Joint IEEE ComSoc Or & SIM-PDX Event

Unleashing Services At The Edge

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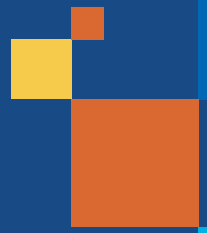

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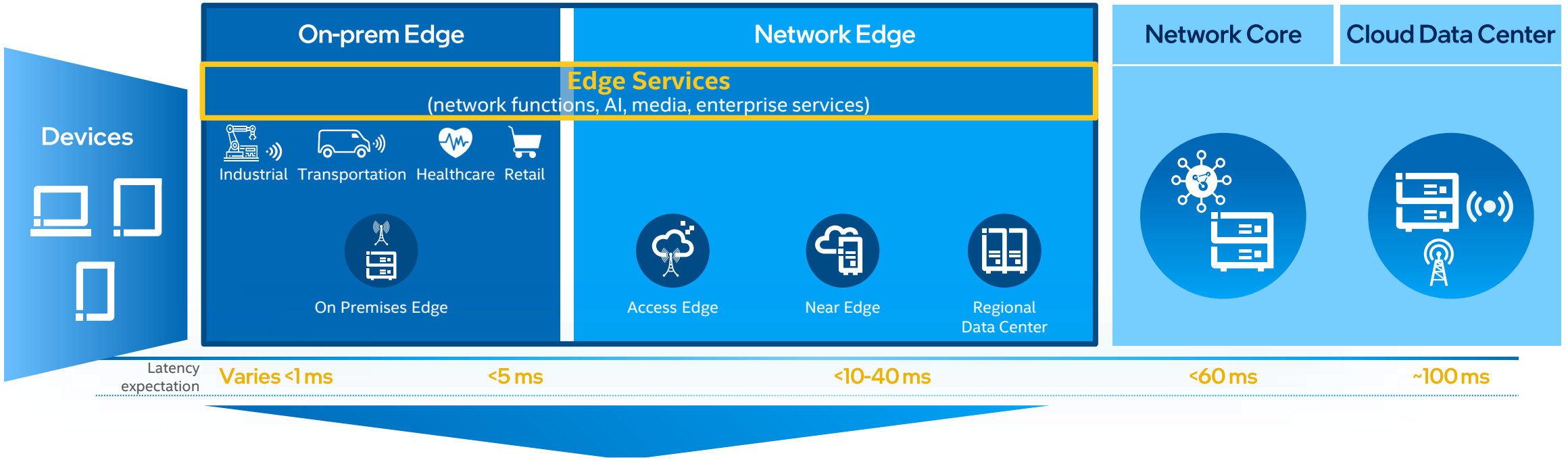
Agenda

- Edge Services
- Smart Edge – Open
- Experience Kits
- Use Cases
- Edge Service Onboarding
- What can you do?

Cloud Native Platforms for the Edge



Lower TCO with a consistent cloud native platform approach across edge locations

- Services
- Middleware
- Resource and service orchestration
- Operating system

Key challenges to overcome

- Deliver platform consistency & scalability across diverse edge location requirements
- Optimize cloud native frameworks to meet stringent edge KPIs and network complexity
- Leverage a broad ecosystem and evolving standards for edge computing

Edge Services vs. Cloud Services

- Mobility vs. Scalability
- Resiliency vs. Redundancy
- Edge Native Functions vs. Cloud Native Functions
- Heavily distributed
- Tiered architecture
- Data locality
- Latency critical operations

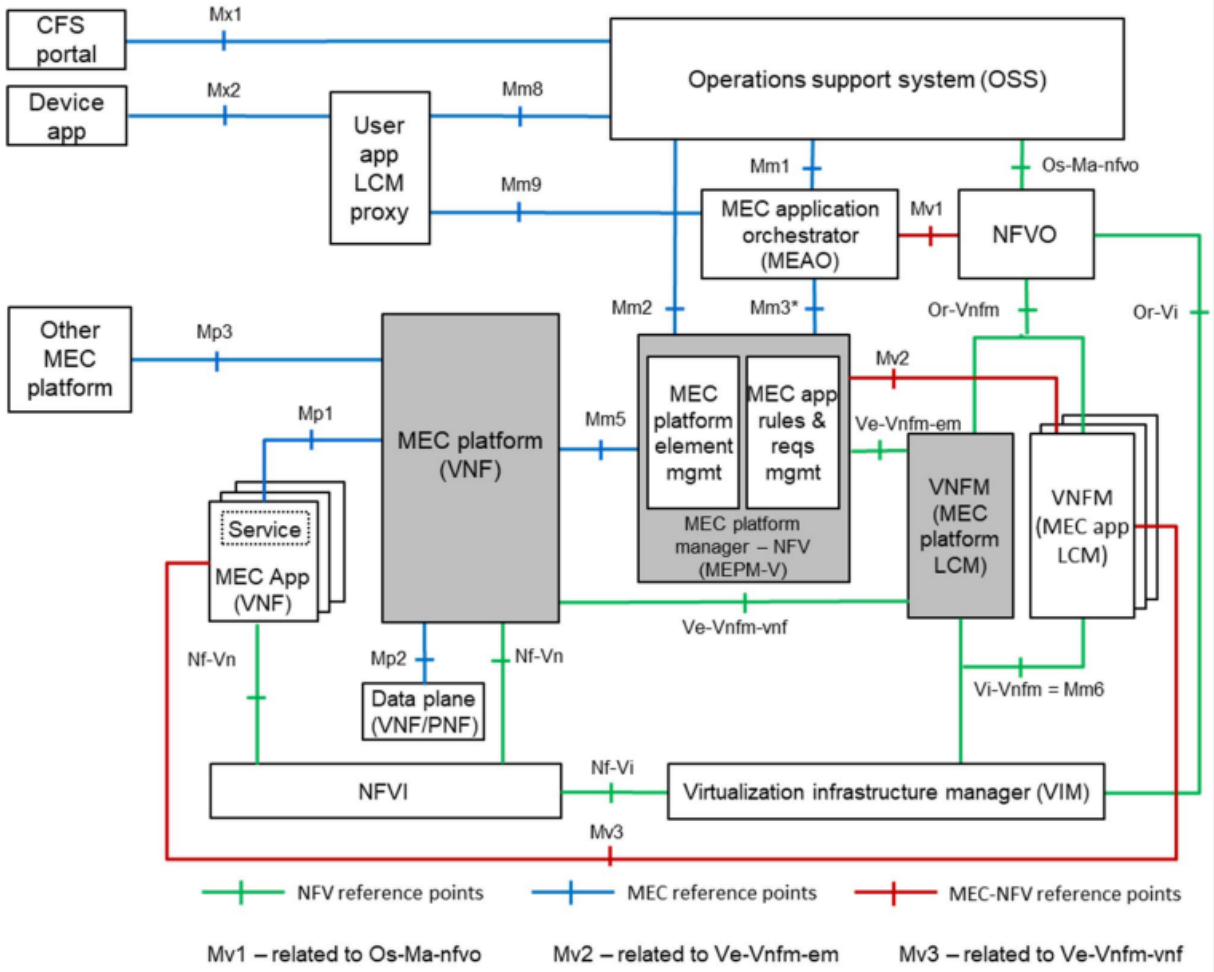


Figure: ETSI MEC Architecture

Challenges Across the Edge

- Resource Constraints
- High Network Performance
- Policy Management
- Seamless scale between Edge to Cloud
- Security & Privacy
- Application onboarding
- Life cycle management
- Public and Private Cloud
- Hardware Abstraction & Utilization
- AI & ML Models for Edge
- Automation/Operation Autonomy

Smart Edge – Open Platform

Smart Edge - Open is an edge computing software toolkit that enables **highly optimized and performant edge platforms** to on-board and manage applications and network functions with **cloud-like agility across any type of network**

Modular

Consume as a Whole or as Individual Building Blocks

Microservices Based Architecture

certified kubernetes

Top Use Cases

- Access Edge Aggregation Point (Cloud Native RAN + Apps)
- Near Edge (5G dUPF + Apps)
- uCPE/SD-WAN + Apps
- AI/vision inferencing apps with MEC
- Media apps with MEC

Smart Edge Building Blocks

Multi-access Networking	Edge Multi-cluster Orchestration	Edge Aware Service Mesh	Confidential Computing	Edge WAN Overlay
Resource Management	Data Plane CNI	Accelerators	Telemetry and Monitoring	Green Edge

