

5GPPP webinar on ICT-42 projects
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Int5Gent

ICT-42 project presentation

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Project Overview

General Information

- › Contract No: 957403
- › Topic: 5G core technologies innovation
- › Type: IA
- › Duration: 36 Months
 - › Start date: **1st of November 2020**
- › Two reporting periods
 - › P1: M01-M18 & P2: M19-36
- › Requested EC contribution: €5,948,029.88
- › Coordinator: Prof. Hercules Avramopoulos (ICCS)
- › Project Officer: Dr. Jorge Pereira
- › Website: <https://www.int5gent.eu>



Project coordinator



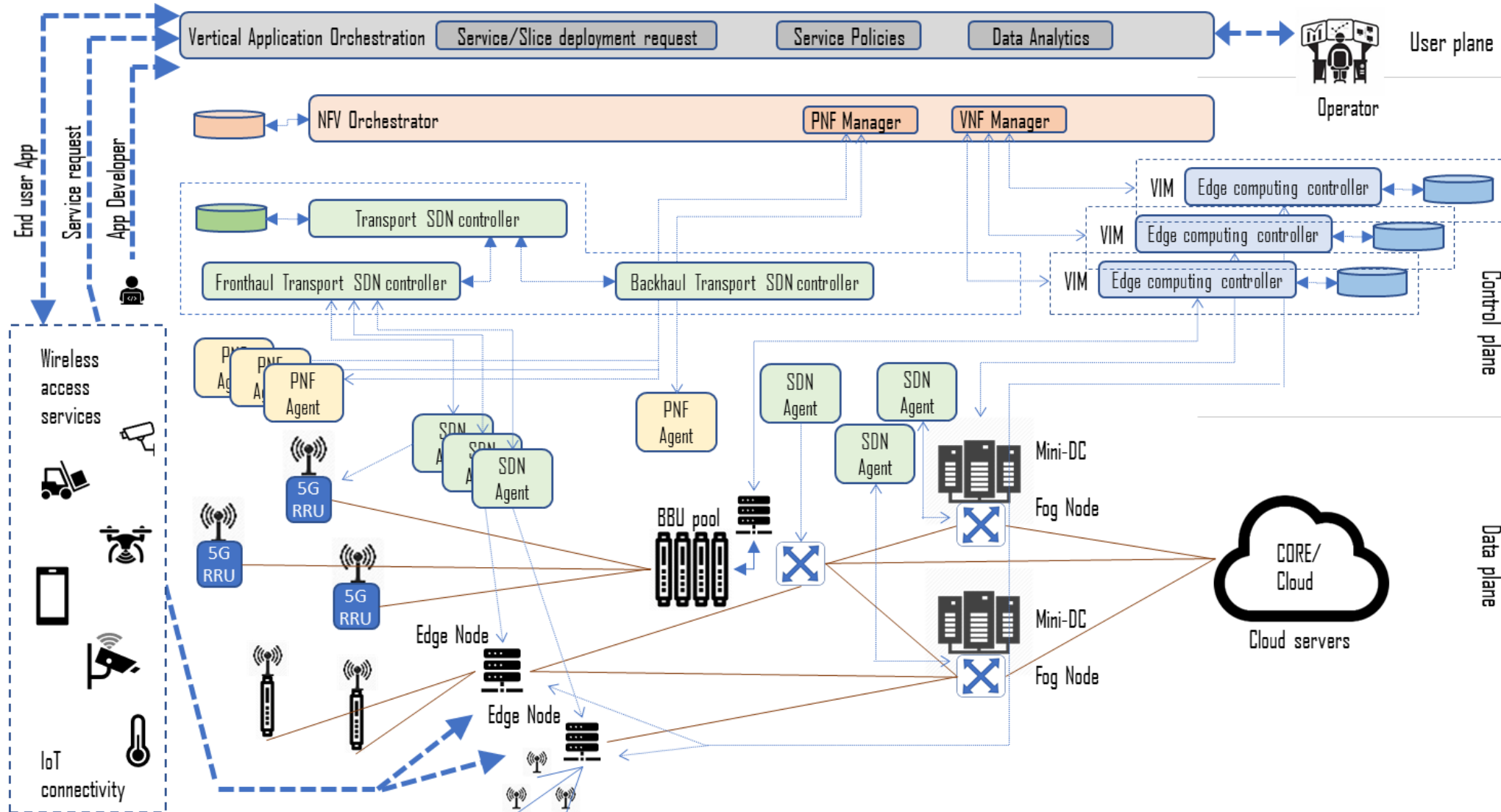
Technical manager



Main goal of the project

- › To deploy a **holistic 5G system platform** that combines:
 - › Advance technological blocks for the data plane infrastructure (both at radio and backhaul HW level)
 - › Complete network orchestration through flexible PNF-VNF instances over a generalized NFV Infrastructure (NFVI), extended to edge computational, storage and networking resources.
 - › An intelligent overlay application orchestrator for the vertical services allow a pragmatic approach for the services' deployment, the extraction of analytics and the inclusion of policy criteria.
- › To **integrate innovative solutions at different development layer of the 5G stack** and combine them optimally in the quest to promote true 5G enabling solutions for new technology and service provisioning vertical markets.
 - › 2 Large test beds extended over real infrastructures (Barcelona, Athens)
 - › 2 Technology demonstration actions
 - › 3 End-user (verticals) driven use case scenarios

