Projet WAVES : Des flux de données brutes et hétérogènes à l'information qualifiée

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Livrable D6.1
Prototype v0 et rapport d'études

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4 Introduction & abstract

The deliverable D6 is organized in two documents:

1. AQUADVANCED, baseline for information qualification.
2. Prototyping (data set & reasoning).

The document in question aims at presenting AQUADVANCED, application dedicated to the follow up of the performance of the drinking water supply system.

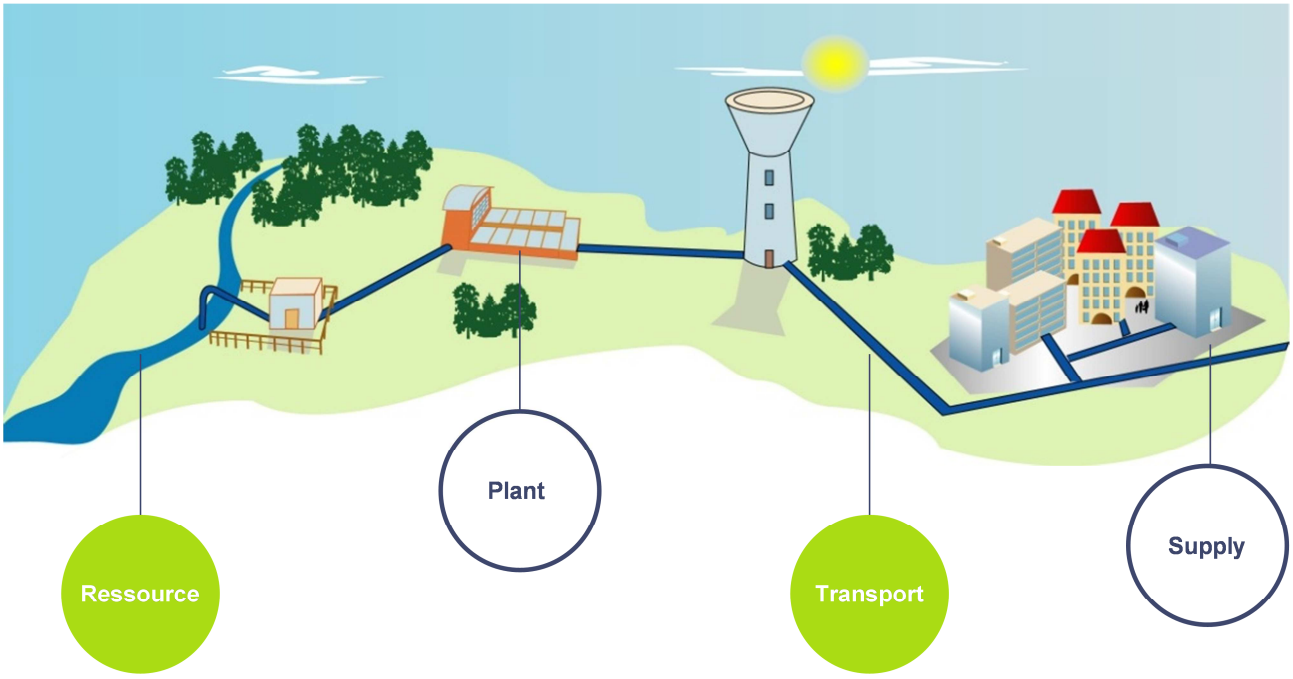
Optimization of the distribution networks performance is a key issue for the control of the water supply service. Improving the efficiency of drinking water supply system requires a continuous and comprehensive knowledge of their functioning.

Today more and more devices are deployed, allowing collection of real-time measurements (sensors, smart meters, etc.) These devices, as well as the other data sources deliver every day an increasing quantity of data: It is necessary to sort out and transform such data in valuable information for various users (operators, public authorities or final users).

Summary

5 Aquadvanced concept

As shown in the following diagram, each domain of the drinking part of the urban water cycle is addressed by AQUADVANCED.



AQUADVANCED is a suite of dedicated modules based on a framework of functionalities (Foundation).