Built on an Open Cloud Native Foundation

Kubernetes | Service Mesh | Telemetry | Helm | Operator Framework

Key Features

- Optimized for Edge KPIs: throughput. determinism, QoS, latency, jitter, security
- Multi-location, Multi-Access, Multi-Cloud
- Delivered via use case specific Reference Architectures for ease of consumption and to accelerate TTM
- Industry Standards (3GPP, CNCF, ORAN, ETSI)

Components of Smart Edge Open

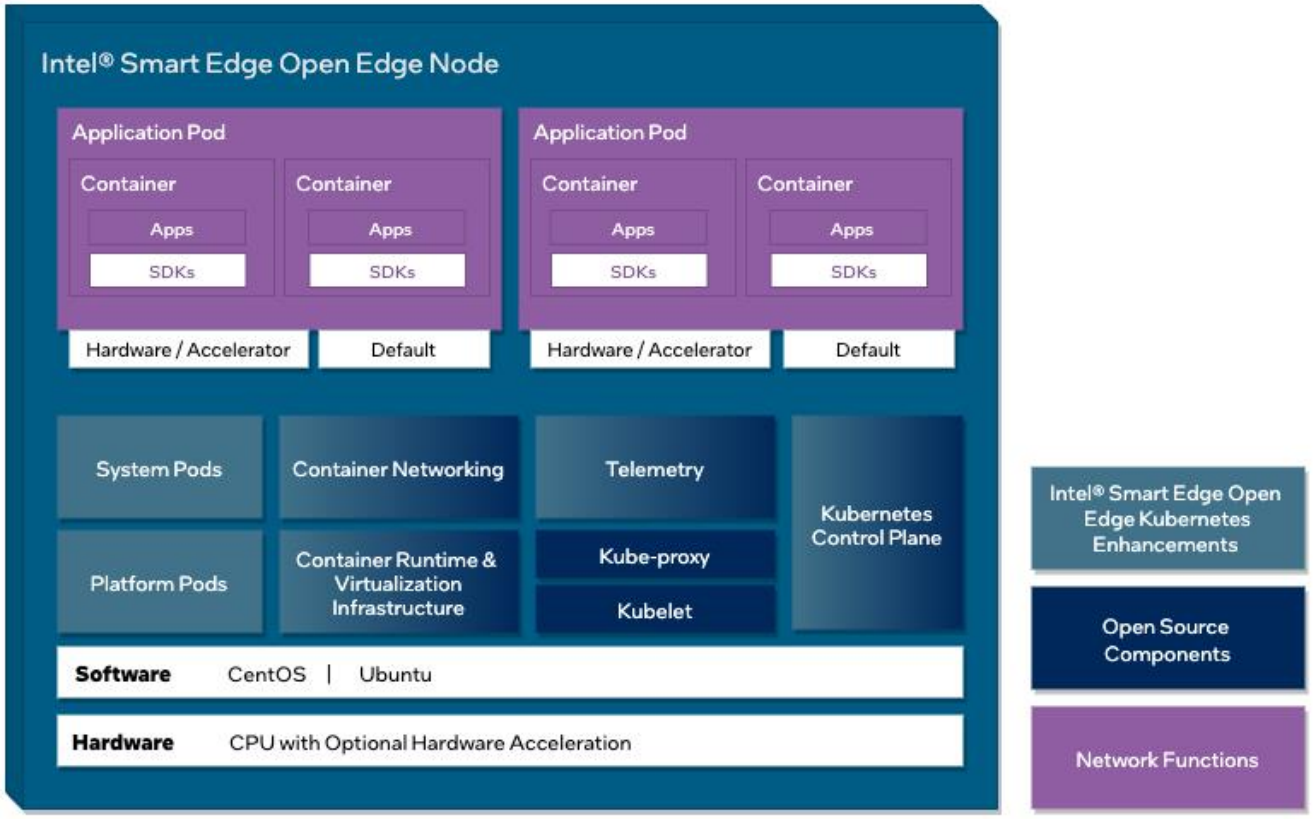
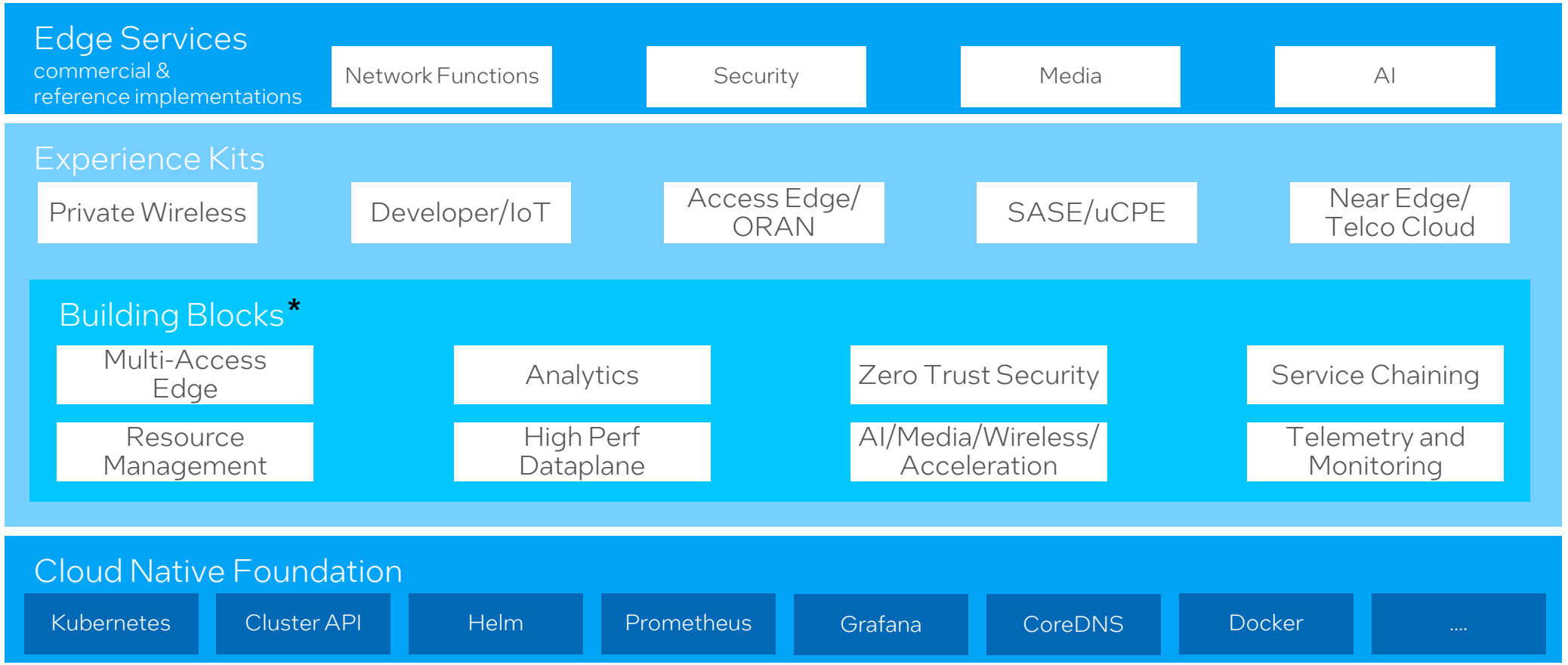