Architecture



A fully operational 5G system platform from the user end to the data plane

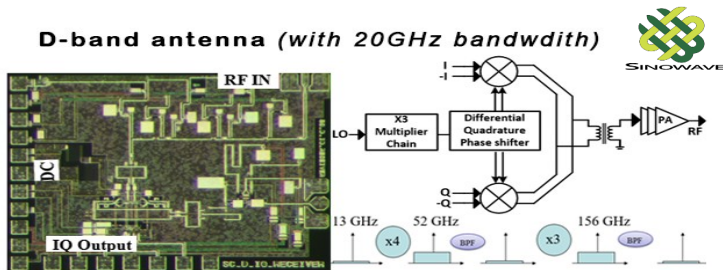
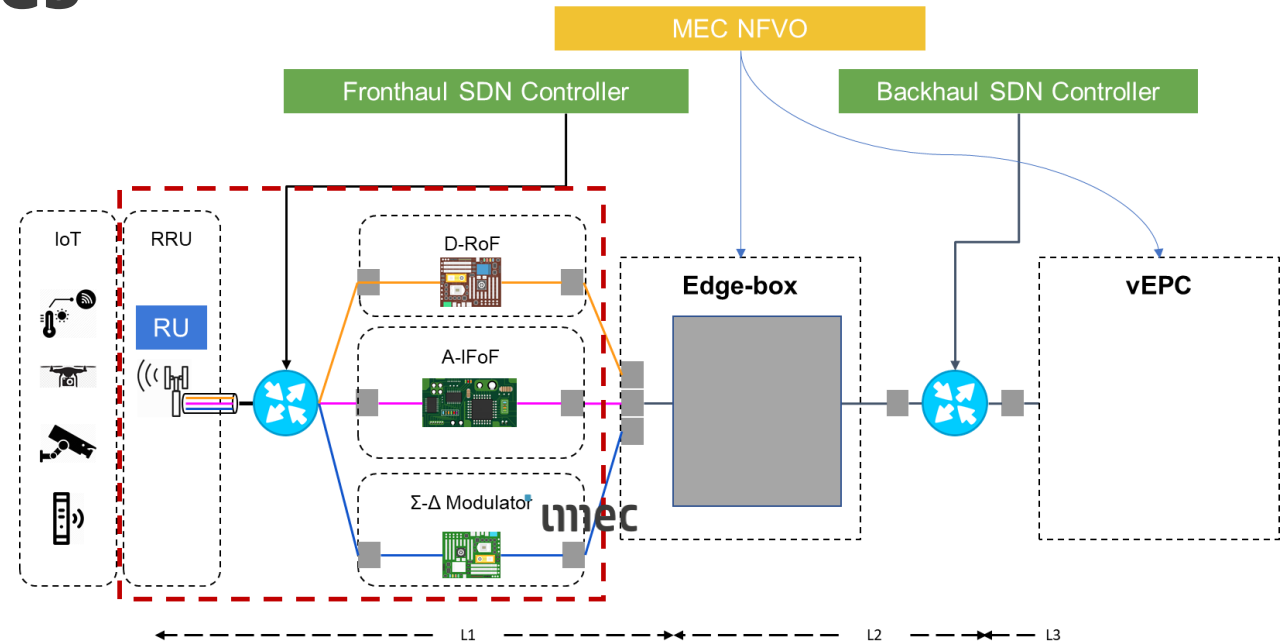
- To demonstrate interoperability among technology providers, service providers, application developers and operators,
- To form the first coordinated effort for a holistic interoperable multi-RAT cross-split environment.

Int5Gent – Technology integration approach

- › Work is split in 3 synergetic different **focus areas** creating an equivalent number of **working groups**, performing under a common idea and architecture.
- › Focus Areas:
 - › Focus Area 1: Fronthaul Technologies
 - › → WG1: ICCS, IMEC, SIKLU, SNW, AUTH, COSM, FGC, WSE
 - › Focus Area 2: Orchestration
 - › → WG2: UBITECH, NXW, CTTC, TID, INTRA, COSM, ININ, WSE
 - › Focus Area 3: Edge node technologies
 - › → WG3: MLNX, ICCS, UBITECH, INTRA, CTTC, AUTH, TID, FGC
- › Horizontal actions (phases):
 - › Action to run in consecutive order with small overlaps between them
 - › 1st – Architecture definition and functional requirements (by M12)
 - › 2nd – Development and continuous integration rounds (by M30)
 - › 3rd – Demonstration and evaluation (by M36)

FA1: Fronthaul Technologies

- › Multi-connectivity interfacing options:
 - › D-RoF
 - › Standardized solution of eCPRI over fibre
 - › A-IFoF
 - › Analogue IF over fibre
 - › Solutions for high bandwidth efficiency
 - › Proven tech through 5G-complet 5G-phos
 - › Σ - Δ modulation
 - › Innovative format merging the bandwidth efficiency of ARoF and transmission efficiency of D-RoF

