



WINGS ICT Solutions Profile

Outline

2

- About us
- Solutions for Verticals
- Products/Platform
- Selected Customers and Partnerships
- Projects
- Contact Information

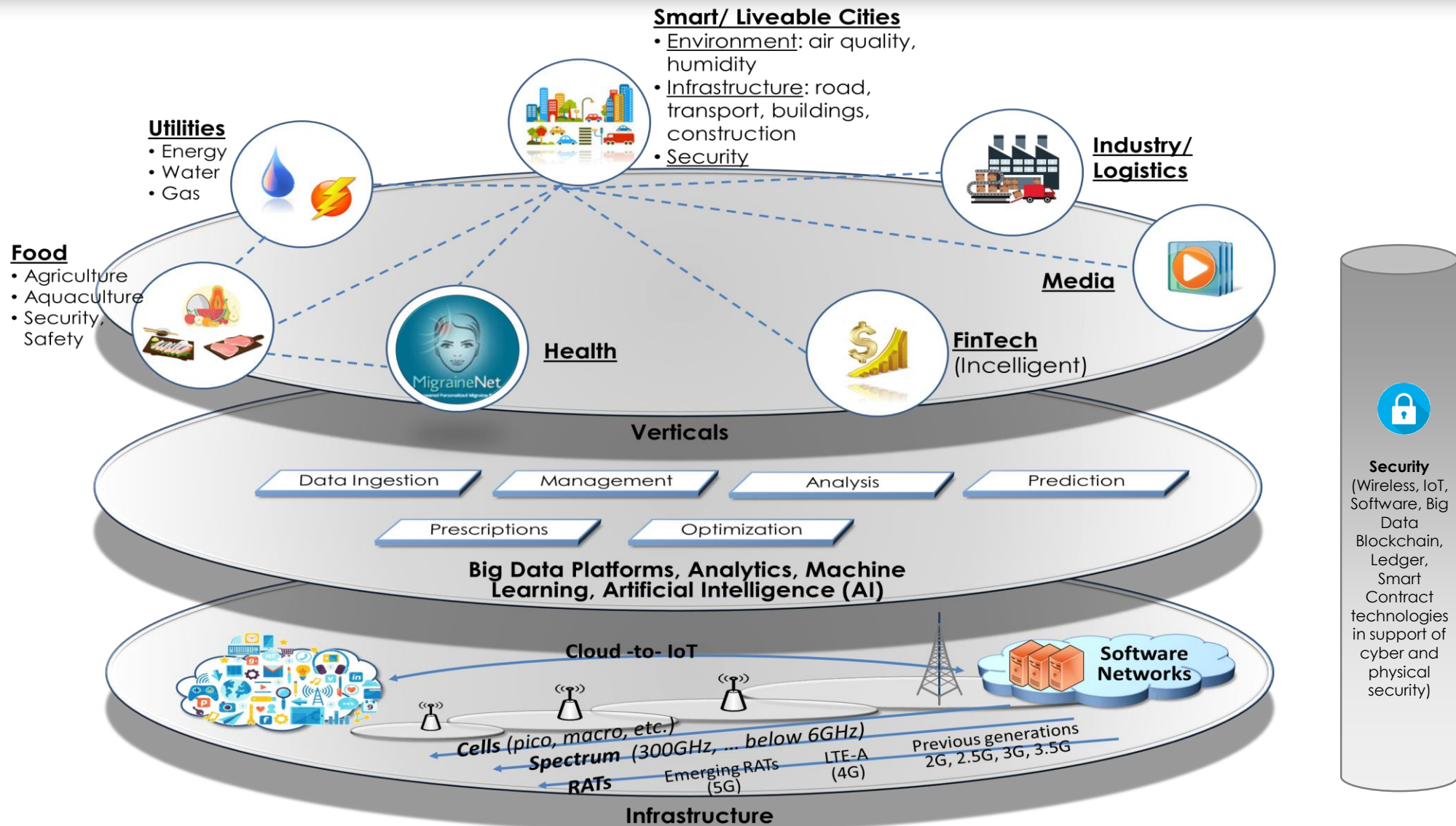


About us

About us

Mission

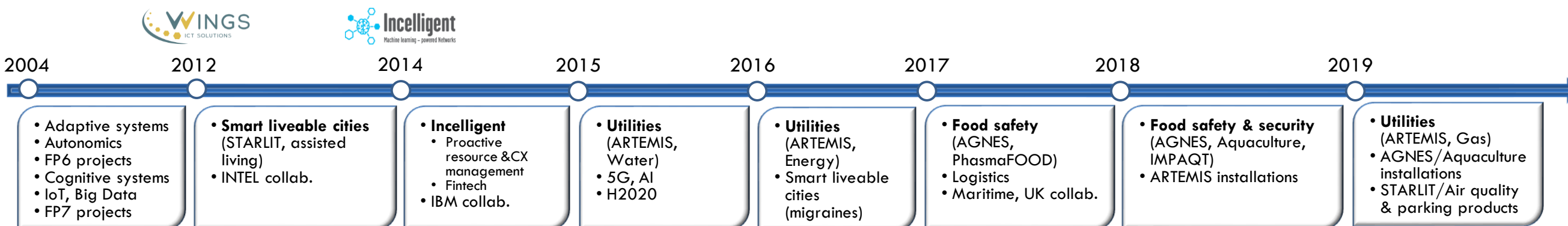
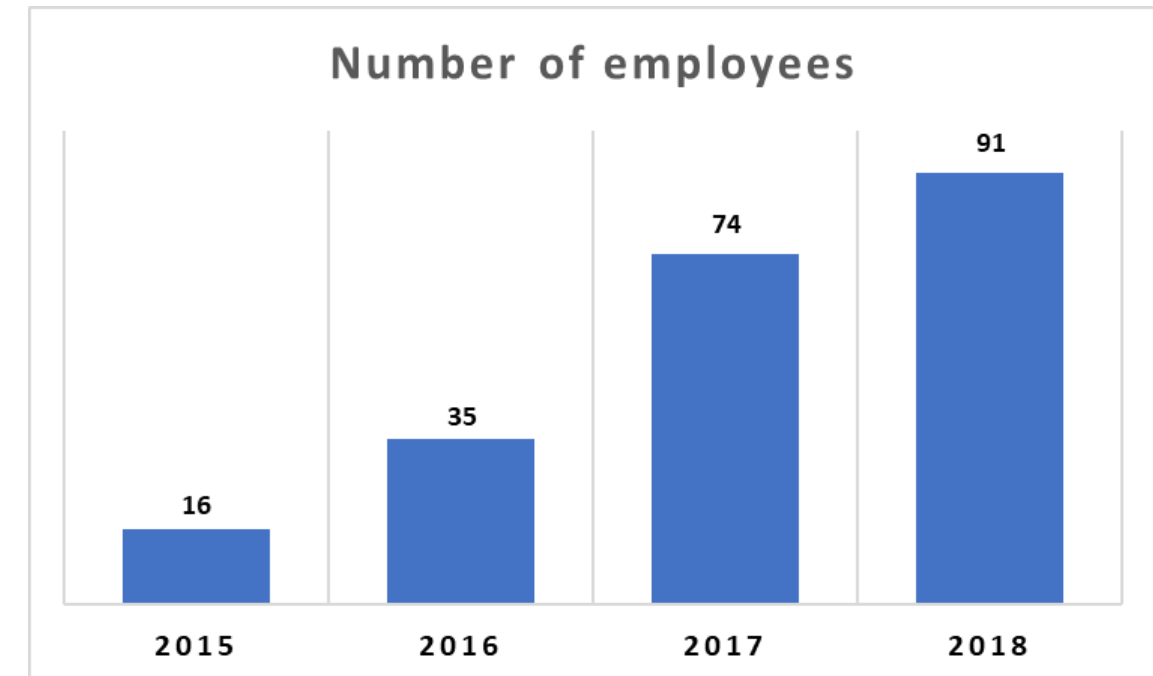
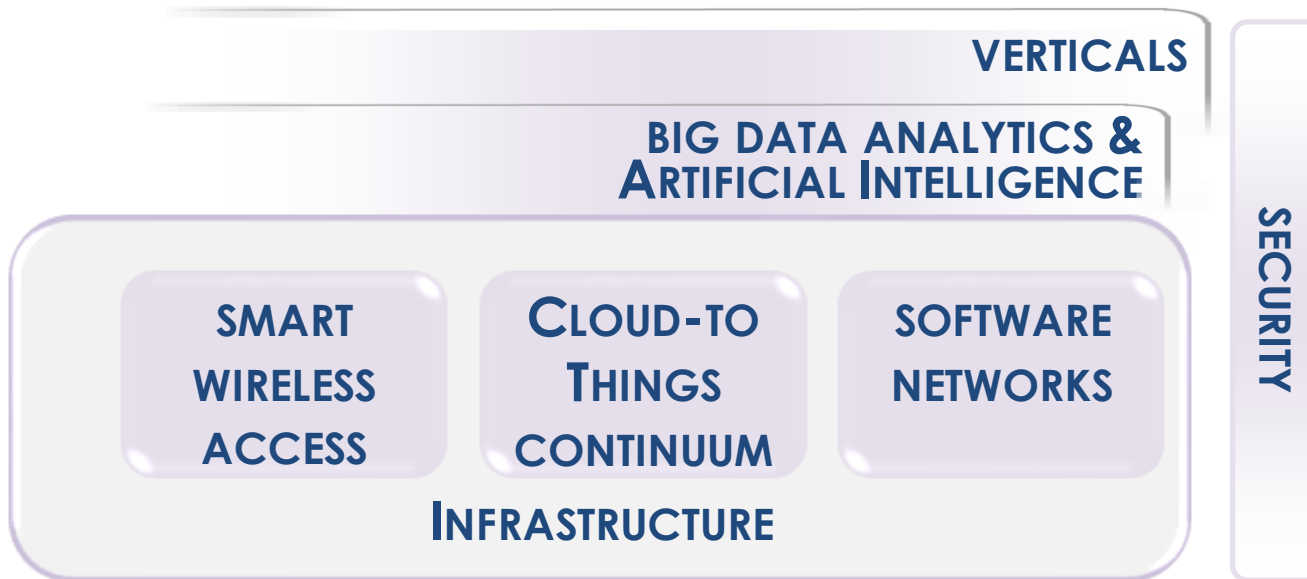
WINGS is an SME that focuses on the development of **AI-powered solutions** (software and hardware) for various **vertical sectors** (namely, utilities, smart/liveable cities, food, etc.) through advanced **wireless networking, cloud/IoT, big data, artificial intelligence** and **security technologies**.



About us

Expertise, team and timeline

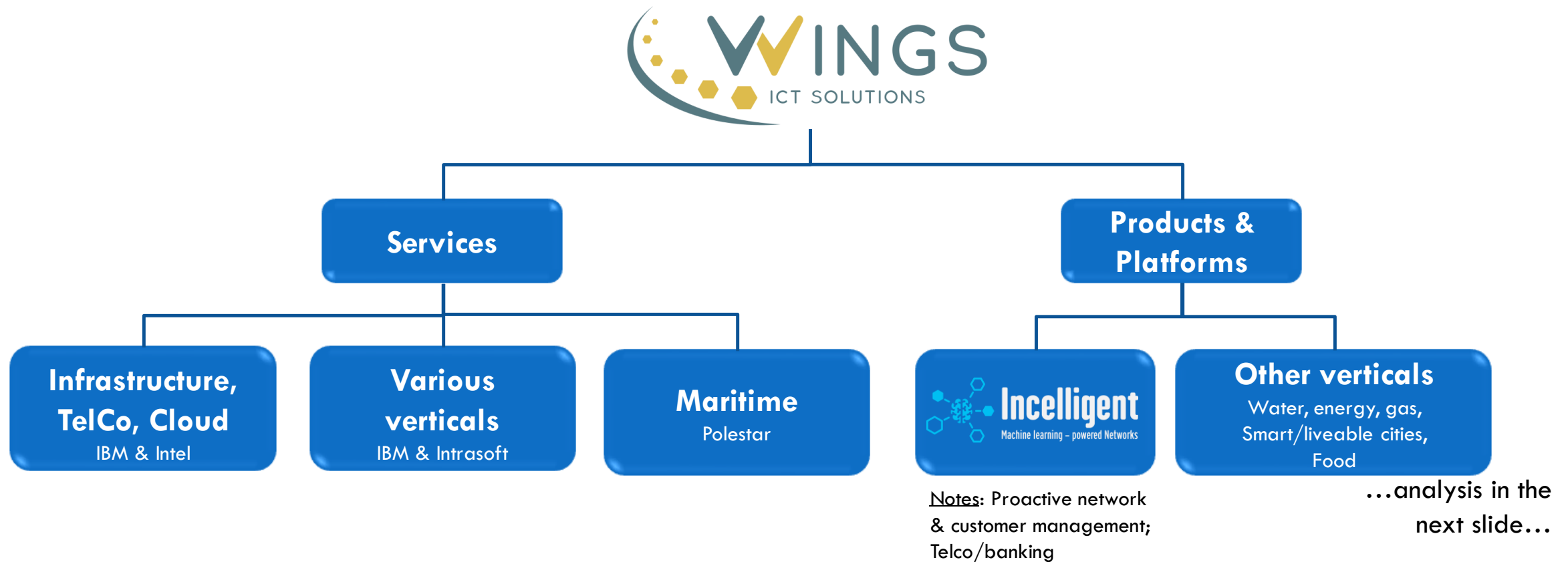
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About us

Strategy

6



Services

- ❑ Subcontracts - partnerships on infrastructure
- ❑ Banks/Insurance, Utilities, Telco, etc.

Platforms/products

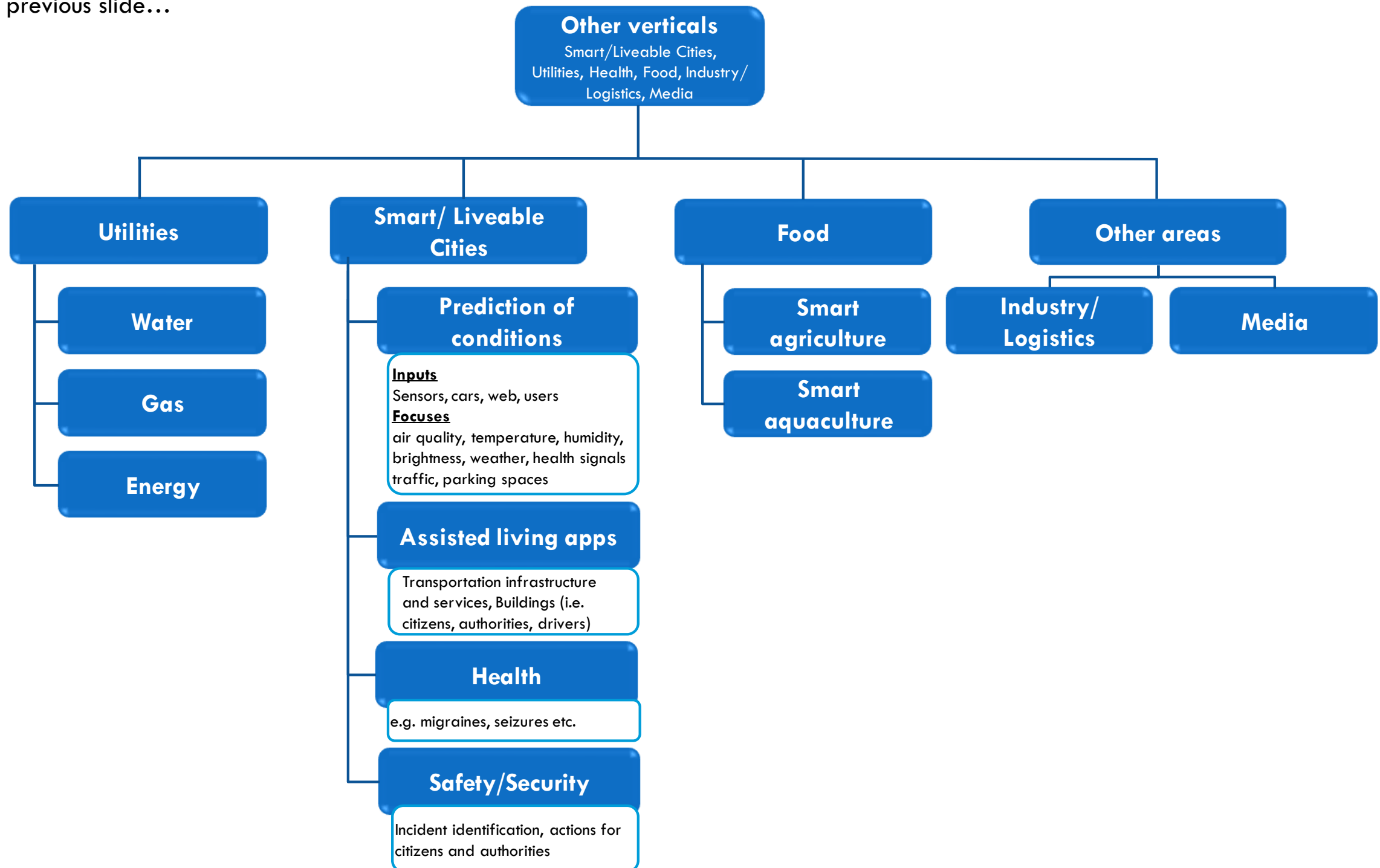
- ❑ Exploitation through WINGS (in conjunction with large companies; through spin-out companies)
- ❑ Incelligent: Telco, Fintech.
- ❑ WINGS:
 - ❑ Utilities: water, energy, gas
 - ❑ Smart / liveable cities (condition prediction, assisted living, health)
 - Input: sensors to cars, etc.; Output: to users, authorities
 - ❑ Food: aquaculture, agriculture
 - ❑ Other areas: Industry / Logistics, Media

About us

Strategy

7

...from the previous slide...

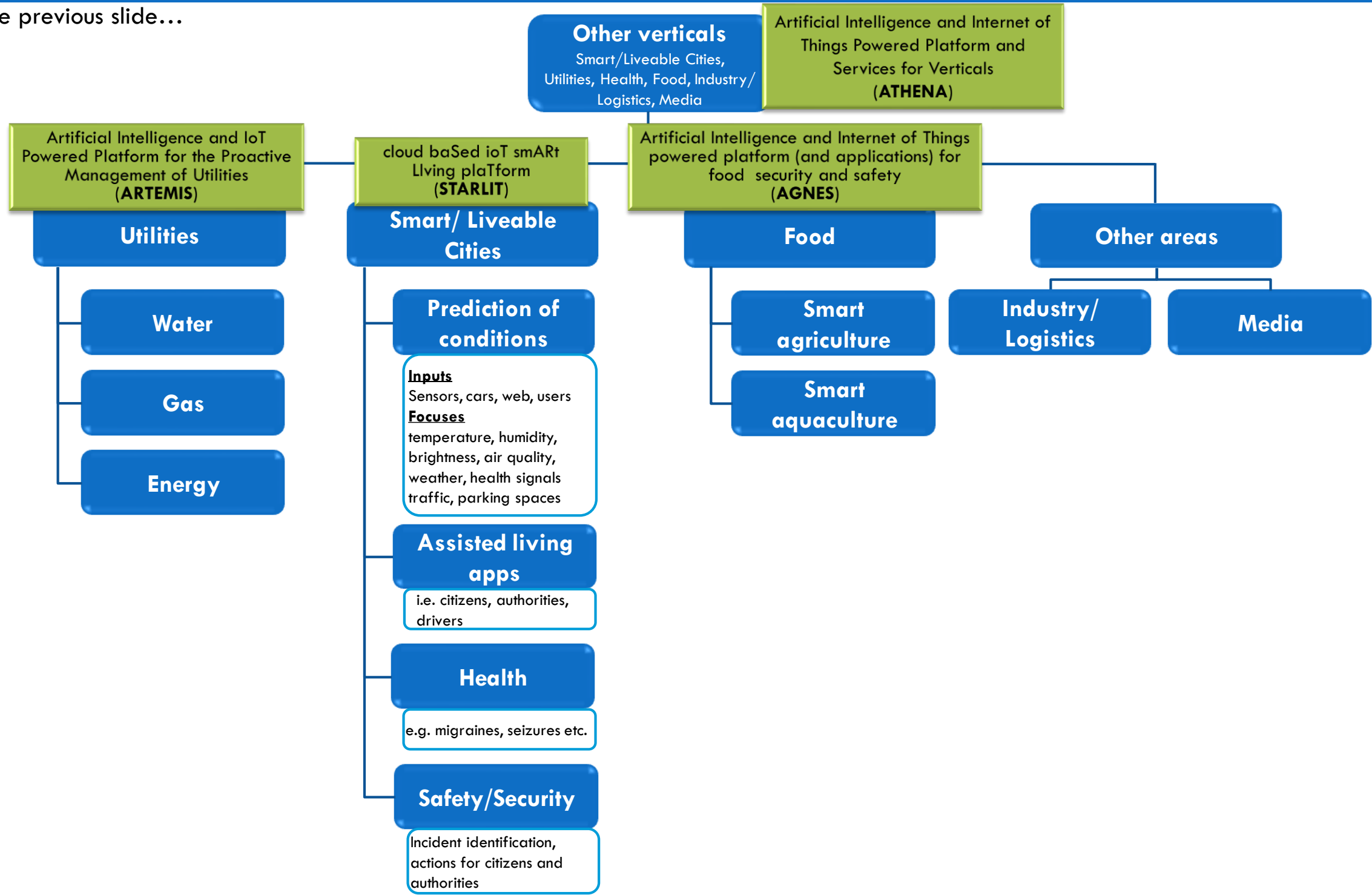


About us

Strategy

8

...from the previous slide...



About us

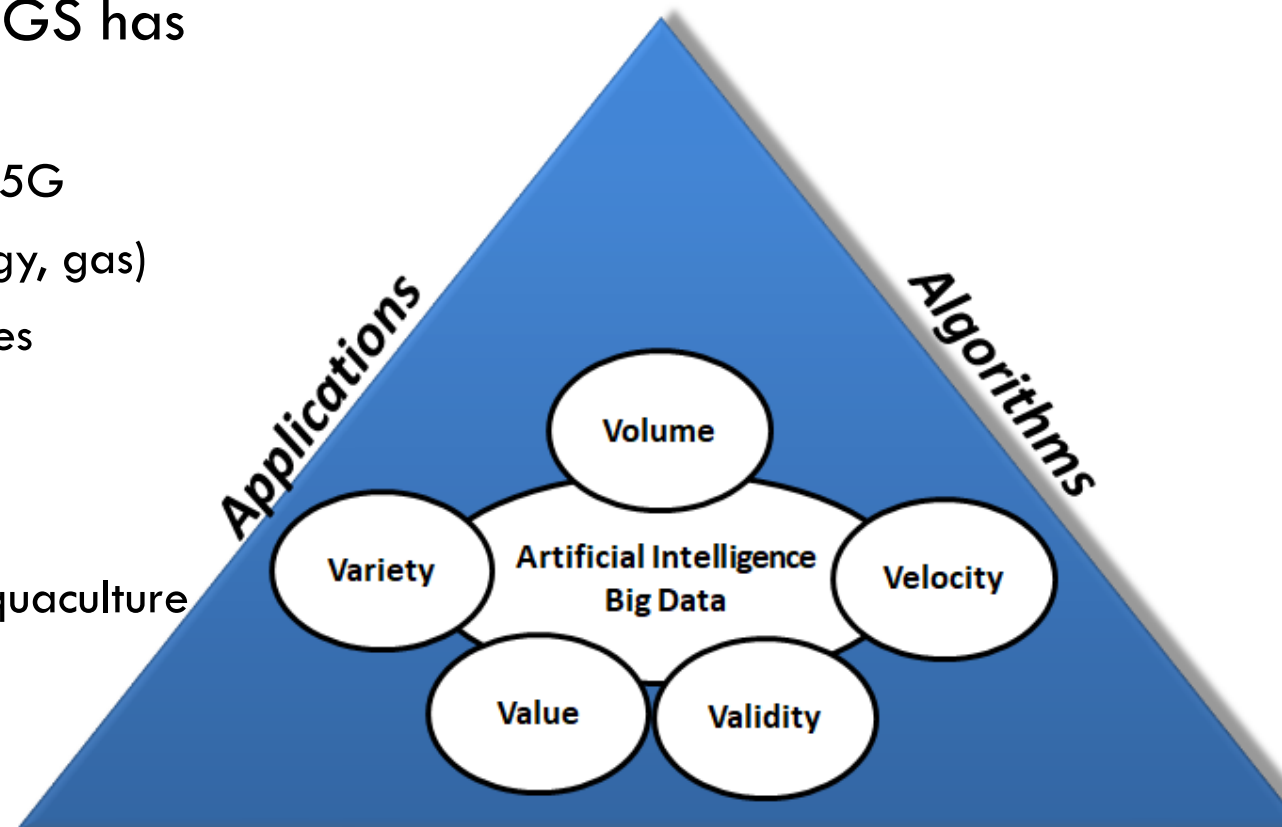
Activities

9

AI-centered products/services

□ Areas in which WINGS has expertise:

- ▣ Telecommunications, 5G
- ▣ Utilities (water, energy, gas)
- ▣ Smart / liveable cities
 - Health
 - Condition prediction, assisted living
- ▣ Food: agriculture, aquaculture
- ▣ Finance
- ▣ Industry / Logistics
- ▣ Media



Platform

Open source platforms:



Experience also in commercial platforms:



Mechanisms

- Predictive & prescriptive analytics, data management
 - ▣ Supervised learning | Unsupervised learning | Reinforcement learning | Deep learning | Handling of noisy or incomplete data | Data storage optimisation, etc.
- Knowledge visualization
- Development of patents
- Contributions in standards e.g. ETSI (various groups), IEEE

Solutions for Verticals

Overview of solutions

11



Utilities (water, gas, energy)

Smart/ Liveable cities (prediction of conditions, assisted living apps, health)

Food (smart agriculture, smart aquaculture)

Industry/Logistics

Solutions for Verticals – Utilities (water)

Platform ARTEMIS

Artificial Intelligence and IoT Powered Platform for the Proactive Management of Utilities

12

Automatic Metering & Control



1. Water Metering and Quality Control



Communication Technologies



2. Data Collection and Transmission



Analytics



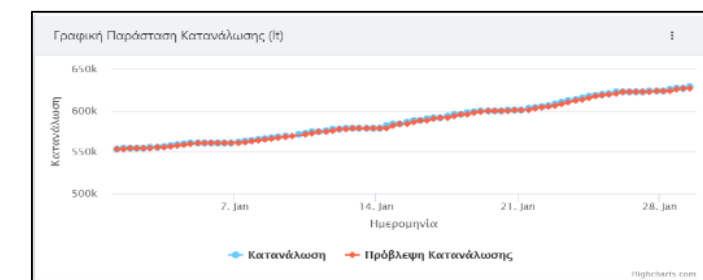
3. Analytics and Decision Making



Dashboard



4. Real time data monitoring, data visualization



Use Cases & Benefits



- a. Leakage - Smart Metering
- b. Water quality
- c. Demand Forecasting & Demand Response
- d. Virtual Hydraulics

Started and continues through own funds, evolved **also** through projects (**PROTEUS**, **5G-EVE**, Collaboration with **IBM**, etc.)

Short range distance (<25m)

Long range distance

Solutions for Verticals – Utilities (water)

Platform ARTEMIS

Member of:

SMART
WIRELESS
ACCESSCLOUD-TO-
THINGS
CONTINUUMSOFTWARE
NETWORKS

INFRASTRUCTURE

Artificial Intelligence and IoT Powered Platform for the Proactive Management of Utilities

13

ARTEMIS deployed pilots

- Smart Water Management using LoRa network
 - ▣ SenseCity, Paris, France
 - ▣ Almada, Portugal
- Smart Water Quality Management using NB-IoT
 - ▣ Xanthi, Greece
- Smart Metering using NB-IoT
 - ▣ Athens, Greece



Solutions for Verticals – Utilities (water) Member of:

Platform ARTEMIS



VERTICALS
BIG DATA ANALYTICS &
ARTIFICIAL INTELLIGENCE

SMART
WIRELESS
ACCESS

CLOUD-TO-
THINGS
CONTINUUM

SOFTWARE
NETWORKS

INFRASTRUCTURE

SECURITY

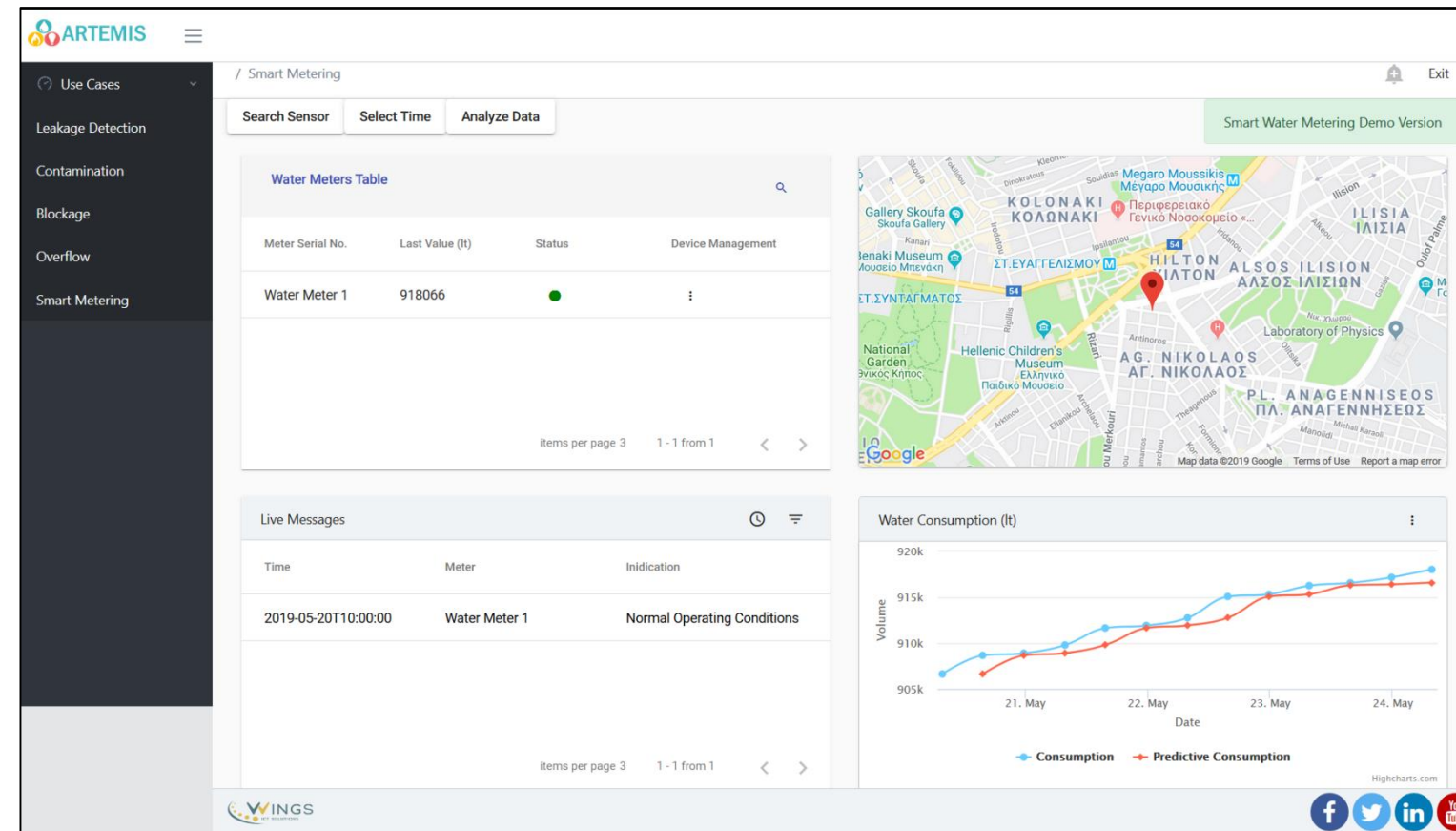
Artificial Intelligence and IoT Powered Platform for the Proactive Management of Utilities

14

Deployment & partnerships

□ Greece

- Xanthi (campus), Athens (business meetings)
 - Dorida, Kozani
- Extended partnerships with technology providers
- Discussions at various levels of maturity
 - Albania, Cyprus
 - EU (different countries)
 - Middle East
 - America (to ramp up)



Installation features

- Minimally intrusive to the water infrastructure
- Compliant to standards
 - **Device:** Modbus, DNP3, IEC 870-5-104
 - **Water Quality:** US Environmental Protection Agency
 - **Leakages:** International Water Association

Solutions for Verticals – Utilities (water)

Platform ARTEMIS

Artificial Intelligence and IoT Powered Platform for the Proactive Management of Utilities

15

Awards

- Awarded with **WssTP Water Innovation SME Award 2016**
- WssTP is the European Technology Platform for Water
 - Consists of 178 company members and a network of more than 700 individuals from Industry, research, technology providers, policy makers and water users
- 2nd place in **PowerWaterPrize-01-2017**: Inducement prize – Zero Power Water Infrastructure Monitoring