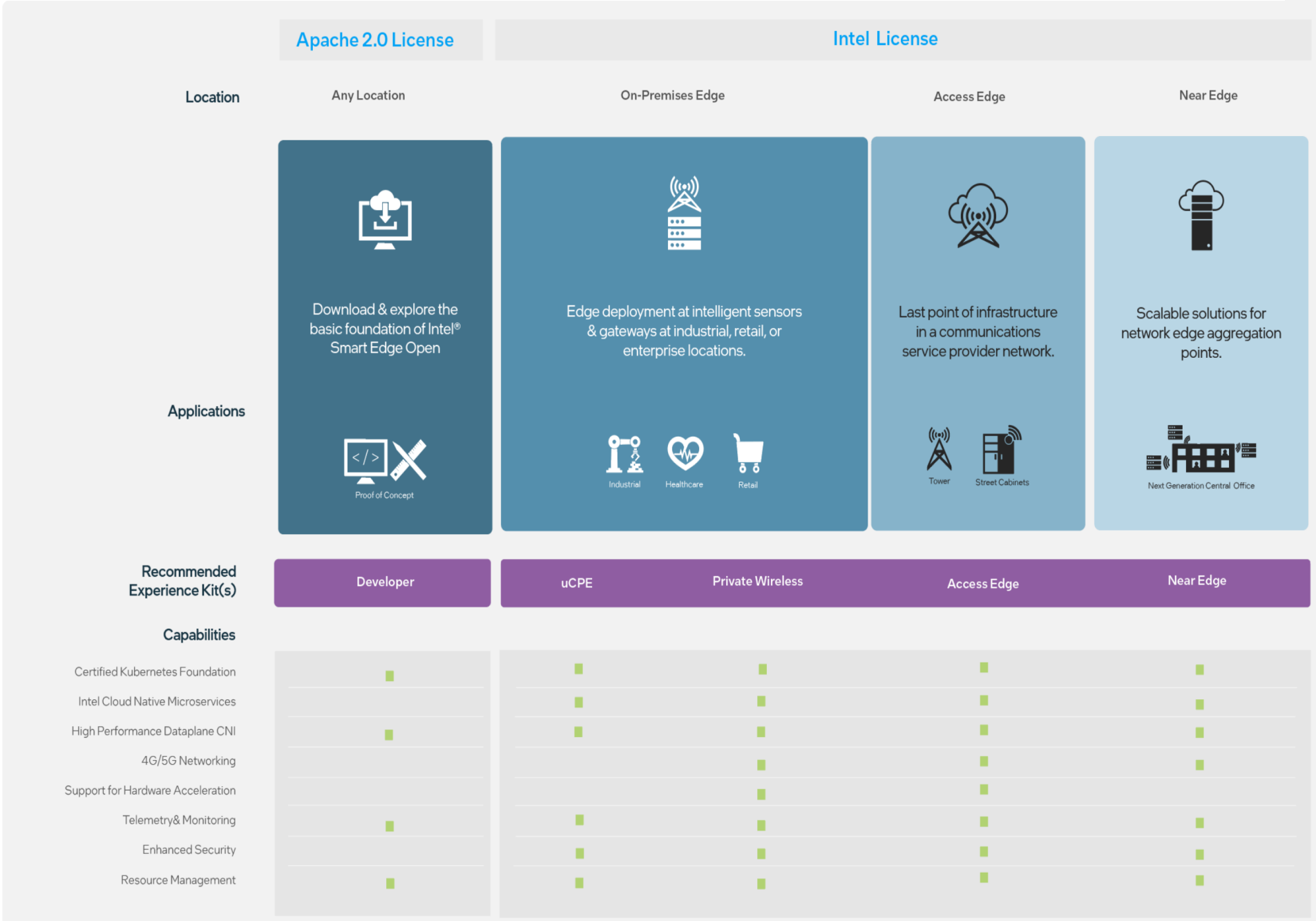
Figure: Internals of Smart Edge Open

- Pre-packaged Kubernetes distribution with customized components for Edge
- Made for open-source collaboration
- On-boards and manages applications with cloud like agility
- Tailored MEC platform for Access, On-prem & Network Edge

Smart Edge Open Building Blocks



Experience Kit Overview



Developer Experience Kit

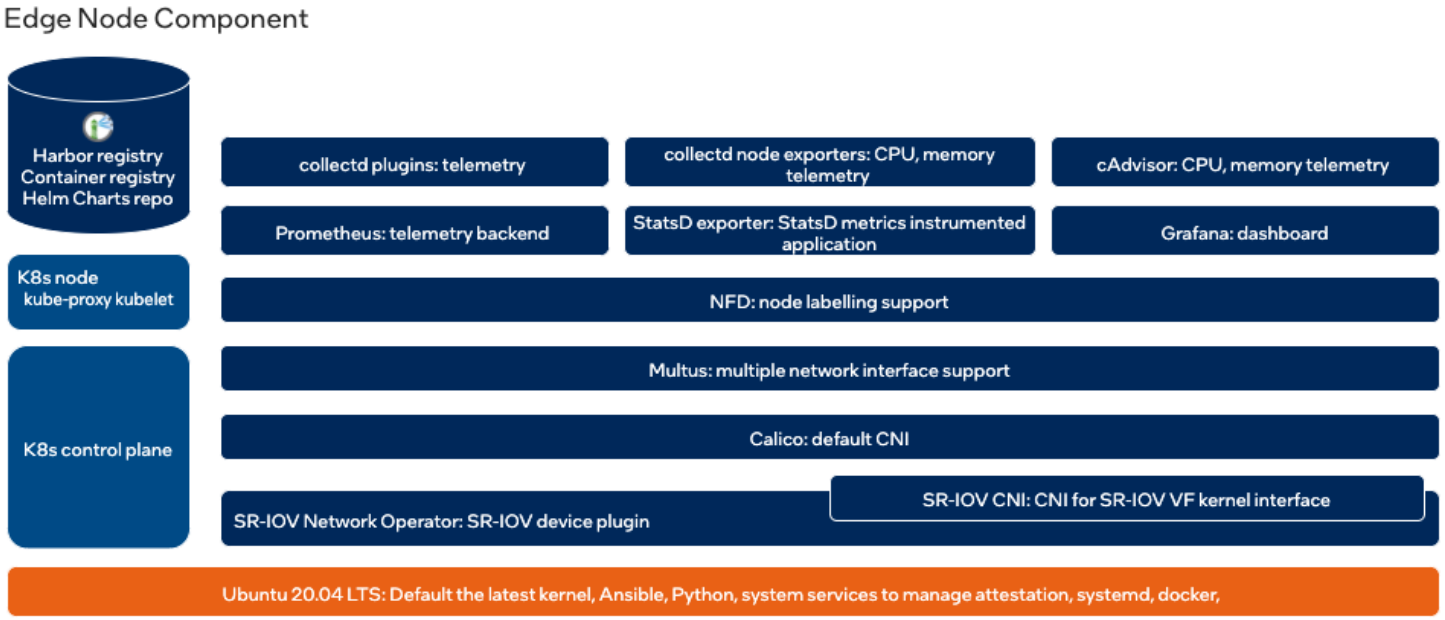


Figure: Developer Experience Kit Components

A basic starting point for Edge Computing on Intel Architecture platforms

Deploys required essentials for services:

- Resource management
- Accelerator support
- Container network interfaces
- Telemetry & monitoring
- Software Development Kits

5G Private Wireless Experience Kit

Cloud native reference architecture for 5G Private Wireless

- Integrated 5G RAN, Core and MEC
- FPGA/eASIC support for Wireless FEC
- OpenVINO AI support

Suitable for private 5G deployments – Factories, offices, Hospitals, etc.

