



Vertical Sector Transformations through Advanced Wireless Technologies and A.I.

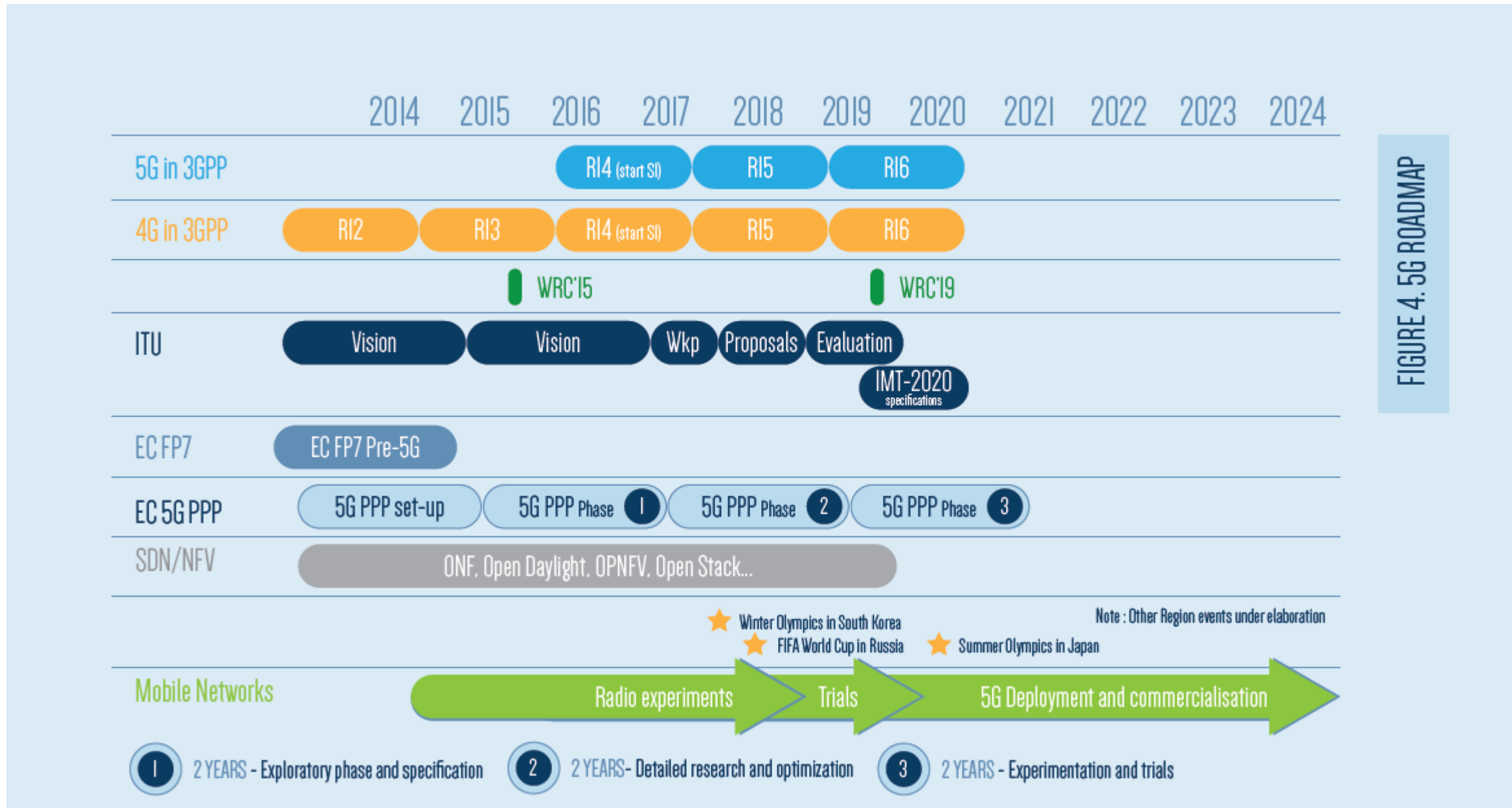
Status, First Experiences from 5G, The Role of MEC, and
Prospects for Beyond 5G

Prof. Panagiotis Demestichas
IEEE 5G World Forum, 30 Sep. 2019

Outline

- 5G Aspects
 - ▣ The prominent role of MEC
- First experiences from 5G-oriented experiments
 - ▣ Infrastructures and first use cases (5G-EVE)
 - ▣ Connected and Automated Mobility powered by 5G (5G-MOBIX, 5G-CARMEN)
 - ▣ Further Verticals (5G-HEART, 5G-TOURS)
 - ▣ MEC role to be discussed
- Prospects (verticals, technologies)

