



INTEGRATED EVENT MANAGEMENT

A new ‘must have’ layer in the operational architecture of water utilities

Abstract

Today, global water utilities face a multi-dimensional challenge: they have aging assets with budget and resource constraints, yet increasing customer expectations. To effectively respond to network “Events” (e.g. leak, water quality issue, faulty meter, etc.), utilities must manage the full life-cycle of events in the right priority and in a speedy manner. This will drive a higher efficiency in water network operations and result in much higher customer satisfaction. This white paper proposes a new paradigm for water Event Management drawn from other industries. It will focus on Asset Management, Customer Relationship Management and the missing layer, Integrated Event Management.

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Introduction – The need

Throughout history, people have devised systems for getting and using water more efficiently: the *qanat* systems of underground conduits in Persia, for example, are effectively pollution proof, suffer no evaporation losses and are over 3,000 years old. Progress really picked up speed in the Enlightenment era. In the 18th century, a rapidly growing population fueled the establishment of water supply networks. In London and Manchester, sanitation systems were added in Victorian times, once it was established that sewage contaminated water was a source of cholera. Since then, rapid urban population growth in developed and developing countries has triggered the establishment of governmental, municipal and private water utilities around the globe. Water utilities have invested billions of dollars in laying down the infrastructure required to supply the increasing demand for high-quality water, and for maintaining a reasonable level of service to their customers.

However, a water utility today faces several challenges:

- Aging assets (of different periods, types, and materials), some dating back to the initial Victorian expansion;
- Highly demanding customers (everyone expects satisfactory water service, adequate water pressure and good water quality in a 24/7 manner) – or, where the 24/7 condition cannot be met, at least an equitable distribution of clean, safe water per head, at predictable times of day;
- Limited resources (e.g. droughts, and over pumping of natural underground reservoirs)
- Costly operations (water utilities are the #1 energy consumers);
- Various exogenous problems such as errant backhoe loaders, traffic vibrations, loss of power, floods or earthquakes, customer theft, etc.;
- Inadequate pricing of their primary commodity – making it difficult to justify updates and in some cases, leak fixes.

As if these operational challenges were not enough, water utilities are also confronted with constant incidents and faults, such as:

- Network incidents such as faulty assets, leaks, bursts, etc.;
- Problems related to water quality;
- Network-operation faults such as a valve left open or installed in the reverse direction;
- Telemetry faults such as broadcasting problems, etc.

Any combination of these multi-dimensional challenges and incidents creates an "Event" that needs to be addressed by the water utility staff.

The challenge for water-utility management teams is optimizing their decision-making process in order to achieve the required level of service and the best utilization of the assets at a minimum cost with an effective response time to all events. In a utility's daily reality, it is often

just about maintaining service at the best possible level, given all the broken assets, and operational events.

An **Event-Management solution** is key to such an optimization challenge, which needs to embrace cross-organizational functions and work across all management levels. We propose here a paradigm for Event Management drawn from the IT industry.

Event Management - The analogy to the IT sector

An “Information Technology Infrastructure Library” (ITIL) comprises a set of practices for IT service management that focuses on aligning IT services with the needs of a business. ITIL defines a category named: **Incident Management**, which is relevant to issues like Cyber Security, where an ‘**incident**’ happens and needs to be detected, contained and resolved.

An Incident Management system is defined by the ITIL as the combination of the following seven phases:

1. Incident detection and recording
2. Classification and initial support
3. Investigation and diagnosis
4. Incident containment, as applicable
5. Resolution and recovery
6. Incident closure
7. Ownership and modeling

These seven components are broadly used in the cyber security industry and can be applied to any business using IT services. A full Event Management solution mirrors that of Information Technology Incident Management, both of which can be presented through a similar process, as seen in the table below.

Phase	Incident Management Description	Event Management Description
Identification & Registration	Detection of an incident	Detect an Event (by smart analytics) and allocate an Event ID number
Categorization	Incident categorization	Classifying Event Type (leak, faulty meter, etc).
Diagnosis & Prioritization	Symptoms of an incident Prioritized for better utilization	Event Information (location, magnitude, etc.) and set priority (big burst in rural area VS. small leak in a central location)
Containment	Limit possible damage	Isolate the incident (by automated pump and valve settings)

Investigation	Determine the cause	Analyze the root cause
Resolution	Solution	API to work order management and other operational systems
Incident Closure	Incident closed in system	Repair Verification (by analytics) and define the Event End Time, plus summary information (total water loss, repair time, etc.).

