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Deployment of networks of Optiqua EventLab refractive index sensors for distribution network monitoring

- a practical case study -

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Optiqua Technologies

TLV Convention Center
Israel's business and culture site

kenes exhibitions

Water Quality - distribution networks are the weak link

Water quality in distribution networks remains largely unknown and unmonitored

- Water Quality is controlled during production
- Distribution network is a black box

Water distribution systems are (physically) vulnerable

- Accidental contaminations (backflow, ingress, pipe bursts)
- Intentional contaminations
- Impossible to protect by physical security measures
- Ageing assets

Current approach

- Relies on grab sampling
- incapable of effective monitoring quality and its dynamics
- (Pro-)active informing of customers impossible

Need for online, real-time monitoring throughout the distribution network

Real time water quality monitoring makes a water network smarter

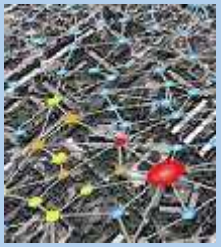
Early warning of water quality incidents

Continuous operational feedback on water quality

Enables utilities to improve understanding and control of

- Distribution process
- Infra-structure condition
- Treatment process

- Cost savings in multiple areas
- Lower operating risk
- Improved process stability
- Greater safety and security
- Improved customer satisfaction



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Optiqua: provider of innovative sensor technology and smart monitoring solutions for the water industry

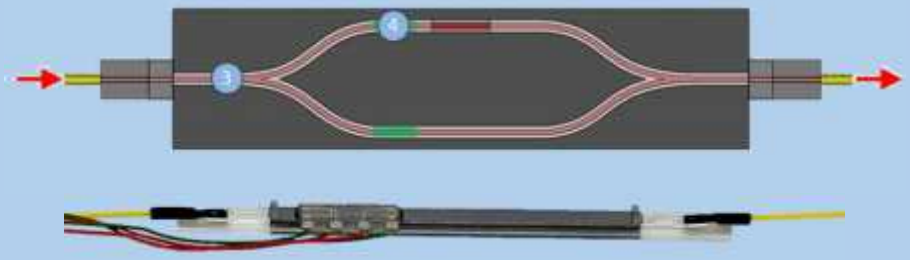
Based in The Netherlands & Singapore



EventLab

Generic online water quality monitoring in the distribution network

Optical sensor platform Patented and awarded technology



Asian Innovation Awards 2011

Water Top 50

MiniLab

Specific (water quality) measurement for sample based analysis

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Optiqua EventLab: complete solution for real time continuous water quality monitoring throughout the network

1

EventLab

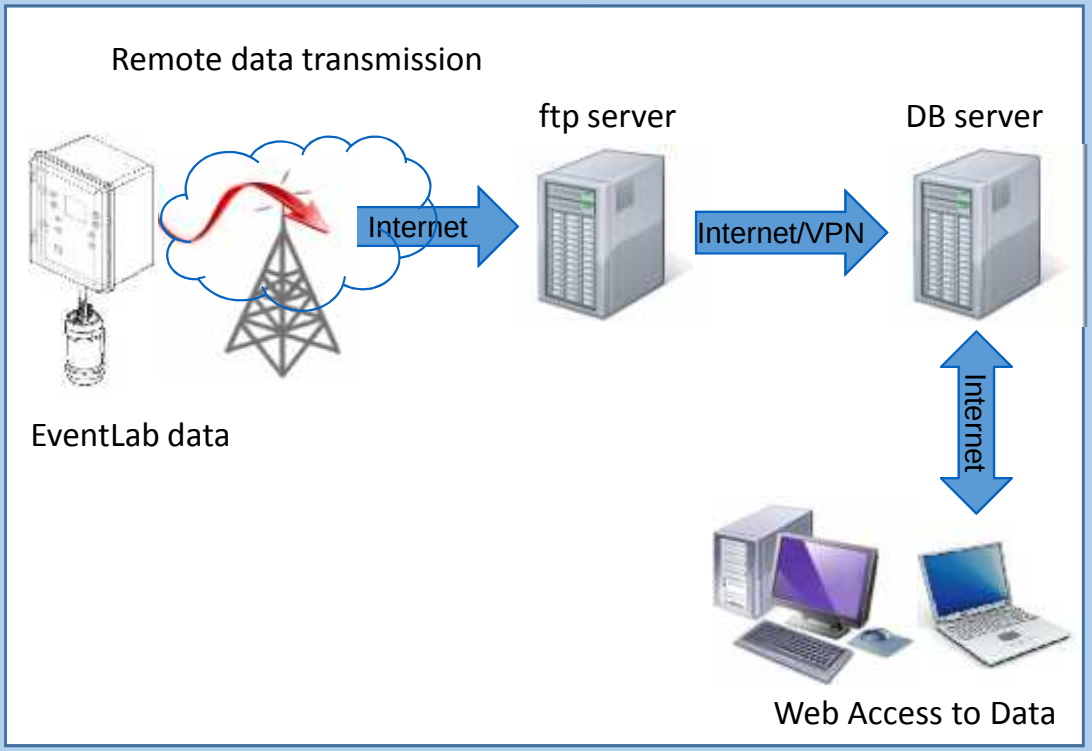
- Optical
- Refractive Index
- Minimal maintenance
- Full spectrum detection
- No calibration
- ppm sensitivity

