Int5Gent

Integrating 5G enabling technologies
in a holistic service to physical layer 5G system platform

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

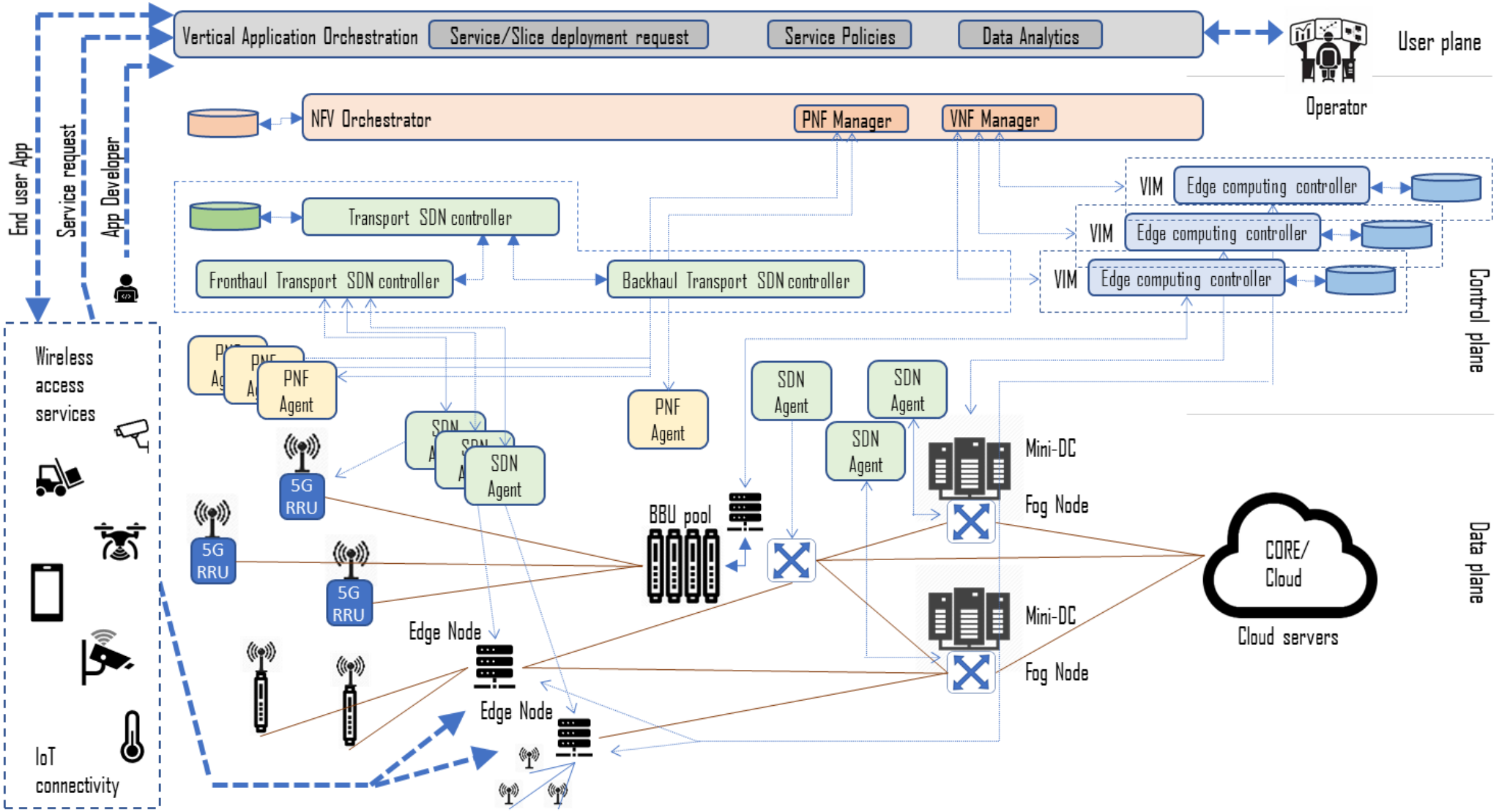
Technical manager

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 co-ordinated effort for a holistic interoperable multi-RAT cross-split environment.

