![Celtic-Plus Smart Connected World logo]

FLEXNET

FlexNet

Project ID: C2016/3-3

Start Date: 1 October 2017

Closure date: 31 August 2020

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# Flexible IoT Networks for Value Creators

FLEXNET project achieved major steps for new paradigm of flexible communication networks to boost the creation of IoT (Internet of Things) services and provides the availability of network resources on demand, in real time, automatically and according to their specific needs.

Main focus

The main challenges of current IoT deployments are related to effective controlling and managing of IoT applications and networks, long service provisioning time, not effective resources usage, as well as complexity and scalability. One of fundamental problem is no flexibility and intelligence in current IoT networks, where there is lack of flexible control and management. Software Defined Networking (SDN) can be applied as a base of solution for the flexible and intelligence control and management of IoT network.

The FLEXNET project provides the solutions for the above mentioned problem based on the SDN and 5G technology (Fifth Generation of mobile communications) as well as AI (Artificial Intelligence) mechanisms, where the main objective is to provide high **quality connectivity** (high throughput, high availability, low latency, high density of connections), adjustable to the **needs of different applications type** and with a significant improvement in the user experience with respect to current technologies. SDN technology and its ability to adapt in real time is the center of the FLEXNET project. The concept of SDN networks is based on separating and centralizing the control of the data (control plane) of the data that goes through the network (user plane).
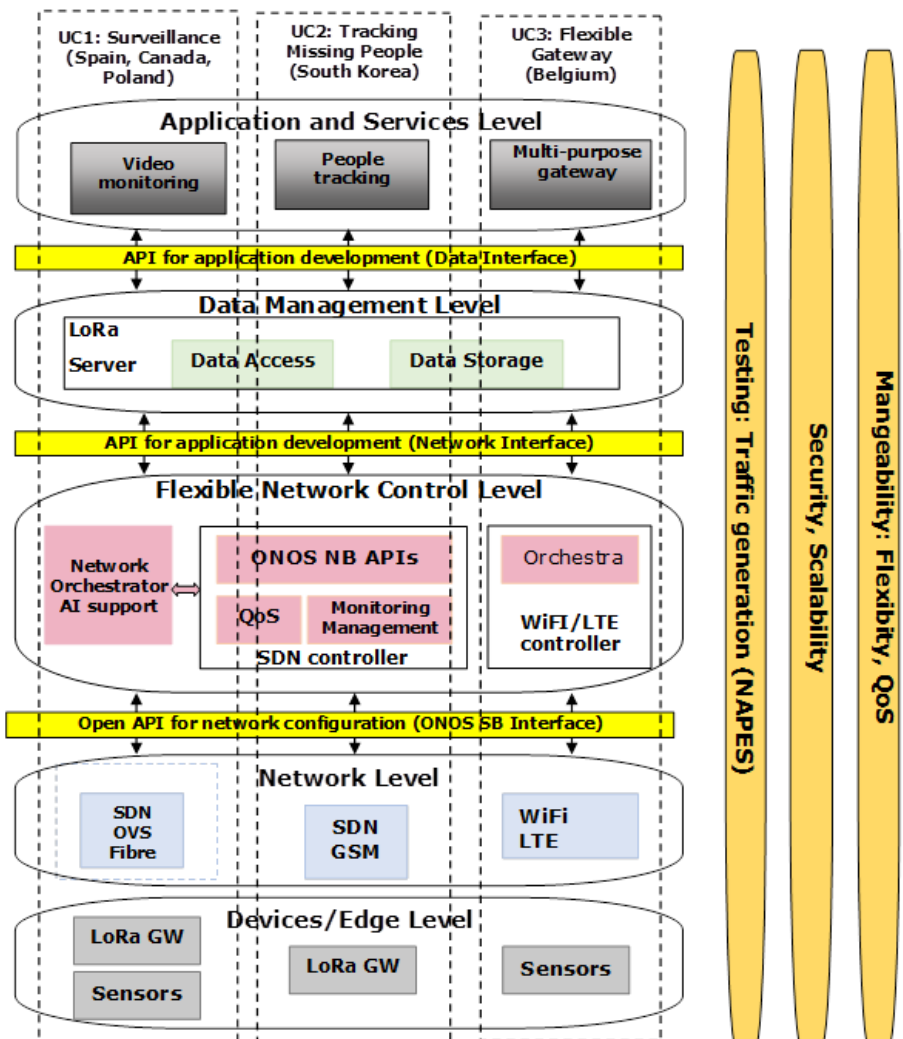
FlexNet architecture

Approach

The **FLEXNET architecture** is composed from the following elements:

- ♦ IoT Platform
- ♦ SDN & Cloud
- ♦ Shared Network & Wide Access

These architectural elements provide complete system for **flexible creation of IoT services** using IoT applications and IoT devices. The key component of the FLEXNET architecture is **SDN and cloud based** solutions. Virtualization technologies provide key functionalities for building IoT solution according to defined in the project requirements especially for dynamic services management. To meet the main requirements of the system related to dynamic network resource allocation according to demands from IoT applications the open source based approach was chosen for SDN network i.e. OVS switches (OpenFlow protocol) with ONOS control (Open Network Operating System). The FLEXNET solution is designed to be flexible for IoT applications demands and have **generic architecture** of the system allowing for providing resources on demand independently from IoT vertical type, while in the project the use cases related to video surveillance, tracking of missing people and flexible gateway were tested.

Existing IoT platforms and services are very different each other. However, they are usually monolithic solutions with strong limitations determined in the design phase: dimensioning of the solutions

type of devices, etc. Thanks to FLEXNET, IoT platforms are able to **dynamically adapt** to the number of users, devices, location of servers, etc. This flexibility will be determinant for fast TTM in new IoT services, as initial deployments will not limit future evolutions, avoiding the need of dimensioning the whole network during design phase.

Achieved results

The main outcome of this project is a **new paradigm of flexible network** providing the IoT value creators the availability to consume the network communication resources on demand according to

implemented solution is based on **SDN controller** for **network resources orchestration with AI support**. It allow for dynamic network resources allocations and their optimisation using AI mechanisms. Additionally, to validate the designed FLEXNET platform the IoT traffic **generator called NAPES** was developed. It allows for IoT application emulation close to real one with implemented protocols and different traffic generation patterns. Using NAPES, IoT platform validation with different types of IoT use cases, with large amount of traffic and large number of connections is getting easier, cost efficient and not required big amount of real IoT equipment. The
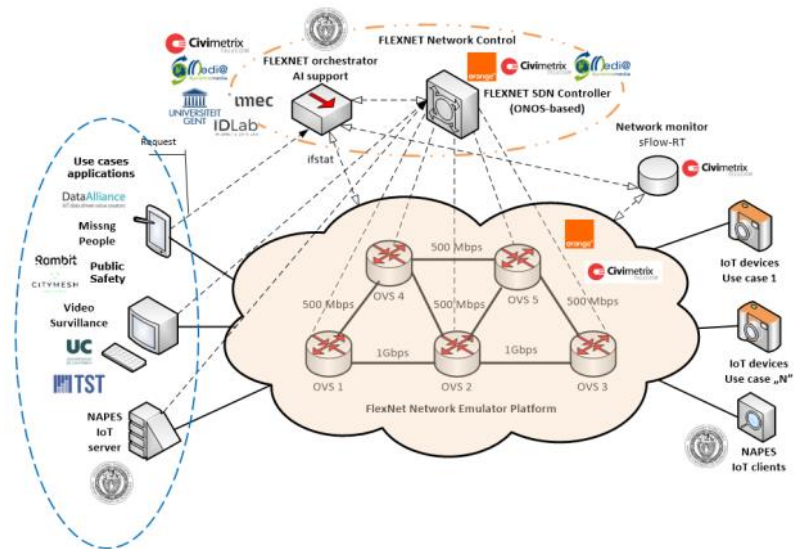
FlexNet implementation

their specific needs. To ensure a specific quality of service parameters, the idea of **reconfiguring the network according to demands** is applied. For this purpose the

designed solution were deployed in the **different IoT use cases** and is planned to use for commercial purposes, have one patent and many publications at journals and conferences.

About Celtic–Plus

Celtic-Plus is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on a new „Smart Connected World" paradigm. Celtic-Plus is a EUREKA ICT cluster and belongs to the intergovernmental EUREKA network. Celtic-Plus is open to any type of company covering the Celtic-Plus research areas, large industry as well as small companies

or universities and research organisations. Even companies outside the EUREKA countries may get some possibilities to join a Celtic-Plus project under certain conditions.

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Impact

The impact of the FLEXNET project can be envisioned in the future IoT solutions based on AI and 5G technology usage. In the IoT industry area, the deployment of the emergency services will be possible automatic in real time. The response time is crucial in all safety and emergency management applications. In this sense, the project will contribute to validate that reduced response times, which are achieved thanks to the flexible network paradigm, significantly improve emergency management. For **the network** operators new networking solutions based on **SDN and AI support** are most promising improvements to be implemented in the future communication networks. The FLEXNET is providing the solution for flexible network resource management and propose the AI support for resources optimisation.