true monitoring of water networks

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true monitoring of water networks

eng. Fabrizio Mancuso

INGEGNERIE TOSCANE

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instituto
tecnológico
de galicia

International Seminar "*European Water Utility Management*", Pisa (IT), June 3rd 2015

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innovative in-pipe hot-tap insertion
floW sEnsor plus smarT NETworks enable
ecowise pervasive monitoring of water distribution grids

Advanced system for analysis, data processing and decision support for **DMA (*District Metered Areas*)** water networks

ETV

WETNET Supervisory is under ETV revision (Environmental Technology Verification) for the validation of the environmental performance of innovative technologies.

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TARGETS

Smart and efficient management of waterworks districts

Managing, planning and developing activities related to the Integrated Water Services

Implement interventions to improve efficiency

Monitoring performance in water grids

Use low-energy hardware and software systems

WETNET Supervisory Unit

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Converting
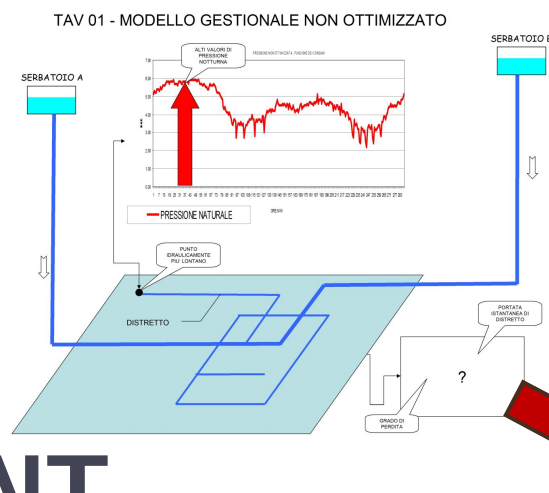**Normal Water Network**
into
Smart Water Networks

KEY TO ACHIEVE EFFICIENT MANAGEMENT

Help with decision making process on good knowledge of the underlying physical system
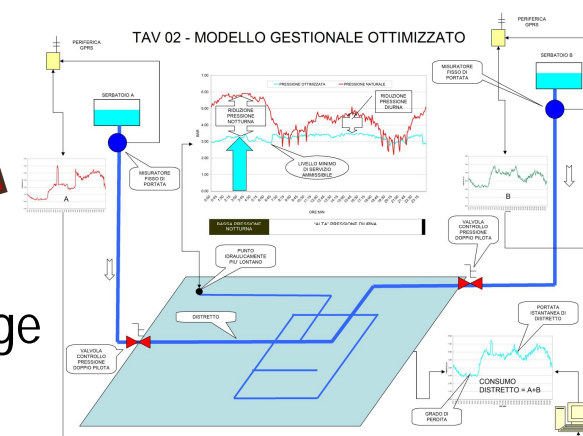
Know water network behaviour over time to set dynamic alarm thresholds

Perform fine-grained investigations to spot leakages and misoperations early

Analyze data to prioritize interventions and explore alternative management choices

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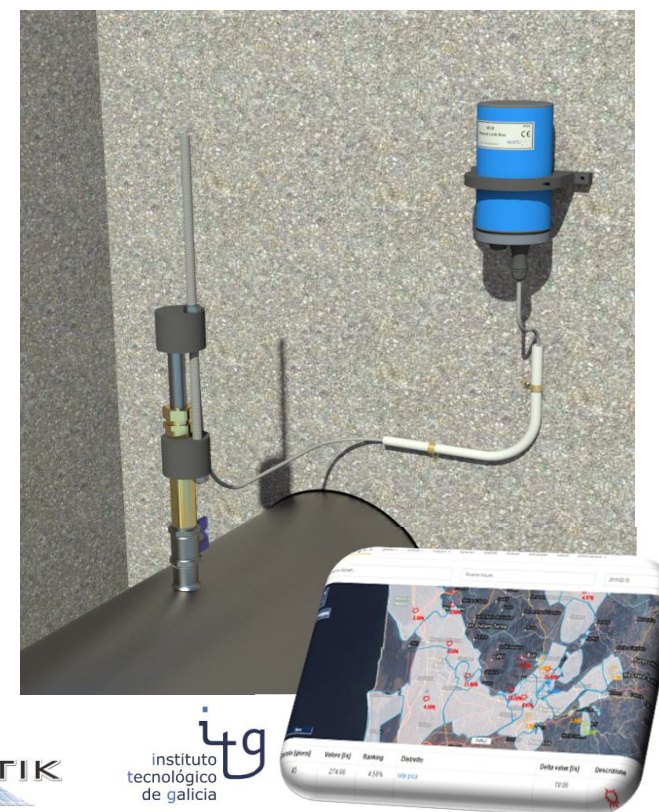true monitoring of water networks

HOW TO DEFINE WETNET

"Complete System for a modern management of the water supply network"

WHAT IT CONSISTS OF

- Insertion flowmeter

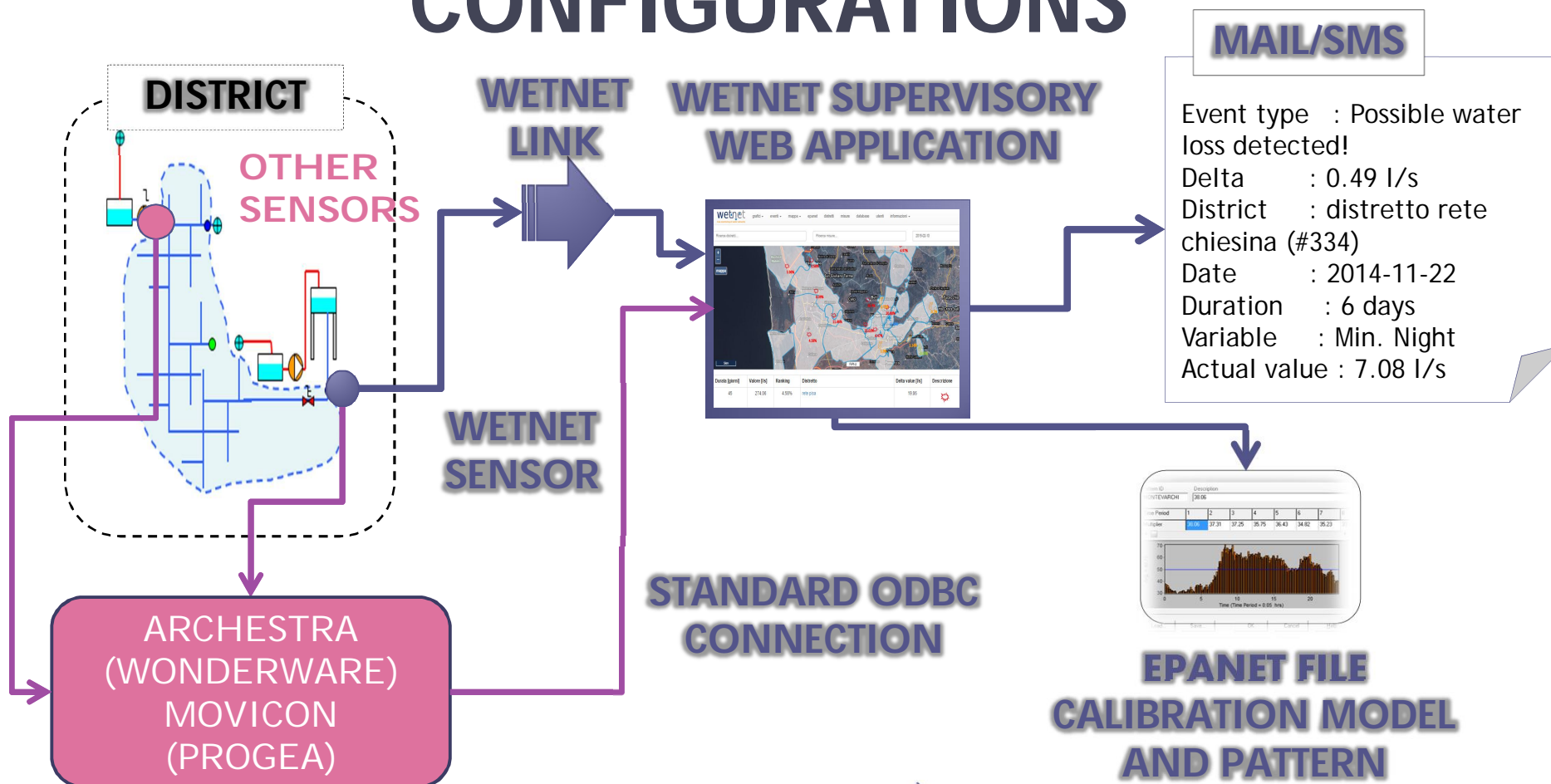- Telemetric Datalogger

- Supervisor – Events Generator

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CONFIGURATIONS

MAIL/SMS

Event type : Possible water loss detected!
Delta : 0.49 I/s
District : distretto rete chiesina (#334)
Date : 2014-11-22
Duration : 6 days
Variable : Min. Night
Actual value : 7.08 I/s

DISTRICT

OTHER SENSORS

WETNET LINK

WETNET SUPERVISORY WEB APPLICATION

WETNET SENSOR

STANDARD ODBC CONNECTION

ARCHESTRA (WONDERWARE) MOVICON (PROGEA)