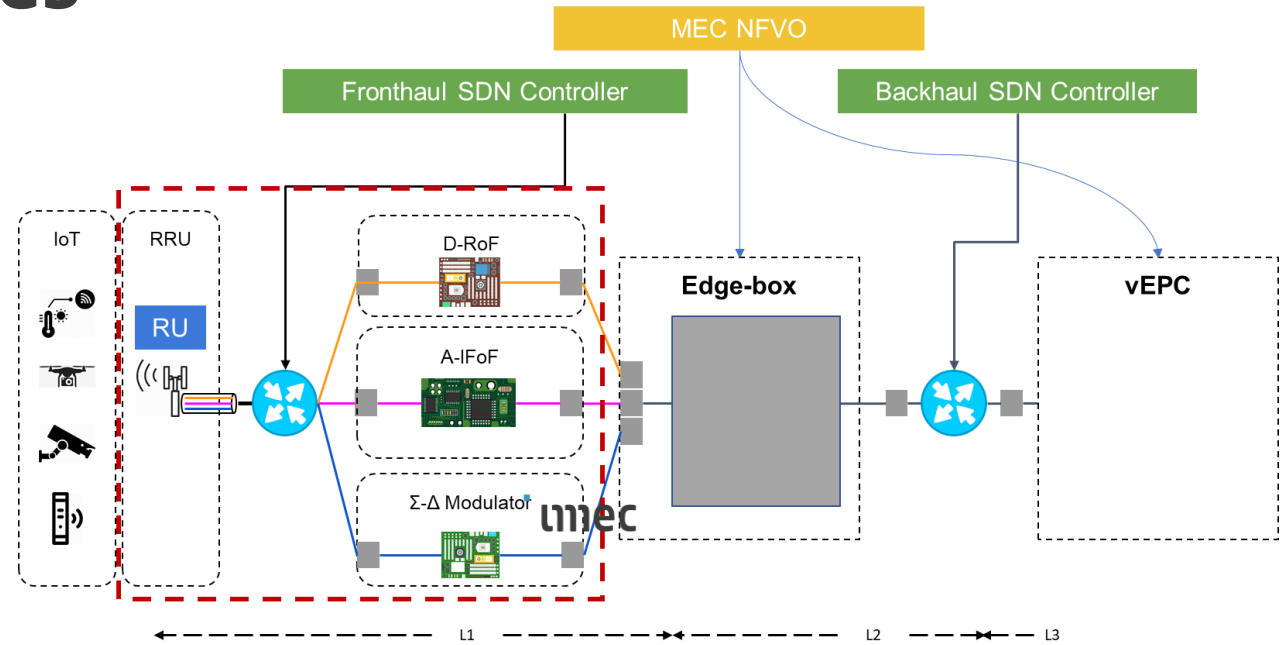
Int5Gent – Technology integration approach

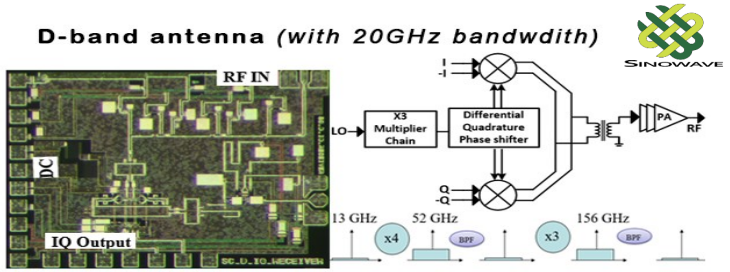
- Work is split in 3 synergetic different **focus areas** creating an equivalent number of **working groups**, performing under a common idea and architecture.
- Focus Areas:
  - Focus Area 1: Fronthaul Technologies
    - ➔ WG1: ICCS, IMEC, SIKLU, SNW, AUTH, COSM, FGC, WSE
  - Focus Area 2: Orchestration
    - ➔ 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

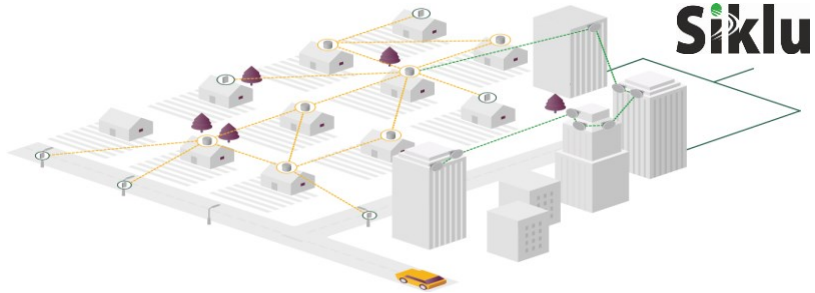
- Multi-connectivity interfacing options:
  - D-RoF
    - Standardized solution of eCPRI over fibre
  - A-IFoF
    - Analogue IF over fibre
    - Solutions for high bandwidth efficiency
    - Proven tech through 5G-complet 5G-phos
  - **Σ-Δ modulation**
    - Innovative format merging the bandwidth efficiency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

