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sensors

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Automated leak detection system for the improvement of water network management

About R2M Solution

What: Innovation, Technology Transfer, and Consulting Company

- We stimulate research ideas
- We bring clients to research programs
- We focus research projects toward exploitation
- We consult to bring research results to market

Pavia
Catania
London
Madrid

Competitive Advantages:

- Focus on exploitation
- Multi-disciplinarity
- High risk tolerance
- Energy that comes with a young growing company

We are involved in the topic area via our participation in

R2M RESEARCH TO MARKET SOLUTION

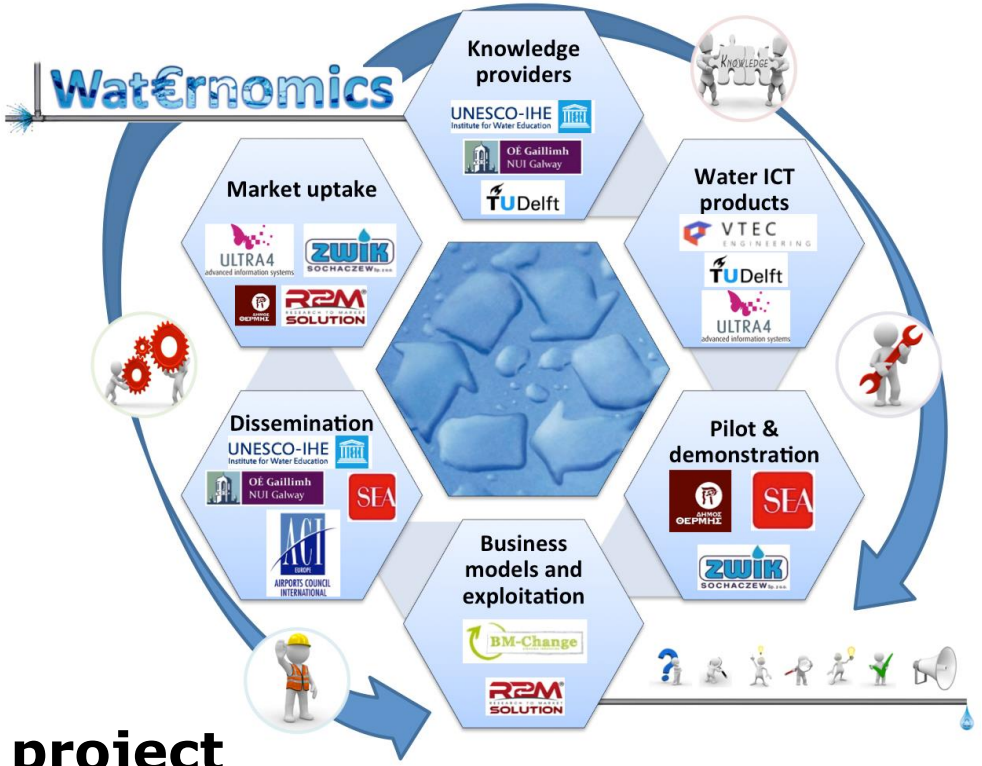
Innovation
Energy Services & Sustainability
Engineering
ICT & Automation

Founded in 2012 | 24 Company staff

Funding raised: 65 M€ | 14 running research projects

Organizations partnered with: 523 | 13 jobs created 2014-16

About WATERNOMICS



- Type of project: **Collaborative project**
- Project start date: **February 2014**
- Duration: **36 months**
- Call: **FP7-ICT-2013-11**
- Effort: **416 PM**
- Budget: **€4.287M**
- Max EC contribution: **€2.905M**

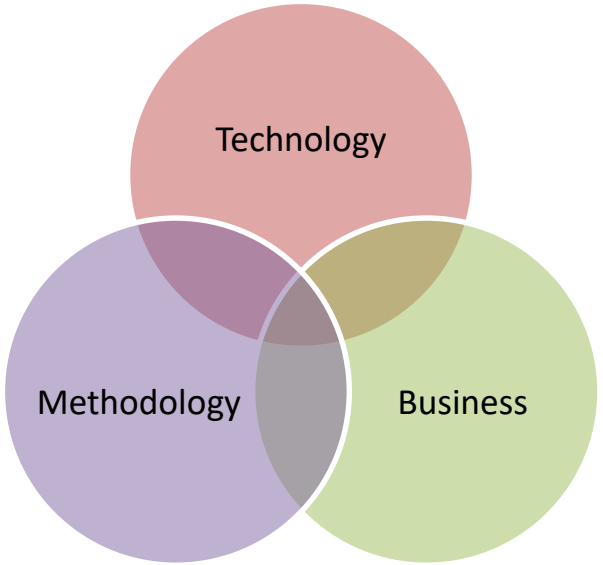
- Grant No.: **619660**
- Consortium: **9 partners**
- Countries: **4**
- SMEs: **4**
- Pilots: **4**

