



The Meet-up Between openEuler and Zephyr

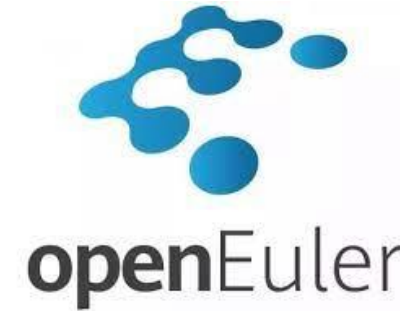
Huawei / openEuler

Wayne Ren

Self-introduction



- **Huawei Tech. Inc.(2020-now)**
 - Embedded OS Technical Expert
 - openEuler TC member (embedded scenario), SIG-Yocto & SIG-Zephyr Maintainer
 - openEuler Embedded Architect
 - Zephyr Project Ambassador
- **Synopsys Wuhan (2013-2020)**
 - Senior software engineer->Software R&D Manager(2016)
 - Embedded system software for Synopsys Designware ARC processor
 - embARC Open Source Platform(2014)
 - Zephyr Project(2016), the maintainer of ARC architecture
- **Ph.D. of Huazhong Univ. of Sci. and Tech. (2013)**
 - Embedded system, RTOS, Robots
 - TOPPERS Special Member (2011-2016)



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Introduction of openEuler

2

Introduction of openEuler Embedded

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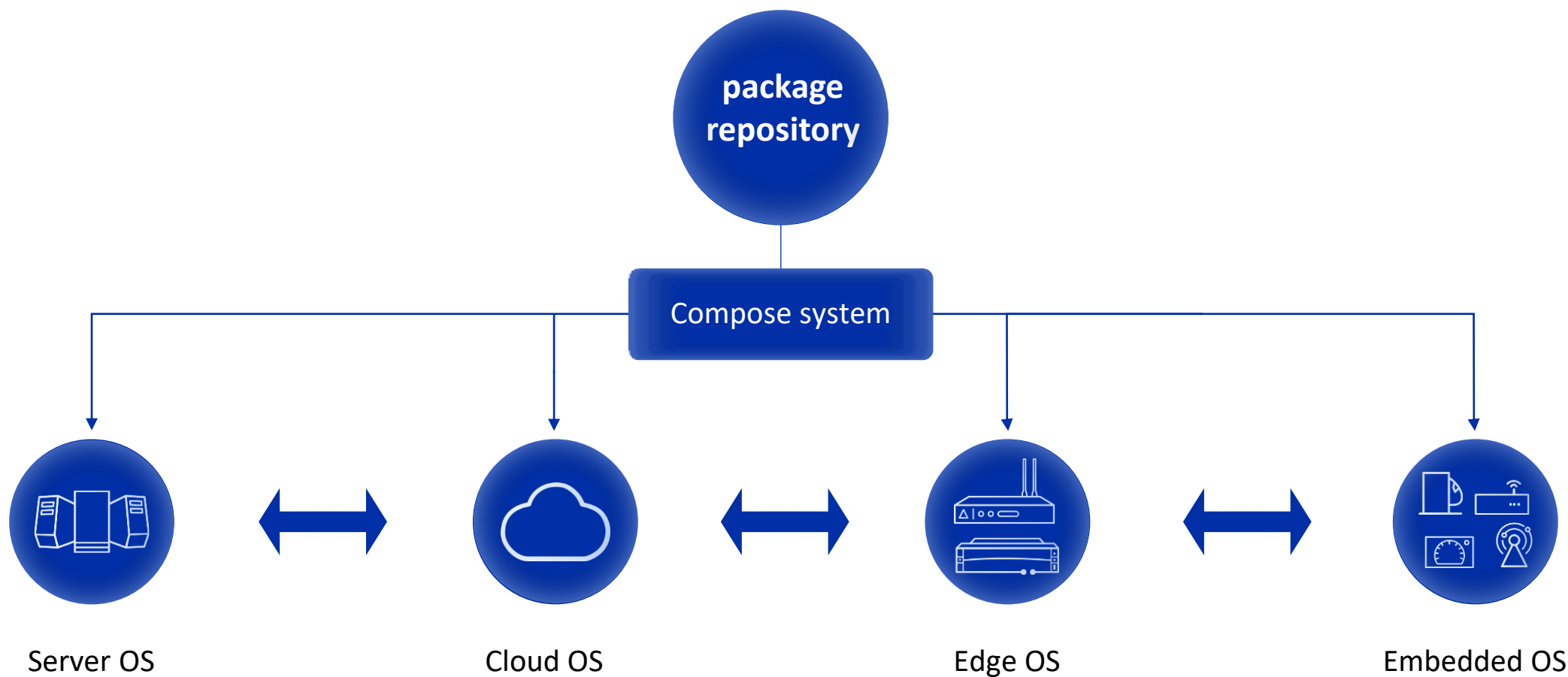
Introduction of SIG-Zephyr

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OS Mixed Criticality Deployment

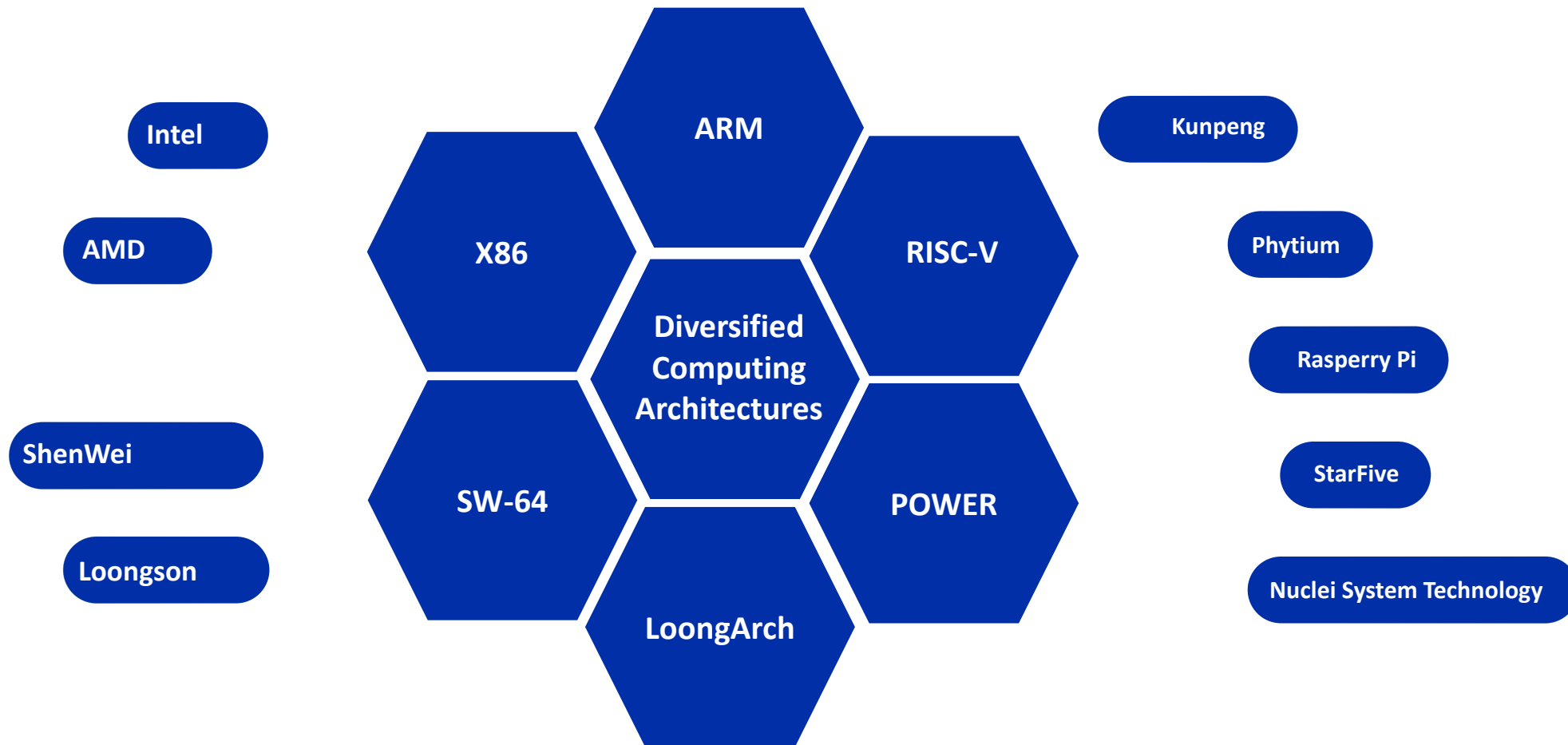
What is openEuler?

