Localization Aspects in 5G era

LOCalization and analytics on-demand embedded in the 5G ecosystem, for Ubiquitous vertical applicationS

Maria Belesioti
Fixed Network R&D Programs Section
Research & Development Department, Fixed & Mobile
Hellenic Telecommunications Organization S.A. (OTE)
mbelesioti@oteresearch.gr

https://www.locus-project.eu/

22nd Infocom World Conference – *Athens, Greece, November 06, 2020*

ΟΜΙΛΟΣ ΕΤΑΙΡΕΙΩΝ

Current Status

Location information in mobile communication systems *not only enables various location-based applications, but also helps to improve communication system performance*

5G enhancements in Localization

- Higher user data rate,
- Higher mobile data volume per area,
- Higher number of connected devices,
- Reduced end-to-end latency,
- Higher accuracy in location information from 10 m to less than 1 m on 80% of occasions, and better than 1 m for indoors.

LOCUS Vision & Key aspects

The goal of the LOCUS project is to **design** and **develop** a location management layered infrastructure not only capable of improving localization accuracy and security, but also to **extend** it with physical analytics, and **extract value** out of it, meanwhile guaranteeing the end-users' right to privacy.

LOCUS will improve the functionality of 5G infrastructures to:

- Provide accurate and ubiquitous location information as a network-native service, and;
- Derive more complex features and behavioural patterns out of raw location and physical events, and expose them to applications via simple interfaces.

ΟΜΙΛΟΣ ΕΤΑΙΡΕΙΩΝ

LOCUS Techical goals

- System architecture with built-in security and privacy
- 5G Terminal Localization, a cellular-based localization thought of as an evolving functionality in terms of performance
- Integration with non-3GPP localization technologies (GNSS, WiFi, Bluetooth, etc.)
- Device-free localization technologies: solutions to use base stations and other transmitters present in the environment as “illuminators of opportunity” for passive radar, and to localize also passive targets (people and things)
- Analytics, Learning and Inference: analyse the behaviour of devices and targets
- Network management: exploit localization information and advanced data analytics to enhance network management
- Exemplary localization-based services: empower exemplary services

LOCUS research Axes

LOCUS project studies and develops solutions corresponding to four research axes:

- Location security and privacy
- Localization enabling technologies including 3GPP, non-3GPP and device-free localization
- Location and analytics for smart network management
- Location and analytics for new services

ΟΜΙΛΟΣ ΕΤΑΙΡΕΙΩΝ

Main 4G LTE Location Services

Enhanced cellular ID (E-CID)	*E-CID augments a coarse position estimate based on the base station ID with signal levels and travel time estimates*
Assisted GNSS(A-GNSS)	*A-GNSS provides user devices with information to speed up and facilitate positioning*
Observed rime difference of arrival (OTDOA)	*OTDOA uses hyberbolic multi-lateration methods to estimate positioning based on signals from at least three BSs*
Hybrid A-GNSS+ OTDOA	*combining A-GNSS and OTDOA extends the reach of GNSS to location where GNSS signals are not available*
Uplink time difference of arrival (UTDOA)	*UTDOA uses hyberbolic multi-lateration methods to estimate positioning based on signals sent to nearby base stations*

LOCUS use cases

- Location Security and Privacy
- Localization Enablers
  - Positioning and Flow Monitoring in Large Venues and Dense Urban Environments
- Localization and Analytics for Smart Network Management
- Localization and Analytics for New Services
  - Transportation optimization based on identification of traffic profiles

