

# Achieving Low-Latency in Wireless Communications

**A key issue for which network operators are seeking solutions is that of determining applications and subsequently defining services which require very low latency and short channel acquisition times. LOLA will provide such scenarios and technologies for LTE-Advanced system architecture development and study.**

## At A Glance: LOLA

### Achieving Low-Latency in Wireless Communications



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## Main Objectives

The focus of LOLA is on access-layer technologies targeting low latency robust and spectrally-efficient transmission in a set of emerging application scenarios. We consider two basic types of wireless networks, namely long-range LTE-Advanced Cellular Networks and medium-range rapidly-deployable mesh networks. Research on low-latency transmission technologies in support of gaming services which will undoubtedly prove to be a strategic revenue area for operators in the years to come. Secondly, we also consider machine-to-machine (M2M) applications in mobile environments using sensors connected to public infrastructure (in trains, busses, train stations, utility metering, etc.). M2M is an application area of extremely high growth potential in the context of future LTE-Advanced networks. A primary focus of the M2M research is to provide recommendations regarding PHY/MAC procedures in support of M2M to the 3GPP standardization process. The rapidly deployable mesh topology component addresses M2M applications such as remote control and personnel/fleet tracking envisaged for future broadband civil protection networks. This work builds upon ongoing European research in this important area. Fundamental aspects of low-latency transmission are considered in addition to validation on real-time prototypes for a subset of the considered application scenarios. The cellular scenario validation is carried out using both live measurements from an HSPA test cell coupled with large-scale real-time emulation using the OpenAirInterface.org emulator for both high-performance gaming and M2M applications. In addition, a validation testbed for low-layer (PHY/MAC) low-latency procedures will be developed. The rapidly-deployable wireless mesh scenario validation makes use of the real-time OpenAirInterface.org RF platform and the existing FP6 CHORIST demonstrator interconnected with commercial M2M equipment.

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## Technical Approach

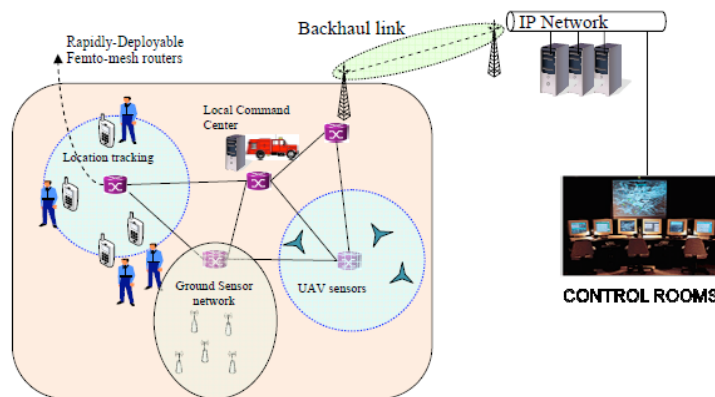
The LOLA project aims to design and validate access-layer radio technologies on three integrated system testbeds covering the two network topologies and the two low-latency application scenarios. Studies will be carried out during the first phase (first nine months) to define the targets of the core workpackages and validation scenarios, their interfaces and their specifications. Subsequently, solutions that meet the determined requirements will be identified; making use of existing technological building blocks available to the LOLA partners. Finally, implementation and integration issues will be dealt with in order to convincingly validate the proposed technological innovations.

The project is built around six technical workpackages with a top-down approach from system overview to technological prototypes:

WP2 covers all system engineering aspects of the two network topologies under consideration (cellular and mesh). After defining precisely the target application scenarios to address in the project, WP2 provides system architecture and requirements for WP3 and WP4, as well as technical specifications for the three testbeds implemented in WP5. WP2 is therefore the starting point of the project allowing for a consistent approach toward common objectives, system requirements and working assumptions. It is the role of the industrial partners to lead this WP in order to guarantee a solid industrial vision regarding the application scenarios and requirements. WP3 covers the study of the traffic characteristics of M2M and gaming applications and derives models of the latter based on real-time measurements.

WP3 involves measurement and modelling of traffic patterns with regard to low-latency aspects. The outputs of WP3 are traffic models integrated into the traffic generation modules used for system performance evaluation on Testbed 1 in WP5.

WP4 covers the study PHY/MAC algorithms (AMC, traffic scheduling, HARQ) and mechanisms in accordance with WP2 requirements. In addition selected implementations will be carried out on existing real-time platforms used in WP5 for



Testbeds 2 and 3 and PHY abstraction models will be developed for Testbed 1.

WP5 covers the integration of selected WP3 and WP4 technologies on three different testbeds satisfying WP2 requirements. A small-scale field trial (Testbed 3) of selected technologies will be carried out at the end of WP5.

WP6 deals with dissemination and standardization issues, which are critical in order to promote the innovations of the consortium.

## Key Issues

LOLA will provide in-depth study of access-layer procedures (PHY/MAC) for next generation network infrastructures allowing for the deployment of new and highly-strategic services, namely online-gaming and M2M/sensory communications

Traffic measurement and modelling for low-latency protocol development also plays a key role in the project for dimensioning the access network.

LOLA promotes the use of globally standardized LTE/LTE-A access networks for massive amounts of M2M sensory traffic rather than specially-deployed networks.

Focus will be on cost/bit optimizations for the huge number of potential M2M devices connected to the future internet via cellular networks.

## Expected Impact

LOLA will provide input to standardization activities as well as LTE development activities by ensuring better understanding of M2M traffic and the impact of such traffic on LTE networks.

The considered technologies will allow for improved public safety services, for instance surveillance through remote controlled sensors in buildings or in vehicles operated by public transportation.

LOLA's prototyping activities will provide important contributions to the development of the open-source initiative **OpenAirInterface.org**