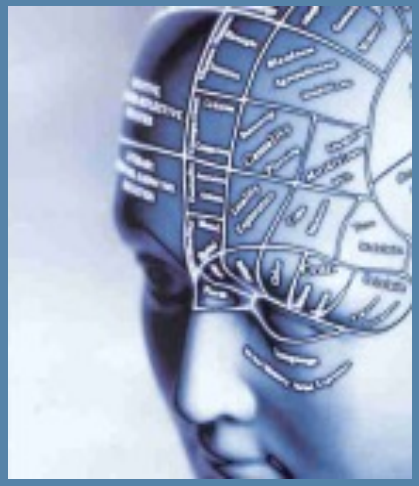
information
management
Unit
imu.iccs.gr



enabling the knowledge organization

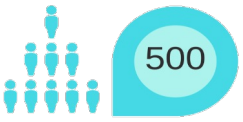
IMU is a research unit of ICCS
Institute of Communication and Computer Systems
of the National Technical University of Athens

Institute of Communication & Computer Systems

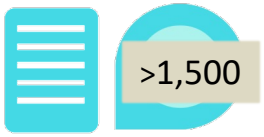
- Non-for-profit **research institute**, established in 1989
  - Ministry of Education & National Technical University of Athens
  - Associated to the School of Electrical & Computer Engineering
- **Mission**: perform top-quality research and development activities
  - and provide scientific services to private and public bodies1

- Research ➔ in EU official rankings ICCS ranks among the **top 3 Institutions** in Greece and the top 20 – 30 in the EU
- Innovation ➔ founded incubator EPI.noo in cooperation with NTUA
- Start-ups ➔ actively participate in spinoffs e.g. PhosPrint and CIBOS
- Education ➔ support young scientists (> 1,600 scholarships)
- Tech transfer ➔ joint actions with industry associations

- Laboratories:
  - Software engineering
  - Robotics
  - Photonics
  - Biomedical
  - Computer Networks
  - Energy Management
  - Information Management

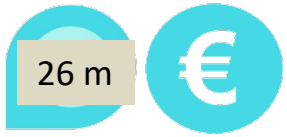


Researchers



Completed projects (1989-2021)

Active Projects (2022)



Average annual budget

IMU - Information Management Unit of ICCS

- IMU is a **multi-disciplinary unit** engaged in research and technology development activities in **Information Technology Management**.
  - IMU carries out research and innovation activities within ICCS

- Our mission is **to enable the development of knowledge-driven organisations**

  - We design, develop and validate innovative models, methods and tools that leverage the creation, sharing and use of information and knowledge at the individual, team and organisational levels

- **IMU is leading the membership of ICCS in :**

  - **AI, Data and Robotics Association (ADRA)** , which joins BDVA CLAIRE, ELLIS, EurAI and euRobotics to create one of the European Partnerships in digital, industry and space

  - **International Data Spaces Association (IDSA),** a cross-industry, transnational coalition working together on the concept and design principles for data spaces and standards for secure and sovereign data exchange, certification and governance

  - **GAIA-X** will establish an ecosystem in which data is made available, collated and shared in a trustworthy federated system that links many cloud services providers and users together

Meet the team

- **Three (3) faculty**
  - Professor in Information Technology Management
  - Professor in Decision Support Systems
  - Assistant Professor in Management Information Systems
- **Nine (9) senior researchers**
  - post-doctoral researchers
    - Ph.D.s in Electrical and Computer Engineering
    - and post-graduate diplomas in:
      - Business Administration and
      - Information Technology
- **Twelve (12) researchers and PhD students**
  - with diploma degrees in engineering and post-graduate diplomas in:
    - Business Administration
    - Information Systems
    - Computer Engineering
    - Telecommunications

Research areas

- **Analyse: from Data to Insight**
  - Data and knowledge discovery, sharing and exchange
  - Machine learning and prescriptive data analytics
  - Personalization and recommender Systems
  - Data harmonization and semantic interoperability
  - Linked Open Data and FAIR data management

- **Compute: from Cloud to Edge**
  - Cloud service modeling and management
  - Resource allocation in hybrid environments
  - Real-time event-driven service management
  - Security and privacy in cloud environments
  - Context awareness and situation management

- **Decide: from Intelligence to Prescription**
  - Mathematical programming, simulation and optimization
  - Multiple Criteria Decision Making
  - Probabilistic, fuzzy and linguistic techniques
  - Information aggregation and prediction markets
  - Crowdsourcing and human computation

Application domains

Factories of the future	Electronic governance	Digital health and well-being	Digital innovation	Sustainable and green economy
Smart manufacturing	E-participation & e-consultation	Innovative healthcare	E-learning and knowledge management	Smart and green mobility
Supply chain management	Citizen-centric services	Mobile health management	Idea management	Digital solutions for water management
Predictive maintenance	Policy modeling	Personalised nutrition	Open innovation	ICT-enabled energy efficiency
Quality management	Citizen engagement	Secure e- health data exchange	Social creativity support	Behavioural change support

Research activities

- Since its establishment in 1997 IMU has contributed actively in **sixty (60) research and innovation projects**
  - Fifty (50) projects were completed during the 1997-2022 period
  - Ten (10) projects are active during the 2023-2025 period
- The total funding of IMU since 1997 exceeds **18,5 million euros**