SCADA

EPANET FILE CALIBRATION MODEL AND PATTERN

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SENSOR CHARACTERISTICS

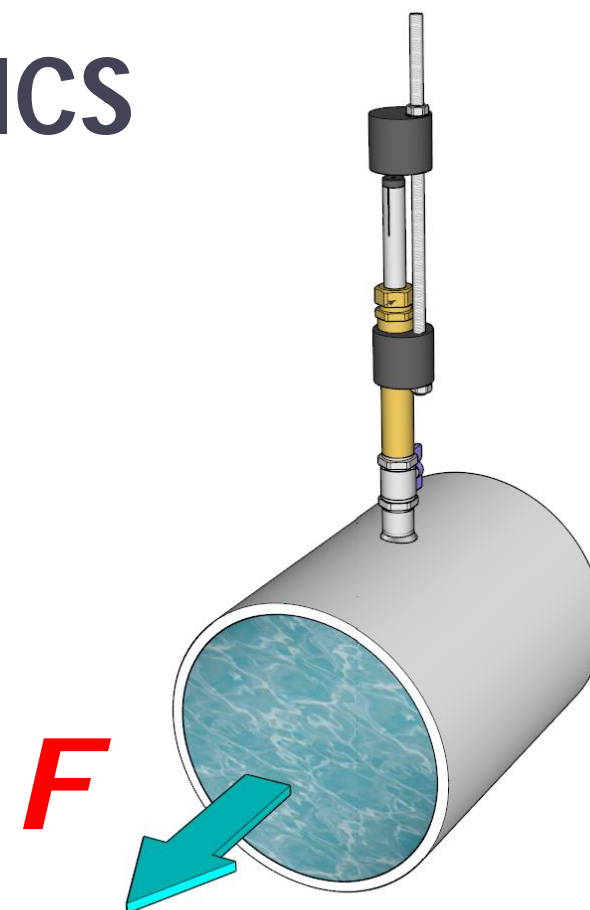Easy Installation

Bydirectionality

Low Energy Consumption

Stand-Alone Installations

Low Costs

Simple and Cheap Hydraulic Works

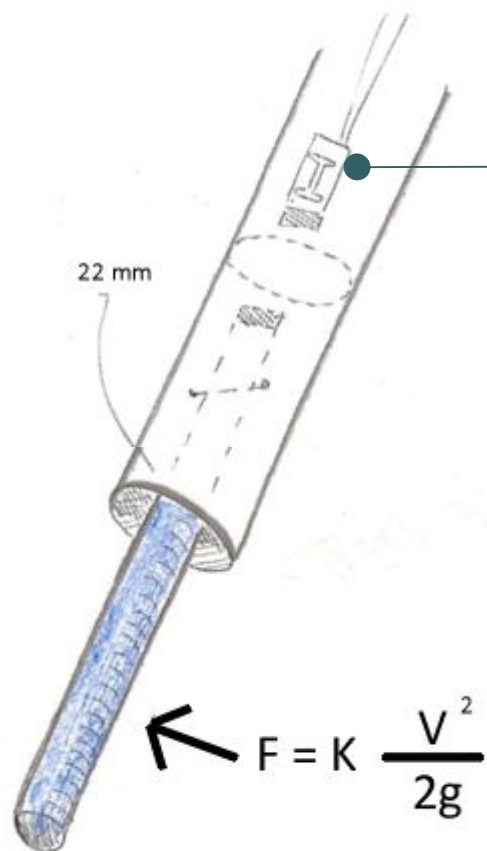Easy Maintenance

No Moving Parts

F

Hydraulic Thrust

true monitoring of water networks
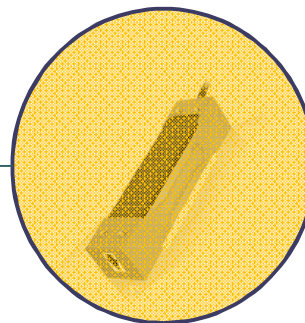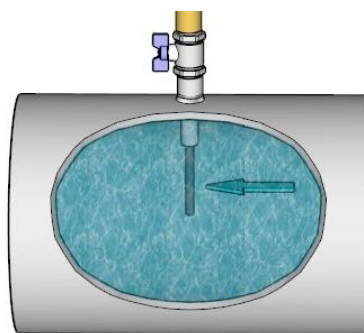
WETNET SENSOR

LOAD CELL

$$F = K \frac{V^2}{2g}$$

22 mm

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WETNET Uplink Flowmeter - WUF

Bidirectional Insertion Flowmeter

Measuring Range: 0.1 to 1.8 m/s

Hot-tap Insertion without flow interruption
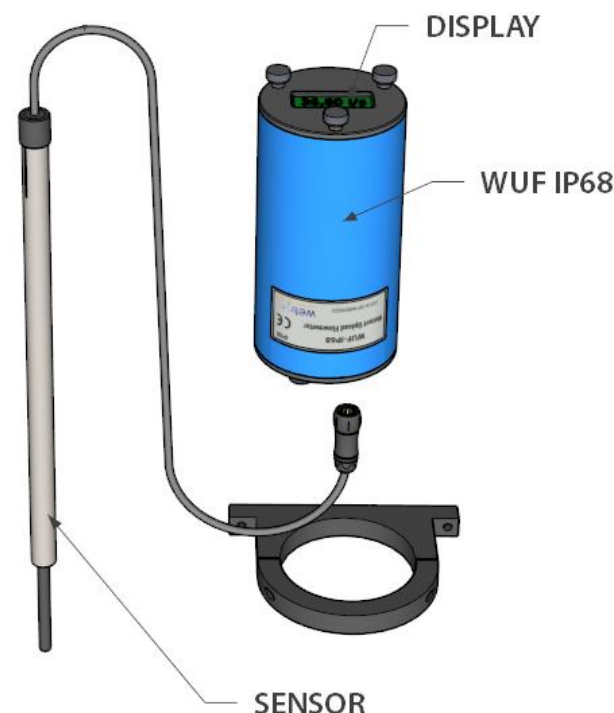
GSM/GPRS Module for Data Transmission

SD card for data logging

Analog Output 4-20mA /0-5V

Low costs

Analog Inputs for External Sensors

Available in IP68 Version

![wetnet — true monitoring of water networks]

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WETNET Uplink Flowmeter

36,80 l/s

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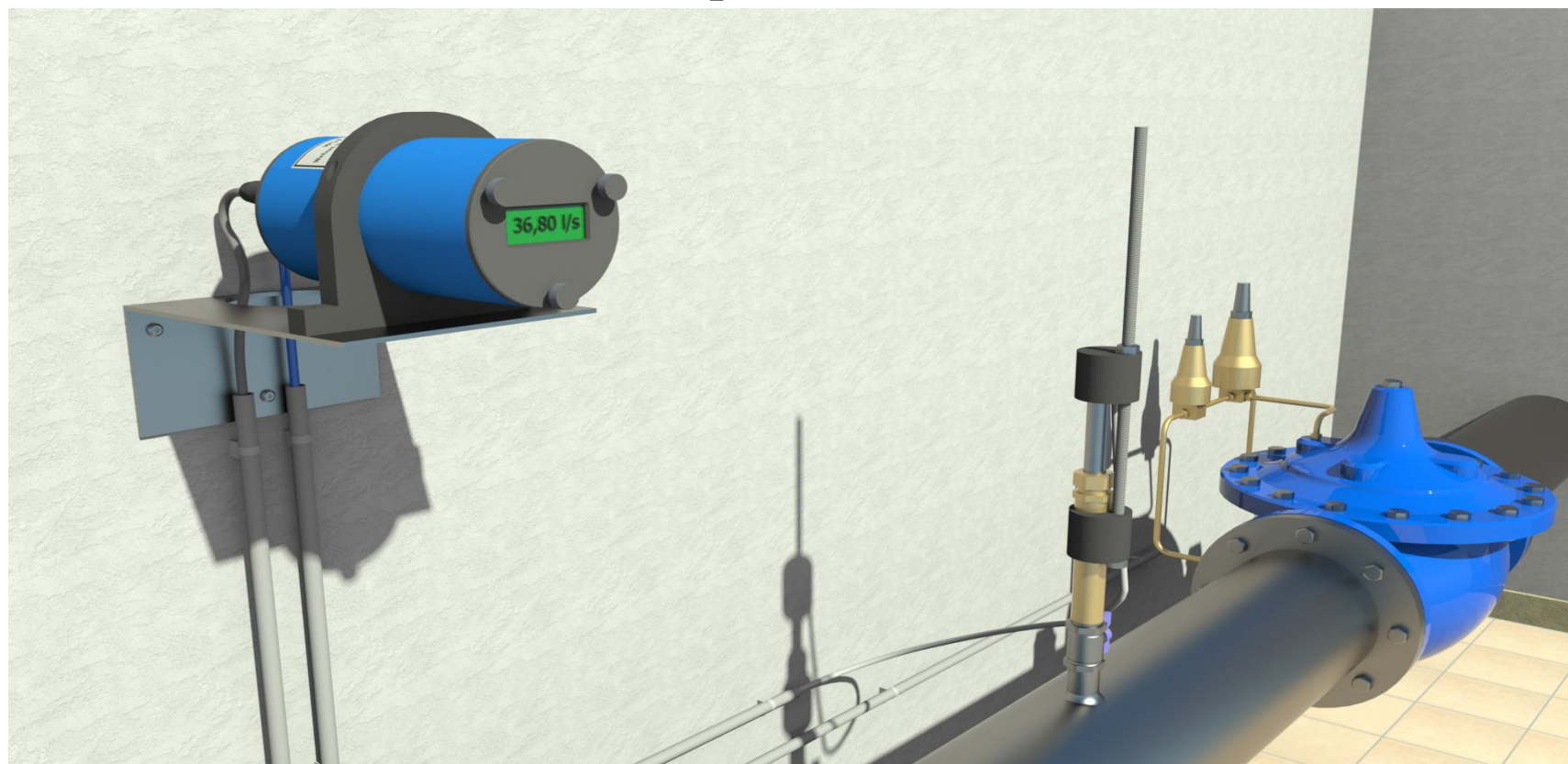**International Seminar "*European Water Utility Management*", Pisa (IT), June 3rd 2015**
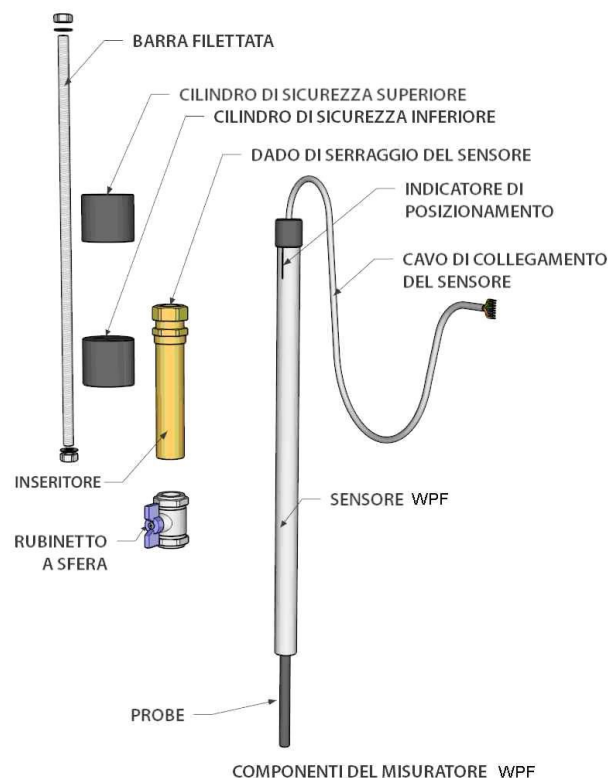
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WETNET Pulse Flowmeter - WPF