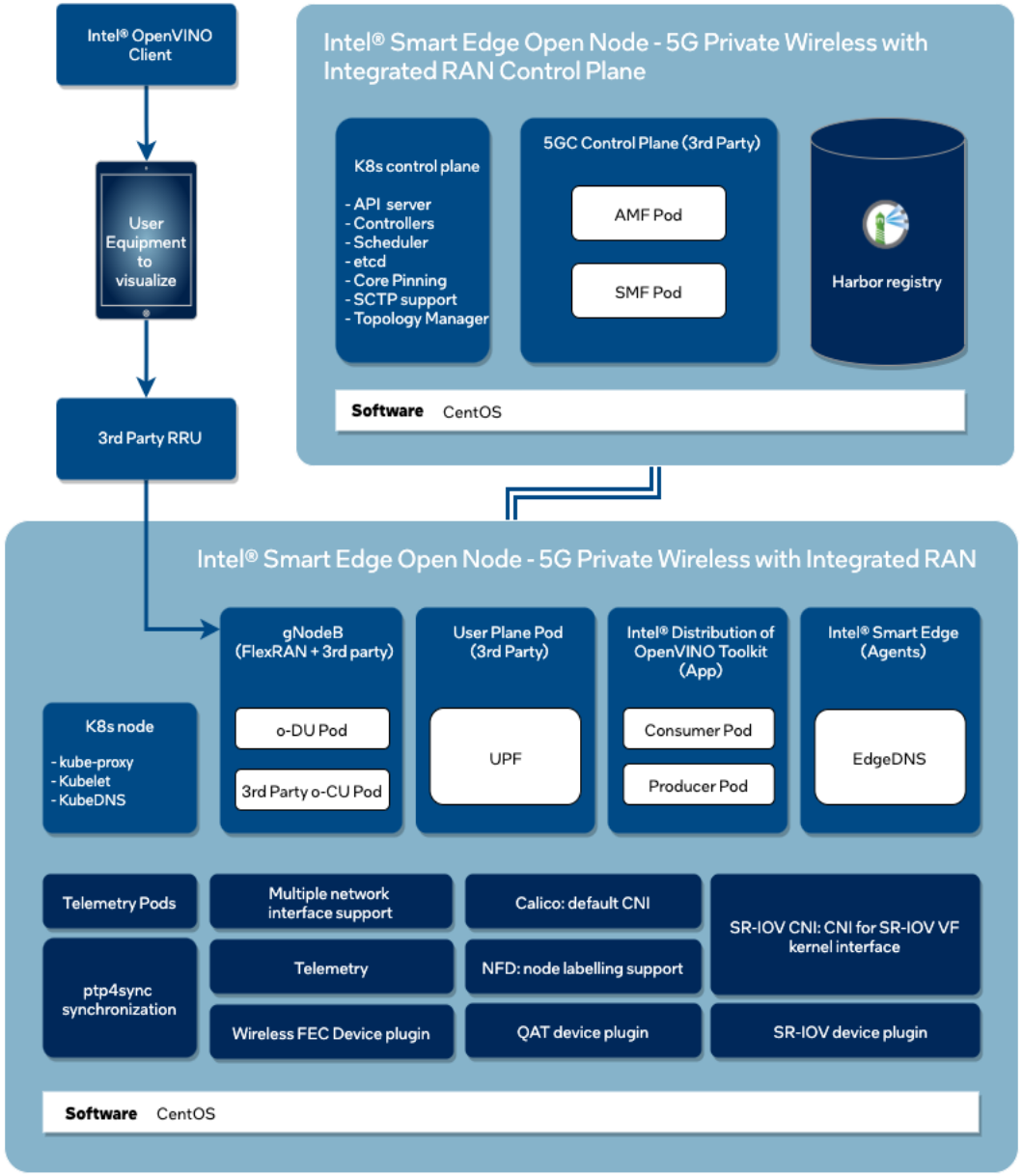
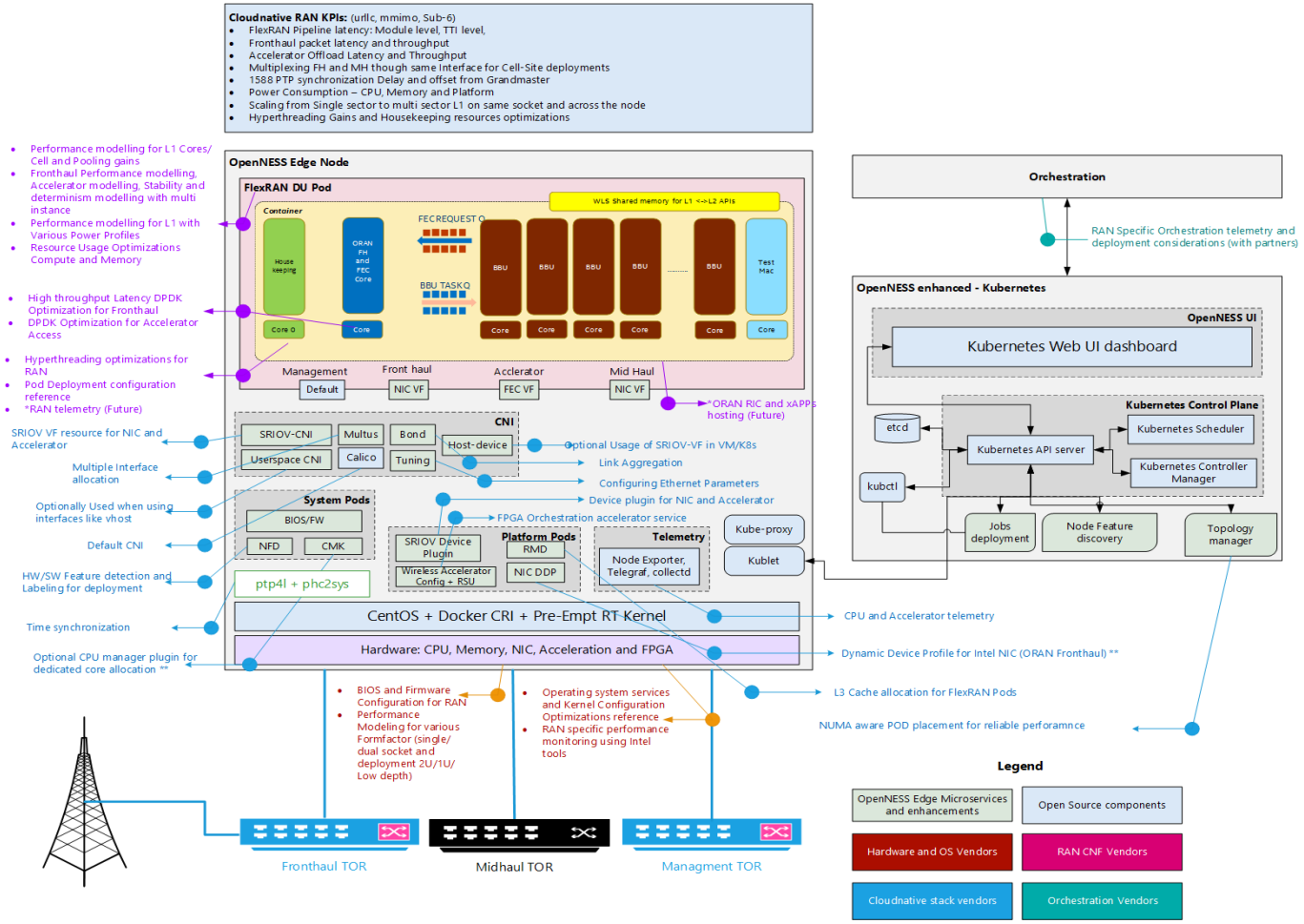


Figure: 5G Private Wireless Experience Kit Architecture

Access Edge Experience Kit



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Notice revision #20110804

Figure: O-RAN DU Deployment Architecture

- Cloud native reference architecture for O-RAN DU
- Uses FlexRAN as reference for 4G/5G base stations
- FlexRAN offers high-density baseband pooling that could run on a distributed Telco* cloud to provide a smart indoor coverage solution and next-generation fronthaul architecture
- Support for determinism (IO, Platform, Acceleration, Orchestration)

Reference Implementations

- Wireless Network Ready Intelligent Traffic Management
- Wireless Network Ready PCB defect detection
- Telehealth Remote monitoring
- Network Optimization and AI inferencing for Telepathology
- Smart VR – Live Streaming of Immersive Media

* https://www.intel.com/content/www/us/en/edge-computing/edge-software-hub.html

TelePathology RI

Problem Statement

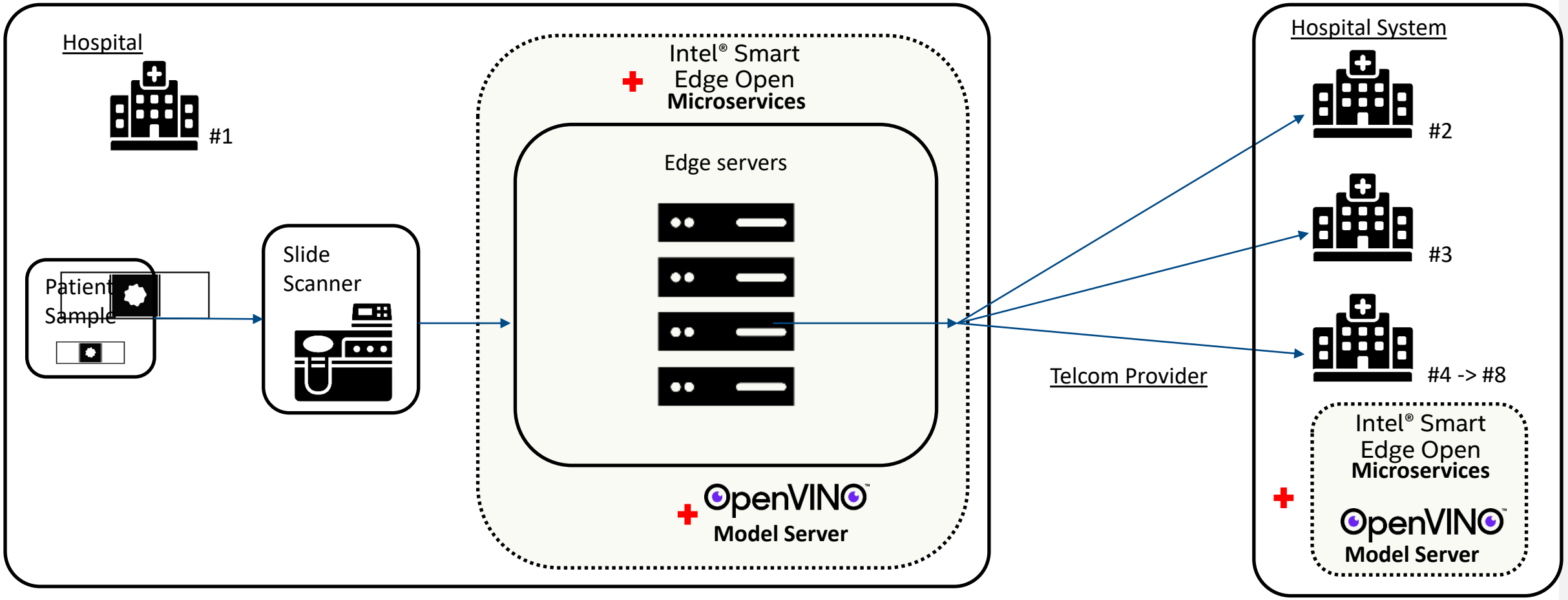
- There is a global trend towards less practicing pathologists* while cancer cases are projected to increase over the next decade**. The volume of work itself is challenging and is made worse by a disproportionate ability to easily and efficiently share images. This introduces latency in the process as well as risk of physical loss of the sample itself.
- Another challenge is sample scans can produce 60-80GB files (uncompressed), which demand efficient edge inferencing to enable data sharing and data reduction.

