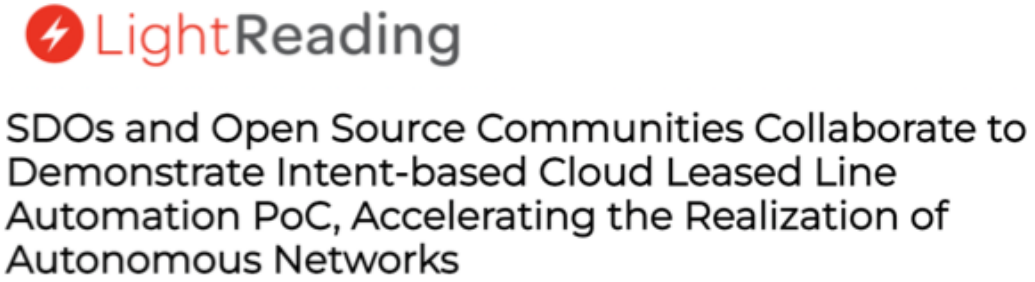
- Intent based networking work in the coming release (London) based on output of ETSI research ENI-013, NFV-IFA050
- Collaboration on CNF data model
- Adoption of ETSI SOL004 packages
- Adoption of SOL007 Networks Service Descriptor
- Creation of ETSI catalog manager module to store and distribute Network Service Descriptors
- Inclusion of a SOL003/SOL interface adapters in the ONAP Service Orchestrator module



A History of Collaboration: ETSI NFV Plugtest & LF OPNV Plugfest (2018)

- The ETSI NFV and LF OPNFV teams came together in Sophia Antipolis in 2018 for the 3rd ETSI NFV Plugtest and the 5th LF OPNFV Plugfest
- The combined event was attended by 105 people, with additional remote attendees, from 55 organizations that included 9 end-users and 14 research/not-for-profit organizations
- Joint activities between ETSI NFV and LF OPNFV included:
  - MANO API testing
  - Open Source MANO (OSM) project integration
  - Service Function Chaining (SFC) testing
  - Review of TST009 (NFVI benchmarking) and TST010 (MANO API conformance testing)

ETSI & ONAP in the News



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ISA Interchange

Open Source foundations + Standards + Alliances

Open Source Software Foundations

- ✓ Linux Foundation & its sub-foundations (LFN, LF Edge, CNCF, Magma, ORAN, LF Energy…)
- ✓ Open Infrastructure Foundation (Openstack, Magma, OAI)
- ✓ Eclipse Foundation (Edge)

- Others (Single Vendor/Open)

Standards/Specs/Ref Arch/API

- ✓ GSMA (LFN, OPG, CAMARA)
- ✓ ETSI (Edge, Core)
- ✓ 3GPP
- ✓ ORAN Alliance (RAN)
- ✓ NGMN (Disagg, Green, 6G)
- ✓ TMForum (API)
- ✓ MEF (API)
- ✓ TIP (Open hardware)
- ✓ IETF (Lower Layers)
- ✓ OCP (Co-Design hardware-software)

Open Alliances & Consortiums

- ✓ AECC
- ✓ IIC
- ✓ Digital Twin Consortium
- ✓ IOTA Foundation
- ✓ Open-IX
- ✓ Several Vertical specific

Collaboration has increased significantly across foundations, SDOs, Alliances and Consortiums

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Leading Cross Standards Interactions

In the ONAP Dublin release, both SO and VF-C are aligned with ETSI SOL003 (NFVO to VNFM) through collaboration with the ETSI NFV Industry Standard Group (ISG). The community is also aligning with SOL001 (Network Service Descriptor), SOL004 (VNF Package), and SOL005 (NB APIs). The ONAP community has also started working with the ETSI Zero Touch Network & Service Management (ZSM) ISG. ONAP represented at ETSI NFV plugtests (June 2019, France)

LF Networking (LFN) and the GSMA today announced a partnership to create a common industry framework for Network Functions Virtualization Infrastructure (NFVi). The CAMARA API project & LFN Anuket are examples of collaboration.

The new TM Forum Catalyst proof of concept that is developing a common Business Operating System (BOS) described how ONAP will be used in its reference implementation. In addition, the ONAP community continues harmonization of northbound APIs with TMForum APIs.

The ONAP community continues harmonization of northbound APIs with MEF LSO.

The 5G blueprint team actively supports 3GPP standards in areas such as performance management data collection and others. 3GPP shared with the ONAP community where they are introducing the option of using ONAP VNF interfaces in the 3GPP standards.

