openEDGE on Arm Architecture

Tina Tsou, Enterprise Architect, Arm Inc.

openEDGE

TELCO

The Open Edge project creates specifications, standards, support documentation and reference designs which will enable global adoption of the Open Edge Computing chassis which meets the requirements of Telco Providers.

Released Specifications
- OCP Open Edge Chassis Specification v1.2
- CPU ISA Architectural Agnostic

Under Community Review
- OCP Open Edge Server Specification v0.1
- Currently only references Intel Purley Platform
- Would like to enable Arm-based Open Edge servers

Specifications

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.

Additionally, LF Edge welcomes new Associate and Liaison member organizations Industrial Internet Consortium (IIC), the LIONS Center at the Pennsylvania State University, OTAinfo, and University of New Hampshire's Interoperability Lab (UNH-IOL).
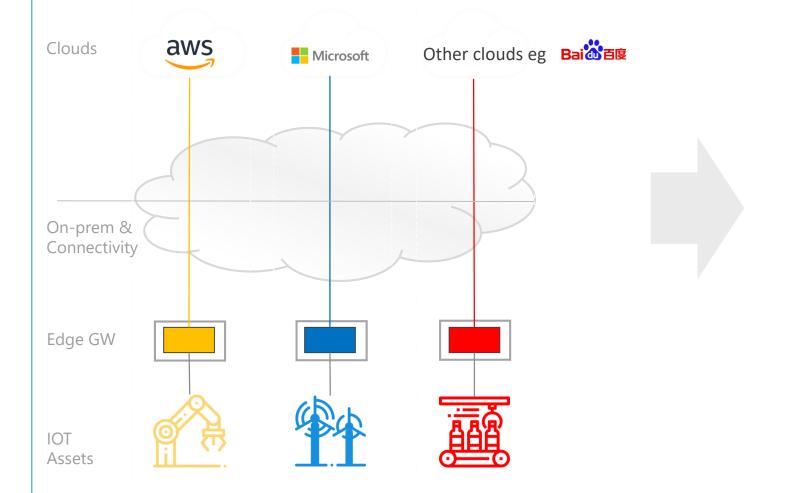
May 2019

Open Source LF Edge
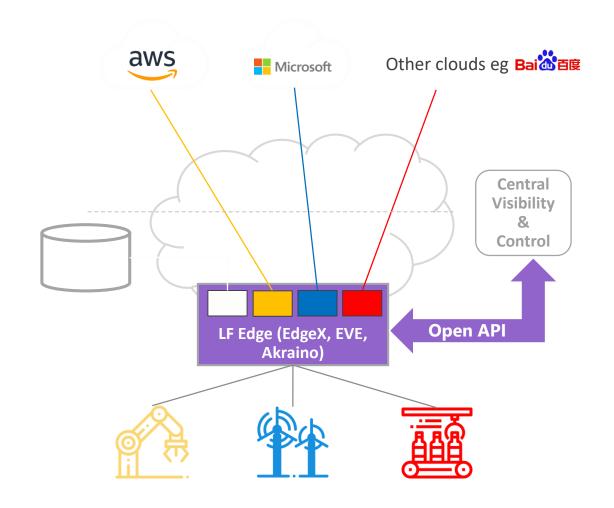
IIoT Today
Vertical data silos & platform lock-in
Data/edge sovereignty & control issues
Hardware-defined & unmanaged edge

IIoT with LF Edge
Open IoT data architecture, no lock-in
Data & edge belong to the enterprise
Software-defined & ubiquitous edge

Clouds

aws

Microsoft

Other clouds eg Baidu 百度

On-prem & Connectivity

Edge GW

IOT Assets

aws

Microsoft

Other clouds eg Baidu 百度

Central Visibility & Control

LF Edge (EdgeX, EVE, Akraino)

Open API

THE **LINUX** FOUNDATION
Consume. Collaborate. Contribute.

