Chapter 13

Software-based solutions

13.1 INTRODUCTION

With advances in digital technologies and data analytics, software-based solutions are being used by the water industry for leak detection, water loss reduction and water efficiency. These solutions need to be accompanied by changes in the mindset of the organization, with an acceptance that analytics can be used by utility management for decision-making and planning.

If we look at the last 10 years, the industry has gone through an evolution, building its trust in data and algorithms. The evolution of software solutions for leak detection can be divided into four main phases.

13.1.1 1st phase: Anomaly/Leak detection by analytics

Water utilities start to detect leaks using simple anomaly detection and statistical algorithms. Flow data was analysed in real-time using time series algorithms, leveraging on flow trends, and consumption patterns. Data from acoustic leak detection systems could also be added to the analysis. Separately, another stand of analytics led to the first leak *prediction* algorithms, based on statistical clustering of data on pipe composition, age, soil type, pressure history and so on.

13.1.2 2nd phase: Event detection by analytics

Leaks are not alone…with many anomalies in the water network, the solution evolved into event detection. Using data analytics and anomaly detection to detect multiple events or incidents in the network, the software expanded the range of anomalies which could be identified, e.g. leaks, bursts, pressure issues, asset problems, water quality to name but a few.

13.1.3 3rd phase: Event management

Once detections were made, it was necessary to bring to the users more information about each leak and other events, e.g. when it started, how big it is. With the growing need to extract more information,

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manage each event and prioritize them, software solutions turned into 'event management', managing the life cycle of the event, from start to resolution.

13.1.4 4th phase: Central event management (CEM)

This is when Central Event Management (CEM) came about, evolving into a central layer for managing all network events and bridging the operational silos between various stakeholders by integrating all the IT modules in the event software.

In a similar way that Customer Relationship Management (CRM) systems provide a central platform for all customer-related information, software-based CEM provides a central hub for incident-related information, combining all the different data sources of events into one operational layer, shared by all who need to see it.

13.2 ABOUT CENTRAL EVENT MANAGEMENT

Central Event Management (CEM) is a holistic system for water infrastructure management, which uses data analytics and machine learning to combine data and information from several sources into a single function.

Network events and incidents are detected early using anomaly detection and predictive analytics. An "event" is any incident or anomaly which the CEM system detects and then captures, analyzes, and prioritizes a response (Figure 13.1). Such events can include leaks (hidden or open), bursts, faulty

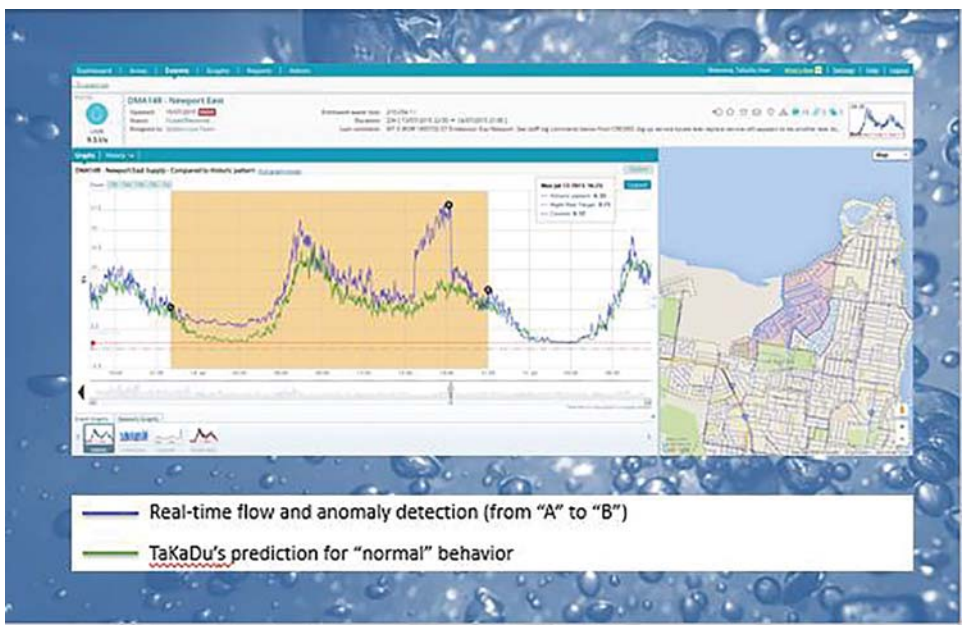

Figure 13.1 Typical leak event screen shot, showing predictive patterns; analysts can also see the zone where it is appearing. (Source: TakaDu)

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assets, telemetry and data issues, operational failures and water quality changes. CEM supports the event lifecycle including:

- Detection
- Classification, characterization and measurement of the event (e.g. size and severity)
- Response initiation
- Response verification and implementation via workflow management
- Outputs to SCADA, work orders and asset management; alerts to external agencies
- Event prediction and maintenance planning.