Project Aim & Objectives

WATERNOMICS will provide **personalized** and **actionable** information on water consumption and water availability to individual households, companies and cities in an intuitive & effective manner at relevant time-scales for decision making

- Combining information from various sources & domains to offer **contextual water information services**
- Making water usage information **accessible** across devices & locations
- Supporting **personalised interaction** with water information services
- Enabling **sharing** of water information services across communities of users
- Demonstrating generic water information services **can be used in a variety of environments**
- Enabling open (collaborative) business models and **flexible pricing mechanisms**

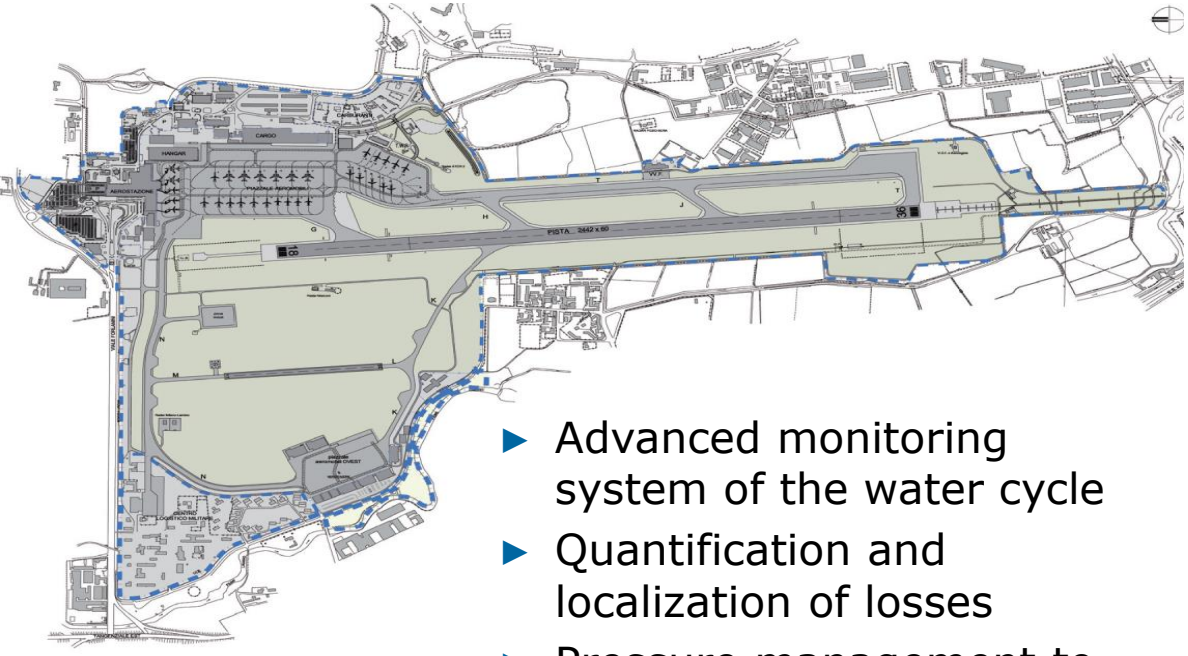
Holistic Approach



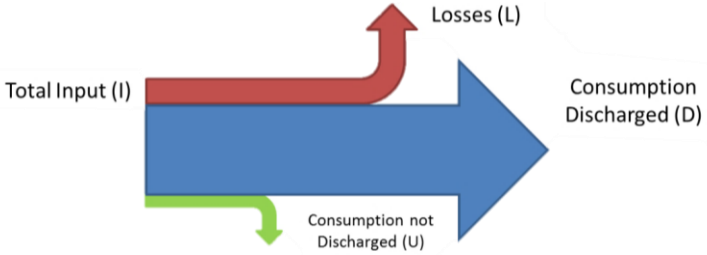
Pilot sites

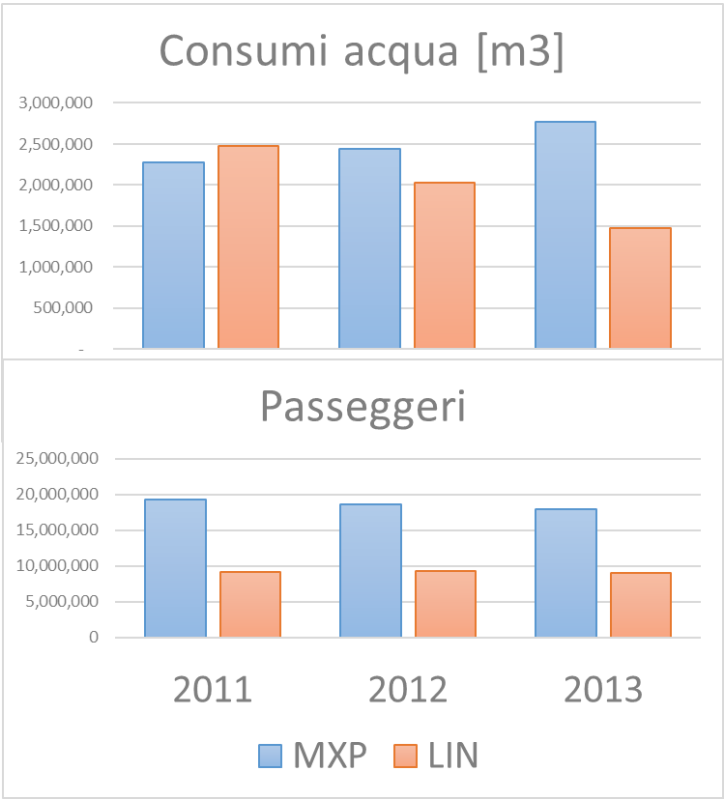
	Corporate	Domestic	Public/Mixed Use	
LOCATION				
	LINATE AIRPORT, MILAN, ITALY	DOMESTIC HOUSES, THERMI, GREECE	ENGINEERING BUILDING, NUI GALWAY, IRELAND	COLÁISTE NA COIRIBE, GALWAY, IRELAND
TARGETUSERS	Corporate Water Consumers Leisure and Business Travellers	Domestic Water Consumers and Utility Providers	Mixed/Public Water Consumers - University	Mixed/Public Water Consumers - School
KEY STATISTICS	no water remote monitoring system in place 10 Km of drinking water network 5 New USF Meters & 47 commercial meters (flow/ pressure/energy / ground water level) proposed by WATERNOMICS Utilities Management, Maintenance Staff, Environmental Managers	15 km from Thessaloniki covering an area of 38.34 ha with 70,000 people 10 households selected Different water usages and different family types Typical cross section of the domestic environment Adults young adults and children	Opened in 2011 Designed as a living laboratory ; 14,000 sqm on four floors occupied by 1,000 students and 100 staff; 11 existing water meters & BMS system in place 8 New USF Meters and 3 inline meters proposed by WATERNOMICS Building/Utilities Manager, Staff Students Researchers	Opened in October 2015 M21; 500 students and 40 staff; 7 water meters and building control system planned in original construction contract 14 New inline water meters and site view screen proposed by WATERNOMICS Building Manager, Staff, Students, Teachers