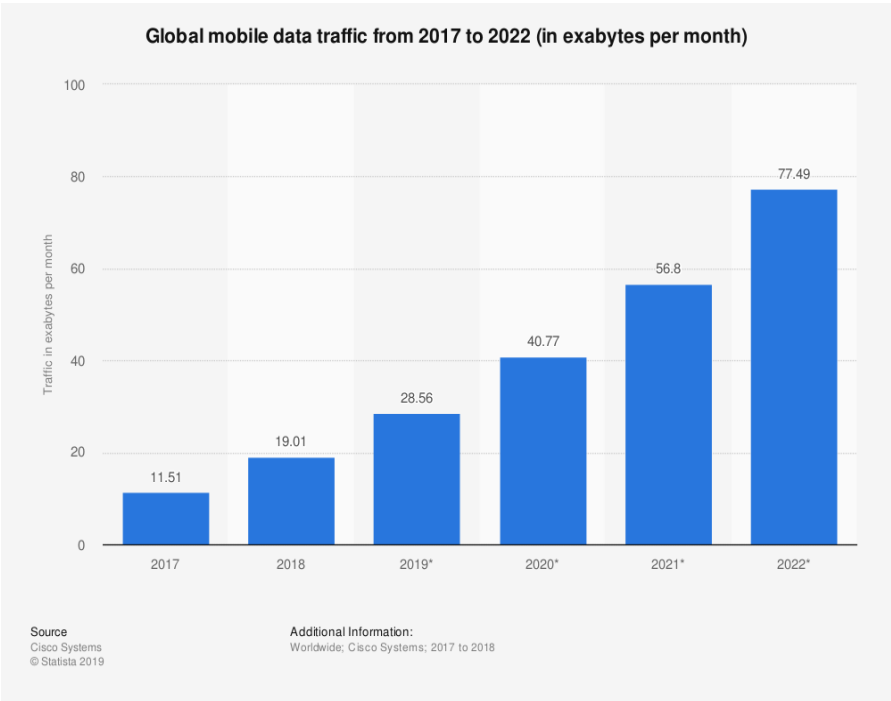
5G Aspects – Overview



Source: 5G-PPP, <https://5g-ppp.eu/wp-content/uploads/2015/02/5G-Vision-Brochure-v1.pdf>

5G Aspects – Viewpoints

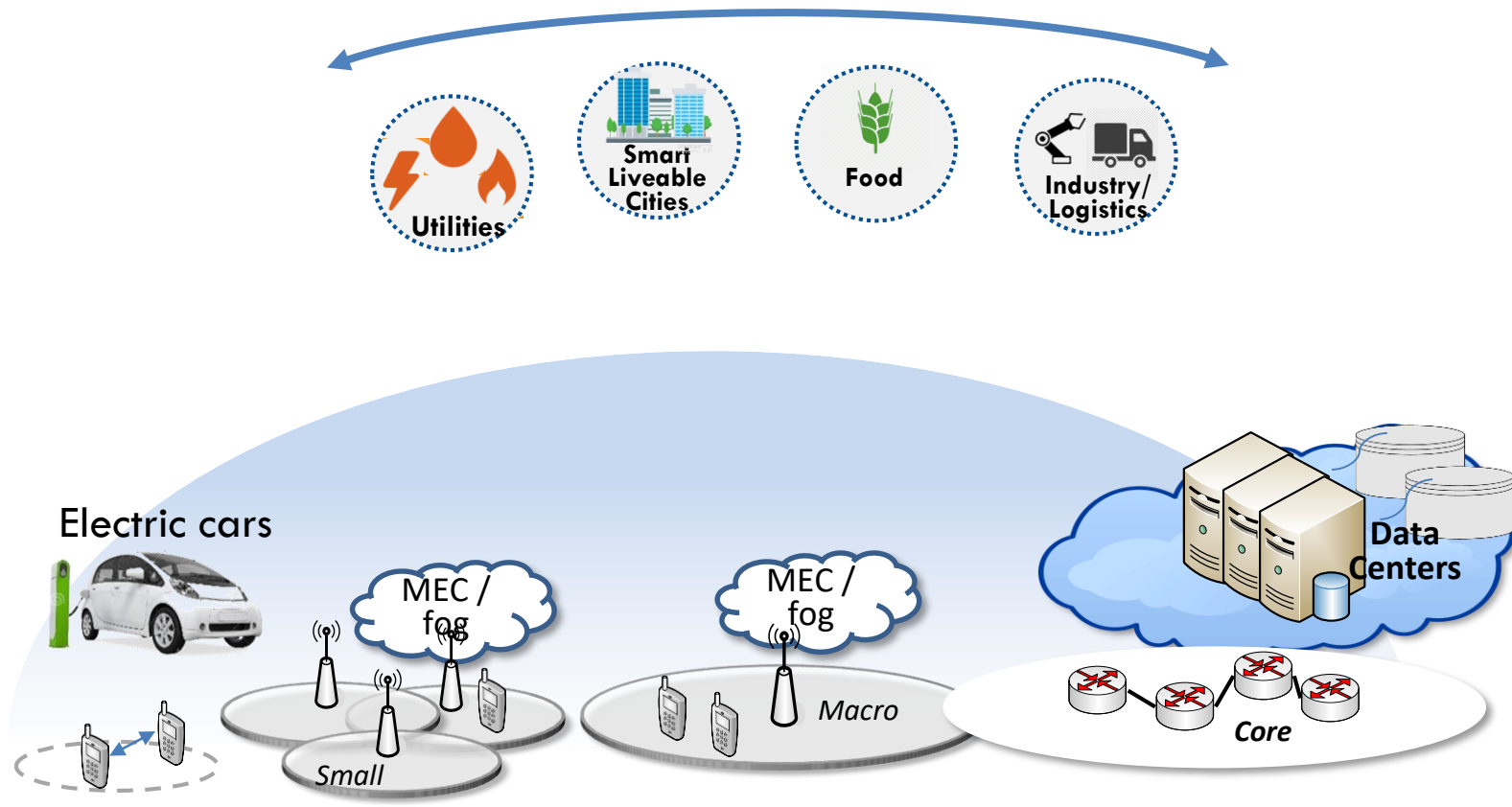
Traffic increase



References:

- Cisco Visual Networking Index: Forecast and Trends, 2017–2022 White Paper
- Ericsson Mobility Report, June 2019

Many verticals

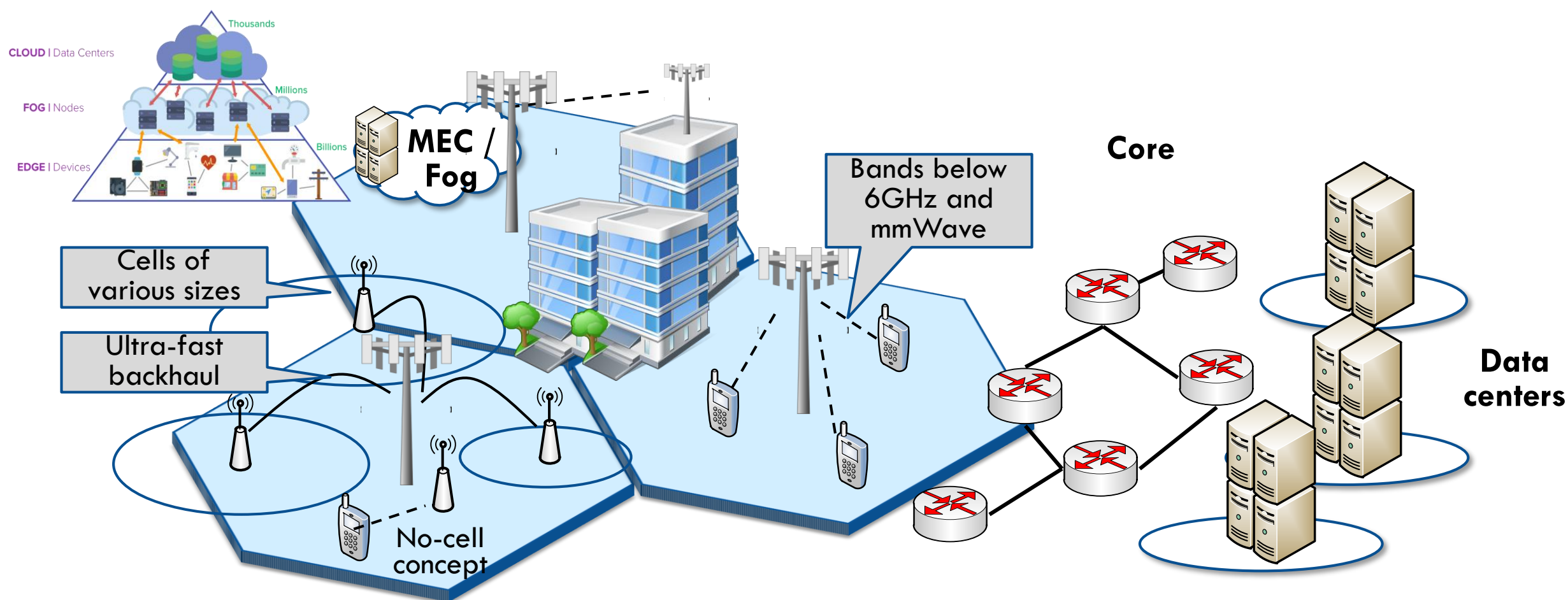


System Features:
 More spectrum, more cells (towards no cells)
 Resources: computing, storage, communication
 Complex infrastructure
 Many options for delivering services

5G Aspects – The role of MEC

ETSI Definition:

- **MEC** is a natural development in the evolution of mobile base stations and the convergence of IT and telecommunications networking.
- **MEC** will enable new vertical business segments and services for consumers and enterprise customers.
- **Use cases include:** video analytics; location services; Internet-of-Things (IoT); augmented reality; optimized local content distribution; data caching
- **Business potentials**



First Experiences from 5G-oriented activities: The contribution of 5G-PPP

From concept to trials



Concepts

- **Physical layer** (Fantastic 5G)
- **System Level Simulation** (plus initial experiments)

Components

- **Resource management** (One5G)
- **Slicing** (One5G, Clear5G)
- **Simulation** and Experiments