LF EDGE

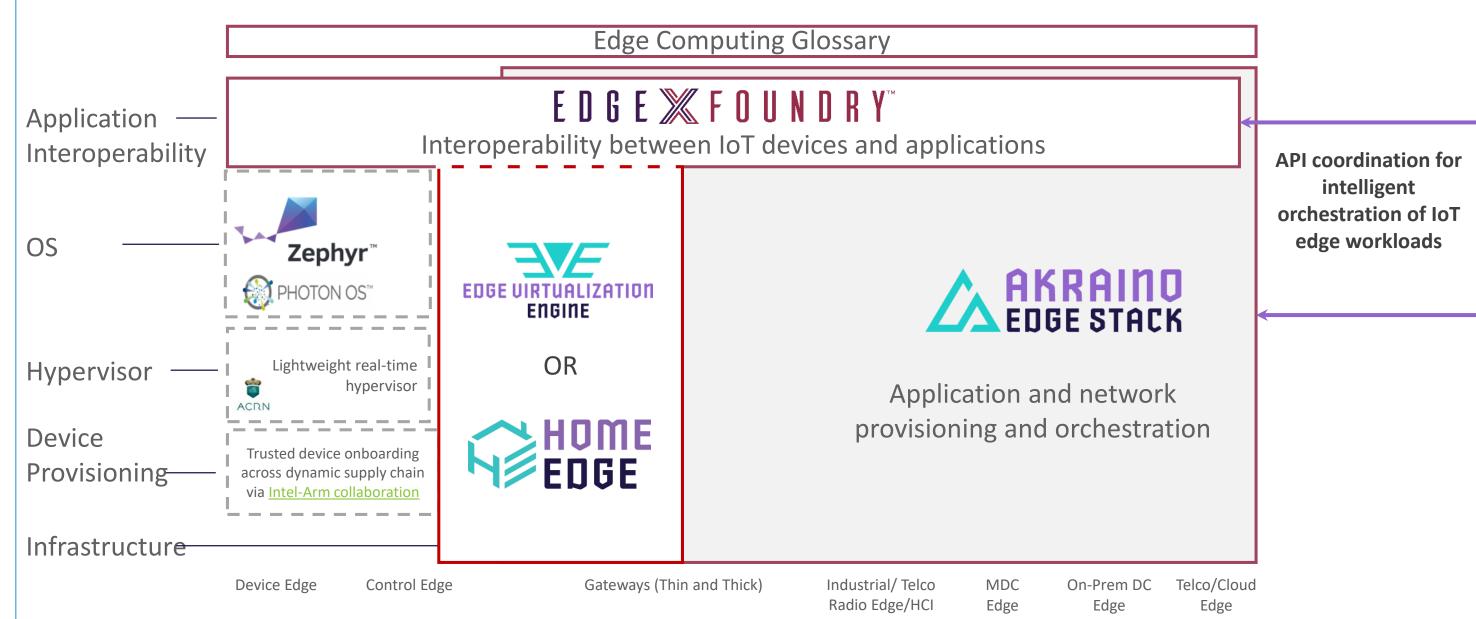# Scope of LF Edge

Edge Computing Glossary

EDGEXFOUNDRY™

Interoperability between IoT devices and applications

Application Interoperability

OS — Zephyr™ / PHOTON OS™

Hypervisor — Lightweight real-time hypervisor / ACRN

Device Provisioning — Trusted device onboarding across dynamic supply chain via Intel-Arm collaboration

Infrastructure

EDGE VIRTUALIZATION ENGINE

OR

HOME EDGE

AKRAINO EDGE STACK

Application and network provisioning and orchestration

API coordination for intelligent orchestration of IoT edge workloads

Device Edge | Control Edge | Gateways (Thin and Thick) | Industrial/ Telco Radio Edge/HCI | MDC Edge | On-Prem DC Edge | Telco/Cloud Edge

LF EDGE

Akraino R1 Blueprint: Radio Edge Cloud

Radio Edge Cloud for 5G use cases

Purpose/Features

- Telco- grade edge cloud platform for near-real time container workloads.