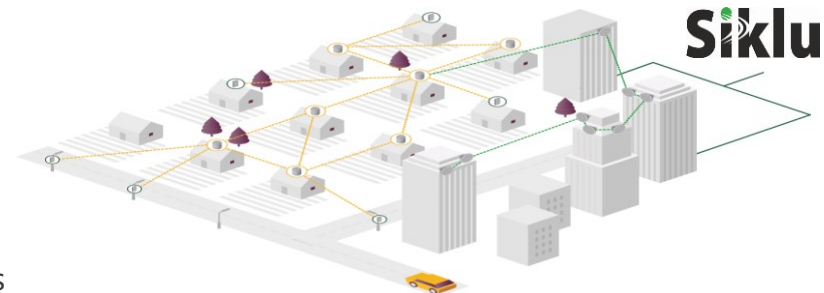


› D-Band radio fronthaul interface:

- › **D-band radio** with co-integrated radio frontends, transceiver RF ICs and opto-electronic units
- › Operation in ~150GHz freq. band – Wide bandwidth of 20GHz
- › Compatible with Digital/Analog/Sigma-Delta data plane interfaces

› mm-Wave mesh nodes:

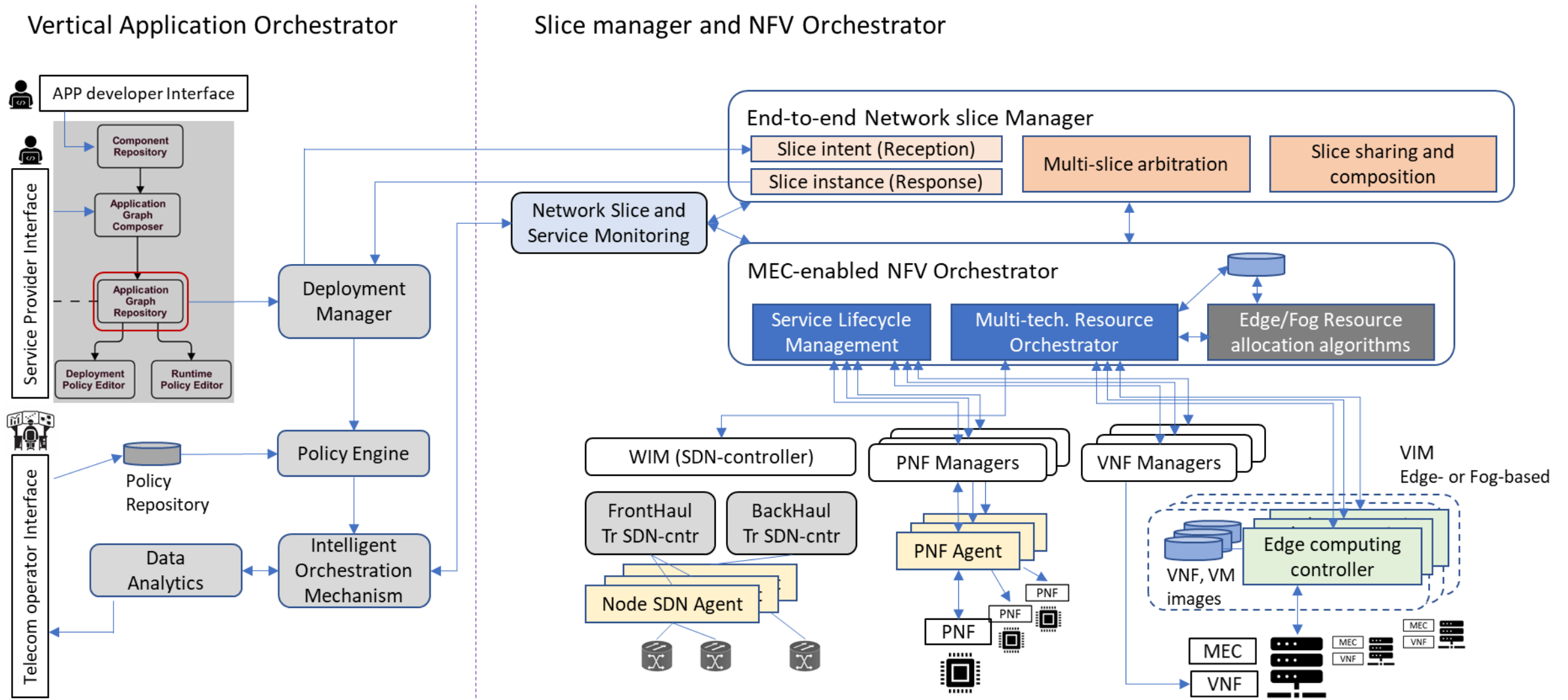
- › **V-band mesh radio nodes.**
- › Support of independent sectors
- › MEC-assisted processing of data generated by edge devices