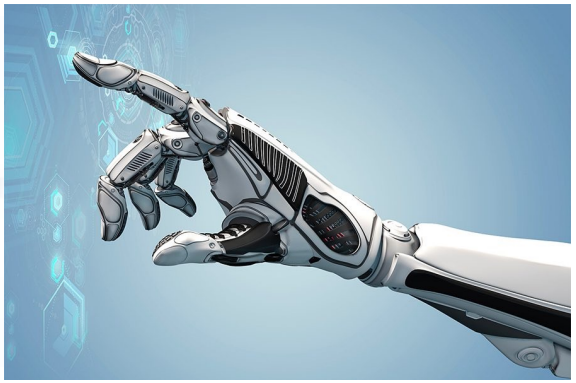
- Our work is funded by these programs and institutions:

➢ **Horizon 2020 (previously FP5, FP6, FP7)** the research Framework Programs of the European Union

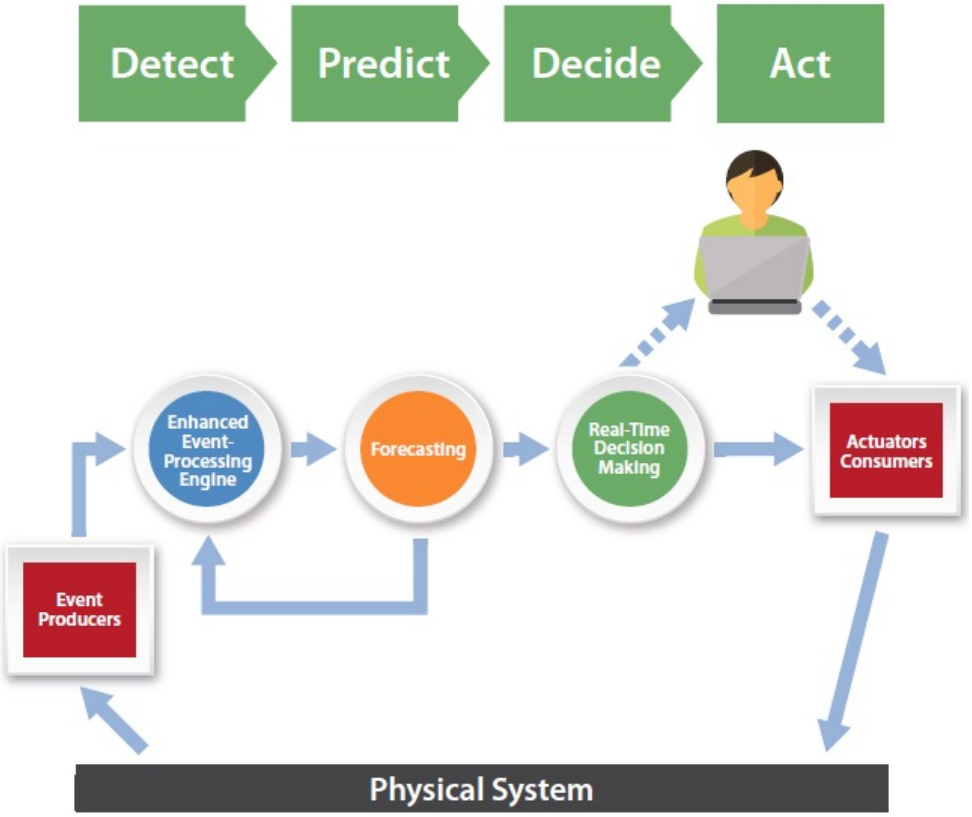
➢ Operational Program for the **Information Society** of the Greek Ministry of Economy and Finance

➢ Research programs of the **General Secretariat for Research and Technology** of the Greek Ministry of Development

Recent research in data-driven and augmented human-AI decision making



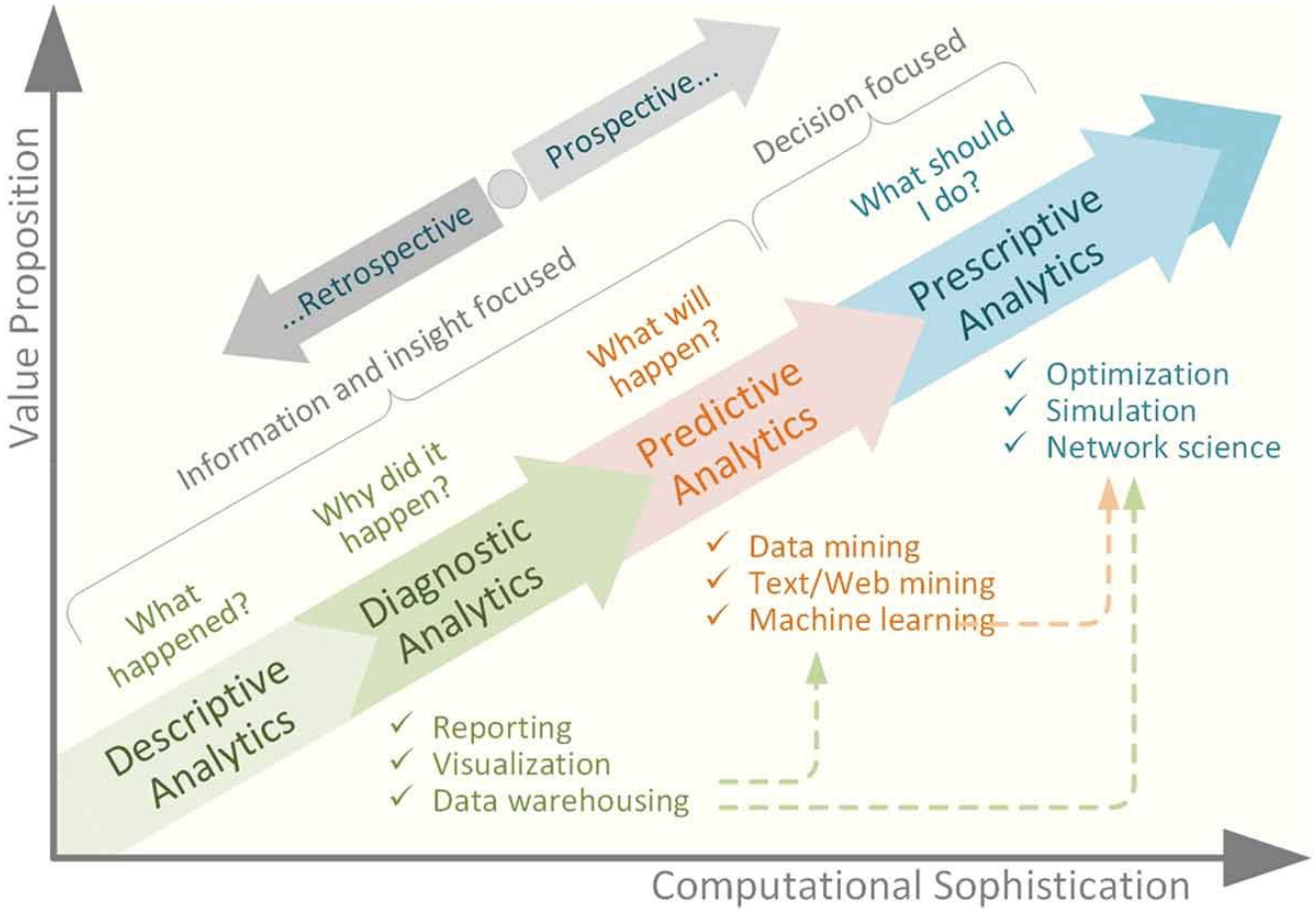
We have developed a suite of methods that facilitate event prediction and support real-time proactive decision making



