

Multimedia Communications Group (COMM)

HEAD OF THE GROUP RESEARCH REPORT

During the last year 2021/2022, the main lines of research of the Multimedia Communications Group (COMM) have continued to be focused on multimedia systems and user Quality of Experience (QoE). The work carried out in multiple public funded projects has focused on the distribution of multimedia content using protocols like Dynamic Adaptive Streaming over HTTP (DASH) and studying low latency variants. In fact, new developments have been released as open source in this topic. Additionally, the monitoring tasks and improvements on the urban platform in MAtchUP project have continued this year, following the group trend inside the Smart City and IoT (Internet of Things) projects.

These lines of action have been articulated through the execution of different research and development projects, european, national and regional funded projects, as well as scientific publications in both international conferences and journals.

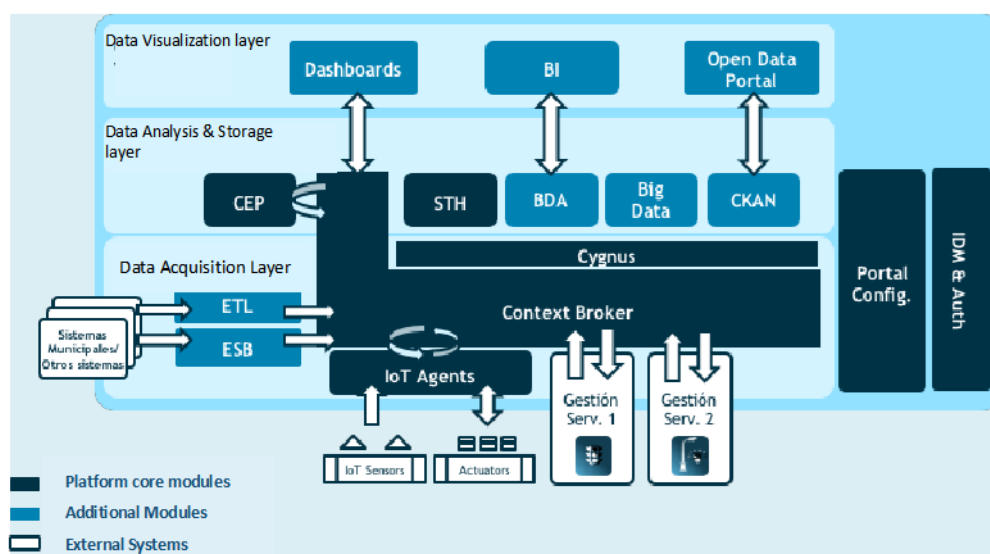
Following, the main results of the group are summarized, which are accessible through the COMM webpage (www.comm.upv.es).

1.- Project activities

Internet of Things and Smart Cities

The use of sensors and application of Internet of Things (IoT) are key factors to improve the life of citizens in the increasingly popular Smart Cities. IoT technologies comprise sensors to acquire data but are not limited to that. For a full comprehension of IoT applied to Smart Cities, a wider vision is needed, including data storage, analysis and presentation. Data can be collected with sensors, but this data must be processed and analysed in order to be transformed into information. At this point, an urban platform is important to gather, collect, process and store all this data. In this sense, in the recent years several technologies and standards have appeared proposing architectures, protocols and components for urban platform implementations, like FIWARE. FIWARE is a market-driving open source software, combining components and standard architectures to enable the connection to IoT with context information management and Big Data services that can be stored in the cloud, and it is the standard which the Valencia urban platform is based on.

Following this approach, during this year, the group has been collaborating with Valencia City Council on tasks related to Valencia Urban Platform (VLCi). Within the context of MAtchUP project, we aim at improving the performance of the city, decision making or citizen participation, among others, guaranteeing interaction between the city of Valencia and its citizens, designing new data models, datasets and APIs



FIWARE building blocks and architecture in Valencia urban platform

for the new services and devices integrated into the urban platform based on FIWARE.

Audio and video synchronization in production systems

During the previous years, we developed an application to carry out an automatic realization of a recording in real-time and tested in real scenarios, such as city council plenary sessions, where the application detected the active microphones in each instant of time and decided which camera should be on air. After the successful tests, this year we have focused on the development of new improvements to the application, adding further compatibility to new microphone brands and systems and deploying a mobile app to manage the production system from a smartphone. Additionally, we worked on improving the scalability by implementing multi-bitrate adaptive encoding using Amazon Web Services (AWS) platform.