Linate Pilot objectives



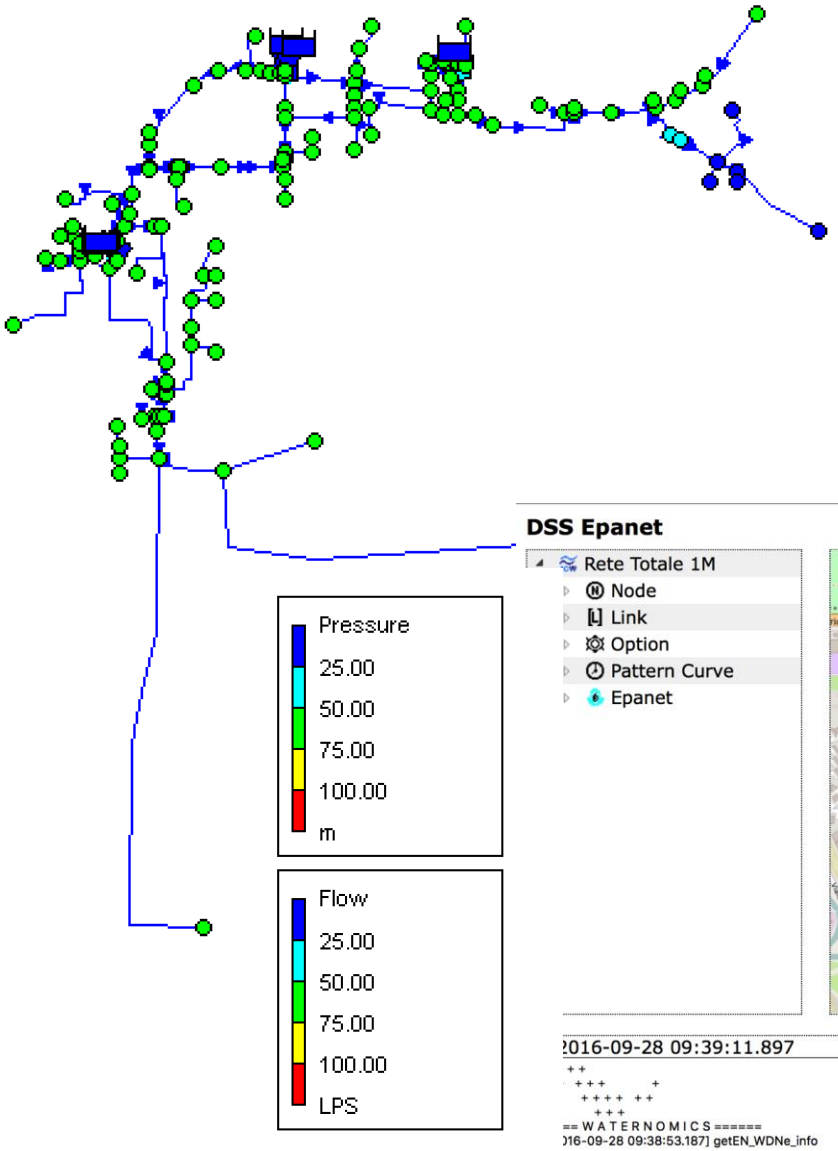
- Advanced monitoring system of the water cycle
- Quantification and localization of losses
- Pressure management to save water and energy