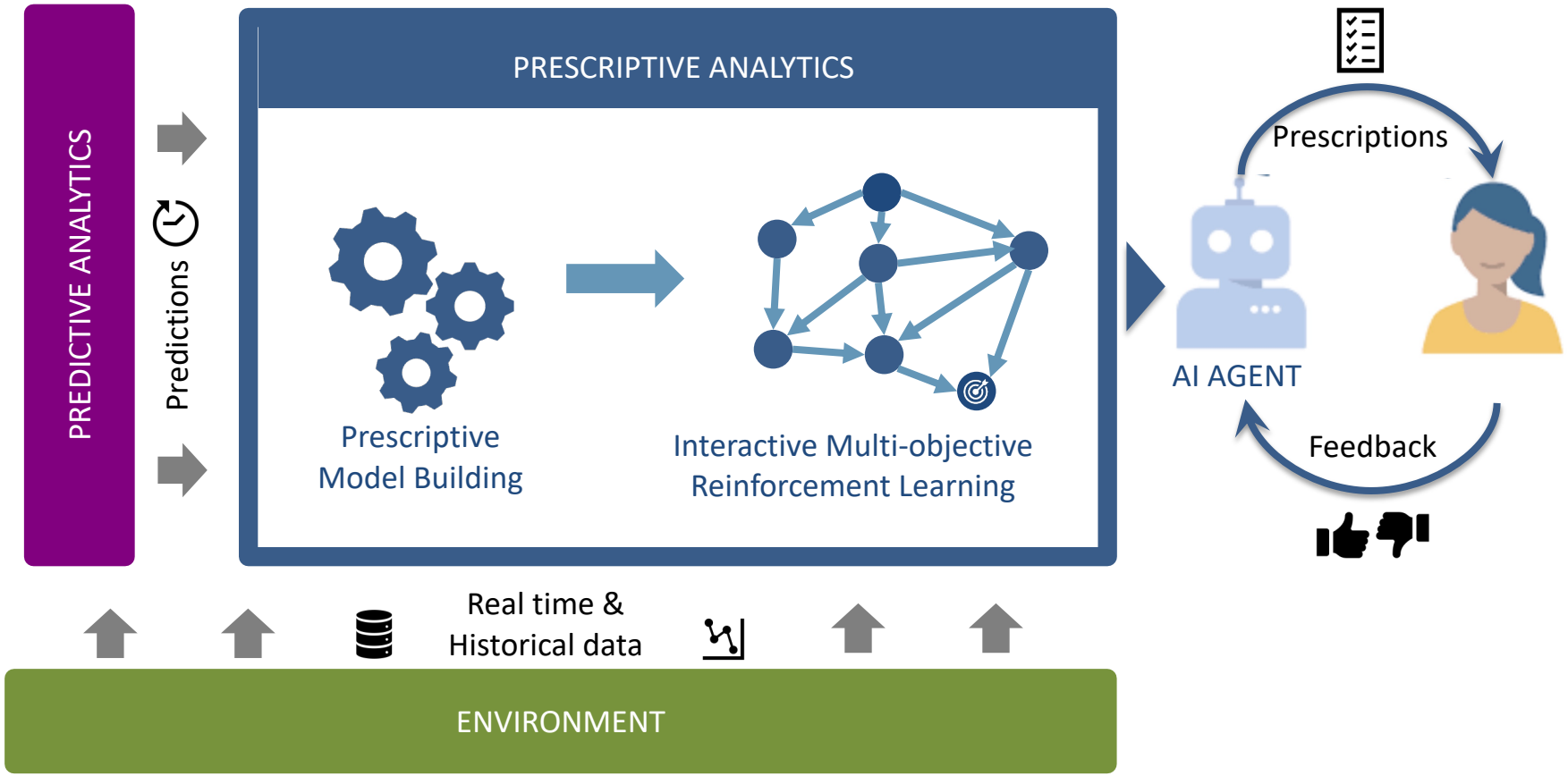
- Proactive information systems aim to enable business analysts to create and configure decision methods for mitigating a future undesired event, which lays outside the desired states space.
- Based on the predictions for undesirable situations derived on the basis of streaming data, decision methods are enacted online to generate mitigating action recommendations and optimal time of action implementation.

