Intelligent Orchestration and Management of 5G Edge Services

Amdocs Orchestration Based on Intel® Smart Edge Open

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- No product or component can be absolutely secure.
- Your costs and results may vary.
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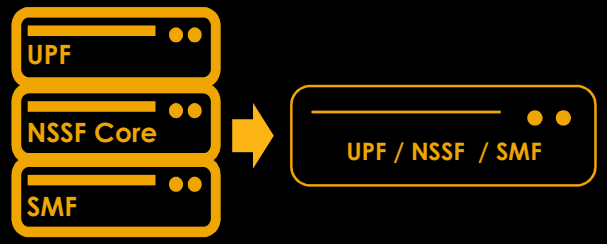
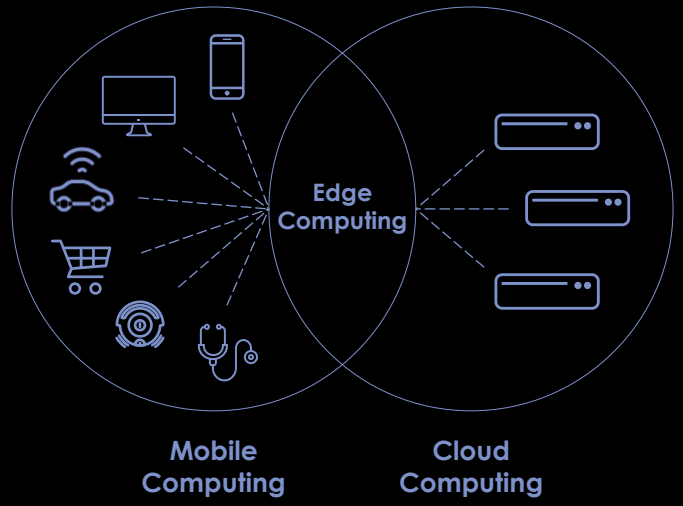
New programmable 5G networks

Open, Virtualized & Elastic



Scalable and dynamic network, with virtualization across all network domains and into the enterprise perimeter

Edge & Network Cloudification



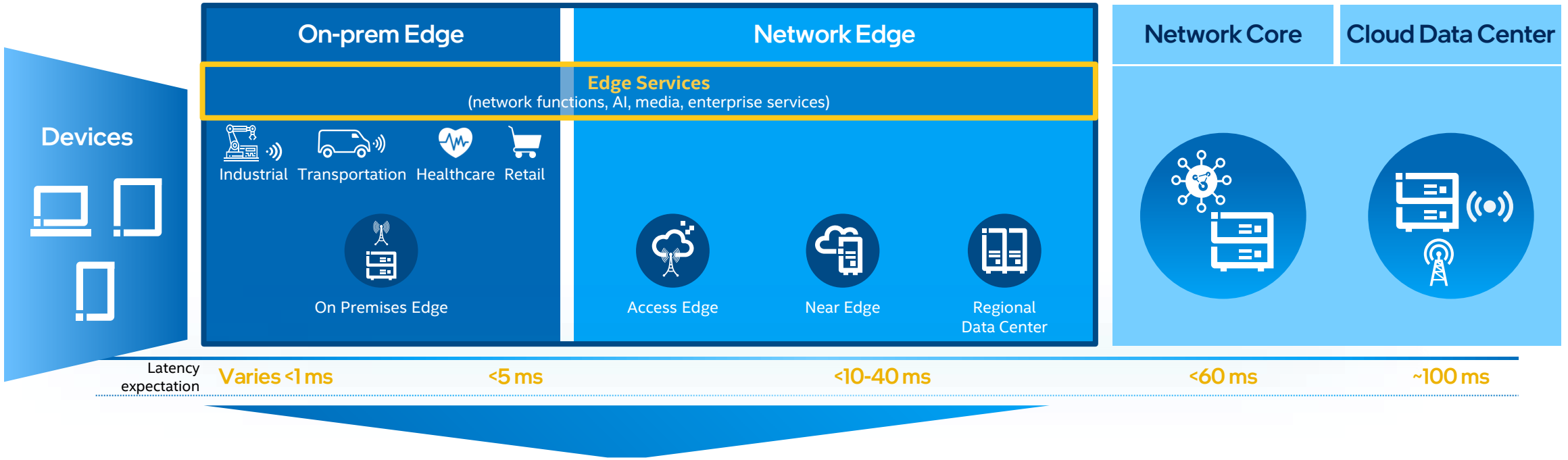
Connected compute, storage and applications placed optimally to address business / user needs

Prioritizable / Intelligent / 5G Slicing

Configurable network to address disparate demands - latency, throughput, reliability, security

Will interoperate and co-exist with current / legacy networks ➔ Hybrid networks

Delivering 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
- Edge hardware platform

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

Common Framework to Address Different Verticals

EDGE END TO END EDGE ARCHITECTURAL FOUNDATION: INTER-OPERABLE, OPEN & SELF MANAGED

END USERS & DEVICE LOCATION + TRANSPORT TYPE

- STREET USERS

Telco Edge

- VEHICLES
- STREET CAMERAS
- STREET SENSORS
- …

IOT Edge

- RETAIL SHOPS
- PUBLIC LOCATIONS (I.E: LIBRARIES)
- PRIVATE ENTERPRISE
- …

Enterprise Edge

INFRASTRUCTURE (5G/LTE, Wireless, Lora, Wired …)