Event Management - Enabling technologies

In the last few years, new technologies have been introduced to the world of water utilities:

- Data transmission costs have dropped significantly;
- Self-powering meters have been introduced;
- Big data technologies enable the collection, aggregation, manipulation, and processing of extremely large volumes of data in near real time;
- Cloud computing reduce the cost of acquiring and maintaining massive onsite hardware in order to maintain and process large volumes of data;
- External data (e.g. weather information, assets histories) have become easily and cheaply accessible.

These technologies and conditions together with a set of newly developed data analytics algorithms enable the automated creation of most events in the water network, which in turn calls for a fully managed lifecycle of "Events."

Managing Life-Cycles

There are three, essential pillars for a water utility’s on-going operations:

1. Assets – in which huge investments have been made in the last few decades
2. Customers – the real users of the service and the ones paying the bill
3. Events – which need to be managed to ensure smooth on-going operations

In the last few decades, most advanced water utilities in the world are using mature Software Products to manage assets (e.g. few Asset Management solutions exist in the market, like Maximo by IBM) and to manage customers (CRM solutions are common with any service provider since the mid-1990’s). It seems that there is high level of similarity between these two solutions since both of them deals with managing the full life-cycle of the relevant ‘entity.’

Managing Assets

Asset Management for asset lifecycle and maintenance management is today's common solution for managing physical assets effectively in asset-intensive industries such as water utilities. A good Asset Management product allows water utilities to maintain system configurations, identify links between critical assets, schedule maintenance based on events, prior maintenance plans or predicted failures, manage inventory, generate work-orders and manage their execution, record work carried out, update asset histories, manage resources and personnel. Such a system enables managing the full life-cycle of all types of assets, optimizing their purchase, deployment, operational use, maintenance, and disposal. Trend analysis also enables persistent weaknesses to be discovered and for sharing and enforcement of best practices.

Managing Customers

A CRM product integrates all the phases of the customer life-cycle into three major processes: Solicitation, Lead-Tracking, and Relationship Management. For water utilities, the most crucial process is the Customer Relationship Management.

Whenever a customer interacts with the water utility, it is vital that the richness of information available on that customer informs and guides the processes that will help to maximize the customer's experience, while simultaneously making the interaction as effective and efficient as possible. This includes everything from avoiding repetition or rekeying of information, to viewing customer history, establishing context and initiating desired actions. Most CRM products available have a true 360-degree view of the customers including views of the past, present and future interactions and potential interactions of the customer with the water utility.

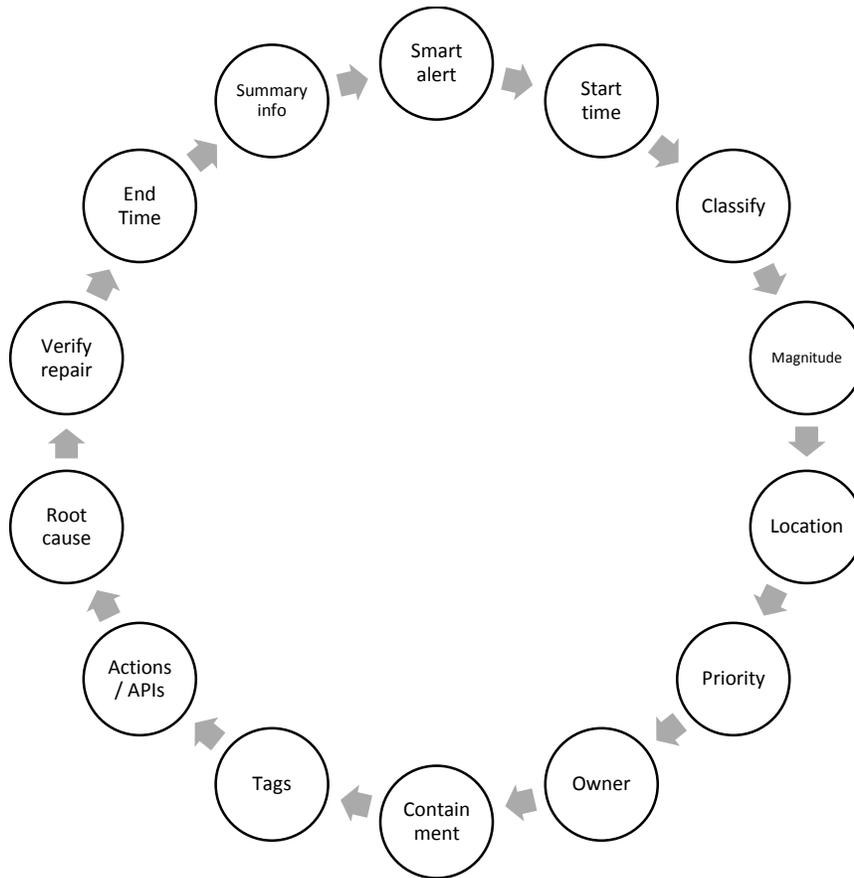
Delivering on managing the customer's full life-cycle with the 360-degree view is not simply about having a unified database of all activity, but rather being able to pull together the pieces of information that are relevant for a specific customer and specific interaction into an intuitive workspace for the agent regardless of organizational department and/or function.