Source: Etzion O. (2016). Proactive Computing: Changing the Future. RTInsights.

Our methods integrate all levels of data-driven analytics in order to enable optimal decision-making



We research human-AI collaboration e.g. by integrating human feedback with rules and interactive reinforcement learning



Our methods have been successfully applied in Factories of the Future cases (cf. the UPTIME, PROASENSE and COALA projects)…

Estimate Remaining Useful Life (RUL)

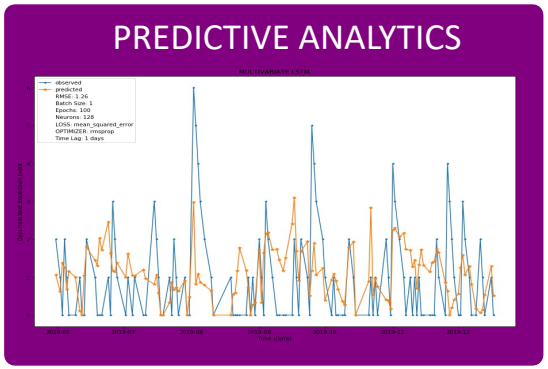
Predict future failure modes

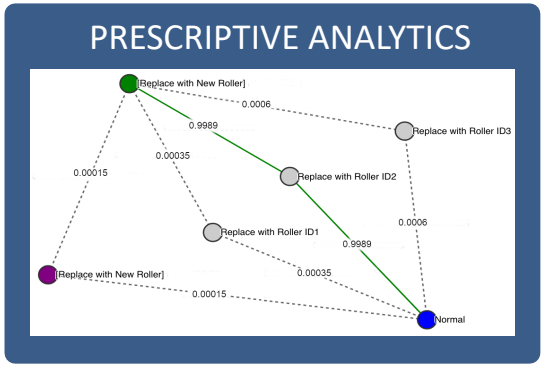
Feature extraction
Online Bayesian changepoint detection
Weibull fitting
Long Short-Term Memory (LSTM)

Prescribe the optimal proactive actions

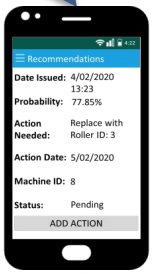
Provide explainable visualization

Markov Decision Process (MDP)
Reinforcement Learning
Multi-Objective Optimization





Prescriptions



Feedback

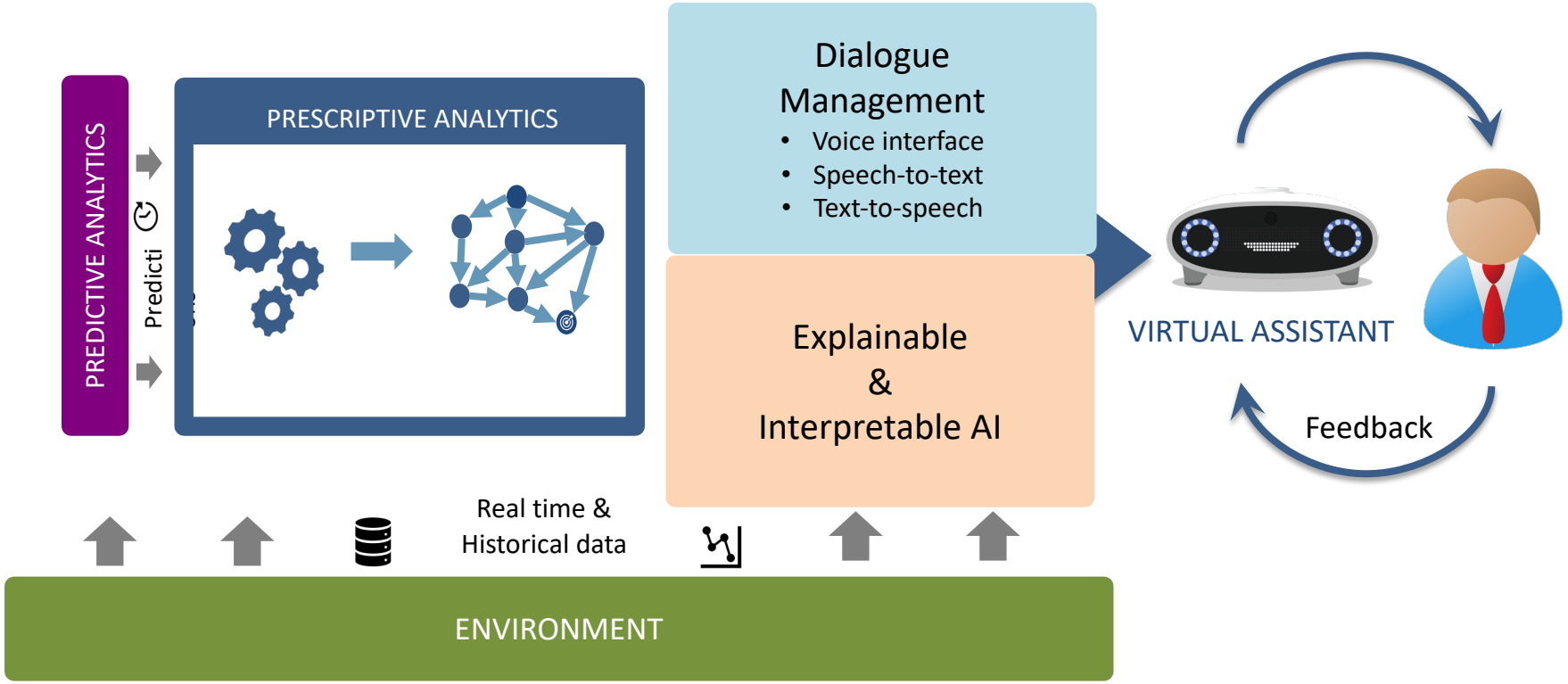
Real time &
Historical data

Real-time data
Accelerometers
Tachometer

Enterprise data
CMMS
ERP

… and also in water management (cf. the AquaSPICE project) and battery prognostics (cf. the MARBEL project)