ONAP Cloud Native Journey

CONFIGURATION & SECURITY MANAGEMENT

- Enable uniform and platform-level Service-Mesh Pattern Security
- Leverage open source projects including Istio, Envoy, K8S Ingress and Egress, Keycloak
- Allow security extensibilities with configurations/policies
- Support integration/deployment flexibilities with external IdAM and IdP

ONBOARDING & DESIGN

- Support VNF/CNF/PNF onboarding
- Conform to industry standard modeling and packaging

HELM
tosca

ORCHESTRATION

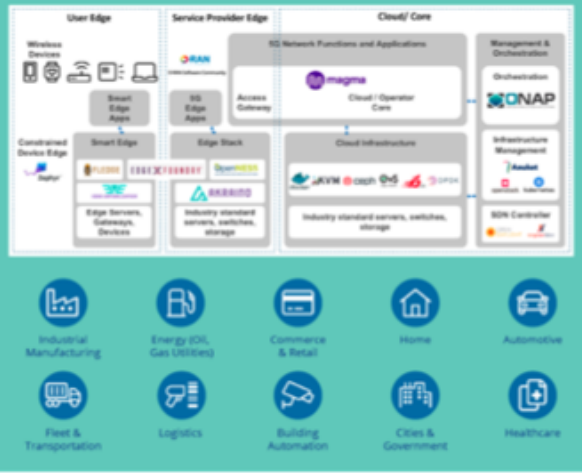
- Support hybrid services CNF/VNF/PNF
- Provide ETSI-aligned and Cloud Native Orchestration
- Manage 3GPP compliant 5G slicing use cases

kubernetes
CAMUNDA
BPMN

CONTAINERIZATION

- Container-based ONAP components support private, public and hybrid cloud infrastructures
- Manage complete lifecycle of ONAP components with OOM leveraging K8 ecosystem

LFN 5G SUPER BLUEPRINTS



OBSERVABILITY & ANALYSIS

App - Log Generation → fluentbit → fluentd → elastic → Kibana

Support open Source & Standard-based Logging Architecture

- Decouple log generation from collection / aggregation / analysis processes
- Enable pick-and-choose solutions for monitoring, aggregating, storing and visualization
- Provide logging reference implementation

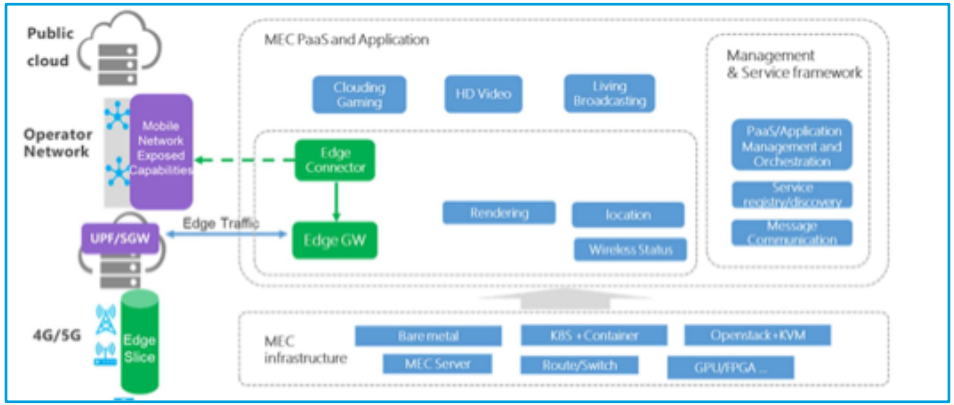
CROSS-COMMUNITY & SDO COLLABORATION

O-RAN ALLIANCE · tmforum · ETSI · 3GPP · MEF · Anuket · XG Vela · CLOUD NATIVE COMPUTING FOUNDATION

5G/MEC Slice System to Support Cloud Gaming, HD Video & Live Broadcast

AKRAINO

BP Family: 5G MEC/Slice



Target Industry: Gaming, Video, Broadcast

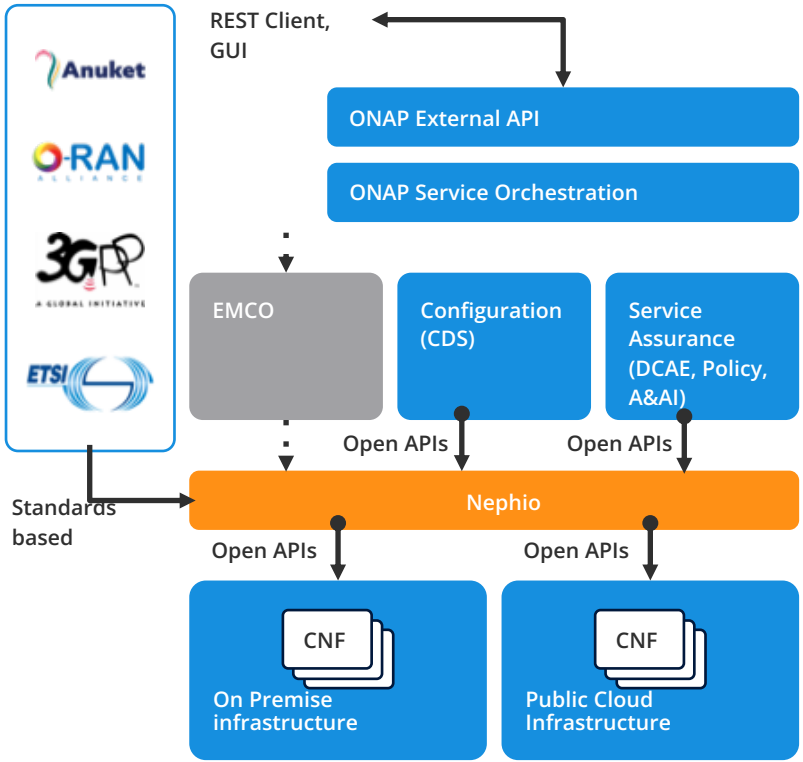
Purpose/Features:

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

Nephio: Synergy with other OSS/SDO projects



- ONAP end-to-end service orchestration layer can interface with Nephio using open APIs for domain automation for a) cloud infrastructure b) Network function automation using Kubernetes Resource model (KRM) /Configuration-as-Data based automation.
- EMCO is another opensource in LFN, that can interface with Nephio for KRM/CaD based automation of a) cloud infrastructure b) Network function automation but it is optional.
- Kubernetes is part of CNCF and fundamental to Nephio. Nephio further expands K8s CRDs/Operators for telecom automation use cases.
- Nephio CRDs are in conformance with O-RAN and 3GPP specifications.

Nephio

ONAP Component (Module Name)

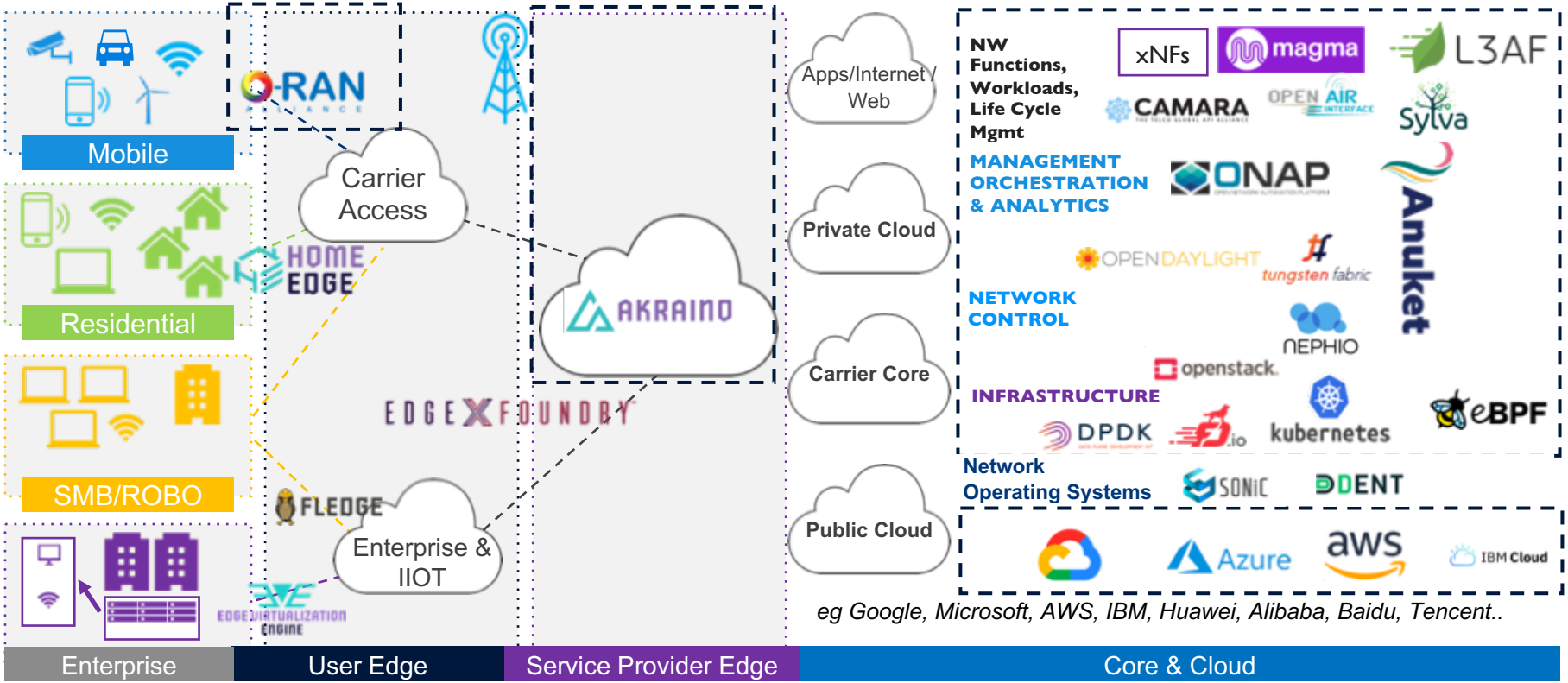
EMCO

NEPHIO

2 Beyond OSS - Industry impacts

Re-Aggregation in the Open

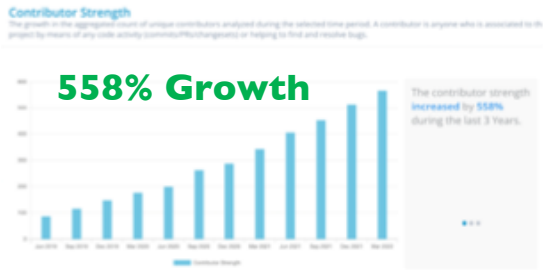
Re-aggregation with End to End Open Source Software