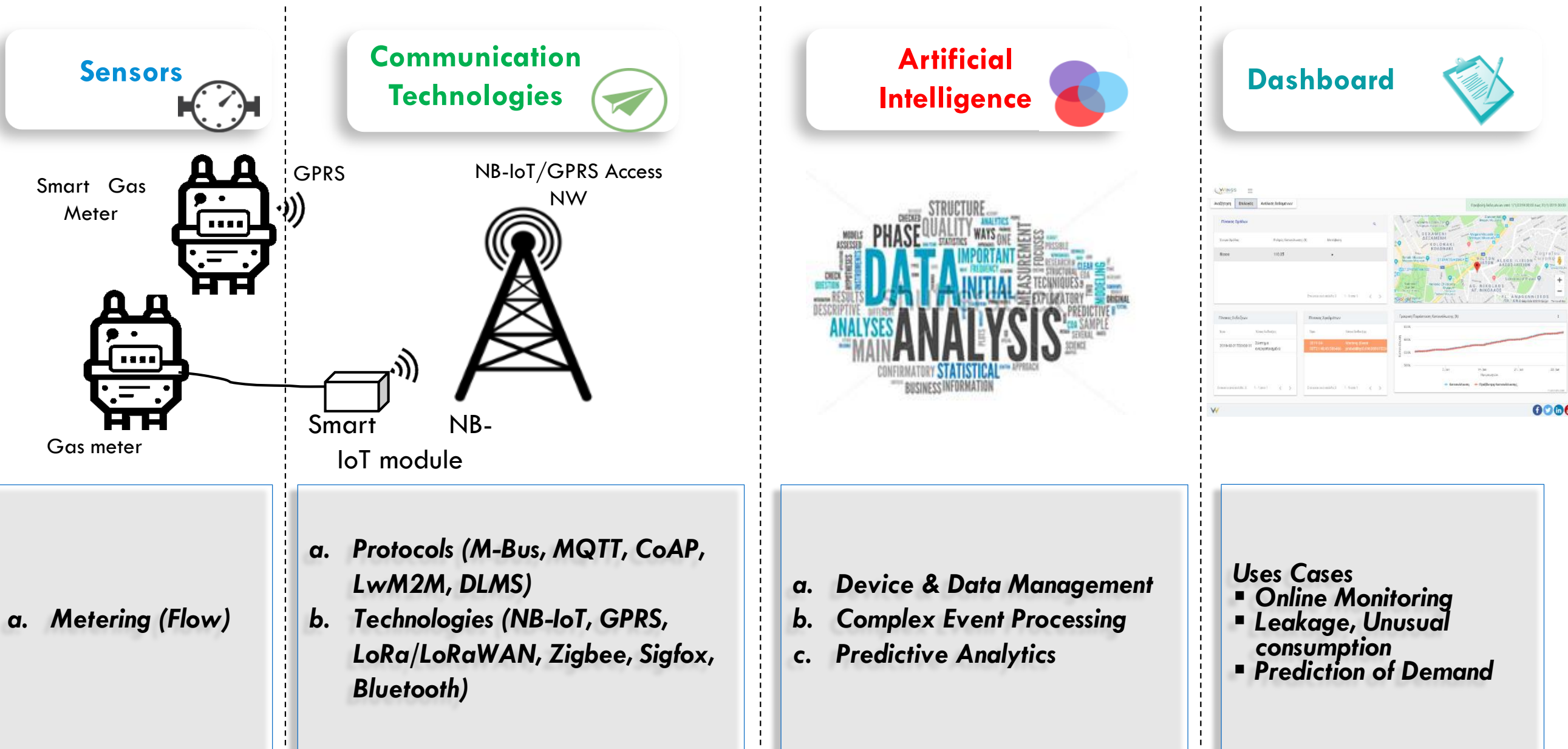


Solutions for Verticals – Utilities (gas)

Platform ARTEMIS

Artificial Intelligence and IoT Powered Platform for the Proactive Management of Utilities

16



Solutions for Verticals – Utilities (energy)

Project/Platform Energywater

17

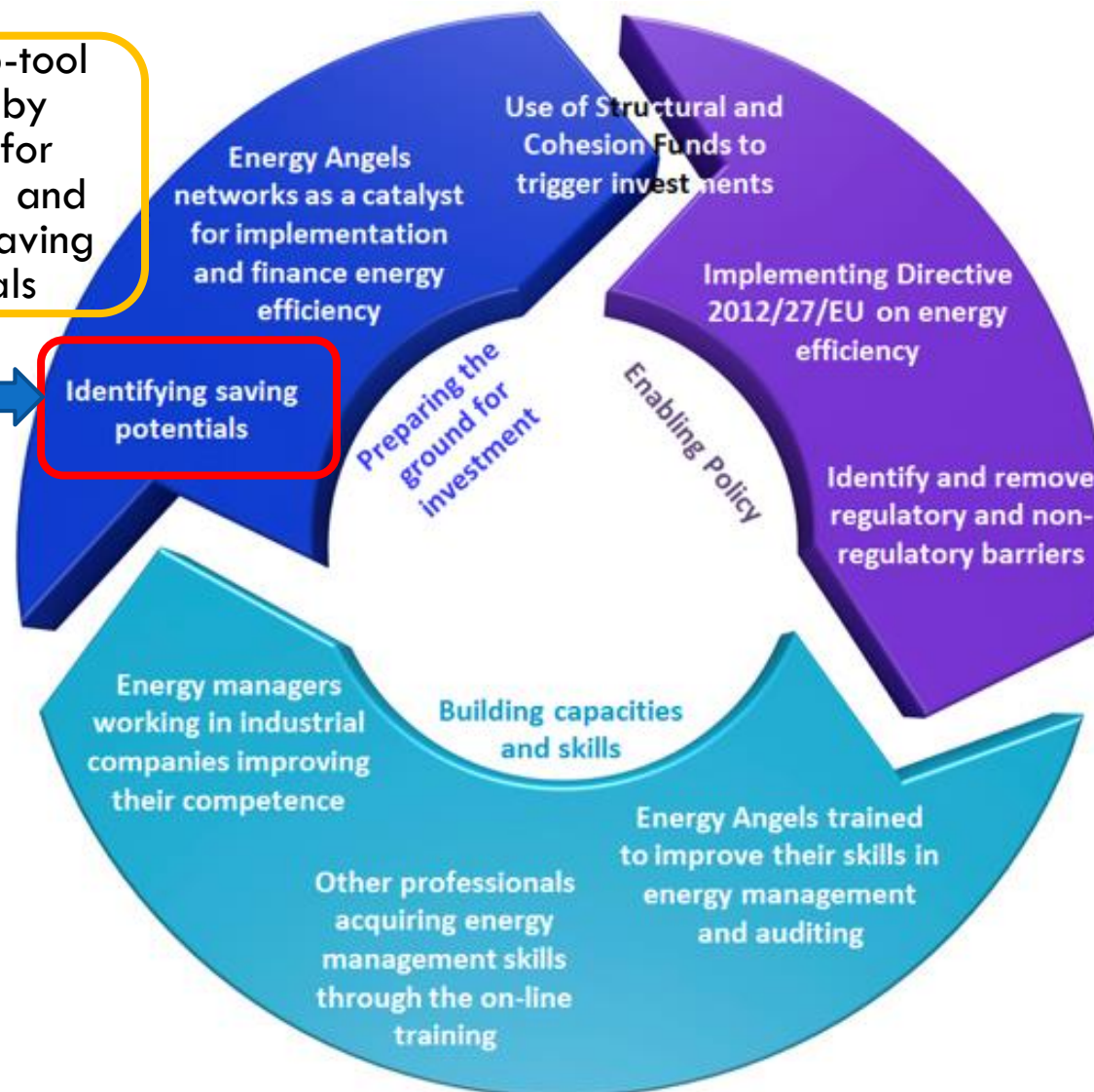
Improving energy efficiency in industrial water processes through benchmarking and benchlearning tools in Europe manufacturing industry

<http://energywater-project.eu/> | H2020 | 02.2016–01.2019



EMSA web-tool
created by
WINGS for
identifying and
assessing saving
potentials

Identifying saving
potentials



- **The project** aims to provide support to SMEs by enabling energy efficient water processing, through the development of the Energy Management Self-Assessment (EMSA) web tool and the creation of an Energy Angels Network

WINGS role:

- **WINGS** is the main developer of the **EMSA web tool** which is used to compare and benchmark the **energy performance in industrial water process** in European manufacturing industries.

Solutions for Verticals – Utilities (energy)

Project/Platform Energywater

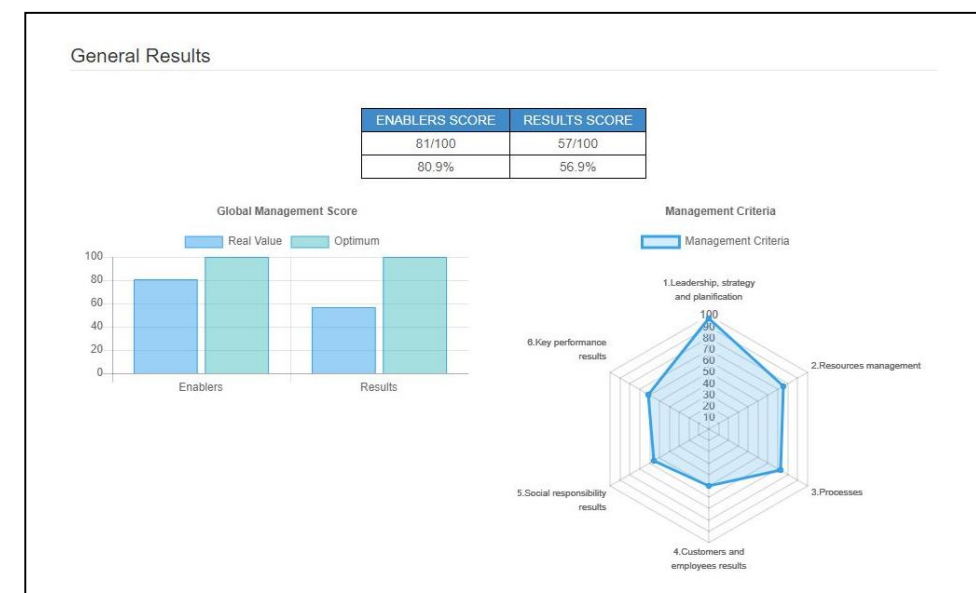
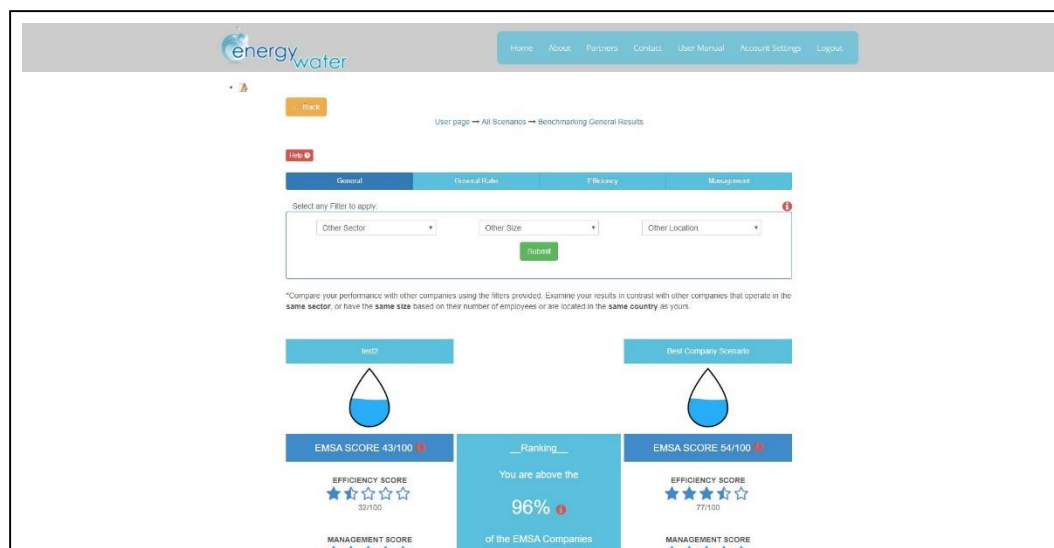
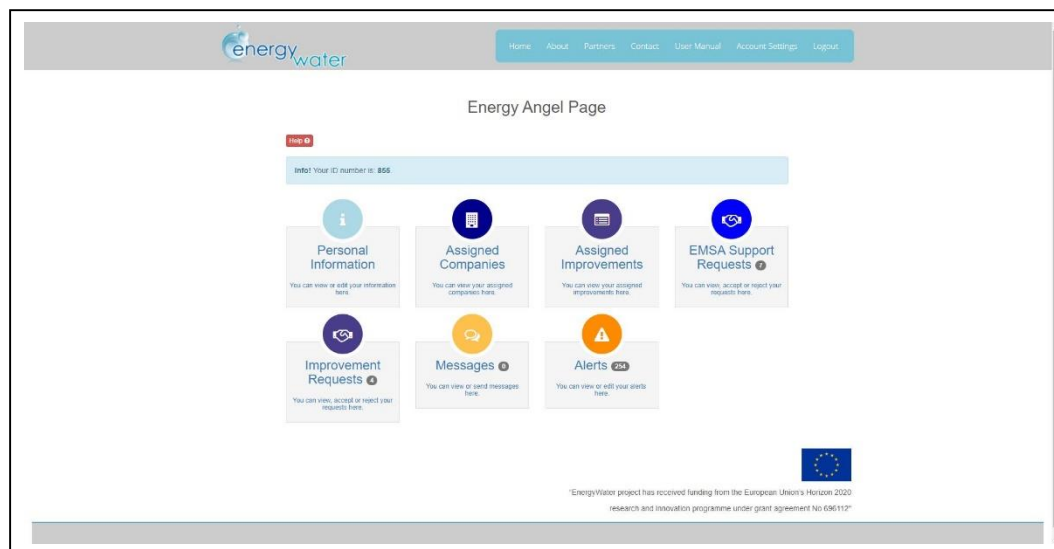
18

Improving energy efficiency in industrial water processes through benchmarking and benchlearning tools in Europe manufacturing industry

<http://energywater-project.eu/> | H2020 | 02.2016–01.2019



- User friendly dashboards for selecting various functions and scenarios
- Benchmarking between different companies and scenarios
- Results and analysis



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WIRELESS
ACCESSCLOUD-TO
THINGS
CONTINUUMSOFTWARE
NETWORKS

INFRASTRUCTURE

Solutions for Verticals – Smart/Liveable cities

Platform Starlit

cloud baSed ioT smARt LiVing plaTform

19

Sensing and Actuation Data sources

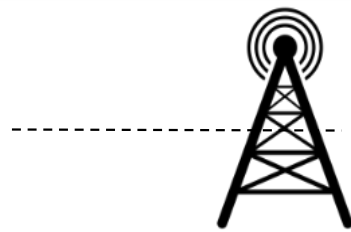
1. Smart cities, Smart
Homes, Wearables



IoT platform
interoperability

Communication Technologies

2. Data Collection and
Transmission



■ Protocols

- REST
- COAP
- MQTT
- AMQP

■ Technologies

- Wi-Fi
- Bluetooth
- NB-IoT
- 3G/4G/5G

Artificial Intelligence

3. Analytics and Decision Making



■ Methodologies

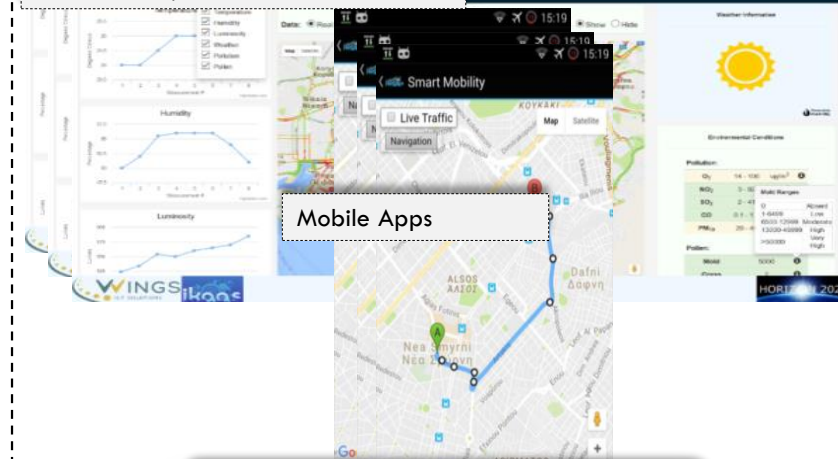
- Machine Learning
- Predictive analytics
- Complex Event Processing
- Data management

Dashboard



4. Data monitoring & visualization

Web Apps / Web UIs



Mobile Apps

Use Cases



- Environmental monitoring
 - Outdoor (Smart Cities)
 - Indoor (Smart Homes)
- Remote health monitoring
- Smart Mobility
 - Parking, Traffic, health environment, weather

Projects iKaaS, Select4cities,
MyCorridor, NetPark

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INFRASTRUCTURE

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20

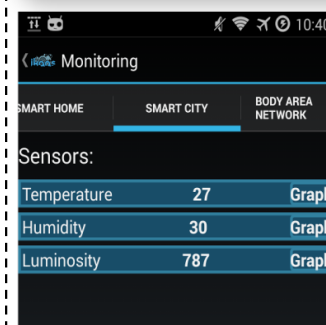
Sensors & Data Sources

- Air quality sensors
- Pollution sensors
- Pollen sensors
- Humidity
- Temperature
- Traffic sensors
- Weather APIs
- Smart watch (wearable device) for deriving user data.

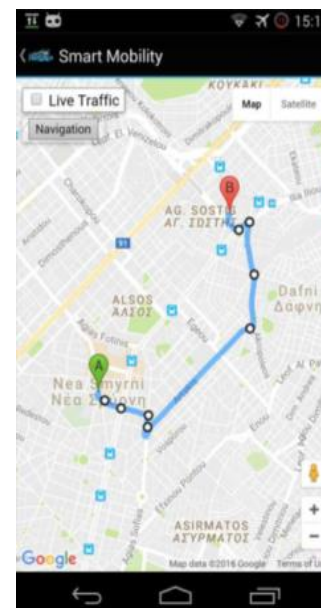
Analytics

- **Smart Mobility:** Retrieval and analysis of data from **smart city devices and sources** (APIs), as well as from **wearable devices**, so as to provide **sophisticated notifications and recommendations** regarding **real time navigation** based on **user health status and smart city data**.
- **City dashboard:** Data ingestion from **heterogeneous smart city data sources**, and visualization of measurements on **interactive heat-maps** that aim to **present the overall city picture at a glance**.

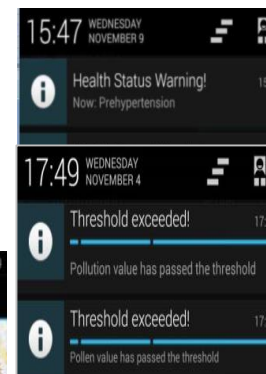
Smart Mobility/ City Dashboard



City environment
monitoring

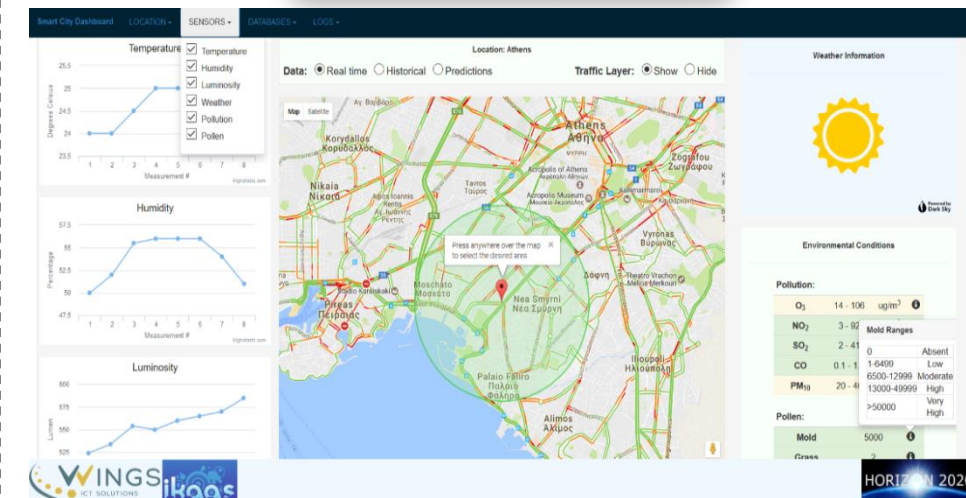


Recommended optimal
route based on user
health status and smart
city conditions



Notifications/Al
arms

User Dashboard



Benefits

- **Smart Mobility**
 - Possibility to monitor the position of an elderly/impaired person outdoors.
 - Notifications when an individual moves towards/enters into a high risk zone/hazardous area.
 - Personalised navigation instructions and public transportation help considering user preferences and health/well-being status.
- **City Dashboard**
 - Visualisation of real time and historical data as well as derived knowledge
 - Prediction of city status

HTTP

REST

MQTT

Projects iKaaS, Select4cities,
MyCorridor, NetPark

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CONTINUUMSOFTWARE
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Solutions for Verticals – Smart/Liveable cities

Platform Starlit

cloud baSed ioT smARt LiVing plaTform

21

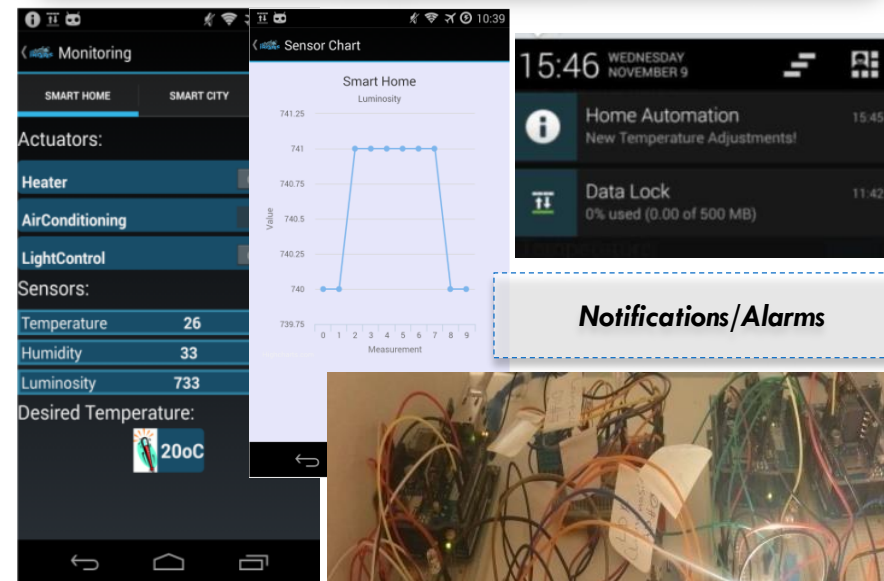
Sensors & Actuators

Sensors: Air quality, Temperature, Humidity, Luminosity.
Actuators: Lights, Heating/Air-conditioning.

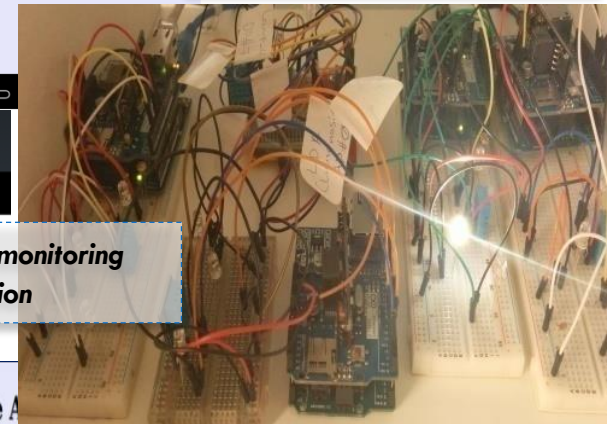
Analytics

- **Learning and forecasting of user preferences** regarding indoor environment/home appliances configuration
- Prescriptive analytics for **proactively taking actions/offer recommendations**

Home environmental conditions monitoring and automated adjustment



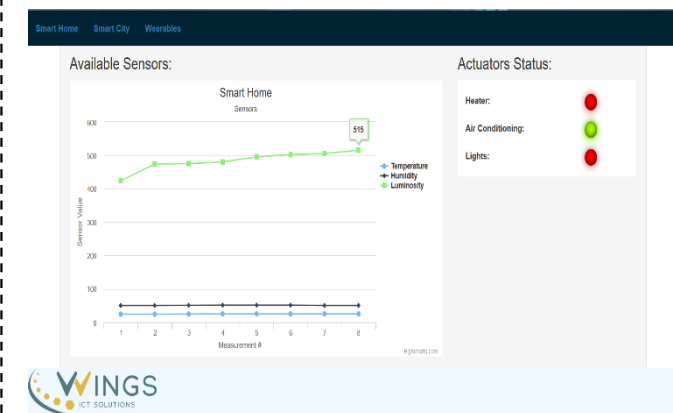
Home environment monitoring and adaptation



| Location | Temperature Probability | | | | | | | | Time-Slot |
|------------|-------------------------|--------|--------|--------|--------|--------|--------|--------|---------------|
| | 18 °C | 19 °C | 20 °C | 21 °C | 22 °C | 23 °C | 24 °C | 25 °C | |
| Smart Home | 0.1033 | 0.1033 | 0.2764 | 0.1033 | 0.1033 | 0.1033 | 0.1033 | 0.1033 | 10:00 - 14:59 |
| | 0.0211 | 0.2091 | 0.2551 | 0.3213 | 0.0211 | 0.0211 | 0.1302 | 0.0211 | 15:00 - 19:59 |
| | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 20:00 - 23:59 |
| | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 00:00 - 04:59 |
| | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 05:00 - 09:59 |

Learning of user preferences for home automation based on Bayesian statistics

Home Dashboard



Benefits

- **Ease of every day life**
- **Personalised indoor environment adaptation and assistance**
- **Contribution to home energy efficiency**

Projects iKaaS, Select4cities, MyCorridor, NetPark

HTTP

REST

MQTT

SMART
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THINGS
CONTINUUMSOFTWARE
NETWORKS

INFRASTRUCTURE

Solutions for Verticals – Smart/Liveable cities

Platform Starlit

cloud baSed ioT smARt LiVing plaTform

22

Sensors 

Wearable devices.
Smart watch with accelerometer, blood pressure, heart rate monitoring.

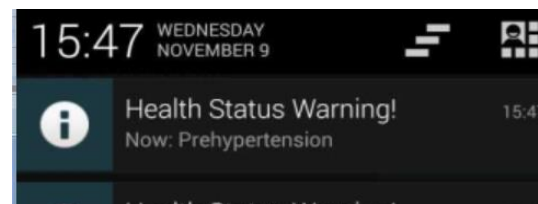
Communication Technologies 

Bluetooth
Wi-Fi
REST
MQTT

Analytics 

Learning patterns in user physical status to identify any abnormality in usual patterns. Family members and/or professional caretakers can be informed and **appropriate alarms** may be raised if necessary.

Remote Health Monitoring & predictions. Input from user 

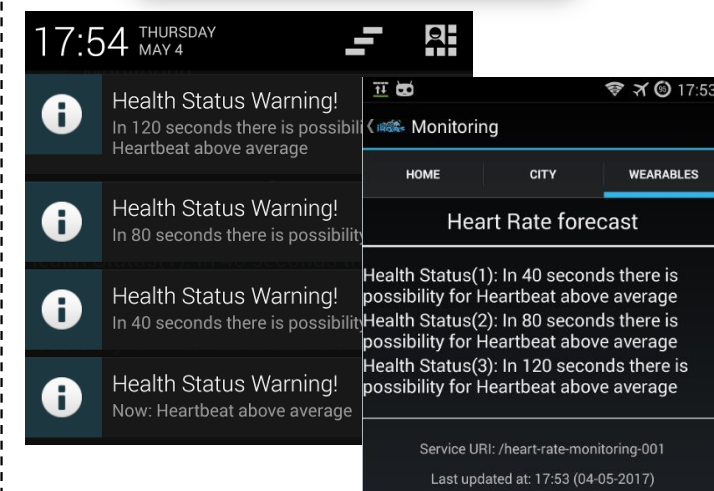


Notifications/Alarms



Blood pressure forecasting using Timeseries

Dashboard 



Benefits 

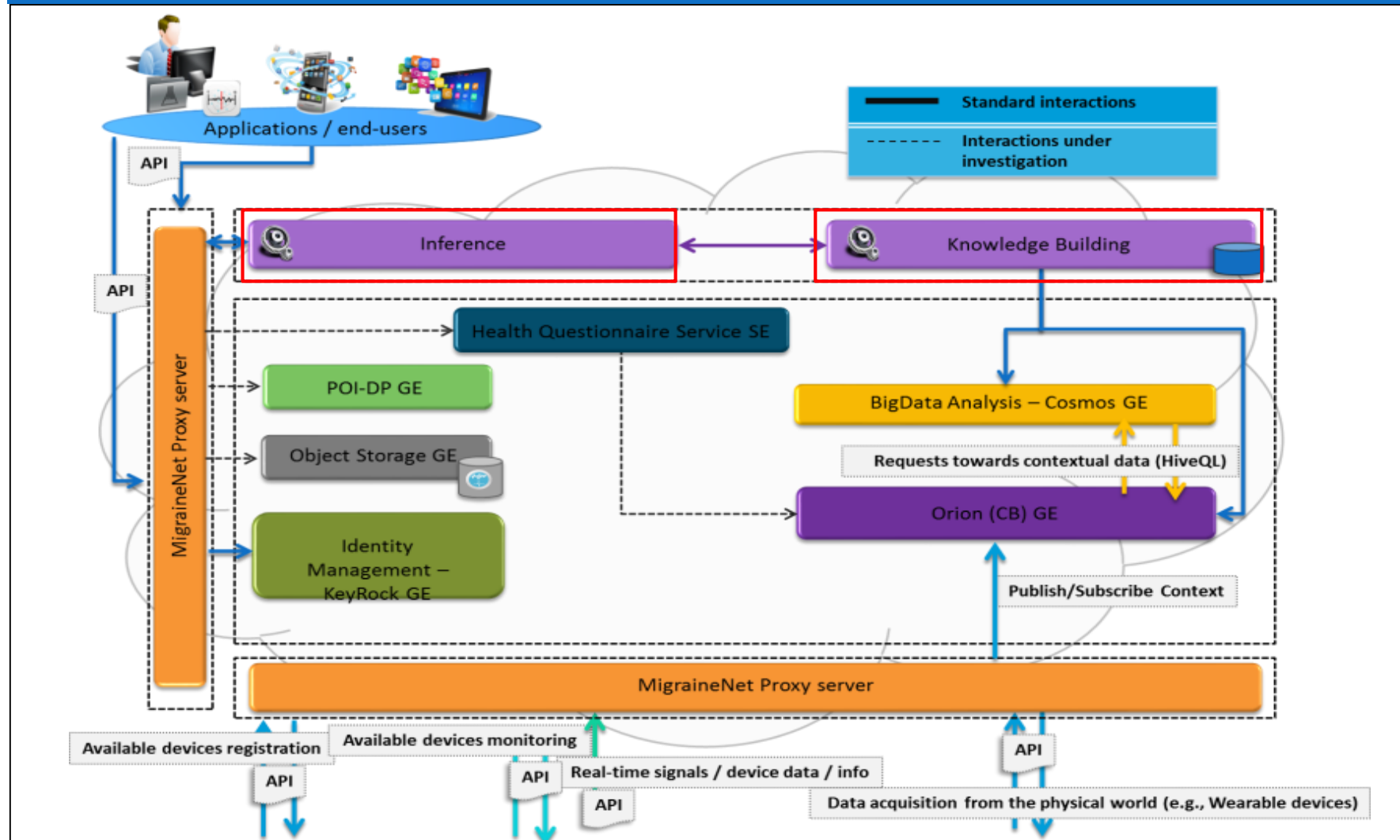
- **Continuous well-being and health monitoring and forecasting.**
- **Notifications for individuals/family members/health-care professionals on potential health issues (e.g. in case something unusual/potentially problematic is observed such as increasing blood pressure).**

Project iKaaS | MigraineNet

Solutions for Verticals – Smart/Liveable cities

Platform MigraineNet

23



MigraineNET

<http://wings-ict-solutions.eu/migrainenet>
 Framework: FI-Adopt
 Open Call project
 Duration: 04.2015–03.2016

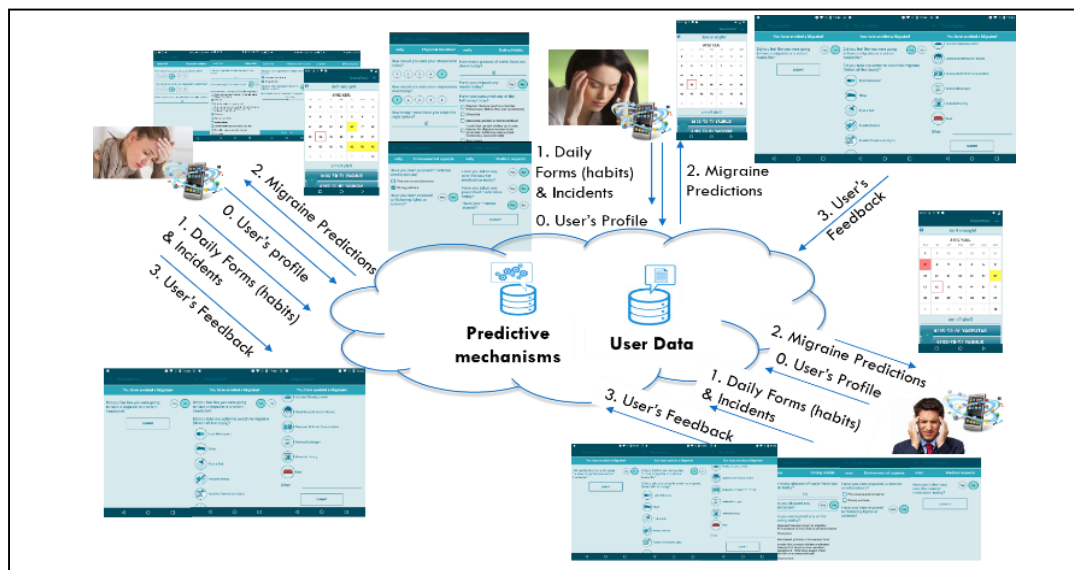
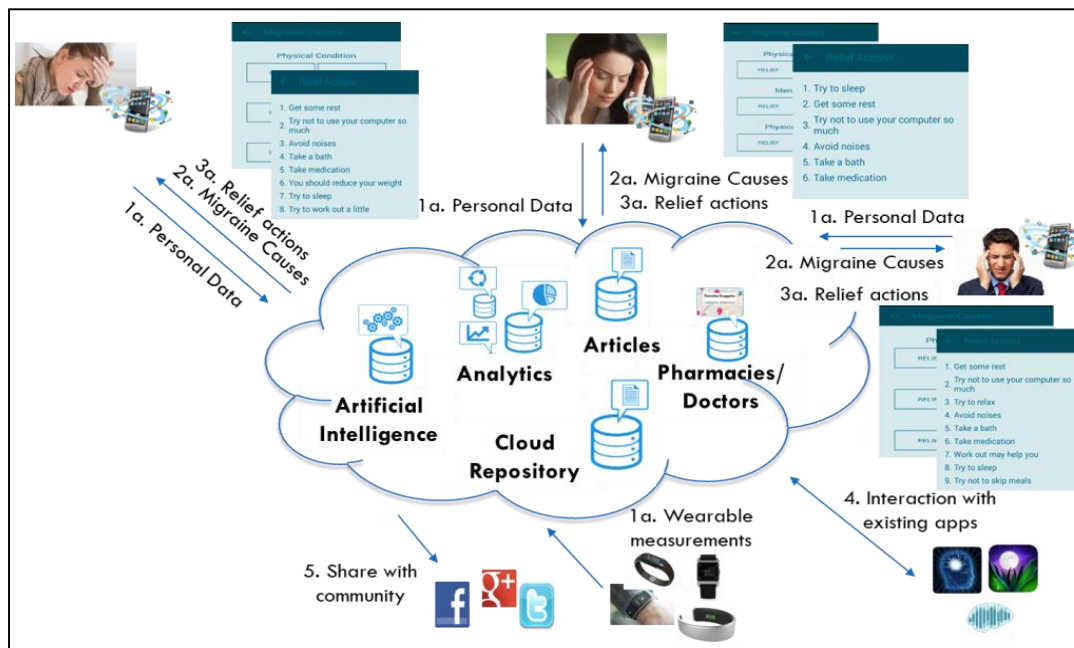


- MigraineNet infrastructure is based on:
 - ▣ FI-WARE Generic Enablers (GEs) and a Specific Enabler (SE) and
 - ▣ 2 WINGS components: Knowledge Building and Inference
- MigraineNet can be implemented also based on Hadoop and/or any other proprietary platform.