In our current research we explore AI for human empowerment with augmented analytics, interactive human feedback and virtual assistants

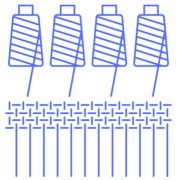


Indicative research and innovation projects

For a complete list please visit: http://imu.iccs.gr/wp/projects/

Cognitive Assisted Agile manufacturing for a labor force supported by trustworthy Artificial Intelligence

- COALA provides a solution for **cognitive assistance that consists of a composition of trustworthy AI components with a voice-enabled digital intelligent assistant as an interface**.
  - The COALA solution will transform how workers perform their jobs and it allows companies to maintain or increase the quality of their production processes and their products



Textile Production

On-the-job training of new machine operators

White Goods Production

Quality inspection during Zero Hour Testing

Detergent Packaging

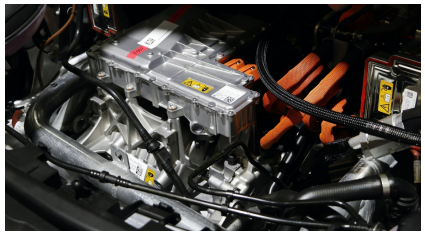
On-job training of new and temporary line managers, change over, issue handling

- From 01/10/2020 to 30/09/2023
- url: https://www.coala-h2020.eu

Manufacturing and Assembly of Modular and Re-usuable EV Battery for Environment-friendly and Lightweight Mobility

- The MARBEL project aims to design and develop an **innovative and competitive lightweight battery** with increased energy density and shorter recharging times
  - IMU will be responsible for the data analytics tasks, the computation of SoX (State of Charge, State of Health, etc.) variables and the development of an AI-based system with early failure detection functionalit

- From 01/01/2021 to 30/06/2024
- url: https://marbel-project.eu



Advancing Sustainability of Process Industries through Digital and Circular Water Use Innovations

- For the vast majority of industries, water is used during some stages of the production process.
  - It is estimated that 20% of all fresh water consumption globally is used by industry and this share is increased to 50% in industrialised countries
- AquaSPICE aims at realising **circular water use in the European Process Industries**, fostering awareness in resource-efficiency and delivering compact solutions for industrial applications.

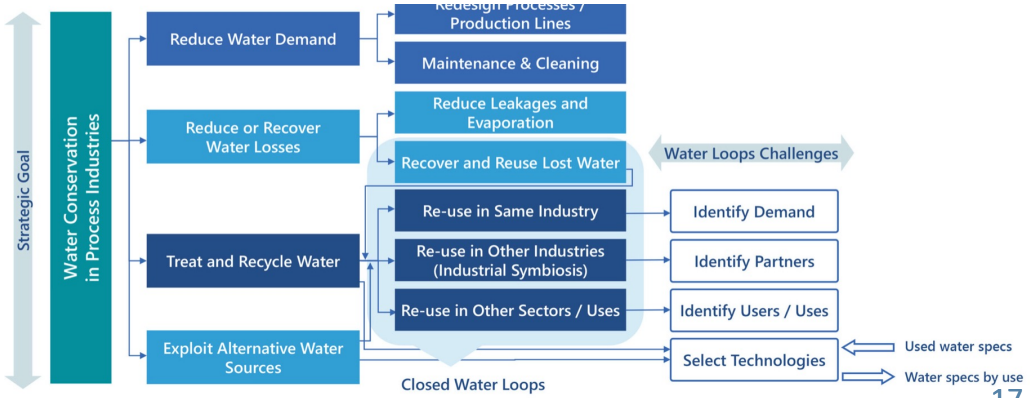
Reduce water demand

Reduce or recover water losses

Treat and recycle water

Exploit alternative water sources

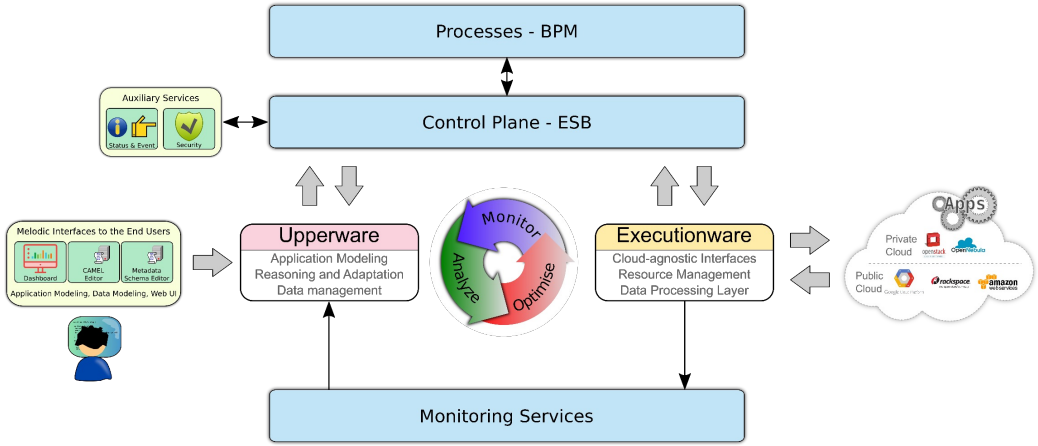
- From 01/12/2020 to 31/05/2024
- url: https://aquaspice.eu