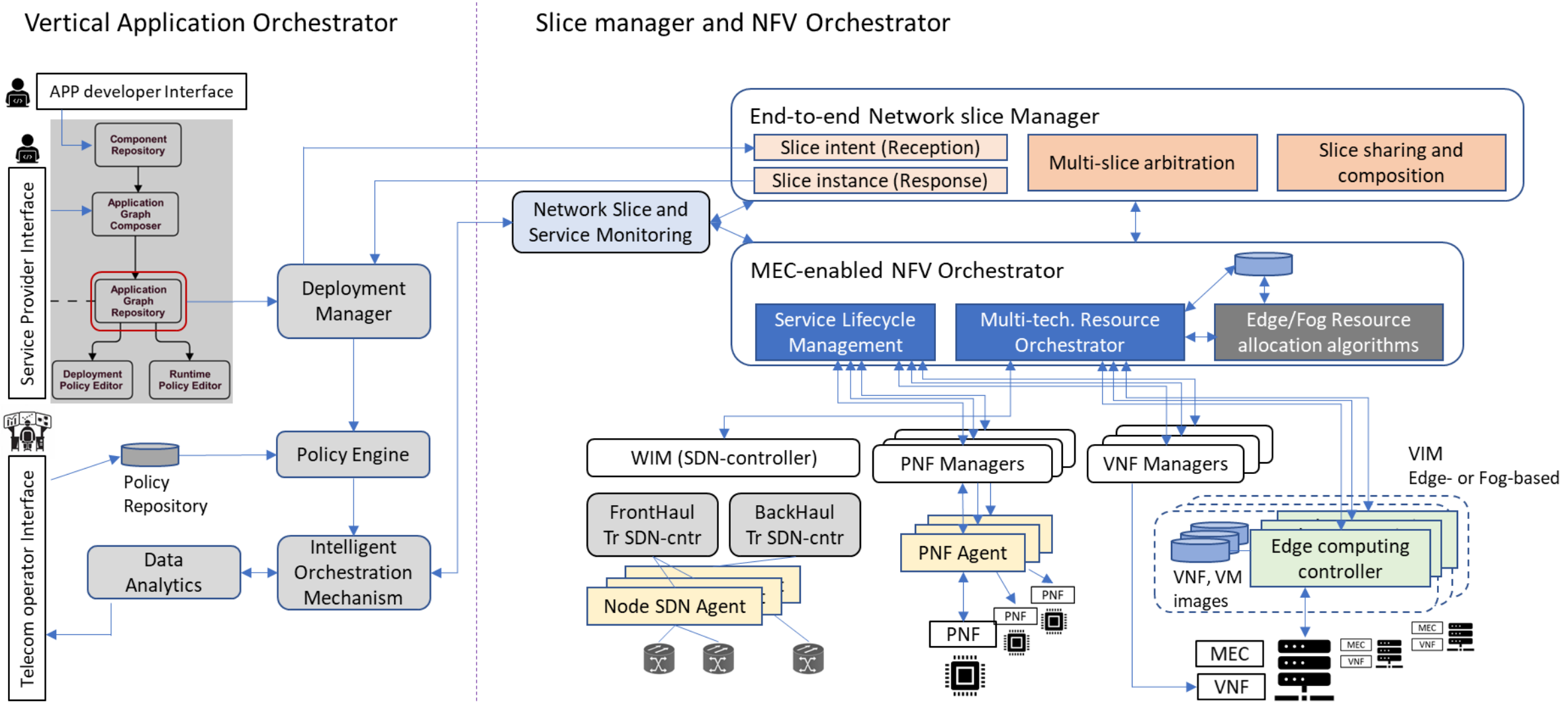
- mm-Wave mesh nodes:
  - **V-band mesh radio nodes**.
  - Support of independent sectors
  - MEC-assisted processing of data generated by edge devices



FA2: Orchestration

- Vertical Application Orchestrator: Service lifecycle management and service function requests.
  - Services components and End-user connectivity demands through **UIs**
  - Composition of a**pplication 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.