BARRA FILETTATA
CILINDRO DI SICUREZZA SUPERIORE
CILINDRO DI SICUREZZA INFERIORE
DADO DI SERRAGGIO DEL SENSORE
INDICATORE DI POSIZIONAMENTO
CAVO DI COLLEGAMENTO DEL SENSORE
INSERITORE
SENSORE WPF
RUBINETTO A SFERA
PROBE
COMPONENTI DEL MISURATORE WPF

Bidirectional Insertion Flowmeter

Hot-tap Insertion without Flow Interruption

Measuring Range: 0.1 to 1.8 m/s

Very Low Power Supply needed

Impulsive Output for RTU or Datalogger Connection

User-friendly software for Settings and Working Analisys

Low Costs

Stainless Steel Case IP68

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WETNET Link Box

Logger unit with Data Sending via *Link* GSM/GPRS

Local Data Storage on SD card

Engineered for *low-power* applications with internal battery, can be also powered from external sourcess

Analog and Digital Inputs, with counting function

Digital Output for Device Activation

Internal or External Antenna

USB Interface for Settings and Data Download

Plug of an Internal Pressure Gauge (Optional)
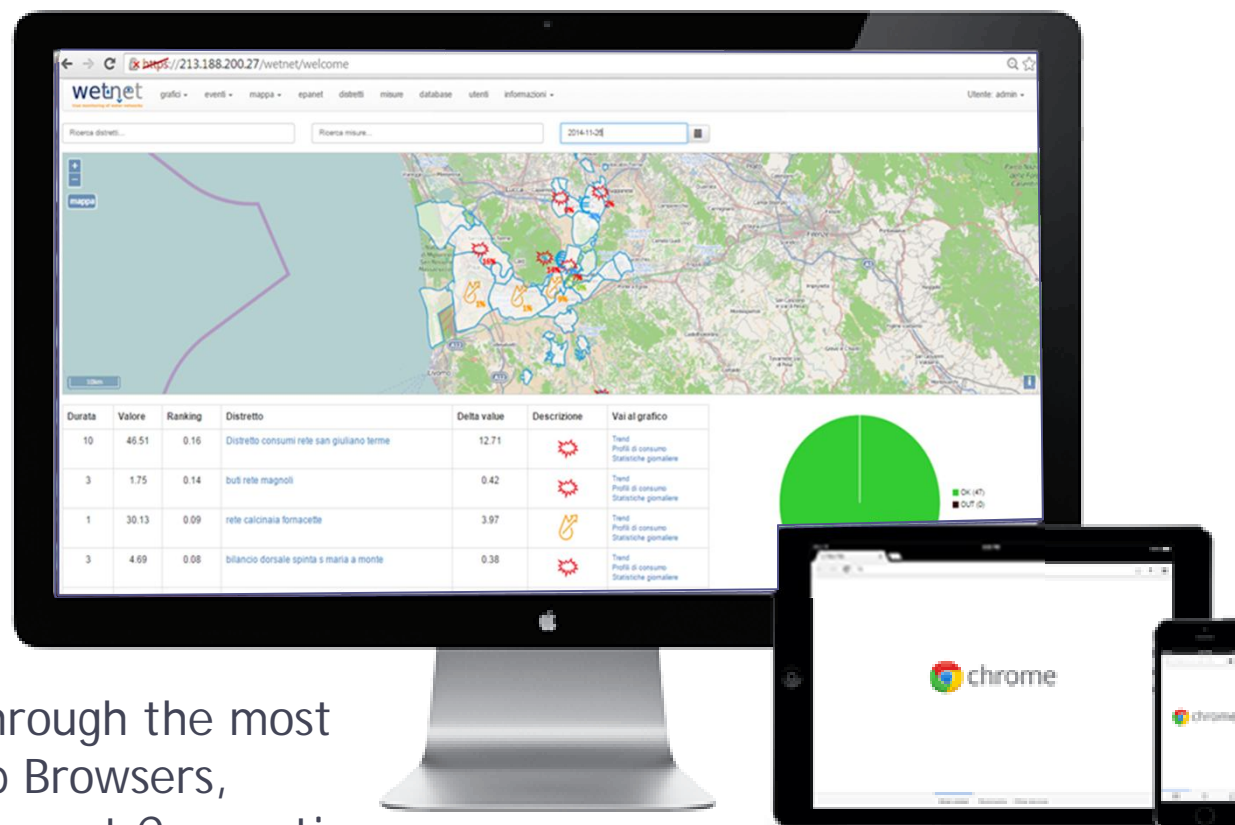
Housed in IP68 Cylindrical Case

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DMA SUPERVISOR

App achievable through the most
common Web Browsers,
simply having an Internet Connection

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WETNET

Measure-ments
- Connection
- Interpolation
- Validation
- Characterization

Districts
- Water Balances
- Energy Balances
- Modelling (Epanet)
- Diagrams
- Reporting

Events
- Analisys
- History
- Communication

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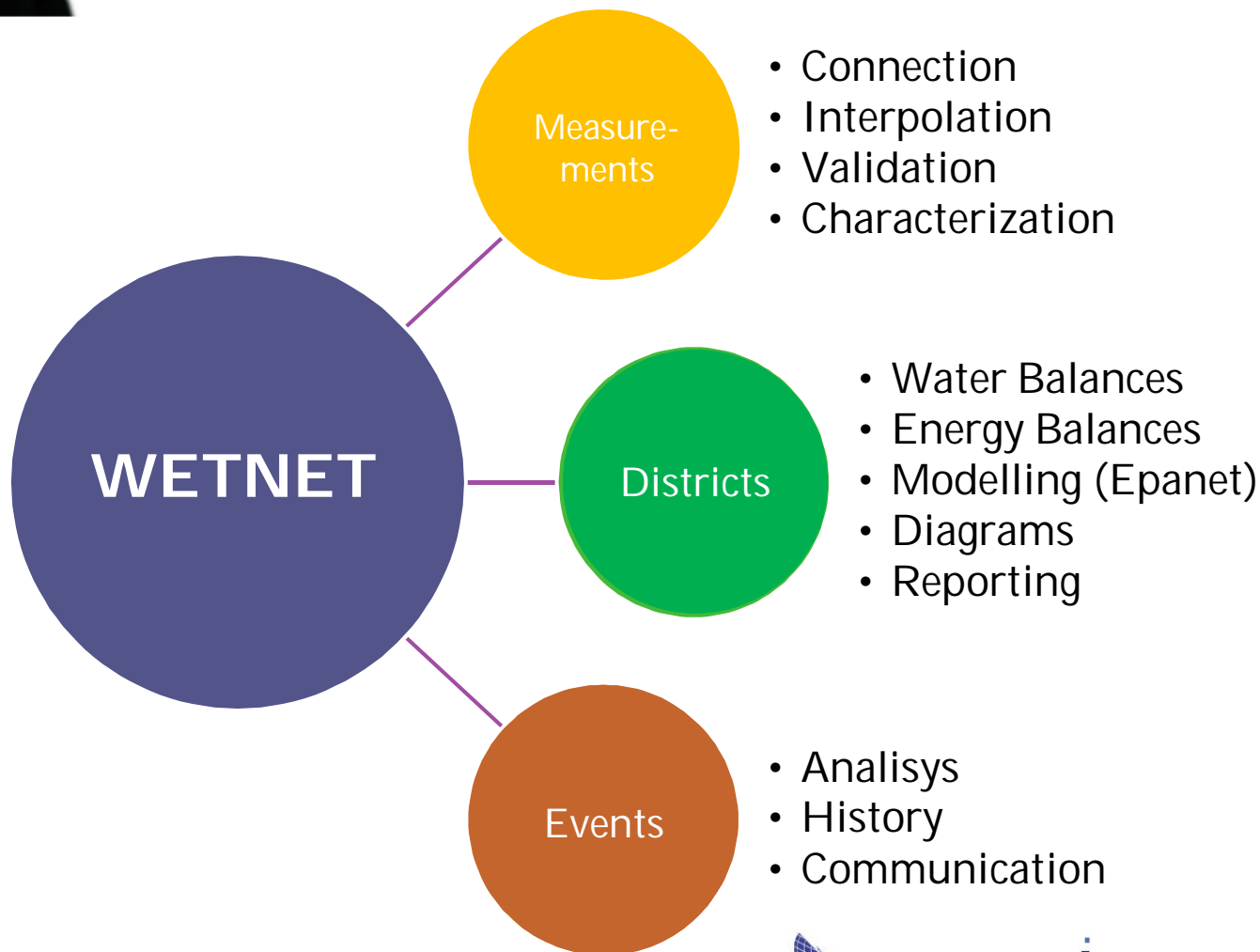International Seminar "*European Water Utility Management*", Pisa (IT), June 3rd 2015

EVENT

For Wetnet, "**EVENT**" is any fact or occurrance that may be univocally given a specific degree of truth and is clearly associated with a measurable fact, with its own place in space and time.
Every single event is defined by a type, a deviation from a "normal" state, a district, a date, a time length in days, a variable and a score.

