Considerations for Deploying a Smart Water Network

by Manuel Parra

Executive summary

Each time a utility gathers, treats, and distributes water— every time a pump starts, a tank is filled, or a tap is opened — data is being generated and distributed. This paper addresses the issue of how that massive amount of data converts into meaningful information and is then shared with appropriate stakeholders. Such a “smart” water network saves water, reduces labour costs, aids in compliance and security, and ensures superior customer service.

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Introduction

Close examination of existing water management technology systems reveals sub-optimal infrastructure information management, and, as a result, lower than expected smart water system return on investment.

World Bank figures, suggest the annual global value of non-revenue water -- water produced and lost by utilities -- is close to $14 billion. Every year, more than 32 billion cubic meters of treated water physically leak from urban water supply systems around the world, while 16 billion cubic meters are delivered to customers for zero revenue.[1] Fortunately, proper investment in water leakage management activities can result in significant payback (see **Figure 1**).

Every time a water utility gathers, treats, and distributes water — every time a pump starts, every time a tank is filled, every time a tap is opened — data is being generated and distributed. In general terms, each and every water management activity creates data that can reveal valuable network operations and business insight.

The challenge is to transform this massive amount of data into meaningful information and transfer it quickly and accurately throughout the utility to all functions and departments that can use it, both within the utility and beyond the utility.

A smart water network not only provides enhanced automated process control, but also can fully process data in real time to yield the meaningful information that can be put to work — to save water and labour costs, optimize compliance and security, and ensure good customer service.

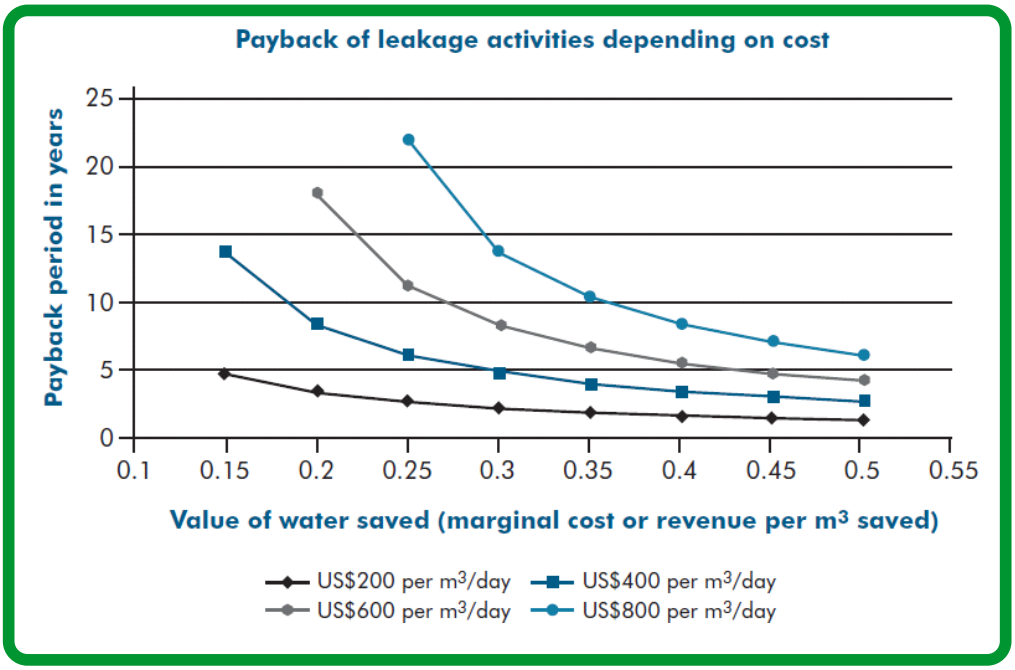

Figure 1
Payback of Leakage Reduction Activities (Figures courtesy of World Bank estimates)

The smart water network takes advantage of real-time data, from pumps, tanks, valves and other vital distribution network points, to automate process control and support real-time

[1] Bill Kingdom, Roland Liemberger, Philippe Marin, "Water Supply and Sanitation Sector Board Discussion Paper Series, Paper #8", *The World Bank Group, Water Supply and Sanitation Sector Board, Public Private Infrastucture Advisory Facility*, 2006

operations decisions as needed. It operates with an information management system with open channels that also make operations data available accurately, securely and in a timely manner to business processes across the utility. This enterprise approach not only improves efficiency and effectiveness of treatment and distribution functions, but also supports planning, operations and maintenance coordination, customer service, and business office activities.