An Unified OS Distribution Platform

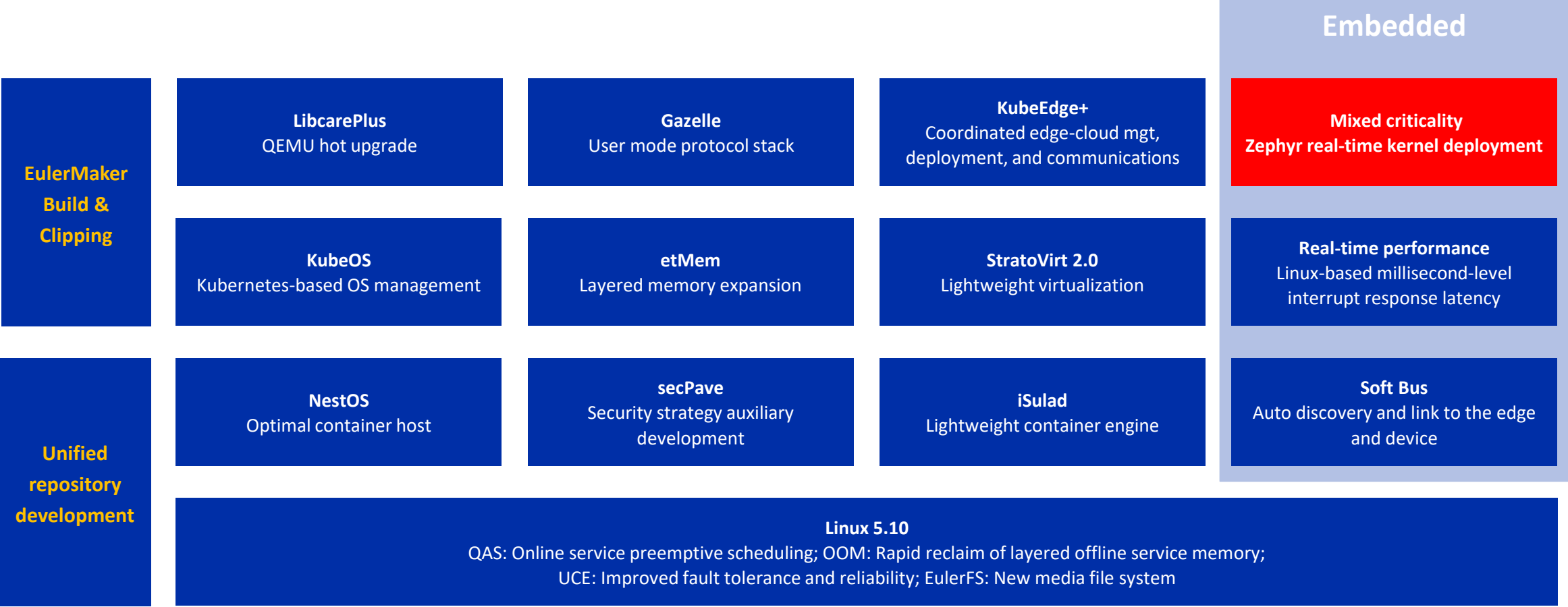


What is openEuler?

An OS Supports Multiple Architectures



Collaborative Development of One Set of Code and Release of OpenEuler Four Images for All Scenarios