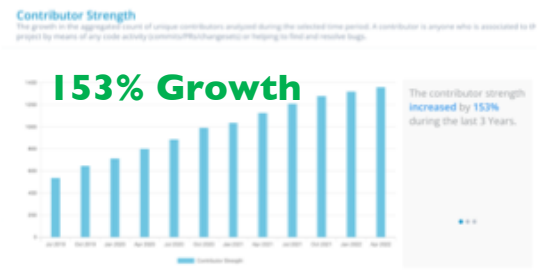
* Sample projects only

Key Projects/Umbrella momentum - Contributions Growth

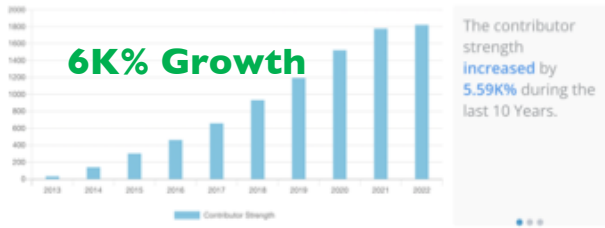
magma



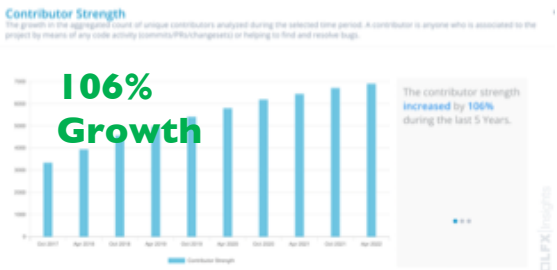
LF EDGE



DPDK



LF NETWORKING



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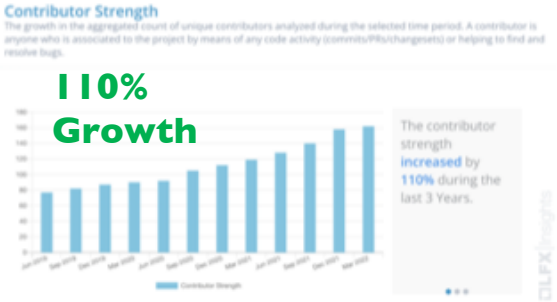
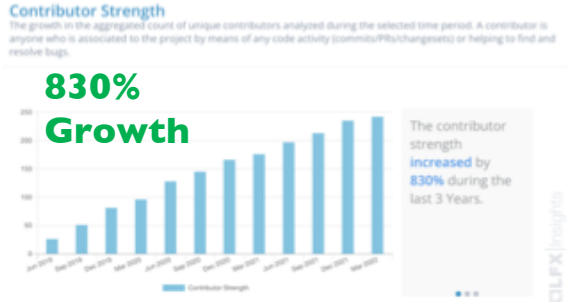


O-RAN Software Community



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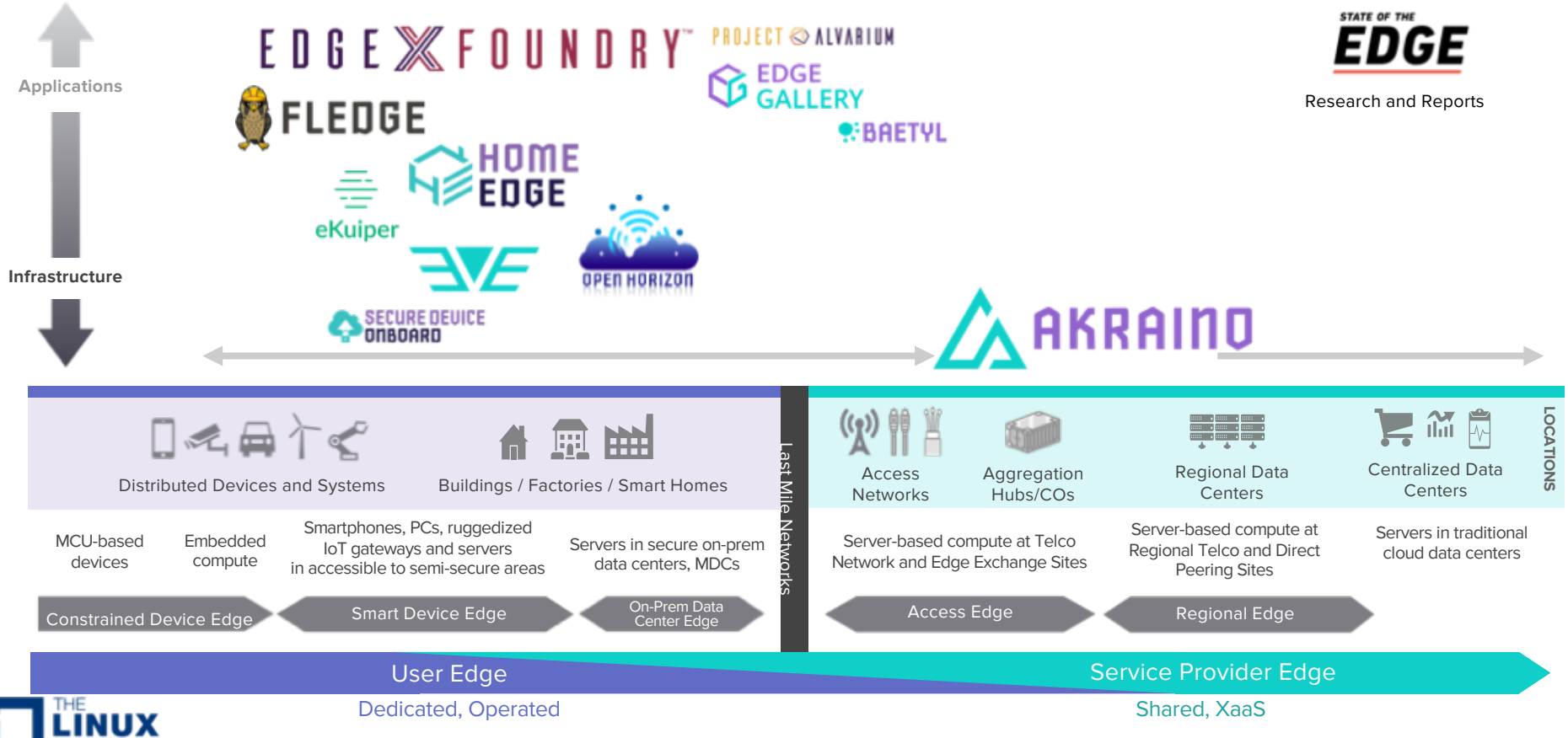
Source: LFX Insights