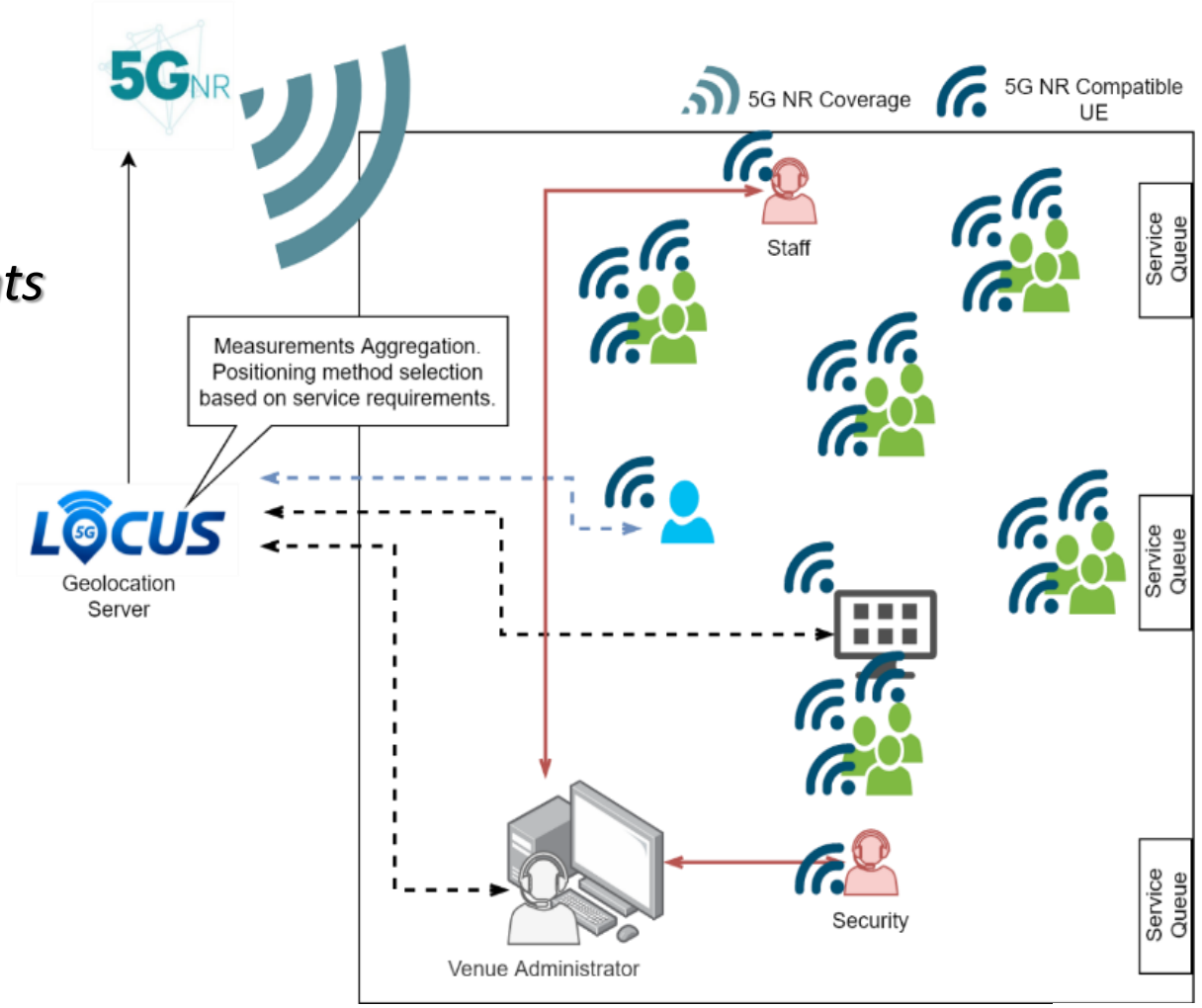
ΟΜΙΛΟΣ ΕΤΑΙΡΕΙΩΝ

Positioning and Flow Monitoring in Large Venues and Dense Urban Environments

LOCUS Geolocation Server
will use 5G-based signals and/or other measurements to satisfy service requirements and decide on positioning methods to use and/or to fuse.

Goals:

- ***Enhance*** *indoor positioning, and enable vertical services.*
- ***Provide*** *real time commercial and convenience information for an enhanced user experience.*