Description

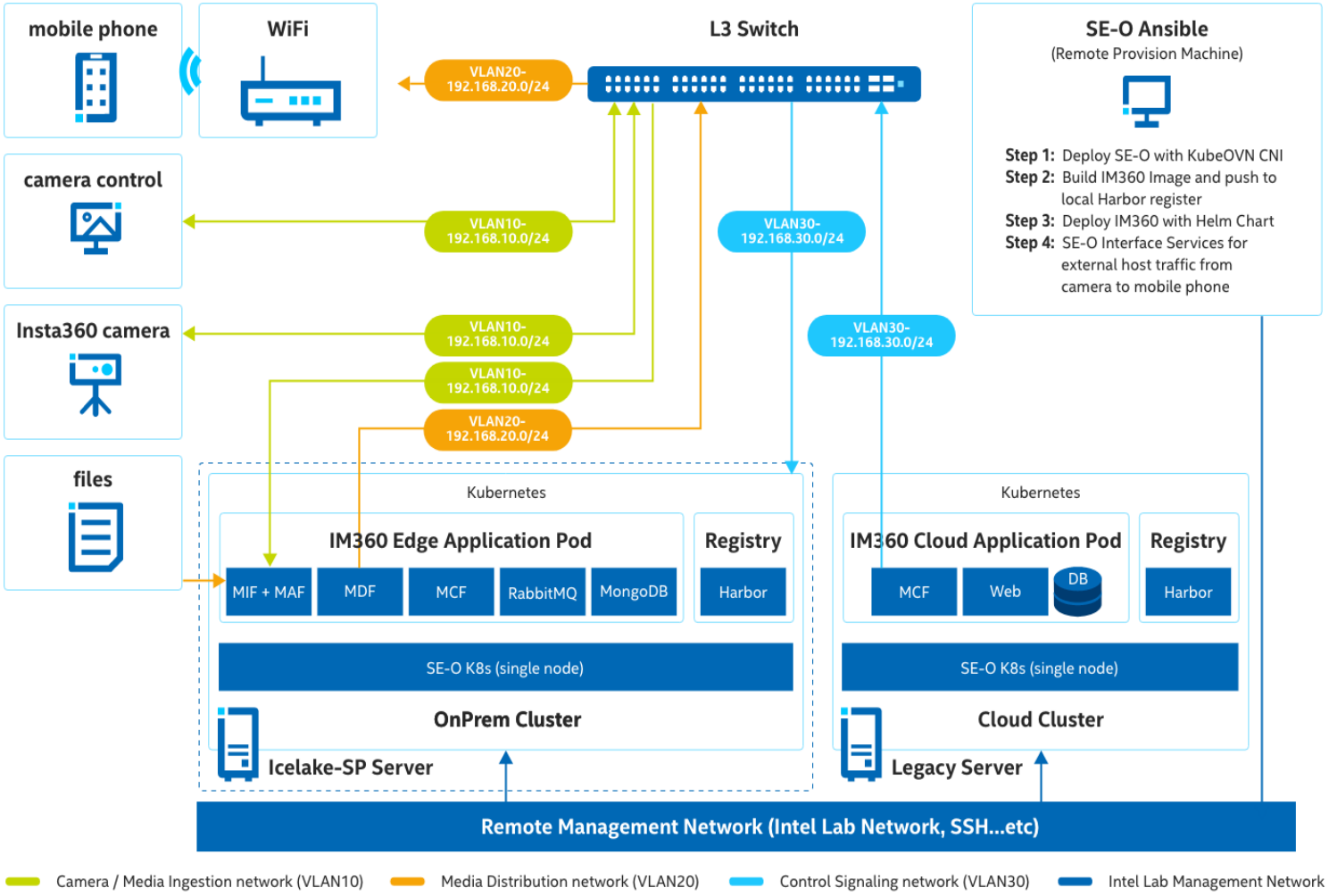
- We want to showcase a hardware and software architecture which optimizes inferencing algorithms applied to digital pathology compute workloads and enables telepathology with a networking optimization framework which provides various microservices.

*https://pubmed.ncbi.nlm.nih.gov/23738764/
**https://publications.iarc.fr/Non-Series-Publications/World-Cancer-Reports/World-Cancer-Report-2014
***https://www.archivesofpathology.org/doi/pdf/10.5858/arpa.2014-0606-RA