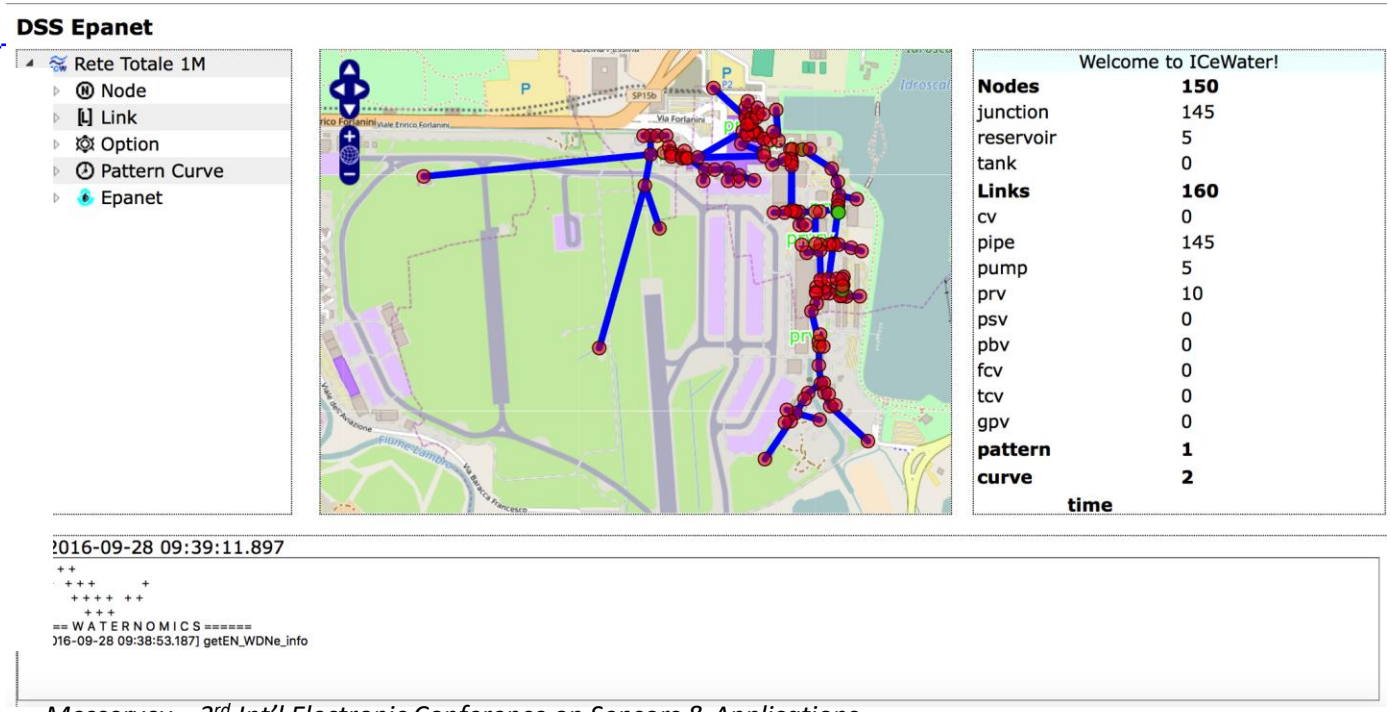


- 10 Km of water network
- 52 meters installed (flow/pressure/volume/Energy/ground water level)
- Data transmission system enabled via GSM

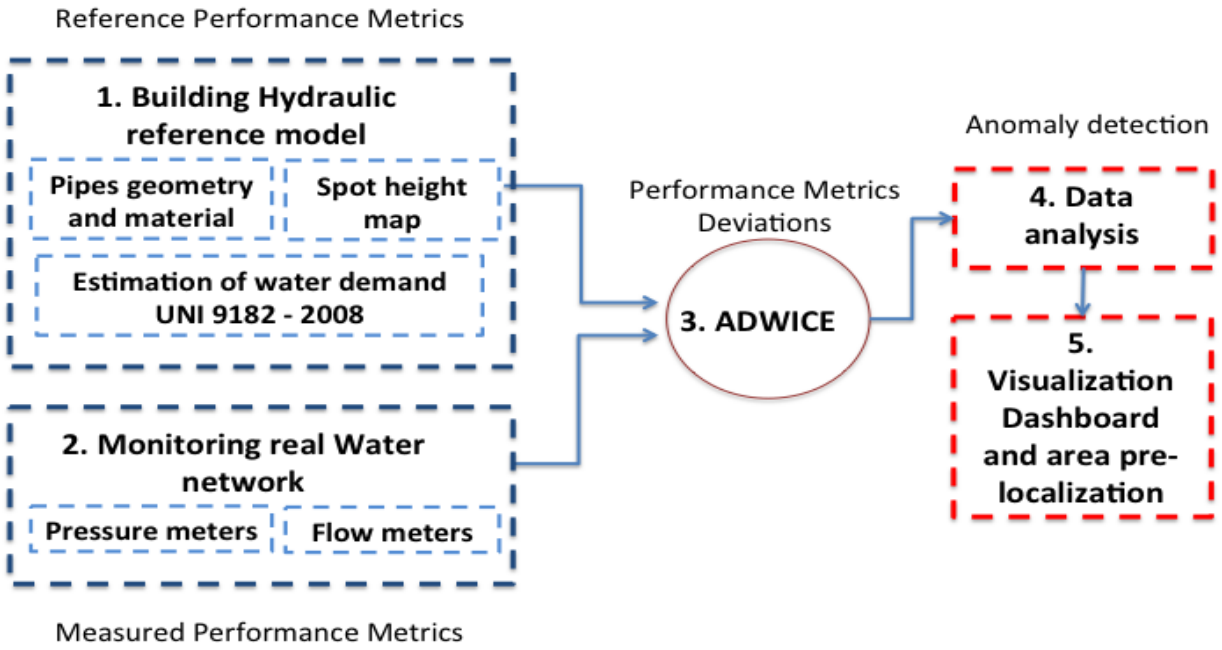
Linate water network optimization



- Using the Epanet Hydraulic model in the operational phase:
  - To detect abnormalities
  - "What If" scenarios (**pressure/leakages/energy**)