AQUADVANCED™ Foundation
• User friendly map based interface • Intelligent detection of events in time and space • Contextual computation of indicators • Integration with the Operation Information System • Data acquisition and treatment

AQUADVANCED™ Wells	AQUADVANCED™ Energy	AQUADVANCED™ Hydaulic	AQUADVANCED™ Quality
Dedicated to the resource management • Management of the well's field • Local pumping optimization	**Energy management for drinking water supply system** • Consumption forecast • Defining of optimised setpoints for production and distribution network • Immediate transmission of setpoints to the control systems • Global energy optimization	**Real-time and thematic network monitoring** • Pressure, quality, NRW, field interventions, customer complaints, etc. • Operating simulations	**Management of the drinking water quality** • Collection of data from quality parameters • Connection to LIMS

Modules can be specific for a domain of the drinking part of the urban water cycle or used in a cross-domain way:

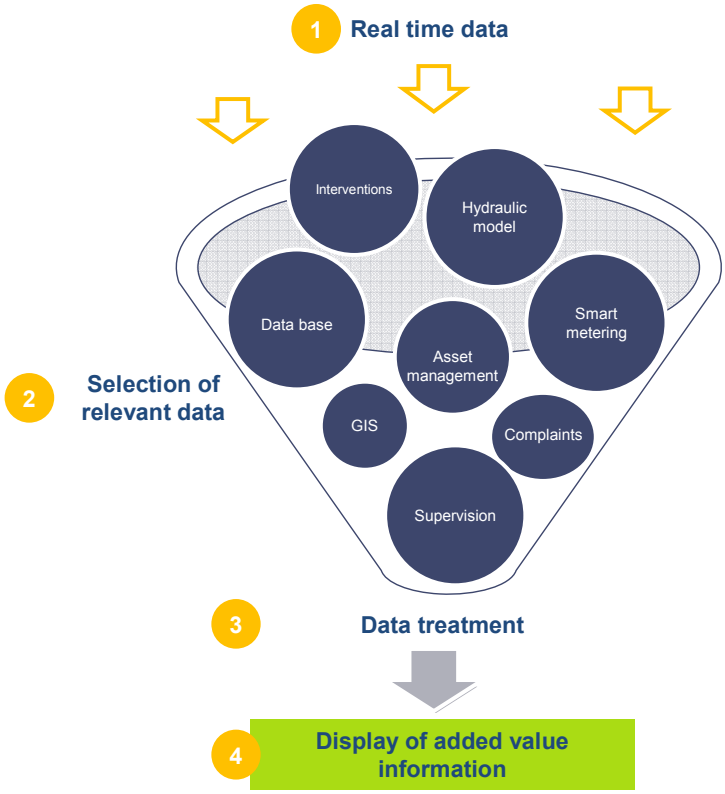
- AQUADVANCED Hydraulic monitors the hydraulic performance of each segment of the water production and distribution system.
- AQUADVANCED Wells helps to preserve water resources.
- AQUADVANCED Energy helps to reduce energetic expenses for drinking water production.
- AQUADVANCED Quality monitors the water quality from the pumping to distribution network.

The principle of AQUADVANCED is quite simple, as shown in the following diagram:

- Heterogeneous data can be accessed from AQUADVANCED (See section 6),
- A two-level data management (data treatment in the diagram below) is applied to the data (See section 8),

– Information created on the basis of the validated data is displayed to the users thanks to a web-based geographical user interface (See section 7).

More details are given in the three following sections.



6 Data access

AQUADVANCED is integrated with the operation information system. Any data from the most commonly existing applications can be accessed:

– Measurements from sensor (hydraulic & quality),
– Data from smart meters (Automatic Meter Reading),
– Complaints (filtered: quality & hydraulic problems),
– Interventions (filtered: related to network),
– Supervisory Control and Data Acquisition (SCADA),
– Geographical Information System (GIS),
– Long term data base (Data Historian),
– Simulation tool, based on hydraulic model,
– Laboratory Information Management System (LIMS),
– Enterprise Asset Management (EAM),
– Workforce management,
– Customer Information System (CIS).