Solutions for Verticals – Smart/Liveable cities

Platform MigraineNet

24



- ❑ MigraineNet is a low-cost, personalized, cloud based system for **predicting migraines**.
- ❑ Mobile application for the user.
- ❑ It can interact with other apps and wearable devices for minimizing user's effort and for increasing pervasiveness.
- ❑ Current performance: prediction of 3 out of 4 migraines, with the accuracy of one day.
- ❑ Intelligent mechanisms in the cloud analyze the user profile, the daily habit and the symptoms of the users' migraine incident so as to **predict** and **provide personalized insights** on
 - ❑ The next possible migraine incident
 - ❑ Potential migraine causes
 - ❑ Relief actions
 - ❑ Supporting info (pharmacies, doctors, articles)



MigraineNet

<https://www.facebook.com/MigraineNetApp>

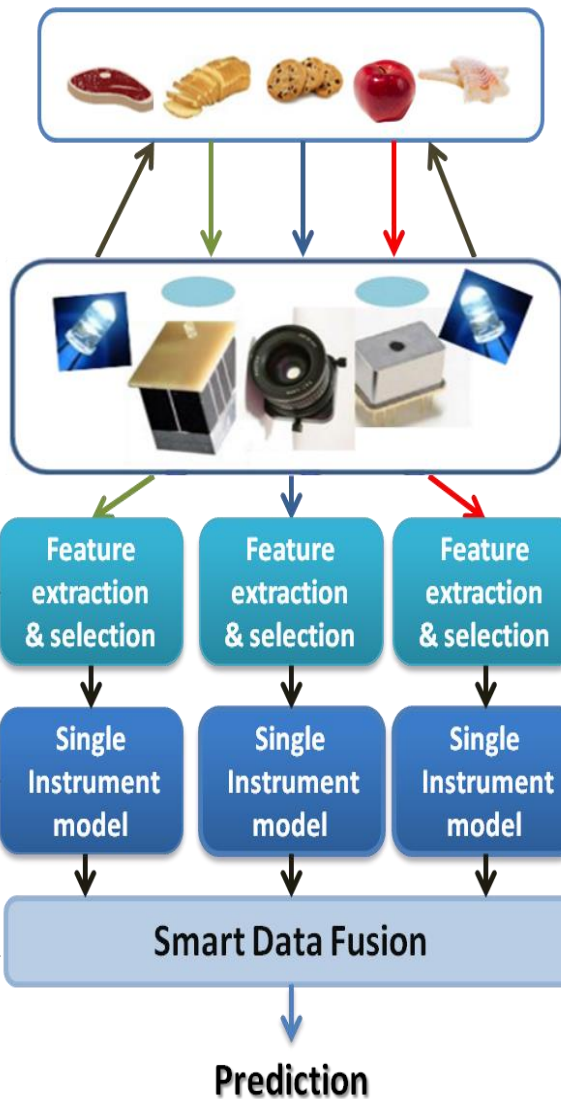
Solutions for Verticals – Food

Smart agriculture

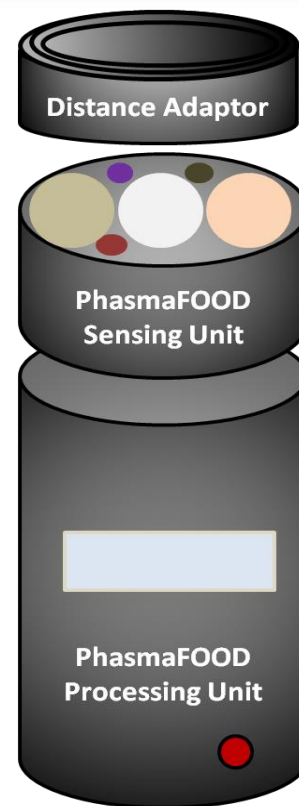
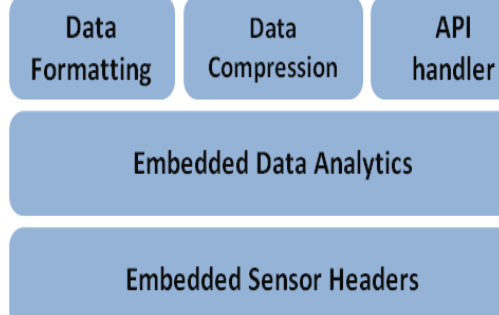
Project/platform PhasmaFOOD

25

Food Quality Control



Sensing Components and Smart Devices

PhasmaFood smart
sensor device

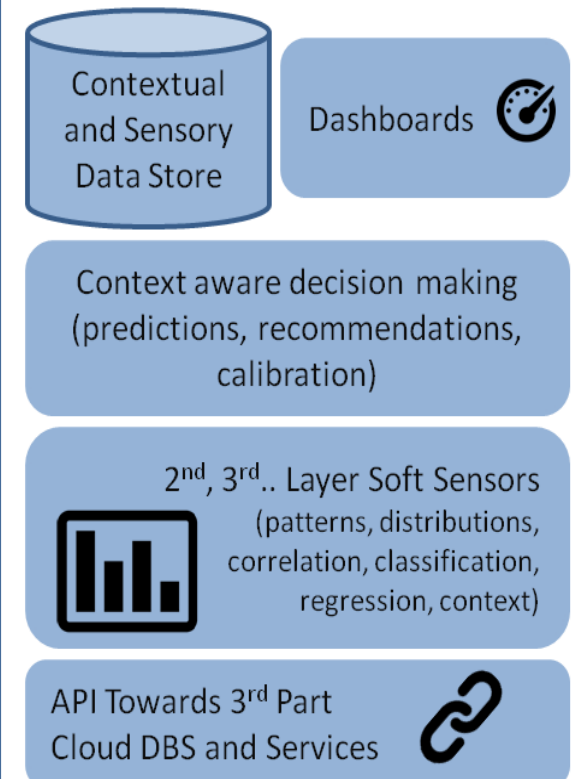
Communication Technologies



Analytics



PhasmaFood Cloud platform

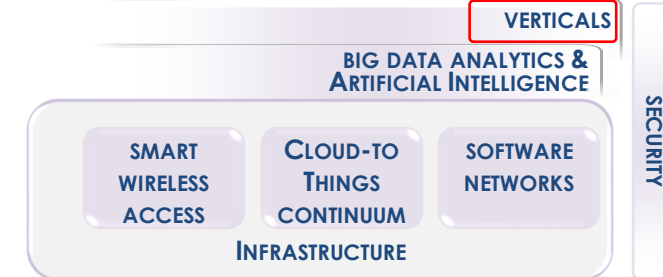


WINGS focuses on embedded hardware design for the PhasmaFOOD sensing device and contributes to the smart embedded software, the development of mobile application and the PhasmaFOOD cloud platform.

Solutions for Verticals – Food

Smart aquaculture

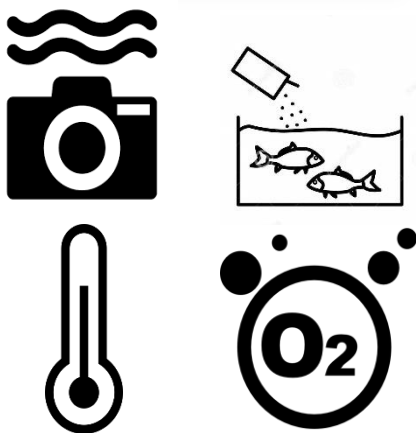
Artificial Intelligence and Internet of Things powered platform (and applications) for food security and safety (AGNES)



26

Sensors and Actuators

1. Water Quantity and Quality Control



Communication Technologies

2. Data Collection and Transmission



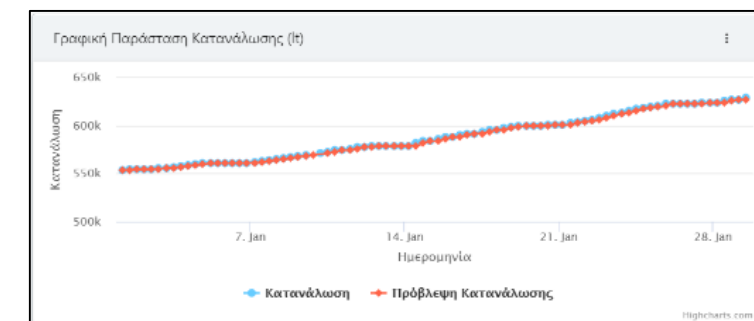
Artificial Intelligence

3. Analytics and Decision Making



Dashboard

4. Real time monitoring, Data visualization



- a. Physical/Chemical (Oxygen, Current, pH, Turbidity, Salinity, Chlorophyll, P redox, Light, Temperature)
- b. Cameras (On-surface, underwater)
- c. Actuators (feeding, maintenance)

- a. Protocols (Modbus, DNP3, IEC 870-5-104, MQTT, CoAP, lwM2M)
- b. Technologies (4G-5G, NB-IoT, GPRS, LoRa/LoRaWAN, Zigbee, Sigfox, Bluetooth)

- a. Complex Event Processing
- b. Predictive Analytics
- c. Data Correlation
- d. Data Management

- a. Behavior Monitoring
- b. Water quality management
- c. Intelligent Feeding
- d. Feed waste management
- e. Disease diagnosis

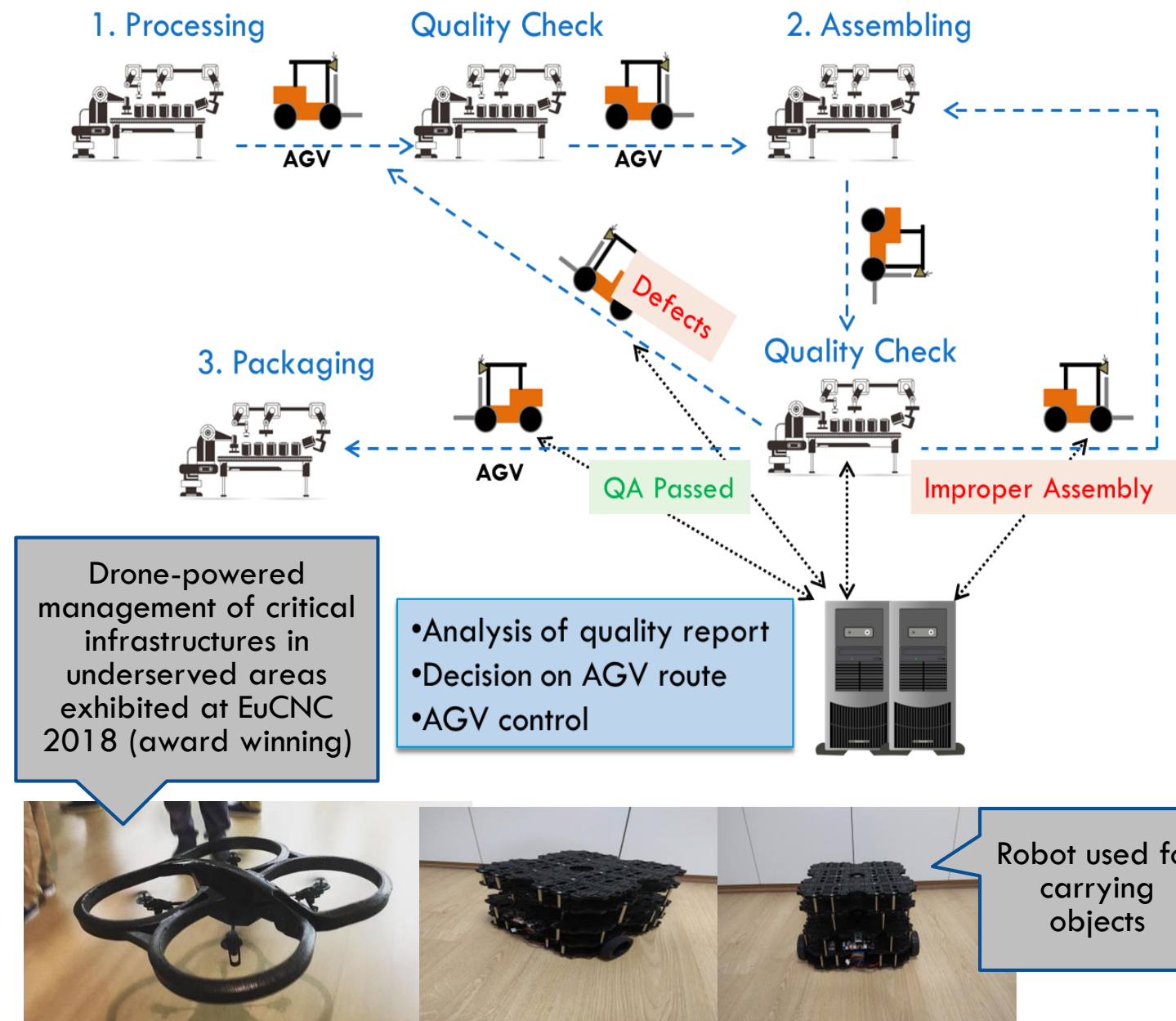
Started and continues through own funds, evolved also through projects (Impaq, 5G-HEART, etc.)

Solutions for Verticals – Industry / Logistics

27

WINGS role

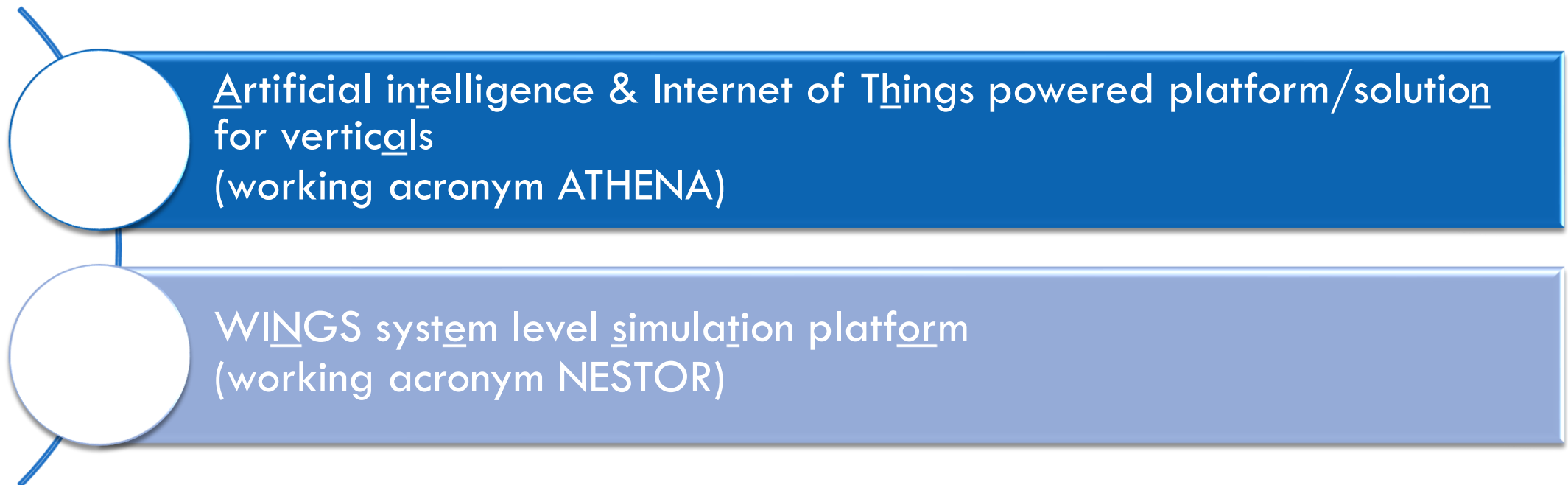
- Factory environment
- Problem: Detecting faulty equipment by proceeding to necessary quality checks and feedback
- Solution: Automation and usage of AGVs/ drones for monitoring and moving parts through production phases
 - ▣ Demonstration on monitoring and closed-loop control of industrial AGV: <https://goo.gl/4nJhYf>
- Overall procedure:
 - ▣ 1. Monitoring and feedback through the procedure of “processing of materials”
 - ▣ 2. Monitoring and feedback through the Assembly procedure
 - ▣ 3. Monitoring and feedback through the Packaging procedure



Products/Platform

Overview of products

29

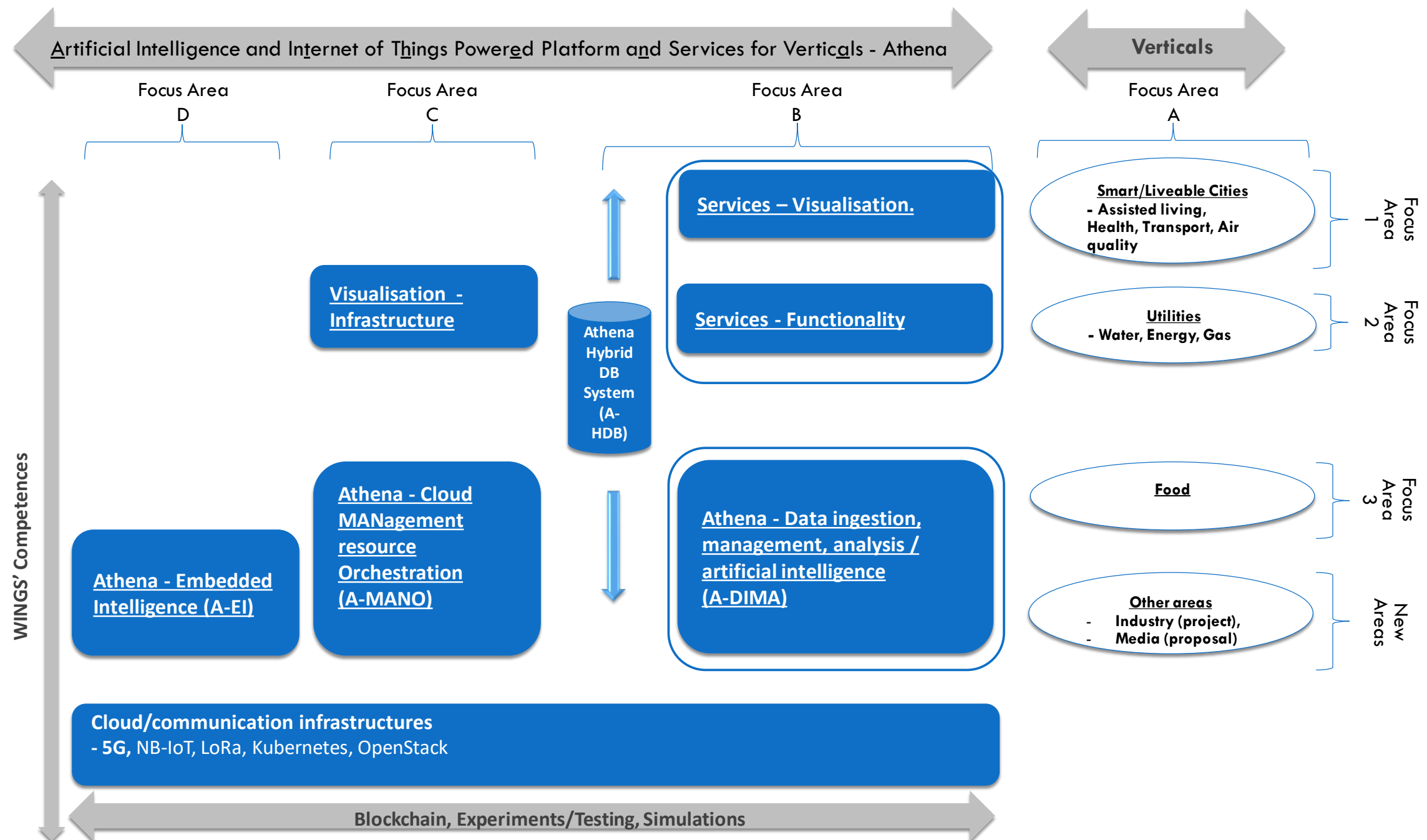


Products/Platform: Artificial intelligence & Internet of Things powered platform/solution for verticals (working acronym ATHENA)

High Level View

30

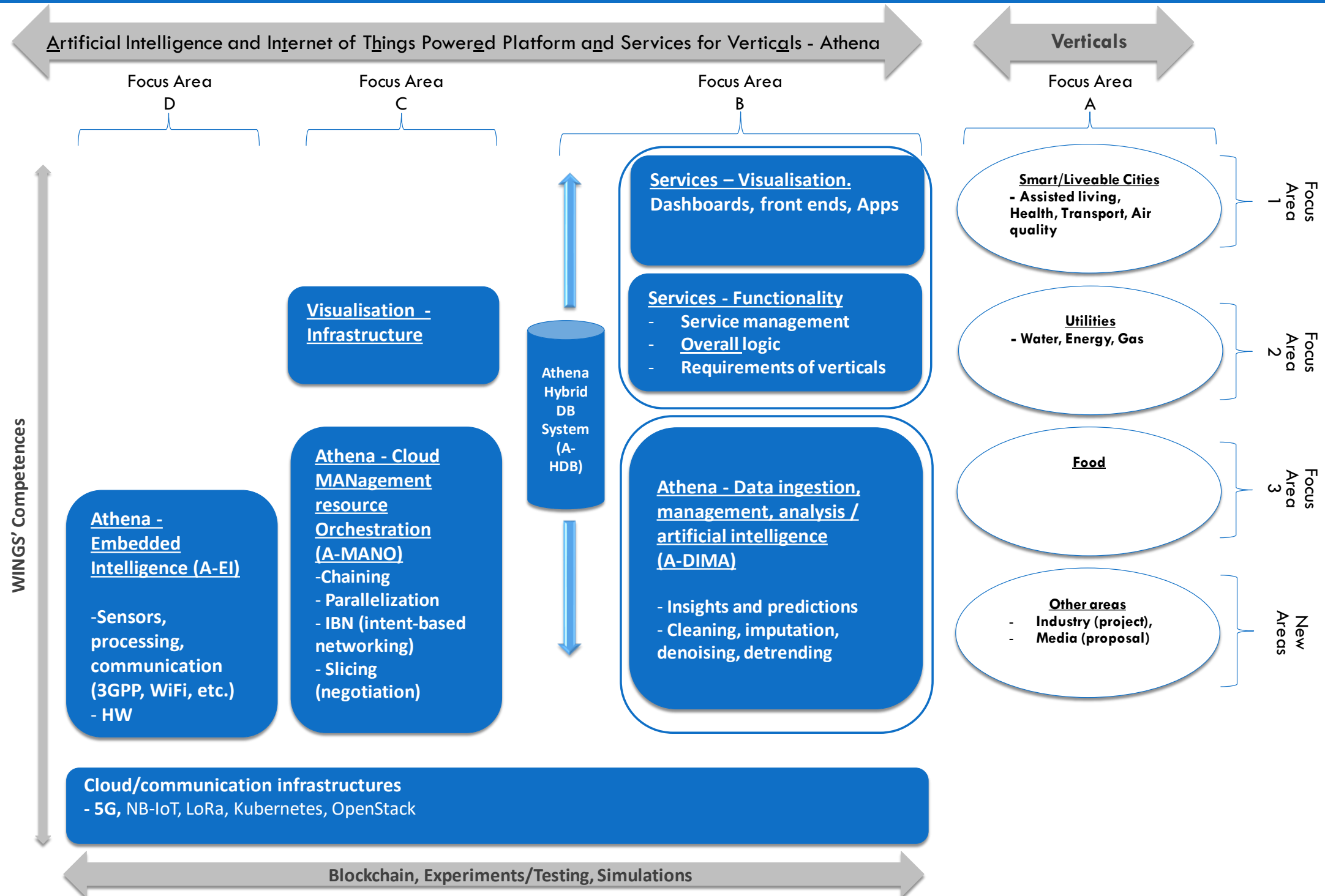
- ATHENA serves as a basis for the solutions for verticals



Products/Platform: Artificial intelligence & Internet of Things powered platform/solution for verticals (working acronym ATHENA)

High Level View

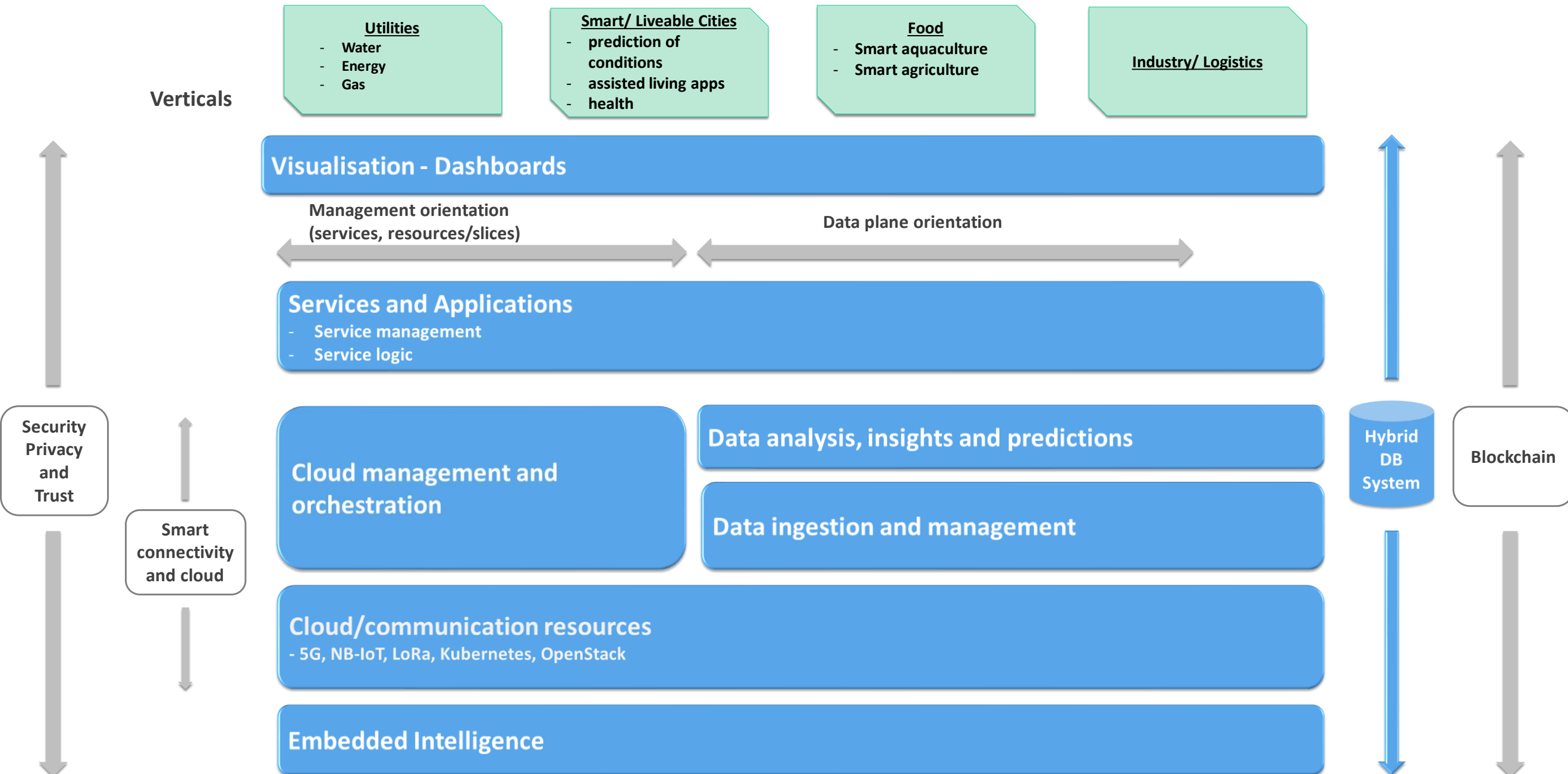
31



Products/Platform: Artificial intelligence & Internet of Things powered platform/solution for verticals (working acronym ATHENA)

High Level View

32



Products/Platform: WINGS system level simulation platform (working acronym NESTOR)

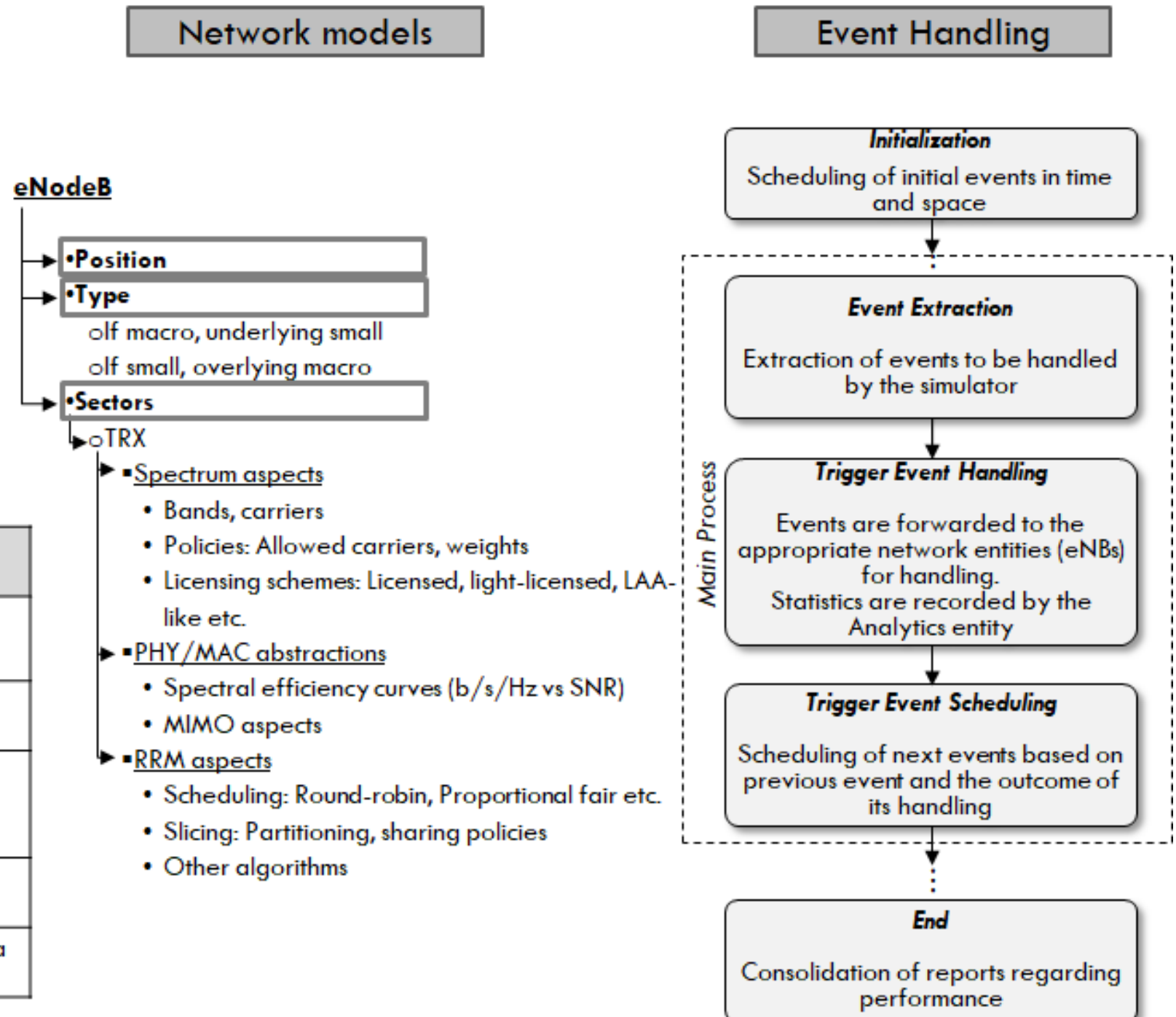
33

Simulating various services related to:

- 5G
- Transport/ UAVs
- Factories of the Future (FoF)

Environment models Traffic models

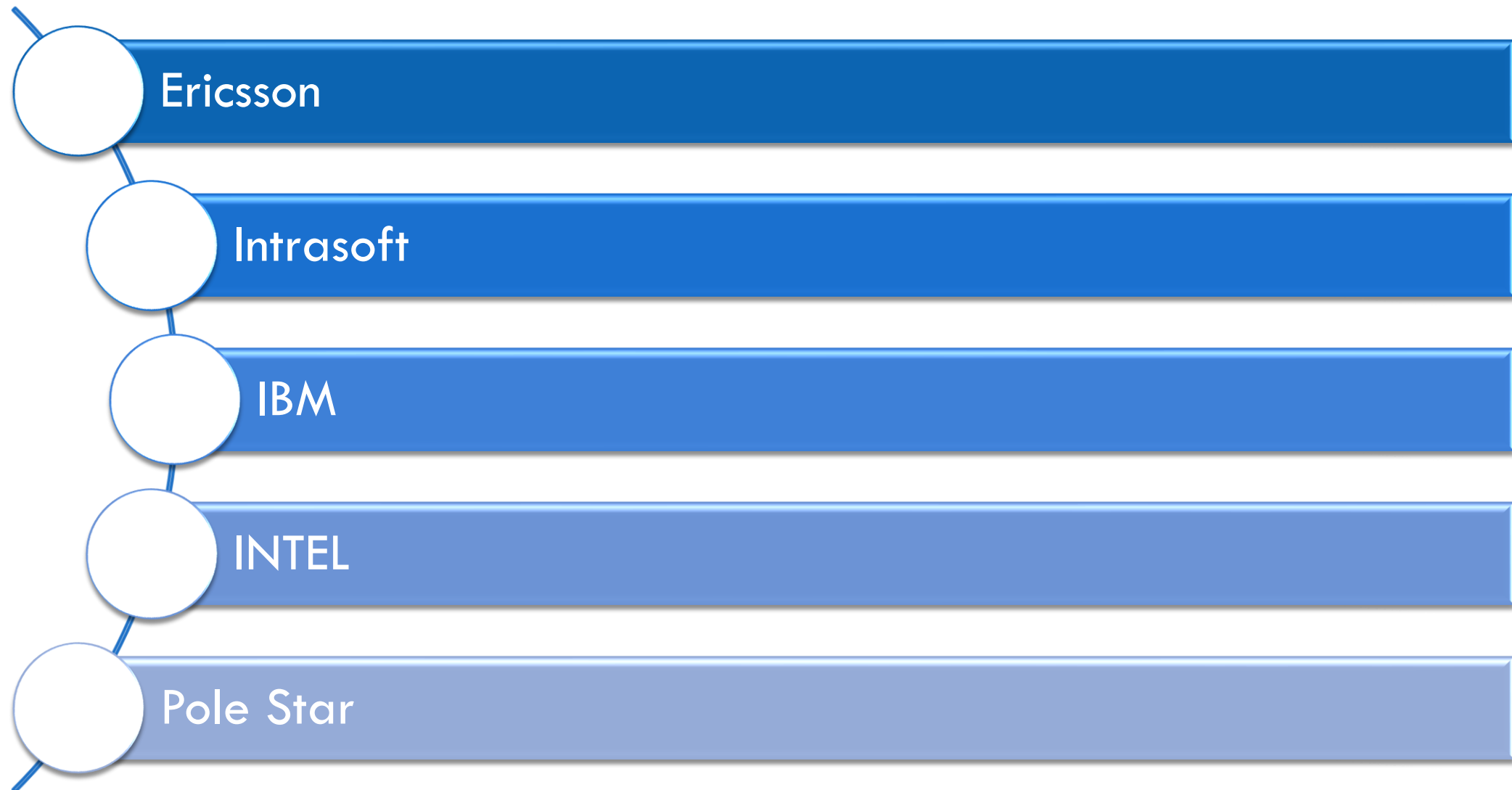
| Service type | Traffic model |
|--------------|---|
| eMBB | FTP Model 1 (TR36.814): Poisson distributed with user's arrival rate λ |
| | FTP Model 2 (TR36.814): Packets arrive exponentially |
| | FTP Model 3 (TR36.889): Packets for the same UE arrive according to a Poisson process with arrival rate λ |
| mMTC | TR37.868: Small packets, Uniform & Beta distribution |
| URLLC | TR37.868: Small packets, bursty, Beta distribution ($\alpha=3, \beta=4$) |



Selected Customers & Partnerships

Overview of selected customers and partners

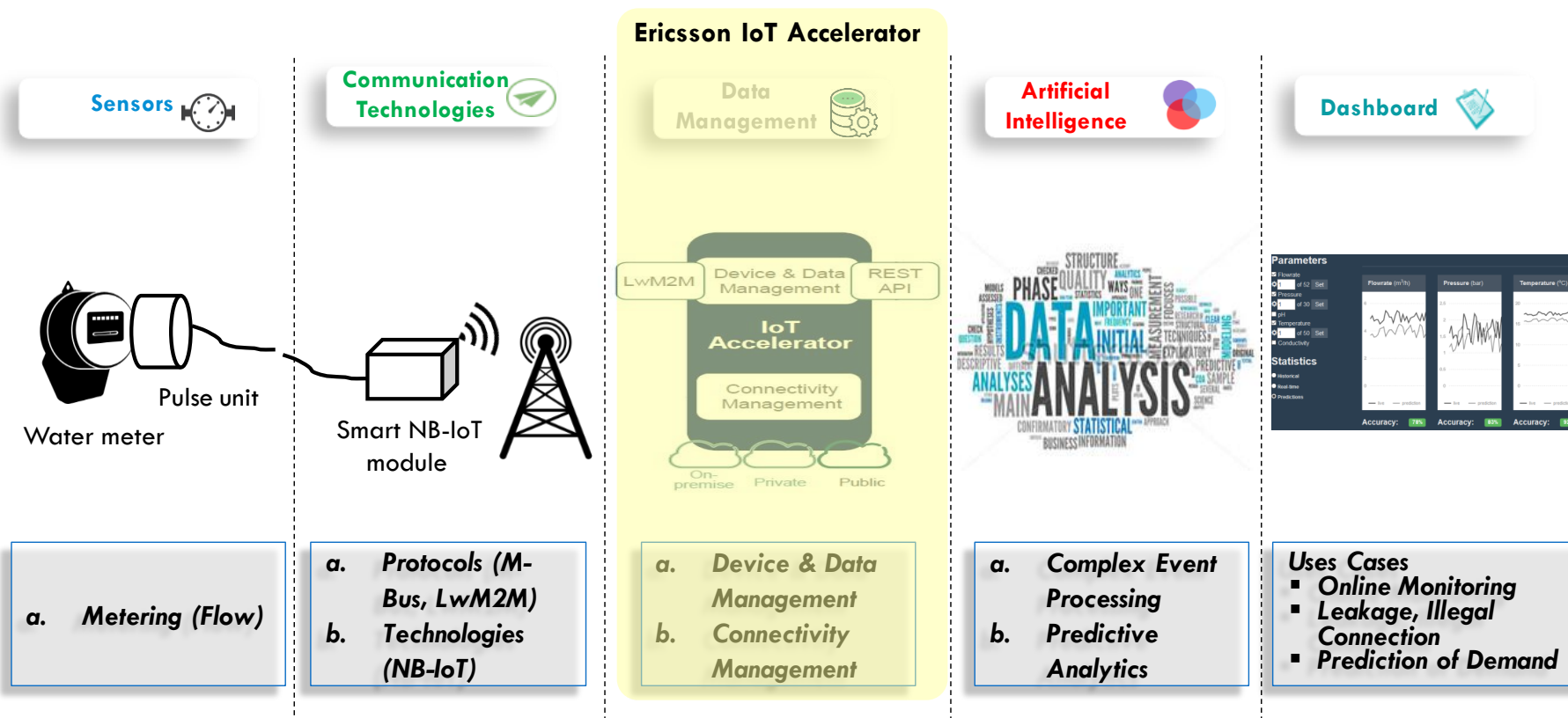
35



Collaboration with Ericsson

36

WINGS has joined the **Ericsson IoT ecosystem as a partner.**



- As part of the product offering, WINGS brings to market a **Smart meter module** that transmits over a **NB-IoT or GPRS** network using the LwM2M application layer protocol towards **Ericsson's IoT Accelerator platform.**

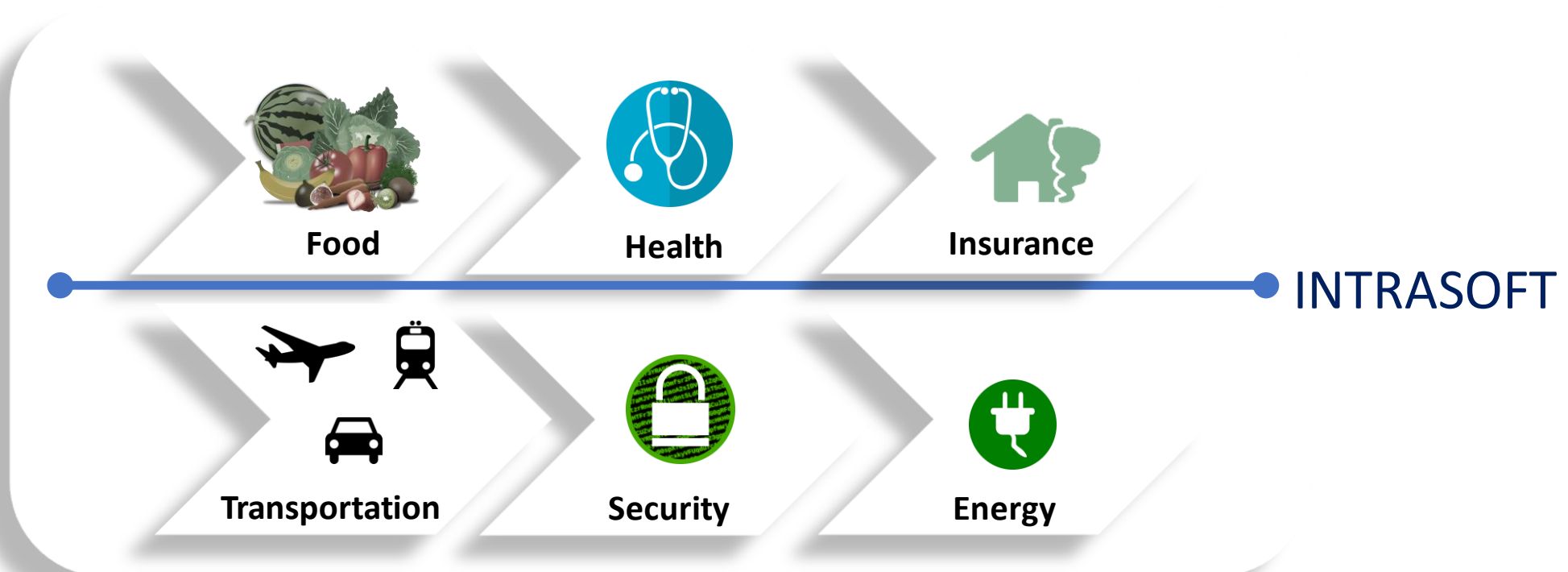
- In addition to this, and **interoperable with IoT Accelerator northbound APIs**, WINGS offers the **CATARACT** platform (proactive management platform for smart connected water), its **innovative water management platform**, which covers and is extended further towards **more utilities** (e.g., gas, energy).
- **Ericsson IoT Accelerator** enables to benefit from a global market of service providers, and to pursue together business opportunities.

Collaboration with INTRASOFT

37

WINGS collaborates with **INTRASOFT** in research & development activities in the context of **various vertical sectors**

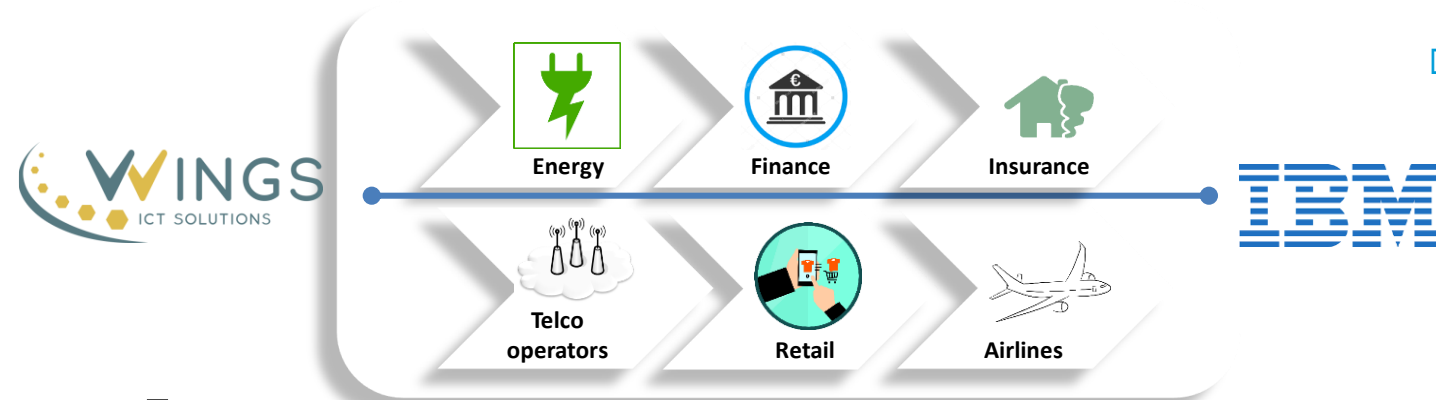
- Indicative areas include:
 - ▣ AI mechanisms in various verticals (i.e. health, food security, energy, transportation and security)
 - ▣ Insurance market research (i.e. markets' policies, growth potential)
- As a result, Intrasoftware and Incelligent (WINGS spin-out company) have recently joined forces for the development of



Collaboration with IBM

38

WINGS collaborates with **IBM** regarding big data and associated services/applications on **energy, retail, airline services** and **finance projects**, as well as on **projects with telecom providers**



□ Energy

- Data analysis and database management
- Data and code validation
- Defect analysis and solution recommendations
- Client consulting

□ Telecommunications

- Network & Service management
- Customer management (CRM)
- Software Testing Process (UAT Testing assistance)
- Data and code validation
- Defect Analysis and solution proposing

□ Finance (Banking & Insurance), Retail and Airline services

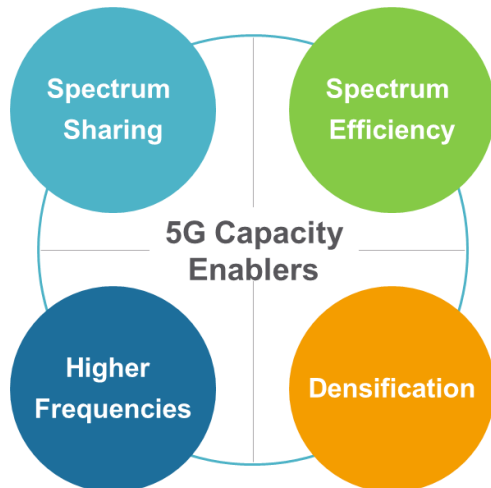
- Loan consulting and management
- Financial analysis and consulting
- Client operations and gap analysis
- Enterprise Data Warehouse (EDW) management; data analysis and report
- MS SQL Server & Oracle database tables management
- Design, built and deploy SSIS packages for ETL
- Reporting and debugging in ETL system
- UAT testing
- House-keeping the production's HPS repository
- Real Estate Credits' i-apply loan granting system management (mainly mortgage loan disbursement)
- Web banking application development for loan creation and management

Collaboration with Intel

39

WINGS collaborates with Intel on advanced spectrum management and device management.

Collaboration on advanced spectrum management and related RRM/MAC protocols



- ❑ **Challenge:** Achieve the ambitious 5G goal for 1000x capacity increase, as cost-efficiently as possible
- ❑ **Investigated Solution: 5G capacity enablers.**
- ❑ **WINGS contribution:**
 - ❑ Enabling more efficient usage of spectrum below 6 GHz – Emergence of new spectrum sharing technologies

Collaboration on Device Management

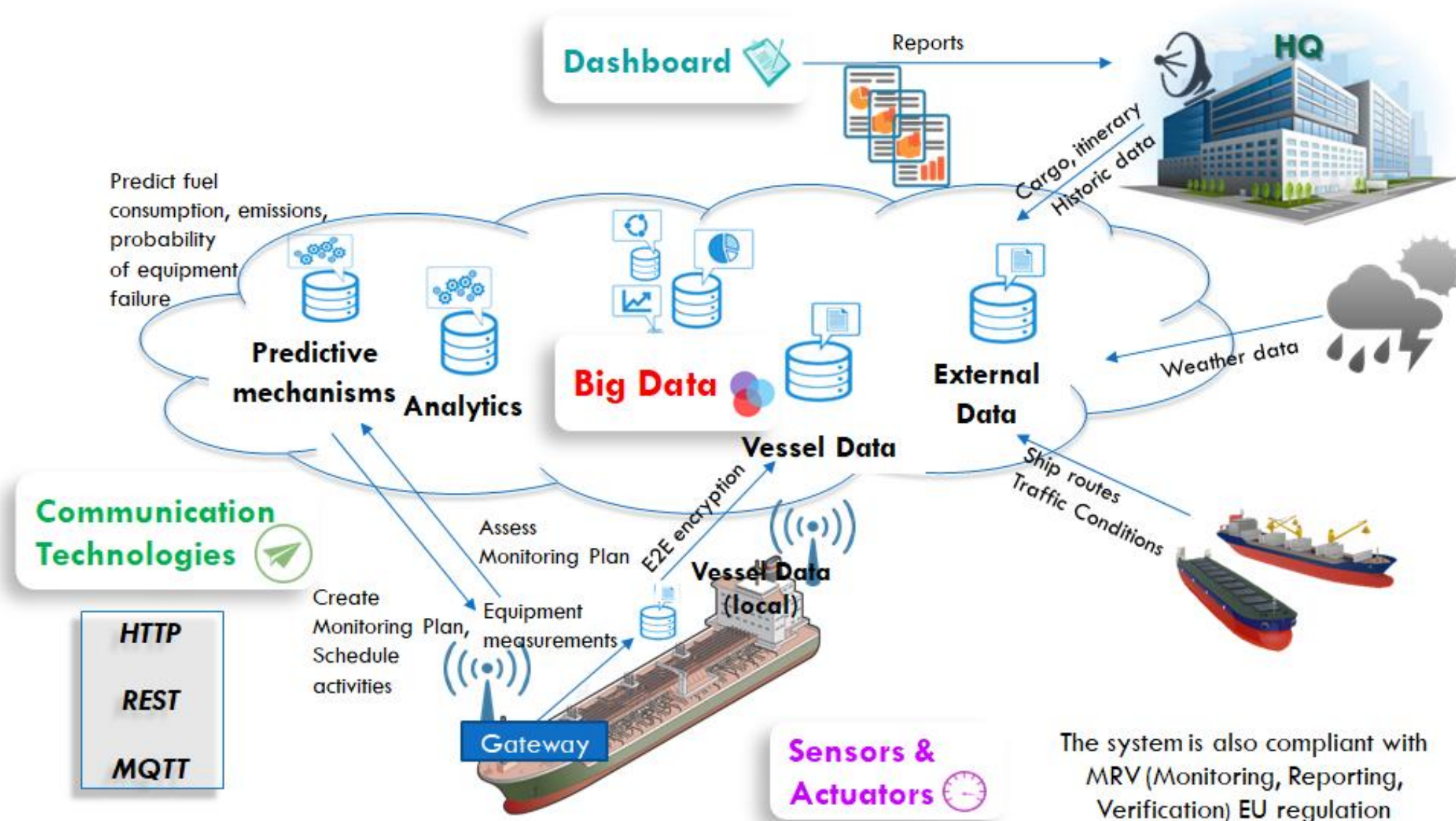
- ❑ **Challenge:** Dynamic network selection based on context/policy information by multi-homing user equipment (UE) operating in evolving heterogeneous wireless environments
- ❑ **Investigated Solution: Support for simultaneous multimedia download from both of the interfaces and playback on the device.**
- ❑ **WINGS contribution:**
 - ❑ Android platform, including the features of context acquisition and network interface selection based on policies, algorithms & machine learning



Collaboration with Pole Star in Maritime Area

40

WINGS collaborates with **Pole Star** on the development of a **Monitoring Reporting Verification (MRV) compliance module**





Projects

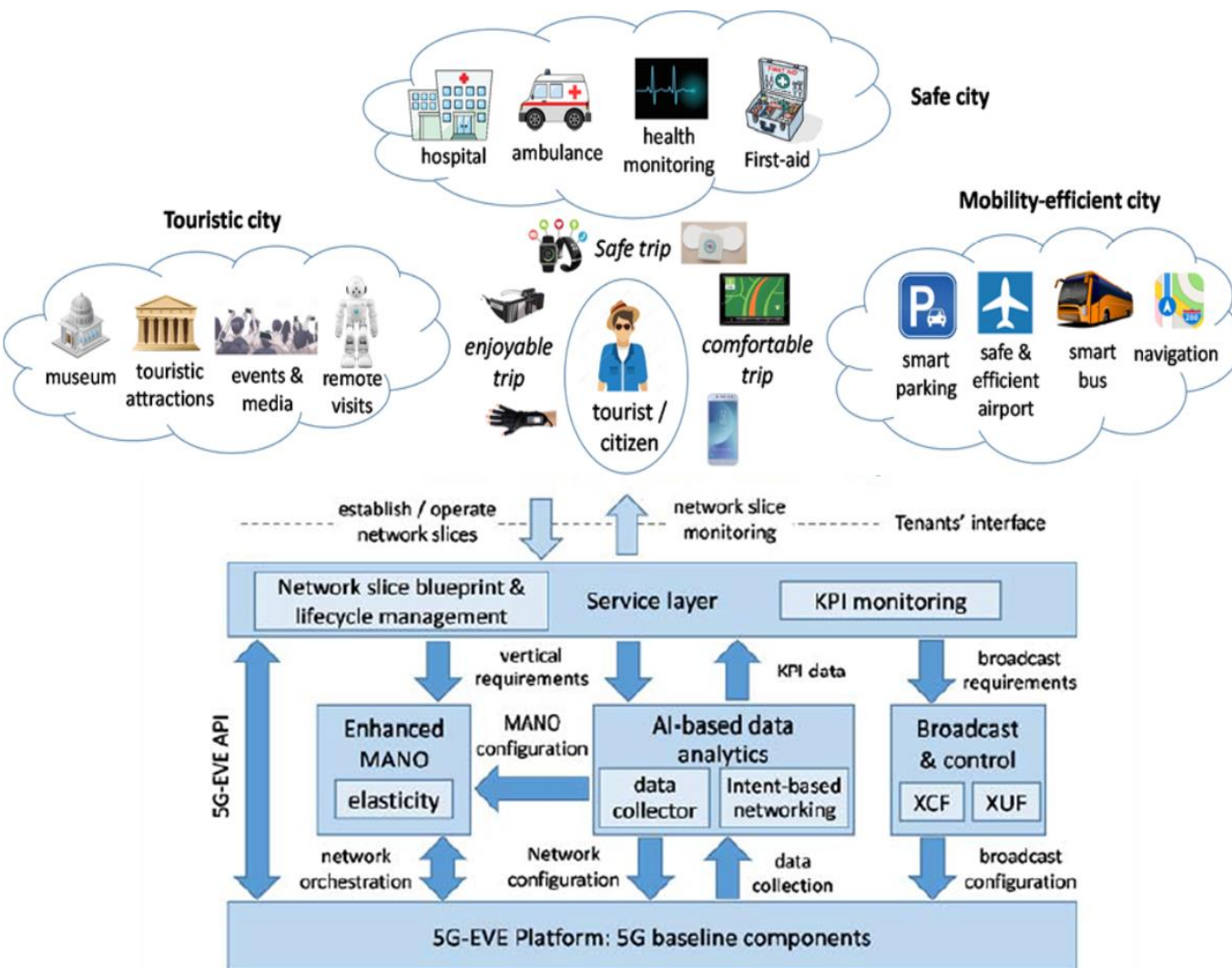
Projects ongoing: 5G/Trials

5G-TOURS

42

5G-Tours: Smart mObility, media and e-health for toURists and citizenS

<http://5gtours.eu/> | 5G PPP Phase 3 | 06.2019-05.2022



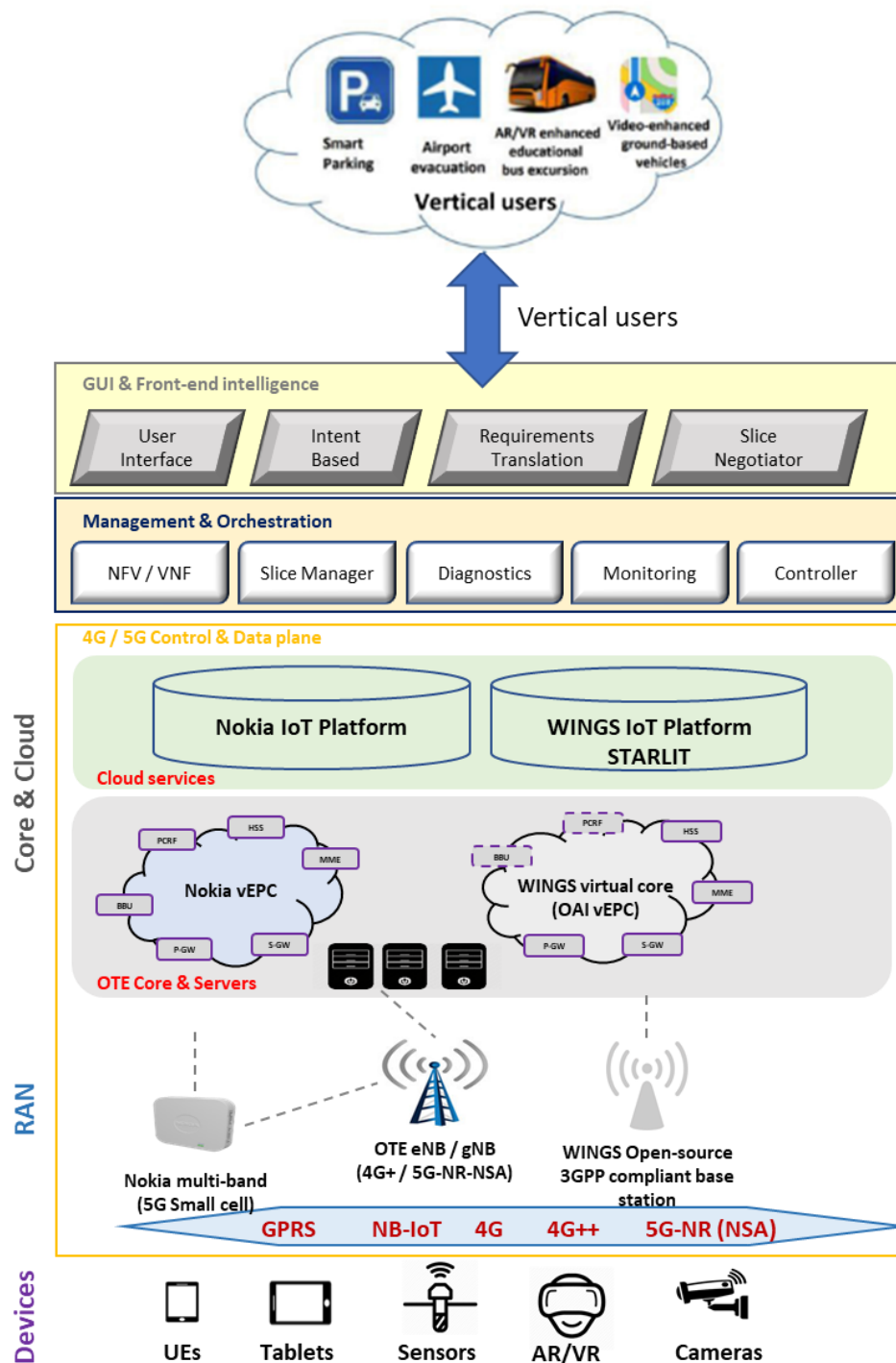
WINGS participates in 2/3 nodes in 5G-TOURS namely, **Rennes and Athens**

- 5G-TOURS (validation trials) will focus on the vital vertical use-cases of smart mobility, media and e-health for tourists and citizens
- **Specific use cases include:**
 - ▣ **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
- **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**

Projects ongoing: 5G/Trials

5G-TOURS

43



WINGS role:

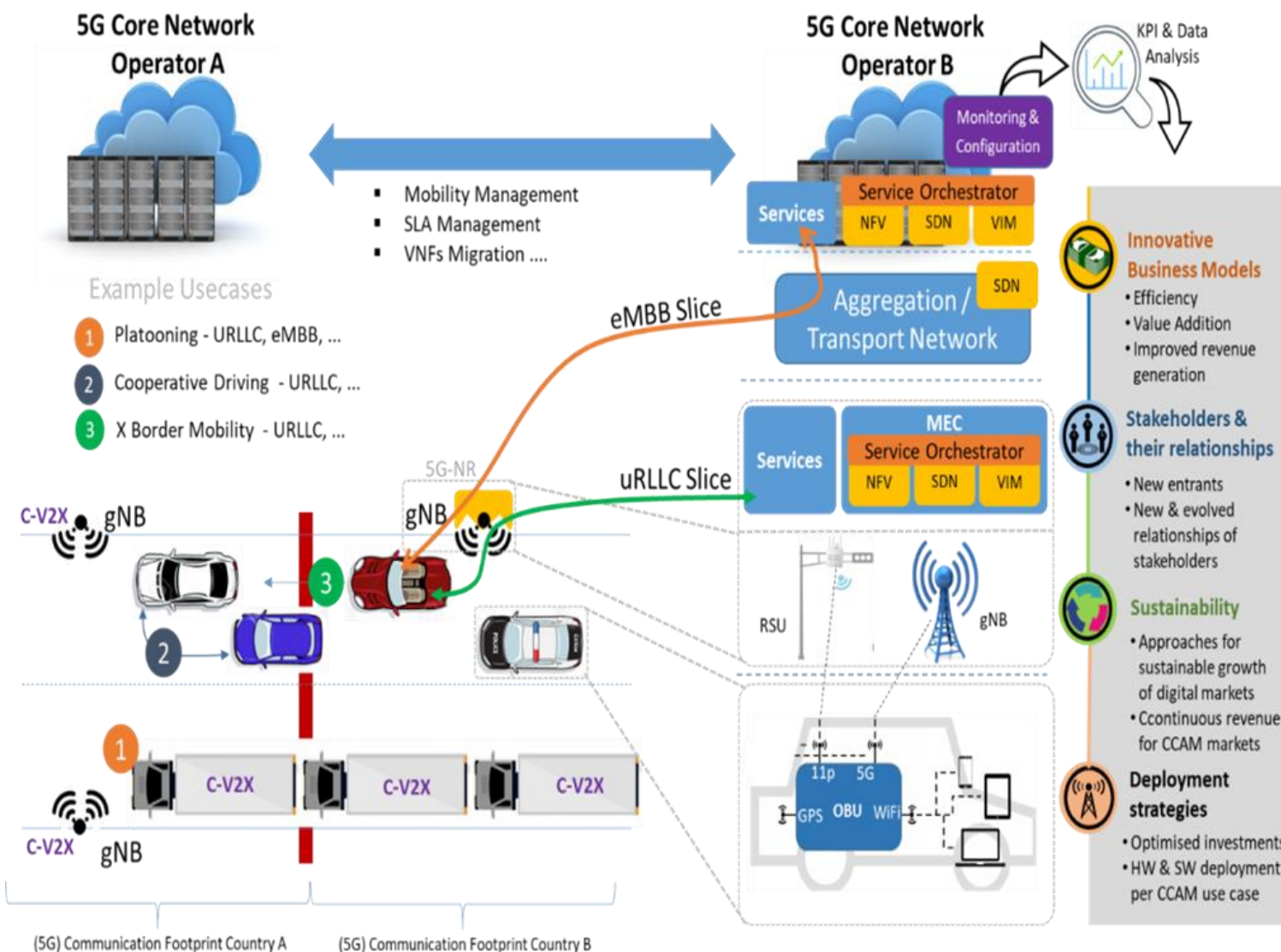
- **Quality Assurance Managers & WP7 leaders** overseeing the system integration and evaluation
- WINGS **leads** 2 use cases in the **safe city** (Rennes node) and 1 use case in the **mobility-efficient city** (Athens node) acting also as the **Greek node leader**
- WINGS supports all Greek use cases by providing hardware and software vertical solutions tailored to the corresponding requirements
 - ▣ An end-2-end **smart parking system** providing the **parking occupancy sensors** as well as the platform and an optimal routing solution leveraging on **AI**
 - ▣ An **indoor evacuation application** providing personalized evacuation routes based on information from the boarding passes
 - ▣ A **live streaming web interface** for the AOC (Airport Operation Center) providing support for day to day operations and instant response in emergencies
 - ▣ Mobile development and integration