FA2: Orchestration

- › Vertical Application Orchestrator: Service lifecycle management and service function requests.
 - › Services components and End-user connectivity demands through **UIs**
 - › Composition of **application graph** for requested service
 - › **Policy engine** for monitoring the lifecycle of the service according to the pre-set properties
 - › Intelligent policy related actions and network state information through **data analytics engine**.
- › Network Slice Manager: The logic to for composing network slices
 - › Optimizing the sharing and the dynamic scaling of their components
 - › Interaction with the NFVO for dynamically provisioned slices according to the runtime requirements of the service applications.
- › Control plane: Management of resource allocation
 - › Distributed in **multiple administrative domains** and controlled through **technology-specific VIMs**.
 - › VIMs to be specialized according to the virtualization capabilities offered in each domain
 - › Service Function instantiation through the provisioning of **custom network paths**
 - › For advance edge node interconnectivity
 - › To be automatically tailored to the dynamicity of the service deployment.
 - › Monitoring data (about network performance) as input for cognitive networking strategies,
 - › Network paths establishment for the inter-/intra-site traffic flows, in compliance with the virtual networking approach adopted at the different VIMs and at the edge of the related PoPs.

FA2: Orchestration architecture

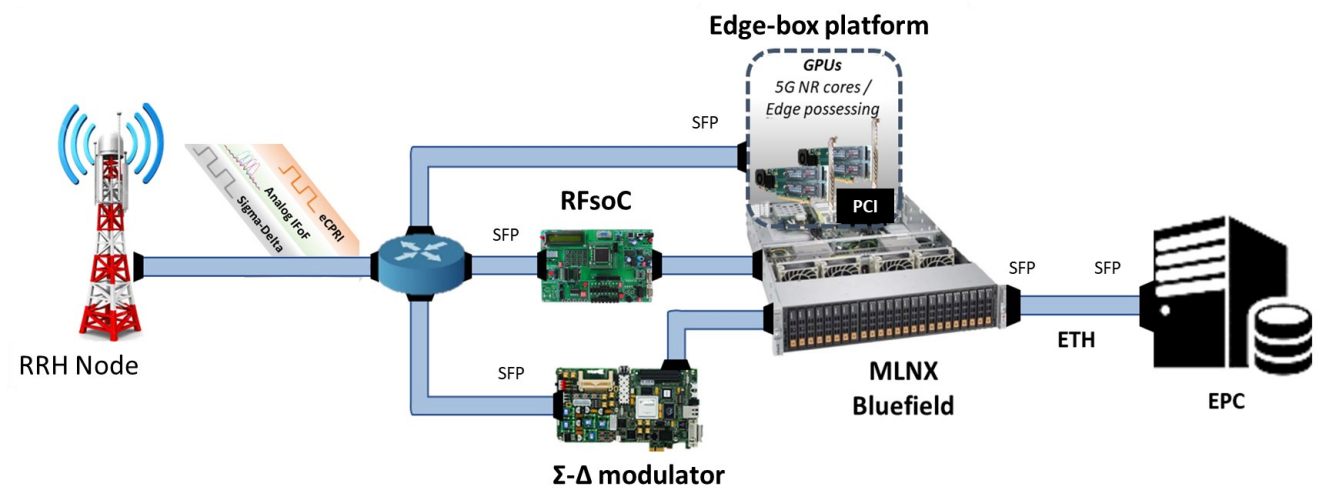


FA3: Edge node

- › The role of Edge Box
 - › Implements the fronthaul connectivity layer
 - › Interconnecting the cloud infrastructure with edge compute resources