Modelling and Orchestrating heterogeneous Resources and Polymorphic applications for Holistic Execution and adaptation of Models In the Cloud

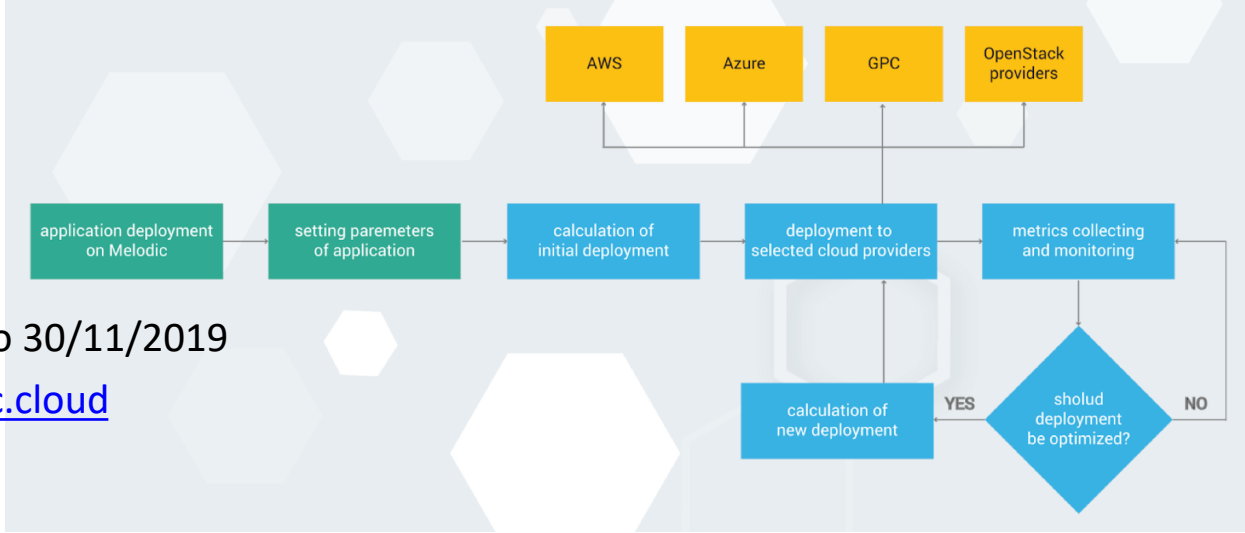
- MORPHEMIC is a **unique way of adapting and optimizing Cloud computing applications**.
  - The project is an extension of MELODIC which is a multi-cloud platform.
  - This open source platform is extended to MORPHEMIC with 2 main innovative pillars:
    - **Polymorphing architecture**: when a component can run in different technical forms, i.e. in a Virtual Machine (VM), in a container, as a big data job, or as serverless components.
    - **Proactive adaptation**: aims to forecast future resource needs and possible deployment configurations -adaptation can be done effectively and seamlessly for the users of the application.

- From 01/01/2020 to 31/12/2022
- Url: https://www.morphemic.cloud



Multi-cloud Execution-ware for Large-scale Optimized Data-Intensive Computing

- MELODIC is a **multicloud optimization platform and automatic deployment solution** of the application to different cloud providers without changing configuration – full cloud agnostic approach.
  - The selection of cloud providers and cloud resources is fully optimized, instead of prices, performance, reliability instead of other factors.
  - After the initial deployment the application is continuously monitored for checking the business goals fulfilment and appropriately reconfigured to always maintain the optimal operation.



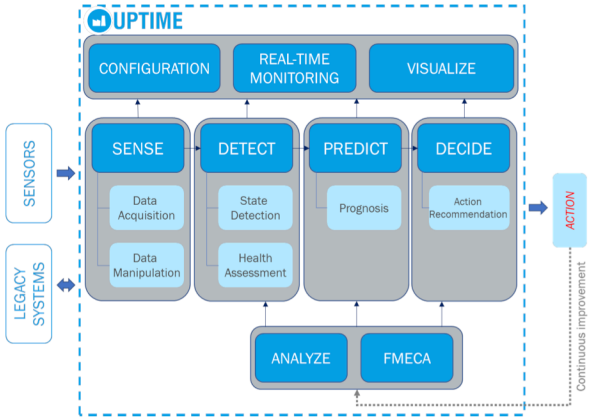
- From 01/12/2016 to 30/11/2019
- Url: https://melodic.cloud

Unified Predictive Maintenance System

UPTIME

- UPTIME provides a unified predictive maintenance framework and an associated unified information system in order to enable predictive maintenance strategy in manufacturing firms
  - Validation in 3 industrial cases: (a) White Goods - Home appliances (b) Steel Industry - Cold rolling (c) Aviation Industry

- From 01/09/2017 to 31/08/2020
- url: https://www.uptime-h2020.eu and https://www.uptime-predictive-maintenance.com