Trials

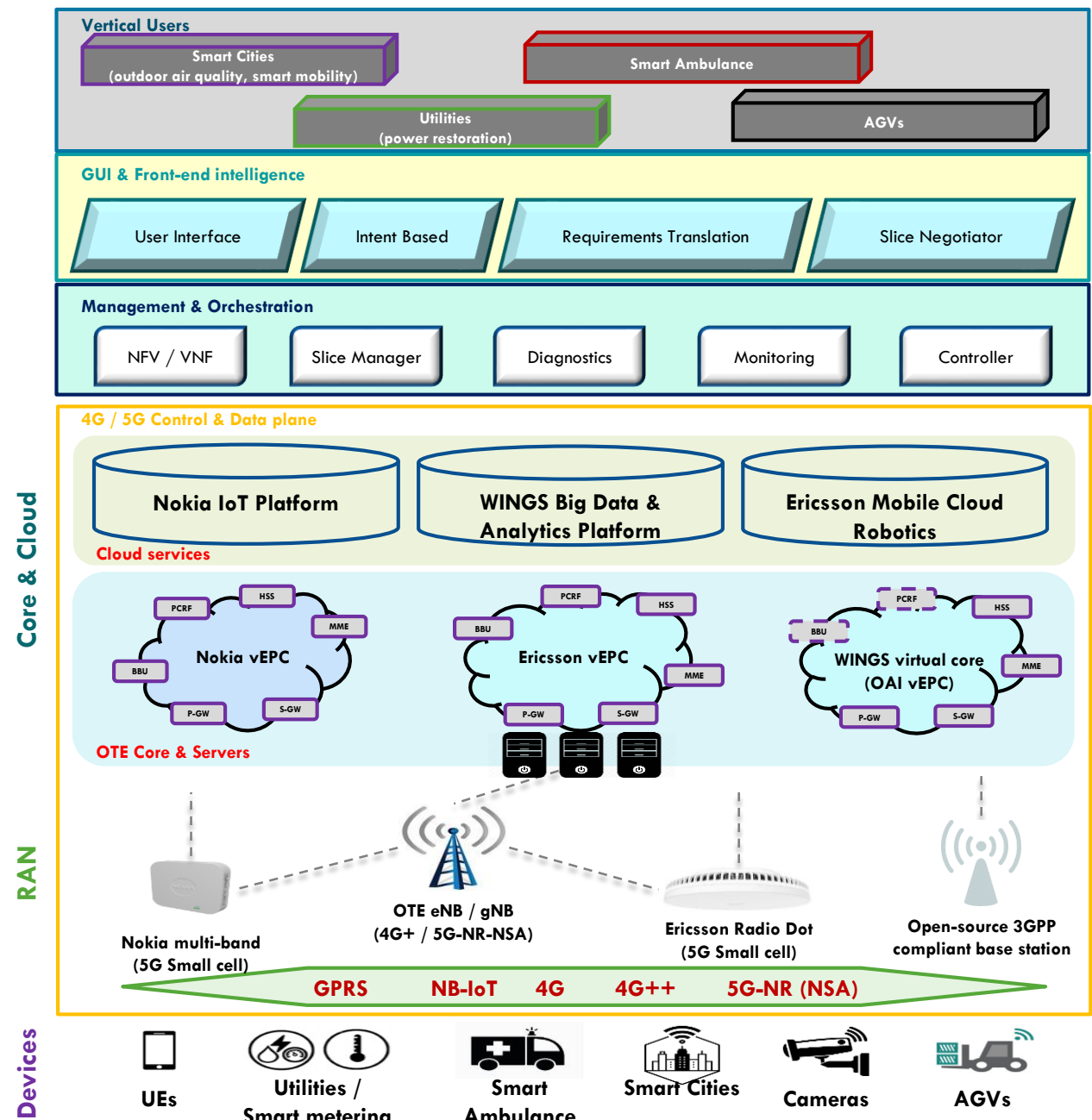
- **Facilities** (5G-EVE)
- **CAM** (5G-MOBIX, 5G-CARMEN)
- **Further cases:** Food, Security/Safety, etc. (5G-HEART, 5G-TOURS)

Facilities: 5G European Validation platform for Extensive trials (5G-EVE)

- The Greek 5G EVE site facility covers a region of Northern Athens, around the R&D site of the Greek National Telecommunication Organization (**OTE**)
 - ▣ **5G end-to-end functionality** for eMBB, URLLC and mMTC
- OTE, **Ericsson GR**, **Nokia GR** and **WINGS** prepare and upgrade the Greek site facility to handle 5G-oriented vertical use cases, namely:
 - ▣ Industry 4.0 functionality with Automated Guided Vehicles (AGVs) (responsible: ERICSSON-GR)
 - ▣ **Utilities** applications on Smart Energy grid monitoring & ultra-reliable / fast **fault restoration** (responsible: **WINGS**)
 - ▣ Smart cities applications focused on air quality aspects and on smart mobility
 - ▣ Smart cities applications focused on Connected Ambulance (responsible: NOKIA-GR)
- Open to vertical industries for execution and validation of pilots with full sets of 5G capabilities
 - ▣ Testing ground for services, equipment, and new features prior to their commercial release
 - ▣ The existing equipment and network functionality are a mix of Ericsson and Nokia technologies (complemented by OAI technologies managed by WINGS), which will be progressively extended