2

Controller transmits sensor readings to SCADA and through wireless protocol (e.g. GPRS)

3

- **Sensor network information** processed at central data server
- Software algorithms determine natural variations and flag water quality incidents
- Network overview accessible via web based user interface



How refractive index compares to other water quality parameters

Responds to all chemical substances
(including chemicals invisible to all other sensors)

Sensitivity for all substances in same order of magnitude

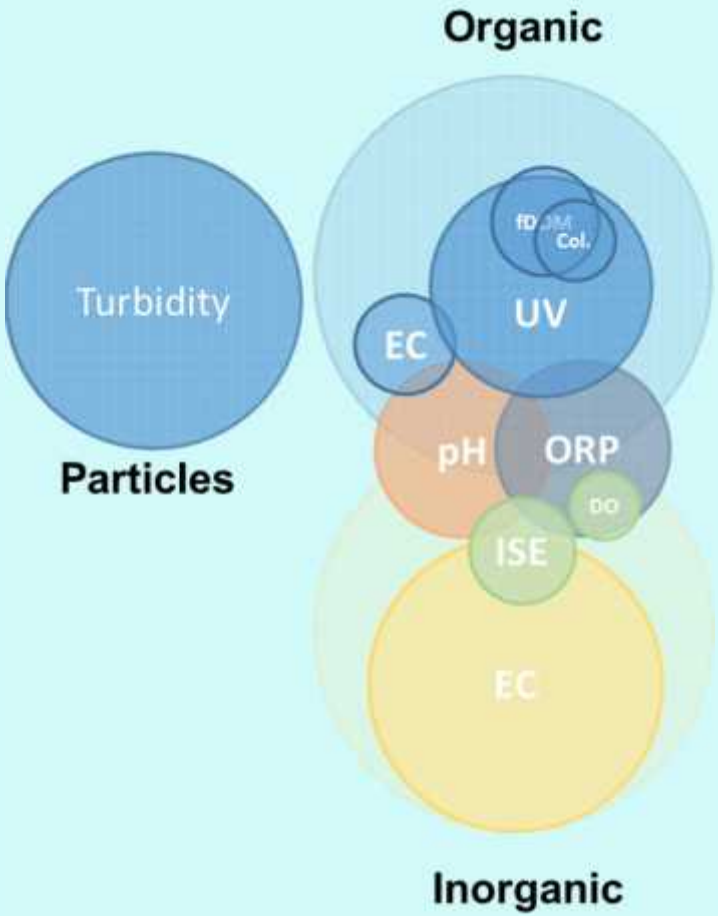
Response linear with concentration

Sensitivity independent of chemical reactivity of substance

Response independent of water matrix (temp., ion activity, …)

- Long term stability (no aging)
- Fast response time (immediate)