Data accessed from these applications is filtered to feed AQUADVANCED with relevant information only, i.e. useful to help in understanding the behavior of the network. As an example, complaints read from the Customer Information System are filtered to get the ones related to hydraulic or quality issues only.

7 Data display

AQUADVANCED can display any data accessed from the various sources listed above in order to provide to the users a unique platform that can meet multiple needs.

7.1 Contextual dashboard

As exposed above, one of the objectives is to measure the performance of the drinking water supply system. To meet this objective, AQUADVANCED provides a set of indicators integrated in a contextual dashboard.

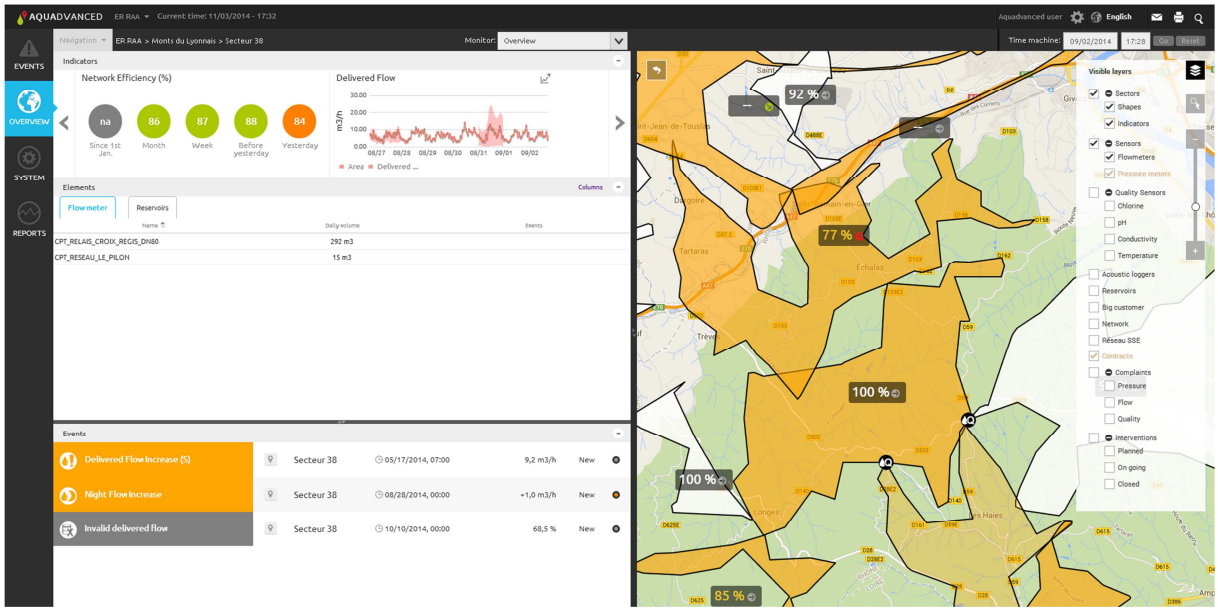
This contextual dashboard allows visualizing, in a simple and ergonomic way, the performance indicators collected or calculated by the application:

- On several timescales (real time, previous day, week, month, year…).
- On various geographical areas, i.e. for the whole network and locally for every hydraulic zone (sector or District Metered Area – DMA).

Every indicator is completed by a trend or an element of comparison (comparison with a reference or previous year, accumulated gap…) allowing a fast understanding of the performance level.

Main functionalities available for contextual dashboard:

- Set of KPIs displayed to highlight the main information to be considered by the operator
- Interactive content depending on the level in the navigation tree, activated functions or chosen filters
- Use of different types of presentation, (tables of sensor values, graph carousels…)
- Drill down into hydraulic hierarchy (network, DMA)



7.2 Map based display

AQUADVANCED offers a way to measure the performance level through a geographical approach. The map view of the network is enriched thanks to a dynamic link with the existing GIS (Geographical Information System) based on OGC (Open Geographical Consortium) standards.

