## Leveraging Big Data For Intelligent, Utility Management

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### Summary of key findings

For many years, water utilities have relied on instrumentation and automation systems to help manage the water lifecycle. However, these systems generate vast amounts of data that must be effectively managed in order to enable intelligent decision making. Today, the term Big Data is used to describe many, complex sources of data that generate vast volumes, often in real-time. Within a water utility, Big Data includes such sources as control systems, telemetry, SCADA, geospatial systems, lab data, the weather, video data, and smart meters. The complexity comes into play as integrating Information Technology (IT) business systems with Operational Technology (OT) engineering systems is a must to address the water challenges now and into the future. Volumes of data from these disparate sources tend to generate data management issues involving data collection, storage, analytics, integration, performance, visualization, and ultimately, how to leverage the data to make smarter, informed decisions to manage water. Many industries including water have been dealing with Big Data for many years, before the term was coined. Time series data is one major source of operations data within a utility. Instruments being controlled and monitored by control systems can generate real-time data at the sub second level, however, rates of 15 - 60 seconds is the norm within water.

Since the early 1980's, time series data management software, commonly known as data historians have been used for collecting and managing real-time operations information. Recently, advanced software solutions provide a data infrastructure or utility wide Operations Data Management System (ODMS) that stores, manages, calculates, displays, shares, and integrates data from multiple disparate Big Data automation and business systems that are used daily in water utilities, see Figure 1. These ODMS solutions are proven and have the ability to manage Big Data from smart water meters to the collaboration of data across third party corporations even through the Cloud. For example, the ability to manage water loss in real-time exists by leveraging the meter data, telemetry, and geospatial information. Answers to questions such as what is my total water loss in the past 6 hours in this area is being answered and visualized in a map. A single smart water meter can produce 7200 readings per day x 100,000 meters = 720 million readings per day for a mid-sized water utility. This platform presentation focuses on utility successes in the water industry where utility managers are leveraging instantaneous access to Big Data from proven, commercial off-the-shelf (COTS) ODMS solutions to enable better real-time decision making and operational intelligence. Successes include saving $600,000 / year in water loss control, safeguarding water quality, saving millions of dollars in energy management and asset management. Immediate opportunities exist to collaborate and leverage these successful case studies to any utility in the world managing the water lifecycle.

### Background and relevance

Several issues arise when managing large volumes of time series data. First of all, data managers must understand and realize this process control data is time series data which consists of a date, timestamp, and value. This is critical as the appropriate technology should be used to handle and mange this data. I.e. A time series database solution is ideal for effectively managing large volumes of time series data, however, many users rely on relational database technologies which leads to poor performance and excessive system support. Second of all, ease of access and speed of retrieval of raw and aggregate data greatly decreases as data volumes increase. Thirdly, many users are building their own time consuming and costly data collection, management, and analysis systems while proven COTS software exists that can connect to and manage continuous data from hundreds of different automation, process control and business systems. Lastly, without the proper system interfaces and

technology, integrating operational time series data and relational business data into useful information becomes a roadblock to addressing business issues.
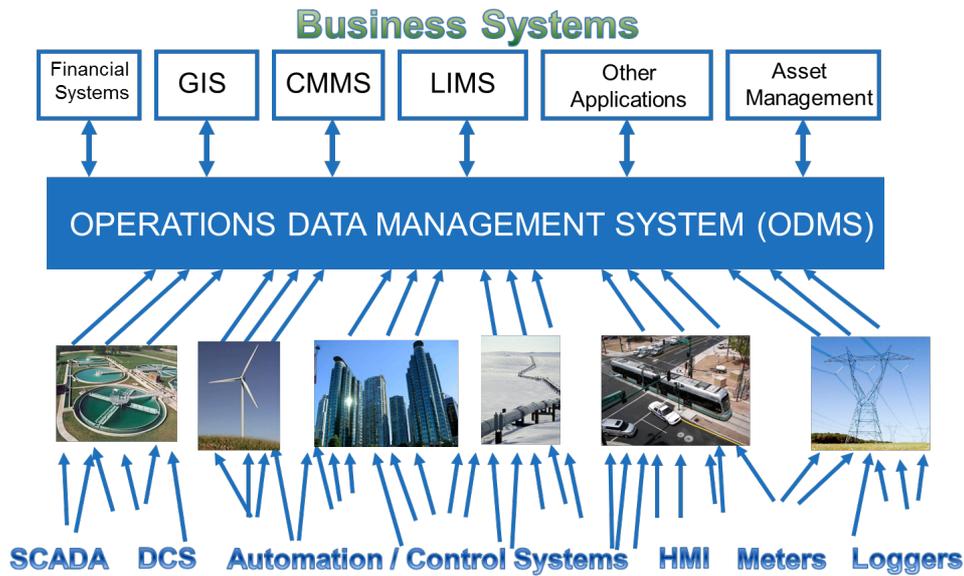