MULTI-SERVICE (NFV & NON-NFV) COMMON SERVICE TAXONOMY

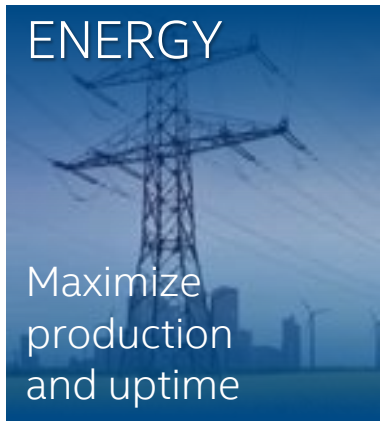
NFV	Internet of Things	Autonomous	AR/VR & Gaming	Data caching & Storage GW
Flexible NFV De-Centralized Ran vEPC, UPF **Resources:** CPUs, storage, **FPGAs , pNIC/sNIC** **Latency:** To be analyzed	IoT devices in many fields such as factory automation, process automation, smart grids, V2V **Resources:** Communication, CPUs, storage, **Movidius, SPH** **Latency:** Factory automation : 0.25ms to 10ms Smart grids: 3-20ms / Process automation: 50-100ms	Assist in autonomous driving **Examples:** overtaking systems, V2V comm, navigation **Resources:** CPUs, storage, **Mobileye, SPH** **Latency:** Ideally <20ms, up to 100 ms	Process images (image recognition) from devices, wearables and annotate useful information **Examples:** Google glass **Resources:** CPUs, **FPGAs, ATS** **Latency:** seamless - <20 ms , sensitive- <25ms Tolerable 50-100ms	Cache data at the edge for faster loading at user end Using Edge as main storage for the devices **Examples:** cache popular videos in a region, Netflix **Resources:** Storage, CPUs **Latency:** Not latency bound
Video/Video Analytics	**FaaS**	**Speech Recognition**	**Medical Applications**	**Enterprise**
Live video analytics and video pre-processing, video transcoding **Examples:** Traffic video analysis and alarm systems **Resources:** CPUs, **FPGAs**, storage, **ATS, SPH for Inference?** **Latency:** To be analyzed	Perform web page related pre-processing at the edge and send page to user device **Examples:** web page rendering, ad block, content evaluation **Resources:** CPUs, **FPGAs**, **Latency:** Not slower than current web page load times	Speech-to-text, User commands, Biometric Recognition **Resources:** Communication, CPUs, **GNA-s, FPGA, SPH** **Latency:** To be analyzed	Assist medical appliances through connectivity and analysis **Examples:** Tele surgery **Resources:** CPUs, Communication, storage, **ATS, SPH** **Latency:** Tele surgery <150ms without haptic, <10ms with haptic feedback	IMBD, Specific Enterprise WL (i.e: Linked In) **Resources:** CPUs, Communication, storage, **FPGA** **Latency:** <10 ms

MULTI-TIER COMMON HW EDGE TAXONOMY

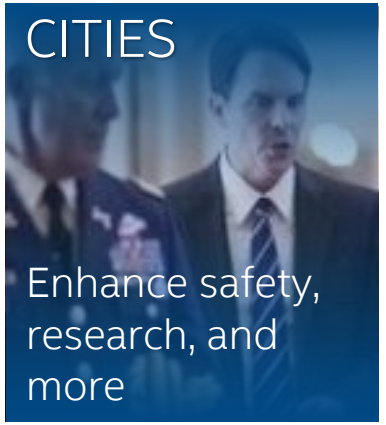
ON-PREM / FAR EDGE — **FAR EDGE** — **NEAR EDGE** — **DATA CENTER EDGE**

