TACKLING NETWORK MANAGEMENT CHALLENGES FOR VERTICAL SECTORS

CUSTOM MANAGEMENT AND CONTROL OF NETWORK SERVICES BY INDUSTRY VERTICAL STAKEHOLDERS

The 5G-PPP Working Group on Network Management and QoS covers two themes:

- Delivering services to users from properly managed data and control planes

- Administering the prescribed quality of service.

In this brochure, 5G-PPP projects involved in the Working Group describe the network management challenges they are addressing in terms of their use-cases within different vertical integration sectors.

5G PPP

PUBLIC-PRIVATE PARTNERSHIP

![5G PPP Public-Private Partnership logo]

5G-PPP PROJECTS INVOLVED IN THE WORKING GROUP

5GCITY

5GCity aims to design, develop and deploy a distributed cloud, edge, and 5G radio platform, showcasing the importance of an open access model, or neutral host approach. The novel open framework allows infrastructure and hardware owners to lease available capacity for third-party service providers to deploy their solutions.

Leveraging 5G, different use cases with different network requirements will be deployed in three European cities: media, automated mobility (CCAM) and waste dumping prevention (City Services). With such deployments, the platform ensures Service Providers get previously agreed-upon levels of QoS/E at deployment using the rented distributed infrastructure and 5G radio.

5GCITY.EU

5GESSENCE

5G ESSENCE provides solutions for Small-cell-as-a-Service and edge cloud computing to three vertical use cases: local video production and distribution in a stadium, mission critical applications for public safety, and in-flight connectivity. The project defines a system architecture to provision cloud-integrated, multi-tenant Small-Cell networks. From the perspective of network management and QoS, the project relies on: network slicing mechanisms to customise the behaviour of the network for different verticals; orchestrator enhancements for distributed service management; and, centralised, Software Defined - Radio Access Network controller to program the usage of resources in a unified way for all Cloud Enabled Small Cells (CESCs).

5G-ESSENCE-H2020.EU

IORL

IoRL improves the managed and quality-assured delivery of advanced 5G services for the media, telecom, smart city and transport verticals in indoor environments. To do so it combines Visible Light Communication with mmWave technology and applies an Intelligent Home IP Gateway (IHIPG) hosting the necessary SDN and NFV capabilities.

The concept supports making infrastructure resources available to operators inside buildings, and foresees the extension of network slices into the home environment and in building premises. IoRL provides an open API to third party service providers for customised network applications.

IORL.5G-PPP.EU

MATILDA

The vision of MATILDA is to design and implement a holistic 5G end-to-end services operational framework tackling the lifecycle of design, development and orchestration of 5G-ready applications and 5G network services over programmable infrastructure. We will follow a unified programmability model and a set of control abstractions.

Network management and QoS aspects are denoted as network requirements in descriptors associated with developed 5G-ready applications. This leads to instantiation of the network slice. A set of end-to-end network monitoring mechanisms, network services deployment and orchestration and resource management mechanisms in the various network parts take place to realise the required network management and QoS assurance mechanisms.

MATILDA-5G.EU

5GMEDIA

5G-Media aims to offer an advanced management environment for network services and media-related applications such as tele-immersive media, that directly links their online lifecycle management with user experience and decisions in resources and infrastructures usage optimisation. In this scope, the 5G-Media Operations and Configuration Platform aims to establish an open source, ETSI-NFV compliant, agile programming orchestrating and verification DevOps platform for network media services and applications. This will be accompanied by a large set of open source network services and functions, responding to the needs of the media network challenges of H2020 according to the 5G vision. It will also design machine learning algorithms for testing and optimizing the use case scenarios of the project, such as immersive media, video broadcasting and UHD video transmission over CDN.

5GMEDIA.EU

NRG5

NRG-5 aims to design and develop a novel 5G solution for the energy vertical context. The NRG-5 vision is the realization of a Smart-Energy-as-a-Service Internet of Things use case that will exploit current 5G results and co-develop additional new 5G communication infrastructure focusing mainly on security, privacy, trust, and high availability.

The NRG-5 solution integrates the network slicing concept, which involves creating segregated, end-to-end, vertical portions on the same infrastructure for simultaneous use by heterogeneous services. The main enabler of this bundle of energy services is the NRG-5 catalogue, which offers a set of VNFs that are ad-hoc designed for every slice owner.