› Key Tech characteristics

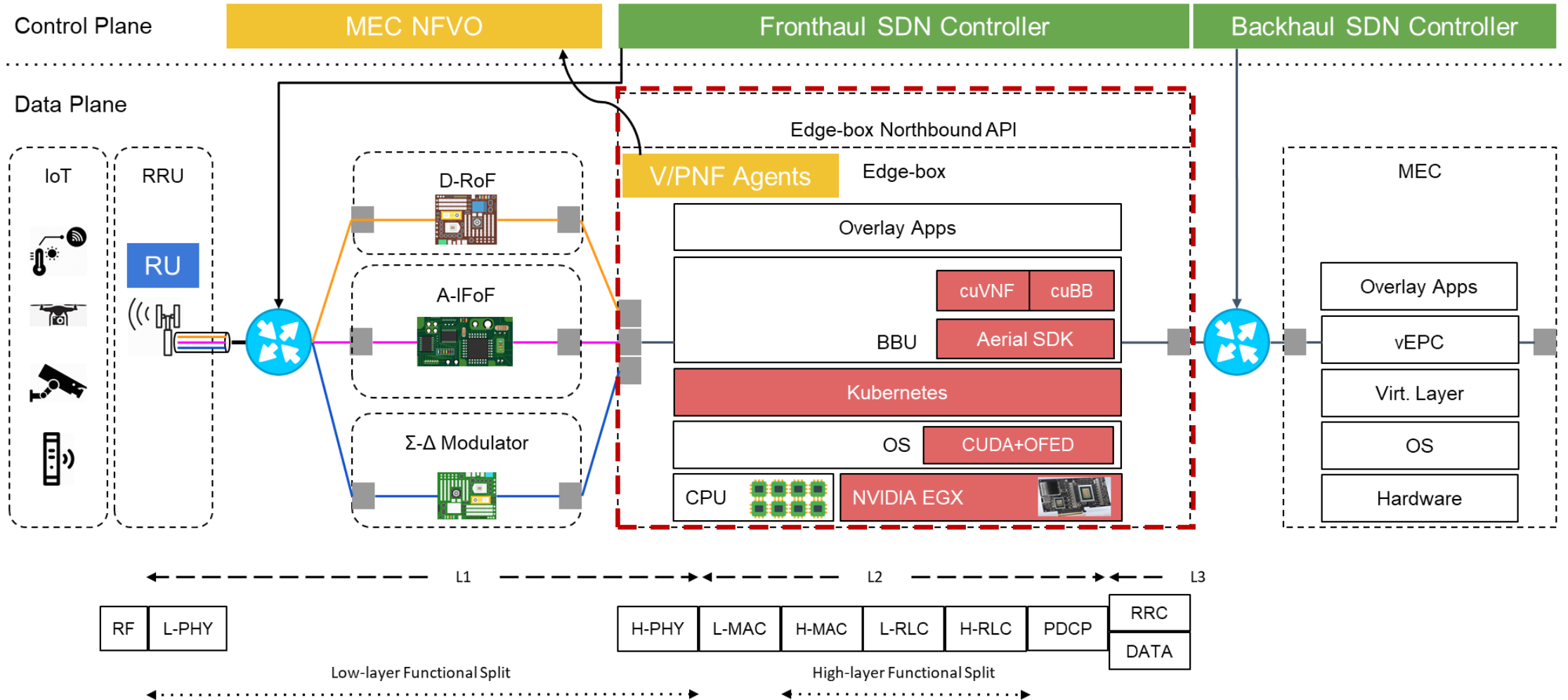
- › Connectivity:
 - › FPGA for $\Sigma\Delta$ and analog interfaces
 - › 5G NR digital interfaces provided by NVIDIA's HW
- › Edge processing:
 - › NVIDIA's Bluefield equipped with GPU slots for hardware acceleration



› Overall capabilities

- › Multi-format signal support for expandability and O-RAN support
- › Single solution for RAN interfacing and edge processing capabilities
- › Seamless SDN/NFV compatibility through orchestration platform