CEM integrates with other enterprise IT systems in the utility to provide a single layer of information about events and incidents. These systems can include GIS (e.g. Esri ArcGIS® Online), Enterprise Asset Management (e.g. IBM® Maximo®), CRM (call centers), AMI data, and acoustic loggers (e.g. GUTERMANN, Aquarius Spectrum).

All events are managed in one interface. With information aggregated from different data sources, the utility can take the relevant action, for example sending out field teams to check assets, and verifying that repairs have been carried out successfully.

CEM systems may also share data with other agencies such as emergency services, energy and highway, enabling greater coordination after a major storm or flood, where bursts might cause widespread disruptions. Management dashboards and reports are also provided for leadership teams for ongoing asset management and regulatory compliance.

13.3 BRIDGING OPERATIONAL SILOS

In many cases, different departments operate as independent silos, maintaining their own data. This can become a problem when the utility tries to make system-wide improvements to respond to incidents and emergencies. The different silos contributions may be affected because they are not effectively

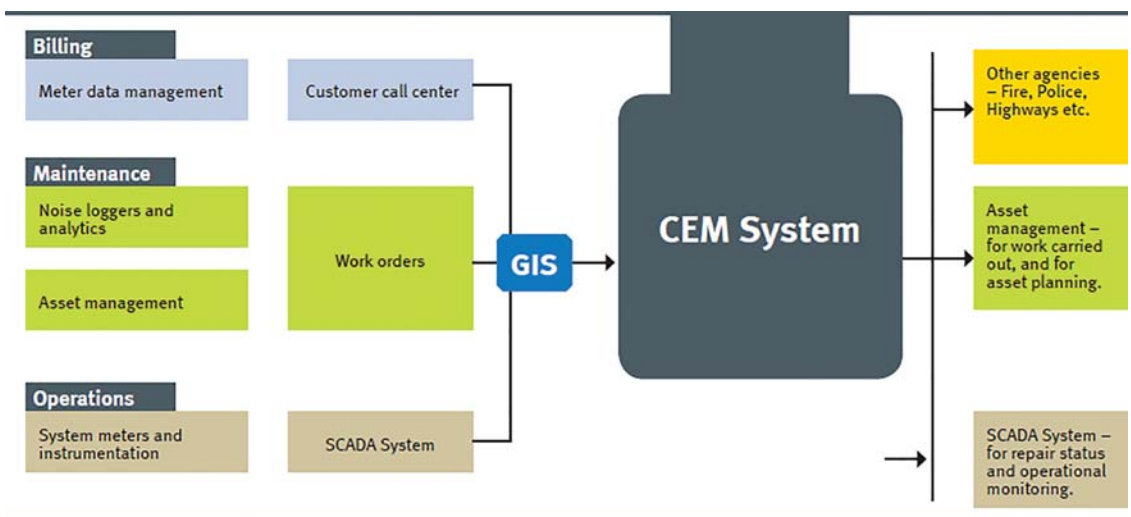

Figure 13.2 CEM integration with other enterprise IT systems. (Source: TakaDu)

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coordinating with each other e.g. asset planning, operations, maintenance and customer service, all disconnected from one other. This can affect the quality of service and increase costs and delays unnecessarily.

The silos exist for good reason and are not going to go away. However, improved performance requires people and processes to be aligned across the silos in order to benefit from new technologies. More value is gained when data is combined from different sources, enabling action, insight and coordination that bridge operational siloes.

By integrating with other systems and technologies in the water ecosystem in a modular way, CEM helps to bridge these silos, providing users with an overall picture of operational activities. With all network systems data flowing into the same central hub, CEM facilitates interactions between different departments, such as asset planning, maintenance, customer service, back office and field operations. Events are managed faster and more effectively with clearer workflows and operating procedures (Figure 13.2).

13.4 CEM INTEGRATION EXAMPLE

CEM integration with acoustic loggers provides alerts and events from multiple, independent data sources enabling event validation (Figure 13.3).

13.4.1 A brief case study

A leading Australian water utility implemented a software-based CEM solution for improving network efficiency, reducing network costs and improving its customer service in around 90% of its water network. The management team formed working groups from different departments across the organization departments (including, billing, operations and contact centers), providing a focal point for collecting information and smarter decisions.

Figure 13.3 CEM platform integrated with GUTERMANN system. (Source: TakaDu)

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As a result, the CEM system served as an efficient management and information system for gathering and disseminating data, improving processes and reducing operational costs. Millions of dollars were saved in hidden (underground) leaks and repair cycles were shortened by over 60%.

13.5 SUMMARY

Software-based CEM is increasingly being deployed by water utilities to improve water management. The solution is based on three core components: data analytics, providing insights based on advanced statistical methods; event management, managing the event life-cycle; and a SaaS (Software-as-a-Service) solution, analyzing multiple types of data in real-time.

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