MATILDA aims to devise and realize a radical shift in 5G-ready vertical applications, by providing the tools to foster and speed up the extension/evolution of the "cloud" paradigm to the 5G ecosystem, intrinsically bridging the application and the network service domains.

In detail, in a vision that foresees a stronger integration of cloud and Mobile Edge Computing (MEC) environments, MATILDA will recognise and conform to the ongoing developments, and it will provide clear interfaces toward the multi-site management of cloud/edge computing and Internet of Things (IoT) resources, supported by a multi-site virtualized infrastructure manager. Based on this paradigm, it will support the **creation and maintenance of 5G-ready applications** through the selection of their service components and the generation of their own Forwarding Graphs, along with the lifecycle management of the required network slices, by properly interacting with the multi-site Network Functions Virtualization Orchestrator (NFVO) residing in the Network Providers' domain. Network- and application-oriented analytics and profiling mechanisms will be supported based on both real-time and a posteriori processing of the collected data from a set of monitoring streams.

To achieve these goals, intelligent, unified and hierarchical orchestration mechanisms are going to be applied for the automated placement of the 5G-ready applications and the creation and maintenance of their network slice instantiations. The concept of **slice intention** will allow the application-level orchestrator to request, negotiate, deploy, maintain and discontinue the proper application-aware slice instantiation, tailored to the specific application's needs, by also providing a set of mechanisms for runtime adaptation of the application components and/or network functions, based on policies defined on behalf of the services' provider.

As an Innovation Action, another **major goal** of MATILDA is to prove the effectiveness of its proposed mechanisms and architectural choices (illustrated in Fig. 1, along with their deployment configuration) in a set of 5G-ready demonstration test beds based on real vertical-industry use cases.

MATILDA has already released its reference architecture (see Fig. 1), driven by an exhaustive top-down requirements' analysis based on the vertical use cases that will be implemented in the project as demonstrators. The required abstractions have been also already designed, by the creation of detailed information models for the following items: chainable application components and 5G-ready application graphs, interaction with Virtual Network Functions (VNFs) and their Forwarding Graphs (VNF-FGs), network-aware applications, and deployment and runtime policy meta-models.

The MATILDA architecture is divided into three distinct layers; namely, a) Development Environment and Marketplace, b) 5G-ready Application Orchestrator and b) Programmable 5G Infrastructure Slicing and Management. In a nutshell, the development environment is responsible to package a cloud-native component in a proper format, so as to be usable by the Control Plane architectural components. Beyond that, the combination of the components in the form of complex graphs is performed by editors that will be provided in this layer. Cloud-native components and application graphs will be persisted in a marketplace, so as to be searchable by developers. On the other hand, the logically centralized service mesh control plane is the layer that is in charge of the orchestration, monitoring and policy enforcement of a 5G-ready application. The MATILDA programmable 5G infrastructure slicing and management is the interface toward the Network Operators' domain for the specification of configuration and management information of all underlying resources based on the requirements of the active policy.

To come up with a holistic approach for enhancing 5G with intelligent orchestration platforms able to support end-to-end 5G-ready applications and services' provision over a programmable infrastructure, the project is currently working along the following main lines:

- Definition of the appropriate abstractions for the design of 5G-ready applications for industry verticals able to take advantage of a 5G programmable infrastructure.
- Development of an agile programming and verification platform for designing, developing and verifying industry-vertical 5G-ready applications and network services.

- Support of mechanisms for automated or semi-automated translation of application-specific requirements to programmable infrastructure requirements.
- Support of unified and intelligent application-level orchestration mechanisms for managing the entire lifecycle of 5G-ready applications.
- Support of mechanisms for the interaction with multi-site network, compute and storage resource management.