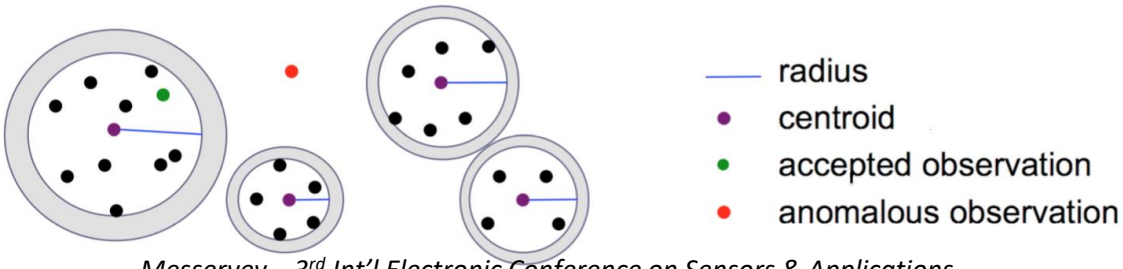


Model – Based FDD

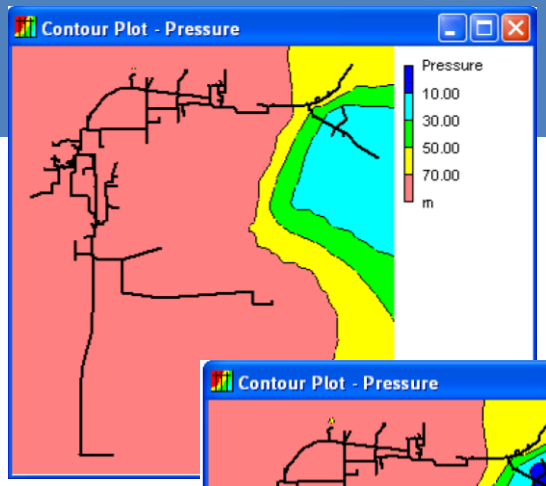


ADWICE (Anomaly Detection With fast Incremental ClustEring) as a clustering-based anomaly detector

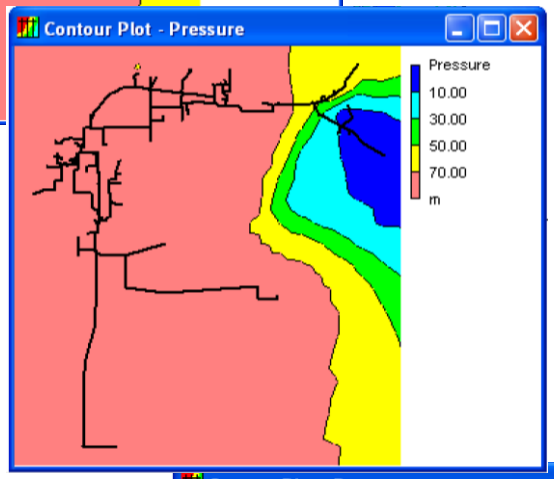
The approach consist of modelling the normality as a set of clusters that summarize the normal behaviour (**identified during training**). Once ADWICE is trained, it can be used for **online detection of anomalies or faults**.