openEuler Community Status Until May 2022



User

532,555

Contributor

8,808

Organization Member

337

Dec. 31, 2019 Officially went open source

Mar. 31, 2020 Released openEuler 20.03 LTS version

Nov. 9, 2021 Donated openEuler OS to the OpenAtom Foundation

Dec. 31, 2021 Reached 1M downloads

Mar. 31, 2022 Released openEuler 22.03 LTS version

Explore more



PR

57.8K

Issue

32K

Comment

307.1K

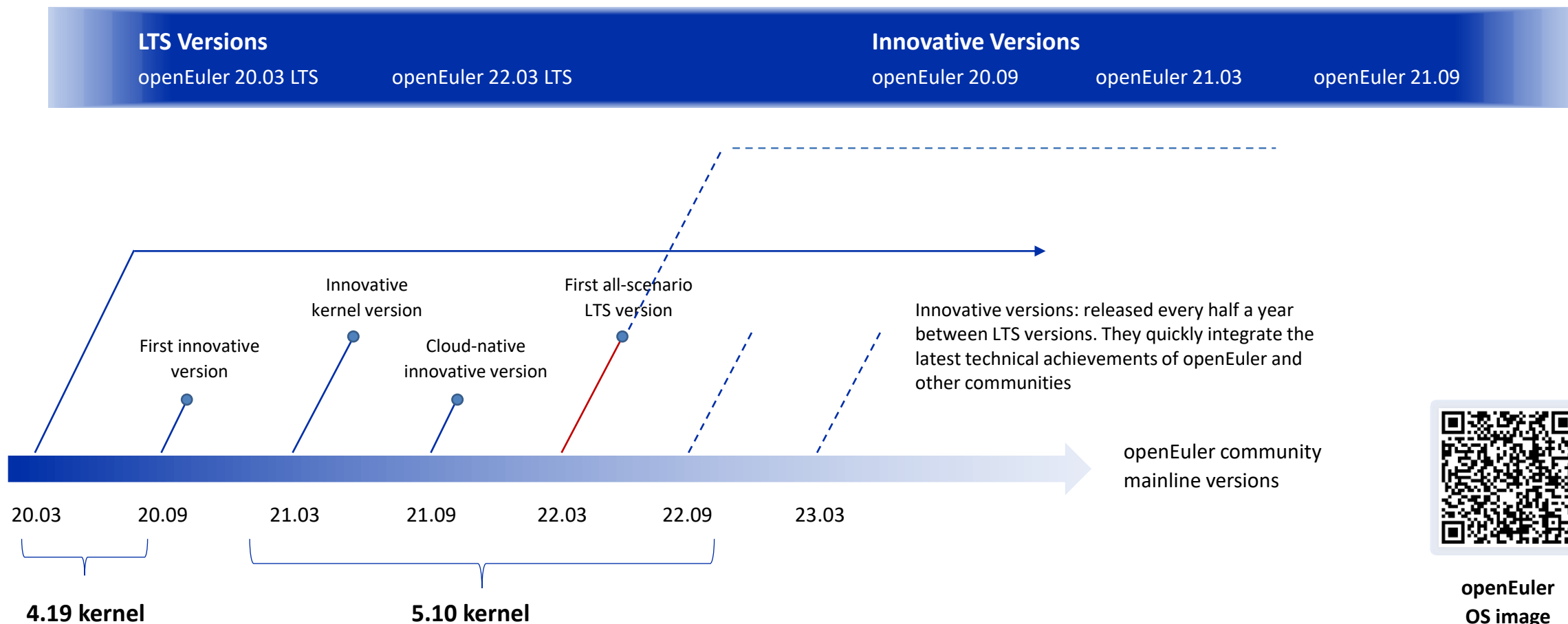
SIG

97

Repositories

8,819

openEuler Release Management



openEuler welcome more groundbreaking innovations

What Can You Do with openEuler?



All kinds of contributions are welcomed.
Join the openEuler Community to start your innovation journey!

Chipset
Hardware

Compatibility certification
New features enablement

.....

OSVs

Release commercial distribution
Build up business model
Contribute PR

.....

ISVs

Application certification
Full-stack tuning

.....

Users

Build your own distribution to
migrate business
Raise requirement and issue

.....

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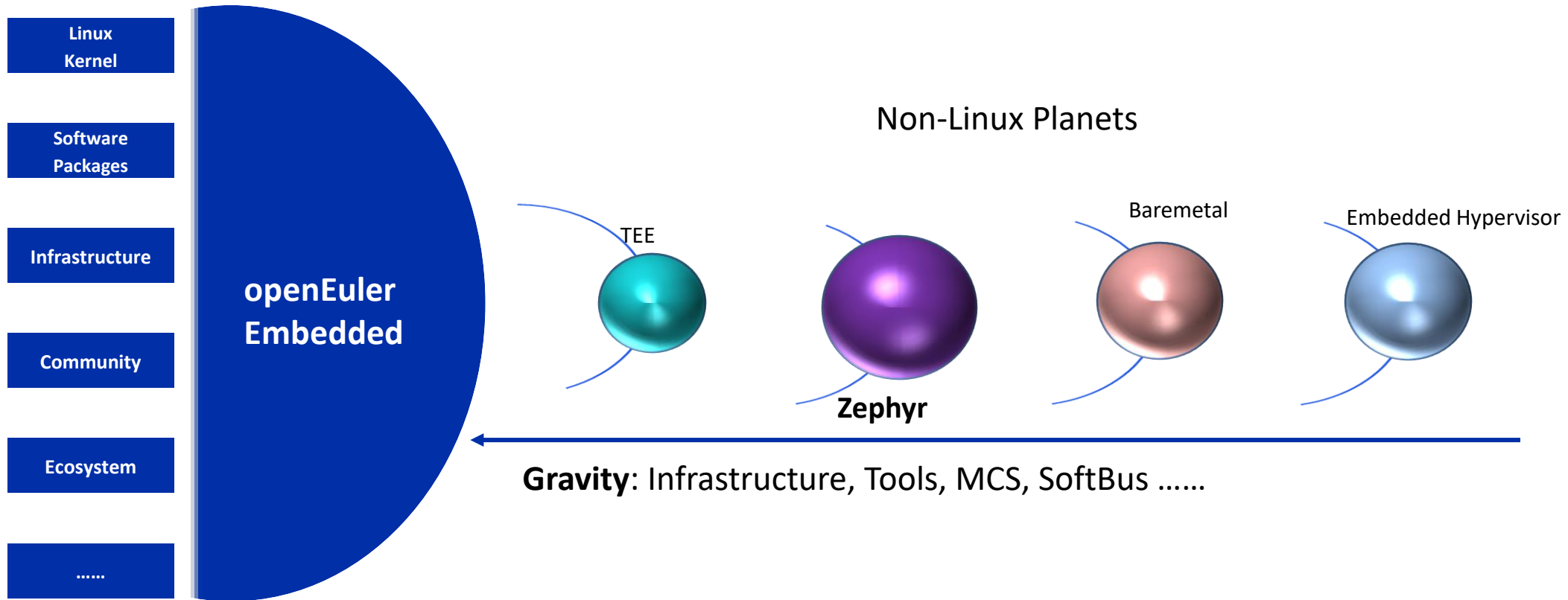
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OS Mixed Criticality Deployment