ABNORMAL EVENTS

When no abnormal events occur, probability distribution of the main statistic variables associated with the hydraulics of the **DMAs** may be approximately equivalent to a **Gaussian model**.

To make some events certain, Wetnet waits for "symptomatic" events to reoccur: this is the case, for example, of '**leak**' events, which are disclosed if, and only if, there have been consecutive "**trigger**" events of some abnormal consumption.

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EVENTS CODING

Event type: **Possible water gain detected!**
Is the coding that Wetnet gives to the event

Delta: ***-2.87 l/s***
Is the deviation from the normal band of the given variable

District: ***Rete Bientina (#55)***
Is the Name/Code of the district in whitch the event occurs

Date: ***2014-10-20***
Is the last consecutive date in which the event recurs
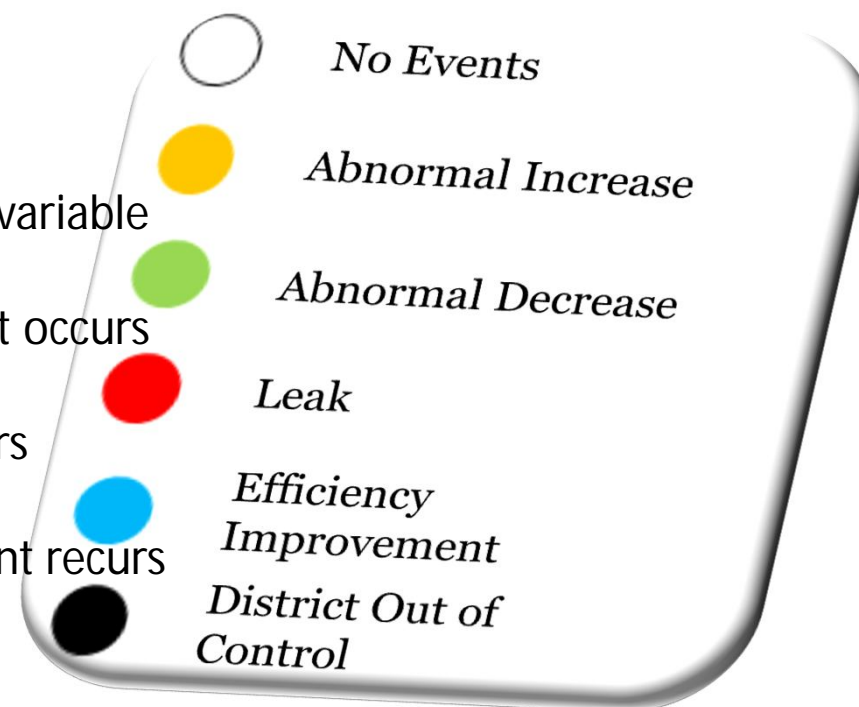
Duration: ***12 days***
Is the number of consecutive days in which the event recurs

Variable: ***Min. Night***
Is the given variable

Actual value: ***11.63 l/s***
Is the value of the given variable corresponding to the last consecutive date in whitch the event recurs
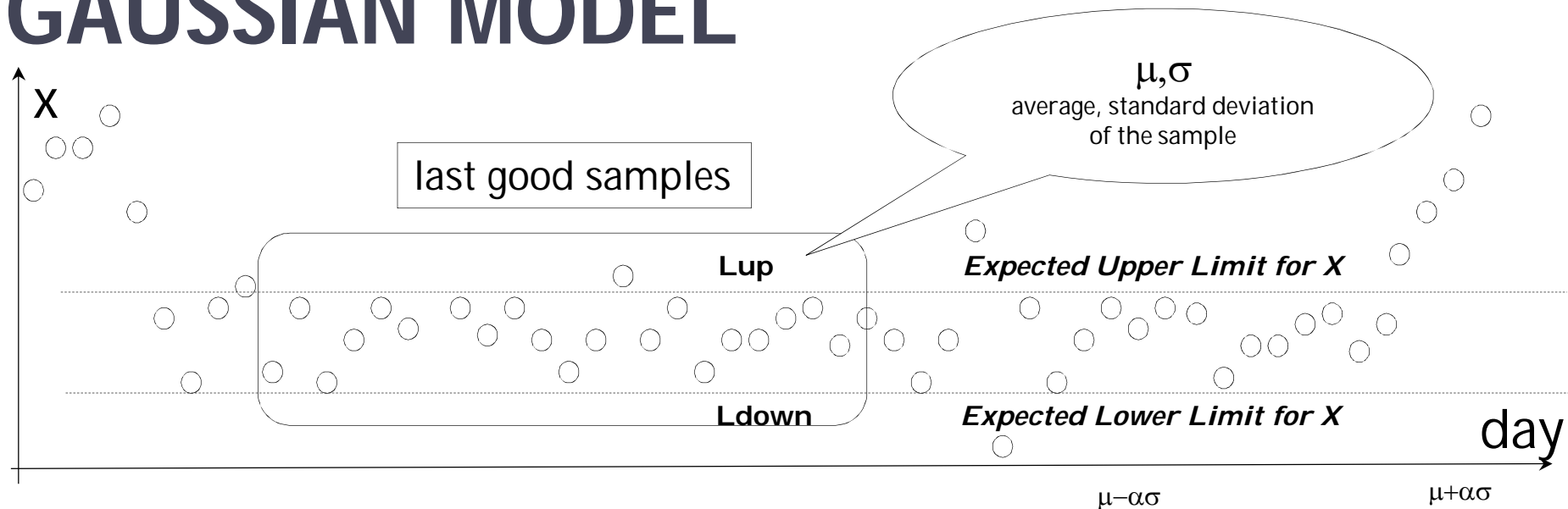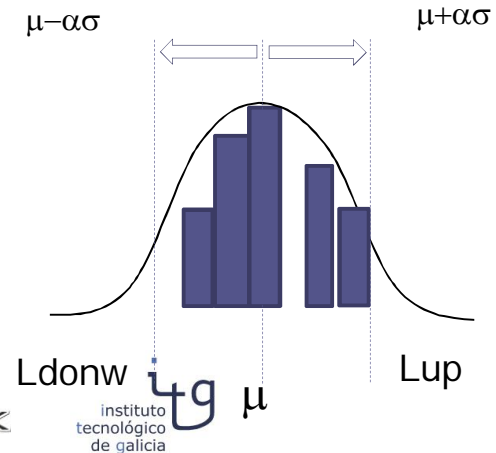
○ No Events

● Abnormal Increase

● Abnormal Decrease

● Leak

● Efficiency Improvement

● District Out of Control

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GAUSSIAN MODEL

μ, σ
average, standard deviation of the sample

last good samples

Lup — *Expected Upper Limit for X*

Ldown — *Expected Lower Limit for X*

X

day

$\mu - \alpha\sigma$ $\mu + \alpha\sigma$

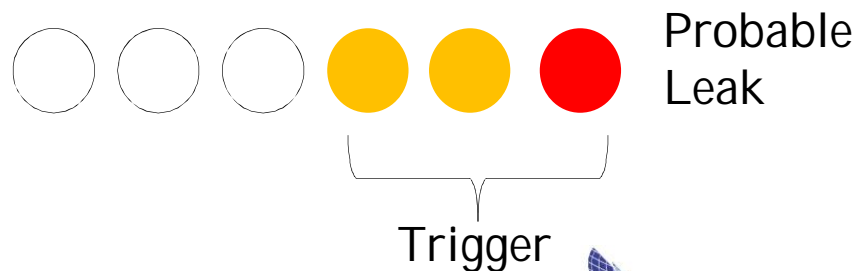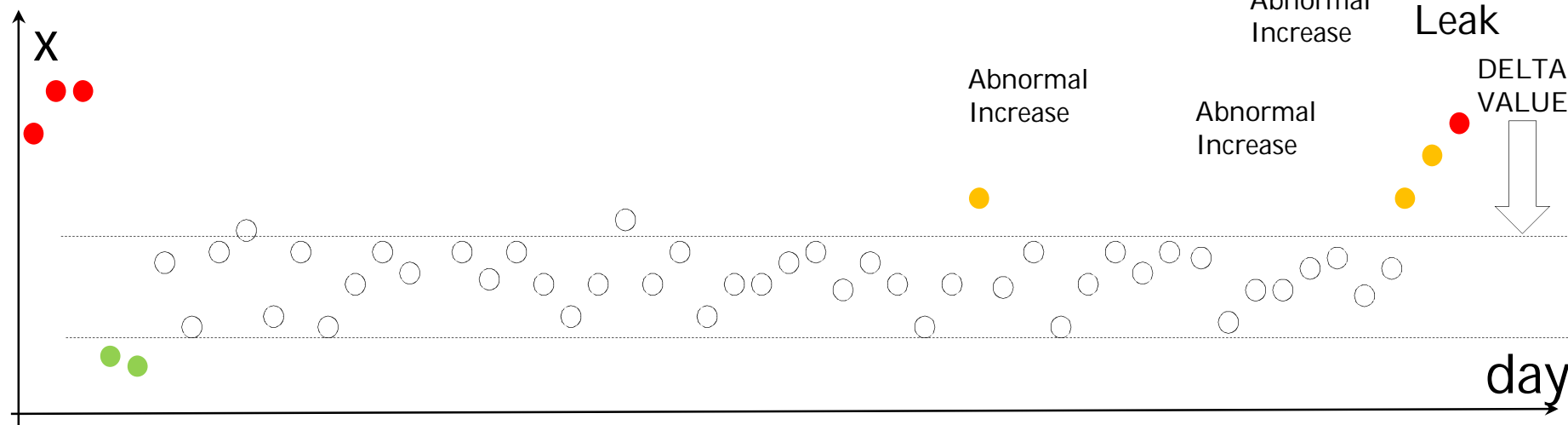X=min_nigth or avg_day