- Integrated with open-source RAN Intelligent Controller (RIC) – helps deploy customized, tailored apps with Zero touch

- Automated CD pipeline testing the full software stack

Target Industry: Telco 5G, Enterprise

* Target architecture shown here and the fully installable building blocks is in R1
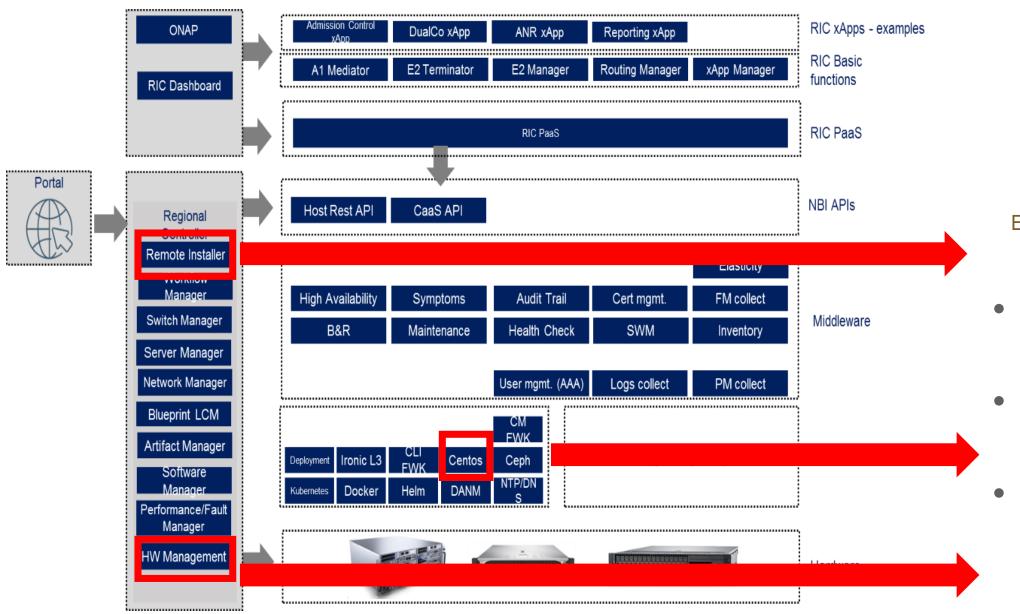
Arm architecture support on Radio Edge Cloud (REC)

Enhancements to support Arm

- Arm packages for Remote Installer
- Arm images/packages for OS
- Arm solutions for HW Management

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Telco Appliance Blueprint

The Radio Edge Cloud blueprint is member of the Telco Appliance blueprint family which is designed to provide a fully integration tested appliance tuned to meet the requirements of the RAN Intelligent Controller (RIC).

Radio Edge Cloud (REC) Use Cases

- Radio Intelligent Controller (RIC) or Virtual Radio Access Network (vRAN)

Case Attributes	Description
Type	New
Blueprint Family - Proposed Name	Telco Appliance
Use Case	RIC
	vRAN
Blueprint proposed Name	Radio Edge Cloud
Initial POD Cost (capex)	
Scale & Type	x86 OCP Open Edge servers x 6
Applications	RIC
Power Restrictions	
Infrastructure orchestration	Airship
	Redfish
	ONAP
SDN	OVS-DPDK
Workload Type	Containers
Additional Details	Submitter to provide additional use case details

Arm is working with partners to enable openEDGE servers

TELCO

Operators are proposing new features for OCP OpenEdge, also work on multiple instruction set architecture including Arm architecture, powered by Arm ecosystem partners like Ampere, Broadcom and Marvell.

Specifications

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Why Ampere At The Edge?

Scalable

8-32 Cores
8 Memory Channels
42 lanes PCIe IO

Powerful

Large cores
High single thread
performance

Efficient

Most energy efficient
high performance CPU

Supported

Linux, Windows
Hypervisors
Stacks

Reliable
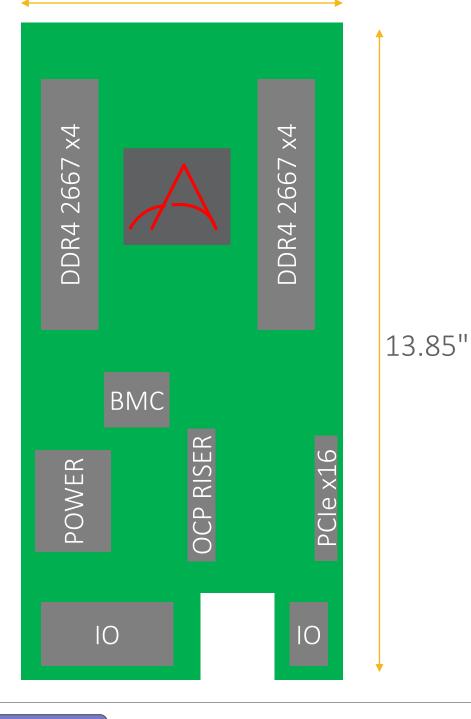
Long life cycle
High temperature