Use cases

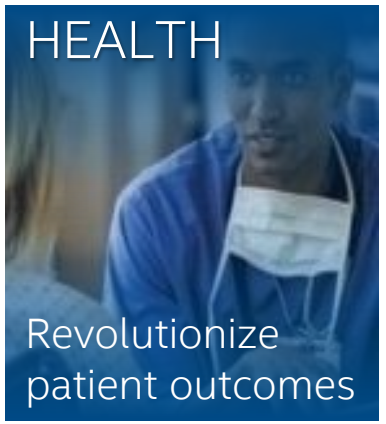

EMERGENCY RESPONSE
Real-time emergency and crime response


ENERGY
Maximize production and uptime

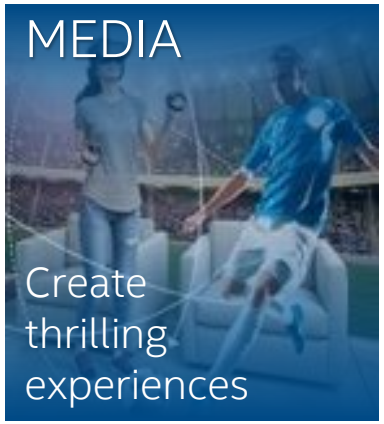

EDUCATION
Transform the learning experience

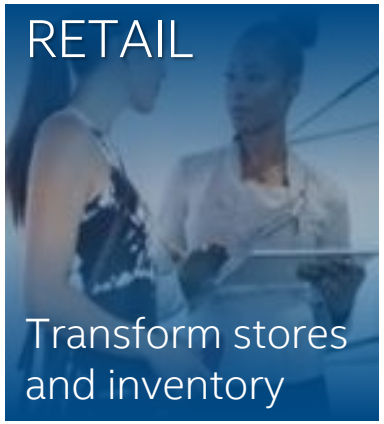

CITIES
Enhance safety, research, and more

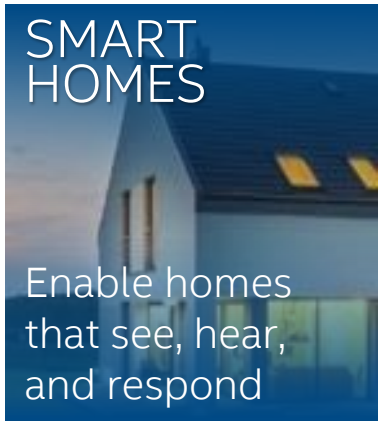

FINANCE
Turn data into valuable intelligence

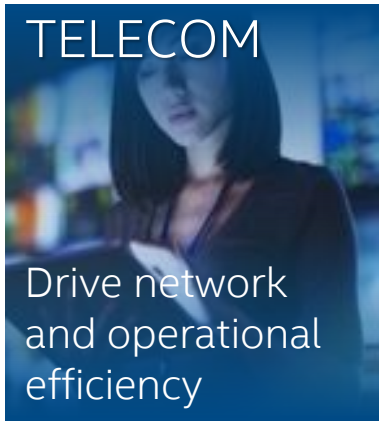

HEALTH
Revolutionize patient outcomes


INDUSTRIAL
Empower truly intelligent Industry 4.0


MEDIA
Create thrilling experiences


RETAIL
Transform stores and inventory


SMART HOMES
Enable homes that see, hear, and respond

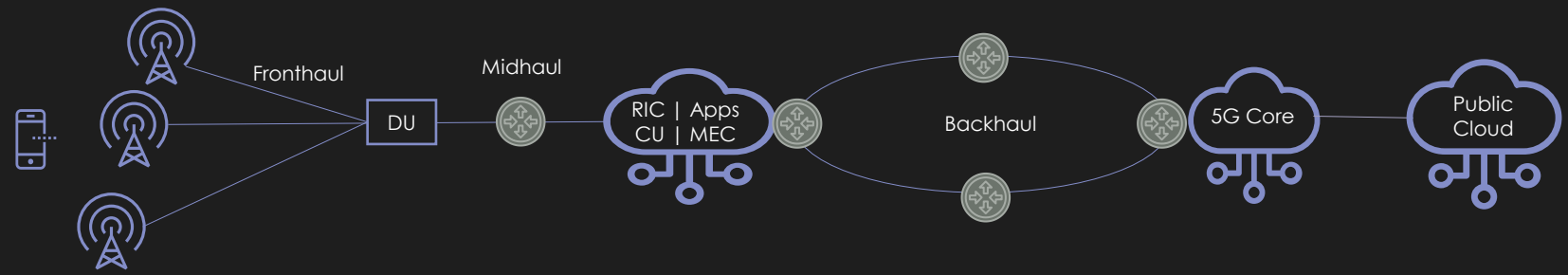

TELECOM
Drive network and operational efficiency


SMART CITIES
Efficient and robust traffic systems

New capabilities needed in OSS & network management

DESIGN, LAUNCH & ORCHESTRATE → **OPERATE, ASSURE & MONETIZE**

Business-driven **Service Design**	On-demand, Adaptive, Contextual **Orchestration**	Real-time Active & Federated **Inventory**	Policy & AI/ML Driven Closed-loop **Assurance**
Unified service design and orchestration for services that are enabled by **stitching together** various relevant network functions and applications		Federated inventory to have a comprehensive view of the **many more 'moving pieces'** in the network now	Advanced assurance to proactively recognize & automatically address service impacts of issues in the **'mosaic' of interconnected** network functions



- **Hybrid networks -** fixed & mobile (FMC); physical, virtual (NFV/SDN) & cloud; 4G & 5G (C-RAN, MEC, UP-CP separation); spanning edge + core + data-center
- **QoS** capable, to address specific performance demands
- **Open & multi-vendor**, plus **more elements** than before
- **Programmable** network with **frequent changes**

Amdocs provides advanced 5G management solutions

5G Slice Manager

End-to-end service lifecycle management for slice-based services

- Slice design
- Slice automation & orchestration
- Slice operation & management

5G Edge Orchestration

Network functions placement and optimization

- Analysis of real-time information of available resources
- Action / instantiation of resources at edge locations

5G Network Inventory

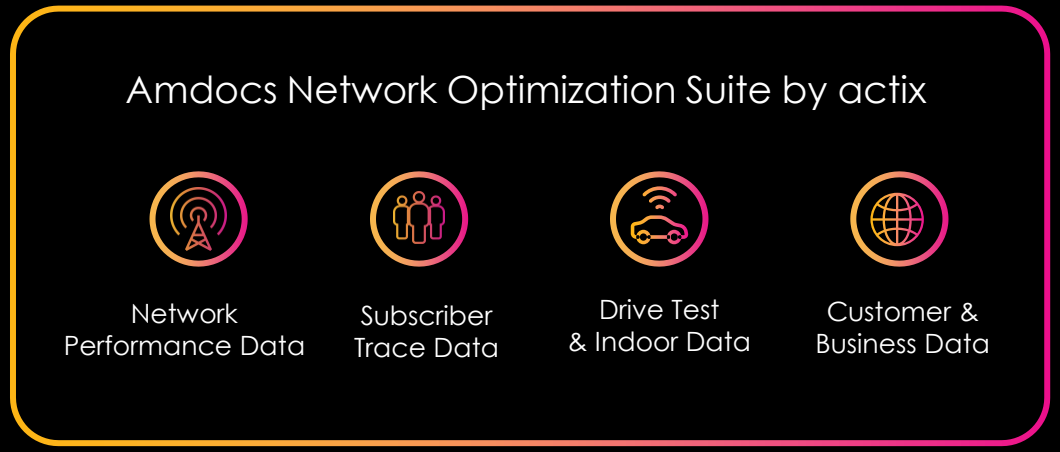
Single reference for network inventory covering all domains