Ldonw μ Lup

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LEAK

Probable Leak

Abnormal Increase

Abnormal Increase

Abnormal Increase

DELTA VALUE

x

day

Probable Leak

Trigger

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EFFICIENCY IMPROVEMENT

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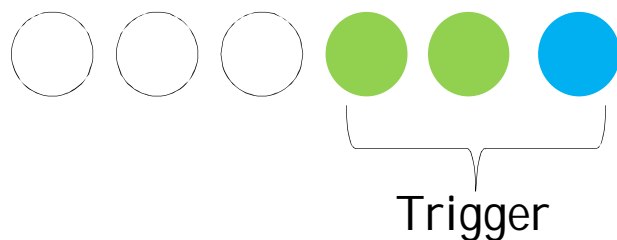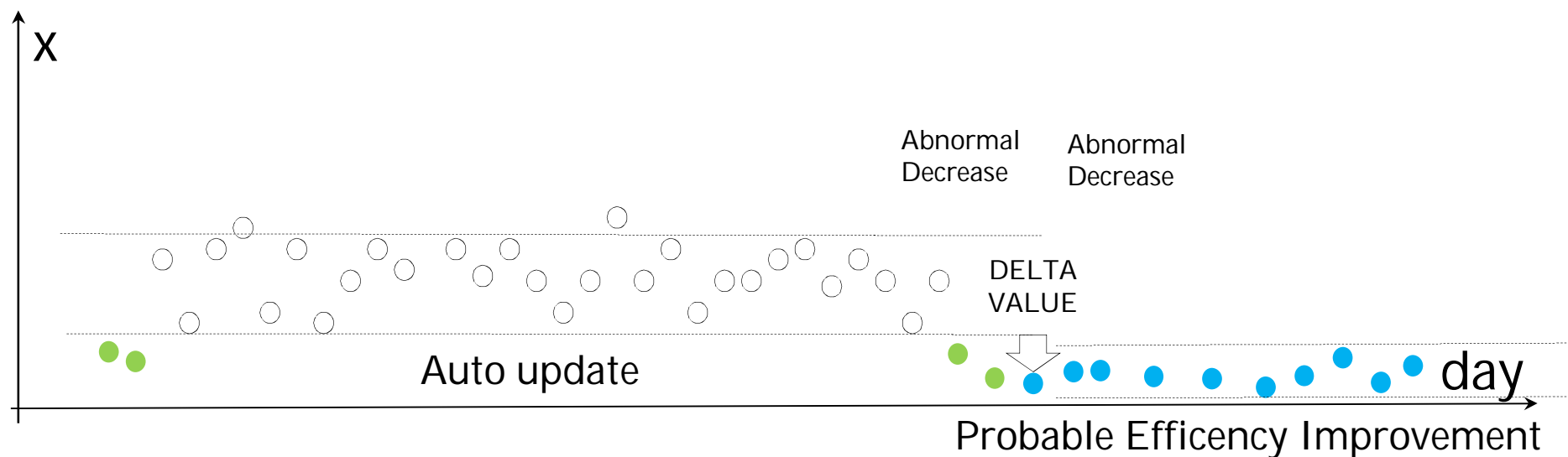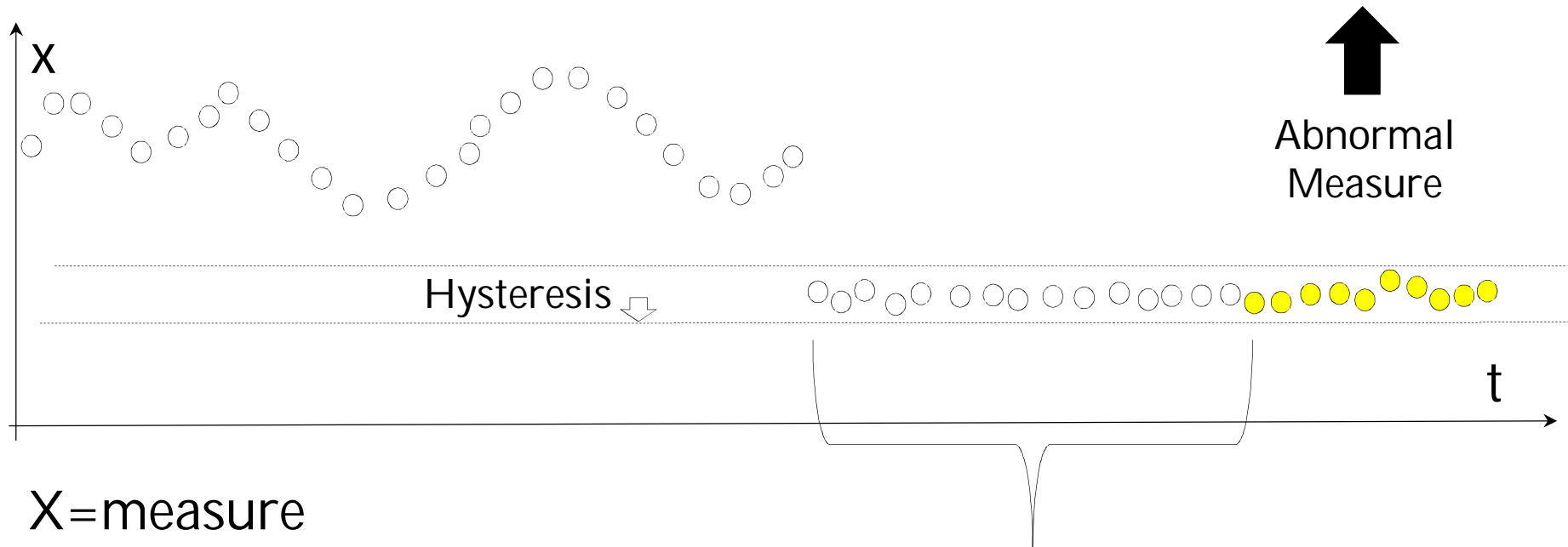
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ABNORMAL MEASURE 🟡 ❓ DISTRICT OUT OF CONTROL

Abnormal
Measure

Hysteresis

Time value

t

X=measure
Lup=x+hysteresis
Ldown=x-hysteresis

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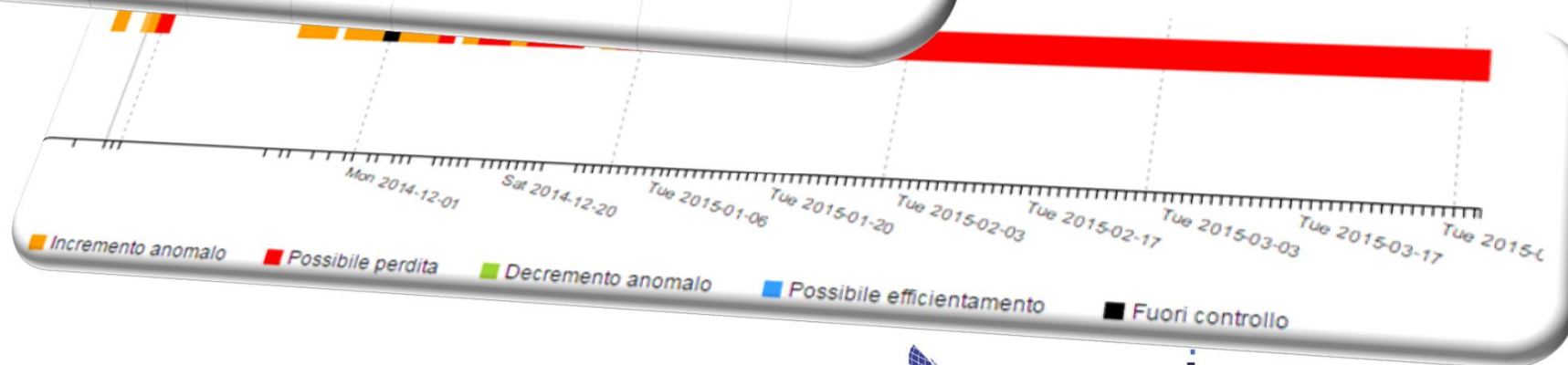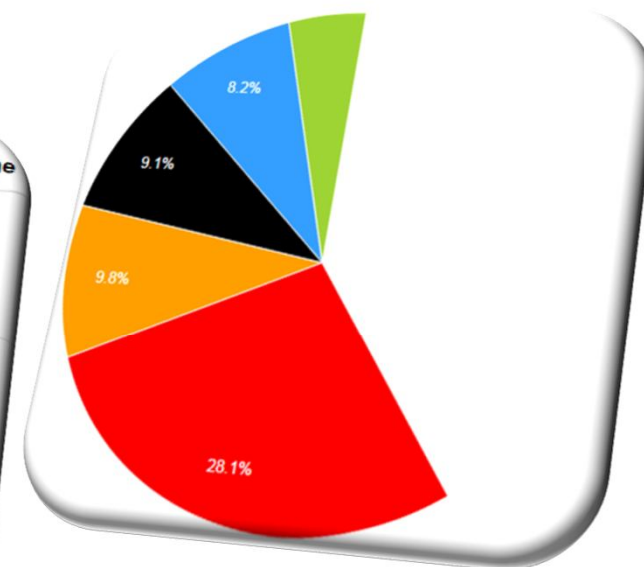
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EVENTS REPORTING