Traditional Arrays



False sense of security

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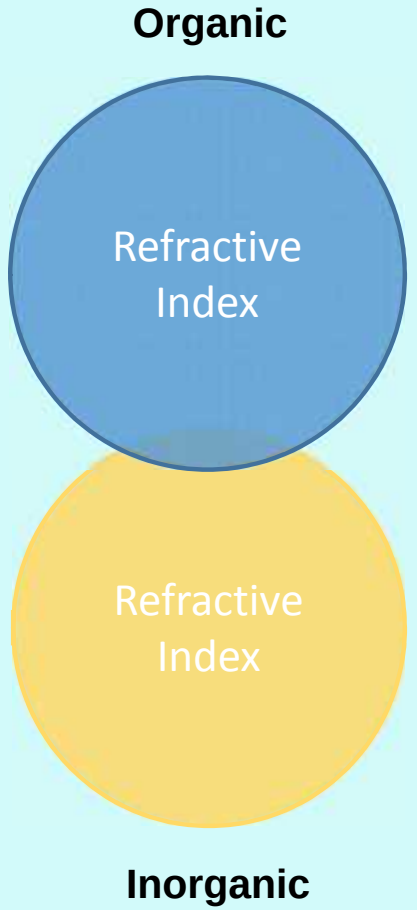
EventLab



Full spectrum of dissolved components

Case Study: Public Utilities Board Singapore
EventLab network deployed throughout Central Business District

PUB is the Singapore national water and wastewater company providing services to approx. 5.5 million customers

Vision: implement real-time monitoring in their distribution networks

EventLab is a part of water safety and security program

Currently 25 EventLab systems deployed in CBD area (plus 5 at temporary locations)

300 locations identified for island wide roll out

PUB
Water for All: Conserve, Value, Enjoy

Case Study: Vitens (the Netherlands)

Vitens is the largest water utility in the Netherlands providing drinking water to 5.4 million customers

Investing heavily into intelligent water supply. First implementation in Province of Friesland (7300 kilometers of pipes, 300,000 connections)

Network of 80 EventLab systems deployed

EventLab formally approved for full scale implementation

"The Optiqua EventLab works and is reliable. The water company is now determining its roll-out plan."

In H2O vol 7/8, 2014 the Dutch magazine for water professionals

Production plant

Pumping stations / Reservoirs

End user points

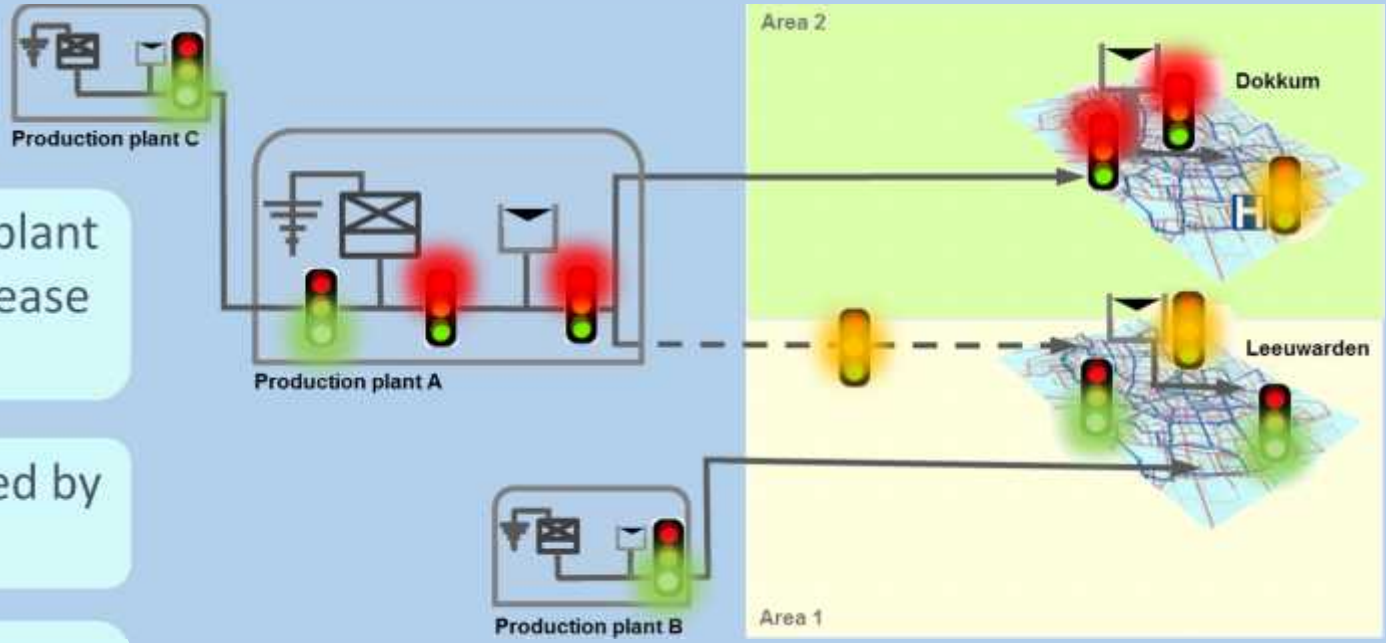
Case study shows how EventLab tracks water quality incidents throughout the Vitens network