- Accurate view of hybrid services, edge DC resources, MBH, xNFs and Slices
- Common data visualization & federation

5G Service Assurance

Real-time closed-loop operations, self-healing and scaling

- Rich data sources
- Based on AI/ML & analytics
- Guided through to zero-touch operations



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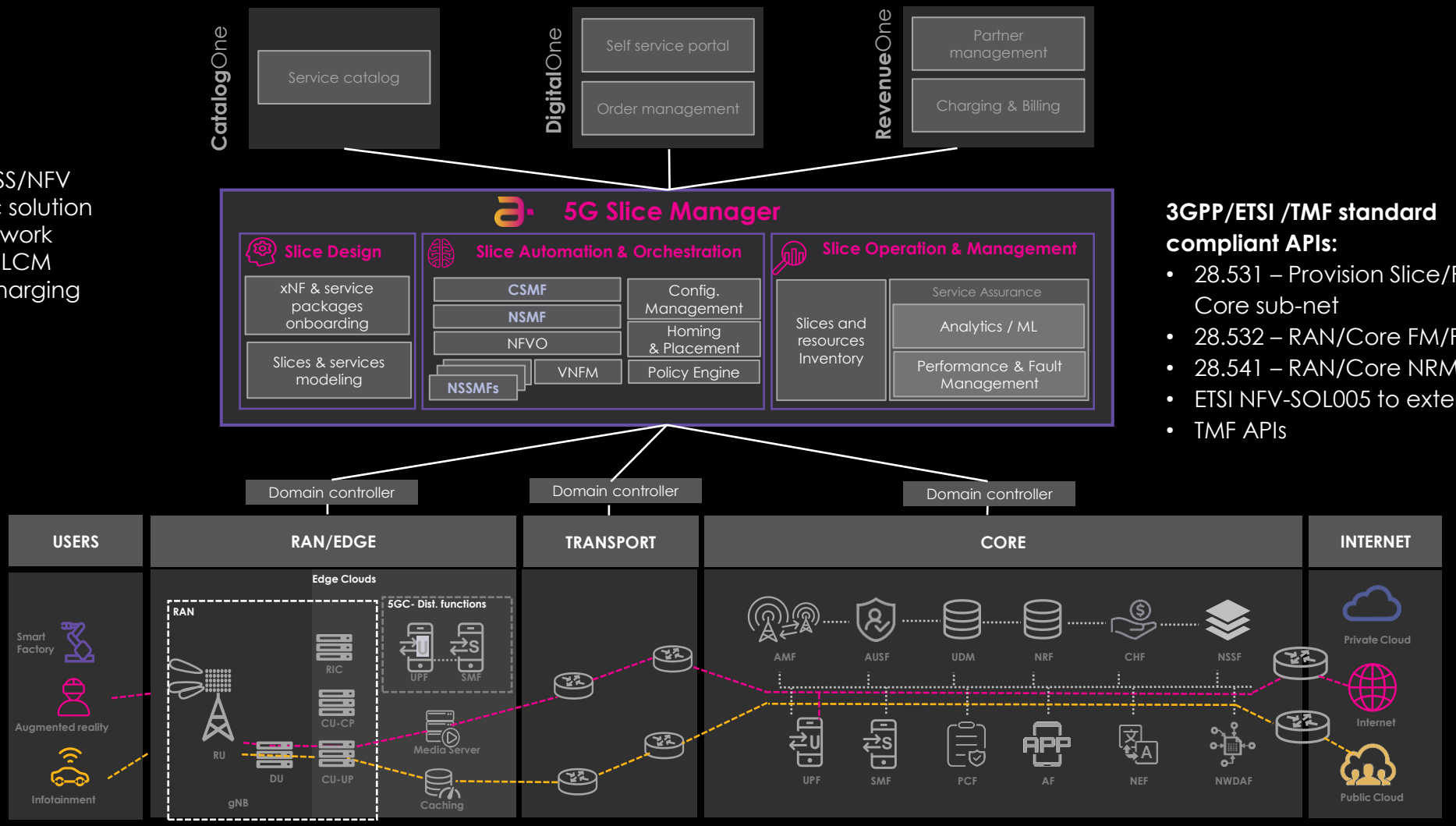
E2E 5G NS lifecycle management