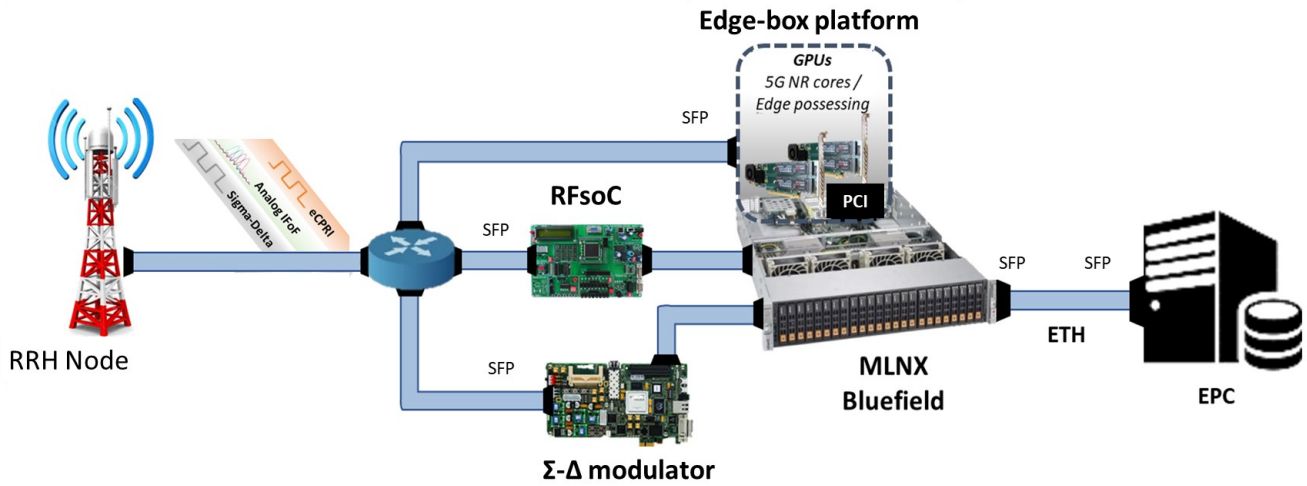
FA2: Orchestration architecture



FA3: Edge node

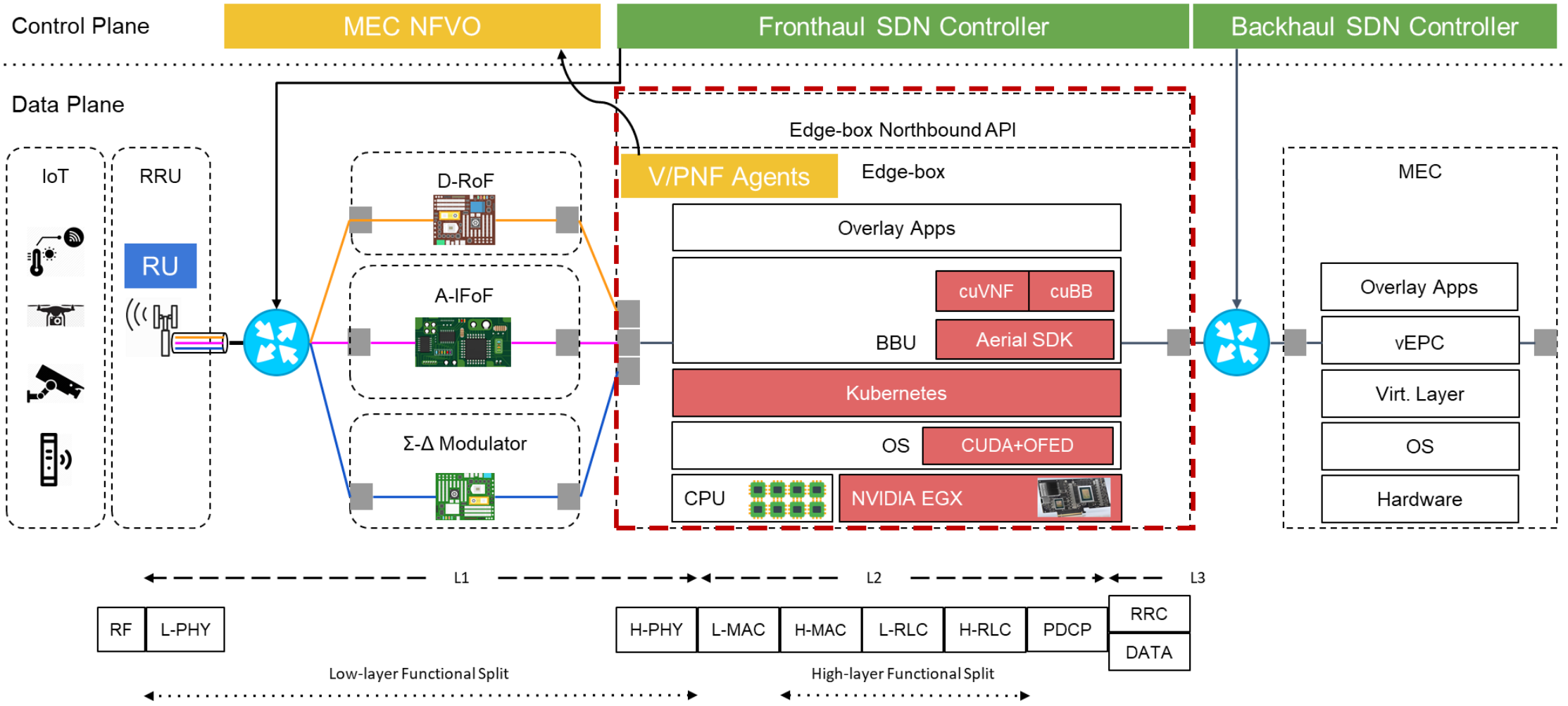
- The role of Edge Box
  - Implements the fronthaul connectivity layer
  - Interconnecting the cloud infrastructure with edge compute resources