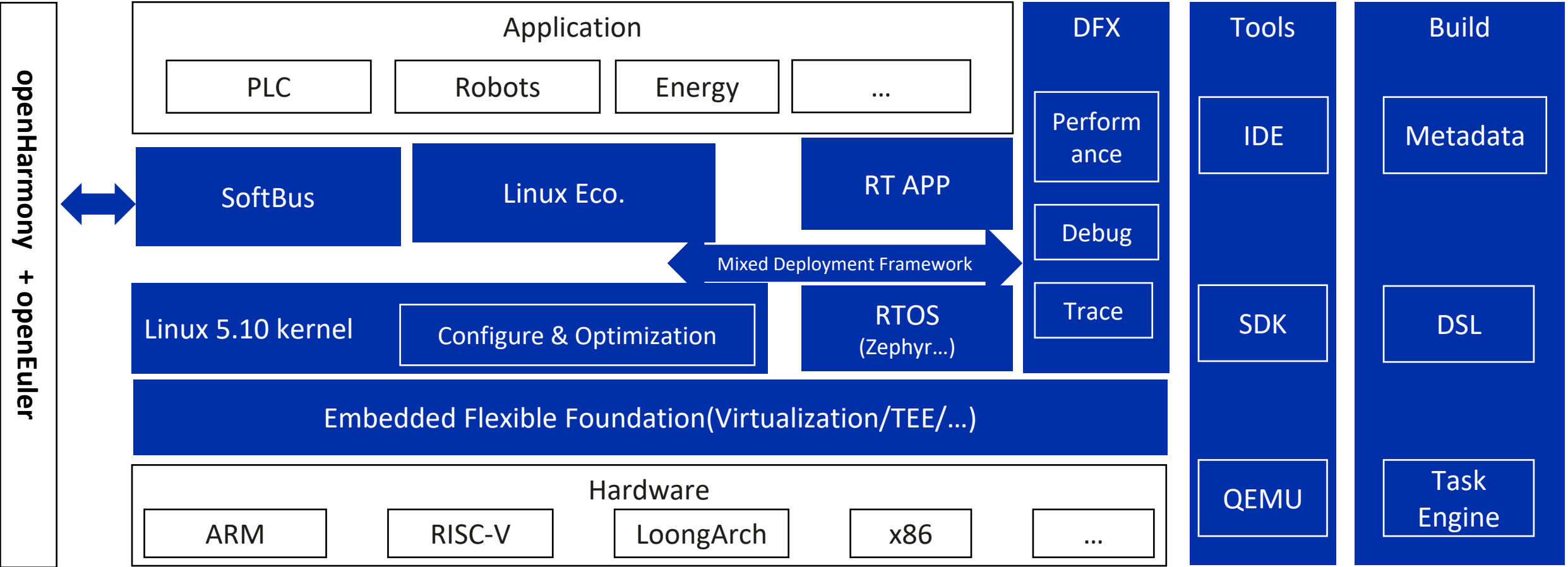
openEuler Embedded

A Linux-Centric Comprehensive Embedded Software Platform



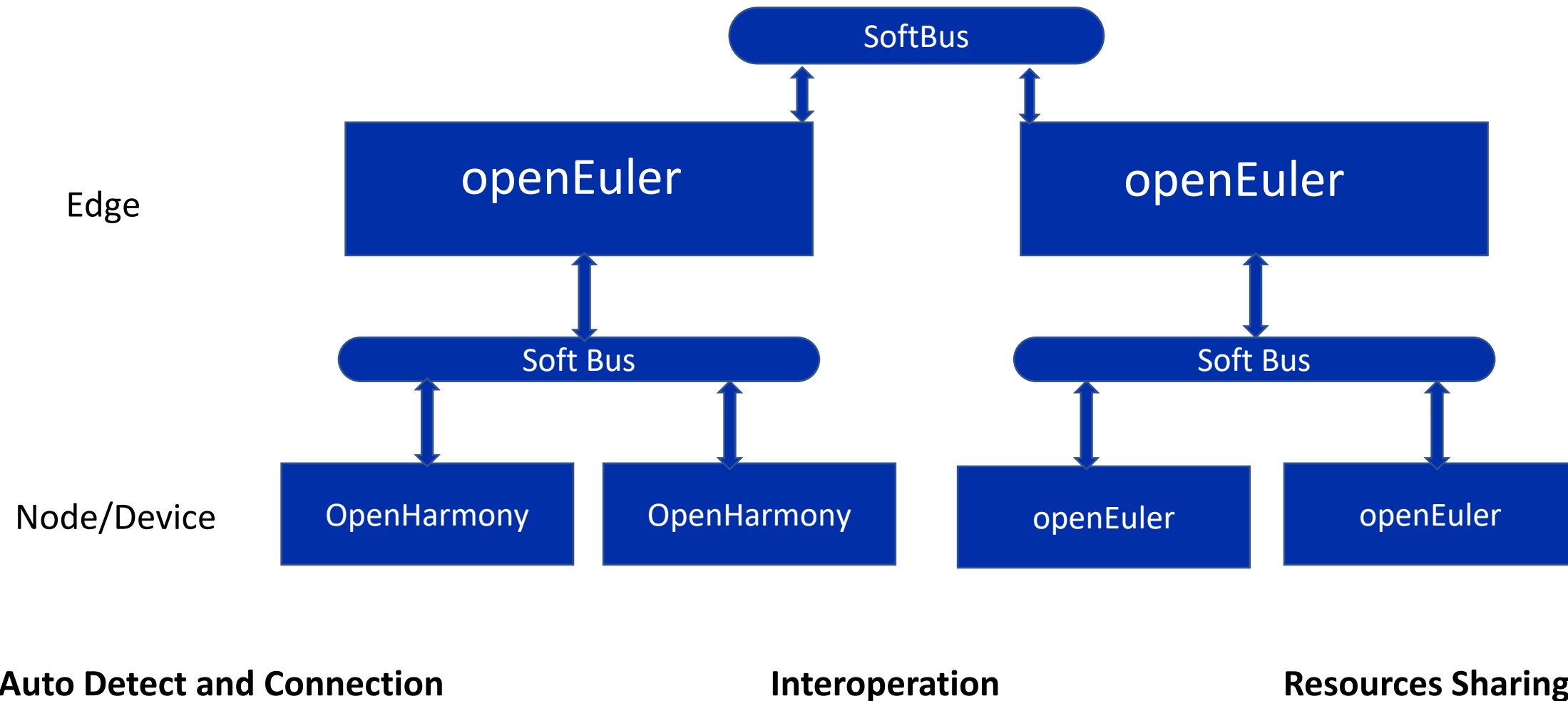
- As the sun of solar system, openEuler Embedded provides **Unified Build, Rich Features, Ecosystem, Interface** to attract other planets
- Planets provides characteristic features: **Hard Real Time (Zephyr), Security (TFM), Low Power, Embedded Virtualization**