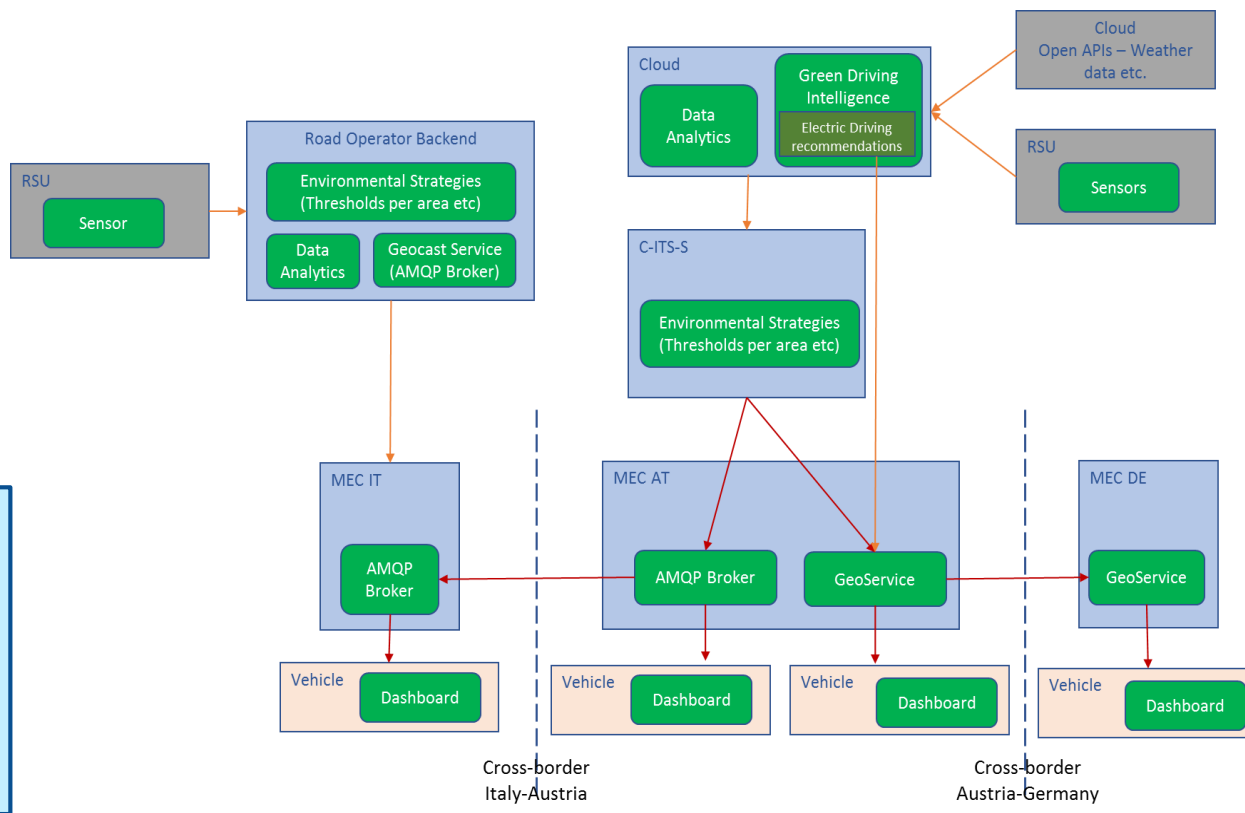
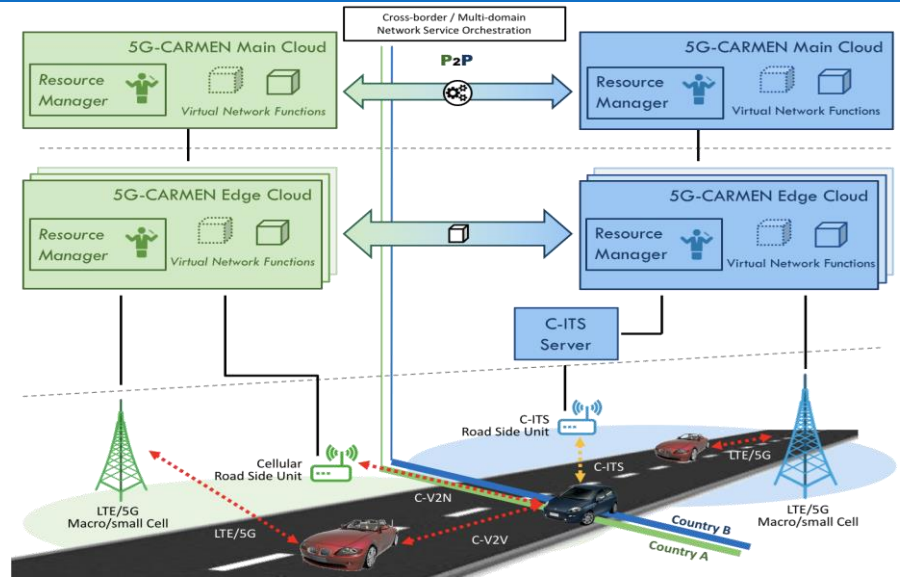
Role of MEC (utility and other use cases):

- Reduced latency for critical services
- Optimize information flow



CAM – Green Driving and Infotainment (5G-CARMEN)