- Key Tech characteristics
  - Connectivity:
    - FPGA for ΣΔ 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

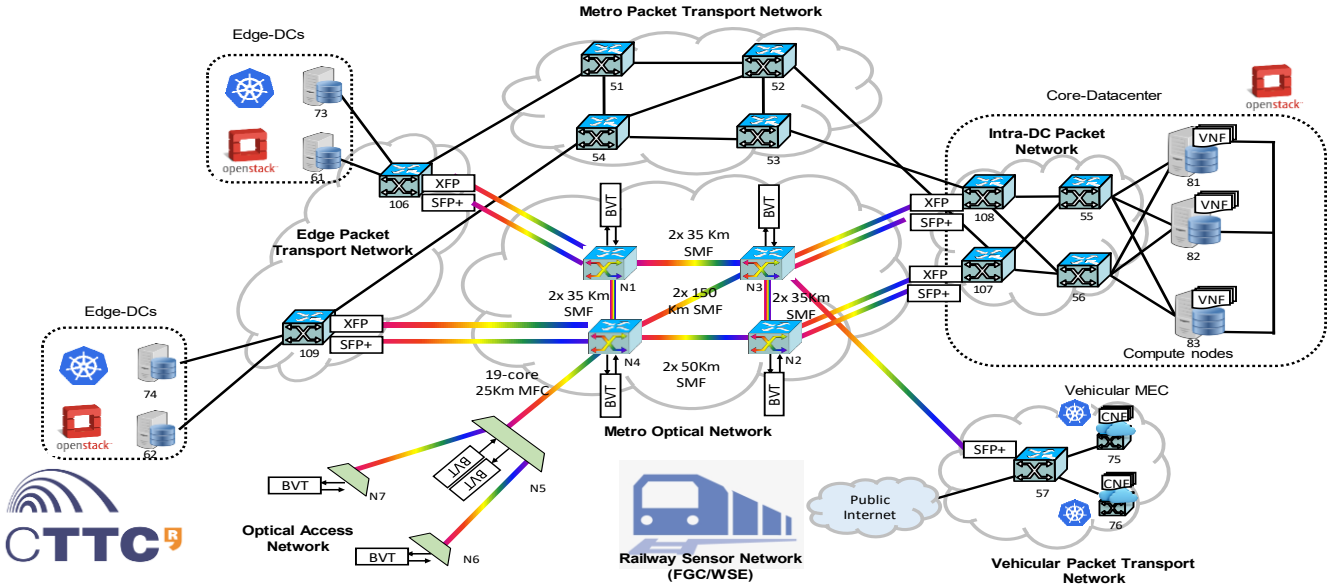


Test-beds

CTTC testbed

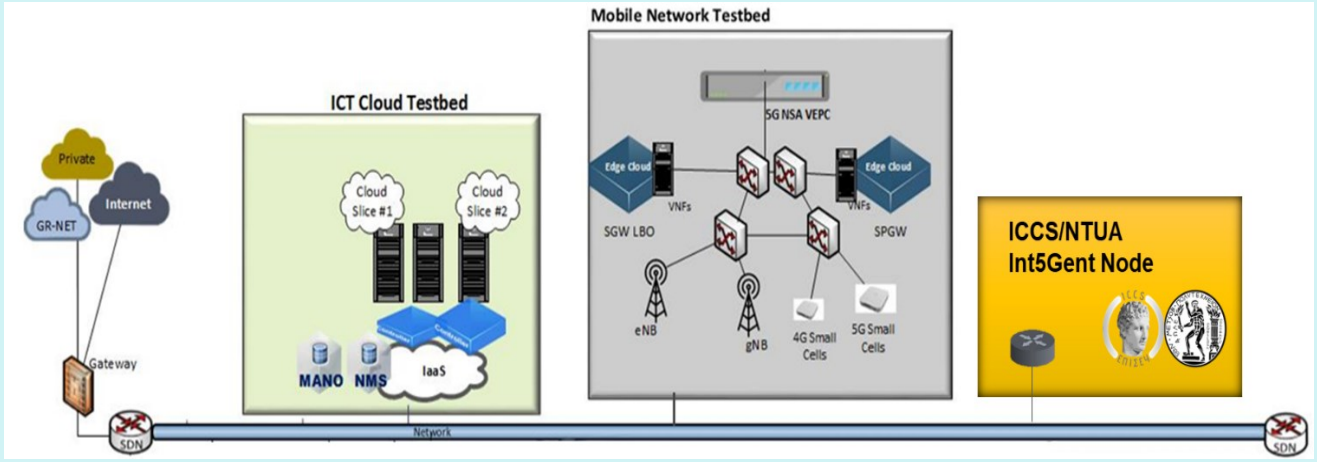
- Hybrid fixed/flexi-grid DWDM core network
- Whitebox ROADM/OXC nodes.
- Packet transport network, at the edge and metro segments,
- Core cloud infrastructure (core-DC with HPC servers)
- Edge cloud infrastructure (micro-DCs in the edge nodes).