Projects ongoing: 5G/Automotive 5G-MOBIX

44

5G for cooperative & connected automated MOBility on X-border corridors

<https://www.5g-mobix.com> | 5G PPP Phase 3 | 11.2018 – 10.2021



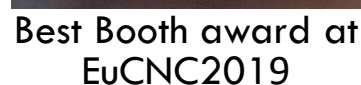
WINGS role:

- **Technical Managers & WP3 leaders** overseeing technology development & integration
- **5G Architecture definition lead** organizing and aligning the specifications of the 5G-MOBIX corridors and Trial sites
- **Greece-Turkey corridor** requirements analysis & 5G network specifications for CCAM
- **Assisted driving functionality** for cross-border CCAM scenarios

45



- 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**



Assisted -zero touch- truck border crossings based on CCAM, 5G and AI mechanisms

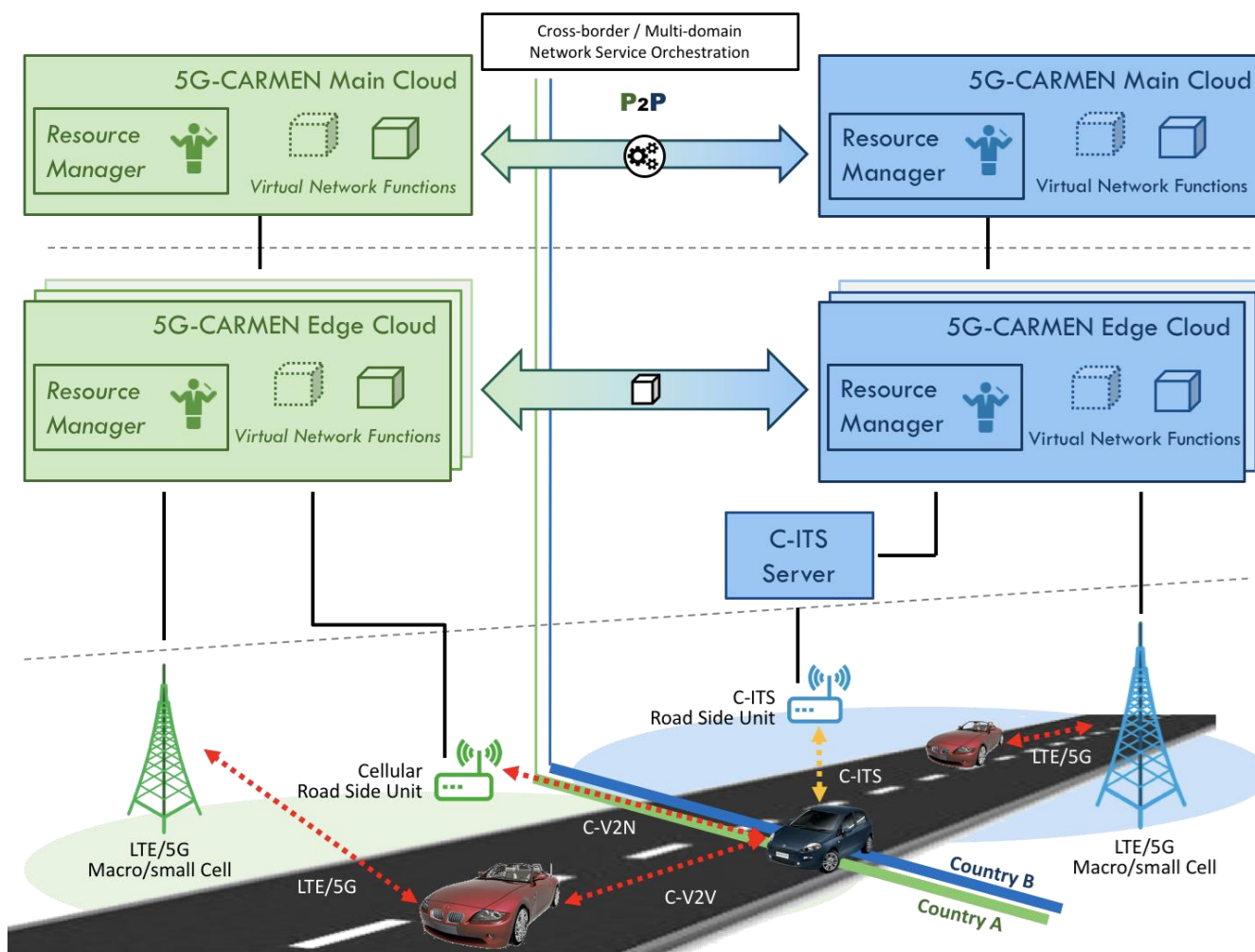
Projects ongoing: 5G

5G CARMEN

46

5G for Connected and Automated Road Mobility in the European Union

<https://www.5gcarmen.eu> | 5G PPP Phase 3 | 11.2018-10.2021



WINGS role:

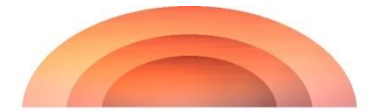
- Data collection and processing, generation of **descriptive, predictive and prescriptive analytics on vehicles' emission** with a focus on sensitive areas, such as Low Emission Zones (LEZs);
- **Decision making towards emission control actions recommendation** to autonomous vehicles/drivers and authorities;
- Participation in personalised services provision in an **in-car** adaptive and prioritised QoE for **next generation infotainment** context;
- **Resource management, service orchestration and life-cycle management** frameworks definition to ensure seamless service continuation as described above in multi-domain and cross-border setups.

Projects ongoing: 5G 5G EVE

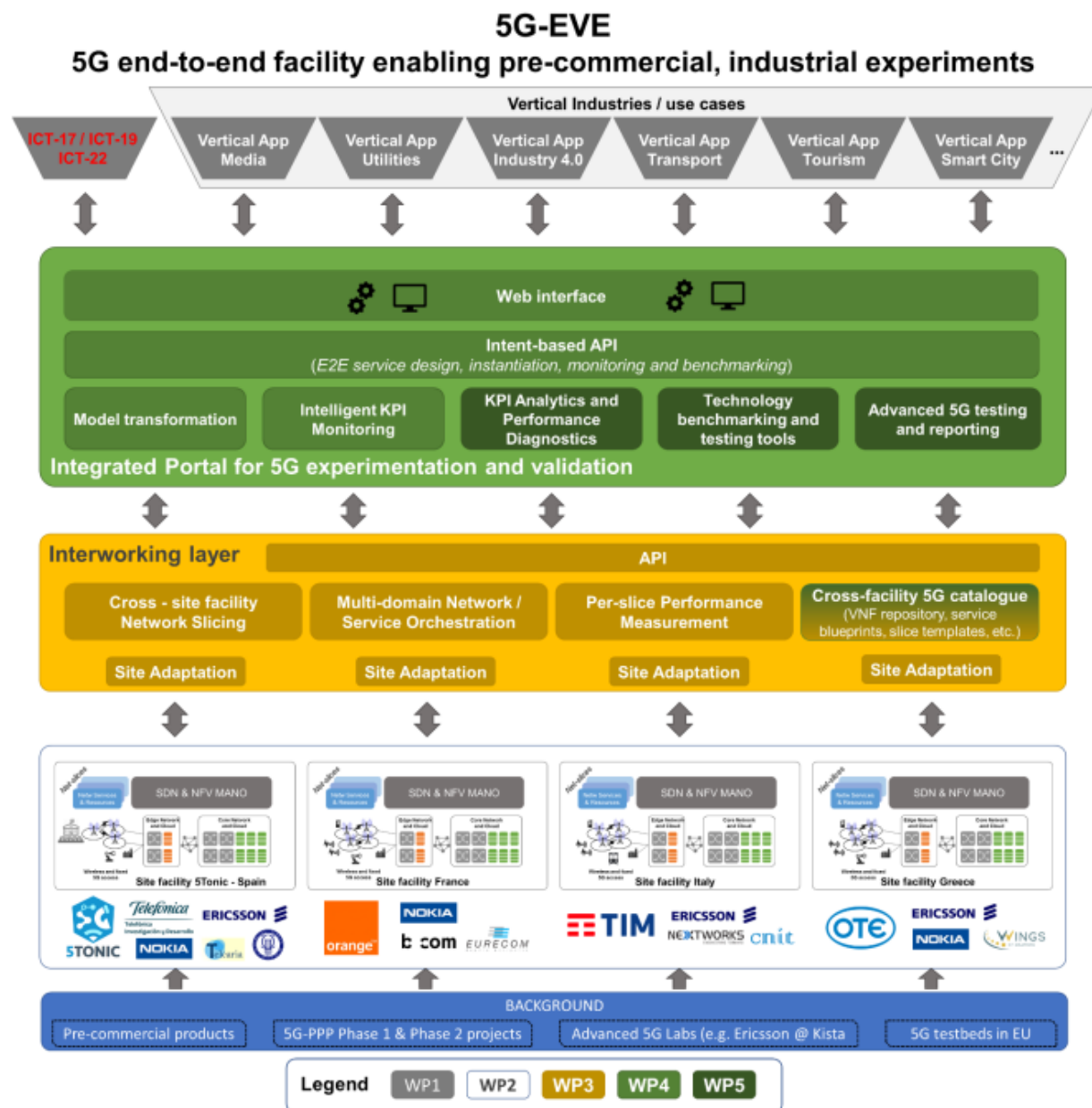
47

5G European Validation platform for Extensive trials

<https://www.5g-eve.eu> | H2020/5GPPP Phase 3 | 07.2018-06.2021



5G EVE

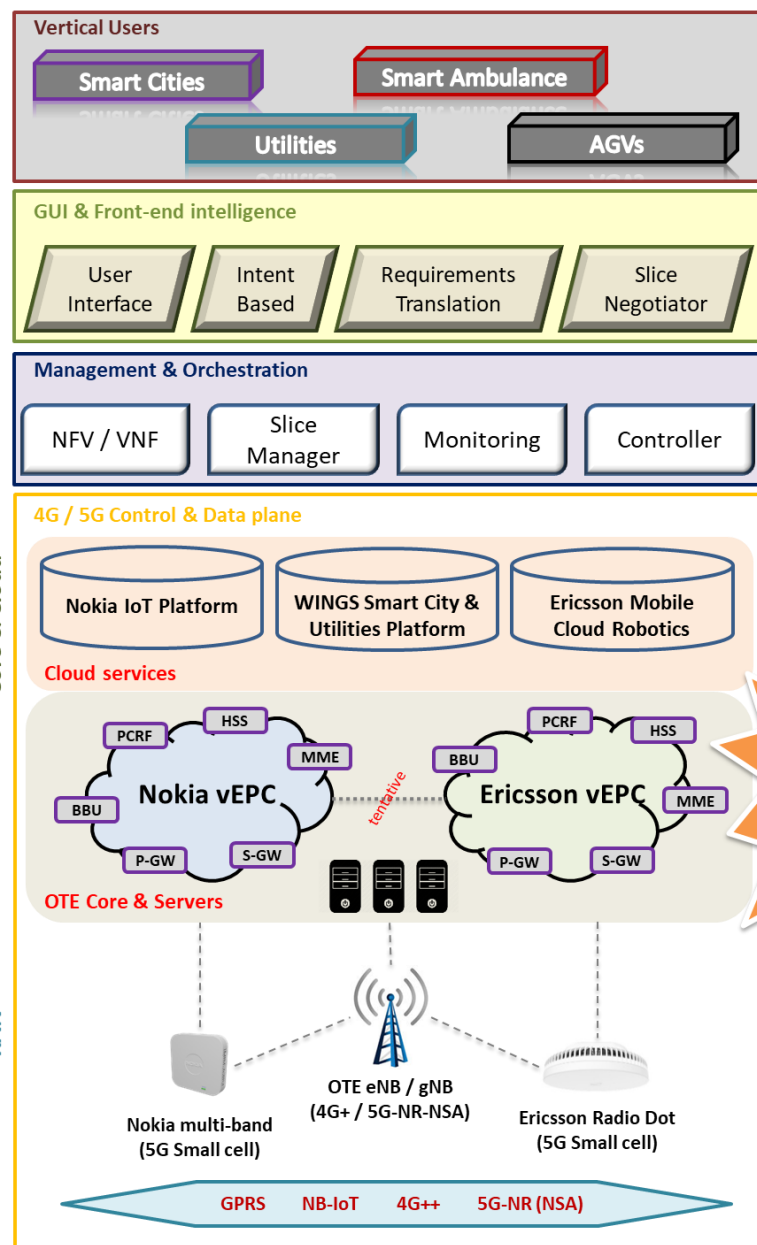


WINGS role:

- Lead the design and implementation of a testing and validation suite of tools including a **performance diagnosis mechanism** as WP5 leader
- Lead the design and development of user experimentation tools for vertical industries including **'intent-based' interfaces**
- Heavily contribute to the upgrades and use case implementation on the Greek testbed as **deputy coordinators of the Athens 5G facility**
- Act as **Quality Assurance Managers** for the entire project

Projects ongoing: 5G 5G EVE

48



WINGS role in Athens 5G testbed:

- Assist OTE with the cross-vendor integration of 5G technologies to implement a **'unified' and interconnected 5G E2E facility**
- Coordinate the implementation of the three selected vertical use cases (**Industry 4.0, Utilities, Smart city**) of the Athens 5G testbed among the Greek site participants
- Provide **smart grid solutions** for the utilities use case implementing ultra-fast / reliable fault detection and management
- Provide **e-Health and predictive analytics** solutions for the smart city use case
- Provide experimenter assistance through the development of **Intent Based Mechanisms**

You Tube

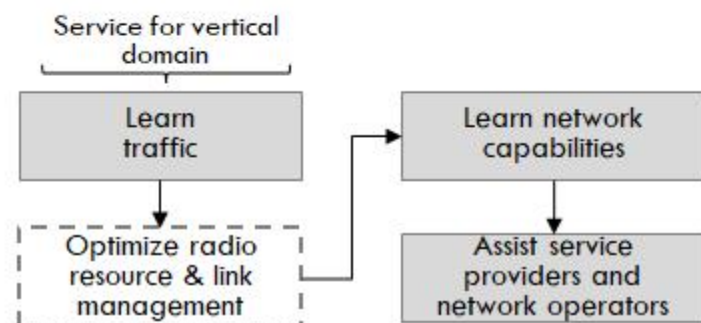
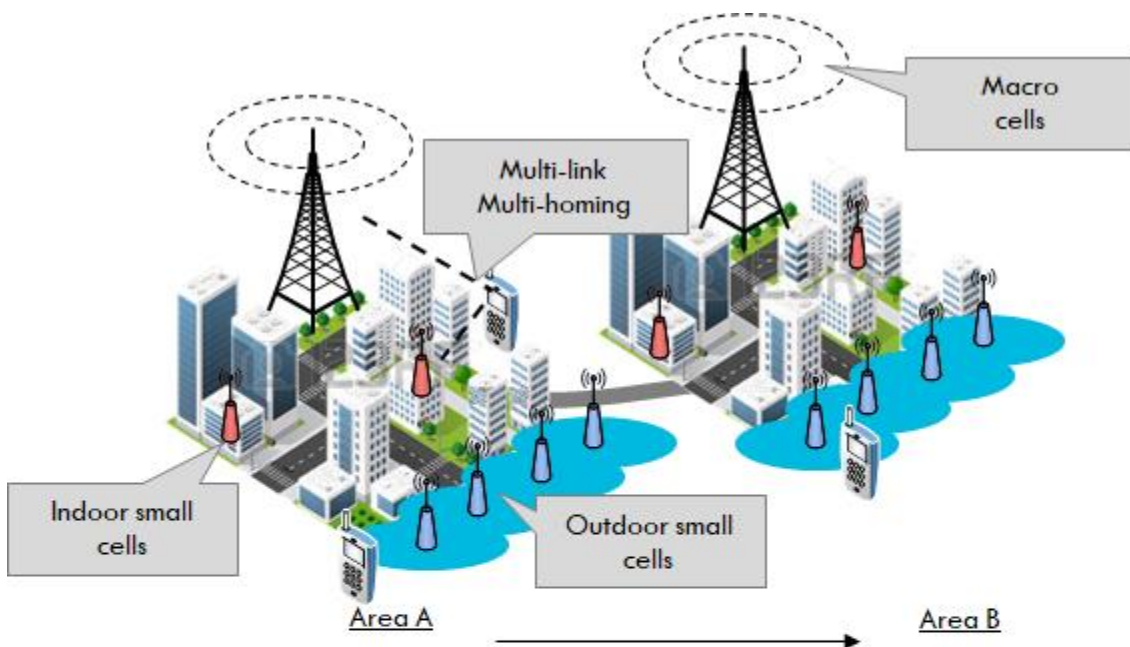
[Introduction of Advanced Smart City Applications by means of 5G](#)
[Intent-based mechanisms for vertical services and experiment specification over 5G infrastructures](#)
[Resolving outages and Ensuring the Stability of Smart Grids](#)

Projects ongoing: 5G One5G

49

E2E-aware Optimizations and advancements for the Network Edge of 5G New Radio

<https://5g-ppp.eu/one5g/> | H2020/5GPPP Phase 2 | 06.2017-05.2019



WINGS role:

- ❑ **Megacities and underserved areas**
- ❑ Investigating benefits of network **slicing** solutions – slice negotiations
- ❑ Distributed **RRM** in megacities (dense, heterogeneous infrastructures) and rural areas (long-distance coverage)
- ❑ Optimal placement of functionality in a cloud RAN context
- ❑ Extending the **5G system level simulator** with new features from above and providing hardware POCs
- ❑ Leading prototype activities



MWC 2018

Demonstration: <https://goo.gl/ufKV1C>



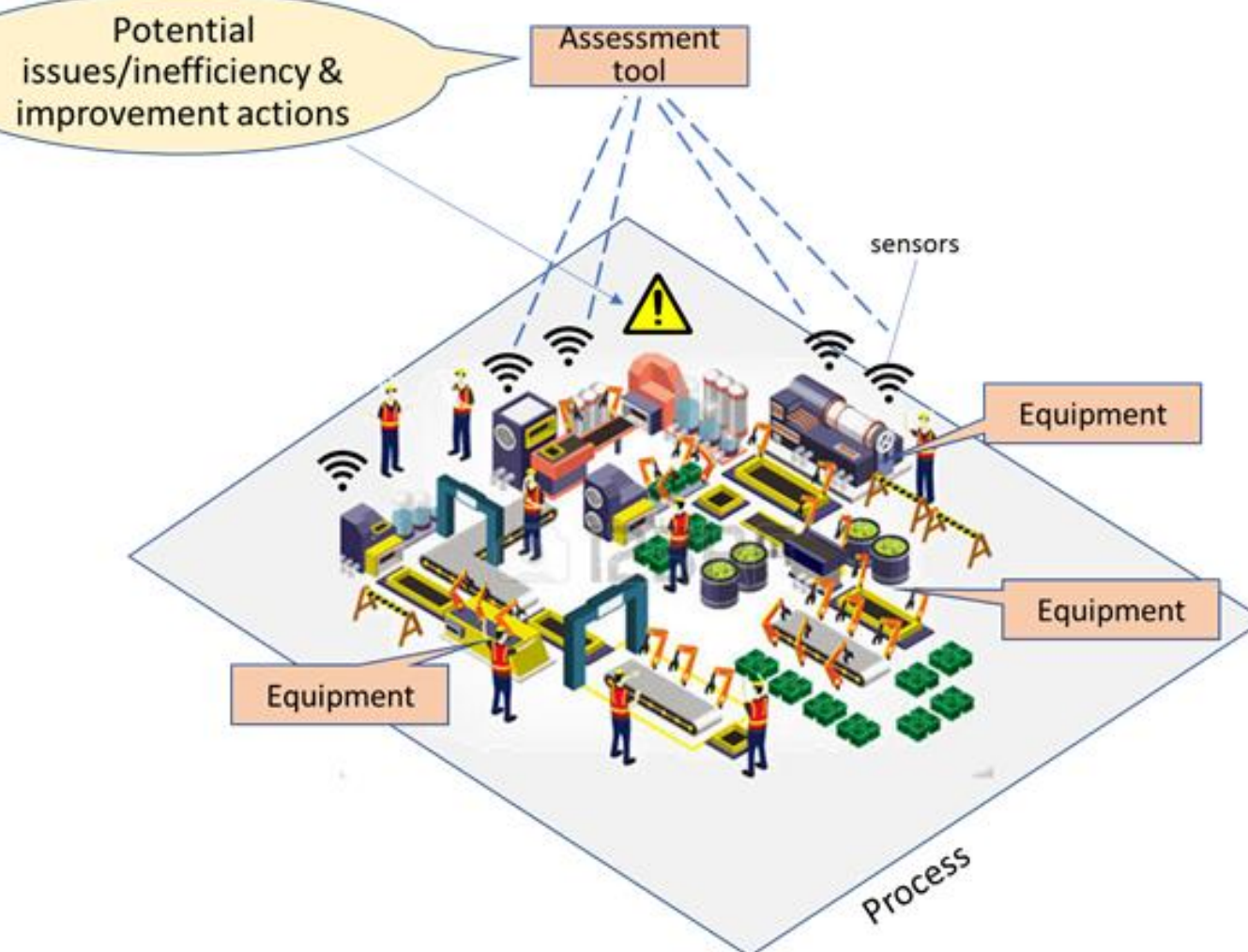
Best Booth award at EuCNC2018
Demonstration: <https://goo.gl/TLKtdH>

Projects ongoing: 5G Clear5G

50

Converged wireless access for reliable 5G MTC for factories of the future

<http://www.clear5g.eu> | H2020/5GPPP Phase 2, EU-Taiwan | 09.2017-02.2020



WINGS role:

- ❑ **AI** and 5G power **robotics** for factories
- ❑ Pursuing **optimal** network **slicing** solutions for critical and non-critical factory processes
- ❑ Extending the 5G **system level simulator** with new features from above
- ❑ Distributed **RRM** solutions in scenarios related to Factories of the Future (especially mMTC and URLLC services)
- ❑ Leading the integration and **prototyping** WP
- ❑ Demonstration on monitoring and closed-loop control of industrial AGV:

<https://goo.gl/4nJhYf>

A more detailed scenario is presented in “Solutions for Verticals – Industry / Logistics” [slide 22]

Projects ongoing: Utilities (gas)

SecureGas

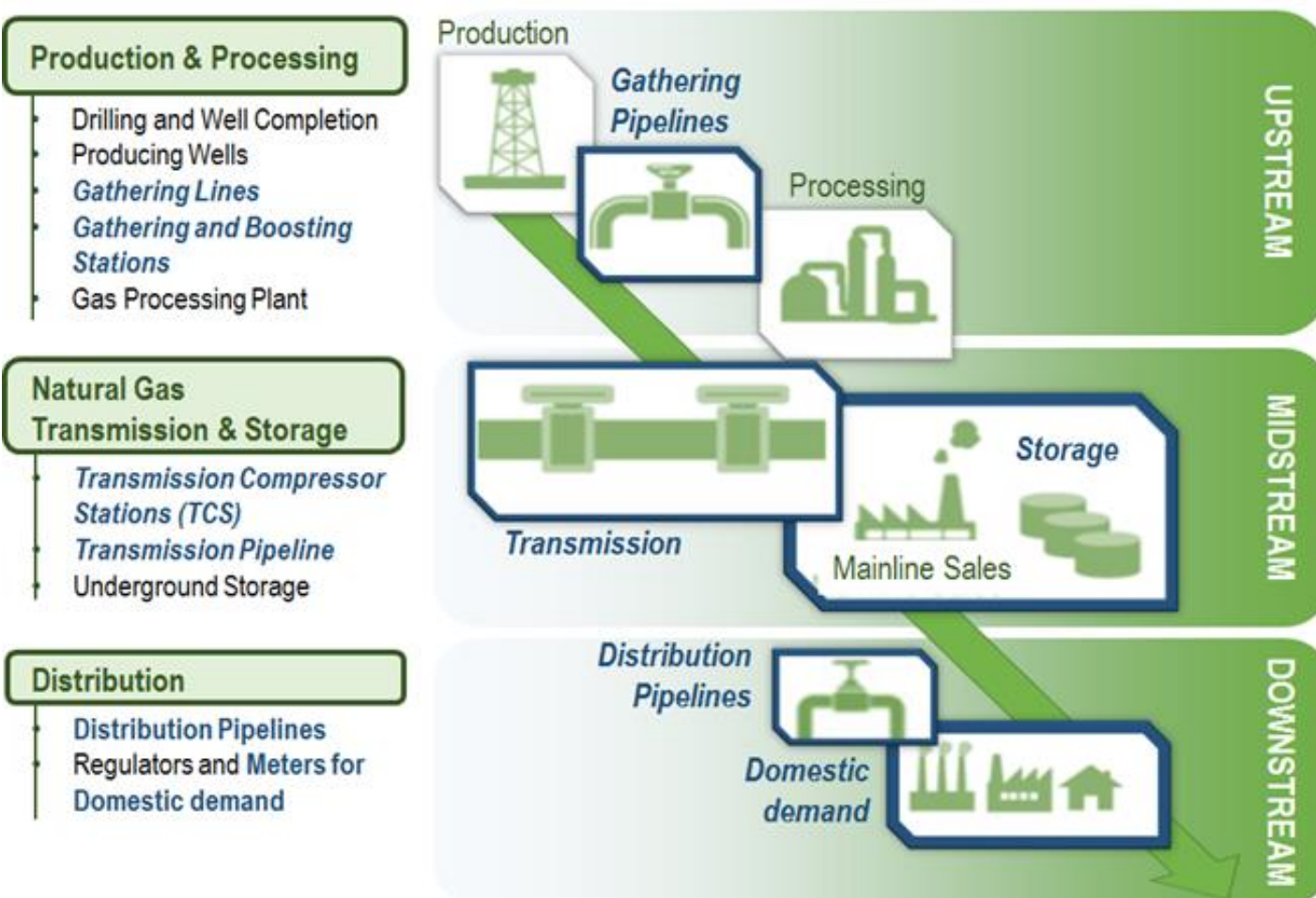
51

Project title: The European Gas Network

Website: <http://www.securegas-project.eu/>

Framework: H2020-SU-INFRA-2018

Duration: 06.2019-05.2021



WINGS role

- Leading the development, customization and integration of Information Processing and Management Components
- Real-time monitoring in health data of gas grids
- Anomaly detection in gas grid SCADA, IT and IoT Systems data flows
- Combination of heterogeneous data for:
- Actionable intelligence
- Cyber-physical anomaly detection mechanisms and system's health check
- Participation in Business Case 1 (Greece) and 3 (Italy)

Projects ongoing: Utilities (gas)

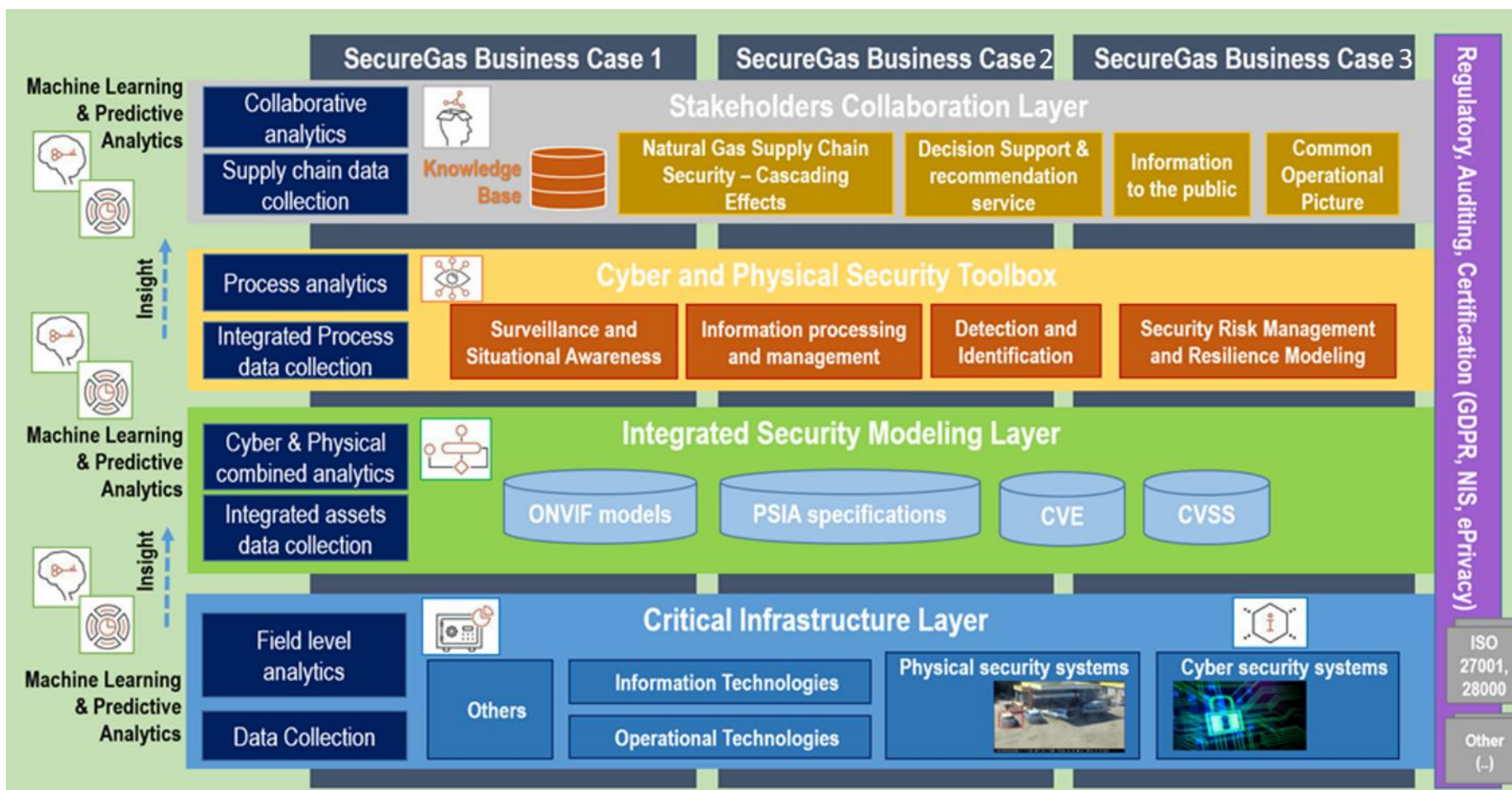
SecureGas

52

Business Case 1: Risk-Based Security Asset Management of Gas CI, provided by DEPA, applied and tested to strategic project managed by DEPA (e.g. IGB, EastMed) and to gas networks in Sub-Urban Areas provided by EDAA.