The monitoring, control and information management solution serving the smart water network is flexible, allowing the utility to integrate the water management technology that creates the specific functionalities it needs, such as energy optimization, demand forecasting, leak detection and water quality management. The utility is the true owner of its system, not obligated to proprietary technology, and invests in only what it needs to realize improvements in its particular processes.

Yet, because it reflects open architecture, this system can be adapted with extensions and system enhancements to continue benefits as the utility's needs change or expand (see **Figure 2**). This scalability protects existing infrastructure investments and 'future-proofs' the system.

Figure 2
As complexity increases the success of the system becomes more dependent upon a sound architecture that allows integration

Fundamentals of deployment

In order to implement a smart water network, a utility must consider:

- **Information:** The large amount of data produced during water network operations presents a great opportunity for making smarter decisions about current processes. But how does the utility optimize today's operations with today's information? The answer lies in making the most of existing capabilities, through legacy information systems integration.
- **Integration:** By integrating existing systems a utility can obtain much more information than if it considers its information tools as individual, isolated systems. This approach fortifies existing systems, ensures past and current investments in information technology, delivers the maximum return, and identifies the most critical areas for potential innovation.

- **Innovation:** A smart water network does not neglect tomorrow's requirements to achieve today's needs. A utility can consider its installed base as the starting point for planning future investments, evaluating current assets to identify gaps in both present and future information requirements.

Enterprise-wide approach

A smart water network builds on new water management technologies that integrate well with legacy systems. This approach creates the channels that will make information transformation and flow available to the persons and departments using the existing technology.

"Some attempts have been made to label certain applications and equipment as the paradigm of a smart water network. They might be a part of the puzzle, but there is no silver bullet that can resolve or prevent all management problems for water utilities."

As a result, information is available to support real-time operations decisions and business processes throughout the enterprise. With a smart water network, the utility as a whole, not just one department or function, benefits from water management system investments.

The utility that wisely integrates current and new technology water management solutions realizes economy-of-scale returns, improving efficiency and effectiveness not only for the treatment and distribution functions, but also for planning and operations and maintenance coordination, customer service, and business office activities. For more information regarding best practices for water network efficiency improvements, go to the Schneider Electric white paper "*Why Smart Water Networks Boost Efficiency*".

Thorough solution evaluation

Every utility is different, so each has different needs. The smart water network incorporates the control and information management solution that provides the tools and information needed, and can adapt to the utility's processes — and not the other way around.

There is, of course, standard information necessary for effective management of nearly any water utility. Yet, there also are specific challenges that translate to different priorities, and consequently, different information needs.

For example, a water utility that has to pump water from hundreds of miles away and distribute it to a scattered population will most likely have different energy management concerns — and information needs — than a utility that distributes by gravity to a concentrated population.

What is universal to the smart water network: regardless of the management system a water utility chooses, is that the system must be flexible and open in its architecture so as to integrate as much as possible with the technology base already installed in the utility, and accommodate extensions and system enhancements to meet future needs of the utility.

Integration of information management

Information from a well-integrated system is accurate, secure, and timely, and helps the utility make better decisions in less time. The cross-departmental nature of the smart water network even allows the utility to take proactive measures in areas where it was not before possible (see **Figure 3**).