LF Edge paves the way for unifying Edge Compute



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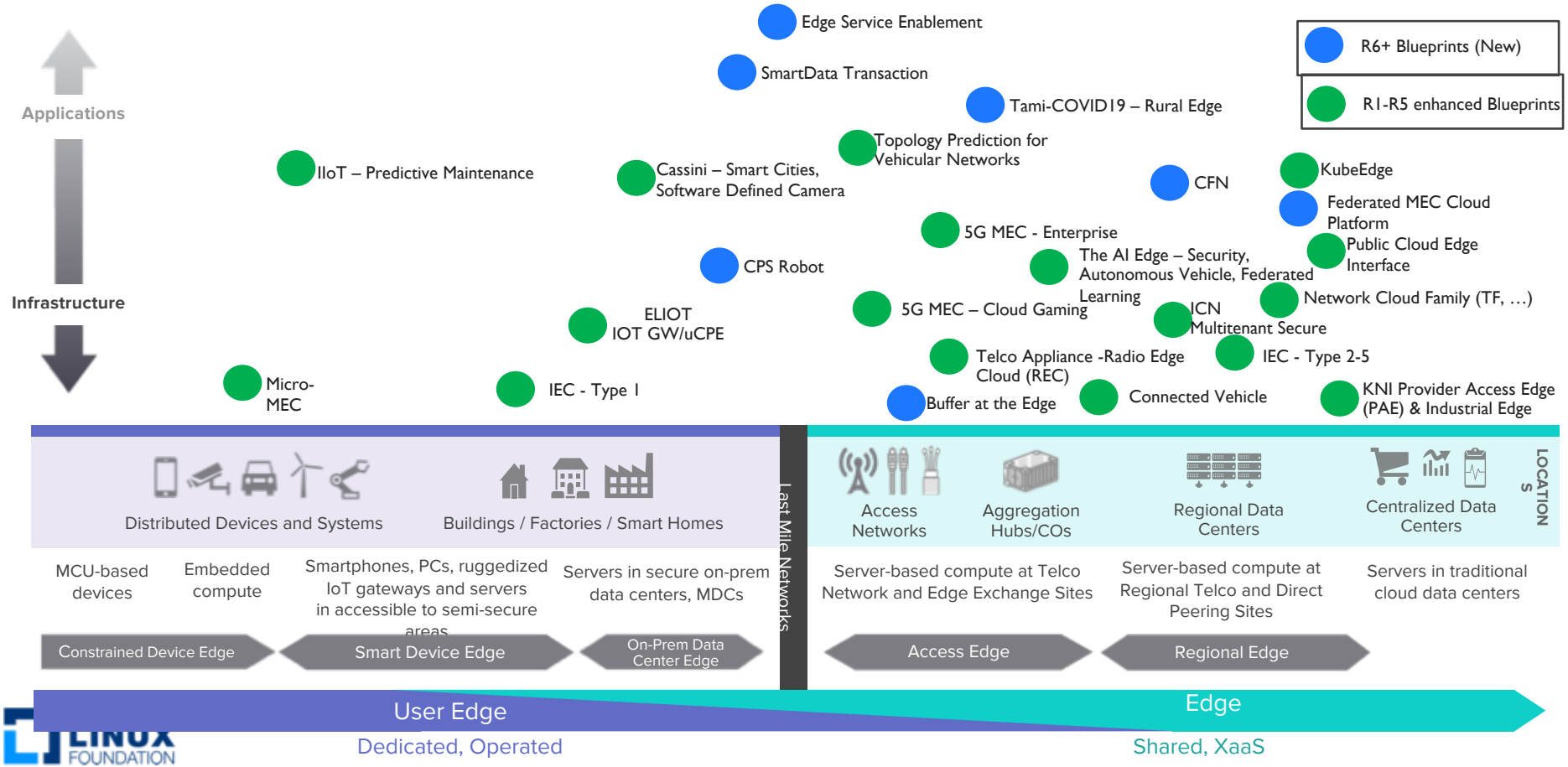
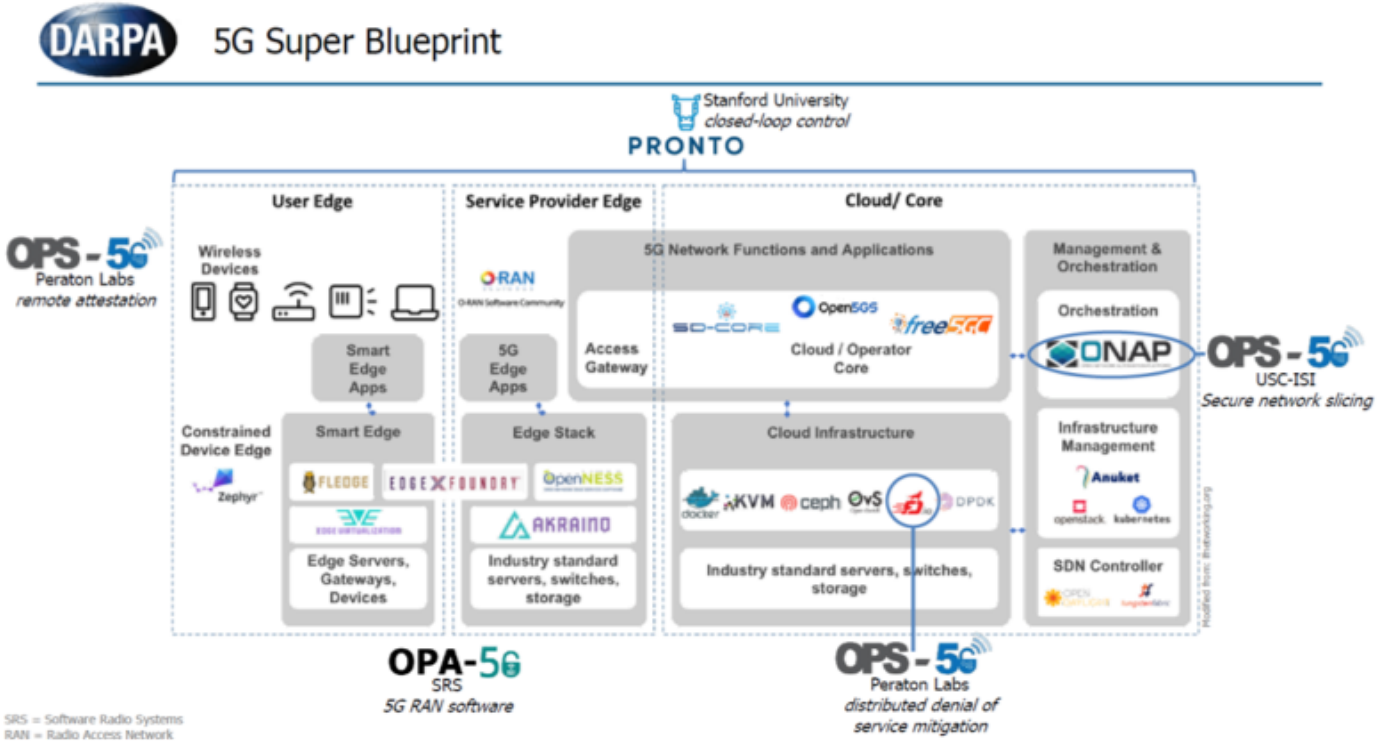
LF Edge: Akraino R6+ Blueprints