Tipo	Durata [giorni]	Valore [l/s]	Ranking	Data	Distretto	Delta value [l/s]	Descrizione
5	0	0	100%	2014-12-01	rete cascina pettori musigliano	0	?
2	30	6.9	5.48%	2015-01-20	rete cascina pettori musigliano	1	
2	4	6.04	0.8%	2015-02-26	rete cascina pettori musigliano	0.14	

8.2%

9.1%

9.8%

28.1%

Mon 2014-12-01   Sat 2014-12-20   Tue 2015-01-06   Tue 2015-01-20   Tue 2015-02-03   Tue 2015-02-17   Tue 2015-03-03   Tue 2015-03-17   Tue 2015-0

■ Incremento anomalo   ■ Possibile perdita   ■ Decremento anomalo   ■ Possibile efficientamento   ■ Fuori controllo

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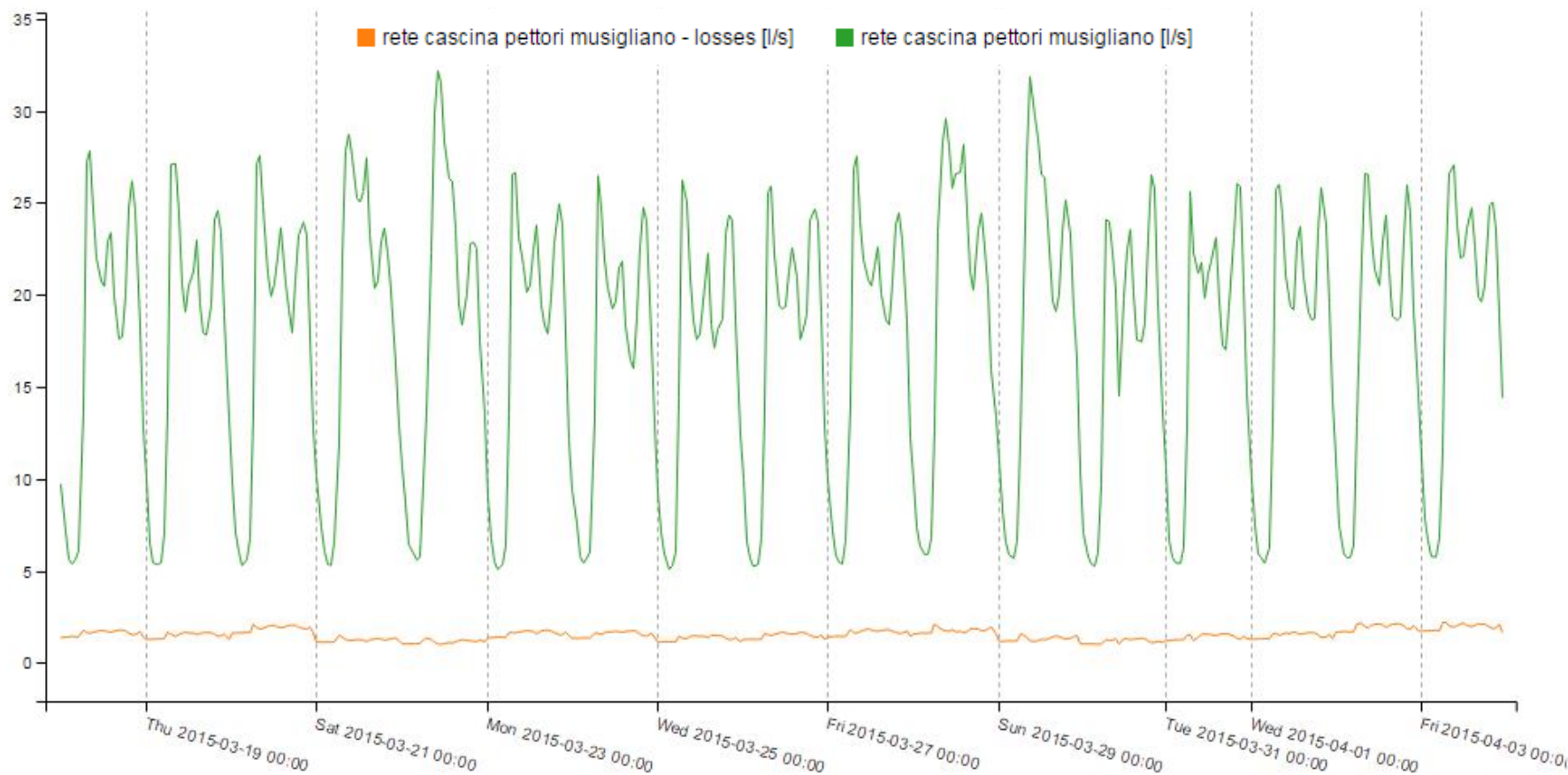**International Seminar** "*European Water Utility Management*", Pisa (IT), June 3rd 2015

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DEMAND PROFILES

rete cascina pettori musigliano - losses [l/s]   rete cascina pettori musigliano [l/s]

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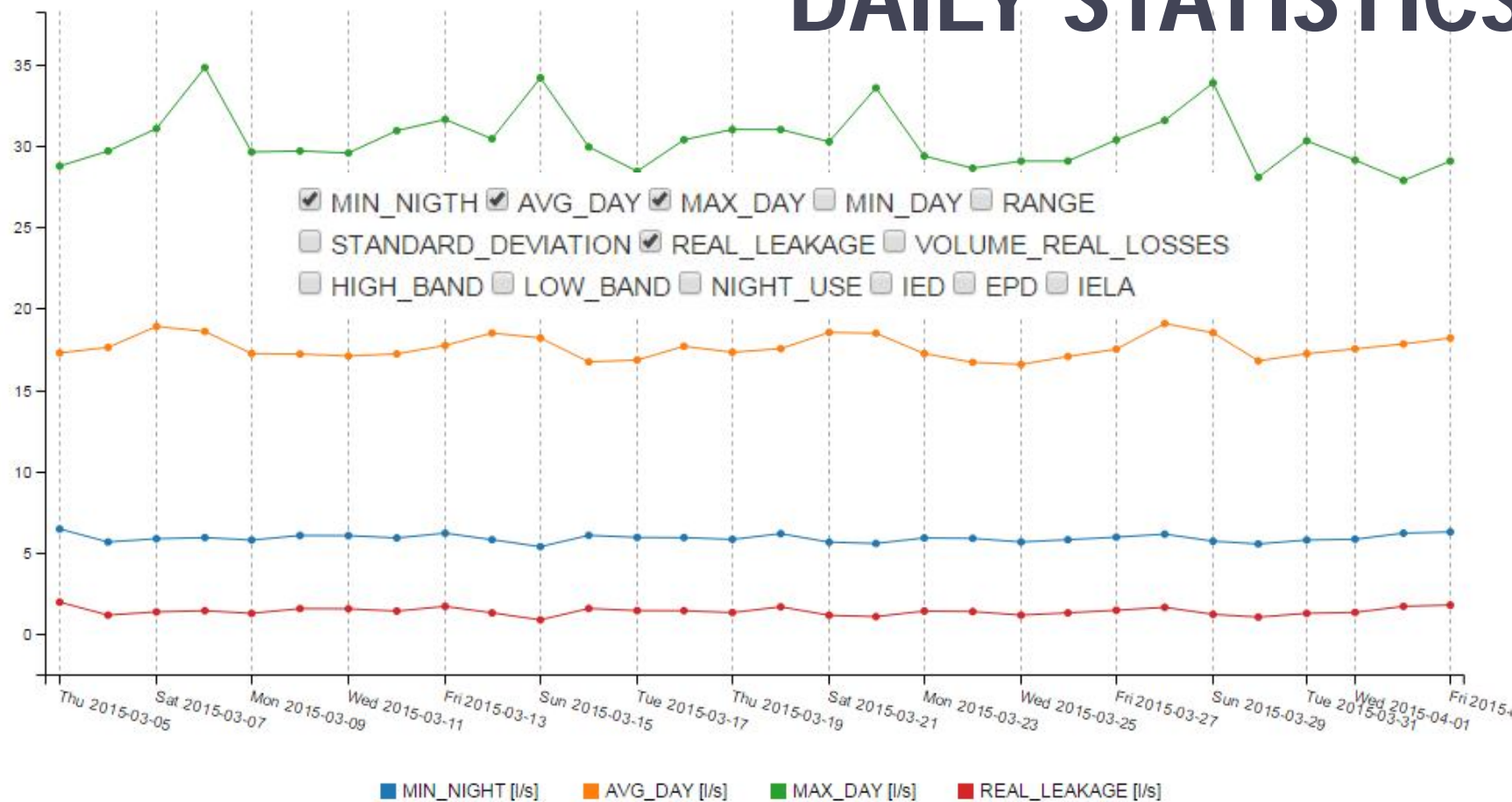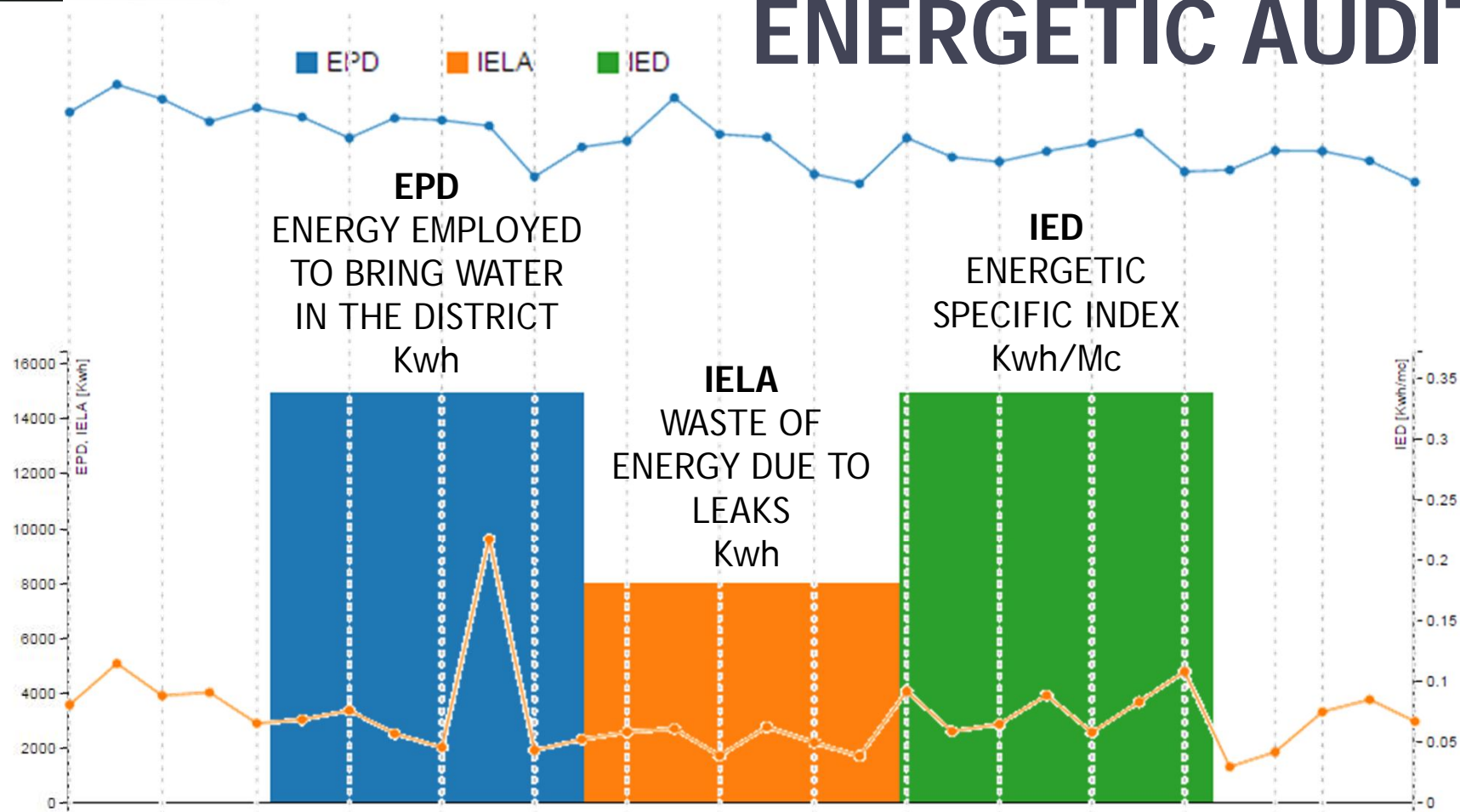**International Seminar "*European Water Utility Management*", Pisa (IT), June 3rd 2015**