NRG5.EU

ONE5G

ONE5G focuses on 5G new radio advancements with the aim to ensure end-to-end fulfilment of URLLC, mMTC and eMBB services for verticals, comprising automotive, industry, and smart cities. The project designs enablers and provisions for network management functions to control radio resource allocations—according to the specific QoS requirements from different services and verticals—to exploit architectural adjustments in the requirements (e.g. through MEC), and to enable traffic isolation, which is a precondition to the proper coexistence of services belonging to multiple verticals.

Additionally, we are investigating C-RAN and D-RAN architectures, where different degrees of RAN function centralisation are employed to reduce network management and operational complexity, as well as cost.

ONE5G.EU

5GPHOS

5G-PHOS aims at releasing a seamless interoperable, RAT-agnostic fibre wireless (FiWi) 5G network, focusing on the following verticals: telecom, media, energy and smart cities. In particular, 5G-PHOS redesigns the fronthaul of traditional C-RAN networks by heavily investing in cutting-edge integrated optical technologies.

In parallel, it supports the main building blocks of 5G (i.e., dense network of RRHs, millimeter wave, massive-MIMO) to offer 5G services in ultra-dense and hot-spot scenarios. 5G-PHOS solutions are expected to offer data rates up to 400 Gbps with energy consumption reduced by a factor of 10. Their performance will be evaluated in lab/field experiments at Orange Labs, TIM, Cosmote Greece, and P.A.O.K. F.C. stadium.

5G-PHOS.EU

SAT5G

SaT5G addresses the satellite-terrestrial network integration within 5G and the provision of a cost-effective plug-and-play satcom solution across all geographies including moving platforms. From the network management and QoS perspective, the requirements of each single end user shall be guaranteed for multiple services, through multiple sliced networks running simultaneously. Slices may be dynamically added, removed or updated.

To support this aim, networks needs to incorporate softwarisation technologies - SDN/NFV. Virtualisation and joint management of terrestrial and satcom network functions enables higher flexibility, programmability, automation and significant cost/energy reduction.

SAT5G-PROJECT.EU

SLICENET

The SliceNet framework supports applications in the verticals Energy, eHealth and Smart Cities. Together with network management and QoS-based network slicing, SliceNet offers a One-Stop API. This API acts as a single-entry point for vertical customers to manage and control their network system functionalities, supporting uniform delivery of customised network capabilities.

Through Plug & Play, the framework provides customised control functions, APIs, and tools that enable verticals to deploy their own logic. This allows verticals flexible offering of tailored services to end-users. Exploiting artificial intelligence techniques, cognitive network management autonomously supports these verticals to meet their network performance and reliability goals.

SLICENET.EU

5GTRANSFORMER

5G-TRANSFORMER addresses uses cases for Automotive, e-Health, Entertainment, e-Industry and MNO/MVNO. It aims at transforming today's mobile transport network into a distributed SDN/NFV-based 5G Mobile Transport and Computing Platform (MTP) capable of simultaneously supporting an extremely diverse range of networking and computing requirements to meet the specific needs of different vertical industries. QoS provisioning in 5G-TRANSFORMER will be offered through three main building blocks: (i) Vertical Slicer as the logical entry point for verticals to support the creation of their respective transport slices; (ii) Service Orchestrator to orchestrate the federation of networking and computing resources from multiple domains; (iii) Mobile Transport and Computing Platform as the underlying unified transport stratum for integrated fronthaul and backhaul networks.

5G-TRANSFORMER.EU

CLUSTERING OF PROJECTS BY VERTICAL

SMART CITIES		IoRL	5G-Phos	SaT-5G		
		Matilda	ONE5G	SliceNet		

MEDIA		5G-City	5G-Essence	IoRL	Matilda	5G-Media
		ONE5G	5G-Phos	5G-Transformer	SaT-5G	

AUTO MOTIVE		5G-City	IoRL	Matilda
		ONE5G	5G-Transformer	

EMERGENCY RESPONSE		5G-City	5G-Essence	Matilda	NRG-5
		ONE5G	SliceNet	5G-Transformer	

TELECOM		5G-Phos
		ONE5G

INDUSTRY 4.0		ONE5G	SaT-5G
		Matilda	

ENERGY		NRG-5	5G-Phos
		ONE5G	SliceNet

5G-PPP.EU/5G-PPP-WORK-GROUPS