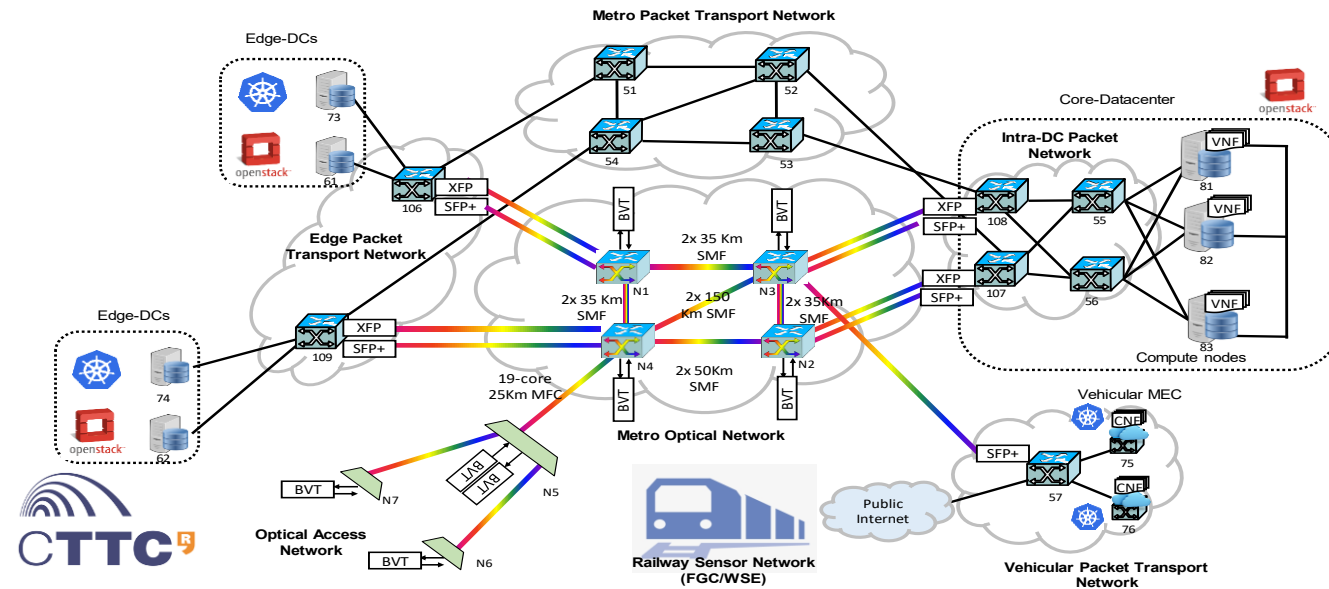
FA3: Edge node architecture



Test-beds

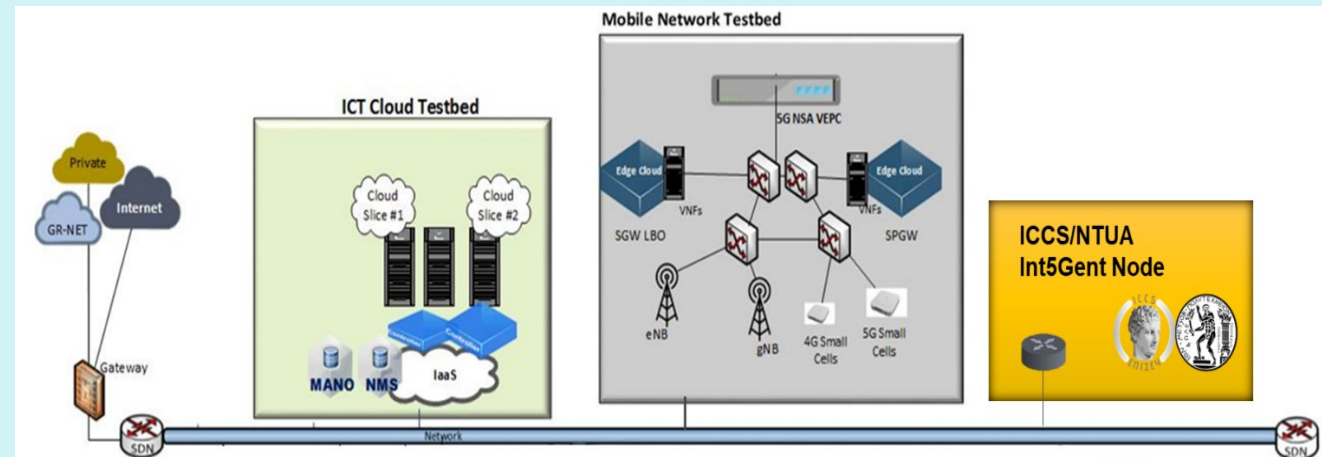
CTTC testbed

- › Hybrid fixed/flexi-grid DWDM core network
- › Whitebox ROADM/OXC nodes.
- › Packet transport network, at the edge and metro segments,
- › Core cloud infrastructure (core-DC with HPC servers)
- › Edge cloud infrastructure (micro-DCs in the edge nodes).
- › Connectivity to the FGC/WSE infrastructure and sensors for railway infrastructure monitoring.



COSMOTE-NTUA testbed

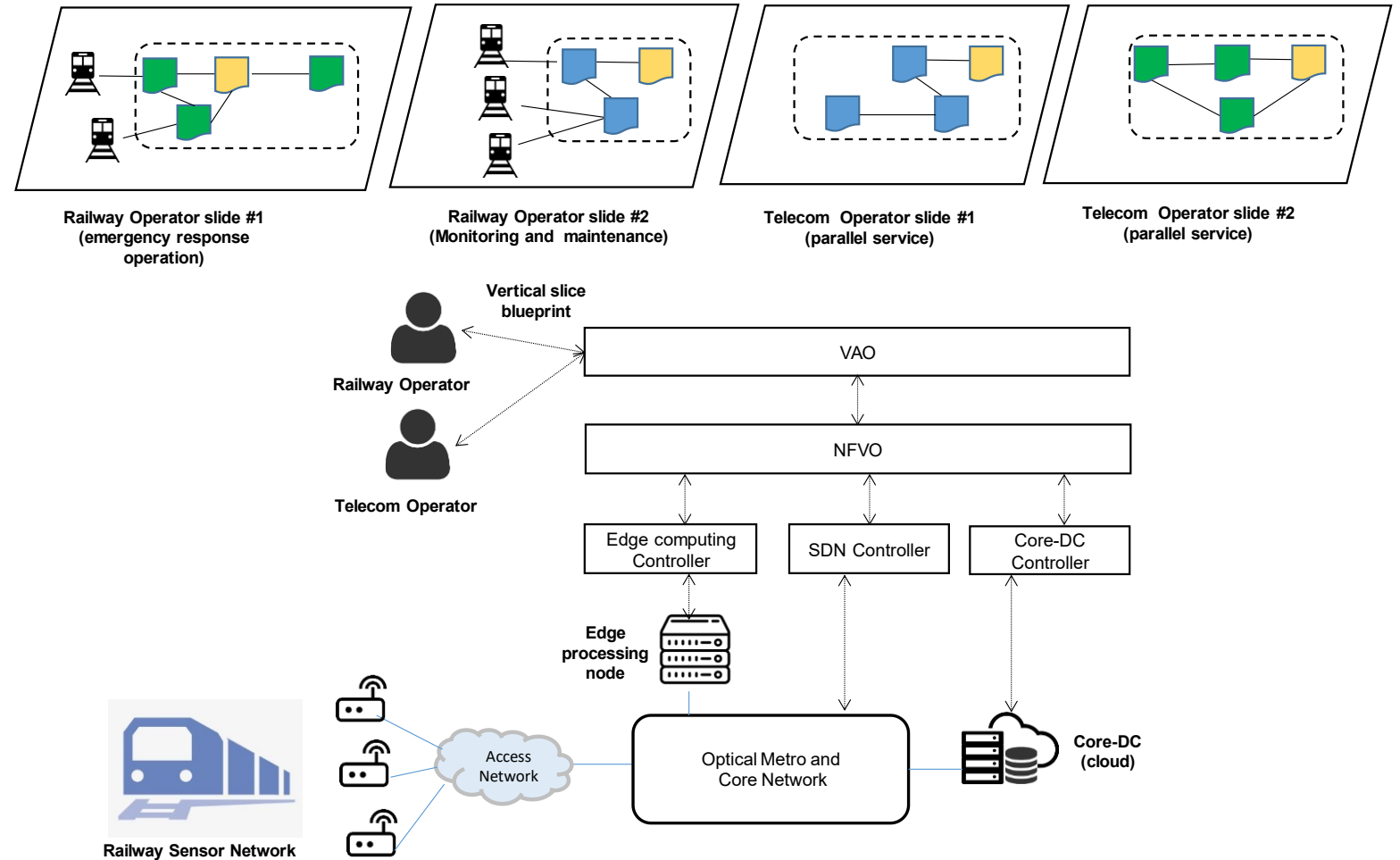
- › COSMOTE Capabilities:
 - › 10G transport/switching network
 - › Openstack-based multi-cloud large scale infrastructure
 - › MANO installation (ETSI OSM – based).
 - › a wide range of IoTs, IoT hubs/gateway, Backend connectivity over a wide range of short/long range technologies
- › ICCS-NTUA Capabilities:
 - › 5G-NR compatible HW/SW blocks
 - › Established Fiber/Wireless segments
 - › Deployment/hosting of Edge node and mmWave mesh network solutions