WINGS role in BC1:

- Leading the customization of the SecureGas extended components to Business Case 1
- Contribution to the pilot execution and testing of components
- Identification of Threat Patterns
- Risk prevention and mitigation countermeasures
- Cyber-Physical Correlation for threat detection



Projects ongoing: Smart/Liveable cities

DeepHealth

53

Project title: Deep-Learning and HPC to Boost Biomedical Applications for Health

Website: www.deephealth-project.eu

Framework: H2020 (ICT-11-2018-2019- HPC and Big Data enabled Large-scale Test-beds and Applications)

Duration: 01/01/2019 – 31/12/2021 (36 months)



DEEPHEALTH



WINGS role

- Use case “Migraine & Seizures prediction” and MigraineNet platform owner;
- Integration of the DeepHealth libraries and toolkit with the MigraineNet platform so as to take advantage of the HPC setting and the parallelization technologies;
- Testing and validation of the DeepHealth outcomes through the MigraineNet platform and UC1 (“Migraine & Seizures prediction”)
- Extension of the MigraineNet capabilities to include more health issues than migraine, e.g., seizures.
- WP7 “Dissemination and Exploitation” leader

Projects ongoing: Verticals – Food Safety & Security Impact

54

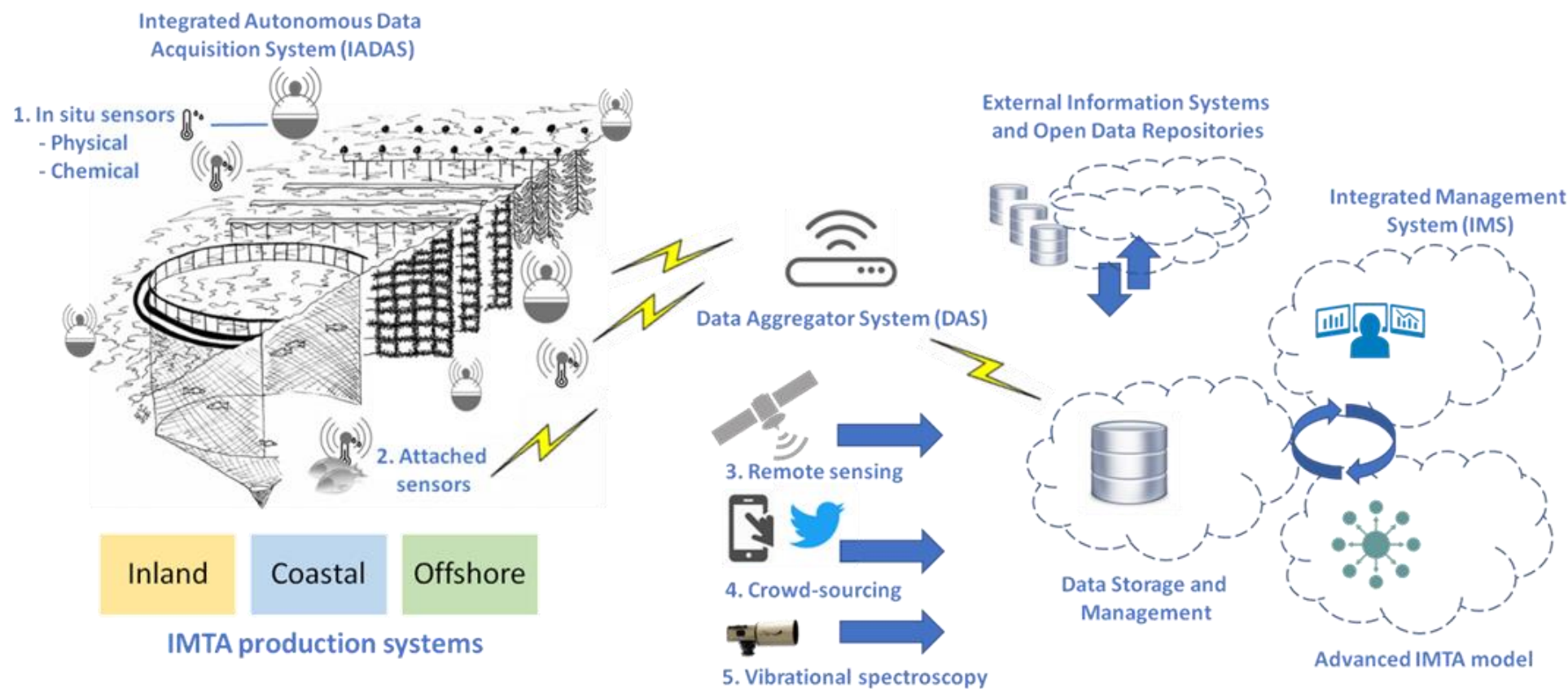
Intelligent Management system for integrated multi-trophic AQUaculTure

H2020 | 05.2018 - 04.2021



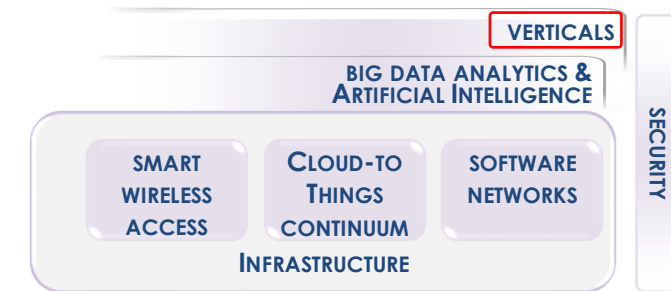
Main activity of WINGS in Impact is to support novel operational functionalities in IMTA context based on:

- **Data and predictive analytics** (behavior monitoring, disease diagnosis, intelligent feeding, feed waste management, water quality monitoring)
- **Optimal decision making and actuation** with automation for optimising production systems, as well as triggering early warning alerts.



Projects ongoing: Verticals – Food Safety & Security

PhasmaFOOD



55

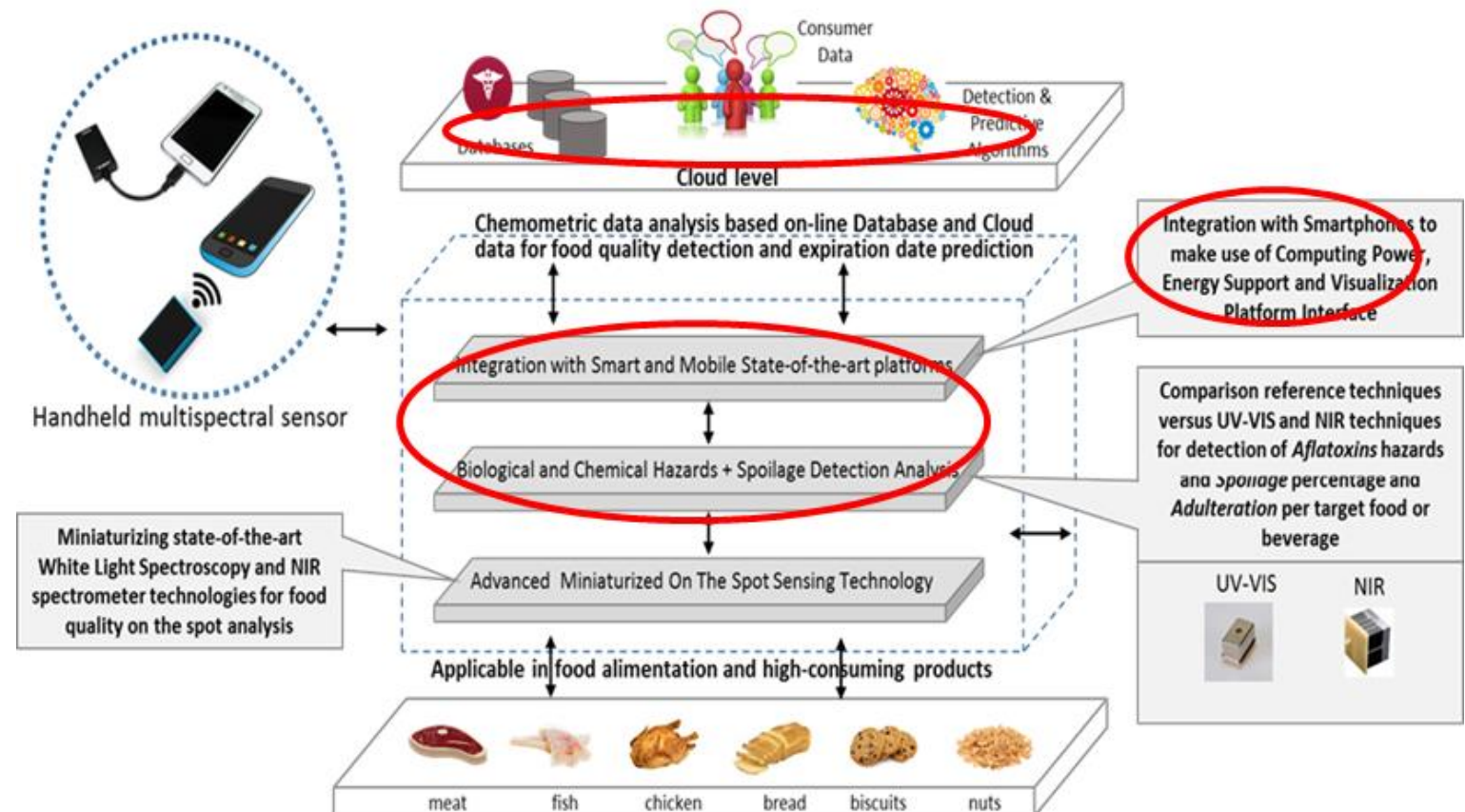
Photonic miniaturised smart system for on-the-spot food quality sensing

www.phasmafood.eu | H2020 SSI - Smart System Integration | 01.2017-01.2020



WINGS role:

- Design, implementation and evaluation of the electronic board on which the non-integrated sub-systems (sensing components array, WiFi/Bluetooth antenna, energy supply system) will be mounted
- Definition of APIs, data models and cloud database organization
- Integration of the multifunctional electronic board and processing unit, with the sensing array frontend, the communication actors, the final housing and by installing the embedded software



Projects ongoing: Verticals – Food Safety & Security

PhasmaFOOD

VERTICALS

BIG DATA ANALYTICS & ARTIFICIAL INTELLIGENCE

SMART
WIRELESS
ACCESS

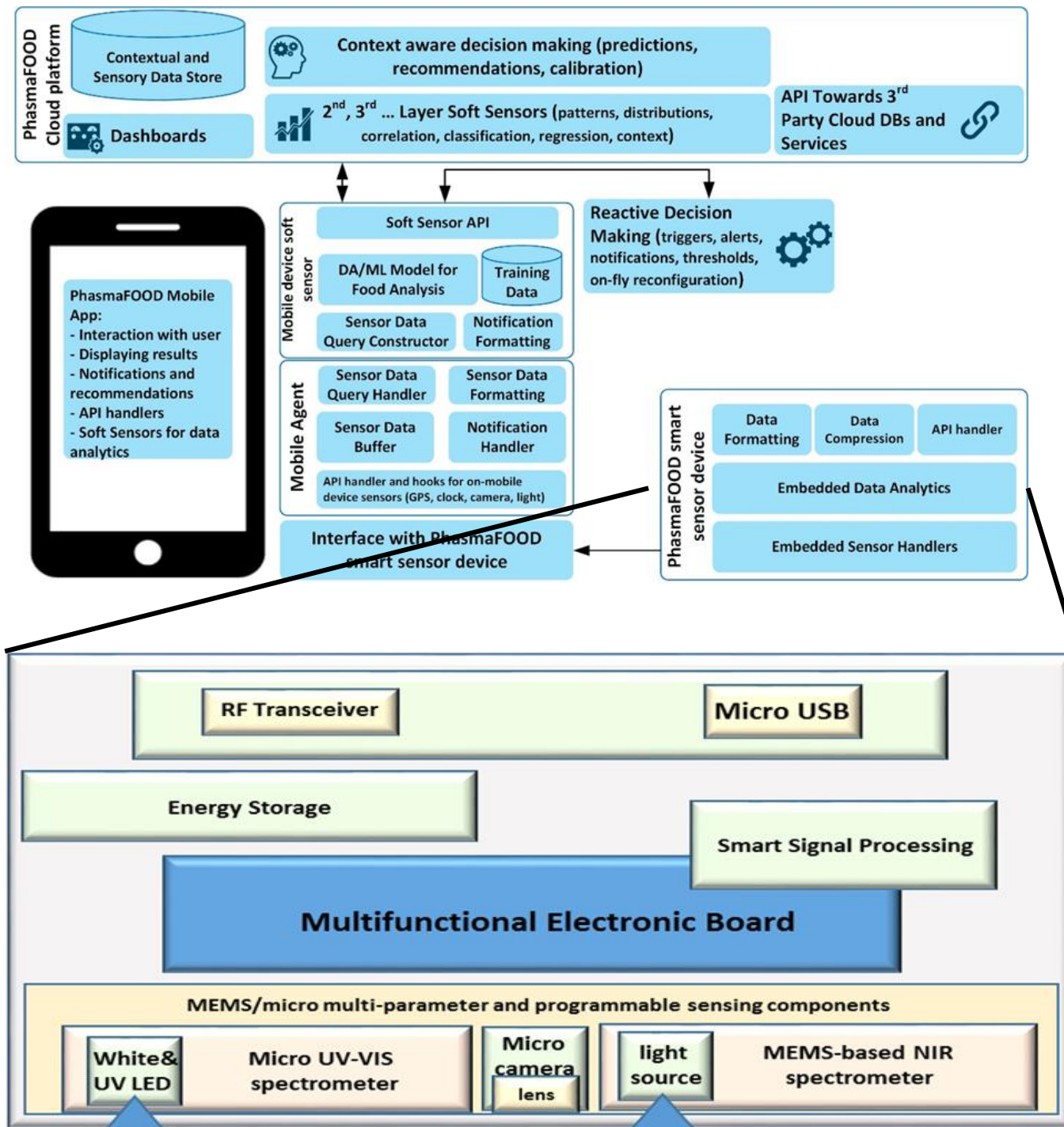
CLOUD-TO
THINGS
CONTINUUM

SOFTWARE
NETWORKS

INFRASTRUCTURE

SECURITY

56



- Design, implementation and evaluation of the required electronic board
 - ▣ Electronic board optimization for the resistive type of sensors
 - ▣ Low power programmable analogue signal conditioning and processing
 - ▣ Analogue routing/switching matrix
 - ▣ Smart signal processing capabilities and advanced communication functions
 - ▣ Smart algorithms integration into the hardware design
 - ▣ FPGAs/ μ -controllers investigation
- System Integration, packaging & prototypes
 - ▣ Manufacture of system housing according to the design
 - ▣ Integration of sensing array frontend, the communication actors, the final housing and by installing the embedded software
 - ▣ Initial prototype testing of sensor operation, data transfer to a smart phone, recording of test spectra and images

Projects ongoing: Verticals – Transportation

MyCorridor

57

Mobility as a Service in a multimodal European cross-border corridor

<http://mycorridor.eu/> | H2020 | 06.2017–05.2020



Our World with MaaS



WINGS role:

- Theoretical analysis of the MaaS landscape
- Specification of the system's architecture,
- Design/development/evaluation of core software modules and services,
- Pilot realization (offering an advanced navigation service – smart mobility)
- Dissemination activities

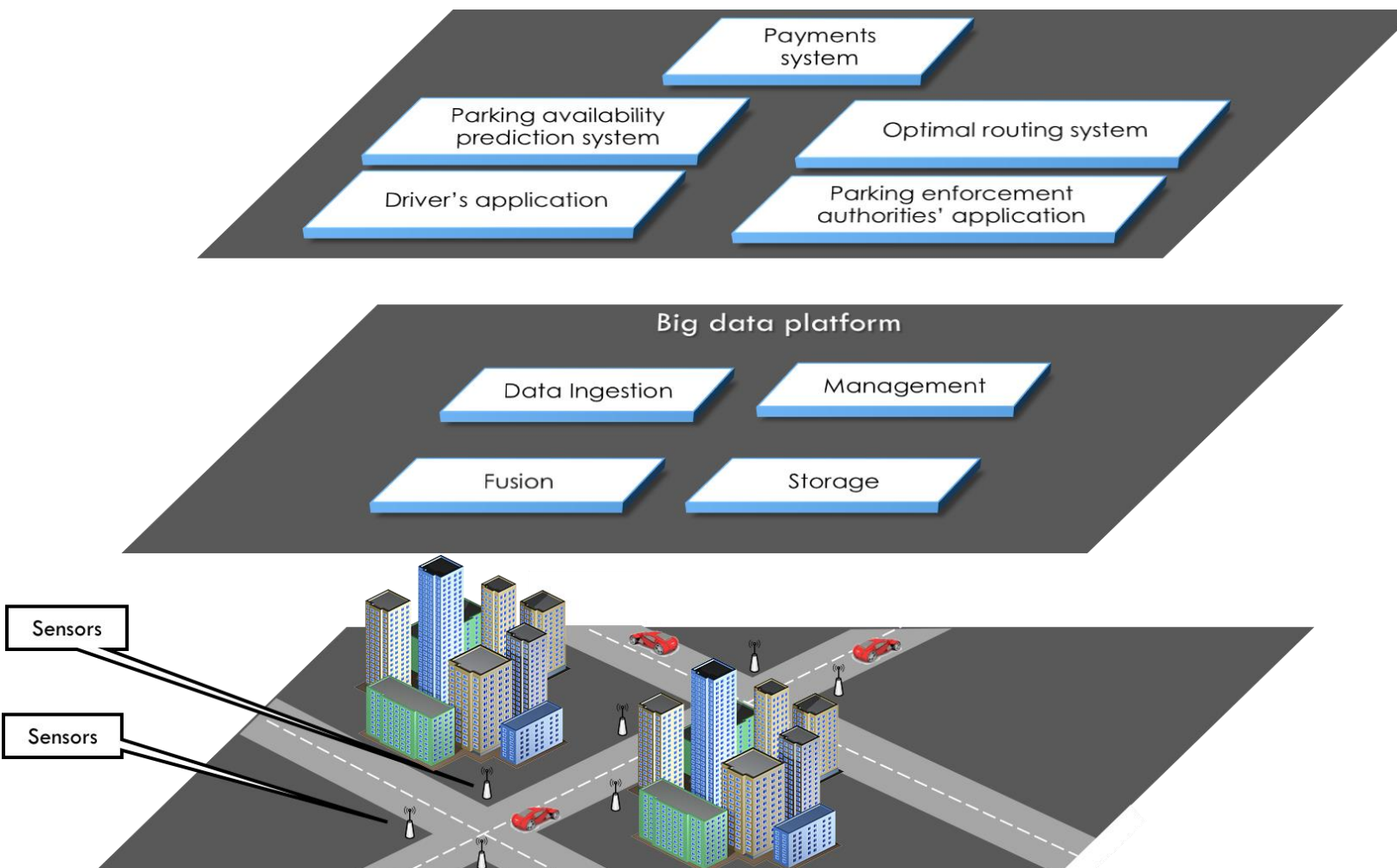
Projects ongoing: Verticals – Transportation

netPARK

58

iNtEgraTed PARKing management system

Funded by NSRF 2014-2020 | 09.2018–08.2020



WINGS role:

- parking-related data collection and processing,
- in-house parking availability **sensors development** supporting **advanced connectivity** options,
- extraction of **parking-related analytics** per municipal area,
- **predictions** generation on **parking space availability** per municipal area,
- **navigation** towards an area in the surroundings of the user's destination and **real-time parking spot suggestion**.

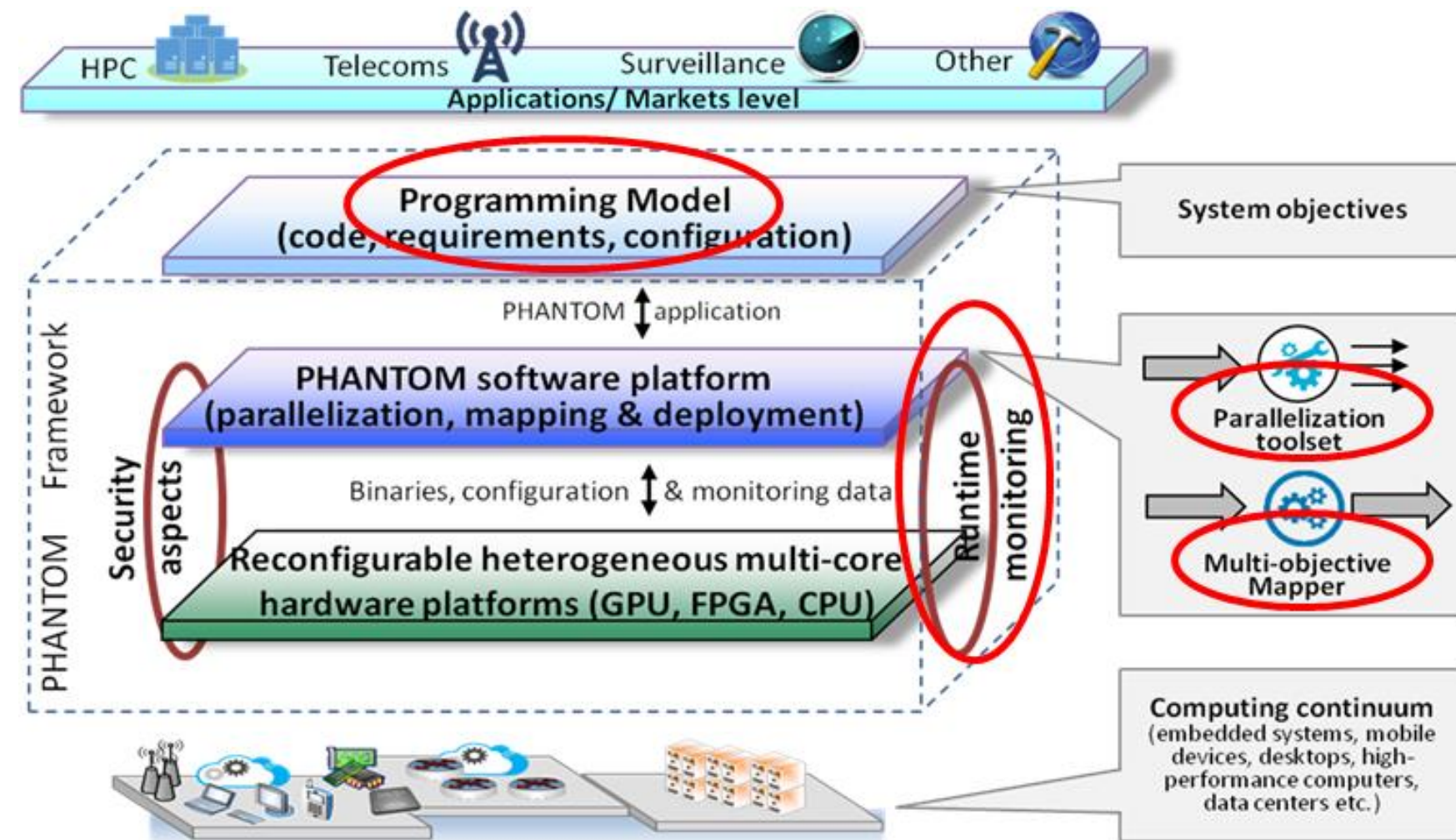
Projects completed: Big Data | Cloud | IoT

PHANTOM

59

Cross-Layer and Multi-Objective Programming Approach for Next Generation Heterogeneous Parallel Computing Systems

www.phantom-project.org | H2020 Customised and low power computing | 12.2015-11.2018



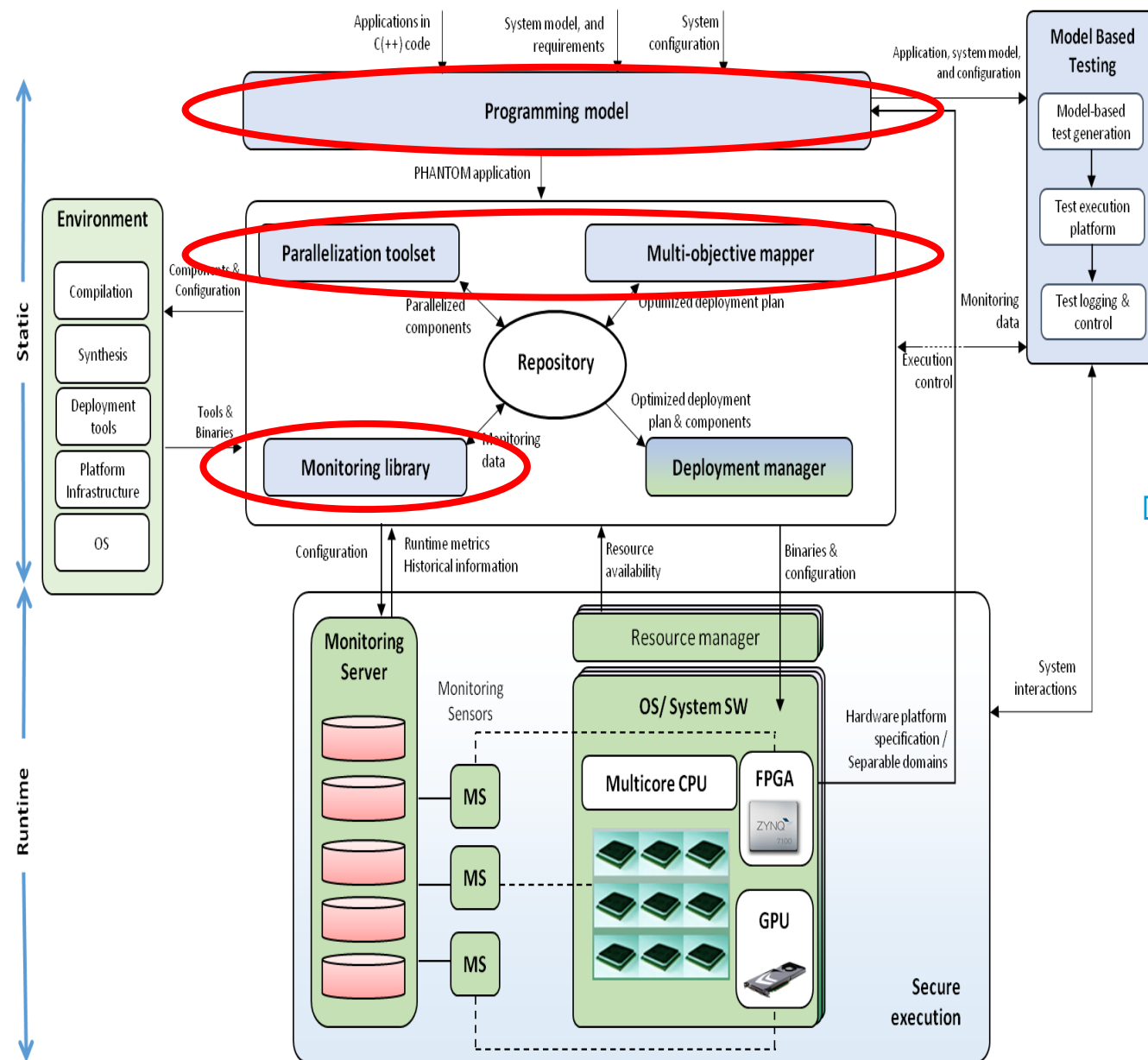
WINGS role:

- Adaptive and multi-objective mapping algorithms for application execution over heterogeneous multi-core HW platforms
- Code parallelization tools
- Cross-layer runtime monitoring and analytics
- Programming model targeting a range of 'application classes' covering the entire computing continuum

Projects completed: Big Data | Cloud | IoT

PHANTOM

60



- Programmer- and productivity- oriented software tools
 - ▣ Component-based programming model
 - ▣ From embedded to the cloud
 - ▣ Enumerates shared data and communications
 - ▣ Captures non-functional requirements
 - ▣ Schemes/algorithms to parallelize code, optimized for heterogeneous platforms (CPUs, GPUs, FPGAs)
- Multi-dimensional optimization on heterogeneous systems
 - ▣ Multi-objective mapping of application components to heterogeneous multi-core HW platforms
 - ▣ User requirements satisfaction and maximum performance (latency, energy, security)
 - ▣ Data analytics
 - ▣ Prediction of upcoming system states
 - ▣ Dependency detection between monitoring metrics

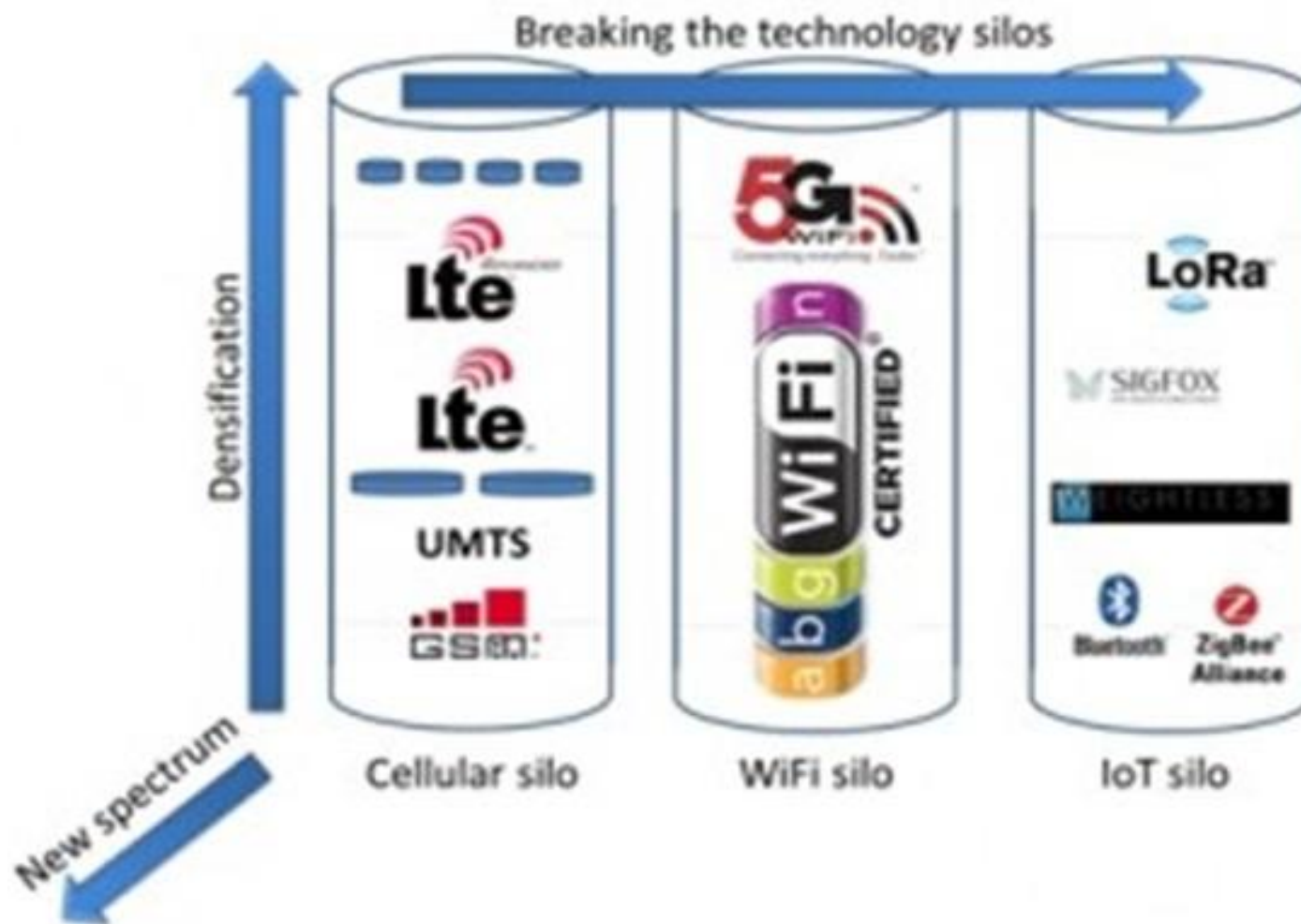
Projects completed: 5G Speed-5G

61

quality of Service Provision and capacity Expansion through Extended-DSA for 5G

<http://speed-5g.eu> | H2020 5GPPP Phase 1 | 07.2015-06.2018

Speed5G



WINGS role:

- Architectural components for supporting eDSA
- Novel RRM and MAC solutions for the realization of intelligent nodes capable of supporting eDSA as defined by the project
- 5G system-level simulations on mobile broadband scenarios (MBB) and machine-type communications (MTC);
- Proof-of-concept and demonstration aspects through the usage of equipment capable of supporting licensed, lightly-licensed (e.g. 3.5GHz) and un-licensed bands.