VERTICAL INTEGRATION

BSS/OSS/NFV holistic solution for network slicing LCM and charging

HORIZONTAL INTEGRATION

NEP independent cross domain (RAN, Transport and Core) orchestration

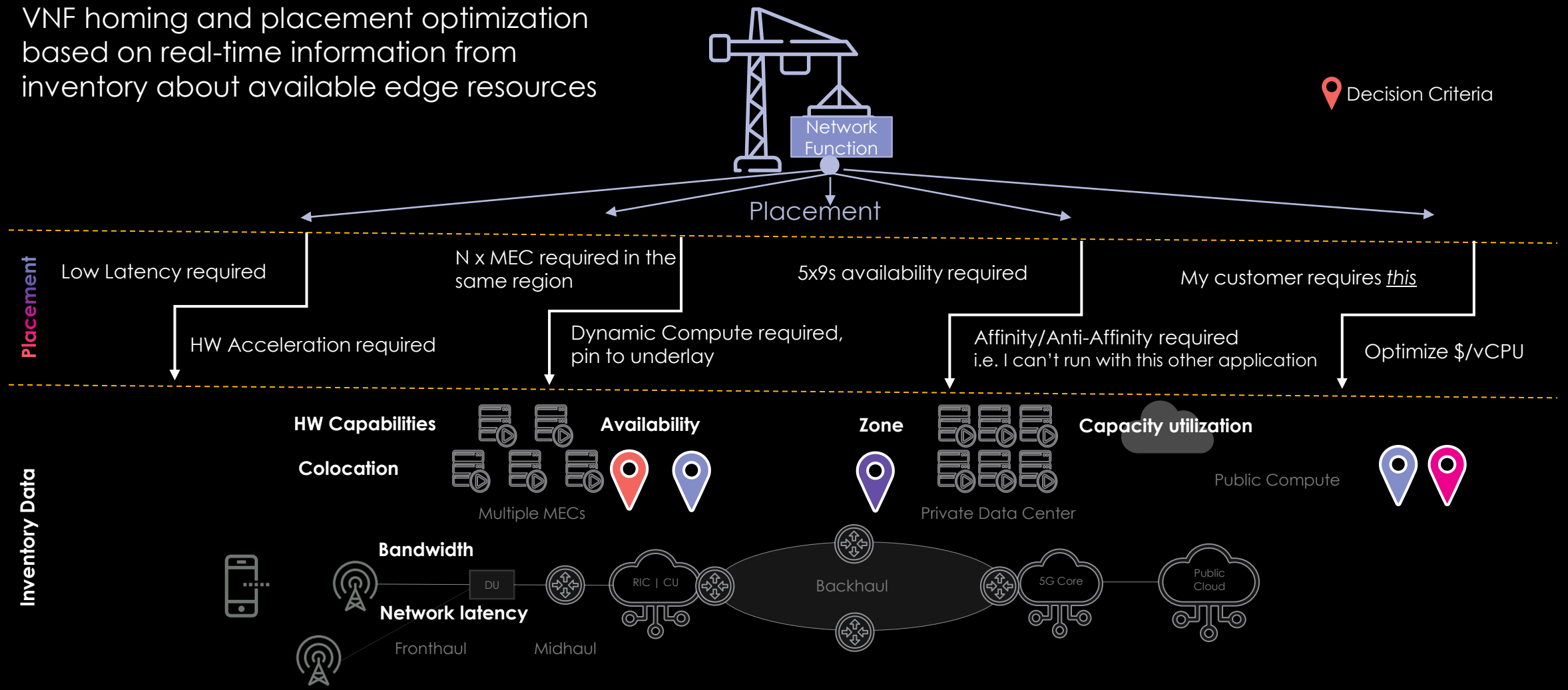


3GPP/ETSI /TMF standard compliant APIs:

- 28.531 – Provision Slice/RAN/ Core sub-net
- 28.532 – RAN/Core FM/PM
- 28.541 – RAN/Core NRM
- ETSI NFV-SOL005 to external NFVO
- TMF APIs

Edge Computing Use-case

VNF homing and placement optimization based on real-time information from inventory about available edge resources



A vibrant ecosystem for building applications, services, and use cases for edge and 5G

5G OPEN INNOVATION LAB

Image & sensors data capture

Microsoft

AR based Remote equipment maintenance

TAQTILE

Safety & Security Video surveillance

MEGH COMPUTING

PEN & EDGE

T··Mobile

innov8.ag EMPOWERING GROWERS WITH DATA

amdocs

AI/ML App

Azure

Internet

- 4G/5G Private Network, with WiFi and FWA
- AI/ML Cloud apps for soil moisture, nutrition data insights
- AI/ML Edge and Cloud apps for remote maintenance and security
- On-prem Edge for processing data of IoT sensors & drone video images
- **Service, Network and Edge automation and orchestration by** amdocs