Use cases

UC1: 5G service and network orchestration framework

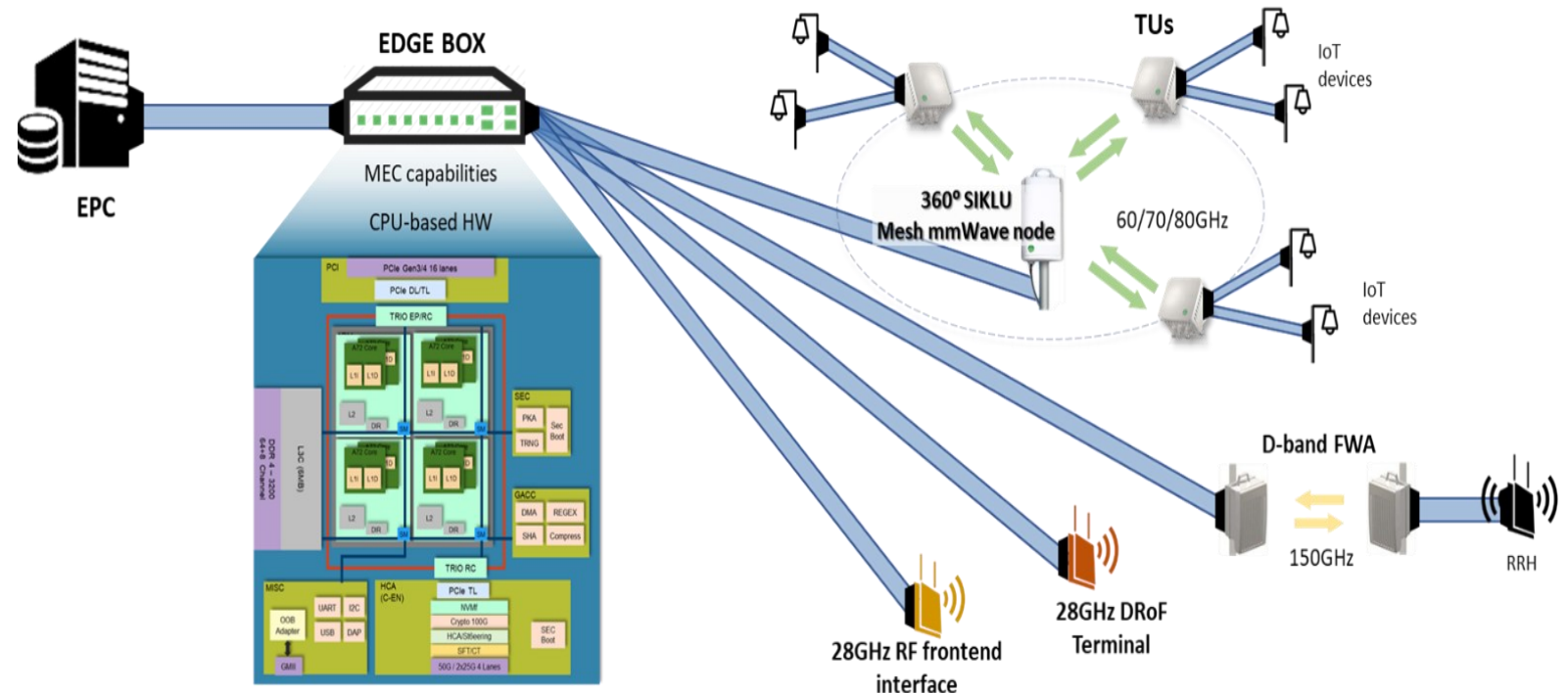
- > Testbed: CTTC+ FGC
- > Main contributors: CTTC, NXW, UBITECH, WSE, FGC, TID, INTRA, (MLNX)
- > Key Features:
 - > VAO-NFVO-transport SDN integration
 - > Multi-service/slice management in multi-vendor environment
 - > Edge node processing capabilities (for certain applications)
 - > (Typical RAN infrastructure)