Projects completed: 5G

Speed-5G

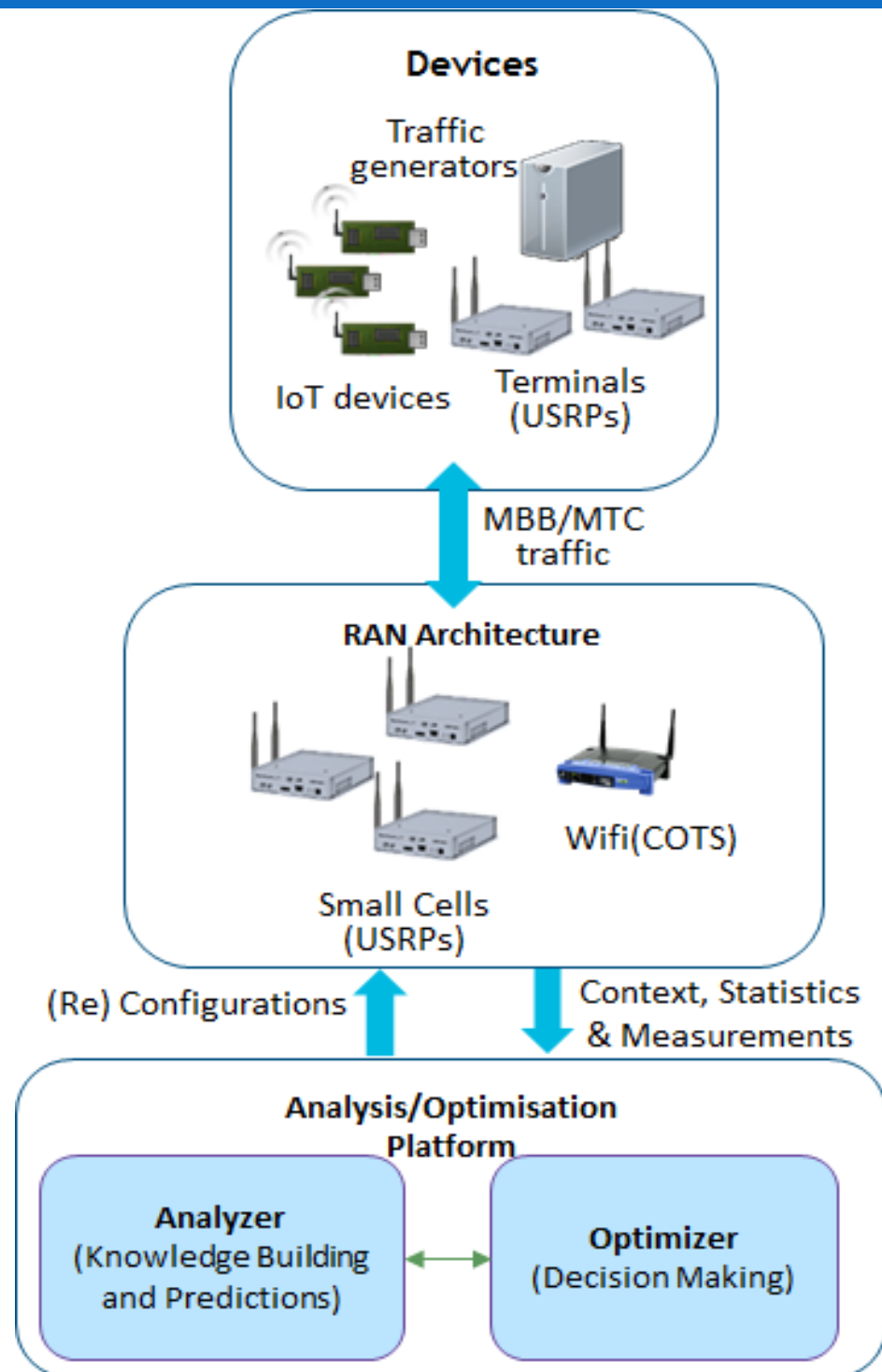
62



- The project focuses on two major innovations:
 - ▣ Resource management techniques across technology 'silos', and
 - ▣ Medium access technologies to address densification in mostly unplanned environments.
- Main use cases that WINGS is interested are:
 - ▣ Mobile Broadband (MBB)
 - ▣ Vehicular Communications (V2X)

Projects completed: 5G Speed-5G

63



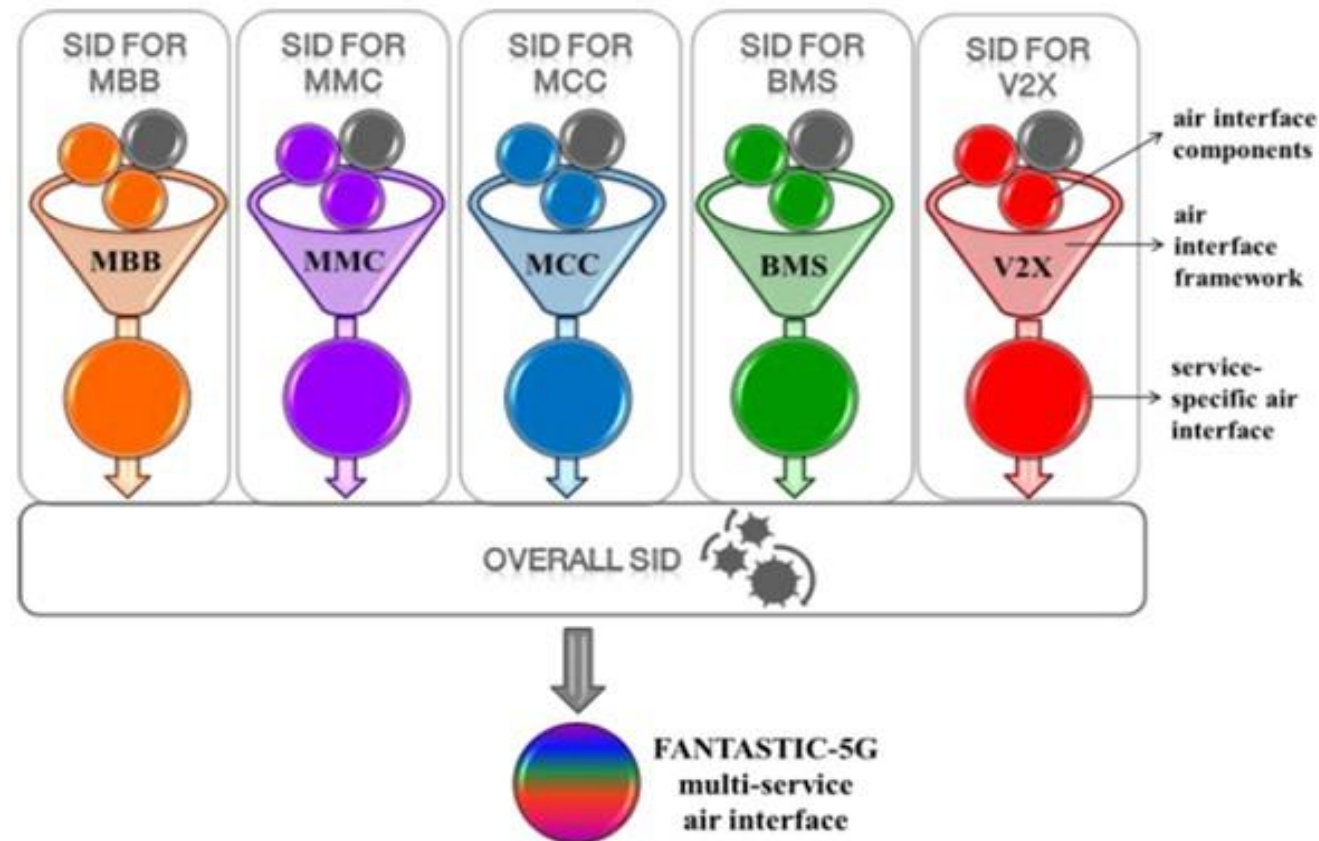
- Main elements used for experimentation:
 - ▣ USRPs with the Open Air Interface (OAI) framework;
 - ▣ Wi-Fi APs (COTS);
 - ▣ In-house software platform for network measurement collection, analysis and optimization;
 - ▣ 5G system-level simulator
- Experimentation can support licensed (LTE), unlicensed (Wi-Fi) and lightly-licensed (3.5GHz) bands.

Projects completed: 5G Fantastic5G

64

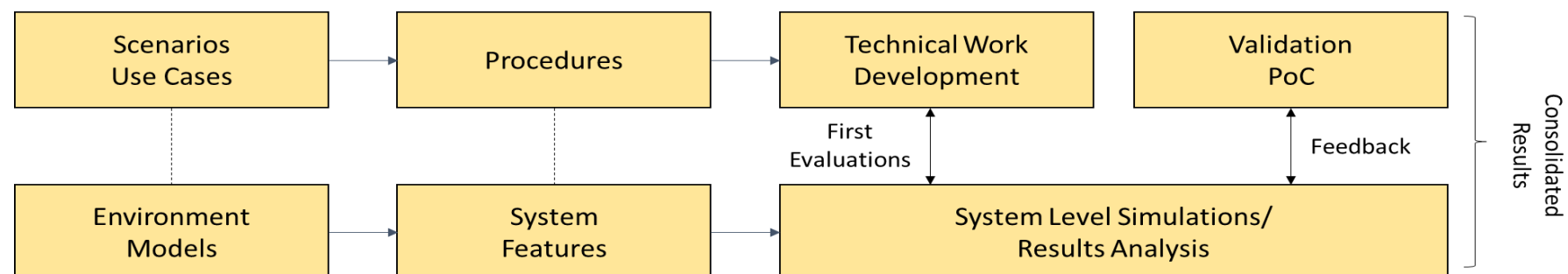
Flexible Air iNterfAce for Scalable service delivery wiThin wireless Communication networks of the 5th Generation

<http://fantastic-5g.eu/> | H2020/5GPPP Phase 1 | 07.2015-06.2017



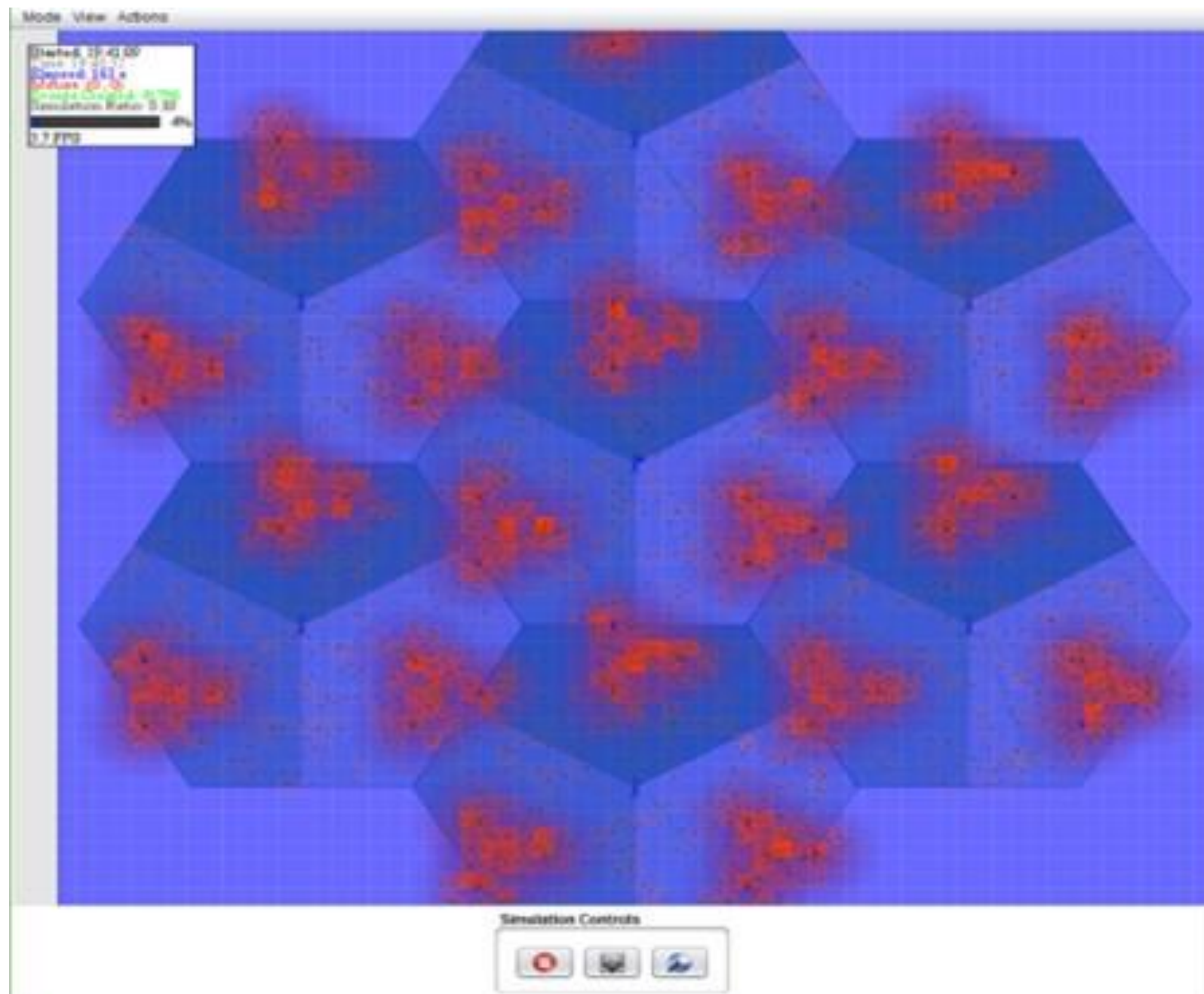
WINGS role:

- To develop and conduct **system-level simulations** for proving benefits of new multi-service air interface
- Traffic classification solutions and frame design aspects
- Novel frame design aspects for supporting new multi-service air interface for 5G



Projects completed: 5G Fantastic5G

65



WINGS tool: Visualization of user's density

Performance evaluation aspects

- Service modelling
 - ▣ Traffic generation modeling
 - ▣ Modeling of service process
- Mobility modeling
- User/device behavior modeling
- Environmental modelling
 - ▣ Cellular deployment
 - ▣ Urban/Suburban/Rural
 - ▣ Indoor/outdoor
 - ▣ Distribution of users
- MAC layer modeling
- PHY layer modeling

Projects completed: 5G Flex5GWare

66

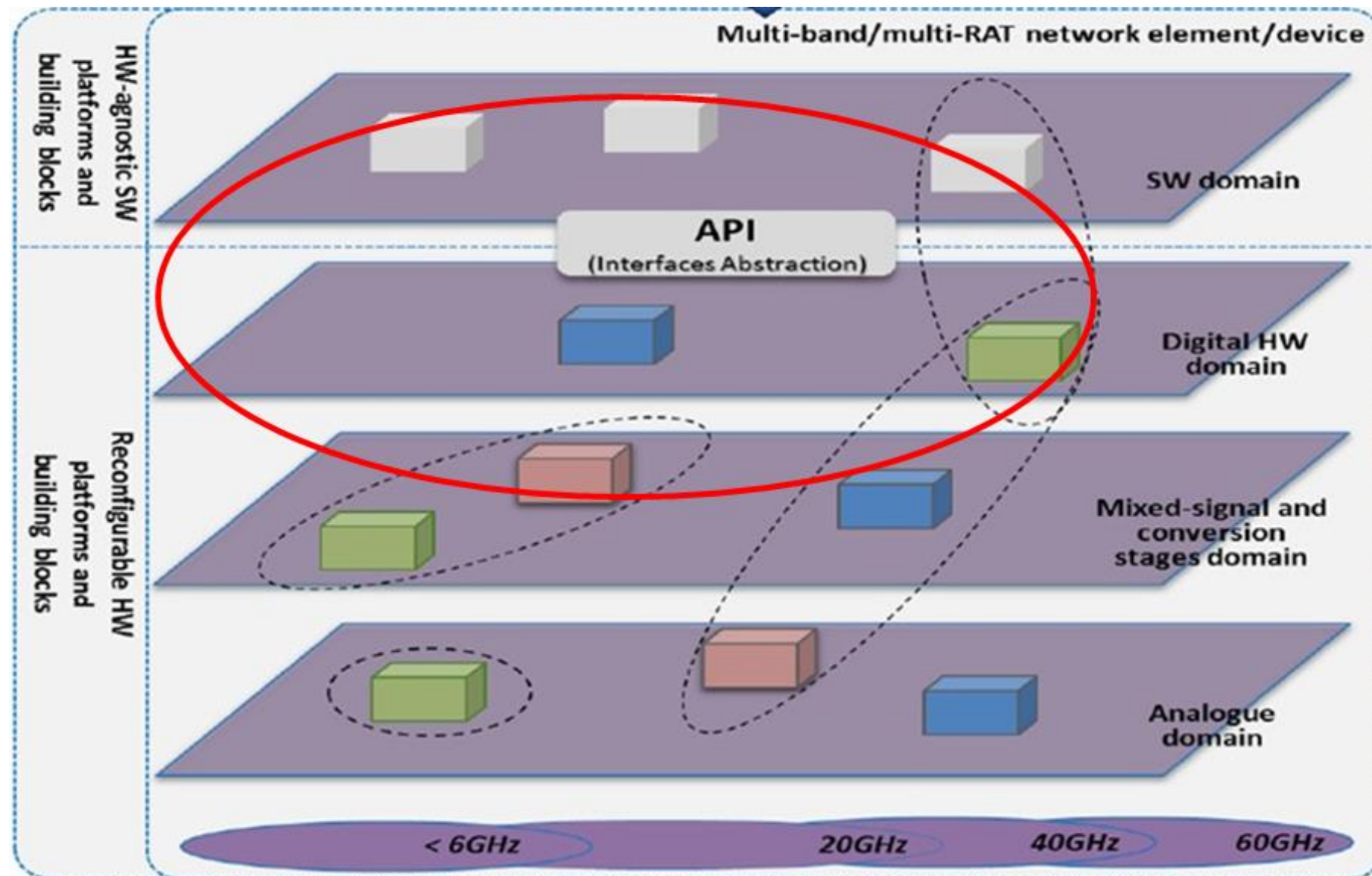
Flexible and efficient hardware/software platforms for 5G network elements and devices

<http://www.flex5gware.eu> | H2020 5GPPP Phase 1 | 07.2015-06.2017



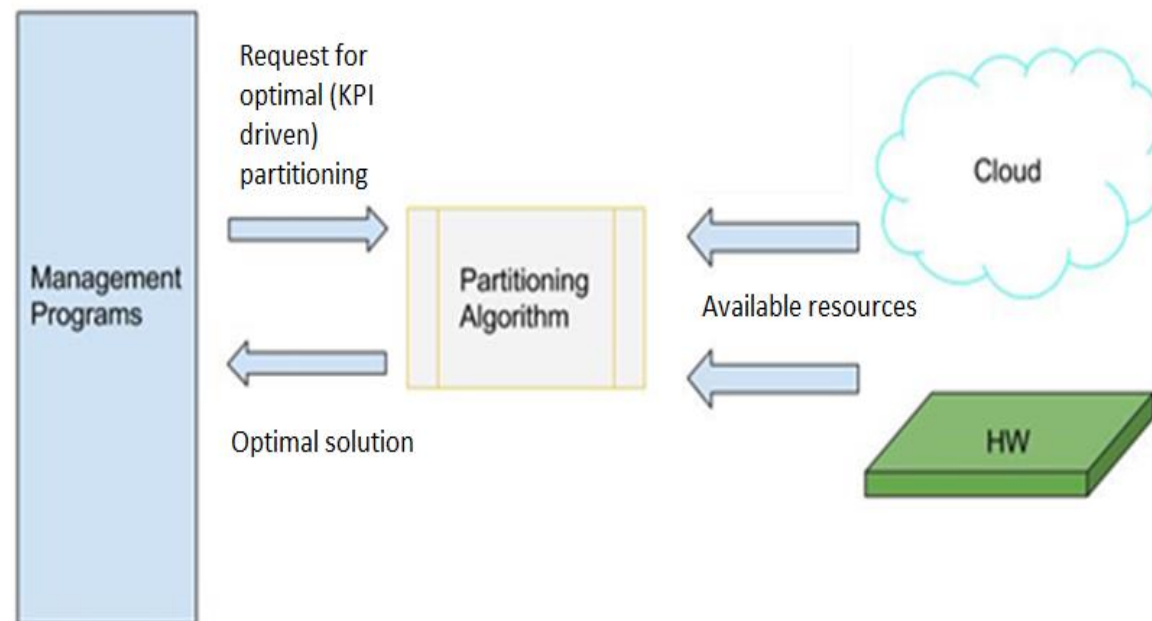
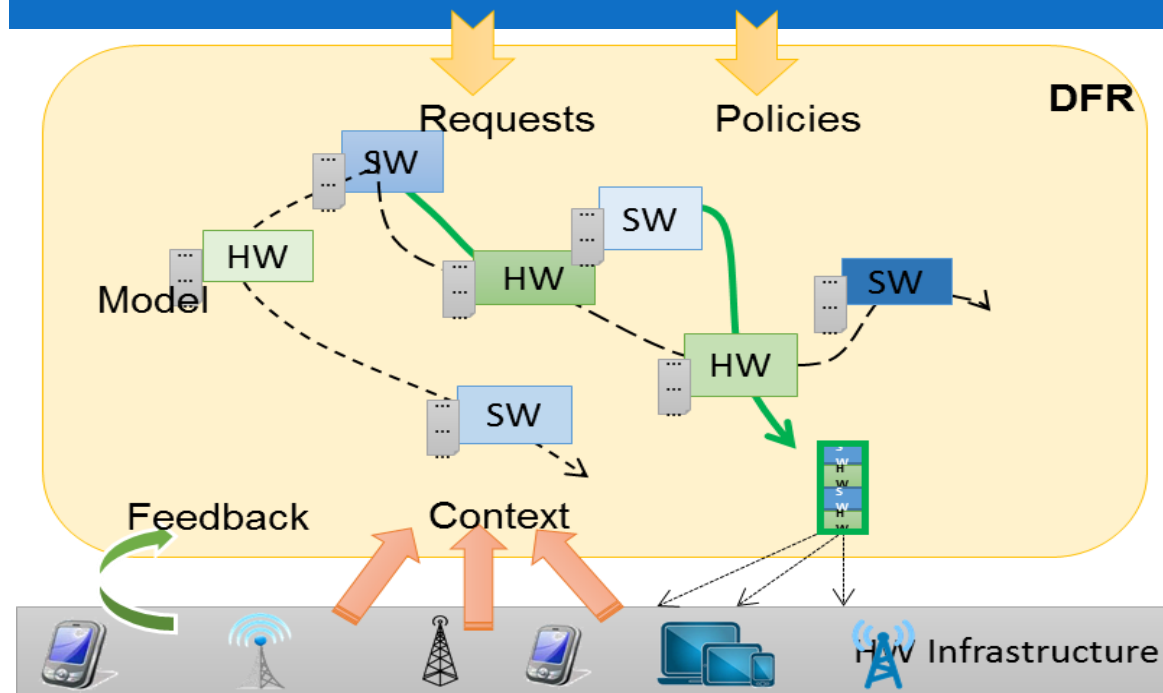
WINGS role:

- Reconfiguration management/ control functionality for dynamic HW/SW functional split and placement
- Software modules for:
 - ▣ Policy-based and context-aware decision on (individual/multiple) resources reconfiguration
 - ▣ Cognitive dynamic HW/SW partitioning and function placement
- Supported by:
 - ▣ Load prediction based on highly heterogeneous data
 - ▣ Gathering/filtering sensors measurements



Projects completed: 5G Flex5GWare

67



5G SW modules and functions

- Hardware abstraction of sensors in 5G context for retrieving useful info and facilitating the dynamic selection of communication technologies and protocols
- Flexible, reprogrammable and reconfigurable functional composition of SW and HW components at runtime

Cognitive, dynamic HW/SW partitioning

- On top of functions virtualization including network centralization (Cloud-RAN)
- Context aware decision making to whether a function will be executed
 - In SW or HW
 - Either inside a network stack layer and/or between multiple network stack layers
- Cooperation with management programs and monitoring agents

Projects completed: 4G CREW

68

Cognitive Radio Experimentation World

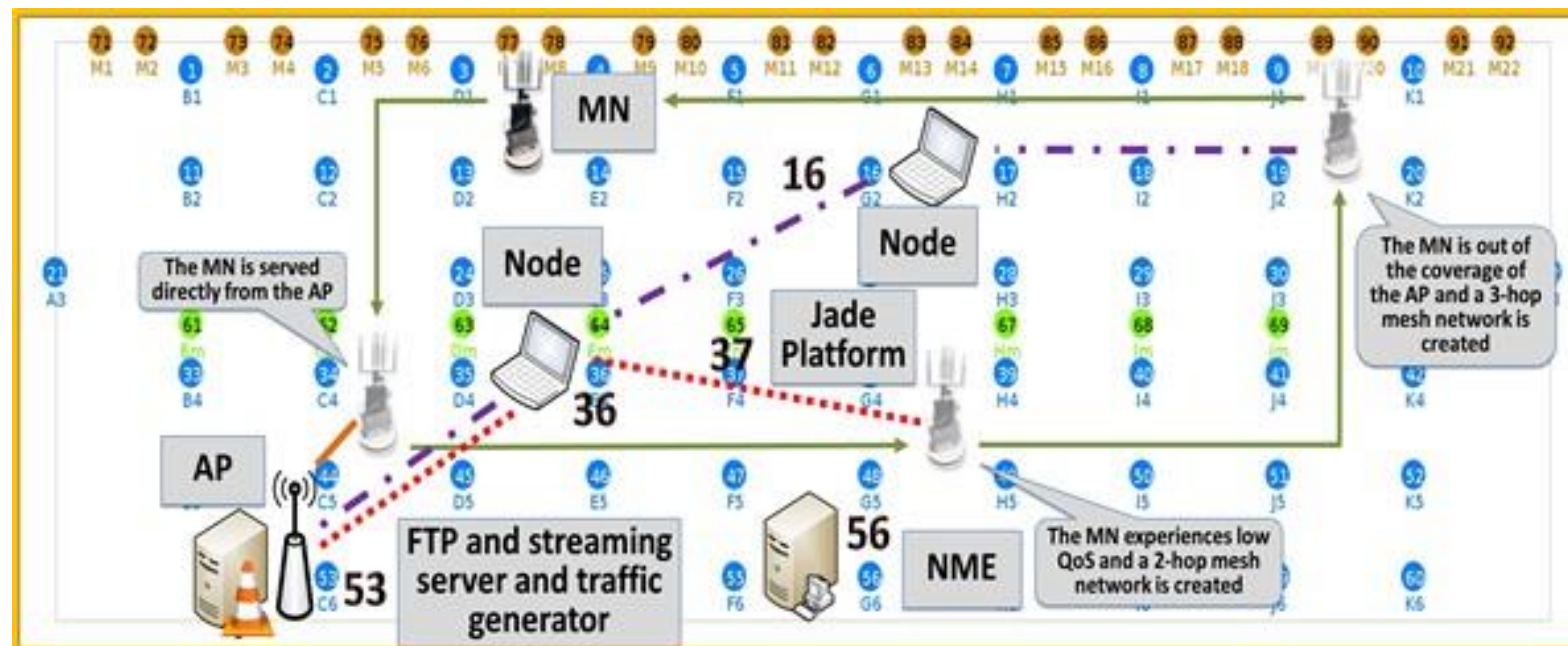
<http://www.crew-project.eu/> | EC/FP7 | 10.2010-09.2015



WINGS role:

- Utilization of Wireless Mesh Networks (WMN) and Control Channels for Cognitive Radio Systems for opportunistically providing the necessary resources to sustain connectivity
 - Proceed to optimal creation and configuration of the WMN
 - Conveying info on the: context of operation, profiles, policies
 - Java-based implementation in the w-iLab.t testbed
 - Real-time QoS measurements
 - Mobility provided by robot nodes
-
- The diagram illustrates a Wireless Mesh Network (WMN) topology. At the top, a row of nodes is labeled M1 through M9. Below this, there are several other nodes labeled B1 through B4, C1 through C4, D1 through D4, and E1 through E4. A central node is labeled MN (Mobile Node). A text box indicates 'The MN is served directly from the AP'. A 'Node' is also shown connected to the network. The diagram shows various connections between these nodes, representing the network structure.

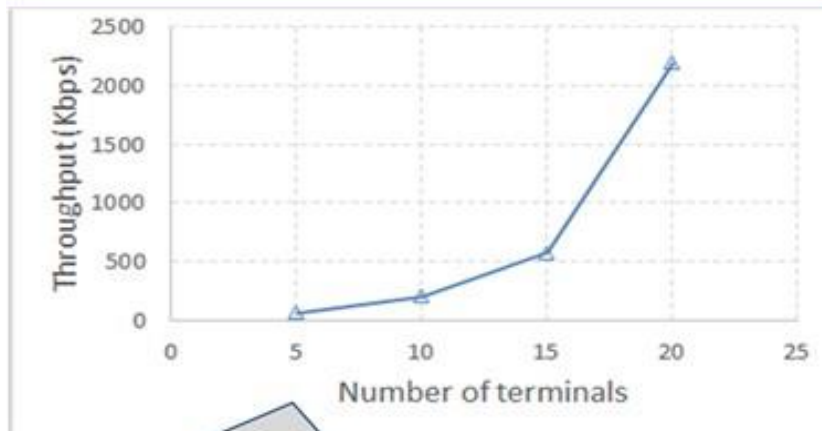
- **WINGS** joined as an Open Call partner for conducting experimentation on “Experiment-based Validation of Control Channels for Cognitive Radio Systems (EVOLVE)”



Projects completed: 4G CREW

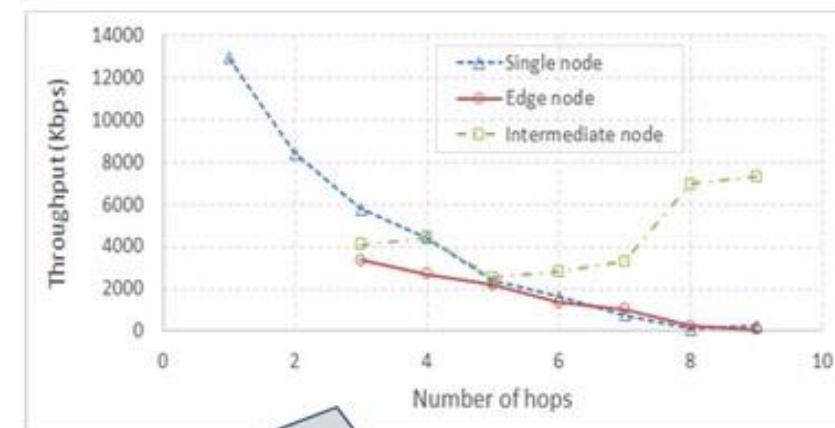
69

Signaling throughput evaluation



For >20 terminals the signaling throughput is around 2Mbps

File transfer throughput evaluation



Bitrate of ~5Mbps for 4 hops in file transfer application

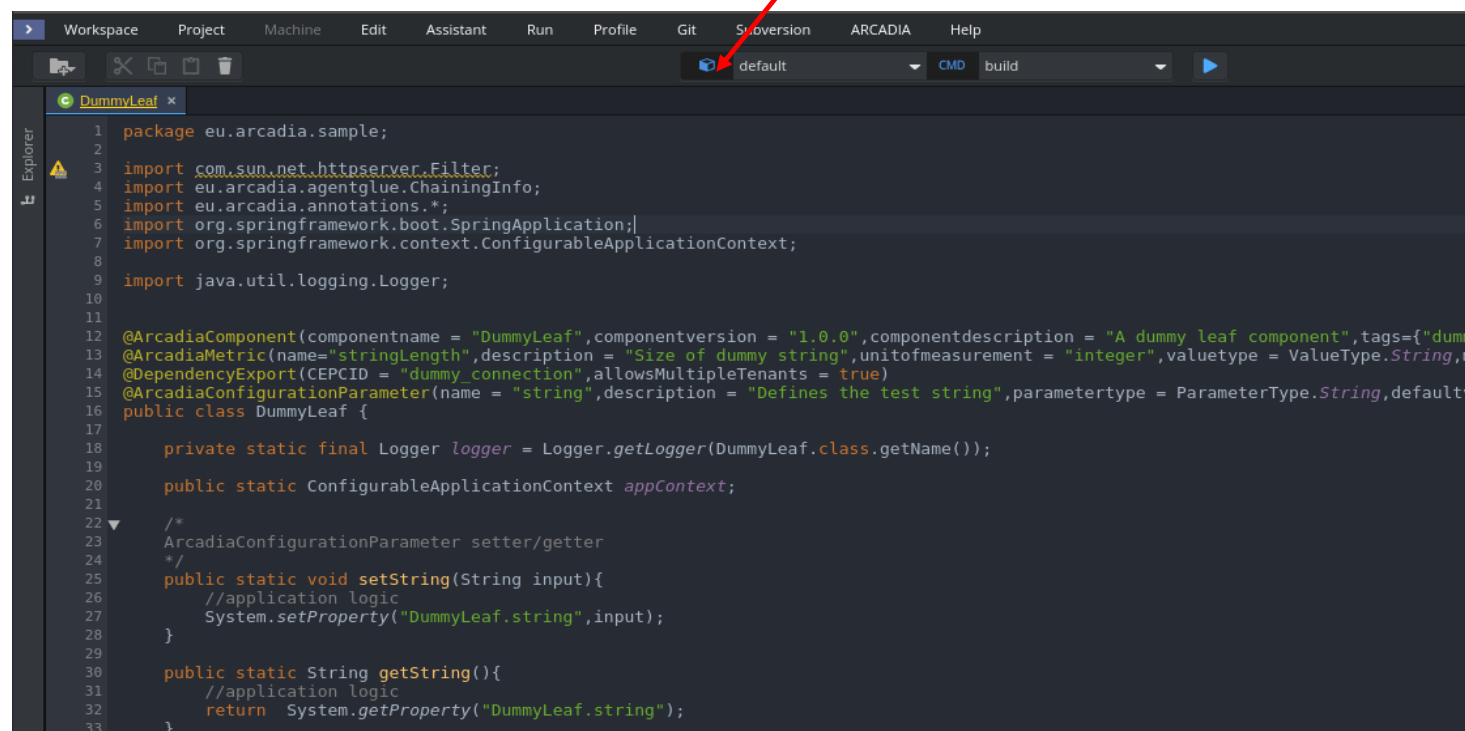
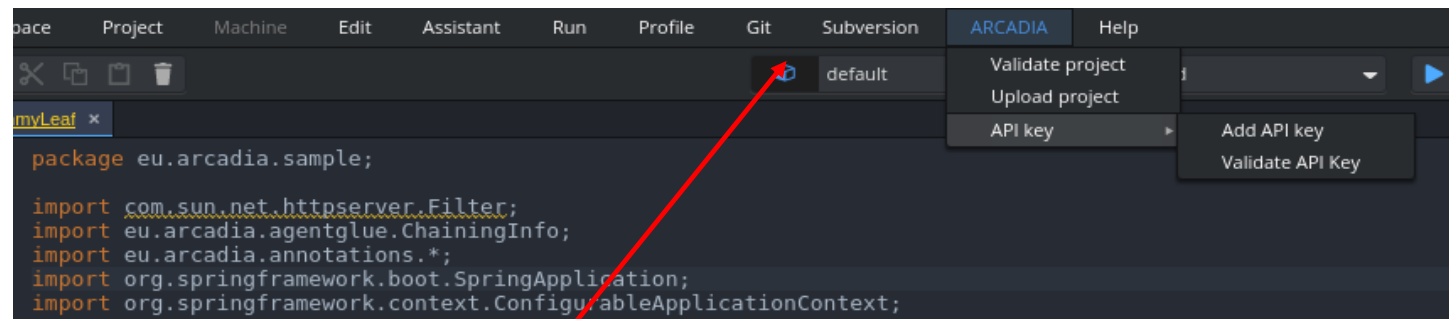
- Main advantages for WINGS were:
 - ▣ Opportunity to conduct various **experiments** in order to assess the performance of **D2D** networks under real conditions of operation of wireless networks
 - ▣ Usage of **802.11s** protocol, in order to create an opportunistic/ D2D network
 - ▣ Availability of many mobile and static wireless nodes
 - ▣ Friendly user interfaces