openEuler Embedded Architecture



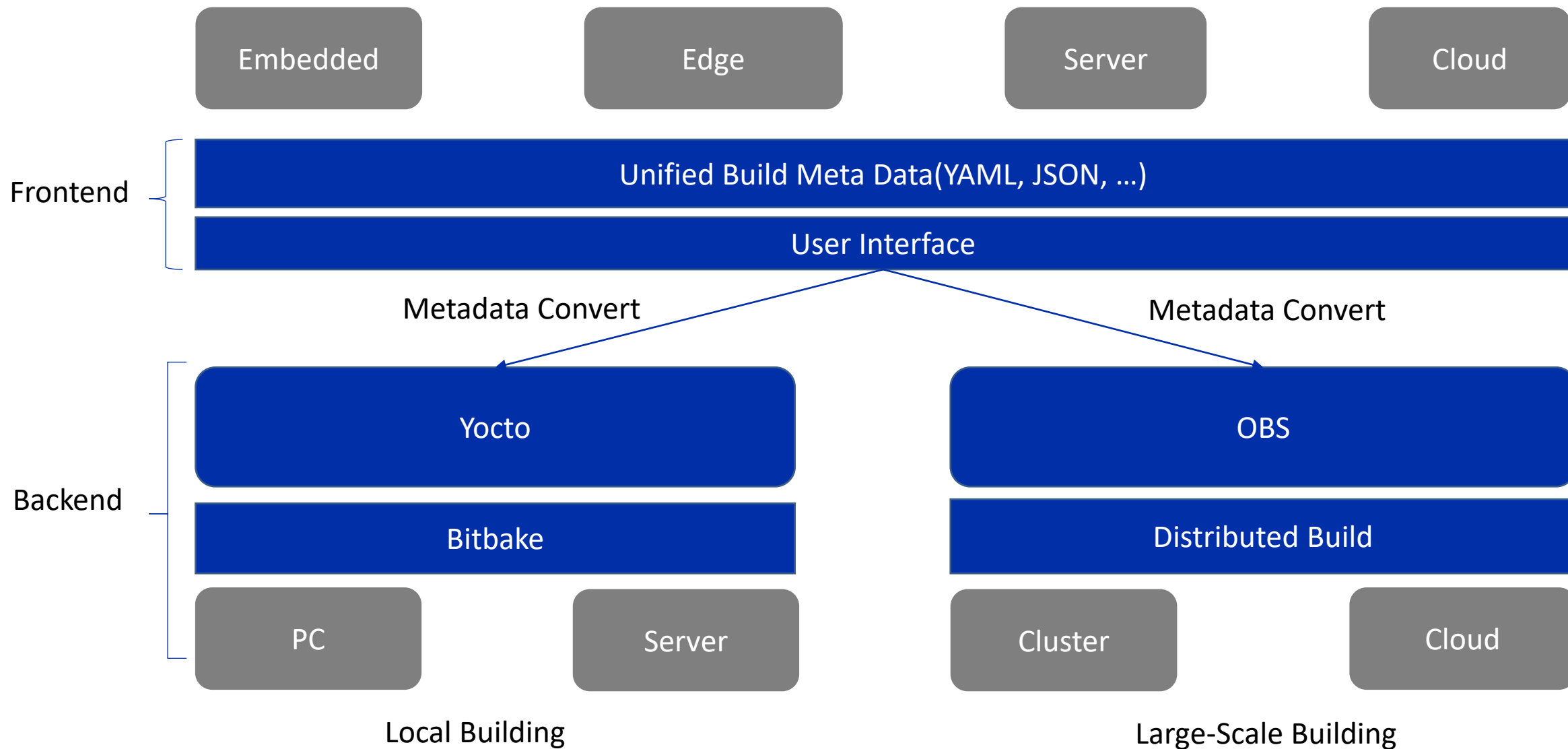
Soft Bus

Unified connection solution to interconnect openEuler and openHarmony



Unified Build

A unified way to build OS for different scenarios



openEuler Embedded 22.03

- **Kernel**
 - Kernel: 5.10.0-60.17.0
 - Preempt-RT patch
 - Raspberry Pi 4B patch
- **Software packages**
 - 80+ software packages: busybox, iSulad, openssl...
- **Key Features**
 - **Mixed Deployment of openEuler Embedded + Zephyr**
 - SoftBus to connect openEuler Embedded nodes
 - Security configuration and enhancement
 - Preempt-RT to improve real-time
- **BSP**
 - QEMU
 - Raspberry PI 4B
- **Build System**
 - Yocto-based build system
 - Container-based Build
 - Sphinx-based doc system



22.03
openEuler Embedded Sets Sail!

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Introduction of SIG-Zephyr

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OS Mixed Critical Deployment

Why SIG-Zephyr

A Win-Win approach for Zephyr and openEuler

- **For Zephyr:**

- Challenge: the ecosystem of Zephyr inside and outside China is **poles apart**
 - World: very hot, github, website, discord, events
 - China: limited, only WeChat, QQ group, because of languages, time zone, access, competition
- Appeal: **cooperate with openEuler to set up Zephyr China ecosystem and accelerate the promotion and usage of Zephyr**

- **For openEuler:**

- Background: 2021.09, openEuler upgrades to open OS for digital infrastructure, covering embedded scenario(openEuler Embedded). openEuler community also upgrades to ubiquitous OS community
- The setup of SIG-Zephyr
 - **A high-quality of “Little OS” for openEuler Linux**
 - Similar develop way, coding style, flow like Linux, most important **Vendor Neutral**
 - The position of Zephyr is **“Fits where Linux is too big”**
 - **Potential benefits for openEuler internationalization**
 - Zephyr Project is TOP IoT OS platform world-wide, talk openEuler’s story in Zephyr Project’s channel
 - openEuler Linux + Zephyr is “Win-Win” combination.

SIG-Zephyr

A Bridge to Connect openEuler and Zephyr



- **Vision:**

- **Introduction and promotion of Zephyr in China**, attract more users and developers
- A bridge to connect openEuler community and Zephyr community, mutual support and interaction to benefit **the localization of Zephyr and internationalization of openEuler**

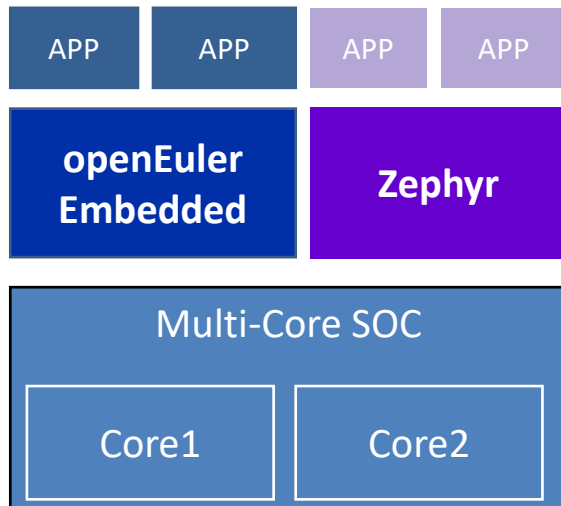
- **Work Scope:**

- Mirrors of Zephyr release, keep sync with upstream(<https://gitee.com/src-openeuler/zephyr/>)
- A local way to share and discuss Zephyr (Wechat, QQ group, gitee issues)
- Zephyr related Chinese docs, e.g., blogs, wiki(<https://openeuler.gitee.io/zephyr-cn/>)
- Periodic online meetings(<https://www.openeuler.org/zh/sig/sig-list/>)
- Events by openEuler and Zephyr(openEuler Developer Day, Zephyr Developer Summit)
- Demos of openEuler + Zephyr(OS Mixed Criticality Deployment)
- Interaction of other SIGs, e.g., SIG-Yocto, SIG-Industry, SIG-embedded

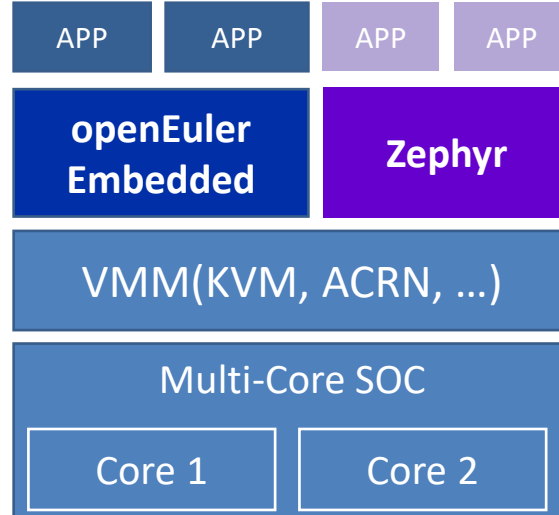
The Scenarios of openEuler + Zephyr



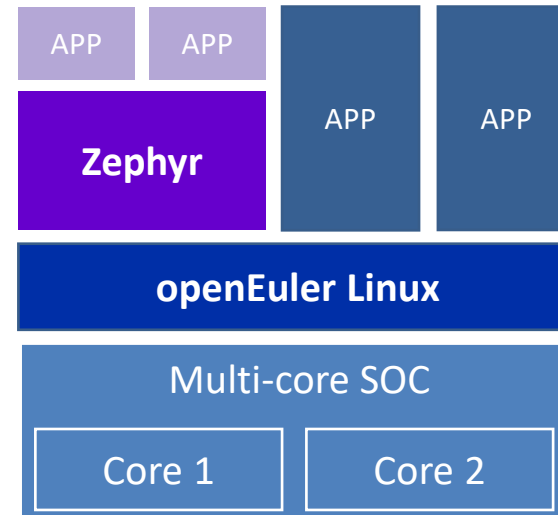
AMP



Embedded Virtualization



LibOS



Fits where Linux is too big

- Data plane OS
- Firmware
- BIOS of Zephyr
-

Call for more volunteers!!!

