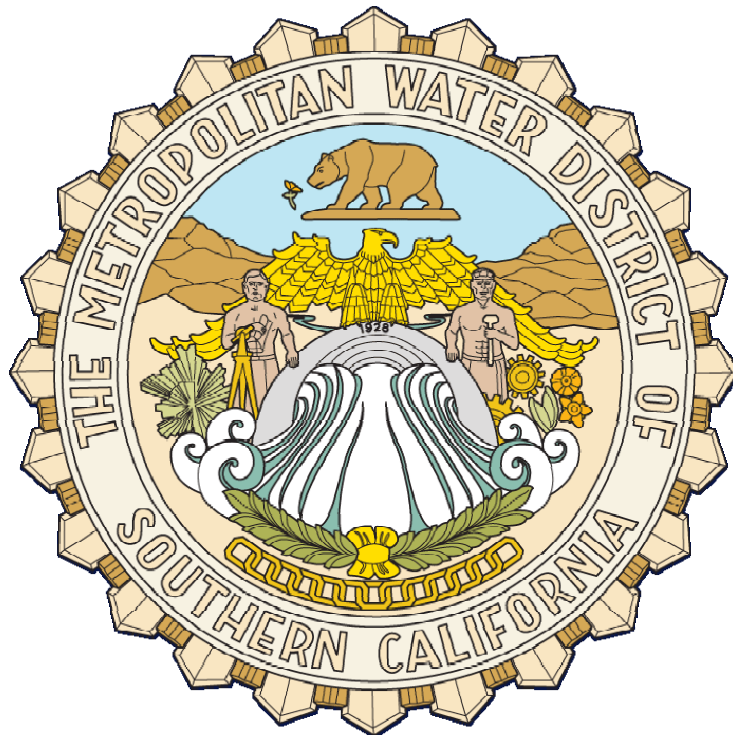


2009 NASCIO Nomination

Enterprise IT Management Initiatives



Metropolitan Water District of Southern California

Metropolitan's Distributed Automatic Meter Reading
System

B. Executive Summary

The Metropolitan Water District of Southern California is a consortium of 26 cities and water districts that provides drinking water to nearly 19 million people in parts of Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura counties. The mission is to provide its service area with adequate and reliable supplies of high-quality water to meet present and future needs in an environmentally and economically responsible way. Metropolitan delivers an average of 1.9 billion gallons of water per day to 300 cities in a 5,200 square mile service area.

In September 2008, Metropolitan substantially completed the distributed Automatic Meter Reading system covering 480 flow meters and service connections throughout the Southern California Coastal Plain. While automatic meter reading is not new, the scope breadth, level of innovation, functionality and technology of this specific project is significant.

Metropolitan imports the bulk of its water from two main sources; the Colorado River and the Bay Delta, both ending in terminal reservoirs in Southern California. Metropolitan draws from these sources and then delivers treated water, via a metered network, from our five treatment plants located throughout the region to our Member Agencies as a wholesale service. These Member Agencies then deliver the water to residential or commercial customers on a retail basis.

Keeping track of this water, either for system control, inventory, emergency response, security or billing purposes is a demanding task. The bulk of this effort is handled through 480 flow meters located along our water distribution system. In past years, these meters and their data were managed manually, requiring 18 dedicated meter readers to drive the system and record flows, provide maintenance and change paper chart recorder forms. Data was manually entered into forms, then spreadsheets and then passed to our billing organization. With water billing revenues reaching one billion dollars a year, and given cost of manual support, it was felt that the investment in a formal automatic meter reading system was warranted.

Our new automatic meter reading system now provides instantaneous, cumulative and reverse flow readings every 15 minutes for purposes of control and billing. Additionally, it provides alarms, data storage and recovery, remote configurability and diagnostics, and hot standby disaster recovery at a remote site, all on an encrypted and secured network covering most of Southern California. Communications, depending on site constraints are via private frequency radio systems, cell modems, and direct Ethernet connection to remote sites, carried by a microwave and fiber backbone over five mountain-top master communications nodes. Data is forwarded to control centers for system operators, and to our Water Information System (WINS) for billing purposes and internet publication to our member agencies. Member agencies also have direct access to the local field remote terminal units (RTU's) via dedicated and secure interfaces.

C. Description of Business Problem

C1. Business Problem

Water is Metropolitan's core business. In classic business and inventory control semantics, keeping track of supply, storage and delivery of water is then our prime business function. Considering that Metropolitan delivers an average of 1.9 billion gallons a day, enough for 19 million people, and enough to keep the 11th largest economy in the world whetted, being able to both control the delivery of this water, and account for it, is of paramount importance.

Metropolitan's prior metering systems used mercury based differential pressure meters and paper chart recorders, maintained and read by a team of 18 Meter Readers driving meter trucks around the southland basin every day. While effective in its time, this system was beyond its useful life provided several problems to solve:

- The use of mercury was an environmental risk
- The thousands of miles driven each year by meter readers, on already congested freeways and roads, provided a daily environmental impact
- The use of staff was not effective, as these persons, if relieved of metering duties, would be available to perform more productive and rewarding work
- Manual recording and double entry of data was time-consuming, inefficient and error prone
- In recent years with higher water demands driven by a growing economy, near-real time metering information is needed for system control, delivery tracking and timely accounting and billing
- A lack of a data interface and core business process input for a variety of key operational and business systems and applications created business process problems

An interim solution replaced the mercury meters and offered data collection via *analog* cell phones, reporting once a day. While this provided a bridge to our current system, the AMR technology was quickly outdated and unsupported, was not secure, had problematic communications, had no backup or disaster recovery provisions, and required significant maintenance and expense. A new, modern, comprehensive system was needed to solve the business, operational and technical problems while filling the voids mentioned above.