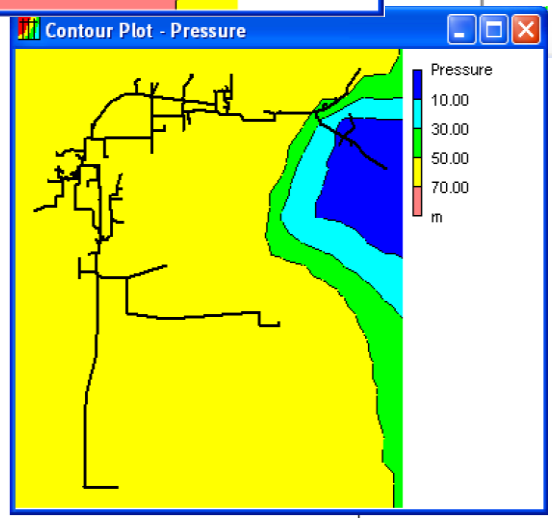
Test conducted



Scenario without leakages

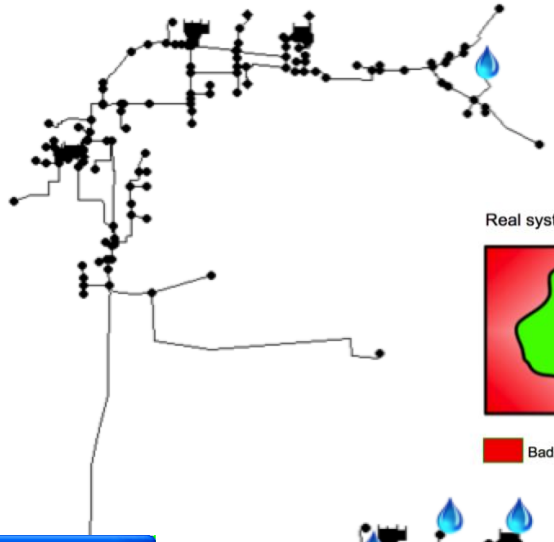


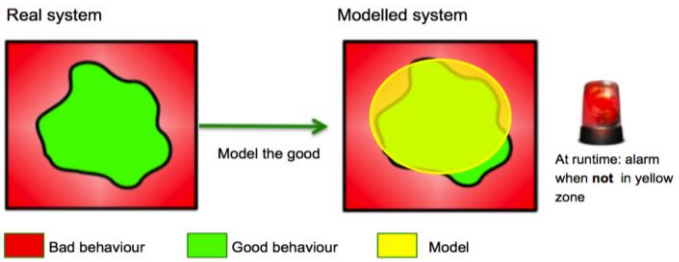
Leakage Scenario n. 1

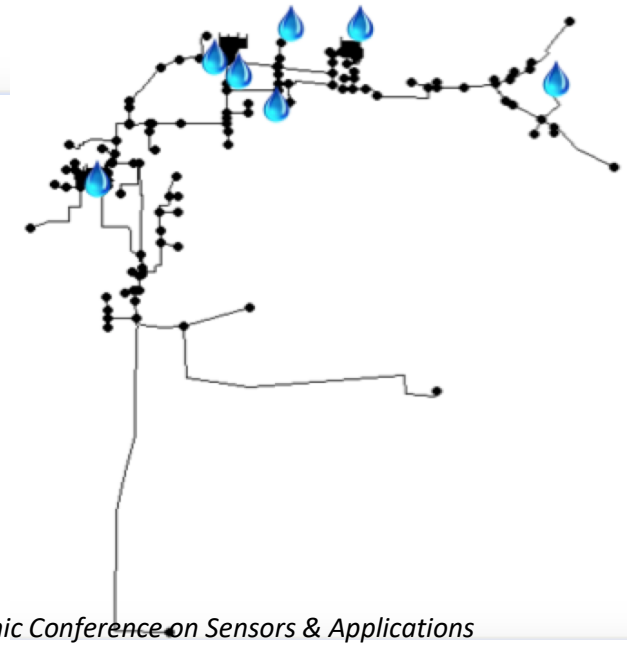


Leakage Scenario n. 2

- Model Based FDD:
  - ADWICE (Anomaly Detection With fast Incremental ClustEring)