- Connectivity to the FGC/WSE infrastructure and sensors for railway infrastructure monitoring.



COSMOTE-NTUA testbed

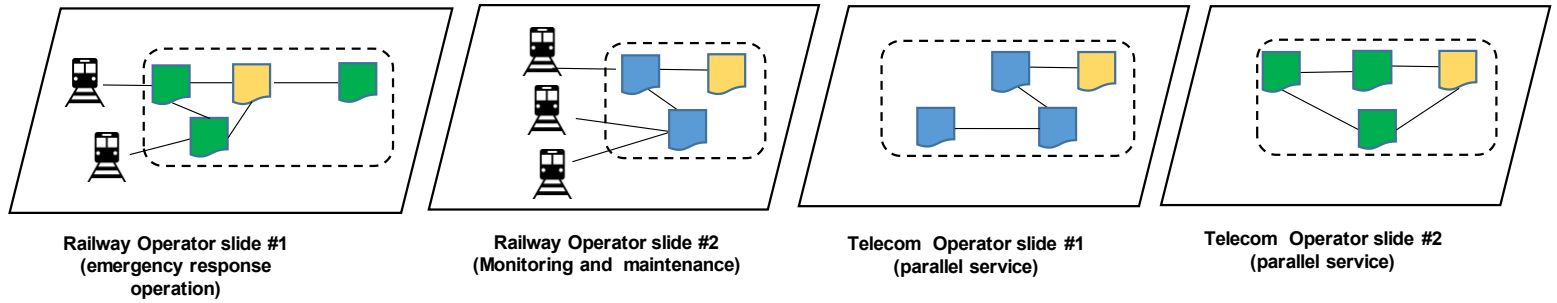
- COSMOTE Capabilities:
  - 10G transport/switching network
  - Openstack-based multi-cloud large scale infrastructure
  - MANO installation (ETSI OSM – based).
  - a wide range of IoTs, IoT hubs/gateway, Backend connectivity over a wide range of short/long range technologies
- ICCS-NTUA Capabilities: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