Sequence of events that led to disruption of water production for 36 hours and water quality incident

Software issues at treatment plant after maintenance led to increase in water hardness

Incident was completely missed by traditional sensors

EventLab detected incident at the source and tracked it in real time through the network



Notification of critical customers

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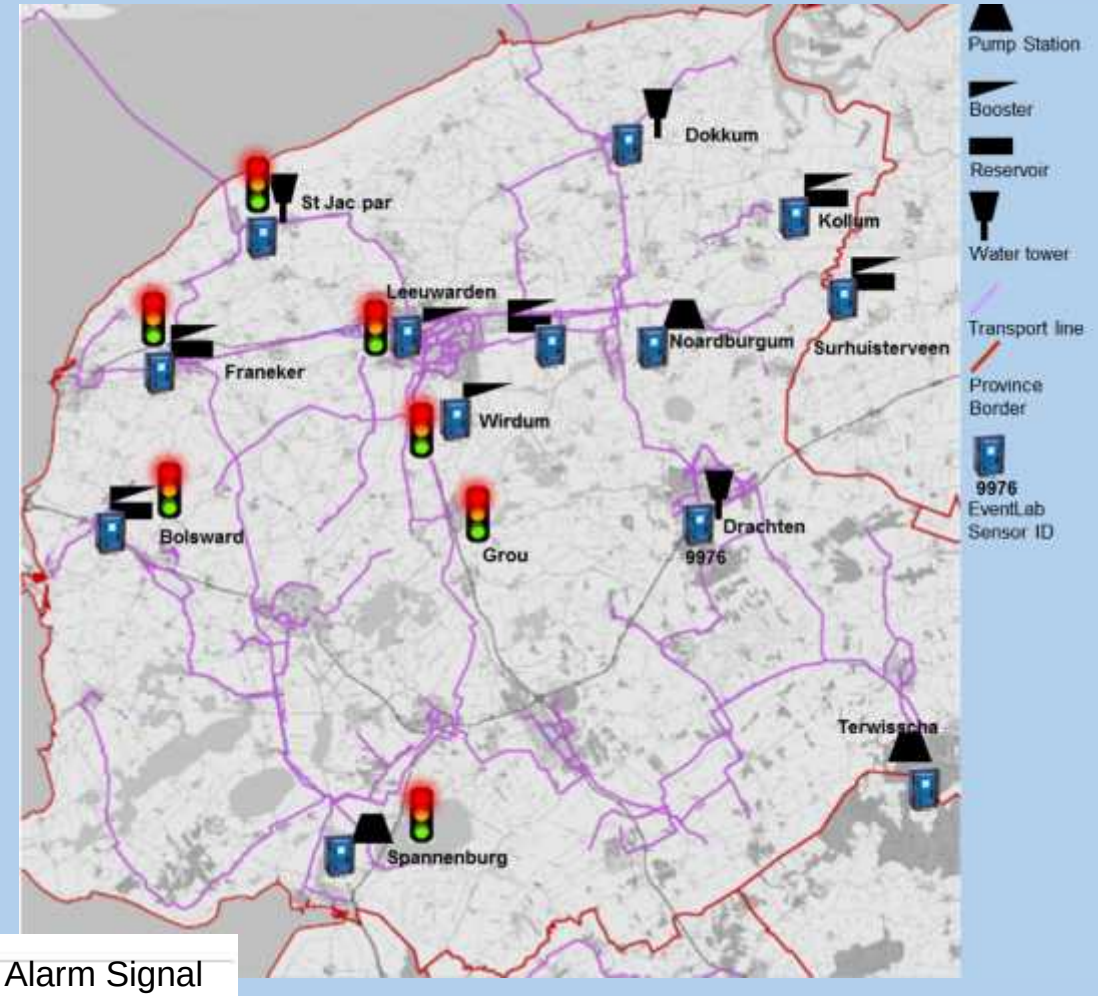
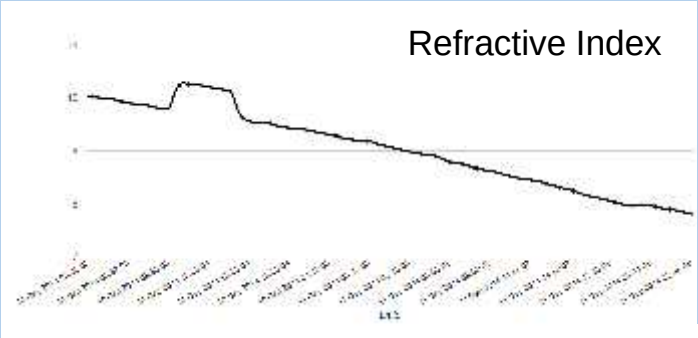
Vitens Case 2: Coloured water distribution resulted in customer complaints