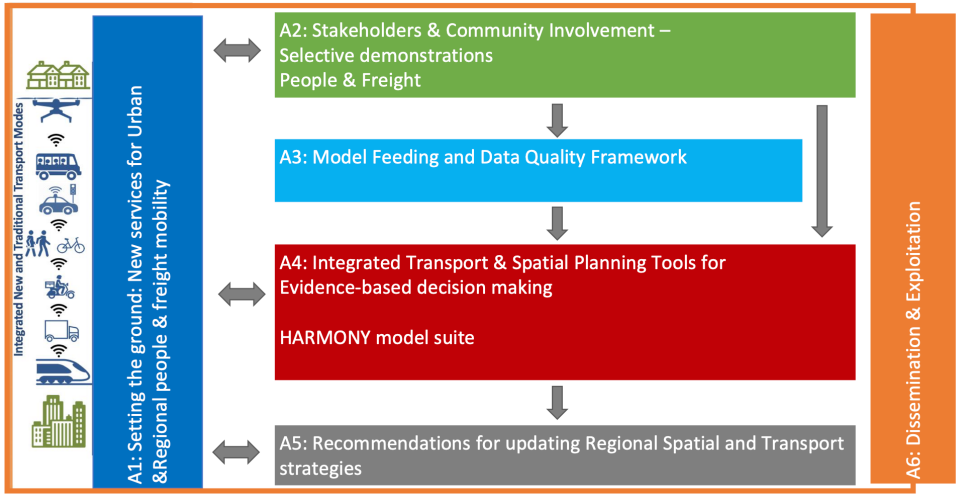
A holistic water ecosystem for digitization of urban water sector

- NAIADES supports the modernization and digitization of the water sector by providing a holistic solution for the control and management of water ecosystems.
- The project aims to address the increased need for **sustainable and eco-friendly water methodologies by defining a new ICT framework**, with a wider scope than a sole technical proposition.
  - Driven by the need to yield an end-to-end, uniform approach, NAIADES redefines water management by taking into consideration issues pertaining to cost, safety, complexity, vulnerability, societal acceptance, user behaviour and ethics.

- From 01/06/2019 to 31/05/2022
- url: https://naiades-project.eu

Holistic Approach for Providing Spatial & Transport Planning Tools and Evidence to Lead a Sustainable Transition to a New Mobility Era

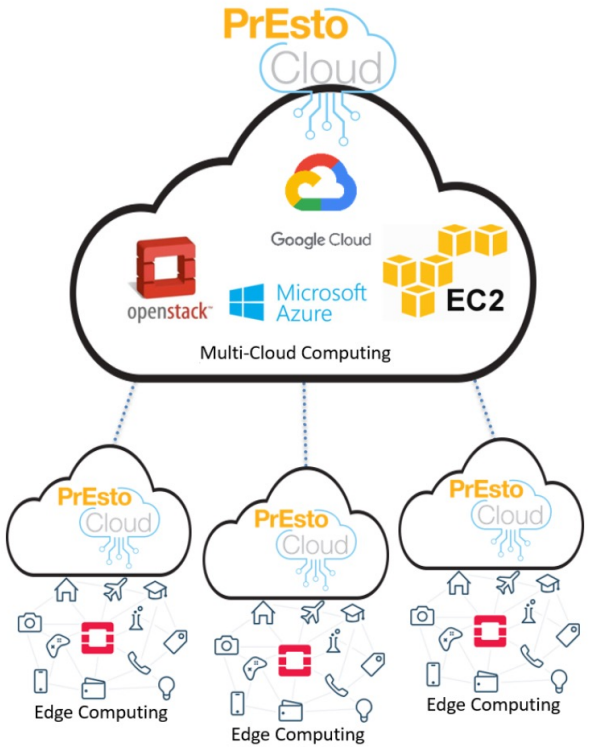
- Harmony's vision is to enable metropolitan area authorities to lead a **sustainable transition to a low-carbon new mobility era**.
- Our spatial and multimodal transport planning tools will update the Sustainable Urban Mobility Plans of the future.
  - HARMONY is demonstrating electric AVs and drones in real-life conditions integrating them with the traditional transport modes to understand the requirements, reactions, barriers and collect real-world data.



- From 01/06/2019 to 31/05/2022
- url: https://harmony-h2020.eu

Proactive Cloud Resources Management at the Edge for efficient Real-Time Big Data Processing

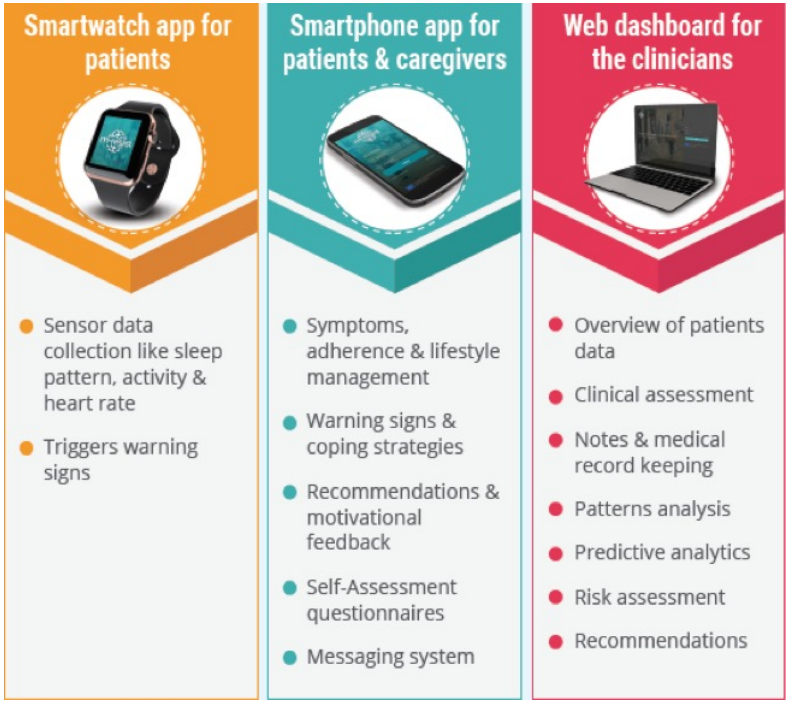
- PrEstoCloud targets a dynamic and distributed software architecture that **manages proactively cloud and fog resources**, while reaching the extreme edge of the network for an efficient real-time Big Data processing.
  - Three use cases demonstrate pro-activeness, self-adaptation, orchestration of distributed processing nodes and processing on the edge: (a) vehicle fleet management (b) media prosumer platform (c) surveillance solution