Multi-Collaboration in an Open World Takes Center Stage With 5G Super Blueprints



Learn more: https://www.lfnetworking.org/5g-super-blueprint/

Read the FAQ: https://wiki.lfnetworking.org/display/LN/5G+Super+Blueprint+FAQ

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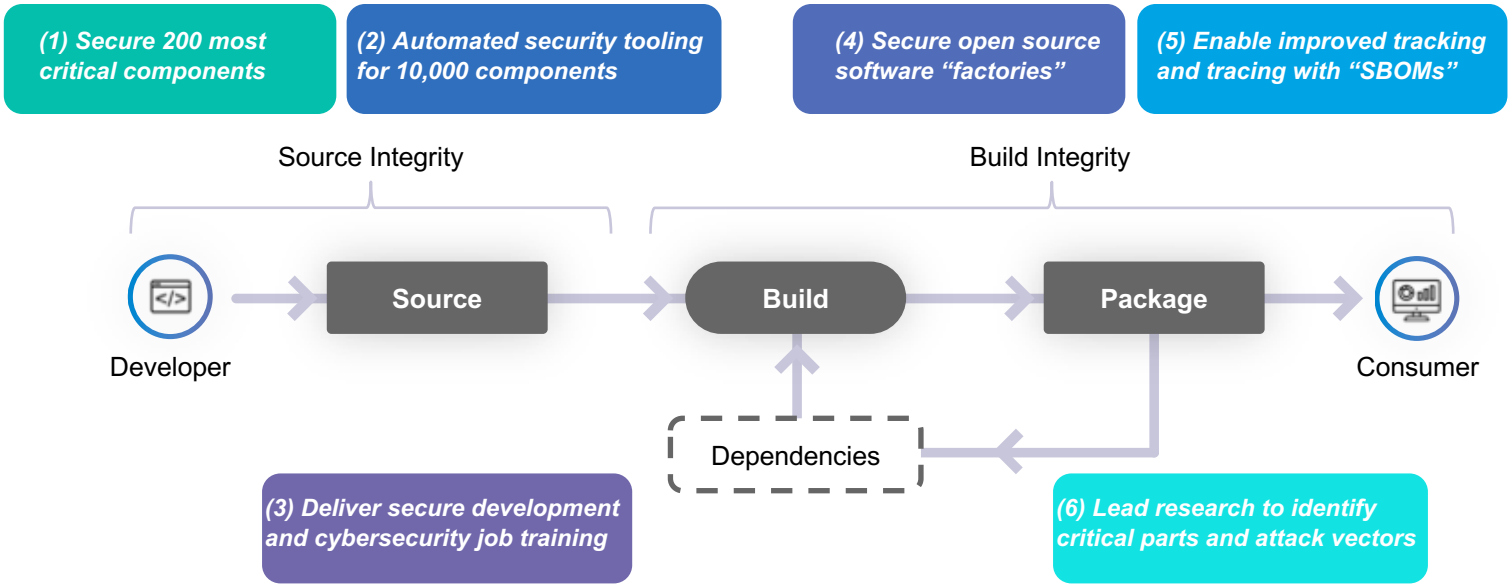
Open Source Security is a Top Priority

Securing the Open Source Supply chain - 6 top actions



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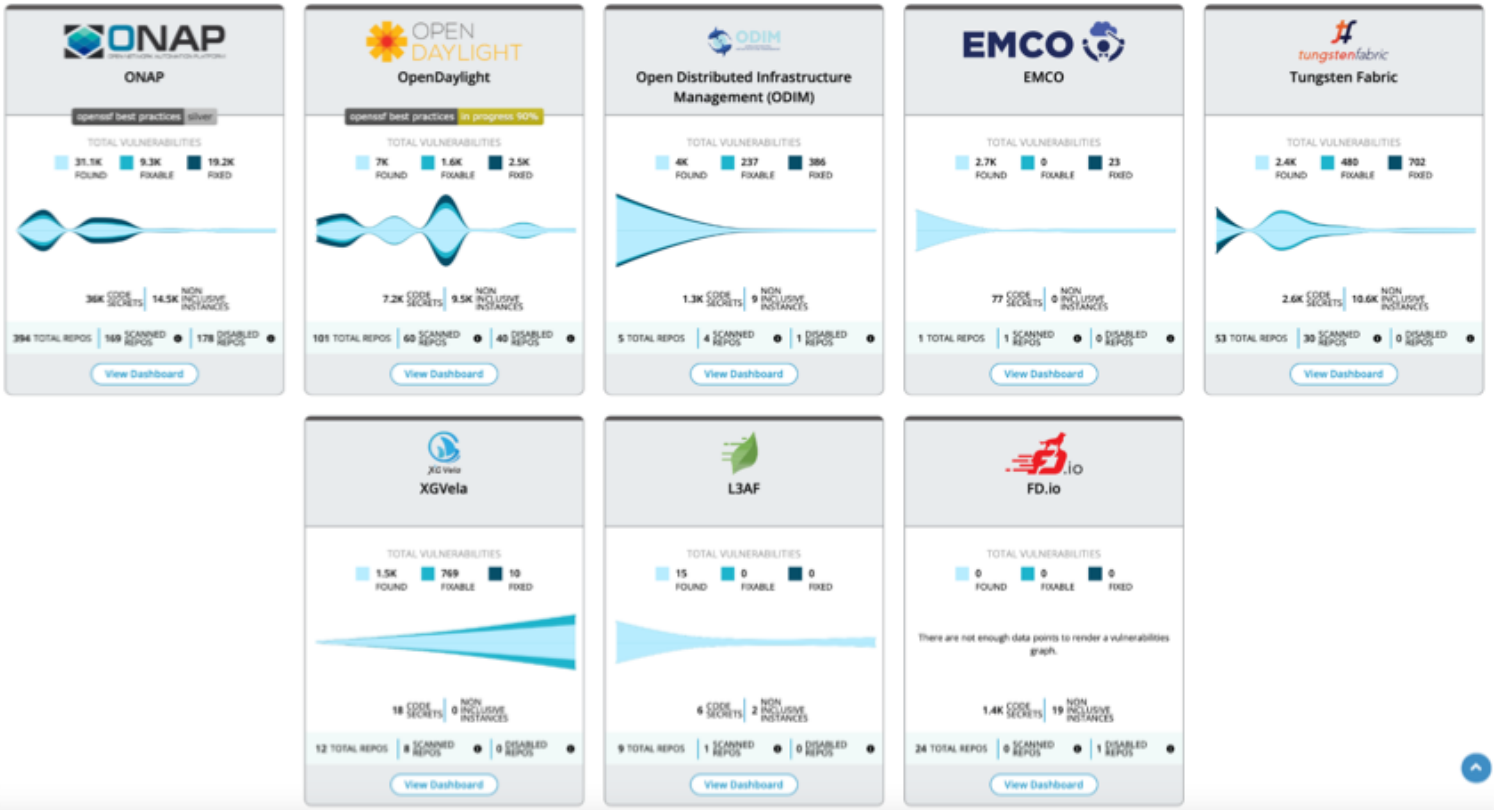
LF Networking Security Dashboard - paving the way