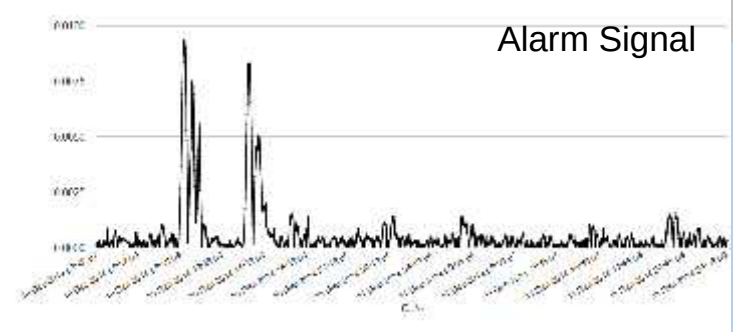
Power Outage

During plant restart issues with decolouring reactor

Plug of Coloured water distributed







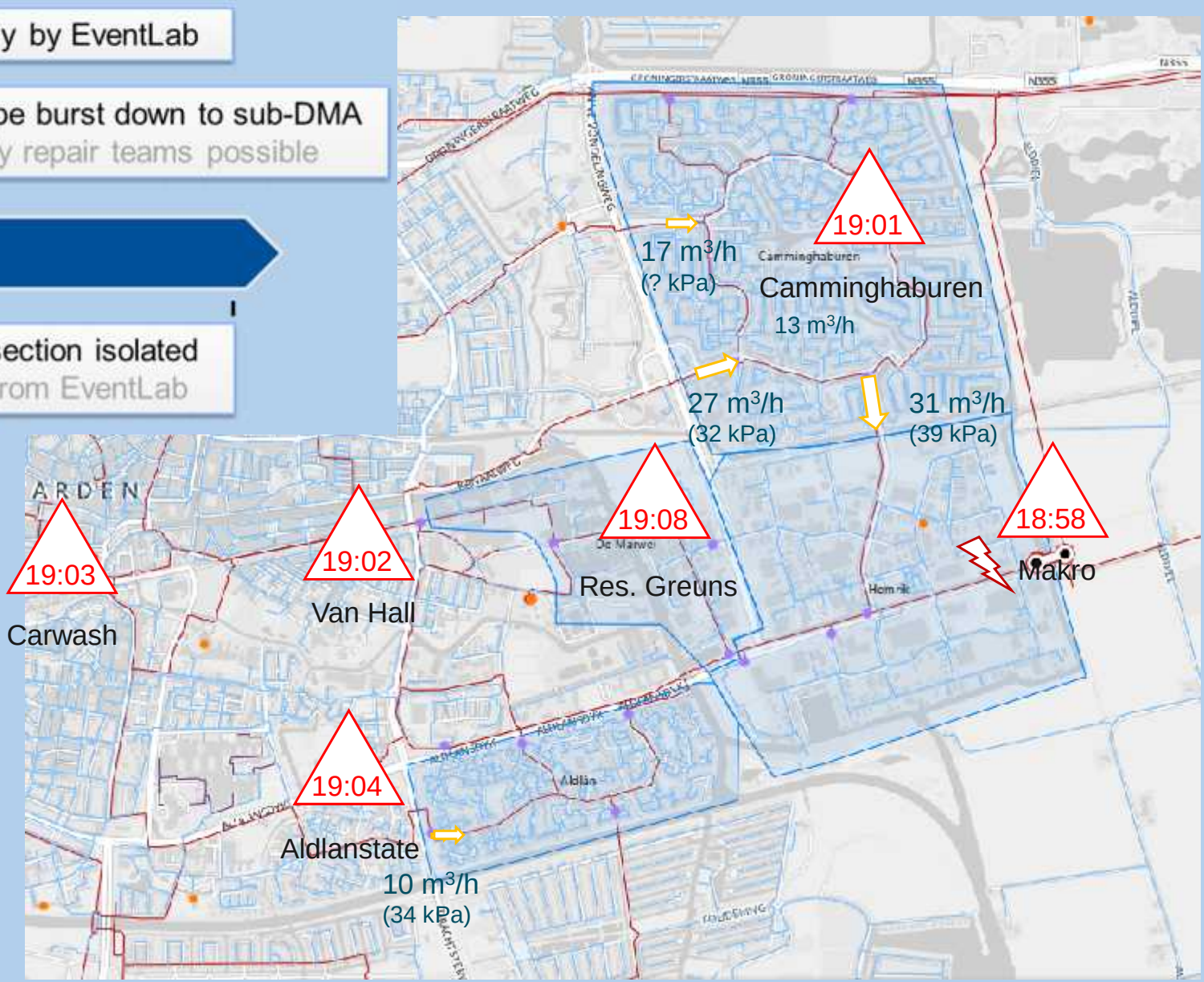
EventLab part of smart water network solution integration with other components = maximum added value

Major Pipe Burst

+1 min Detection of anomaly by EventLab

+5 min Localisation of pipe burst down to sub-DMA level, focussing search by repair teams possible