Role	Name	Gitee Account	Domain
Maintainer	Wayne Ren	@vonhust	RTOS, Zephyr Ambassador, Embedded Linux
Maintainer	Hongbo Wang	@hwang37	Intel Shanghai Zephyr team leader
Maintainer	Guoliang Li	@lgl88911	Embedded System, Doc, Tutorial
Committer	Lingao Meng	@menglingao	Bluetooth, Zephyr Ambassador
Committer	Kai Xu	@overheat-cn	IoT Connection

22.3.30

- Mirrors of Zephyr LTS2 and 3.
- Initial Docs and tutorials
- Zephyr + openEuler Embedded AMP Demo

22.06.30

- Zephyr Developer Summit
- Zephyr + openEuler Embedded on Raspberry Pi 4B

22.09.30

- Service oriented deployment
- Zephyr + openEuler Embedded Virtualization Mode (Challenge)

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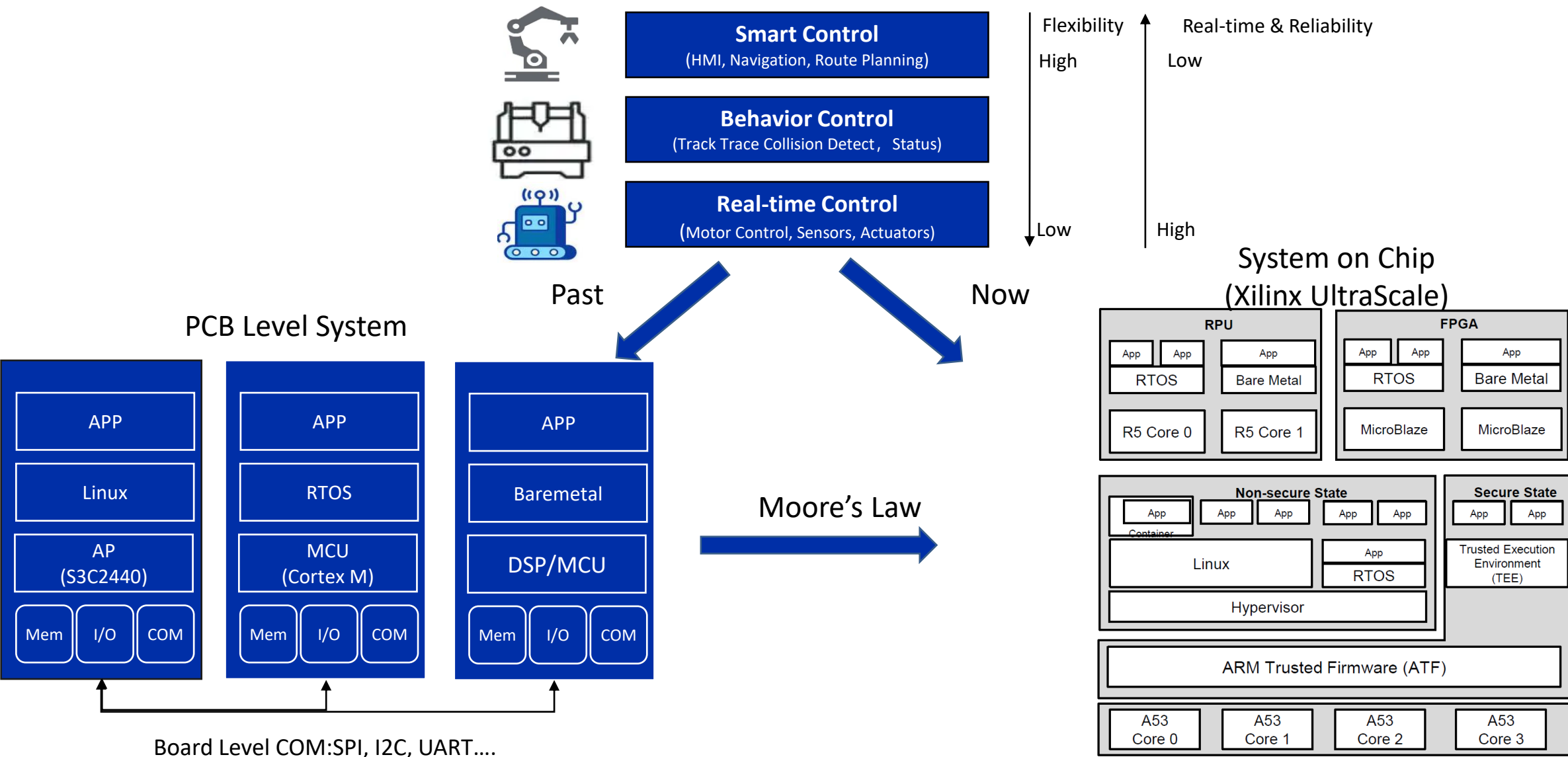
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OS Mixed Criticality Deployment

CASE: Motion Control System(Robots, CNC Machines)



Cons: HW Complexity, COM Efficiency, SW Flexibility, Difficult to develop and maintain