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DAILY STATISTICS

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ENERGETIC AUDIT

■ EPD   ■ IELA   ■ IED

EPD
ENERGY EMPLOYED
TO BRING WATER
IN THE DISTRICT
Kwh

IELA
WASTE OF
ENERGY DUE TO
LEAKS
Kwh

IED
ENERGETIC
SPECIFIC INDEX
Kwh/Mc

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ENERGETIC AUDIT

REMEMBER THAT:

Every cubic meter of water pumped into a water network, that does not reach final use, sums up the quantity of **WATER TAKEN IN EXCESS**, the **ENERGY** to treat it and the **EMISSIONS** linked

Just think that the energy required to deliver 1000 litres at tap is in a range between **0.3** to **0.6 KWh**

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ARCHITECTURE

KNOW-HOW

SCADA

WETNET SENSORS → Engine ⟷ Database WetNet ⟷ Web-Application

Others...
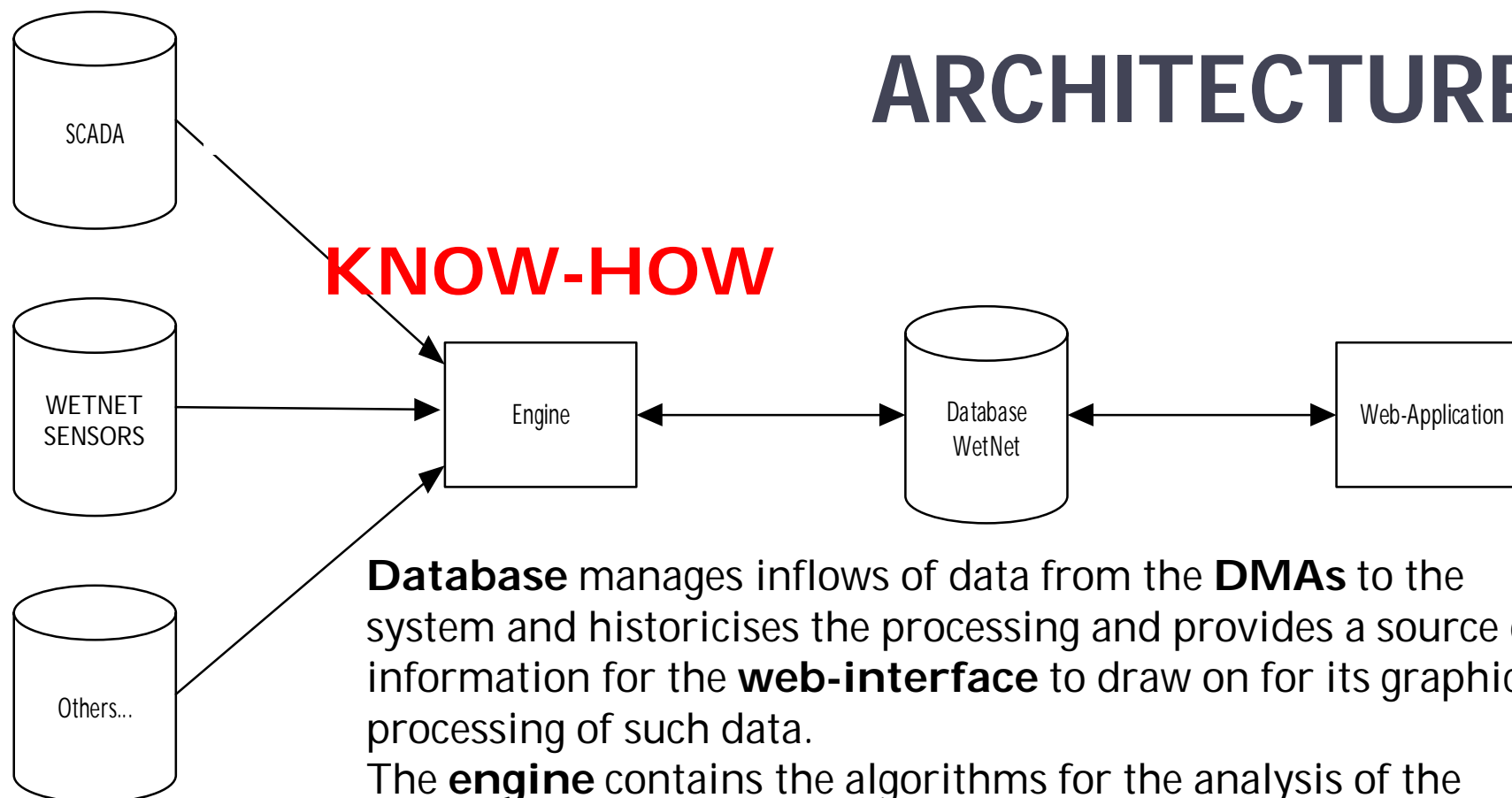
Database manages inflows of data from the **DMAs** to the system and historicises the processing and provides a source of information for the **web-interface** to draw on for its graphic processing of such data.
The **engine** contains the algorithms for the analysis of the **DMAs**.