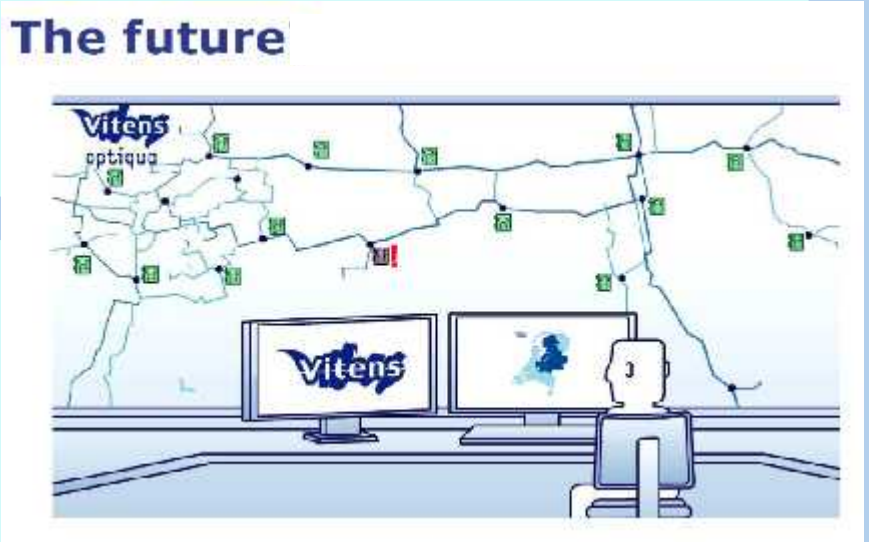
+2h Leak localised, section isolated
Without information from EventLab



Vitens Conclusions

Added value of Optiqua Eventlab has been demonstrated based on:

- Laboratory experiments
- Controlled experiments in distribution network
- Real events



Challenges:

- Optimize Sensor Placement
- Reponse strategy
- Embed in Utility Organisation

Next Step - Friesland Live!