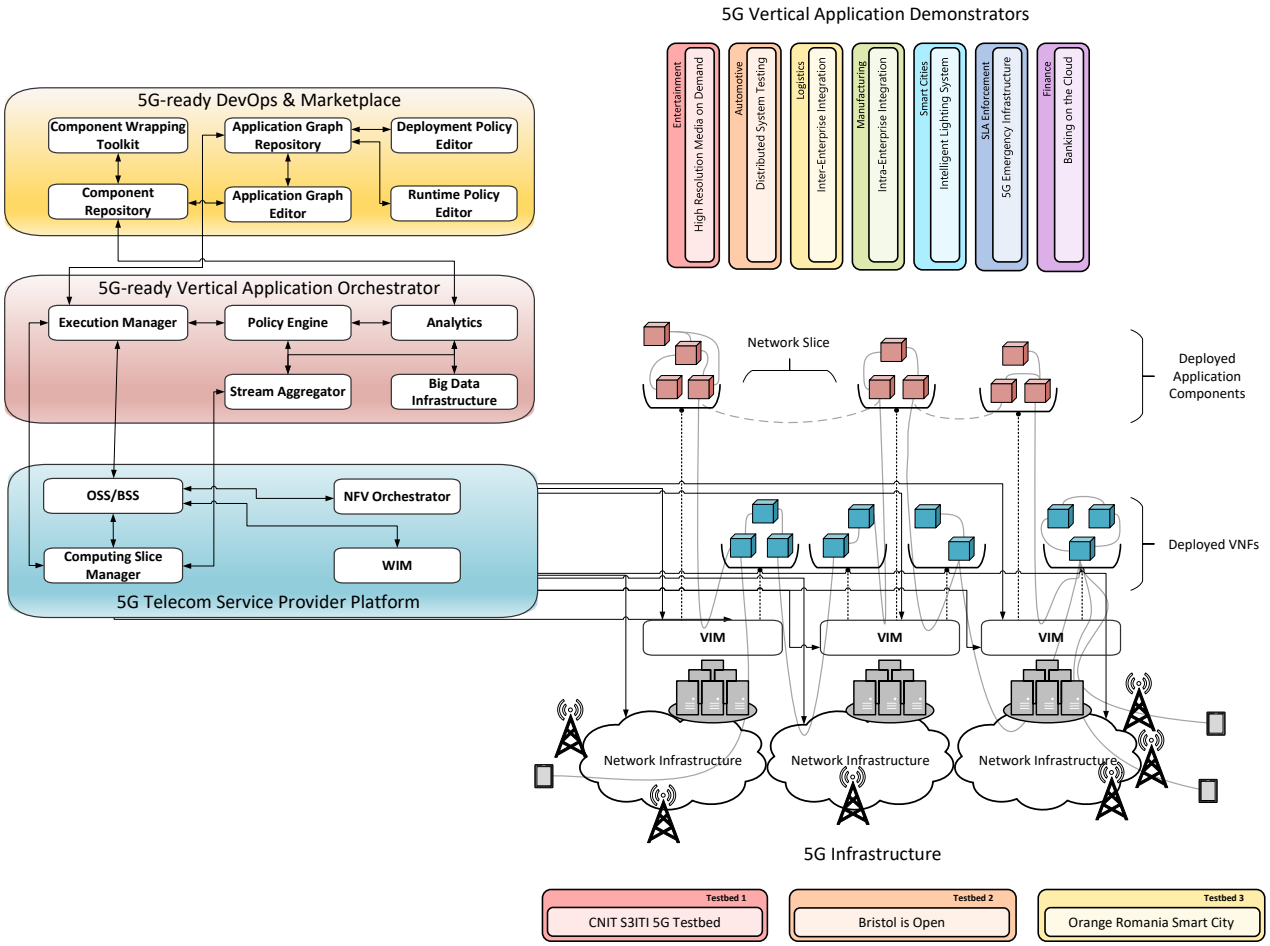

Fig. 1. Overall architecture of the MATILDA platform, reference infrastructure, demonstrators and test beds.

The ongoing development will be conveyed to a number of demonstrators addressing a broad portfolio of verticals with different characteristics and application requirements. The goal here is not to demonstrate the benefits of 5G *per se* in diversified application fields, but rather to show the impact of the MATILDA architecture and mechanisms on the entire lifecycle of the 5G-ready applications, in terms of easing and smoothing the development, deployment and operations phases; likewise, the goal of integrating cloud-native applications in a much more dynamic NFV and MEC environment will be demonstrated.
The **seven vertical applications** in different domains that will be demonstrated are also shown in Fig. 1, on top of the MATILDA architectural layers and components. They will be mapped over three different **test beds**:

- Bristol-is-Open, integrating an extensive Smart City environment of LTE radio, WiFi and mmWave devices, interconnected by fibre backhaul, and providing OpenStack on High Performance Computing nodes in Bristol, UK;
- The CNIT-S3ITI test bed in Genoa, Italy, based on WiFi and LTE radio devices, emulated Enhanced Packet Core, a MEC platform (OpenVolcano) and a cloud infrastructure stemming from a FIWARE Lab node, in a controlled laboratory environment;
- The Orange Romania Smart City test bed in Alba Iulia, Romania, integrating LTE/5G Lighting Sensors, radio access and VNFs hosted in the Orange Regional Datacentre, and a Cloud middleware IoT platform.