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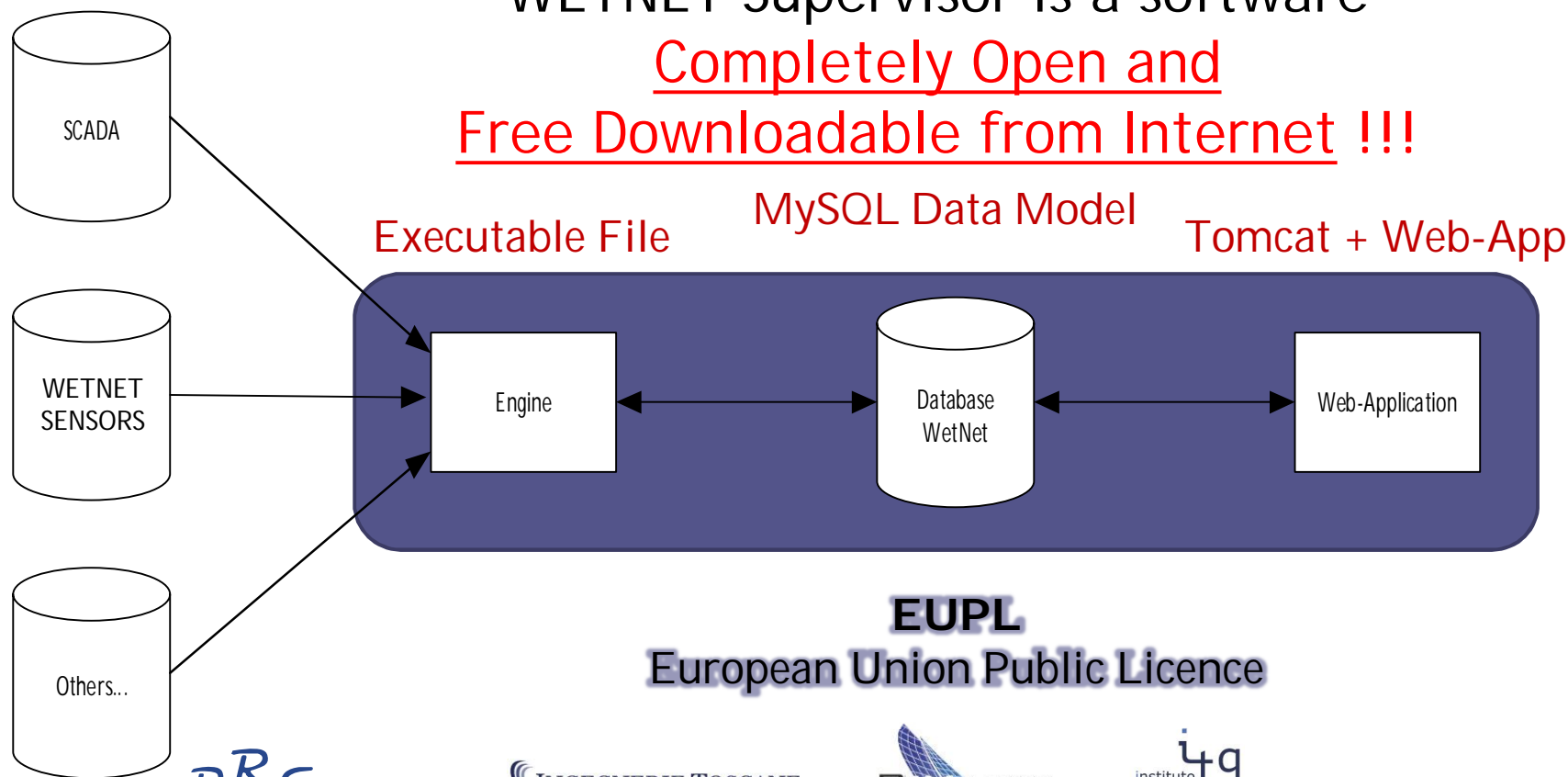
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OPEN SOURCE

WETNET Supervisor is a software
Completely Open and
Free Downloadable from Internet !!!

MySQL Data Model

Executable File

Tomcat + Web-App

SCADA

WETNET SENSORS

Others...

Engine

Database WetNet

Web-Application

EUPL
European Union Public Licence

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SOFTWARE ARCHITECTURE

Microsoft Windows Server
OPERATIVE SYSTEM

.NET
Framework

Java

MySQL
Database

Engine
Service

Apache
Tomcat+Web-App

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WETNET ADVANTAGES AND CHARACTERISTICS

Good fit for **major operators** and
small municipality services

Good for **pipes of different age and type** and when
networks are managed with **different approaches**

Solution that fits seamlessly in water operators' daily work

Maintenance and **replacement** are **easy** and **cheap**

Flexible, in terms of configuration and resolution, and
scalable, in terms of degree of delegation and automation
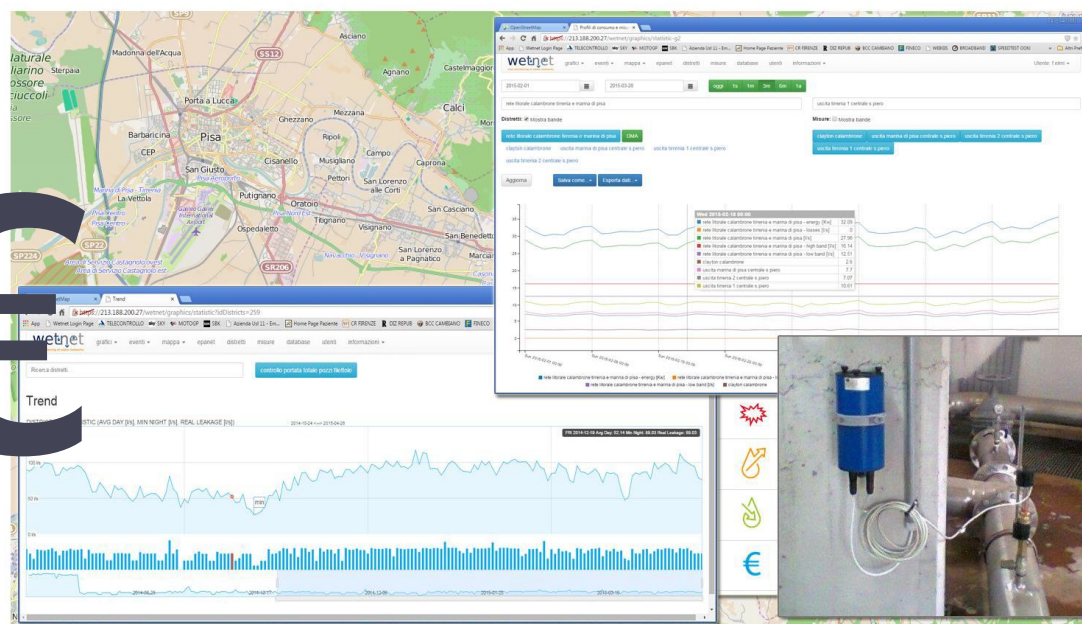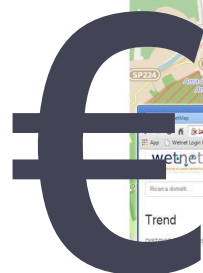
WETNET Supervisory Unit

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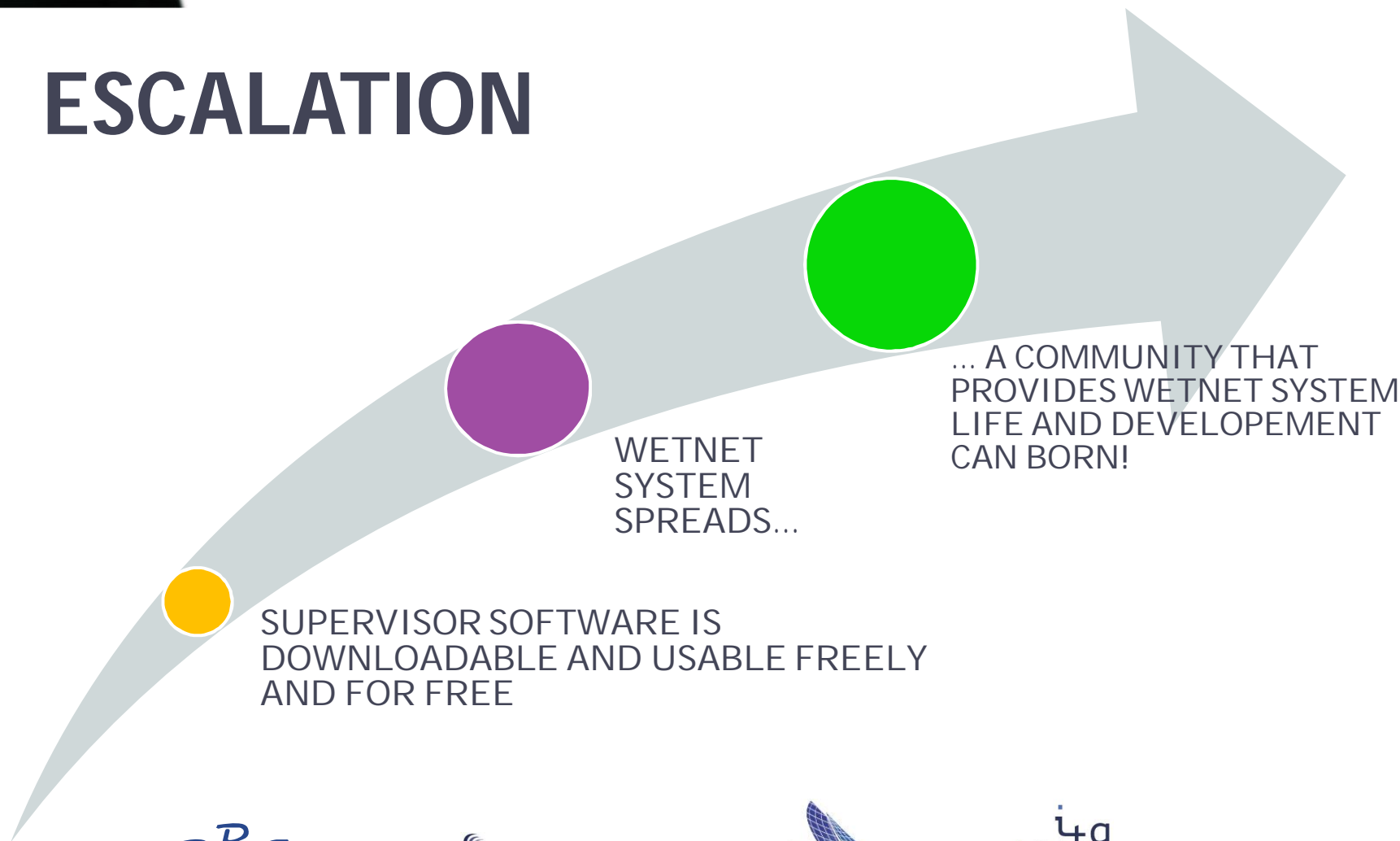**International Seminar** "*European Water Utility Management*" , Pisa (IT), June 3rd 2015

ESCALATION

... A COMMUNITY THAT
PROVIDES WETNET SYSTEM
LIFE AND DEVELOPEMENT
CAN BORN!

WETNET
SYSTEM
SPREADS...

SUPERVISOR SOFTWARE IS
DOWNLOADABLE AND USABLE FREELY
AND FOR FREE

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CONTACTS

wetnet

Web source: http://www.wetnet.it
E-mail: wetnet@wetnet.it ; sales@wetnet.it

INGEGNERIE TOSCANE

Web source: http://www.ingegnerietoscane.net

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Web source: http://www.bre.pisa.it
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