Projects completed: Software Networks ARCADIA

70

A novel reconfigurable by design highly Distributed applications development paradigm over programmable infrastructure

www.arcadia-framework.eu | H2020 | 01.2015-12.2017



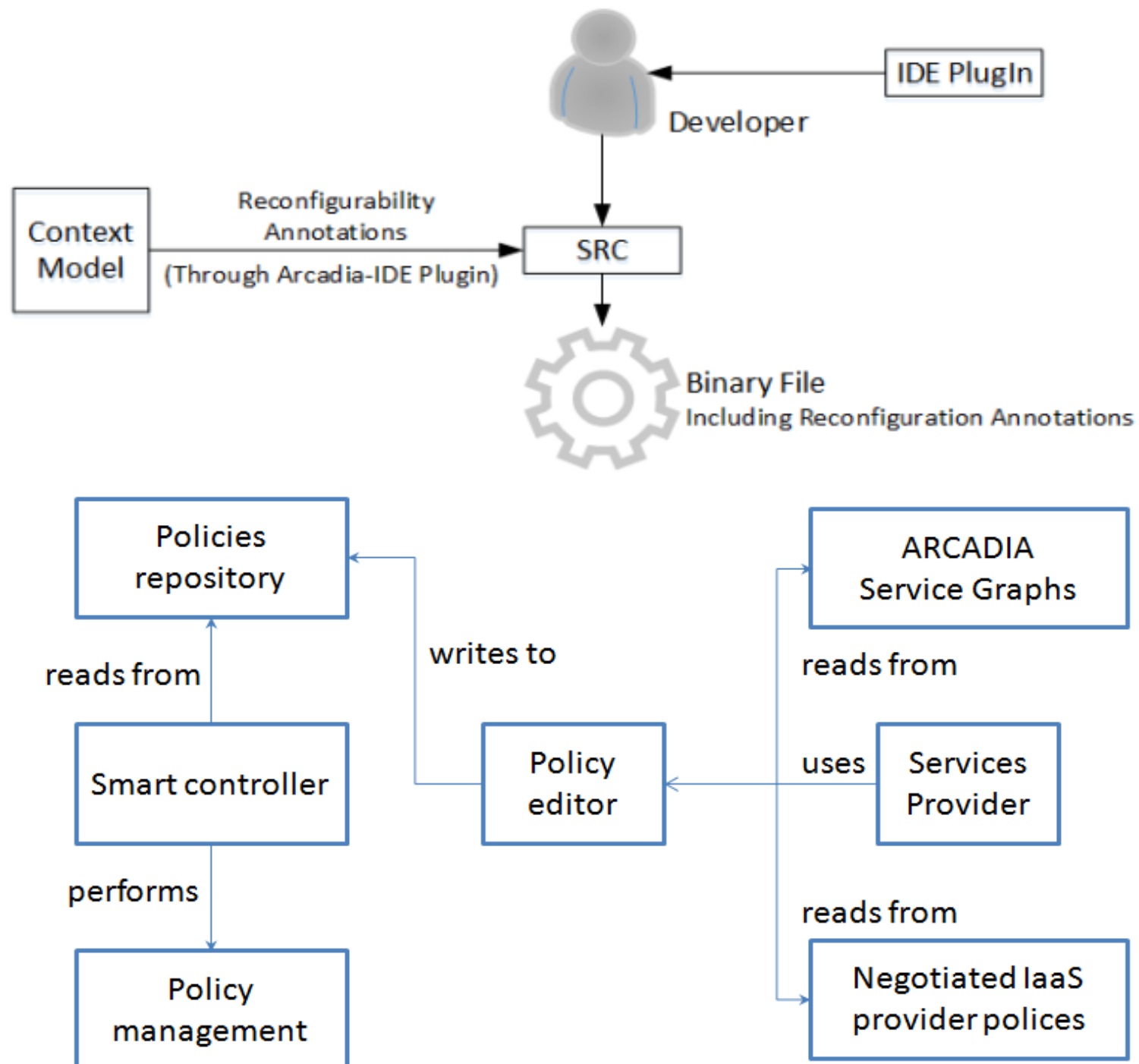
WINGS role:

- ❑ Lead the Arcadia Component Development Toolkit activities and be the main contributor to the IDE plug-in implementation
- ❑ Design the Arcadia Policy framework and contribute to the policy management and adaptive configuration features

Projects completed: Software Networks

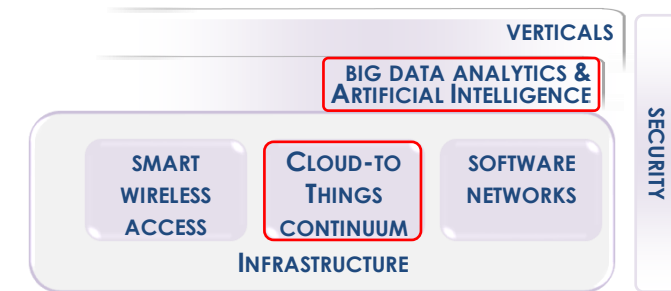
ARCADIA

71



- The **Arcadia framework** includes a Context Model for the underlying cloud infrastructure
- It is based on source level annotations, improving the developers' ability to leverage the benefits of cloud computing
- Arcadia Policies affect the deployment and configuration facets of an application and can be defined by the Service Provider and the IaaS provider, as well as being intrinsic to the application.

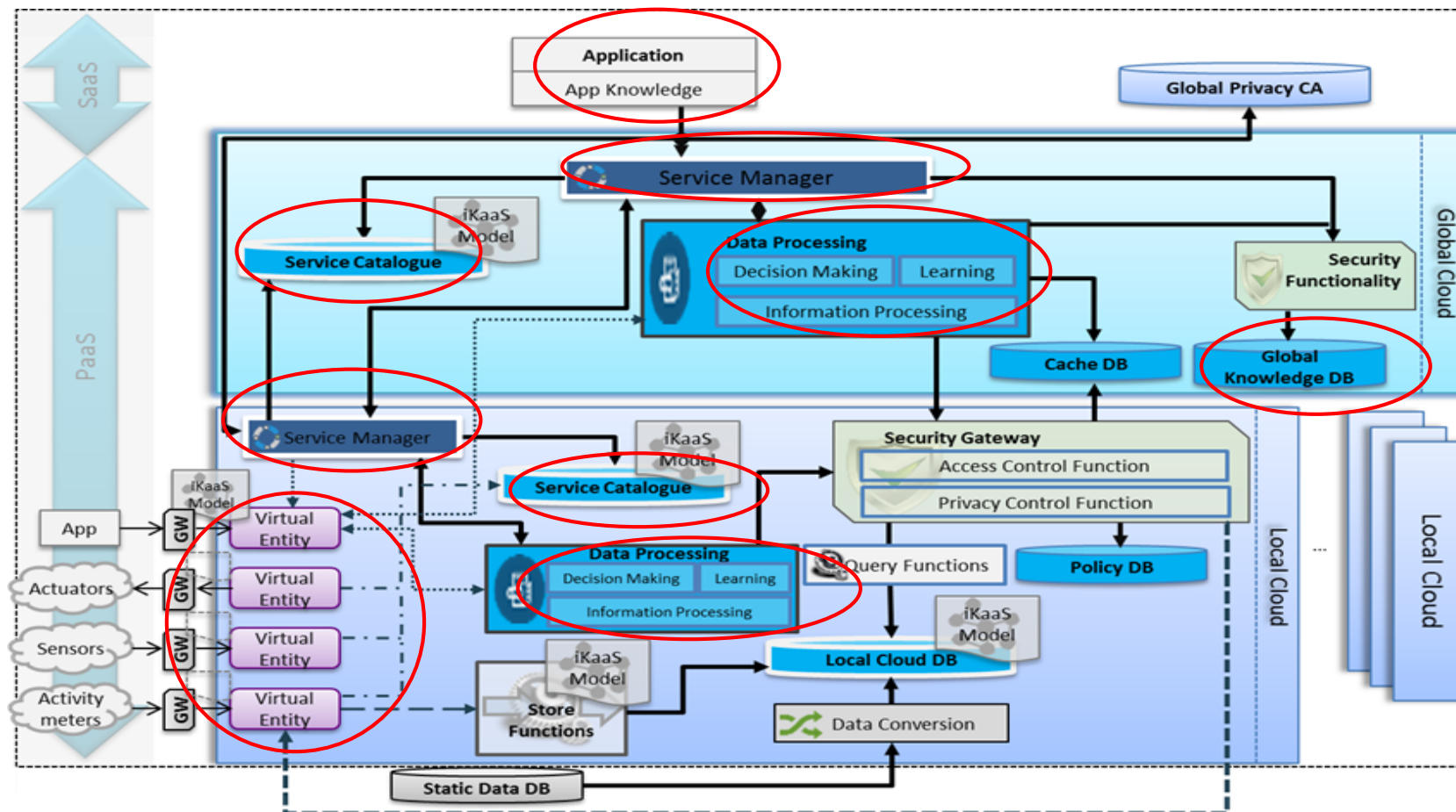
Projects completed: Big Data | Cloud | IoT iKaaS



72

Intelligent Knowledge as a Service

<http://ikaas.com/> | H2020 EU-Japan collaboration | 10.2014-10.2017



WINGS role:

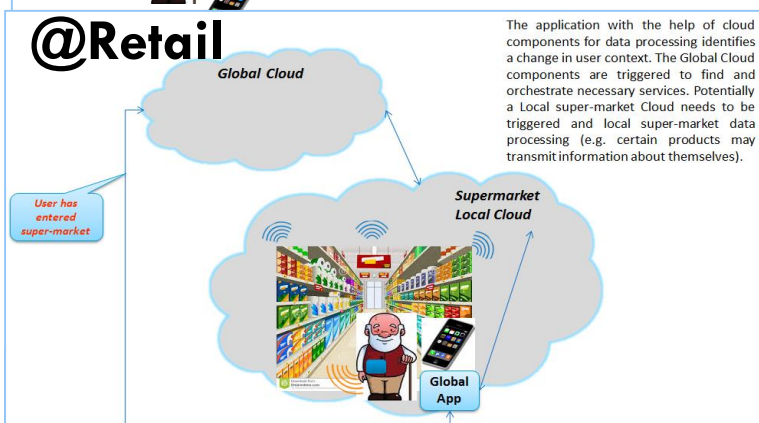
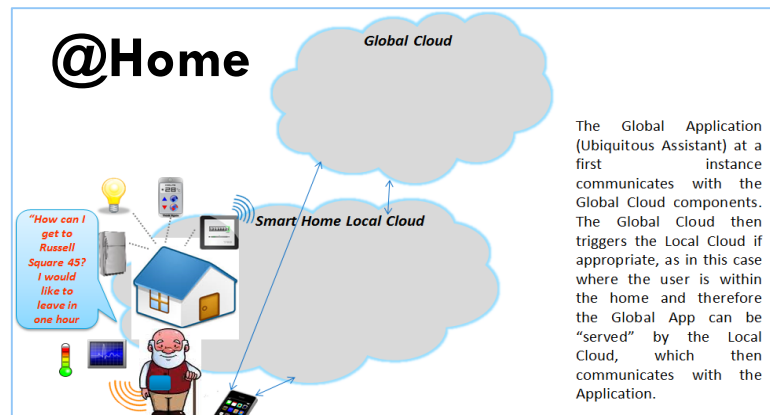
- Distributed data processing and storage
- Data and service descriptions and catalogues
- Knowledge as a service
- Autonomic service management/orchestration
- Knowledge-based IoT applications
- Validation through experiments

WINGS and iKaaS received the “**Best Booth Award**” in the context of the EuCNC2017, June 12-15, Oulu, Finland

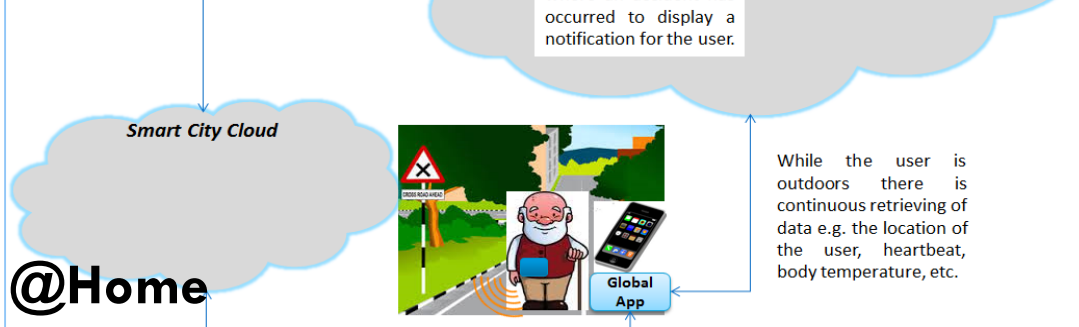


Projects completed: Big Data | Cloud | IoT iKaaS

73



**@Transport/
Leisure**



- Global and Local Cloud Service Catalogues for discovery of (simple/complex) services
- Global and Local Cloud Service Management functionality for autonomous, dynamic composition, deployment, migration and orchestration of services
- Global and Local Cloud Data processing for big data analytics, learning, knowledge inference and reasoning to support autonomous behavior and self-adaptation of applications.

- Ubiquitous assisted living application including **smart cities/ smart home, health monitoring and forecasting and smart city services**
- Virtual Entities (software) that provide generic interfacing to Smart Home, Smart City and Body area (wearables) devices such as indoor temperature, pollen sensors, blood pressure, etc.



Knowledge as a Service for Assisted Living in Smart City

https://www.youtube.com/watch?v=_QloorrjAWM

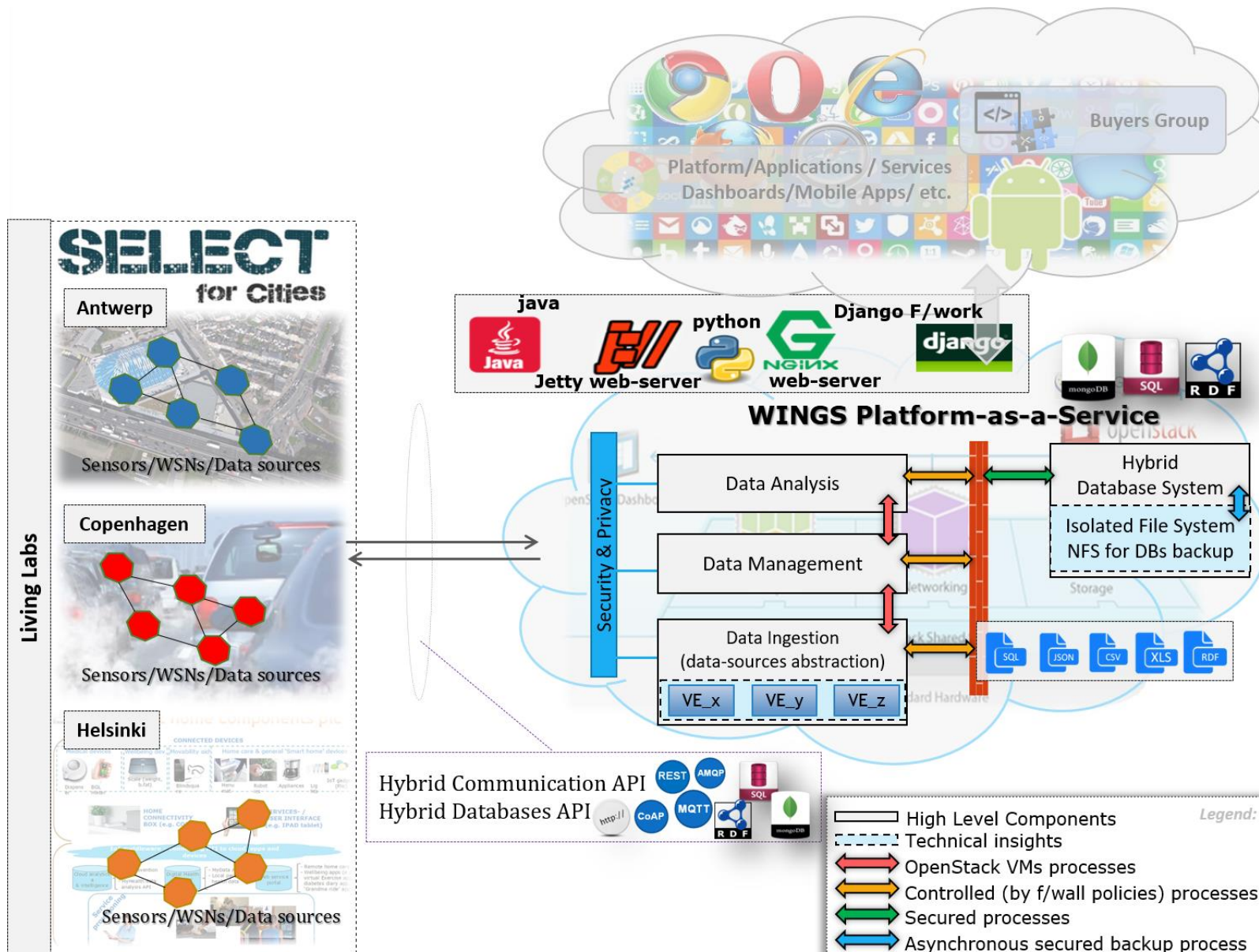
Projects completed: Big Data | Cloud | IoT Select for Cities (Phase 1)

74

Select for Cities

<http://www.select4cities.eu> | H2020 Pre-Commercial-Procurement | 06.2017-07.2017

SELECT

for Cities


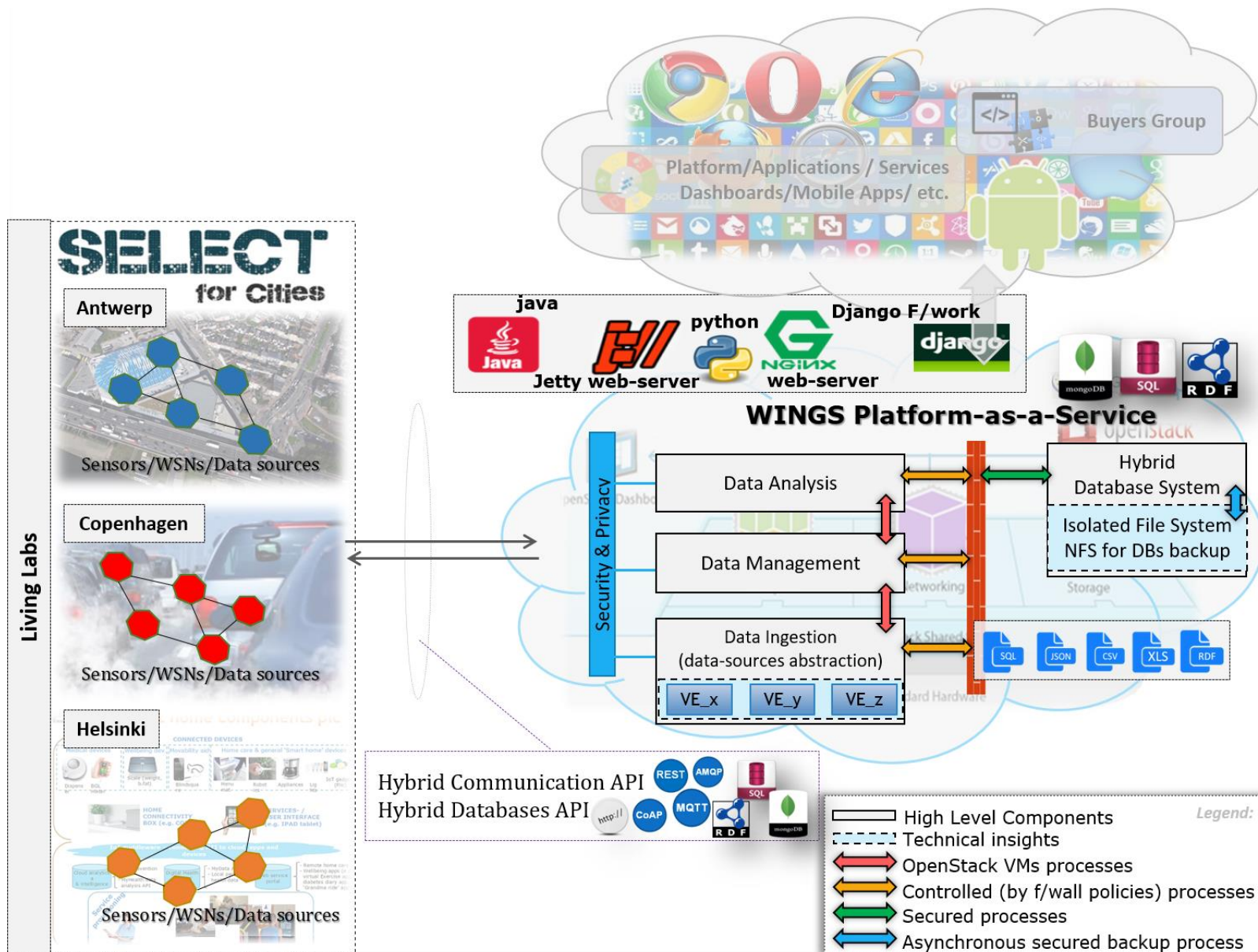
WINGS role:

- Development of an open, standardized, data-driven, service-oriented and user-centric platform that enables large-scale co-creation, testing and validation of urban Internet of Everything (IoE) applications and services.

- Phase 1: Concept Design
- Phase 2: Prototype
- Phase 3: Living Labs pilots
 - Antwerp, Copenhagen, Helsinki

Projects completed: Big Data | Cloud | IoT Select for Cities (Phase 1)

75



□ Data ingestion

- ▣ Heterogeneous smart city data sources
- ▣ Visualization of measurements on interactive heat-maps
- ▣ Presentation of overall “city picture at a glance”.

□ Visualisation

- ▣ Real time / historical data
- ▣ Knowledge / insights

□ Visual exploration (Zoom In /Out functions).

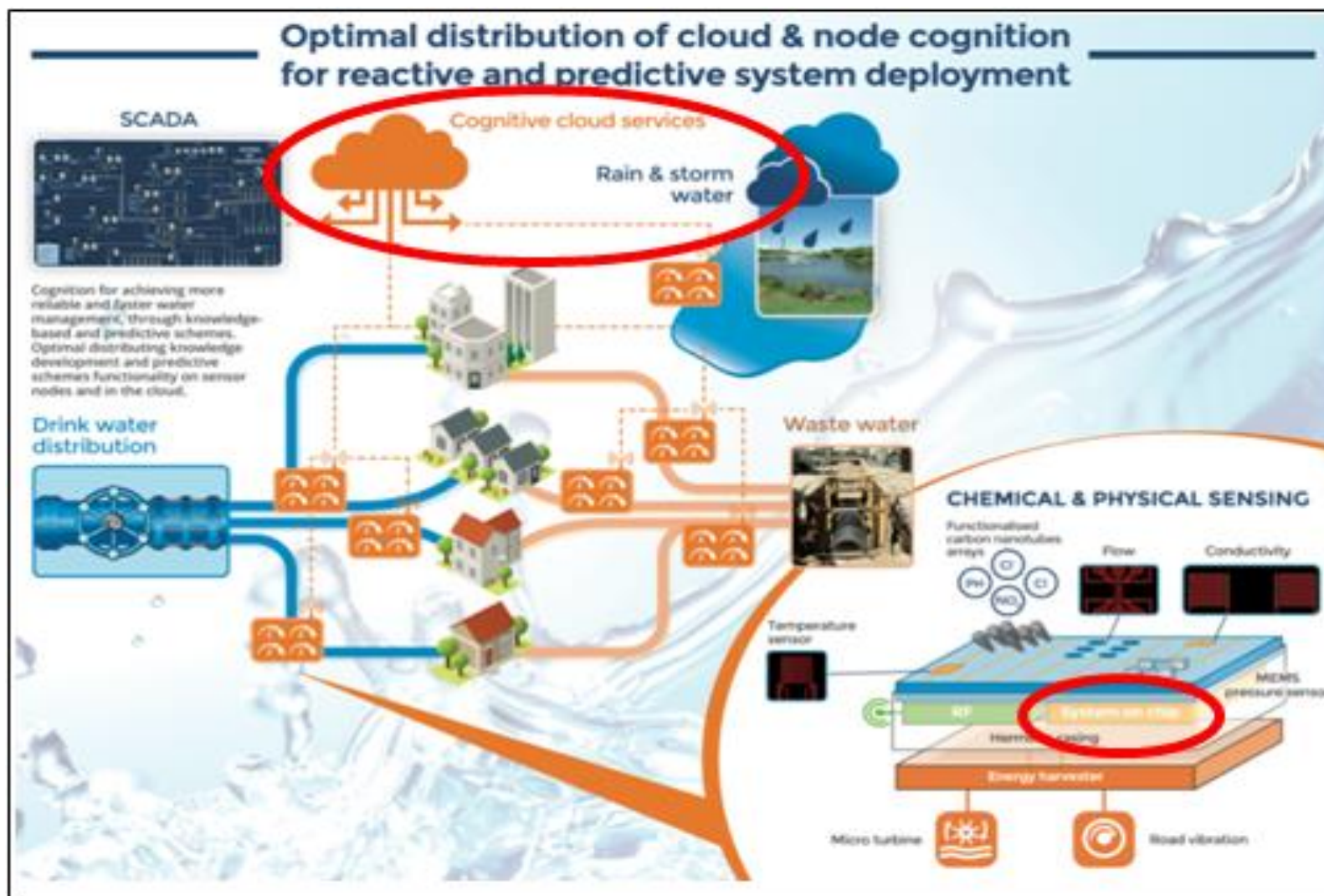
- ▣ Data source processing
- ▣ Level of detail tuning
- ▣ Representative maps

Projects completed: Big Data | Cloud | IoT PROTEUS

76

AdaPtive micROfluidic- and nano-enabled smart systems for waTEr qUality Sensing

<http://www.proteus-sensor.eu> | H2020 | 02.2015-01.2018



WINGS role:

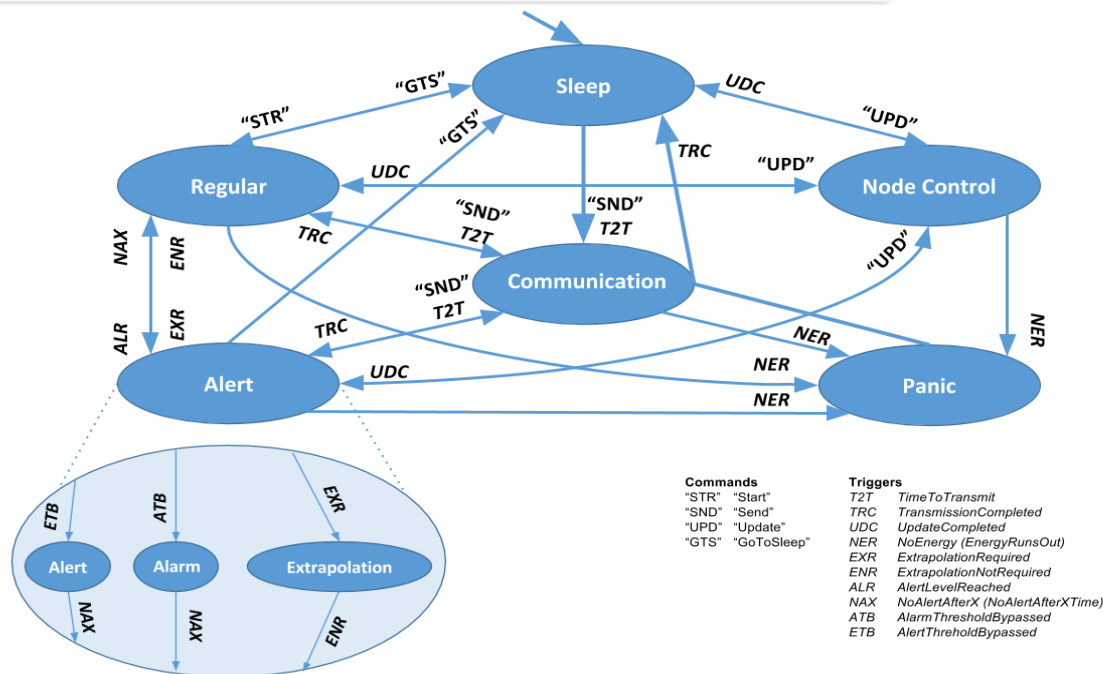
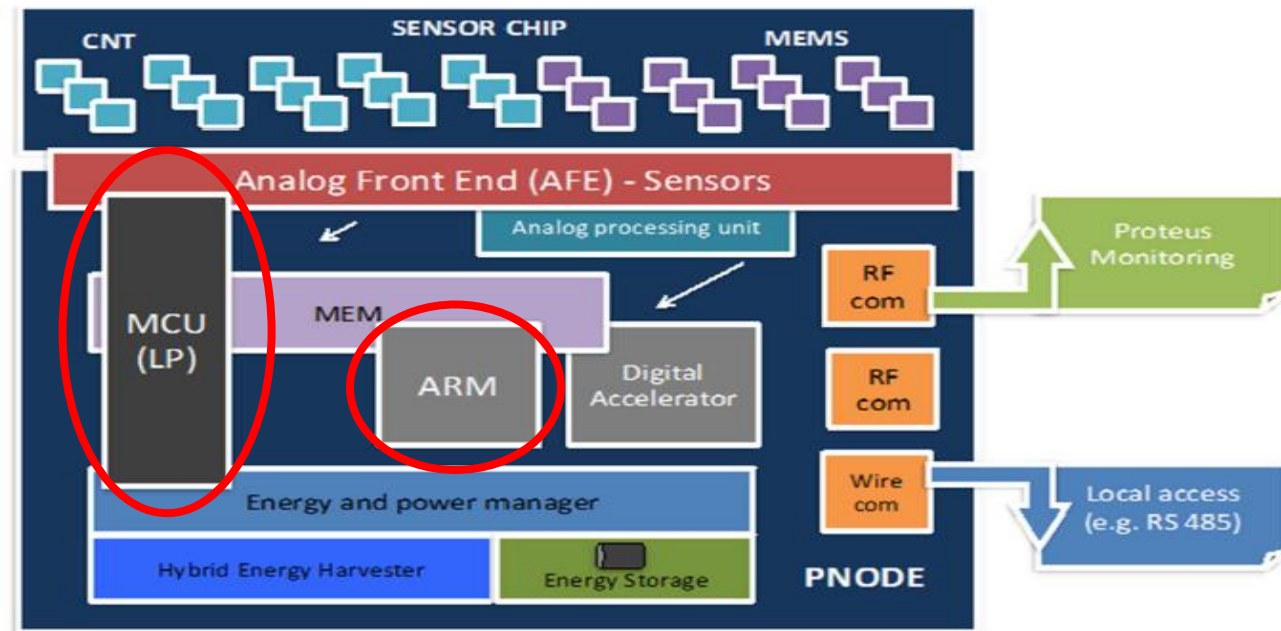
- Embedded intelligence for context awareness and reactive capabilities (smart behaviour)
- Embedded and cloud-based intelligence for **cognitive** and **predictive** smart systems (smart application)

WINGS and PROTEUS received the “**WssTP Water Innovation SME Award**” in the context of the **Water Innovation Europe 2016**, June 21-23, Brussels

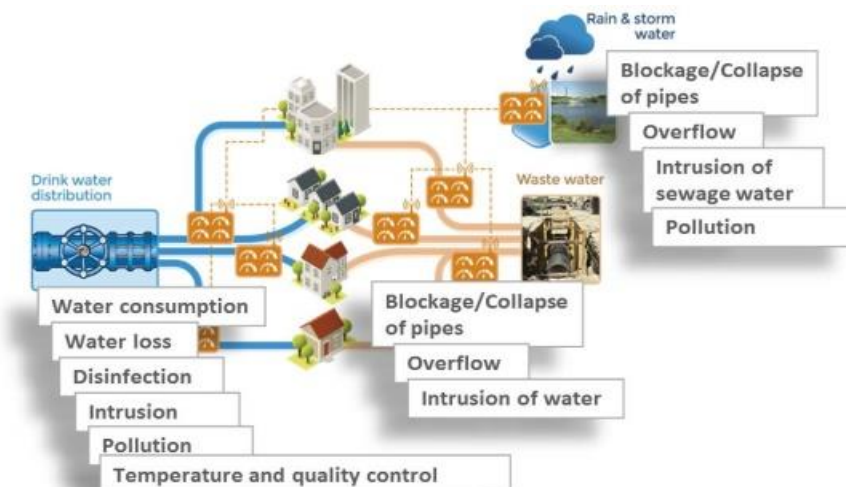


Projects completed: Big Data | Cloud | IoT PROTEUS

77



- Embedded intelligence for smart behaviour
 - Identification of critical events (alerts/alarms)
 - Self-adaptation of measurement and transmission profiles, readjustment of range profiles
 - Energy management
- Embedded and cloud-based intelligence for smart application
 - Prediction of critical events
 - Data correlation for virtual sensing, event detection based on combined measurements, detection of faulty sensor (e.g. damage, calibration, calcium deposit) for maintenance
 - Automatic calibration for supporting sensor manufacturing



Contact information



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



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Thank You!