Managing Events

Integrated Event Management solutions are now becoming available, and allow the water utility staff to manage the full event life-cycle.

The types of Events which can now be automatically detected is very wide, some of which are: Water Loss, Leaks, Bursts, Hidden Leak, Abnormal Usage Pattern, Faulty Meters, DMA Breach, No Data, Water Quality, Over/Under Pressure, Water Balance, and more.

The following diagram depicts an event management process from start to end.



Managing Water Quality, Level of Service, Environmental Impacts and more

The overall responsibility of water utilities is not about managing assets, nor is it about managing Events. They are expected to deliver good quality product ('water'), at appropriate pressure, in a 365/24/7 manner, with minimal environmental impact and at the lowest possible cost (it is a basic human civil right to get water). Achieving this target is highly dependent on being able to manage the three 'entities' mentioned above: Assets, Events and Customers.

Integrated Event Management - The missing layer

Utilities around the world collect a large amount of raw data, from internal sources (meters, sensors) as well as external ones (customer calls, central control room of the city, etc.). An Integrated Event Management solution aggregates different data types, from different sources, and by using several technological approaches (Data Analytics) it is able to detect 'significant events' which is the first phase in the event's full life-cycle. The ability to trigger that process is key and in most cases it is based on automated process.

From there on, the process continues according to the flow of information gathering about ‘the event’ and presenting it to decision makers in order to optimize their decisions, by getting higher visibility to each event or to any correlation between several.

Here is an example of a typical set of information that can be collected on each event and is needed in order to make smarter decisions. The table below shows a generic data set and a simple example with a water leak.

General Event	Example: LEAK
Smart Trigger / Smart Alert	The flow pattern in a specific supply zone has an abnormal pattern & higher levels of flow
Start Time	Analyze the pattern, compare to the ‘normal’ behavior, and estimate when the leak started
Classification / Type	Understand that this is a suspected leak
Magnitude / Size	Estimate by means of analytics what is the magnitude of the leak. Is it 5 liters/sec? or 50 l/s?
Location	Where the leak is? In which DMA or Pressure Zone?
Priority	Which is more important now? A big burst in a suburb area? Or a small hidden leak in the city center? Which critical non-water assets (such as hospitals) might be affected?
Containment	Which valves needs to be closed to limit the leak?
Owner	Accountability – who has the responsibility to take the necessary actions and fix the leak?
Tagging	Mark the event with sub-classification (e.g. there are several types of Leaks), some finer resolution of understanding the ‘event’
Actions & API	Connect to any other IT system in order to streamline the process (Assets Management, Work Order Management).
Root Cause	Possibly understand the root cause of the event
Verify Repair	Confirm (automatically, by means of analytics) that the flow data is back to its normal values and normal pattern
End Time	Measure the time when the event ended and mark the time it took to ‘repair’ the event (as an operational KPI)
Overall Measures	How much water was lost in this event? How much time it took to resolve? etc.

The target of an Integrated Event Management system is to provide real-time, actionable “Event” alerts such as faults, leaks, bursts, pressure, flow and level anomalies, water quality, and telemetry problems. This enables water utilities to ‘know’ about all the events, to manage the situation by receiving valuable insights and informative details (e.g. type and location), as well as helpful management tools (e.g. event prioritization, the event’s root cause, and repair verification). Therefore providing benefits on both a tactical and strategic level.

Such a comprehensive, decision-making platform can be utilized across the utility from the analyst monitoring the network to the executive team considering long-term strategic goals or CAPEX investment for the next quarter (e.g. where to replace assets).

The Future of Event Management

Today, water utilities transmit and collect more data than ever before. Cloud computing provides a cost-effective approach for processing and analyzing large volumes of data (Big Data). Integrated Event Management systems allow utilities to respond to network problems in real-time and manage the full event life-cycle. This enables utility management to make more educated decisions about their network operations from event identification through categorization and classification, prioritization, resource allocation, and all the way up to closure.

It is our vision that Integrated Event Management systems will transform the way utilities operate, resulting in a culture change and improved managerial processes. Already, implemented by major utilities worldwide, these innovative solutions will continue to become the reality for modern cities as they strive to become more efficient and customer-centric. In the future, Integrated Event Management systems will become essential for utilities seeking to maximize the value of their data and raise the bar on their performance.