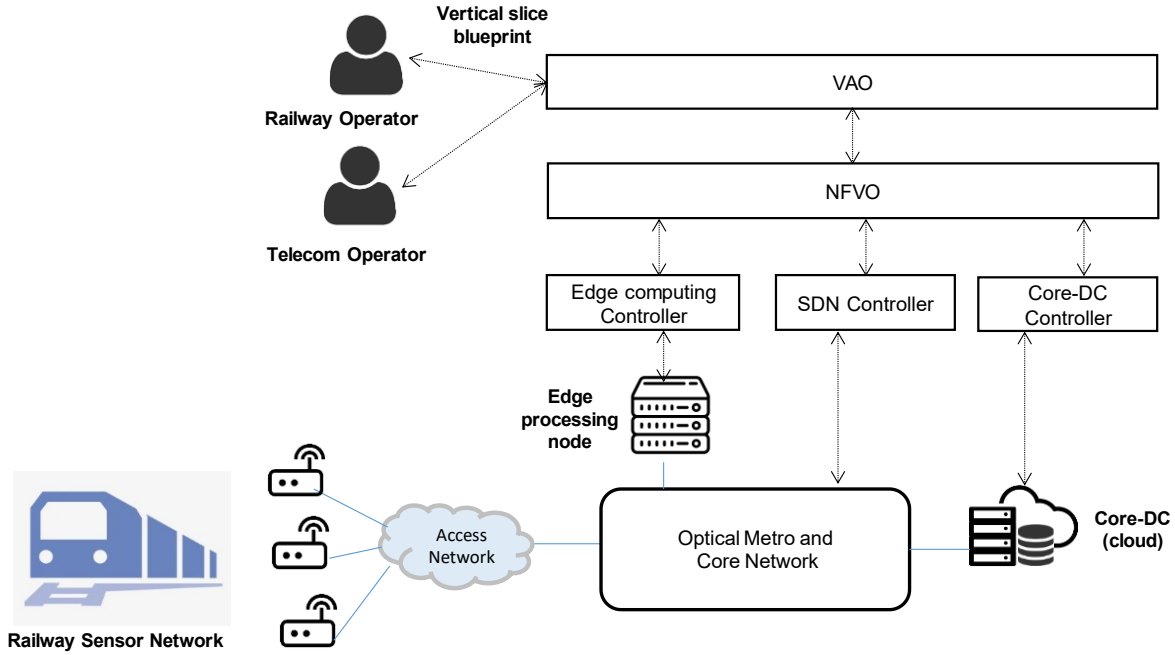


Use cases

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)