Delivering Better Business Outcomes at the Edge

ROBUST

DEVELOPER TOOLS/ EDGE SW ASSETS

DRIVING CONVERGENCE OF ANALYTICS, MEDIA AND NETWORKING WITH **VERTICAL SPECIFIC OFFERINGS**

OpenVINO™ Intel® Smart Edge

oneAPI

VAST

ECOSYSTEM SCALE

SCALE WITH ECOSYSTEM TO **ACCELERATE** DEPLOYMENTS AND DELIVER RESULTS

intel. Market Ready

intel. Select Solutions intel. RFP Ready

intel. Network Builders

DIVERSE

PRODUCT PORTFOLIO

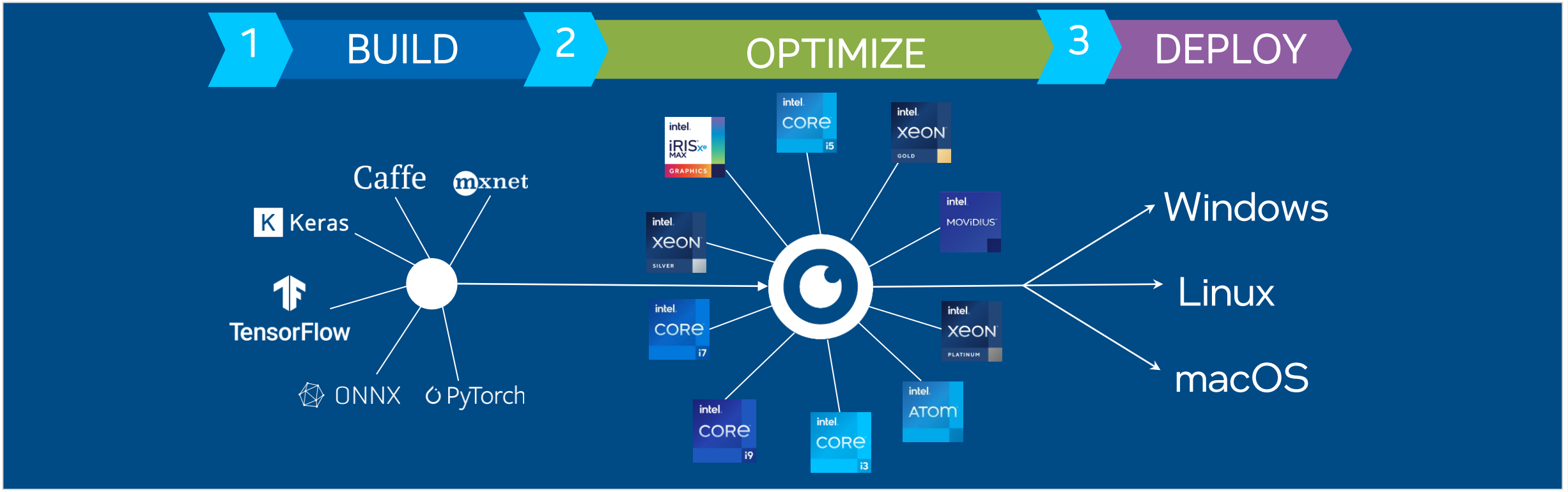
WITH EDGE SPECIFIC **OPTIMIZATIONS, FEATURES** AND **ACCELERATORS**

intel. ETHERNET | intel. Si PHOTONICS | intel. TOFINO | intel. OPTANE SSD | intel. OPTANE PERSISTENT MEMORY | intel. XEON | intel. ATOM | intel. CORE | intel. STRATIX | intel. AGILEX | intel. eASIC | intel. MOVIDIUS | habana | Xe

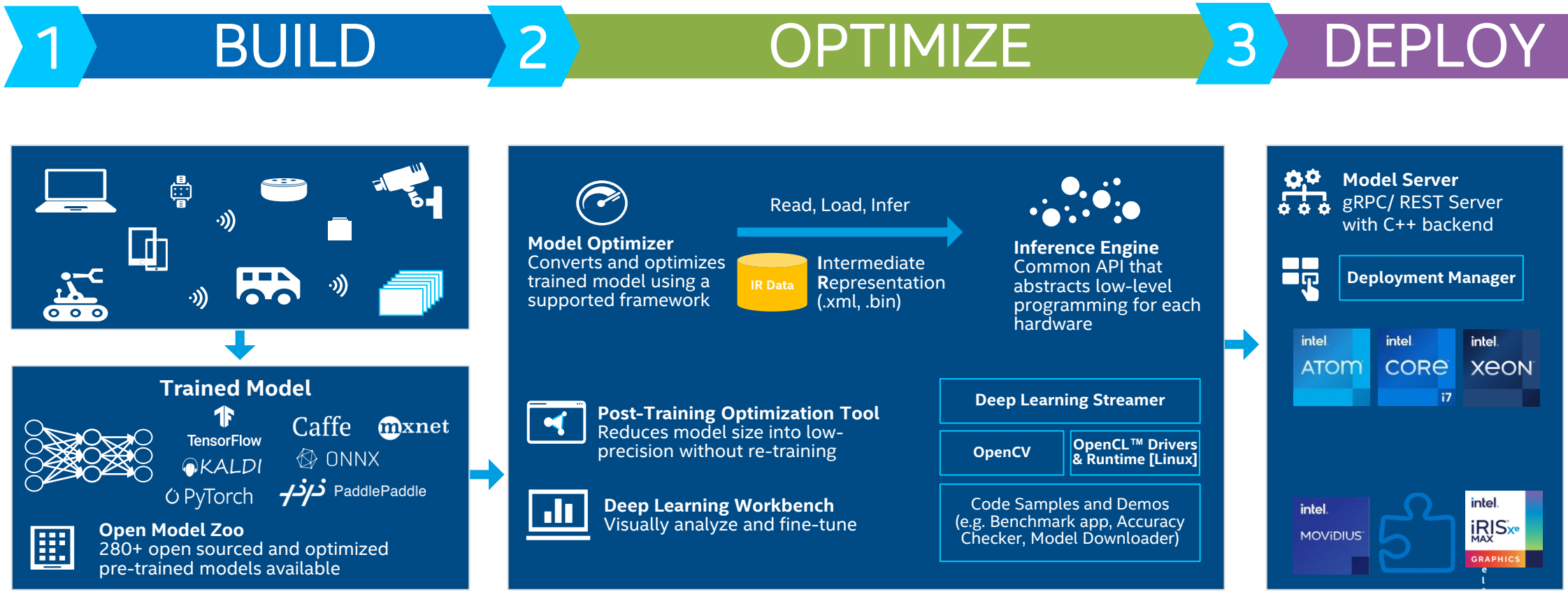
Why Intel® Distribution of OpenVINO™ toolkit