1.1.- Ongoing projects

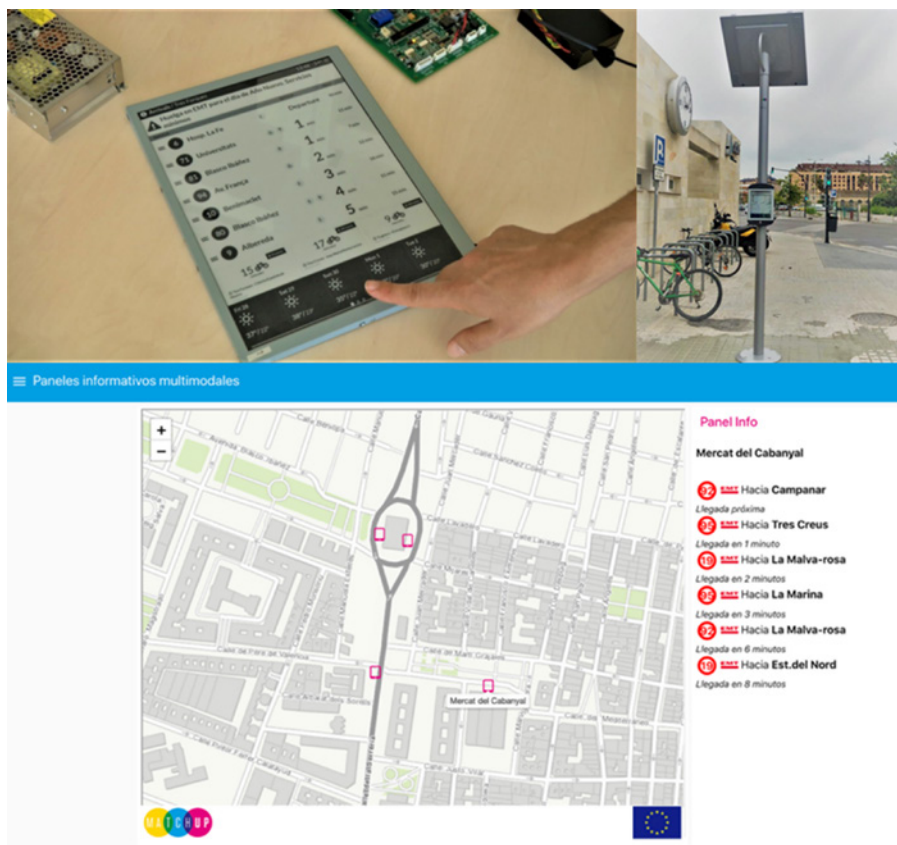
Name of the project: MAtchUP: MAtximizing the UPscaling and replication potential of high level urban transformation strategies (774477, Call H2020-SCC-2017)

Webpage of the project: <http://www.matchup-project.eu>

Funding entity and duration: European Union's Horizon 2020 Research and Innovation Programme. 2017-2023.

Summary of the project: The project aims at strengthening the planning processes for urban transformation, consolidating the benefits of deploying large scale demonstration projects of innovative technologies in the energy, mobility and ICT sectors, by means of substantially improved models for replication and upscaling, based on impacts evaluation, and ensuring the bankability of the solutions by means of innovative business models, which lead to achieve real deployment further than the pilots carried out in the lighthouse cities. With this, it is sought a high penetration of the validated technologies in those cities less prepared to adopt very innovative solutions and formalize it in a standard commitment, accompanied by capacity building strategies, to guarantee at least medium-term implementation. The project started in October 2017, with an expected duration of five years. COMM focuses on actions related to ICT.

In the Valencia demo pilot, sensors have been installed during the project, collecting data about four main pillars, Energy, with data from energy consumption, comfort, energy storage, energy generation, energy accumulation; Mobility, with data from electric and hybrid



Multimodal hub info panel and dashboard.

buses and electric bikes and vehicles from the municipality; ICT, with data from the urban platform and connectivity; and Social, with data from the social interventions and improvements. As an example, one of the interventions within the project was to develop e-ink solar-powered panels showing information about transport lines and schedules in the city multimodal hubs. This information is also available through a dashboard on the web.

The project is in its final stage. Almost all interventions are deployed and data is being collected and monitored. Moreover, some tasks in this phase are devoted to the analysis of the data quality and avoid or correct the errors that can arise from the data collecting process. Last developments are foreseen to be deployed shortly.

In addition, the project has been extended one more year (until september 2023). During this extra year it is intended to collect more data from sensors in order to obtain enough insights and extract conclusions on the impact that the project interventions have had on the city.