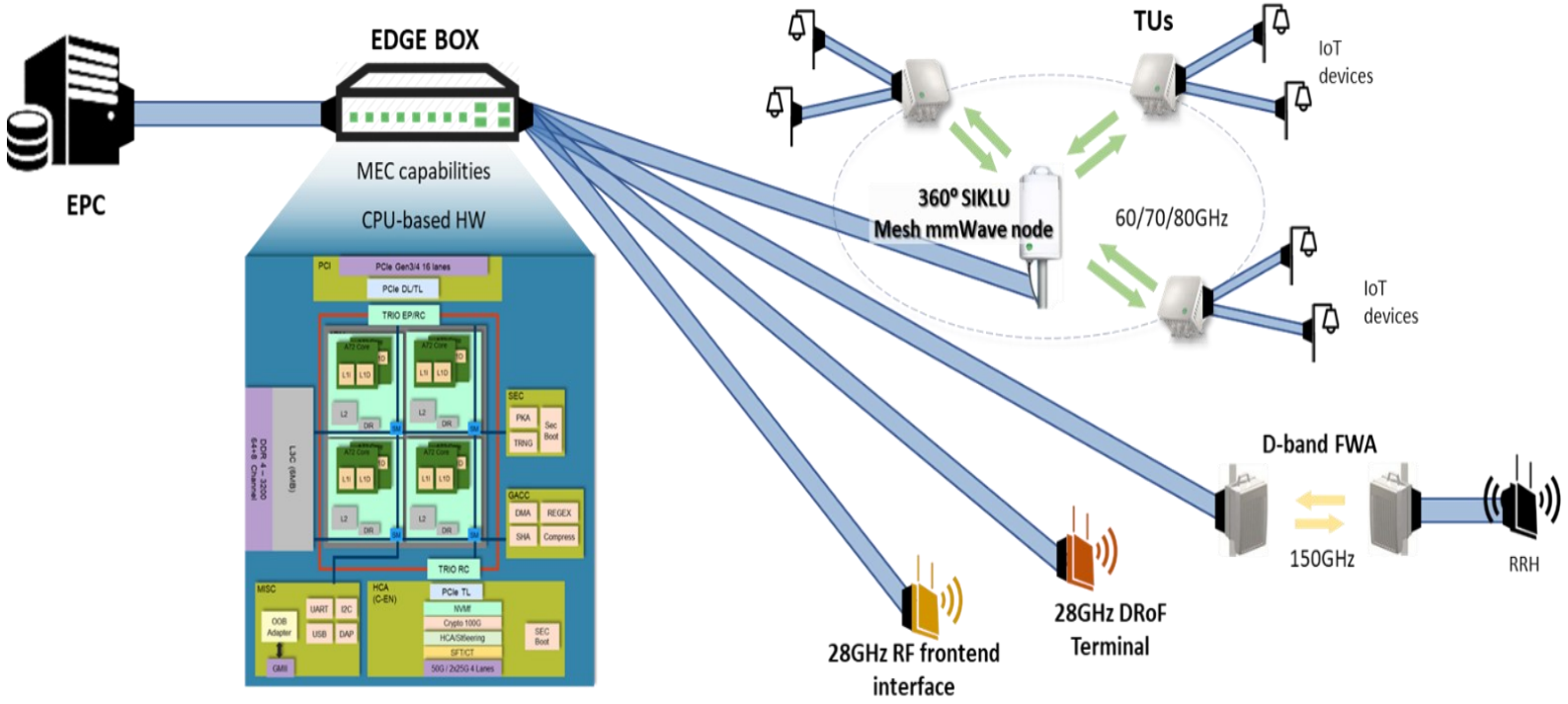




Use cases

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
  - 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



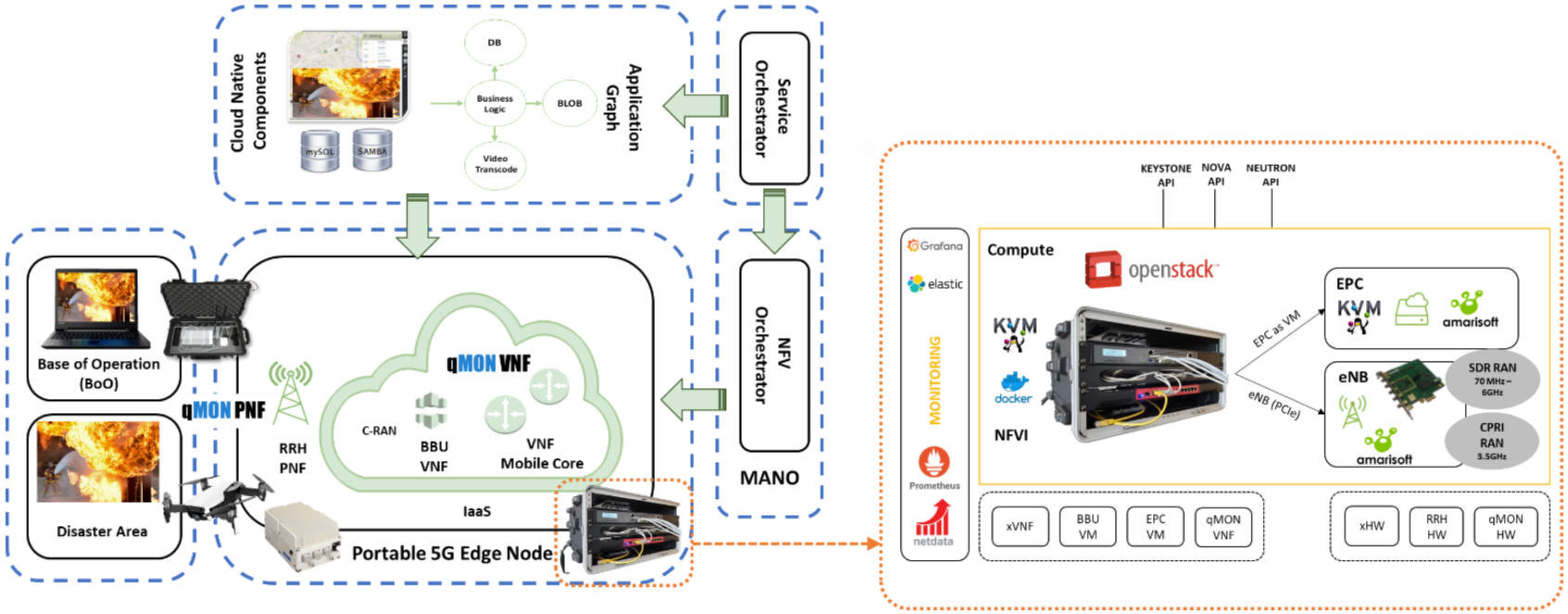
Remarks:

- 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
- 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

Thank you

Questions?

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