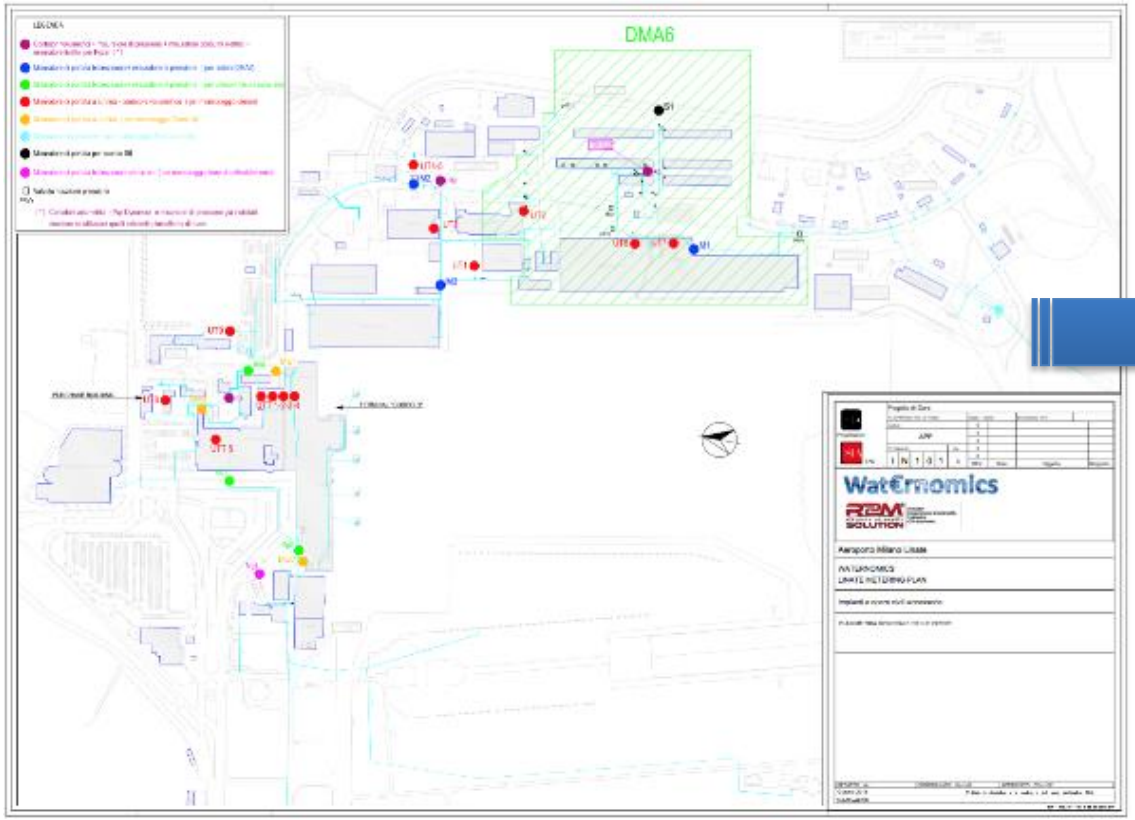




Preliminary results

- **Results**
  - False Positive Rate: **4.9 %**
  - Detection Rate: **60 %** (average value) [min. 0,33 – max. 0,93]
  - Accuracy: **80 %** (average value) [min. 0,66 – max. 0,94]

Main next step is to re train the algorithm and apply it to real time measurements

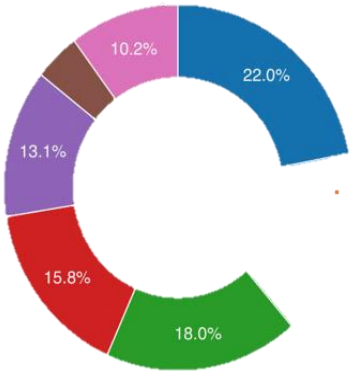


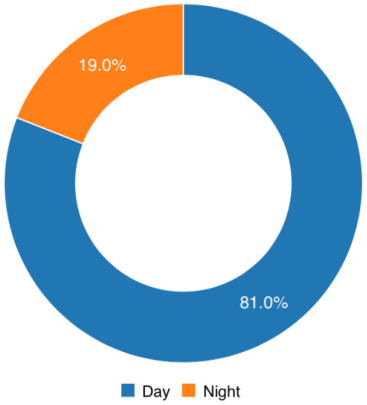
TEST WITH REAL DATA FROM MEASUREMENTS IMPLEMENTED IN PLACE

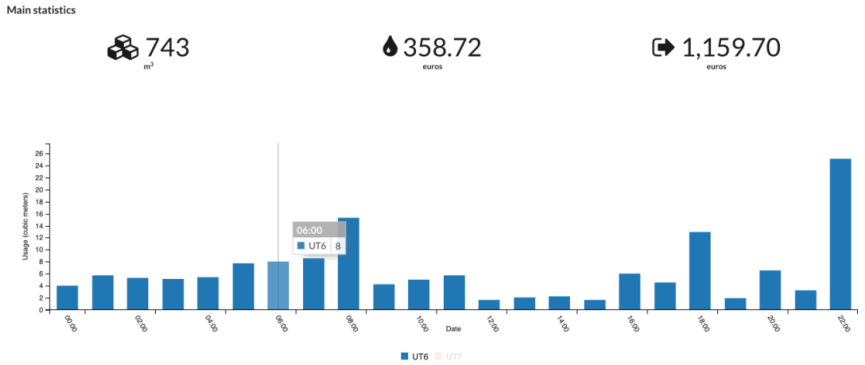
What do we expect?

Expected results based on data collected in the field

13% 16% 20%







Conclusions

- Water management considering water as a resource is a challenge
- Finding innovative ways to address ageing water infrastructure is a challenge
- To facilitate decision makers and stakeholders at all levels into taking action to address these challenges, a model-based FDD can serve as a powerful enabler
- This paper has presented such a FDD method
- We're always available to talk about solving water problems.
- Much of the work is available online and we are happy to be contacted directly.

More info about WATERNOMICS:
www.waternomics.eu
www.r2msolution.com

Thank You

Innovation
Energy Services & Sustainability
Engineering
ICT & Automation

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