- Province of Friesland will become showcase of Vitens of Next Generation Water Company

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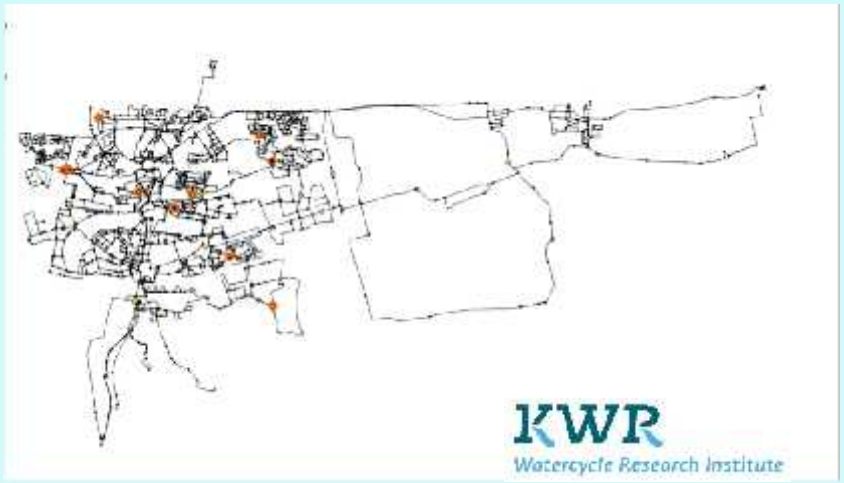
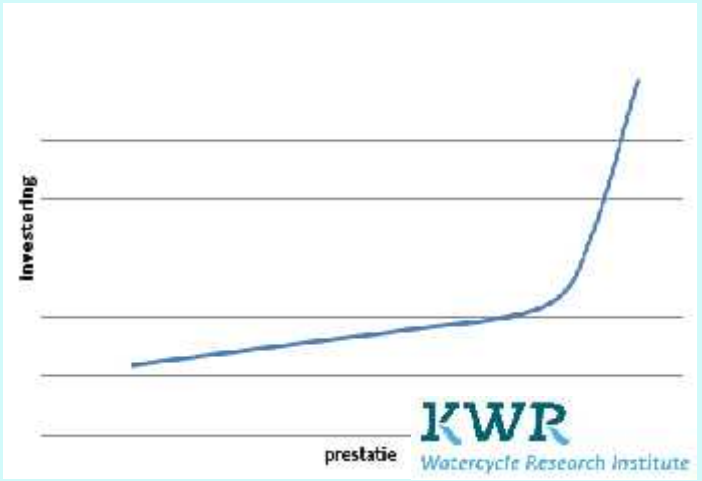
Optimising Sensor Placement



Modelling Sensor Placement



Cost Benefit Analysis

Practicalities of sensor placement

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Strong international interest and fast growing commercial traction

Optiqua's products have been developed in partnership with leading utilities

PUB
Water for All: Conserve, Value, Enjoy

Vitens

Las Vegas (USA)

EventLab selected for smart water network.

Acciona Agua (Spain)

acciona Agua

Network of sensors in Burgos (Spain).

SW4EU

This project is supported by EU FP7 Grant Agreement 619024

eThekwini (South Africa)

EventLab network in city of Durban.

Mekorot (Israel)

MEKOROT

National water company of Israel.

Further customers include:

Agbar

TÜV SÜD

Université Lille1

Maynilad

waternet

wlr water ecosystems advies

Summary

There is a need for online, real-time water quality monitoring throughout the distribution network

Optiqua's Refractive Index Measurement

- One technology for monitoring the whole spectrum of dissolved components
- Meets requirements for system suitable for deployment throughout distribution networks where traditional monitoring technologies fall short

Optiqua EventLab

- Validated and proven in operational networks
- Basis for WQ monitoring strategy

Implementation requires organisation

- Sensor placement is critical for success
- Operational and organisational integration

Thank you for your attention!

For more information

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