C2. Business Solution

The business solution to this range of problems was delivered through several steps. A holistic approach to system requirements resulted in a requirements document and set of system specifications incorporating a broad range of end user, system support and technical needs. End users included our 26 Member Agency customers (and eventually the public), accounting, finance, planning and modeling, operations, risk management, audit, and disaster recovery functions. A relatively small support staff includes IT, communications and maintenance management. Each of these users has either a direct or indirect link to the system, as can be discerned by their function. The data

provided by the Automatic Meter Reading (AMR) system, besides being a stand-alone product, also feeds a variety of other IT and business systems and applications including input to our Water Information System, direct postings to our member agencies, support for system and hydraulic modeling.

The collective requirements of these users and system interfaces resulted in a specification and public RFQ and contract. In a partnership arrangement between Metropolitan and the Contractor, the system itself was replaced in a rolling fashion, with no service interruptions.

The technical aspects of the solution include the following:

- A full GIS-based theoretical communications survey, supplemented with local/site physical surveys and traneivance mapping. This was necessary to design and operate a system in one of the most airwave-congested regions in the world.
- Stand alone Remote Terminal Units, (RTU's), all 460 (20 of the 480 are dual meters) generically deployed with multi-function capabilities, including:
 - 15 minute data reporting of instantaneous and cumulative flows
 - On-unit 60-day data storage, with removable backup memory
 - Secure HMI interface
 - Remote configurability
 - Multiple meter and communications interfaces
- A highly resilient and configurable communications network, distributed and functioning over a very large area network, consisting of:
 - Multiple Local RTU communications capabilities:
 - Digital cell phone (GSM and CDMA),
 - MAS, private frequency radio network
 - I-net spread spectrum Ethernet radio
 - Direct Ethernet and Modbus connections
 - Redundant master communications backbone, consisting /capable of:
 - Redundant master radios and gateways
 - DS3, GiGE, T1, Fiber and Microwave
- A multi-function master users/admin station
- "Virtual" meter capabilities (used for creating meters where there are none, saving the interruption and expense of installing a physical meter)
- Communications network monitoring and reporting software
- NIST compliant security, 64 bit encryption, DMZ and firewall controlled access
- Master station application and performance (data) servers
- Redundant data management and storage
- A completely redundant, real-time replicated, hot-standby disaster recovery system situated at our remote Disaster Recovery IT site
- Remote log-in, configuration, diagnostics and maintenance
- Interfaces into multiple control and business systems, supporting both internal organizations, external agencies and, by extension, the public

D. Significance of Project

The overall significance of MWD's AMR project is the ability to communicate this critical, core function data to internal and external organizations in a timely, accurate, secure and reliable manner.

Of key technical significance is the breadth and depth of the communications network. To reinforce, this is a vastly distributed, always-on, near real-time data communications system that is highly resilient, flexible and configurable. All local and distributed communications options were evaluated and best of breed methods options were selected and engineered to accommodate each specific site, sub-net and the network as a whole. A focus on radio systems significantly reduced prior cell service contract costs. Being that it operates in a congested air traffic region, built-in flexibility allows us to adjust on the fly, or swap out communications modes as needed, and still maintain operational objectives. Digital modems for both major cell technologies are built in and allow us to switch providers if needed. Hot-standby network redundancy and dynamic multiple path routing is built in for trouble free operation, ease of maintenance, and pliant disaster operations. Remote monitoring and configurability aid in system operation and reduce driving trips to check specific sites, often at remote locations. Even if the communication system went down, the RTU's store data and recover/transmit to current status as soon as communications are restored. Expansion is built into the system to account for 25% additional growth.

The stewardship of water is our responsibility to the public. The control of water supply and delivery, as well as the delivery of data and information needed, both internally and between agencies and the public, is a necessary means to support this end. Such tools to support these varied functions, deployed in an increasingly demanding environment are difficult to design, implement and maintain. Proper requirements gathering, specification, planning and execution allowed this system to be deployed in such a smooth manner that there were no interruptions to daily real-time operations.

E. Benefits of Project

This system provides near real-time critical data communications to both internal groups and external agencies. The security, reliability and flexibility of this system have resulted in lower cost, trouble free operations. Moving to our AMR system has allowed 18 FTE's to move on to more productive work. The elimination of mercury meters and driving have reduced environmental impacts. The emphasis on radio systems allowed us to considerably reduce system operating costs. The contract structure resulted in award to a Small Business Enterprise (SBE), with installation work subcontracted out to local electricians.

Water is becoming a scarce necessity to life and our economy, often taken for granted. We believe that, in some ways, the reason it is taken for granted is that systems such as this provide for reliable and worry free delivery to the public, and consistent and accurate data and information communications to those that provide this service.