Telepathology Reference solution



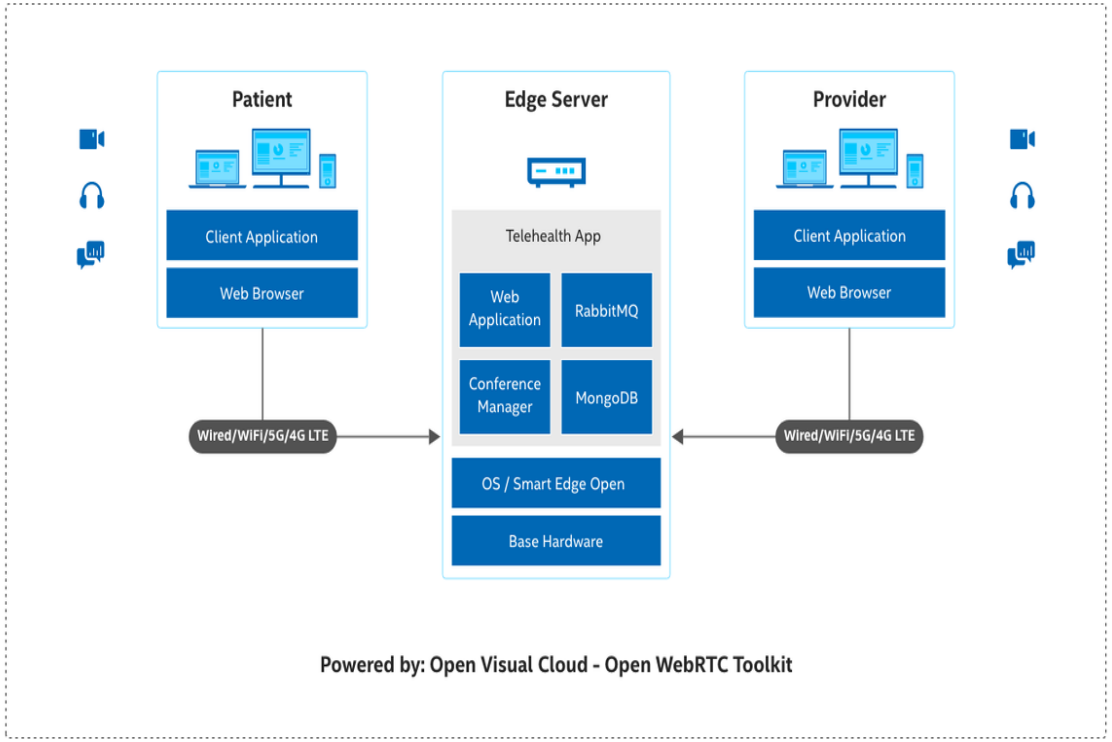
Immersive Media RI



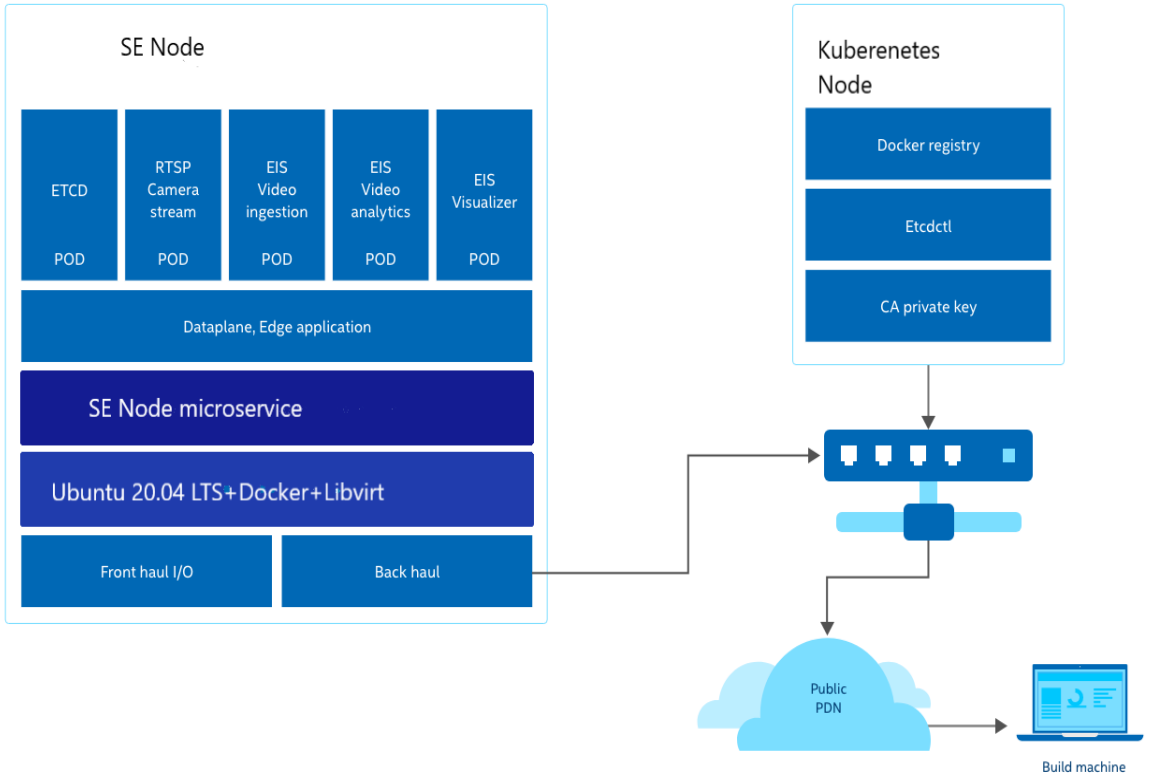
- Smart VR solution leveraging edge platforms for media ingestion from multiple streams, media processing (360 view construction, 360 frames analytics), and interactive media distribution based on Field of View (FoV) request.

Telehealth Remote Monitoring RI

- Containerized telehealth application design providing a real-time audio-visual framework leveraging Intel® Collaboration Suite for WebRTC (Intel® CS for WebRTC)
- Communication is provided through video, chat, and screen sharing.



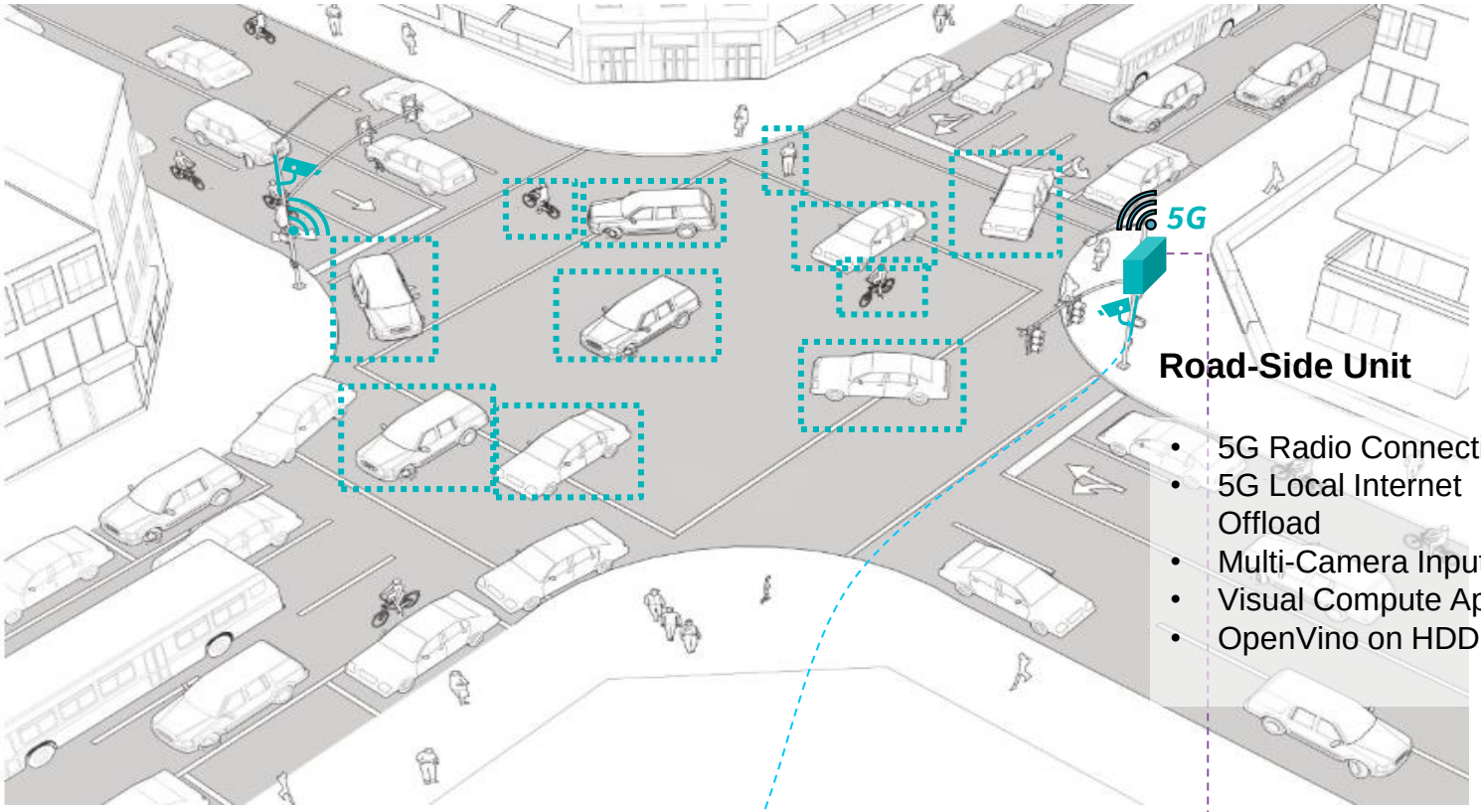
PCB Defect Detection RI



- Helps deploy a solution for Printed Circuit Board (PCB) defect detection using AI for product quality checks and enabled by Intel Edge insights for Industrial (EII) and SEO-DEK platform.
- Supports two types of defect detection: missing components and short circuits due to solder bridge formed during the assembly process.

5G Smart Road-Side Infrastructure Platform

Foundation Kit for Visual Compute + 5G Smart Road-Side Infrastructure



Road-Side Unit

- 5G Radio Connectivity
- 5G Local Internet Offload
- Multi-Camera Input
- Visual Compute App
- OpenVino on HDDL-R

Central Cloud

- RSU Management
- App Orchestration
- 5G NGC Control-Plane

Visual Compute App Dashboard

Road-Side Unit (RSU)

- Hardware Foundation Kit based on Intel Hardware Platform Single-Socket, Xeon D, Xeon SP
- The RSU Software Platform integrates Capgemini Engineering ENSCONCE Edge PaaS
- The RSU Software Platform will have integrated support for Intel OpenVino
- Intel HDDL-R accelerator based VPU Offload for Intel OpenVino Apps
- Intel PAC N3000 FPGA for 5G Layer-1 offload
- The RSU can also provide 5G Connectivity supported through Capgemini Engineering 5G gNodeB L2/3 and Intel FlexRAN L1/FPGA
- Capgemini Engineering 5G NGC UPF for local data offload