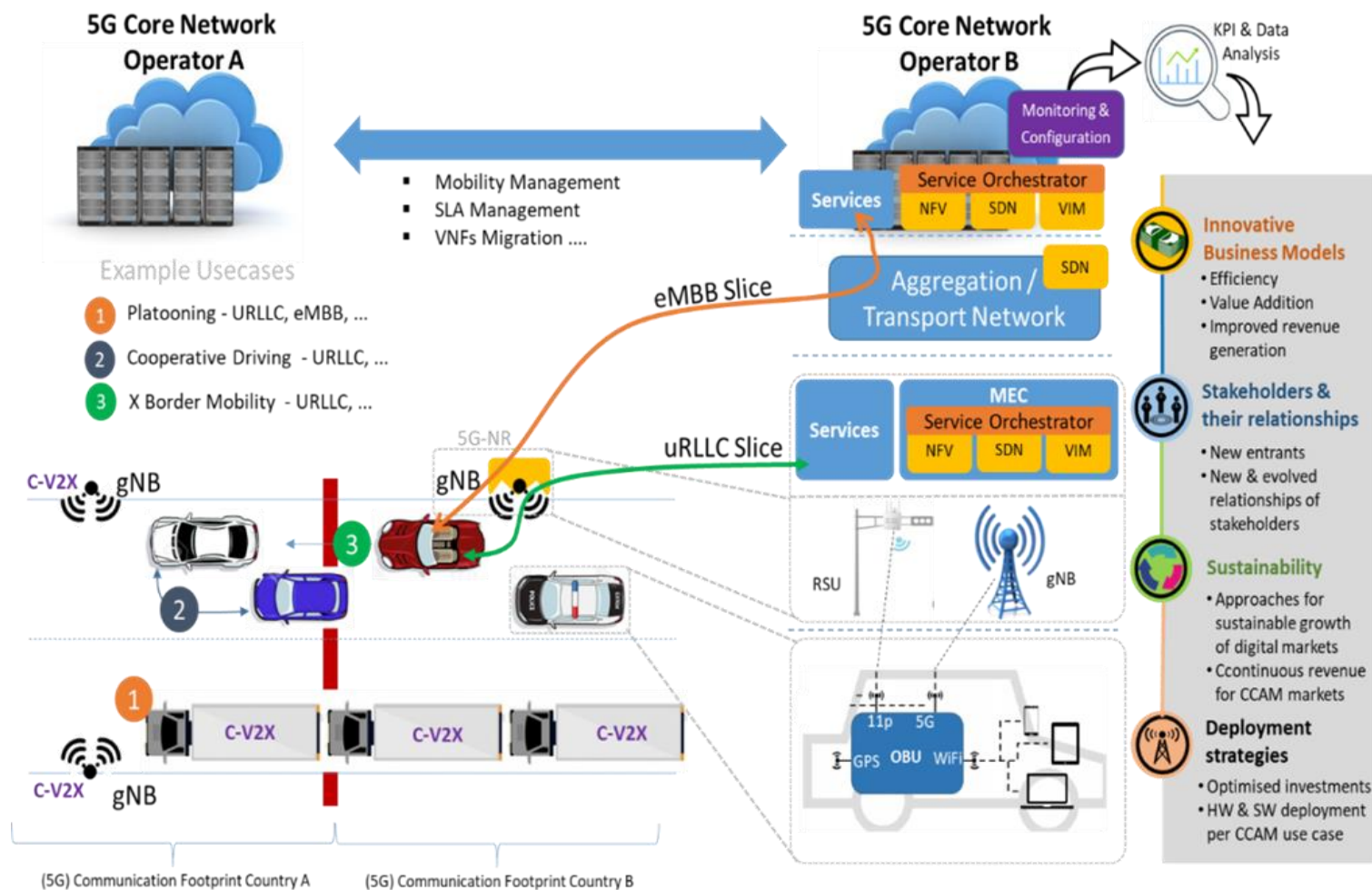
- Generation of descriptive, predictive and prescriptive **analytics**, based on **roadside** and (potentially) **vehicle** data, towards **value adding car/passenger** services;
- **Decision making** towards **green driving**, and other services;
- Personalised services including **infotainment** context;
- **Resource management, service orchestration** and **life-cycle management** for seamless service continuation, in **multi-domain** and **cross-border** setups.
- Cross-border **corridor**: Germany – Austria – Italy



Role of MEC:

- Reduced latency for critical services
- Proactive caching for video streaming applications
- Bringing content closer to the user
- Distributing the computations

CAM and 5G driven services: Advanced customs and border control applications (5G-MOBIX)



- Development and integration of AI/ML techniques to enable Assisted “**zero-touch**” truck border crossing
- **Threat assessment and classification** of incoming trucks based on on-board and road-side sensors
- Protection against **smuggling, human trafficking and contraband** through data fusion and intelligent analytics
- Increased safety and **protection of customs personnel**
- Cross-border **corridor: Greece-Turkey (and ES-PT)**

Role of MEC:

- Reduced latency for critical services
- Reduced reaction times in threat assessment

Further cases: Food Security/Safety, Health, Transport (5G-HEART)

Use cases

- **Healthcare:** pillcams for automatic detection in screening of colon cancer and vital-sign patches with advanced geo-localization as well as 5G AR/VR paramedic services
- **Transport:** autonomous/assisted/remote driving and vehicle data services
- **Aquaculture:** remote monitoring of fish and water quality