ΟΜΙΛΟΣ ΕΤΑΙΡΕΙΩΝ

Transportation optimization based on identification of traffic profiles

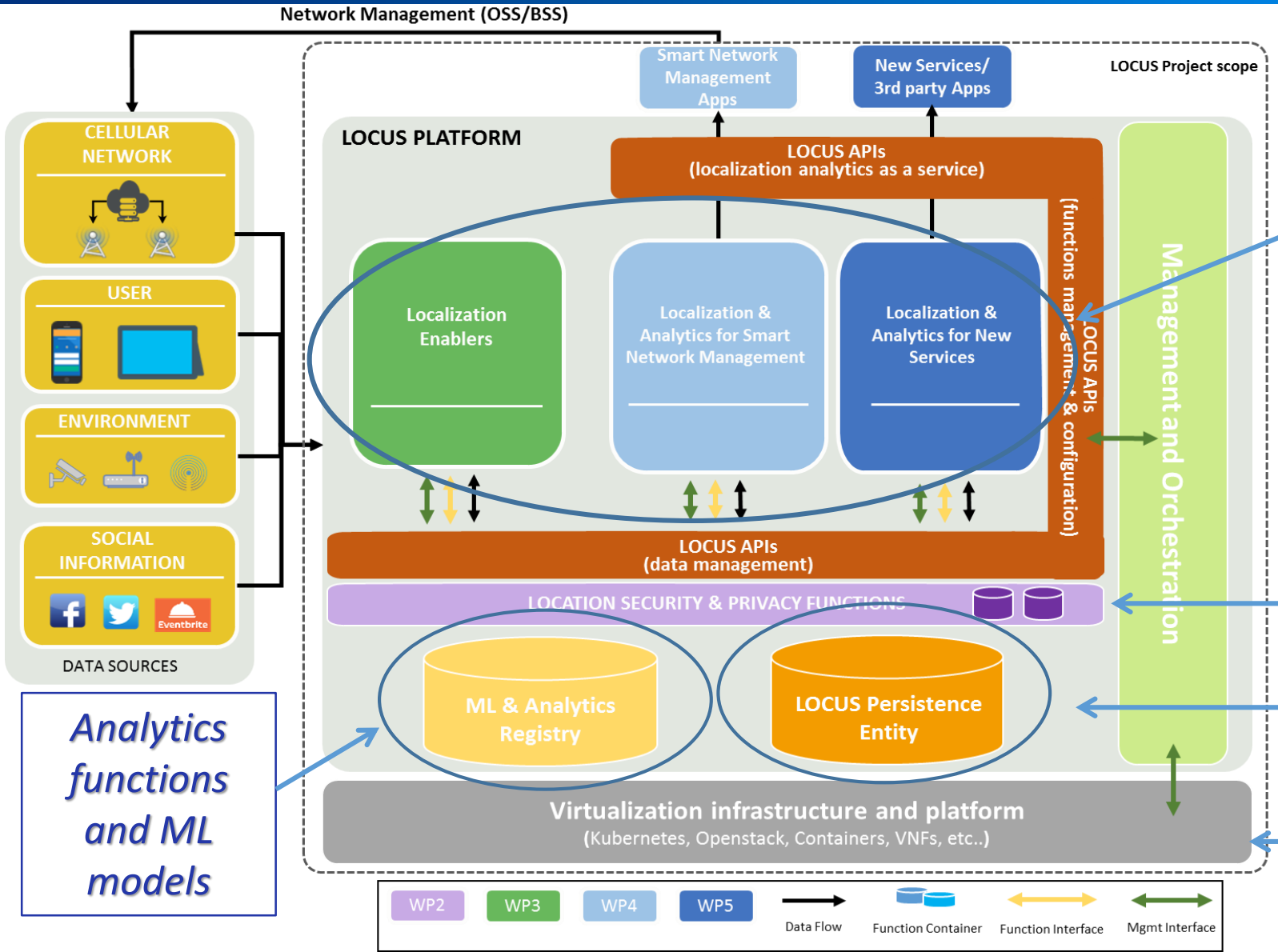
Goal:

Prove the feasibility and exploitability of location information through time for smart city traffic management.

- *Localization information is gathered for the various mobile terminals that are moving in a large transportation hub, consisting of various mobility profile users.*
- *LOCUS will exploit geolocation-velocity data to provide identified areas.*

ΟΜΙΛΟΣ ΕΤΑΙΡΕΙΩΝ

High Level Architecture



Responsible for providing the user device location information, feeding Analytics and ML mechanisms for Smart Network Management & New services

Applies horizontally

Responsible for the storage of all relevant data

5G virtualized infrastructure

Analytics functions and ML models

ΟΜΙΛΟΣ ΕΤΑΙΡΕΙΩΝ

Thank you.

Questions?