Challenge: How SW fully utilize HW, How SW define HW

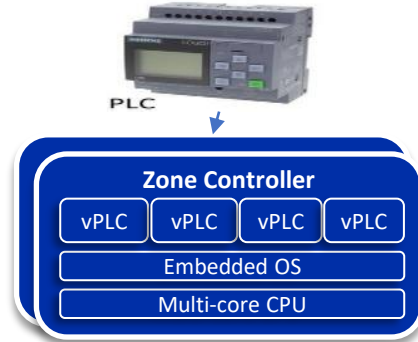
Mixed Criticality System

The future trend of embedded system

Path 1: From distributed to centralized

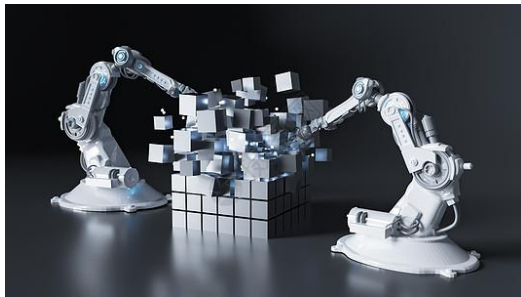


Smart Vehicle



vPLC/Cloud PLC

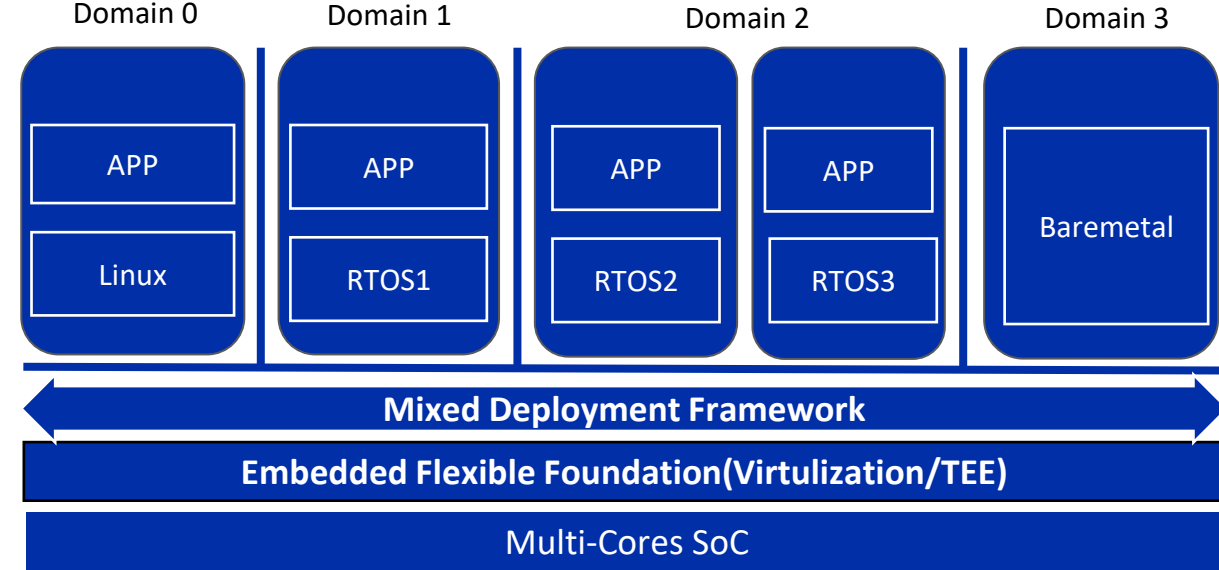
Path 2: The evolution of node device



AI Smart Robot ARM



Drone

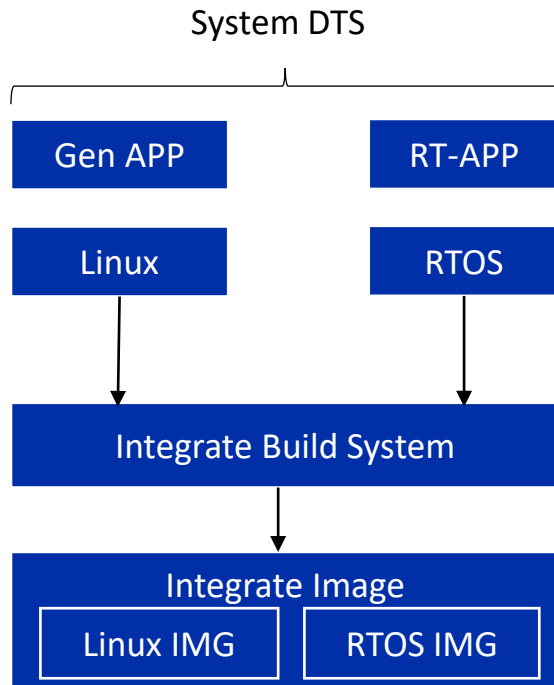


The Architecture of MCS

- Mixed Criticality System :
 - Criticality: mainly Safety, also extended to other index: real-time, security, power, etc.
 - **MCS= Deployment + Quarantine + Scheduling**, Mixed OS
Deployment-> Resource Quarantine->Scheduling for better resource utilization
 - Academy: more focus on the **Mixed Criticality Scheduling** of shared resources, less on quarantine
 - Industry: more focus on **Time and Space Quarantine**, static allocated resources->low resource utilization

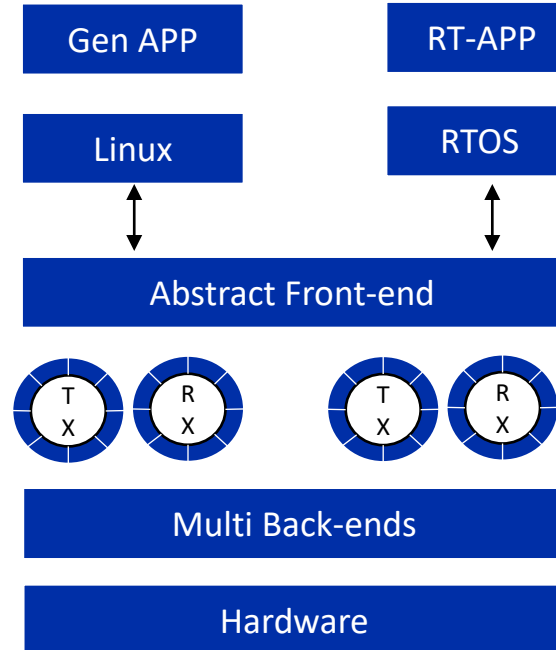
Multi-OS Mixed Criticality Deployment

Multiple OS Integration



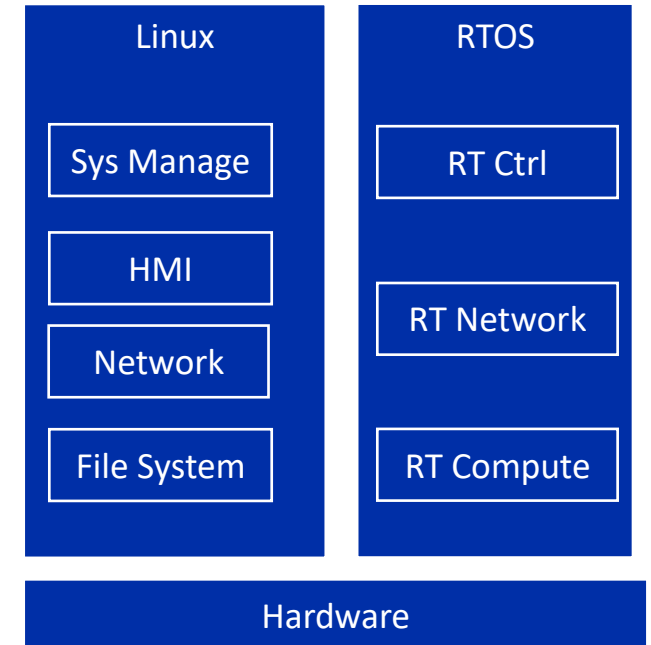
- System DTS to express resource allocation and OS relations
- Integrate Build System to build multiple OS in a unified way and generate the integrate image

Efficient Cross OS Communication



- Virtio-based lock free share memory mechanism to connect multiple OS
- Hardware independent abstract Front-end and Multi Back-ends (IPI, HW mailbox, HW event)

Service Oriented Deployment



- Service oriented deployment, different OS provides its best services
- Linux is centric, define standard interfaces: manage , communicate, debug, life-cycle.....