Test cases to be integrated in the Greek node (aquaculture)

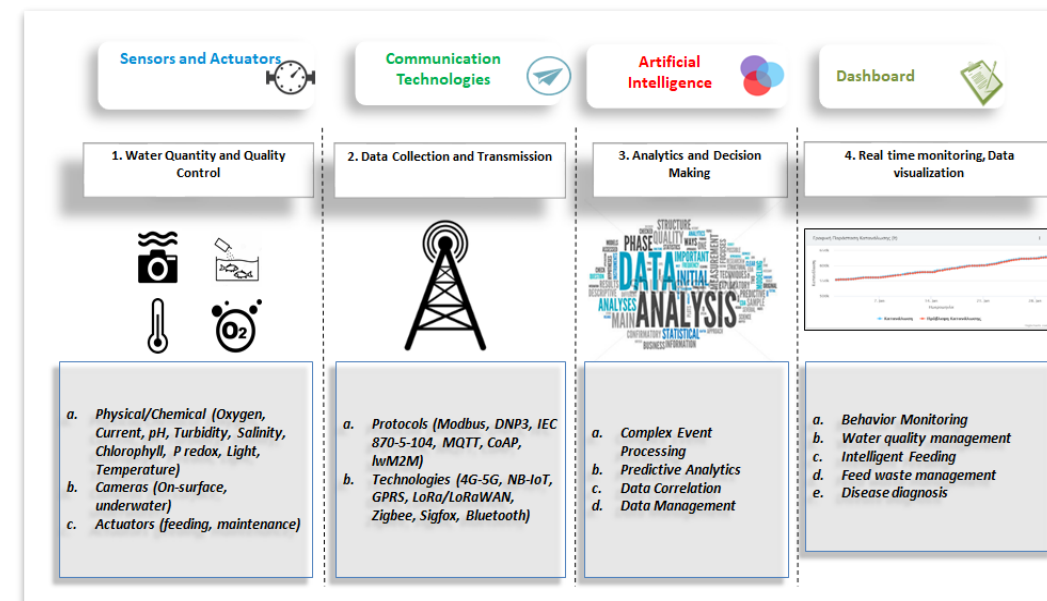
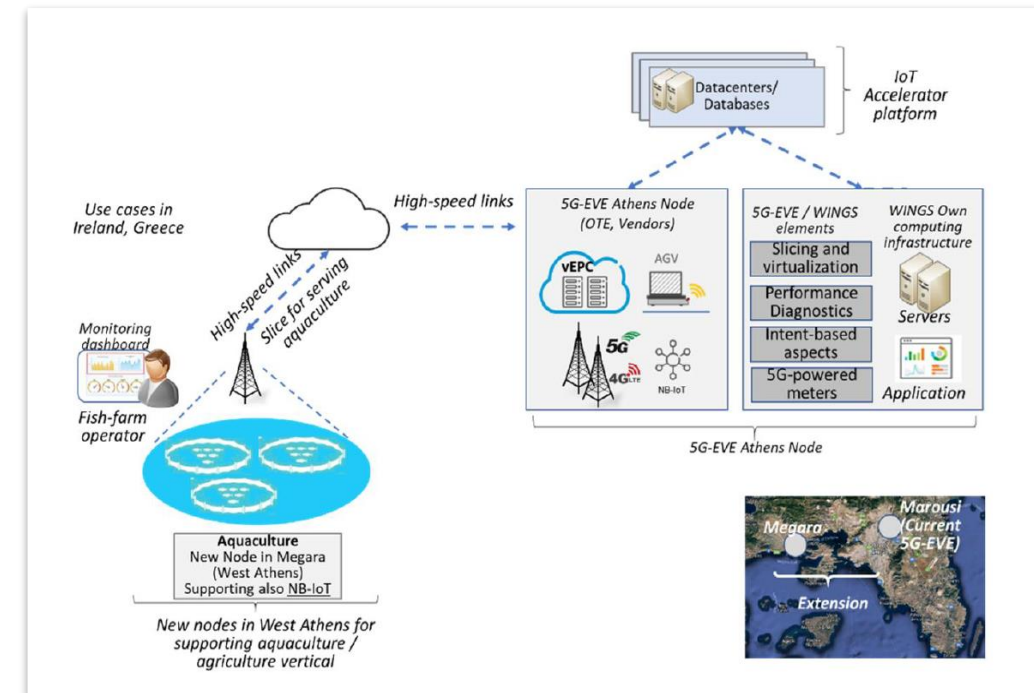
- Multi-parameter monitoring/data collection (mMTC)
- Security camera footage (eMBB)
- Fish and infrastructure monitoring (eMBB)
- Autonomous functionality (URLLC)

Underwater cameras, drones and sensors will be attached in the net or near the surface

Exploitation of **AGNES platform** (Artificial Intelligence and Internet of Things powered platform (and applications) for food security and safety)