**Figure 1 Operational and business big Data integration and management through an Operations Data Management System.**

### Results and Discussion

The findings and results of both technical and business successes are examined. The paper will discuss water case studies from Metro Vancouver, Las Vegas Valley Water District, Moulton Niguel Water, Water Corporation, Major League Baseball, and Veolia Eau. A very brief summary of two are discussed in this abstract.

Metro Vancouver and LVVWD manage over 200,000 tags or streams of real-time / historical data which is all time series information generated by their various, process control systems. Both utilities originally used a Relational Database Management System (RDBMS) to manage this data. With many instrument values being recorded every few seconds, the amount of data became overwhelming in terms of storage, analysis, management, support, and programming of their RDBMS solutions. The excessive time required to create reports (which sometimes took weeks to complete) and to access and analyze data became a roadblock to using the data for decision making as the task to just get data became a project onto itself. Most of the data was not being used to help better manage the utilities. Results are shown in Table 1 of switching to a proven ODMS time series infrastructure.

**Table 1 Before and after results of switching to a time COTS ODMS time series solution**

|  | Before (RDBMS) | After (Time Series ODMS) |
|---|---|---|
| **Data Storage Size (Gigabytes)** | | |
| Las Vegas Valley Water District | 1000 | 15 |
| Metro Vancouver | 100+ | 6 |
| **Daily Data Loading (minutes)** | | |
| Las Vegas Valley Water District | 150 | 15 |
| Metro Vancouver | 180 | Real-time |
| **Report Query (seconds)** | | |
| Las Vegas Valley Water District | 360 | 20 |
| Metro Vancouver | 10,000+ | 5 |

As a result of adopting the IWA/AWWA framework and technology integration with an ODMS solution, Halifax Water has reduced leakage of potable water from an Infrastructure Leakage Index (ILI) of 9.0 to 3.0, which means direct savings of $600,000 per year (savings of ~$2 per person served). Figure 2 shows real-time information identifying out of spec flow profiles that may mean a

leak. Incorporating the value chain of water and extending beyond utilities, major consumers of water and energy in the industrial and agricultural sector are leveraging ODMS solutions to better manage their facilities, water, and energy through the cloud. Collaboration and secure sharing of data between these large consumers and the local water and power utility enable higher efficiency, sustainability, and conservation. Much greater detail will be presented in the platform presentation and full paper.
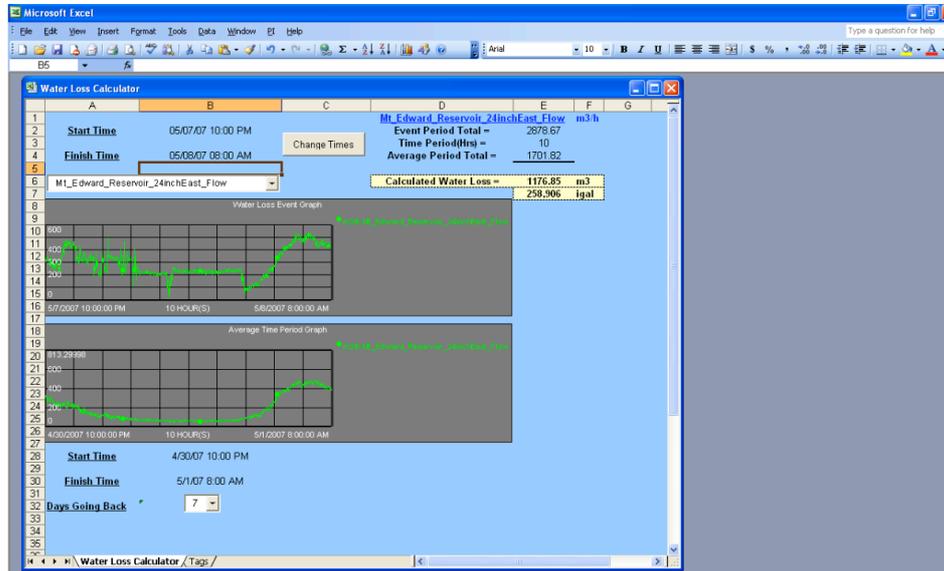


**Figure 2 Real-time water loss calculator.**

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