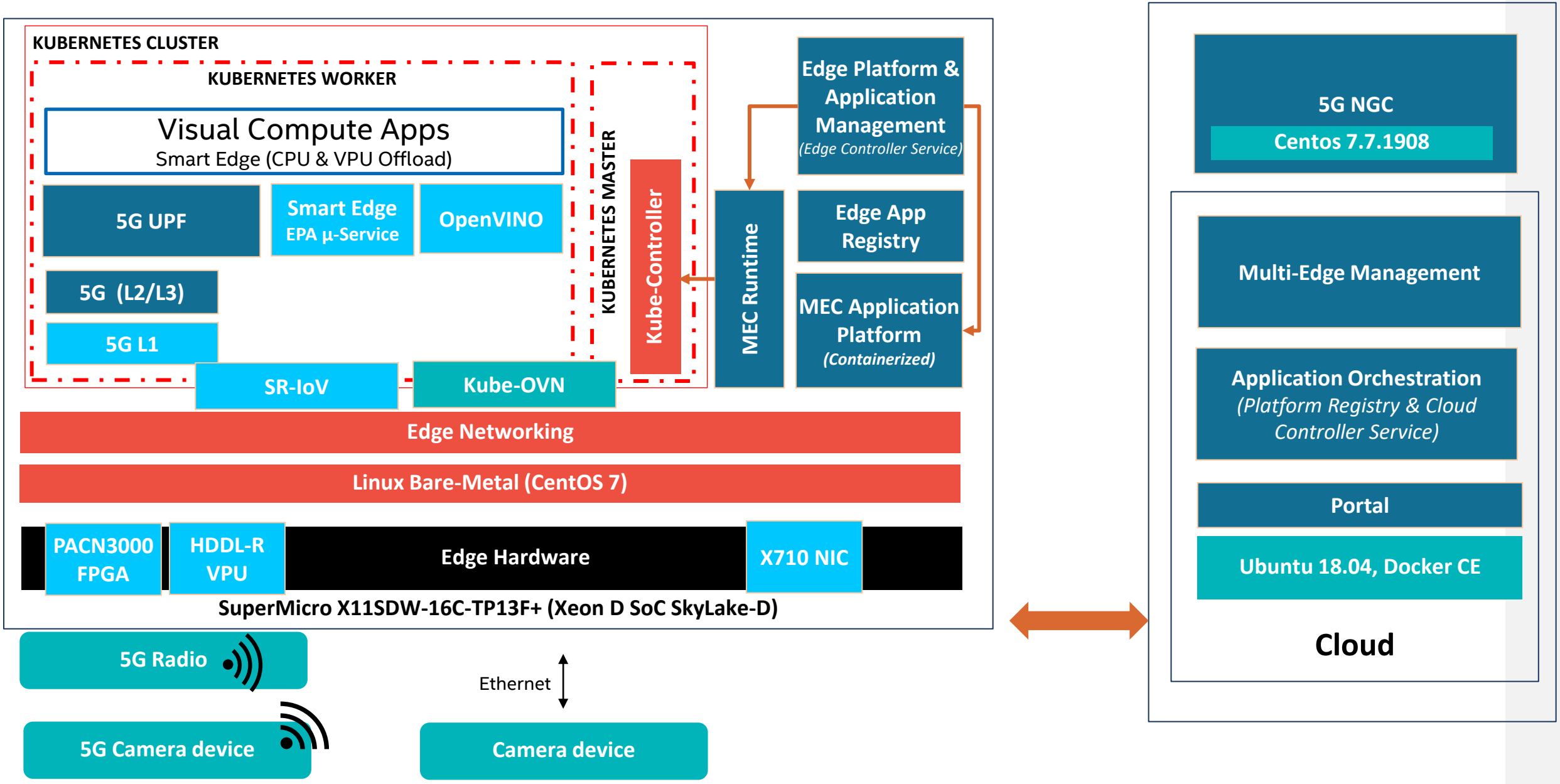
Central Cloud

- The Central Cloud would consist of CapGemini ENSCONCE Cloud PaaS (Platform as a Service)
- ENSCONCE Customer Portal
- Capgemini Engineering 5G NGC

Edge- Applications

- Run Visual Compute Inference Applications using Intel OpenVINO and HDDL-R Accelerators
- Stream Traffic Meta-Data for V2X Applications

5G SMART CONNECTED PLATFORM : ARCHITECTURE



Enabling Various Service Models

- Simplified application on-boarding
- Ability to utilize AI & Accelerator toolkits
- Network policies, Edge DNS Data Security
- Edge Application API support

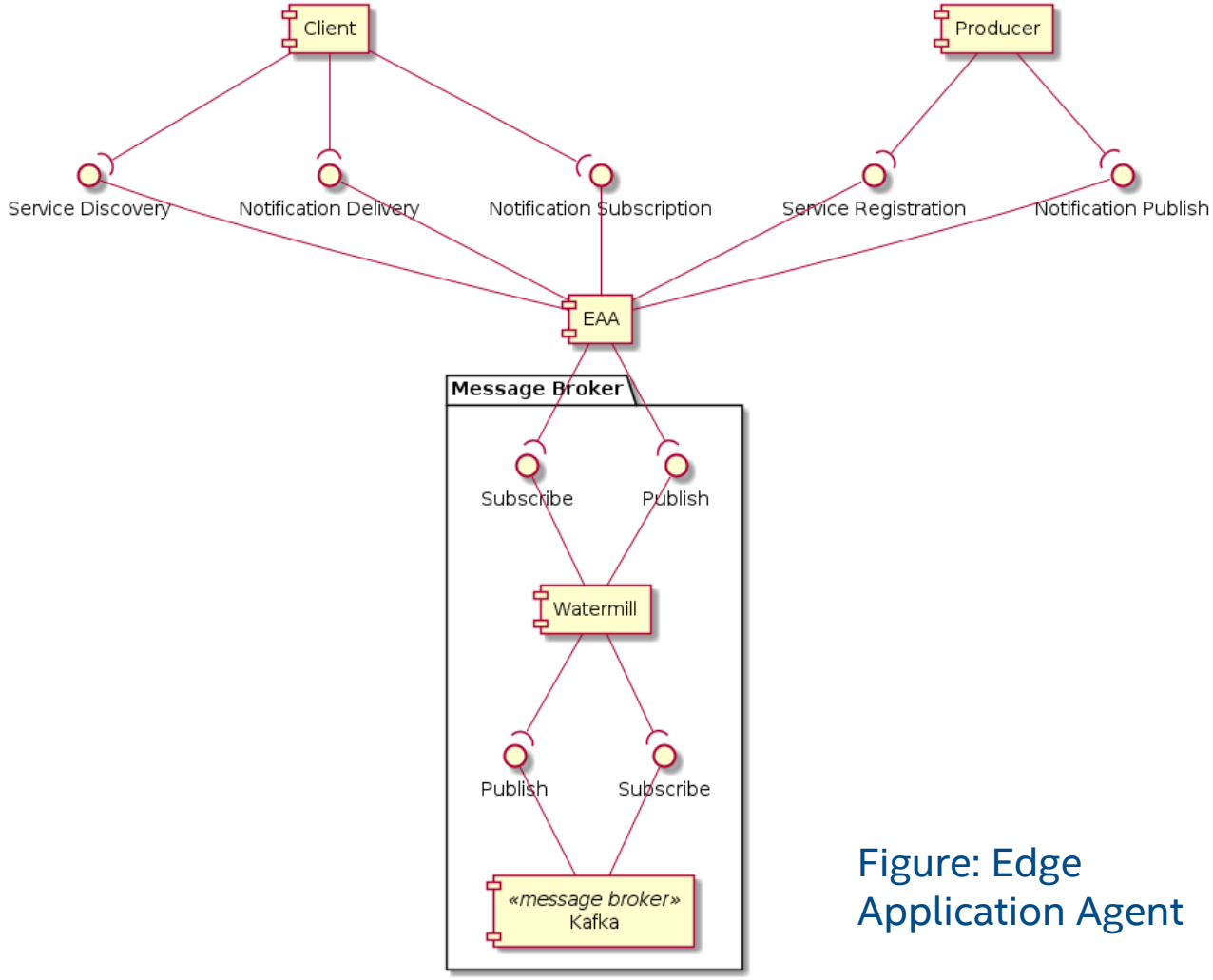
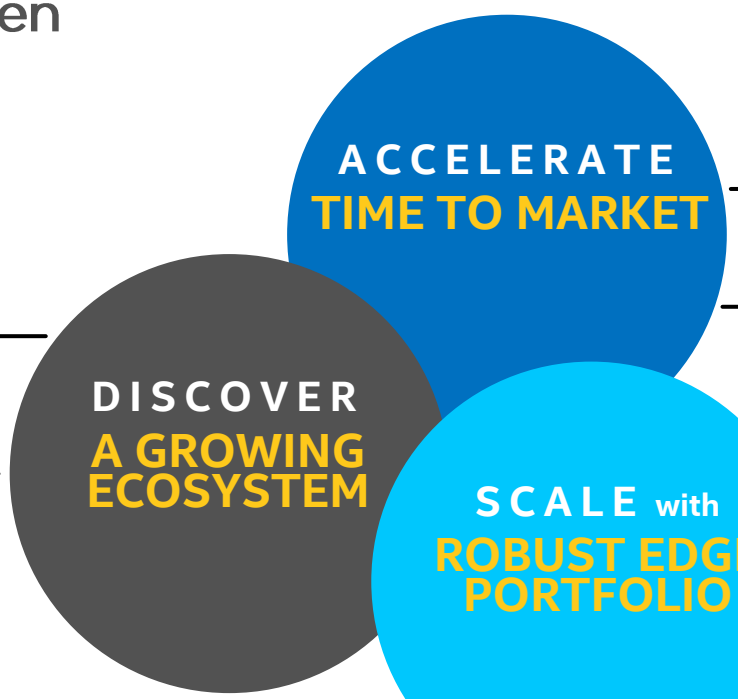


