TOWARDS METER READING INTEROPERABILITY AT AMERICAN WATER

By David Hughes

In Metering International Issue 4 2011, American Water’s Paul Gagliardo made the case for interoperability with meter reading transmission and collection systems. In 2012, American Water essentially achieved a high degree of this interoperability through a change in meter/AMR vendors facilitated by a cooperative venture with a data software vendor and a meter/transmitter vendor. This article details how this was accomplished from conception to implementation and offers an insight into some of the benefits to be realized.

As noted in the cited article, “the adoption of a common communications standard to encourage third party device manufacturers to build solutions would accelerate the industry at lower costs… Through a standards-based communications strategy, water utilities could better realize the value that comes from linking various disconnected devices currently used to monitor and control water distribution networks.” American Water placed a high value of interoperability as it went to bid its meter and AMR equipment in late 2011.

Meter operations point out both the problem and the promise of common and open standards. Water meters themselves employ open protocols and this has promoted the development of a variety of meter reading collection systems. Generally, almost any vendor with a reading transmission/collection/data management system, whether mobile AMR or fixed network AMI, can connect to any electronic meter regardless of the manufacturer. Meters from company A, B and C can be connected to the AMR system of company A, B, C or D. However the data collection system is not as open. Company A’s transmitter cannot be read by another company’s data collection devices and processed into the data management system of any vendor. Collection systems vary in a number of ways so utilities must choose one vendor and stay with that product until the system needs replacement. Replacement often favours the vendor who already has a system in place as it is most compatible with what has been installed previously.

AMERICAN WATER’S APPROACH

As water utilities contemplate AMR/AMI for the first or second time, interoperability should be an important factor. North America is steadily moving from either manual read or touchpad to advanced metering reading techniques. In just a few years American Water has moved from the so called “walk by” techniques of direct reads and touchpad to mostly drive by technology and has been piloting the more advanced techniques of AMI. It is projected that 90% of American Water’s 3.1 million customer meters will be read using AMR within 3 years. While American Water had been using a company with a very good meter and AMR transmission system through 2011, the vendor’s AMR data management system limited migration potential to AMI and its approach to interoperability was not progressing as quickly as hoped. It was decided in 2010 to place metering and meter reading devices out to bid and place importance not just on price but also these other key elements.

Discussions with all of the major vendors prior to the bid process alerted vendors to a willingness to change from a vendor who had provided meters to American Water for 20 years.

At the same time, American Water had established a relationship with Smart Earth Technologies (SET), a technology company that shared American Water’s growing interest in the intelligent water system. SET began by providing PA American Water with radio operated customer shutoff valves. The radio controlled units were installed inside where individual outside shutoffs did not exist. SET demonstrated the ability to monitor the system using a GIS platform and a cloud-based data management system. Subsequent discussions led American Water to encourage SET to focus on meter operations as the base for a comprehensive system. The idea of using meter operations for a distribution communication system was made apparent several years earlier when American Water partnered with an AMI vendor and an acoustic monitoring leak detection company and activated the first acoustic monitoring system that was transmitted back to the office on a daily basis in 2005. SET was introduced to a number of meter vendors and ultimately partnered with Mueller Systems who appeared to see the value of utility devices that can all communicate and work together.

The bid process for meters and AMR equipment moved in stages. Following receipt of a preliminary bid from various competitors in October 2011 for a variety of meters large and small as well as AMR systems, the field was narrowed and remaining vendors were encouraged to sharpen their pencils as well as make more intentional efforts to provide interoperability in a second and final bid. Bid results in December 2011 led to narrowing the choice on AMR and small meters between the incumbent vendor and a proposal from Mueller Systems and SET. What the new system offered was substantial savings and potential significant improvements to the system. What the incumbent offered was a safe choice with no major changes and less uncertainty and risk.

The new approach proposed suggested significant change and essentially a practical approach to interoperability with multiple AMR systems. SET proposed to combine the existing system, which was largely a mix of AMR transmitters, touchpad units and a few...
remaining manual read sites, into one system along with a different AMR transmitter. Since most vendors view their transmission systems as proprietary, SET did not propose to intercept the transmission signals but would allow the information to be received by the vendor’s receiving equipment and then acquire and use the data.

The typical American Water meter route in 2012 was a combination of existing touchpads and existing AMR units. The touchpads would be replaced by the Mueller AMR units. This creates the common practice with a meter reader walking the route and collecting reads from existing touchpads and incumbent AMR transmitters with one handheld device and collecting reads from the new AMR units with another specially made device. This new device was about the size of a cigarette pack to make it as convenient as possible. The reader would return to the office and download the various devices and the software vendor’s programming would provide a sophisticated look at the route run and identify any issues. There were notable exceptions to the typical system. One state with 75,000 customers had an AMR system in place since 2006 from a third vendor. American Water also operated six AMI pilot projects from four different vendors. Some of American Water’s more southerly locations had manual read meters, largely located in pits. All of these differences raised obvious concern about how a change could be executed.