Fast, accurate real-world results with high-performance, deep learning inference

Convert and optimize models, deploy across a mix Intel hardware and environments, on-premise and on-device, in the browser or in the cloud



OpenVINO™ toolkit Developer Journey



Intel® Smart Edge Open (previously called OpenNESS)

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

Modular

Integrated

Microservices Based

Top Use Cases

- Access Edge Aggregation Point
- Near Edge
- uCPE/SD-WAN
- AI/vision inferencing
- Media

Building Blocks

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

Foundation

Kubernetes	Service Mesh	Telemetry	Helm	Operator Framework

Key Features

- Optimized for Edge KPIs
- Multi-Location, -Access, -Cloud
- Reference Architectures for ease of consumption
- Industry Standards

Amdocs enhanced Edge orchestration powered by intel Smart Edge Open

Amdocs and Intel join forces to create a solution that brings the benefits of cloud native operational model to the edge based on Amdocs Service and Network Automation platform

- Enabling distributed 5G core deployments which use Intel® Smart Edge Open features and allowing Intelligent placement and homing of those network functions at the edge
- Delivering advanced services (i.e. real time video surveillance etc.) and applications enhanced with hardware optimization provided by Intel Smart Edge Open at the edge of the network
- Reduced time-to-market/investment of new edge services deployment through simplified architecture

The joint solution targets :

- Onboarding and deployment of Network functions, Services, and Apps that are enhanced by Intel Smart Edge Open
- Unified architecture, relying on Kubernetes with Intel Smart Edge Open support
- The solution requires integration from selected NEPs, OSVs and cloud partners of end customer preference

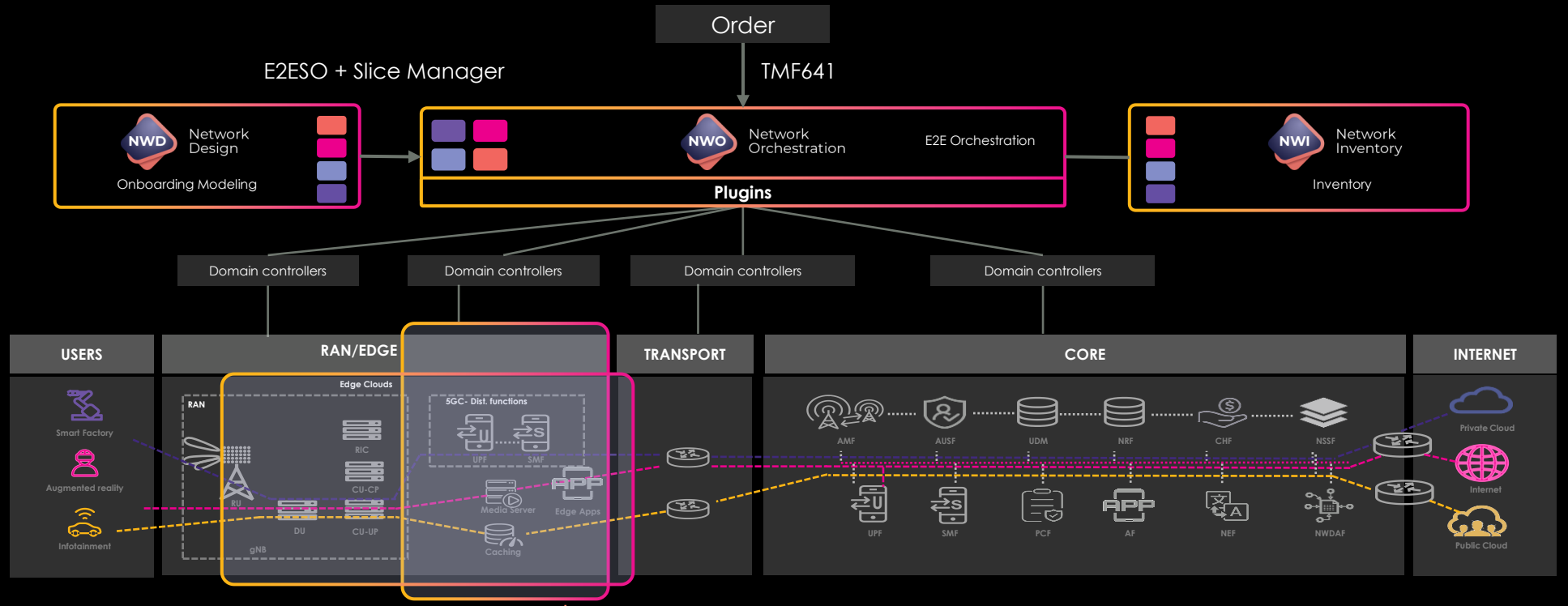
Intel Smart Edge Open previously known as OpenNESS

5G Slice & Edge Automation

Amdocs and partners integrate Intel® Smart Edge Open (previously called OpenNESS) **k8s Operators** to accelerate TTM and edge deployment at scale (e.g., HW accelerators FPGA, QAT, SR-IOV, etc ..)