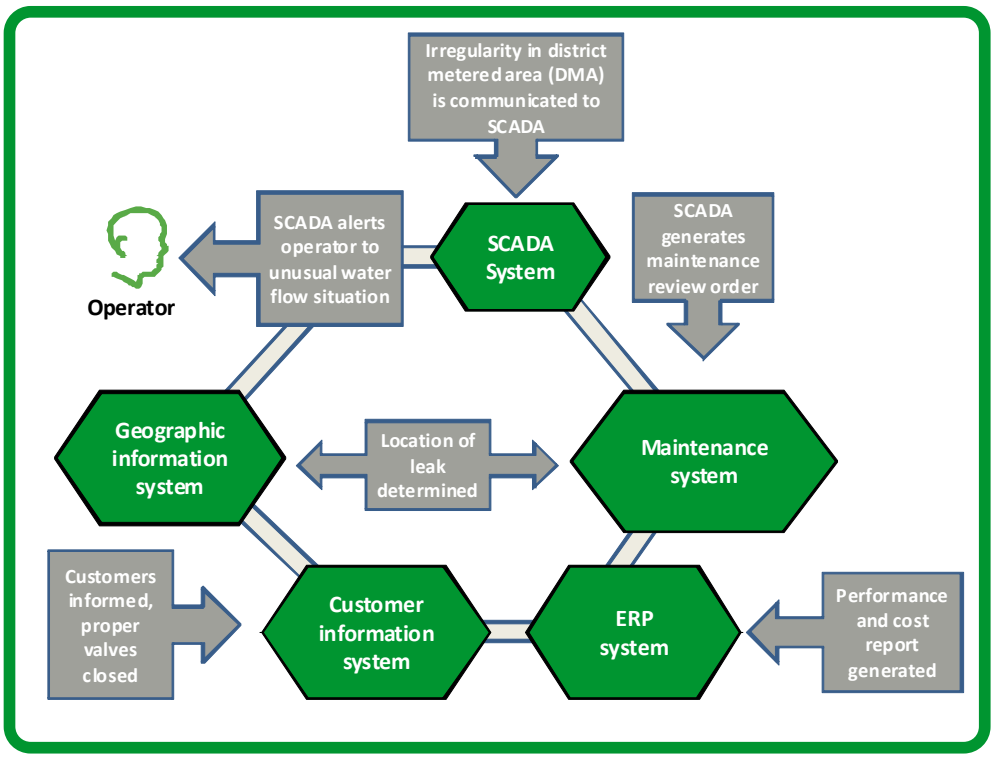

Figure 3
The smart water network allows for direct and immediate communications to critical systems

Managing water leaks is a good example, because the occurrence of a leak usually impacts several departments. The utility operating with a smart water network has reliable information that can help prevent leaks and expedite location and repair when they do occur — and save costs and water:

- Real-time information from the supervisory control and data acquisition (SCADA) system alerts the operator about unusual patterns in the minimum night flows for a specific District Metered Area (DMA). Based on this information, hydraulic supervision software helps to confirm an actual leak and the need for action.
- This same real-time SCADA information triggers a review order in the maintenance system, which, in the well-integrated information management solution, is linked to a geographic information system (GIS).
- The GIS query, identifies where the problem exists, which course of action will minimize impact on the rest of the network, and notify the control room as to which valves must be closed to isolate the problem.
- Linked with the client database, the GIS identifies the customers who will be impacted, allowing Customer Information Service (CIS) to notify those customers prior to remedial action.
- Integrated with the Enterprise Resource Planning system (ERP), all maintenance activity and even the actual amount of the leak is converted into time and cost information identifying the impact on several performance indicators at a corporate level.

Recommended actions

The most effective way for a utility to establish a smart water network that serves their specific needs is to pursue a phased approach:

1. Prioritize issues across the organization
2. Look at what systems are already in place and what can be done with those systems

3. Decide what new investments are needed to complement existing capabilities

As logical as this sounds, utilities often proceed straight to the third phase, without first determining what the enterprise needs and if it is making the most of existing information management infrastructure.

Referring to the previous example of leak detection and response: most water utilities have a control system and a hydraulic model, but very few link these two systems together for real-time leak management. Even fewer link these two systems with a GIS and a maintenance management system for preventive leak management. Linking these three systems to an ERP to know the total cost of their leaks is also rare.

The water utility that implements monitoring, control, and information management processes through a suite of modular, integrated solutions will not only see immediate improvements in operations efficiency and security, but also will continue to reap benefits as its needs change or expand. Water utilities worldwide that adopt an architecture based on open, standardized information management solutions can upgrade and extend the system easily without costly configuration thereby 'future-proofing' their infrastructure. They can become the true owners of the system, and can determine which vendors and applications best serve their changing needs. Nor are these organizations constrained by existing technology in their future business decision making.

Conclusion

By automating processes and improving operations efficiency, the smart water network reduces costs, saves water, optimizes security and compliance, and provides better service to all stakeholders. Water utilities that adopt open, standardized information management solutions are the true owners of their monitoring and control system and can determine which vendors and applications best serve their changing needs. In addition, they can upgrade and extend the system easily without costly configuration and are not constrained by existing technology in their future business decision making.

About the author

Manuel Parra is the Global Water Solutions Director for Schneider Electric. After having worked for the Inter American Development Bank and the Spanish Embassy in Washington, D.C., he joined Schneider Electric in 2005, where he held business development and director positions. In his current role, Manuel is responsible for the definition of the company's water and wastewater product and solutions strategy and roadmap. He is co-founder and board member of the Smart Water Networks Forum (SWAN). Manuel promotes the Smart Water Networks concept worldwide. He holds a degree in Business Administration from the University of Murcia (Spain), a degree in International Business from the Manchester Metropolitan University (UK), and a Masters in Strategic IT Management from IUP.