The near future condition would be when the touchpads and manual read meters were fully replaced and most routes reduced to a mix of AMR transmitters from two vendors. When that occurred, the meter reader would drive the route and readings would be collected by vehicle mounted collectors from the two vendors connected to a computer in the vehicle that provided the visual detail of what was read (or left to be read) and what locations had issues (no read, tamper and other alarms). In the near future, the information will be expanded to include what locations had issues (no read, tamper and other alarms). This will allow the reader to resolve reading issues viewing one screen without returning to the office. In the more distant future when the incumbent AMR transmitters are replaced by the new vendor transmitters, the AMR system would be capable of migration to AMI using repeating receivers in fire hydrants.

PROJECT IMPLEMENTATION

A potential move to such a revolutionary system required input from many segments of the business at American Water. The bid team which included key meter staff experts first needed to address the technical issues of whether the system would work under various conditions. Pilot testing in three locations began in January 2012. Multiple pilots allow for testing of some variation in meter reading conditions and combinations of meters and transmitters. American Water is a mix of pit meters and inside sets. In all, meter reading is operated out of about 120 different offices. Some offices control a single system, but others serve multiple systems directly or remotely. A critical element of the read process was making sure that the software system could successfully receive a list of customer meters from routes to be read and then return the list complete with reads in the proper format for use by the billing system. This process had been employed on the AMI systems but this operation was to take place on a massive scale. The ITS department was instrumental in coordinating this effort and addressing various anomalies. Complicating the process was American Water’s conversion to SAP which was to start in 2012. This required that the SET conversion take place at the same time the field offices were learning and implementing the new financial system. But it also meant that the upload routes/download read cycle would have to adapt to the upcoming SAP processes shortly after installations were underway. The American Water innovation staff provided technical input and a project manager to oversee the project.

A business case was constructed by the finance department with input from all key parties. A major positive factor was the price reductions in the cost of the meter and AMR equipment. A major concern was the inherent risk in placing the company’s cash register process in the hands of a small company. Once certain risks regarding ownership of equipment and software were identified and contained, the company elected to proceed with a partial installation. Upper management provided guidance and key support when the decision was to “go.” Systems began conversions in May 2012, starting with some of the areas that had been piloted. Just prior to installation of the SET software and the first of Mueller’s meters and AMR transmitters, Mueller and SET led an effort to train staff at meter upload/download sites to acquaint them with the new hardware and provide software instructions on how to upload and download. After training, each system would prepare a test file and ITS would verify that the reading file generated was in the proper format. Included in the early testers were the few systems in American Water that read meters either quarterly or bimonthly as it would take more than a month to test all of the customers in those districts.

As progress continued favourably, the project was approved to continue for all the districts except the AMI systems (serving 35,000 customers in all) and the one state where a third vendor’s AMR system was in place (serving 125,000 customers in all). Interesting challenges awaited the installation effort. Some systems did not have the expected incumbent vendor version of software that was thought to be universally in use. A few isolated, recently acquired systems used a different third vendor AMR system. Perhaps the most surprising issue was the use of remote uploads and downloads using the incumbent software that was integrated into the American Water computer network. The SET software functioned outside of the American Water system and was accessed via an FTP site. Consequently additional computer interfacing with these remote locations was required. The planned procedure to use wireless communication for the SET system was modified at some locations. A separate hardwired interface was utilized when wireless...
lacked sufficient reliability and speed to perform tasks. As the work progressed, it became apparent to the business transformation team, responsible for implementing the SAP system, that the SET system would actually better facilitate a transition for billing than the incumbent network for all locations. As a result approval was granted to extend conversion of the third vendor AMR system and a quick conversion of the AMI downloads to the new software layout.

OUTCOMES
In six months, 108 individual download/upload areas were addressed serving 120 meter operation locations. Very few anomalies in the reading file occurred and these were quickly remedied. The system is now moving forward with some major enhancements to manage the non AMI systems. At this time the AMI systems will remain with the vendor who provides the meter read information. The AMR data management system will provide summaries by reading areas, by state and companywide several key elements including tampered meters, unread meters, inactive or no use meters showing consumption, and continuous use and backflow on about 20% of customers who have intelligent meters purchased between 2005 and 2012. When a number of meters were identified with a potential manufacturing defect, the SET system was able to identify defective meters with no use that had serial numbers within the narrow range. The system can also track transmission type and keep an accurate count as American Water progresses to automated reading throughout the company.

While the new AMR vendor has been willing to promote interoperability, other vendors in the industry do not appear as progressive as of today. The third AMR vendor remains reluctant to share the data received by its vehicle collector. The SET system can still manage the information once downloaded at the receiving office. The incumbent vendor is understandably distressed at losing a major customer and has remained available to provide needed supplies but there is no movement towards interoperability in their approach. The interoperability achieved by American Water at this point is not so much the result of the vendors, though the new vendor has made open architecture a part of its bid. It is actually a software work around that allows utilities to use multiple vendors’ equipment through a middleware solution. We believe this approach will serve to promote interoperability standards in the future. Interoperability is now viewed more as inevitable rather than unlikely. The ultimate goal would be to develop a single collection device that can communicate with all end points in the system. Our vision is to encourage other vendors to adopt standard methods to communicate with this distribution system data platform. This would create a comprehensive dataset that could be analyzed to build operations facing dashboards and customer facing portals. Ultimately this same concept would allow for facility SCADA data to be consolidated and incorporated into the system. By normalizing distribution system and SCADA information, a platform is created where all information, in no matter which database, will be accessible for analytics, command and control and asset management. This would truly introduce the Water Utility of the Future.