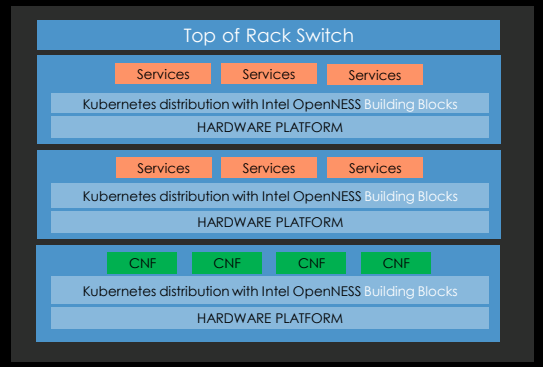
Intel Asset Applicability

- SDEWAN Controller
- OpenVINO™
- Service Mesh
- Distributed Telemetry
- FPGA, HDDL, SDEWAN CNF
- SRIOV-NIC

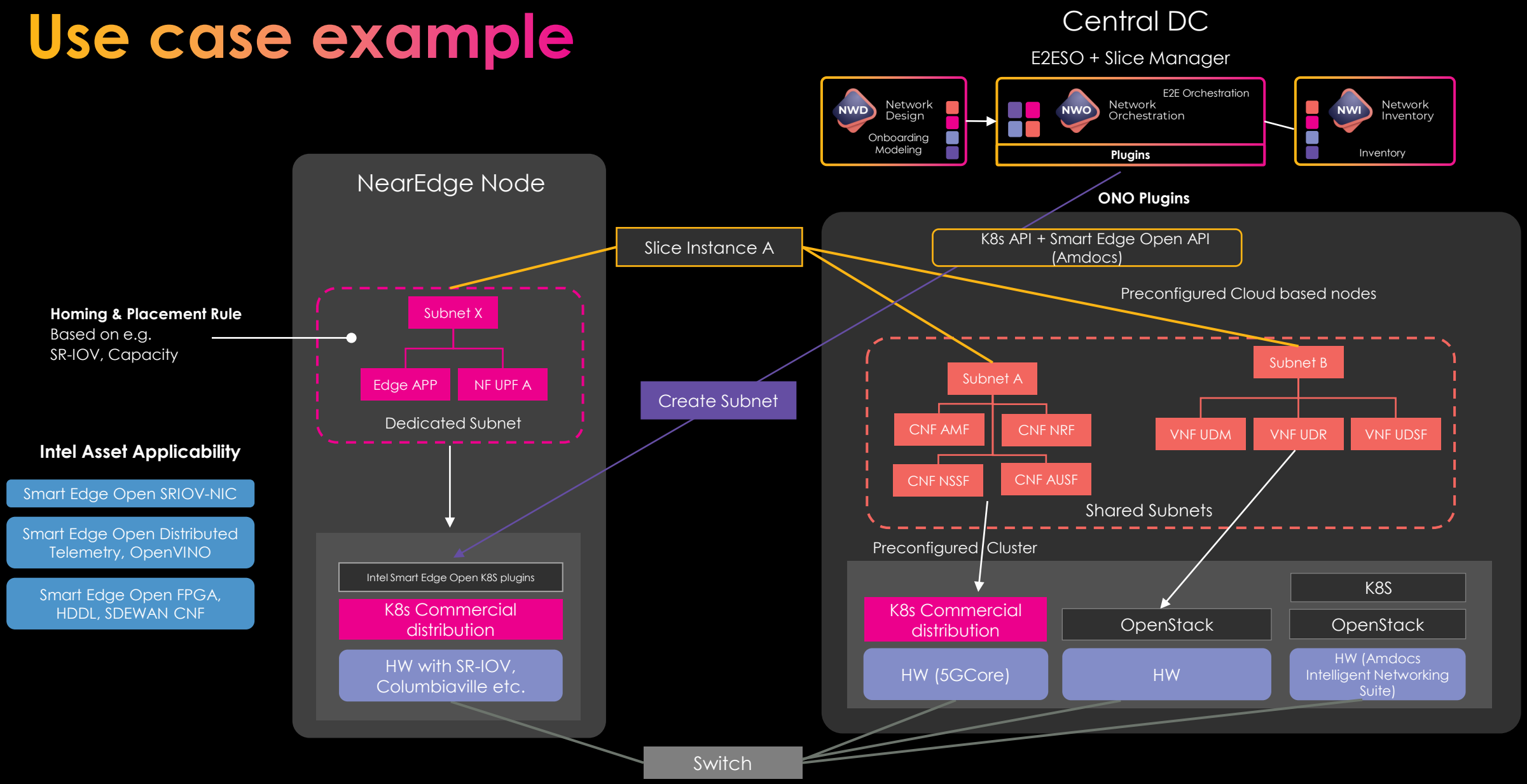


Use cases
1. Safety (Street Video Analytics)
2. Surveillance
3. AR/VR (Tourism and Retail)
4. CDN (Video and Tourism)

Solution Configuration:
1. Co-located UPF with MEC Apps (possibly CU & DU as well)
2. Deployment on Commercial Kubernetes Container (Baremetal)
3. Support Public and Private Cloud.
4. Utilizes COTS HW – a Rackmount of servers for UPF, MEC, NF's. Can be as small as 1 server.



Use case example



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