- From 01/01/2017 to 31/12/2019
- url: http://prestocloud-project.eu

Mobile Therapeutic Attention for Patients with Treatment Resistant Schizophrenia

- M-Resist helps **predict patient's behaviour** and allows the establishment of a **reaction alert system**, as well as to draw up protocols and recommendations to give **doctors support in the clinical decisions**.
  - During the m-resist project, a model of analysis was implemented, in order to move forward in **understanding resistant schizophrenia**.

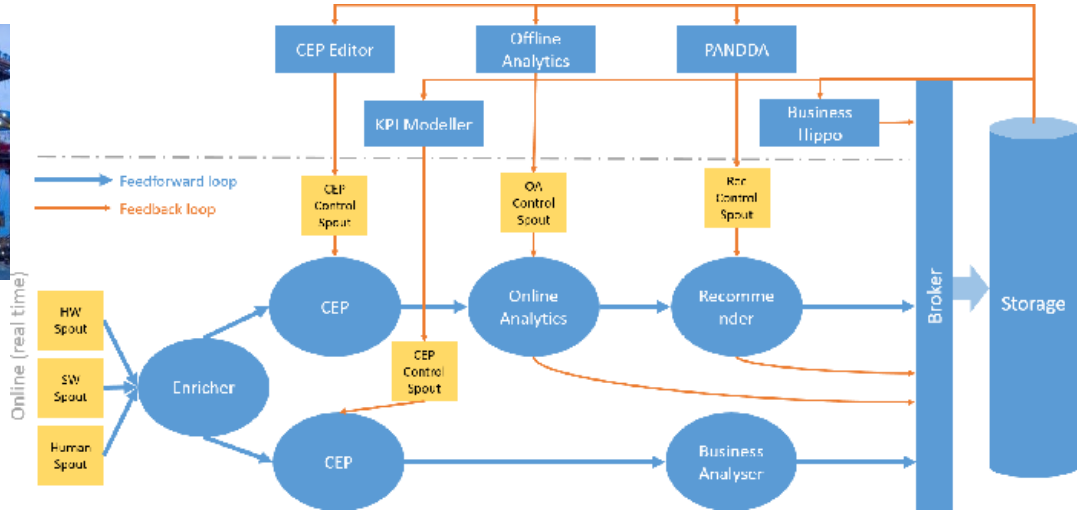


- From 01/01/2015 to 31/12/2017
- url: http://www.mresist.eu

The Proactive Sensing Enterprise

- The vision of ProaSense is a new class of **proactive enterprises** that will be continuously aware of that **what "might happen"** in the relevant business context and will optimize their behaviour to achieve **what "should be the best action"**

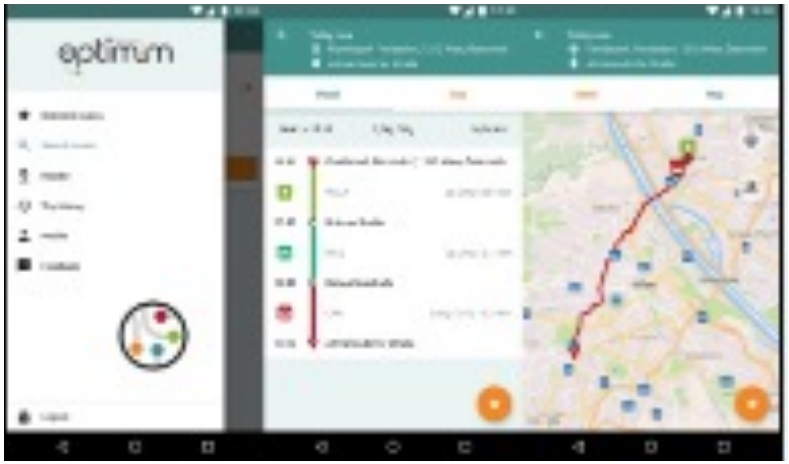
- ProaSense's core goal is to pave the way for an **efficient transmission from Sensing into Proactive enterprises**.



- From 01/11/2013 to 31/01/2017
- url: http://www.proasense.eu/

Multi-source Big Data Fusion Driven Proactivity for Intelligent Mobility

- OPTIMUM aims to unveil state-of-the-art solutions to improve transit, freight transportation and traffic connectivity throughout Europe.
- OPTIMUM established a scalable distributed architecture for the management and processing of multi-source big data, enabling monitoring of transportation system needs and proposing proactive decisions and actions in a (semi-)automatic way.
  - OPTIMUM follows a cognitive approach based on the Observe–Orient–Decide–Act loop of the big data supply chain for continuous situational awareness.



- From 01/05/2015 to 30/04/2018
- Url: http://www.optimumproject.eu

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http://imu.iccs.gr

https://www.linkedin.com/company/2929404/

https://twitter.com/imu_ntua

https://www.youtube.com/channel/UCenUYJveI5WHb92x-jiH8Zg