ADV5G-TWINS-MEC

Resumen del proyecto

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Plan de Recuperación, Transformación y Resiliencia

1. Project summary

Universitat Politècnica de València and OpenNebula Systems, have joined their forces for the enhancement of an innovation project targeted to transform the Port of Valencia into a Smart Port through digital twin concept benefiting from the latest 5G and cloud-edge innovations. Integrating the cloud-edge continuum and (B)5G technologies has been an essential step in optimizing the performance of the 5G networks underlying smart port operations, and implicitly, in significantly boosting the real-time data management, the sustainability, the data collection and the operational efficiency of the Port of Valencia.

At the core of the project is the deployment of a digital twin application that will ensure a dynamic, real-time virtual 3D replica of the port port environment and operations. The combination of B5G technologies, distributed infrastructure and digital twinning will allow the Port of Valencia to visualize, simulate and optimize the port operations with unprecedented precision, supporting smarter and real-time decision making across logistics, infrastructure and environmental monitoring.

Led by Telecommunications and Multimedia Applications Institute (iTEAM) of the Universitat Politècnica de València (UPV) and having OpenNebula Systems as the main partner, this project represents a bold step forward in building next generation of intelligent and distributed 6G-ready port infrastructure. Leveraging the flexibility and the rich feature-set of OpenNebula, iTEAM has been able to lay the groundwork for (B)5G networks supporting URLLC, mMTC and eMBB across a distributed and heterogeneous infrastructure and enabling the smart port use-case. The smart ports are not only intelligent and responsive but also fully connected and autonomous. This project brings together a suite of state of the art Open-Source Software, having OpenNebula at its core, that will become the foundation for this smart port use-case providing an ubiquitous connectivity, a precise management and orchestration of the project's hardware resources, an IaaS that can bridge seamlessly between the heterogeneous cloud-edge continuum and the innovative workloads deployed on top.

As B5G networks are evolving to enhance their support for the three key pillars of 5G, the User Plane Function (UPF) becomes a critical component for ensuring the end-to-end performance. and its benchmarking becomes an essential process to validate the level of performance needed for various business cases.

The digital twin concept relies on the core advantages of (B)5G networks needing a high-throughput, low latency, cloud-edge distributed deployment and the capacity to support thousands of devices. An optimized user-plane distributed across cloud-edge continuum path enables a real-time synchronization between the twin and real scenario but also instant actionable recommendations to solve congestions, disruptions, traffic adjustments or environmental events. AI-driven orchestration is a very much-needed addition that will help intelligently place the workloads and optimize their size in order to have the workloads at the right time, at the right place efficiently delivering the required performance level.

Creating a flexible end-to-end open-source based (B)5G network, having OpenNebula as the virtualization layer, this project complements a suite of additional projects that are all targeting the transformation of Port of Valencia into a 6G-ready Smart Port. We have managed to create a strong base for the upcoming infrastructure evolution and verticals' validation through an optimized and stable pilot network enabled by OpenNebula.

This project is a logical step in helping iTEAM to enrich their next-generation communication technologies for the smart port operations, and implicitly their testing ground for the validation of the specific smart port and digital twin use-cases. The UPV laboratory is the first step in the validation process, strategy reflected also through our project - having this B5G network deployment stable and optimized, the next step will be to expand it into the port of Valencia. The works concluded in this project represent a significant advancement in the optimization, expansion and adoption of new open-source technologies, used to support ongoing projects in this partnership between Port of Valencia and UPV.