Figure: Edge Application Agent

A Portal for Commercial Edge Apps

A One-Stop Shop for Commercial Edge Applications Optimized for

Intel® Smart Edge Open & Intel® Smart Edge



Benefit from Intel's vast ecosystem that is edge ready now

Vertical and function specific apps spanning a rich set of use cases

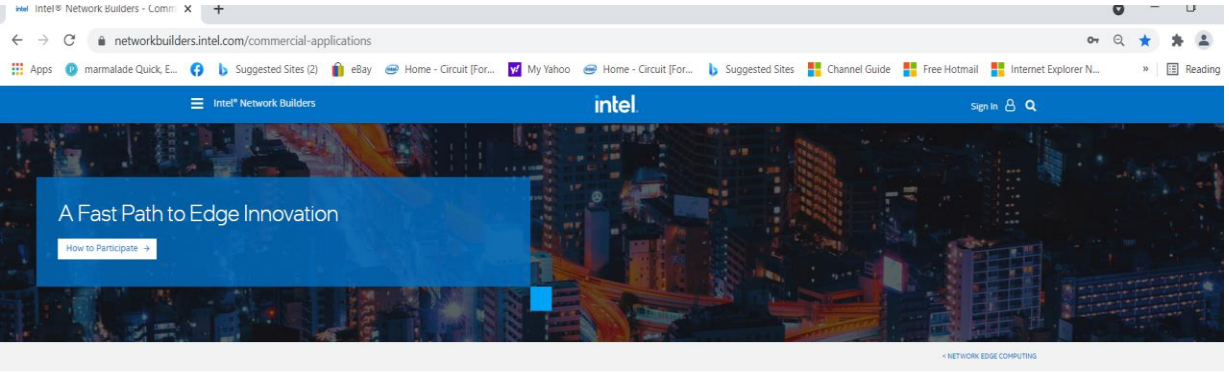
Deployment-ready, commercial applications

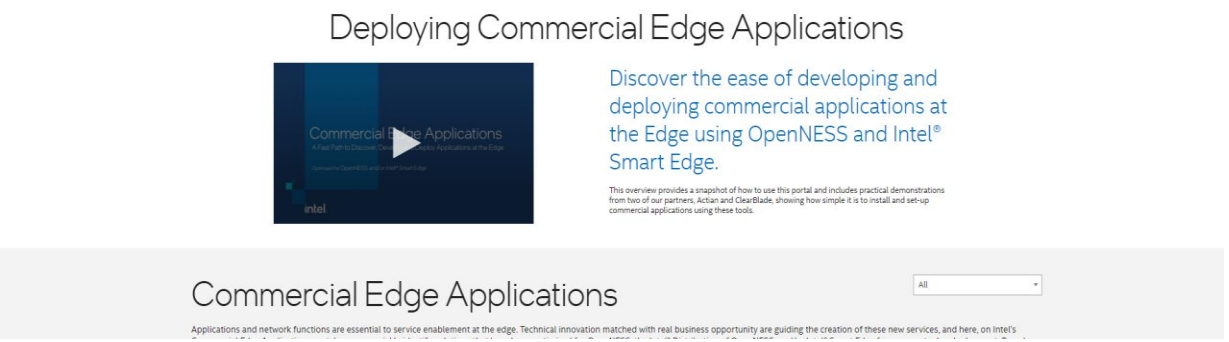
Innovate jointly with Intel and benefit from our partner enablement programs

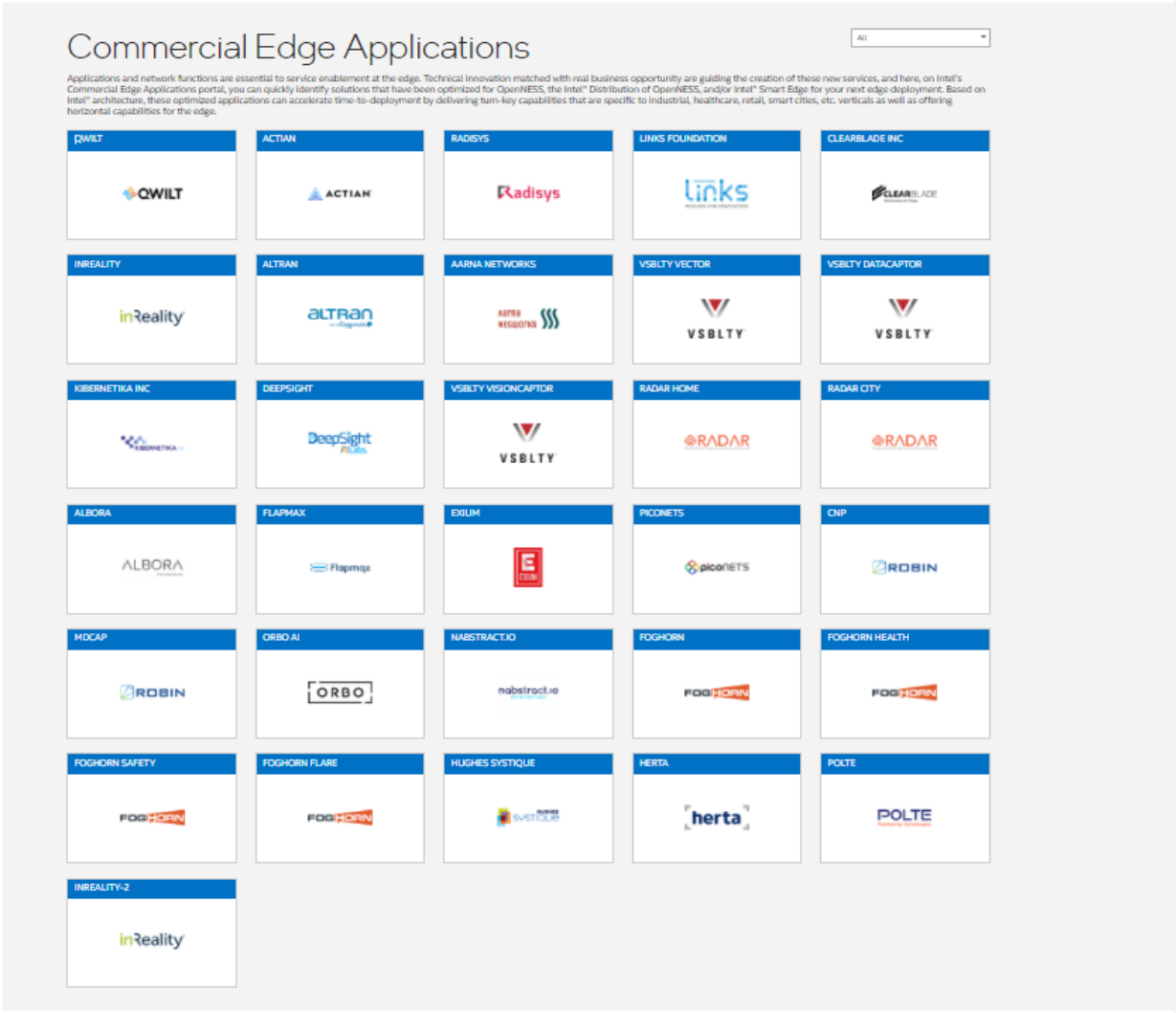
Complementary and interoperable Intel & ecosystem offerings

Benefit from Intel's investments in hw/sw optimizations to hit edge KPIs

Commercial Apps Portal







https://networkbuilders.intel.com/commercial-applications

What Can You Do?

- What are your use cases?
- Try out Smart Edge – Open Platform
- Expand on existing use cases
- Participation in Standards, Industry Consortia, Open-source software
- Open Collaboration

Q&A