Enterprise, Cloud & Telecom driving Naas

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, GOVERNMENTS

1. Built on Open Source projects
2. Open Solutions and Blueprints
3. Unified Cloud, Enterprise, Telco

5G SUPER BLUEPRINTS BUILT ON END TO END OPEN SOURCE PROJECTS

O-RAN ALLIANCE · EVE · HOME EDGE · AKRAINO · EDGEXFOUNDRY · FLEDGE · Anuket

.io · ONAP · OPEN DAYLIGHT · kubernetes · DPDK · tungsten fabric · magma

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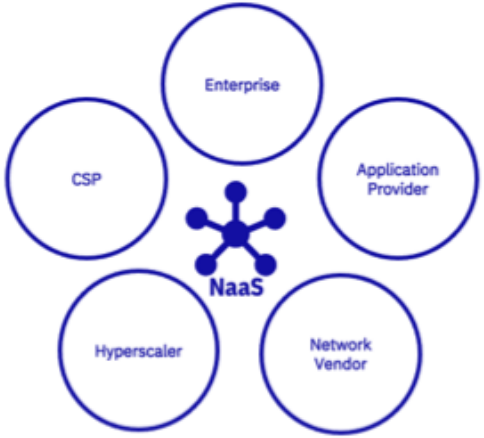
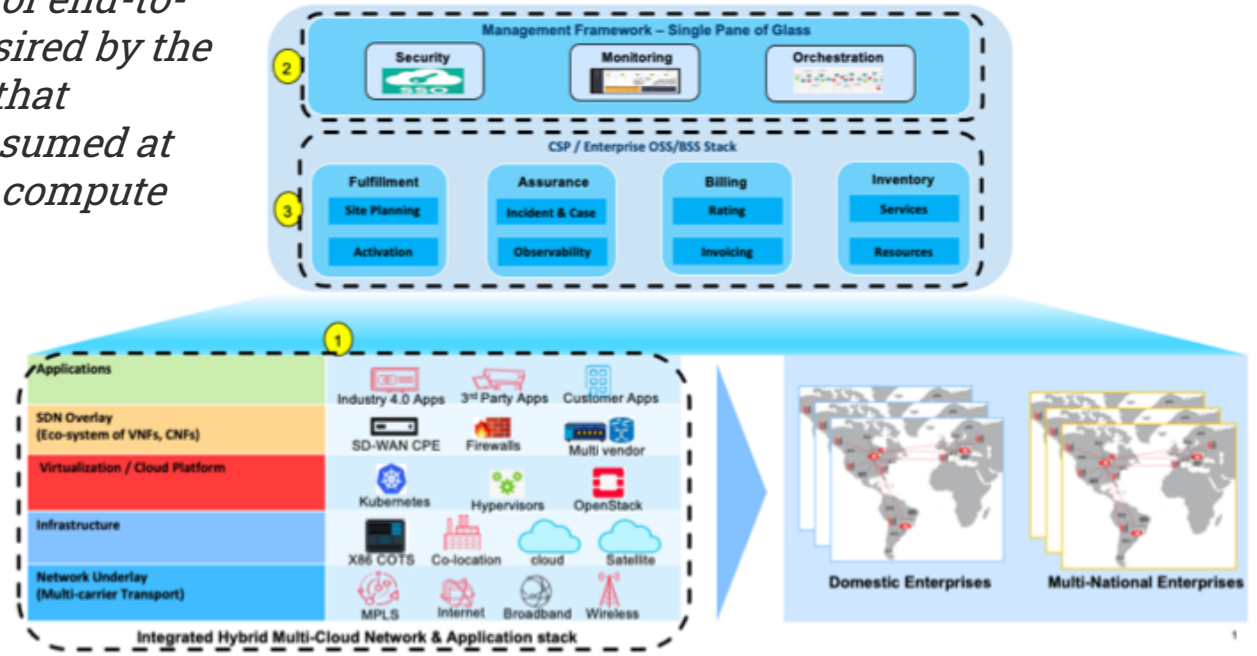
Network as a Service (NaaS)

To achieve the higher levels of end-to-end automation maturity desired by the Enterprises, it is imperative that network services can be consumed at the same speed and scale as compute and other cloud resources





https://lfnetworking.org/resources/research/ebook-network-as-a-service/

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3 Next phase of collaboration

Summary and call to action

1. 2022 was the tipping point for 5G, Edge & IOT deployments, all possible with Open Standards, Solutions, Open Collaboration and Open Communities

2. Open Source Software is now the basis of all verticals including Government & Enterprises - request alignment across functions within members (eg CTO/PLM group participating in Standards and Engineering depts participating in Open Source)

3. Request additional collaboration around Interop Testing through 5G Super Blueprint support, ONAP, Anuket etc.

Open Source community is looking forward to a great collaboration in 2023


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