22.03: Basic Ability of Multi-OS Mixed Deployment

openEuler Embedded + Zephyr

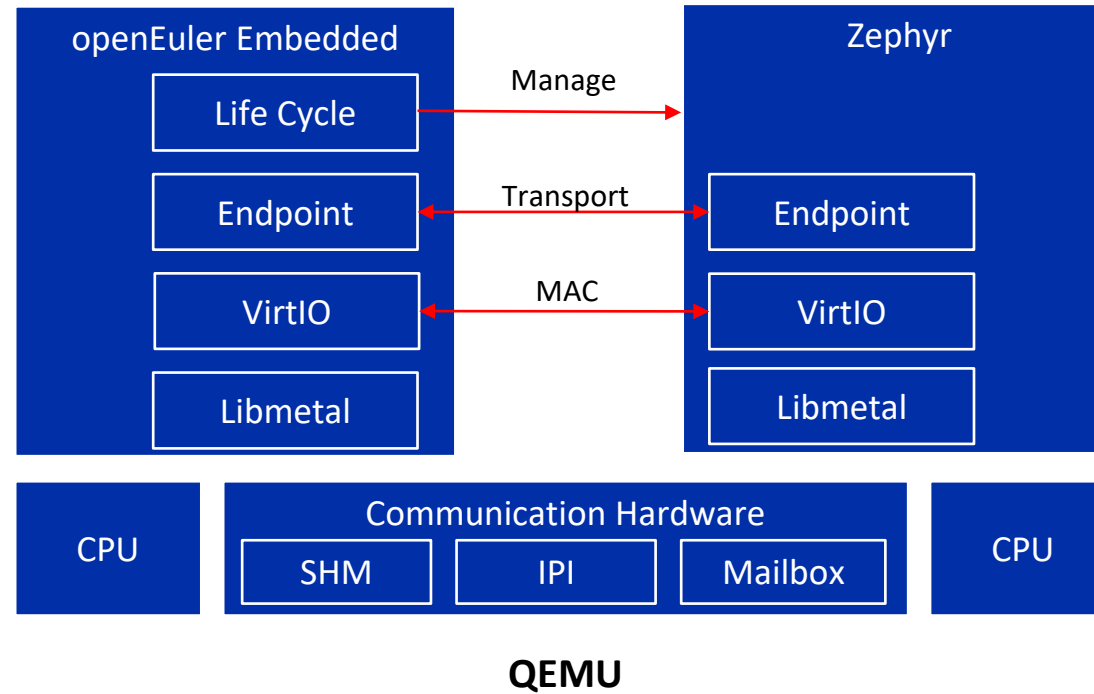


Scope:

- OpenAMP based basic multi-OS mixed deployment, 3 cores for openEuler Embedded, 1 core for Zephyr
- openEuler Embedded as host, Zephyr as client, Proof Of Concept on QEMU virt, then Raspberry Pi 4B (WIP)

<https://gitee.com/openeuler/yocto-embedded-tools/tree/openEuler-22.03-LTS/mcs>

- **openEuler Embedded**
- Integration of OpenAMP and Libmetal in Yocto
- Resource Allocation: memory for Zephyr, shared memory, IPI and peripherals
- OpenAMP Adaption: kernel module
- Demo: echo server



- **Zephyr**
- Integration of Zephyr build in Yocto
- OpenAMP Adaption: port to QEMU aarch64, modification of GIC driver, SGI based IPM driver
- Demo: echo client

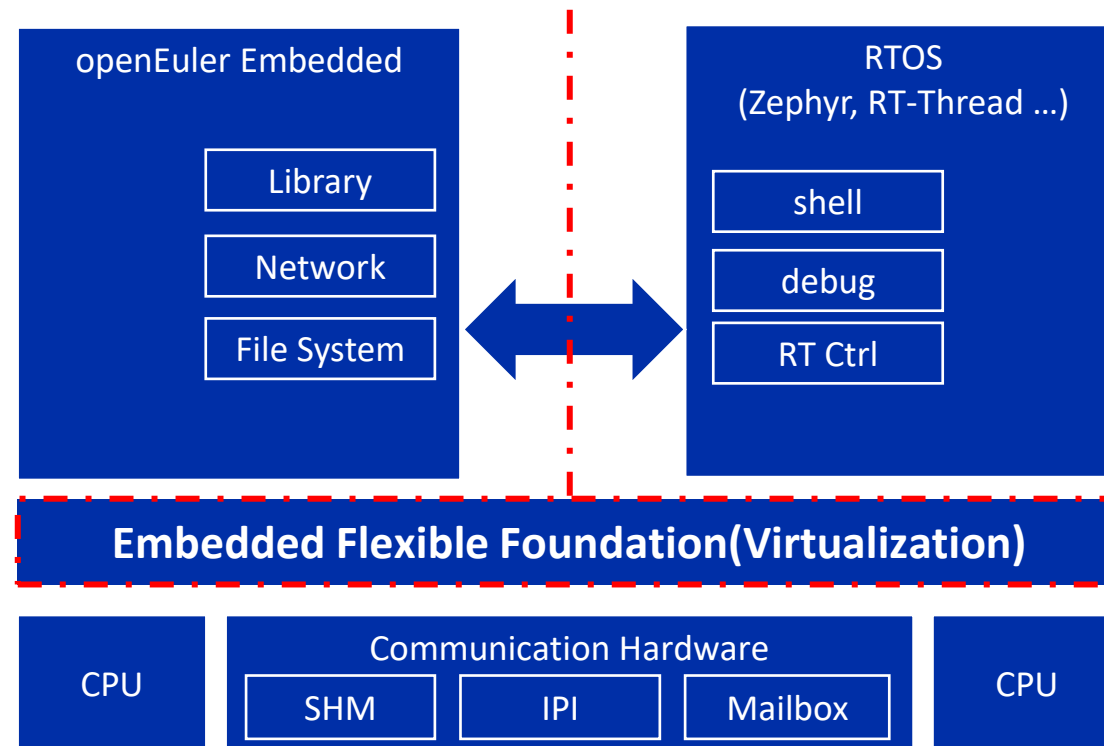
- Extra peripherals: extra UART console, extra reserved mem

22.09: Service Oriented Deployment

Scope:

- Improvements based on 22.03, service oriented deployment (log, shell, debug)
- Deployment on hardware boards (Raspberry PI 4B, RISC-V boards)
- More RTOS options: Zephyr, RT-Thread

- openEuler Embedded**
- **File system service:** Zephyr can access file system in Linux side
 - **Network service:** Zephyr can access network in Linux side
 - **Library service:** Zephyr can access library(math, tool) in Linux sides



- Zephyr**
- **Shell:** communicate with Zephyr by shell
 - **Debug:** debug Zephyr APP from Linux side
 - **RT Ctrl:** Zephyr provides real-time ctrl service

- **openEuler**: a ubiquitous open OS for the digital infrastructure, covering Cloud, Server, Edge, Embedded
- **openEuler Embedded**: a Linux-centric comprehensive embedded software platform based on openEuler ecosystem
- **SIG-Zephyr**: a bridge to connect openEuler and Zephyr, devoted to Zephyr localization and innovation of openEuler Embedded + Zephyr
- **Mixed Criticality System**: the future trend of embedded system, deployment -> quarantine -> scheduling, the cooperation point of openEuler Embedded + Zephyr