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Ampere OpenEdge Compute Platform
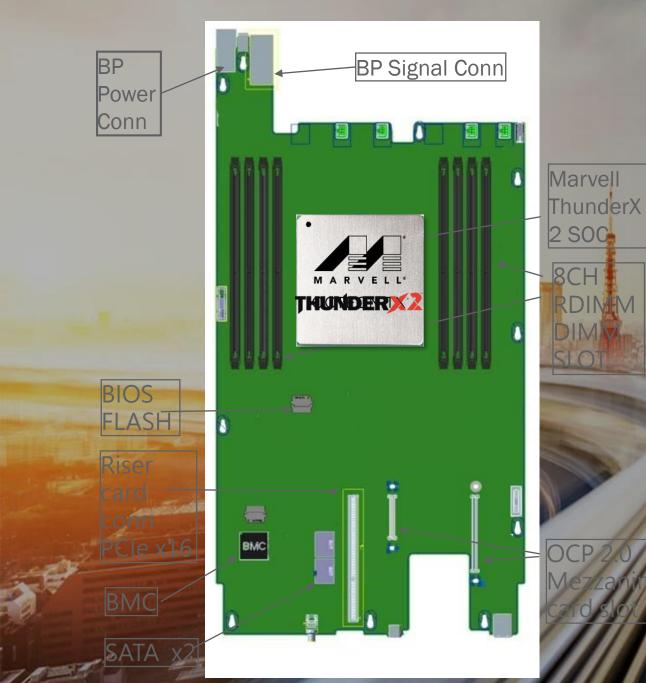
Overview
- Compatible with OCP OpenEdge Chassis CPU sled
- 32 and 16 core SKUs
- 32bit and 64bit Support

Processor
- 32 / 16 Ampere ARMv8 64-bit CPU cores 3.3 GHz Turbo
- 32 KB L1 I-cache, 32 KB L1 D-cache per core
- Shared 256 KB L2 cache per 2 cores
- 32MB globally shared L3 cache
- TSMC 16 nm FinFET

Memory
- 8x 72-bit DDR4-2667 channels
- Up to 16 DIMMs and 1 TB/socket
- ECC, ChipKill, and DDR4 RAS features

I/O
- OCP Mezzanine v2 (Conn. A/B) 10/40/100 GbE NIC
- 1 x16 PCIe slot
- 2 x M.2 x4 NVME
- 4 x SATA3
- 2 x USB 2.0

Power
- 125W TDP 32 cores
- 75W TDP 16 cores
- Advanced Power Management

Performance
- SPECrate2017_int_peak: 68
- SPECint_rate2006 (peak): 502

Availability
- Sample Q419
- MP Q120

6.5"

13.85"

DDR4 2667 x4   DDR4 2667 x4

BMC

POWER   OCP RISER   PCIe x16

IO   IO

Marvell Open Edge ARM Server Board Detail

BP Power Conn

BP Signal Conn

Marvell ThunderX 2 SOC

8CH RDIMM DIMM SLOT

BIOS FLASH

Riser card conn PCIe x16

BMC

SATA x2

OCP 2.0 Mezzanine card slot

Feature	Specification
Form factor	Proprietary (407.95 x 205.8 mm)
Processor Support	Marvell ThunderX2 CPU with up to 32 cores, 128 threads 2.2GHz in nominal mode, 2.5GHz in Turbo mode.
Chipset	SoC
Memory	8 x DIMM slots support/8 channel DDR4 2666 MT/s @ R-DIMM with 1DPC configuration
LAN	1G Base-T to backplate 1 x Management LAN 10/100/1G
VGA / VRAM	Integrated in BMC
BMC	ASPEED AST2500
Expansion Slot	1 x PCIe x16 (@Gen 3 x16) 1x OCP mezzanine PCIe (@Gen 3 x16)(TYPE 1 P1,P2,P3,P4 NCSI support)
Storage	2 x SATA(6Gb/s) Optional PCIe M.2 on riser
Rear IO Connector	2 x USB3.0 1 x ID Button, System RST BTN; PWR BTN,
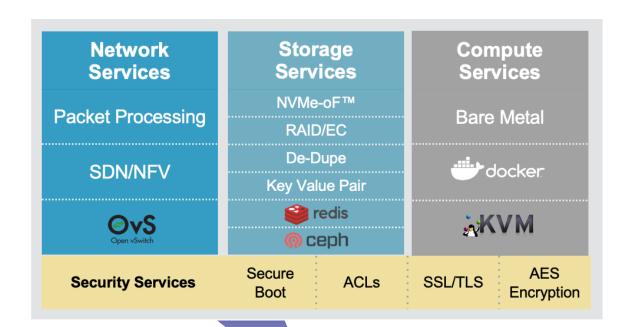
Broadcom's Stingray and OpenEdge