Name of the project: Sistema de realización audiovisual automatizada y desatendida (Automated and unattended audiovisual production system)

Webpage of the project: <https://esveu.es>

Funding entity and duration: Generalitat Valenciana IVACE (Institut Valencià de Competitivitat Empresarial). 2020-2022.

Summary of the project: The main objective of the project is the design and development of a new multimedia system for automated and unattended audiovisual recording and production. At the same time, the recording is timestamped with the start and end of each participant in the meeting. The new solution is designed for environments in which the recording of a session or meeting involving several participants, such as a municipal plenary session of a city council, a conference or a meeting of the board of directors of a company, is carried out.

The main novelty of this solution is that it allows an automated and unattended management of the production process, i.e., without requiring a dedicated person to carry out the realization of the different shots that make up the video. Also, by enabling the generation of timestamps of the video recording, it allows the identification of the person involved for subsequent location in a concrete and immediate way. The project

thus aims to implement a new application responsible for managing the entire process of making and recording a session.



Automatic video production system in a plenary session.

Name of the project: Nueva plataforma a bordo basada en redes 5G y WI-FI 6 para medios de transporte terrestre.

Webpage of the project: <https://www.azimutelectronics.com/>

Funding entity and duration: Ministry of Science and Innovation. CDTI (Center for the Development of Industrial Technology). FEDER Funds. 2020-2022.

Summary of the project: The main objective of this project is the design and development of a new entertainment and communications platform for means of transport based on 5G and Wi-Fi 6 networks. Specifically, the platform is oriented to ground transportation (buses, trains). The generation of this new solution requires research on 5G and Wi-Fi 6 technology and its application to the transmission of multimedia content in mobility environments, as well as the software development of the management processes of this new communications technology and, ultimately, of a new entertainment platform capable of working on these new standards, thus making the most of the technological innovations and advantages it introduces, generating new services for the passenger.

2.- Research results

2.1.- Featured publications

1. DASH Streaming traffic influence over energy efficient ethernet to improve energy savings. T. R. Vargas, J. C. Guerri, P. Arce. Ad Hoc Networks, vol. 136, article 102951, doi <https://doi.org/10.1016/j.adhoc.2022.102951>, 2022.

Dynamic Streaming over HTTP (DASH) is the main standard used in online video

streaming services, given that more than 1.2 billion pay subscribers around the world use this standard. This fact entails billions of streaming connections between video servers and client displays. These devices involved in the streaming connection use an Ethernet Interface Card that consumes energy. In order to reduce the energy consumption, IEEE proposed the 802.3az Energy Efficient Ethernet standard, with a mechanism to make the network card change to a low power consumption mode when it is not in transmission mode. This behavior will be beneficial for services where traffic is sent in bursts, for instance video packet bursts like in video streaming over Real Time Transport Protocol in IPTV or the widely used DASH standard. Therefore, in this study the Ethernet traffic pattern when transmitting online video content using DASH is characterized in order to analyze the efficiency of the IEEE 802.3az standard under this video streaming scenario, and to verify the convenience of activating this energy saving alternative at the network interface of billions of client devices. The experiments have been conducted using a test-bed consisting of a full DASH streaming architecture, comparing different video segment sizes and changing the available bandwidth during the experiments in different scenarios in order to analyze the effect of the DASH content segment size on the Ethernet traffic pattern to identify

the trade-off between energy efficiency, the energy savings, and the impact on the performance of the dynamic adaptation on the video streaming and reproduction.

2. Study on the Impact of DASH Streaming Services using Energy Efficient Ethernet. T. R. Vargas, J. C. Guerri, P. Arce. Proceedings of the 18th ACM Symposium on Performance Evaluation of Wireless Ad Hoc, Sensor, and Ubiquitous Networks (PE-WASUN'21), November 22–26, 2021, Alicante, Spain. Pp 89-94, doi <https://doi.org/10.1145/3479240.3488527>, 2021.

Dynamic Streaming over HTTP is the main standard used for online video streaming, service that has about 1.1 billion subscribers around the world. That implies billions of streaming connections between video servers and client displays. These devices involved in the streaming connection use an Ethernet Interface Card that consumes energy. In order to reduce the energy consumption, the IEEE 802.3az Energy Efficient Ethernet has been proposed. In this study, the ethernet traffic pattern when transmitting online video content is characterized in order to analyze the efficiency of the IEEE 802.3az standard under video streaming scenarios, and to verify the convenience of activating this energy saving alternative at the network interface of billions of client devices.