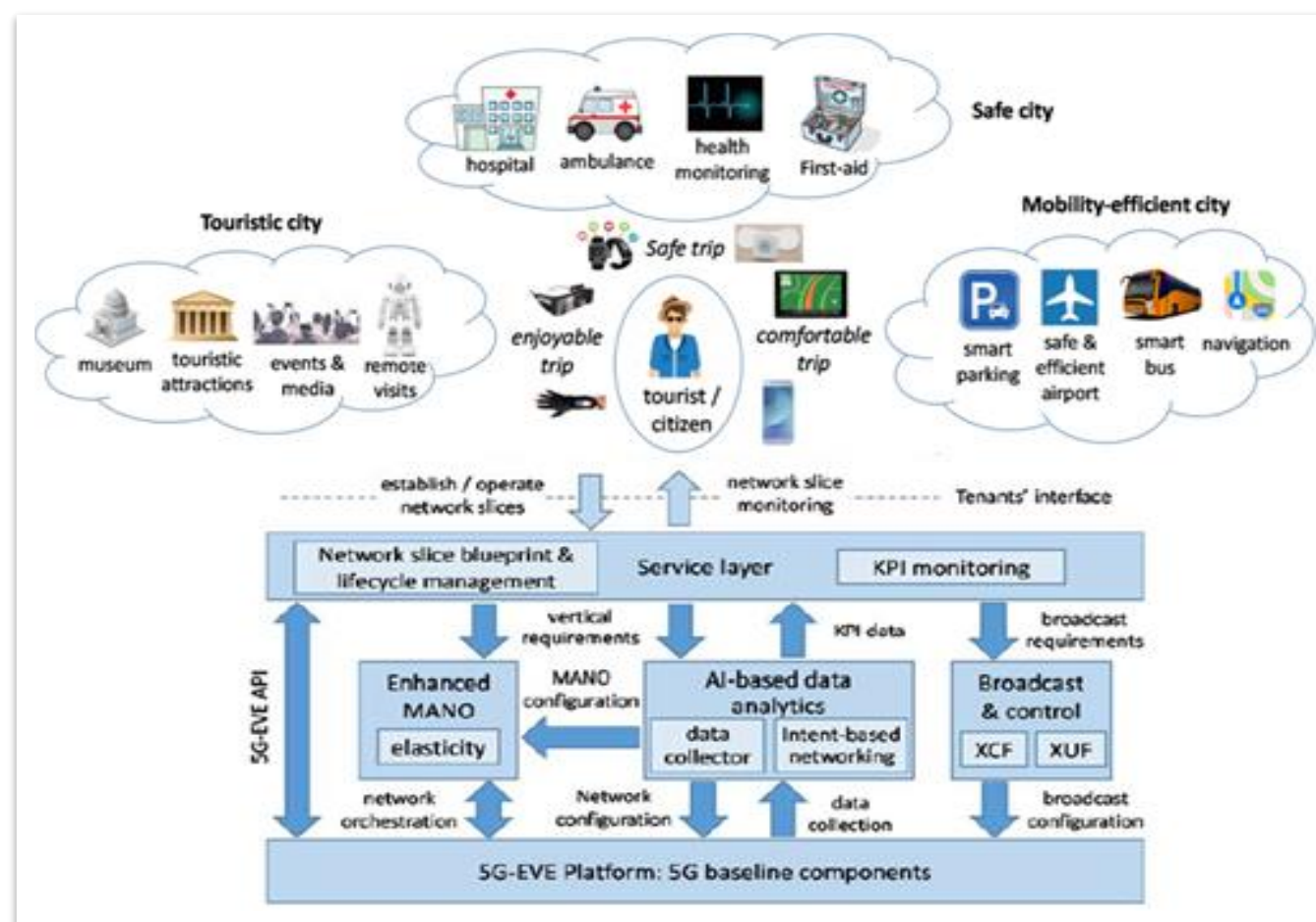
Role of MEC:

- Reduced latency and higher throughput for video/images
- Installation monitoring and decision making functionality



Further cases: Cities (5G-TOURS)

- Use cases:
 - ▣ **Turin, the touristic city:** focused on media and broadcast use cases
 - ▣ **Rennes, the safe city:** where e-health use cases will be demonstrated
 - ▣ **Athens, the mobility-efficient city:** that brings 5G to users in motion as well as to transport-related service providers
- “Complex” services
- The Athens node is based on 5G-EVE Athens site facility which will be extended towards the **Athens International Airport** where the following scenarios will be trialed:
 - ▣ Smart airport parking management
 - ▣ Video-enhanced ground-based moving vehicles
 - ▣ Emergency airport evacuation
 - ▣ Excursion in an AR/VR- enhanced bus
- Exploitation of **STARLIT platform** (cloud baSed IoT smARt Living plaTform)



Role of MEC:

- Reduced latency for critical services
- Better experience of demanding services such as AR/VR

Prospects – Wrap up

- MEC is a network architecture that brings real-time, high-bandwidth, low-latency access to radio network information,
 - ▣ Allowing operators to enable a new ecosystem and to create win-win situations.

- Multiple types of services enabled
 - ▣ Currently: results are collected and evaluated

- Further work
 - ▣ Aggregate management
 - In conjunction with the communication and software technologies advancements
 - ▣ Technical, Business, Regulation

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Please find the detailed technical company profile at <https://goo.gl/BYmOh4>