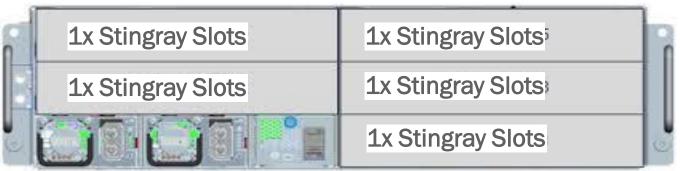**BROADCOM**®

SmartNIC Offload Services for OpenEdge Applications Today

BROADCOM®

Network Services	Storage Services	Compute Services
Packet Processing	NVMe-oF™	Bare Metal
	RAID/EC	
SDN/NFV	De-Dupe	docker
	Key Value Pair	
OvS Open vSwitch	redis / ceph	KVM

Security Services	Secure Boot	ACLs	SSL/TLS	AES Encryption

Onload
Appliance Functions

...Offload
Server Overheads

Stingray

35W HH/HL

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OpenEdge Server with Stingray SmartNIC:

1x Stingray Slots	1x Stingray Slots
1x Stingray Slots	1x Stingray Slots
	1x Stingray Slots

Stingray SmartNIC Platform:

8x A72 3Ghz Cores

2x25Gbe or 1x100G

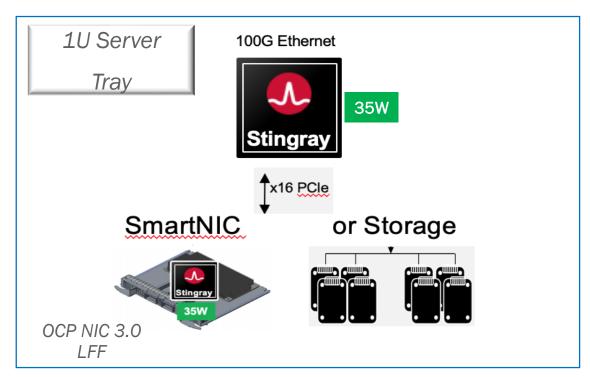16GB DDR4 (2 Channels)

Hardware Accelerators:

Packet Processing

Crypto

RAID/EC/De-Dupe

Stingray Offload Capacity with OpenEdge:

Stingray Resources	Offload Capacity
Arm A72 3Ghz Cores	40 3Ghz Cores
Network / Storage Bandwidth	250Gb/s (2x25G) or 500Gb/s (1x100G)
Crypto Engine (90 Gb/s)	450 Gb/s
Packet Processing (90 Mpps)	450 Mpps

OpenEdge Stingray SmartNIC 1U/2U Tray Concepts

1U Server Tray

100G Ethernet

Stingray 35W

x16 PCIe

SmartNIC   or Storage

OCP NIC 3.0 LFF

BROADCOM®

2U Server Tray

Host CPU

x16 PCIe   x16 PCIe

Stingray 35W   Stingray 35W

OCP NIC 3.0 LFF

BROADCOM®

Appliances:

- Real-Time Edge Storage Trays or

- Low Power Server + Plus SmartNIC

High Density Server:

- Virtual Network Functions

- Packet Processing & Security

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Call to Action

- Collaborate between Arm and Arm Partners and openEDGE to
  - Cover Arm in the Open Edge Server Specification
  - Where to find additional information (URL links)

OCP openEDGE Project: https://www.opencompute.org/wiki/Telcos/openEDGE

Akraino REC Blueprint: https://wiki.akraino.org/pages/viewpage.action?pageId=6128402

Consume. Collaborate. Contribute.

Thank you