The “zoom” function helps the user to reach several levels of information according to the considered scale: from the most general (whole network or system) to the most detailed (at the pipe level). A detailed view by hydraulic zone is displayed showing all elements relevant for the analysis of the situation in real time. Every available element is classified by category in thematic views (thematic views are describe below). The information can be displayed or masked easily thanks to a layer panel for a user-friendly display of the information.

Main functionalities available in map based display:

- Dynamic map view of the monitored perimeter (distribution network with DMAs, transportation network, consumption areas…)
- Read-only link to GIS with synchronization based on web services,
- Display of any geolocalized entity (assets, sensors, complaints, consumptions, interventions …)

7.3 Performance indicators

AQUADVANCED monitors computed indicators in real time for each level in the navigation tree (from DMA to the entire network) as:

- NRW (Non-Revenue Water),
- Loss index,
- Low chlorine residual occurrences.

7.4 Event details

- Automatic detection of anomalies in real time,
- Localization of dysfunctions,
- Event life cycle process.

7.5 Specific view

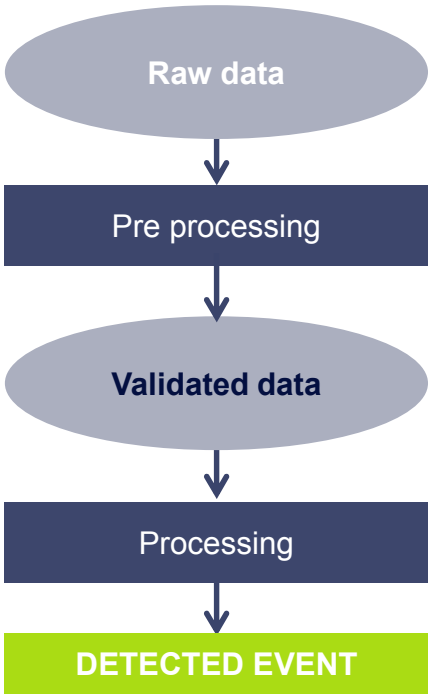
- Hydraulic view: monitors hydraulic performance and leak detection,
- Acoustic view: leak detection based on acoustic loggers installed in the water distribution network,
- Water supply,
- Water quality analysis.

8 Data management

The diagram below shows the logic of the data management.

Quality of data must be assessed prior to computation of event or indicator. This is why preprocessing is a key step of the AQUADVANCED data management. Specific preprocessing treatments are embedded:

- Automatic raw data validation using attributes of the entities (e.g. flow data limited using diameter of meter),
- Automatic estimation of missing & invalid data,
- Early detection of sensor malfunction (noise, drift, failure).



Processing aims at computing information useful for the user as indicators and events. This is detailed in the two following sections.

9 Event detection

AQUADVANCED has specific event detection functionality. Each anomalies or dysfunctions will be notified to the operator through a specific view: the event management view.

Different types of event can be detected and displayed:

- Hydraulic event, based on flow, pressure, level, acoustic sensor,
- Quality event, based on water quality parameters,
- Data quality & system event.

AQUADVANCED uses various event detection methods, such as:

- Threshold method,
- Advanced detection, based on signal forecast or other techniques.

The user manages the status of events thanks to the event life cycle which allows:

- Traceability (type, event's status, date, number of occurrences…),
- Comments.

10 Computation of indicators

AQUADVANCED provides different types of indicators. Those indicators are computed taking into account the level in the hierarchy, i.e. network, pressure floor or DMA.

- Hydraulic performance indicators

  - Non-Revenue Water (NRW) or Network efficiency,
  - Daily delivered volume,
  - Night flow,
  - Loss index…

- Quality indicators

  - Global water quality as a combination of parameters,
  - Number of DMA with a parameter below a threshold per a period of time,
  - Number or % of values above a certain threshold for a parameter (e.g. chlorine residual)…

Each indicator can be computed on different time bases: daily, weekly or monthly for instance.

11 Bibliographie

Aucune source spécifiée dans le document actif.