Use cases

UC2: 5G Radio Access Network Technologies and edge processing

- > Testbed: ICCS
- > Main contributors: IMEC, SINK, SNW, COSM, MLNX, UBITECH, INTRA, NXW
- > Key Features:
 - > Technology demonstration of:
 - > mmWave V-band self-organised node
 - > D-band 5G terminal
 - > SD transmission and RRH
 - > Flexible edge-box TRx
 - > High capacity optical and wireless fronthaul
 - > Edge node baseband processing capabilities
 - > Edge node service data processing capabilities
 - > Supported by smart applications (e.g. face recognition, energy data analytics, CAM related video analytics) adapted to edge processor platform
 - > requires control plane framework deployment



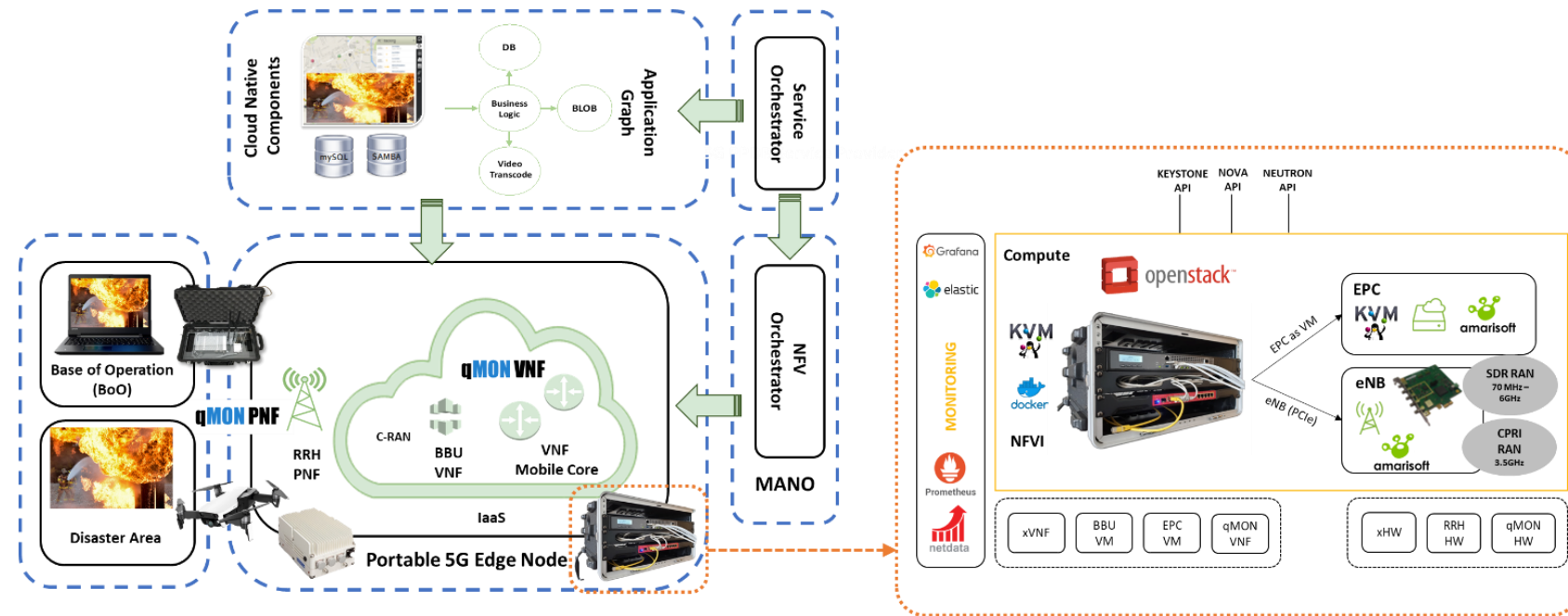
Remarks:

- Expected to run mainly in ICCS/NTUA premises, with COSM providing the EPC.
- UBITECH can also contribute with EPC simulation and sub 6GHz RAN if required

Use cases

UC3: Portable 5G system in support of a complex drone-based service

- › Testbed: COSMOTE/ICCS
- › Main contributors: ININ, UBITECH, NXW
- › Key Features:
 - › VAO-NFVO-transport SDN integration
 - › Chainable application components
 - › VNF and PNF networking capabilities
 - › 5G Slice manager and AI based video and data analytics
 - › Edge processing capabilities



Remarks:

- Ultimate goal is to be performed at Cosmote site together with UC2 running at ICCS so essentially having 2 RANs

Key expected benefits

- › The build and demonstration of a complete E2E 5G-platform testbed
 - › Interworking of data plane – control plane – service plane

- › An integrated environment for the testing of enabling HW components under real 5G applications

- › A unique edge node comprising:
 - › Multi-technology interfacing capabilities
 - › Build-in GPU processing capabilities

- › An intelligent service management + network resource orchestration + connectivity control framework

Thank you

Questions?

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