Why SCADA has Failed Rural Water and How Cloud Technology is Fixing the Failure

By Paul Sagues, P.E. XiO, Inc.

When I started out as a water operator, I was given a four-wheel drive truck and a key to the gas pump. I drove all over checking tanks, adjusting disinfection and living in the treatment plant. Today, we expect more from our technology. Driving around is expensive and unproductive. Surely, the same electronics that have revolutionized our daily lives can change the water industry. Not exactly, it seems.

The idea was that electronic controls would make water plants run themselves! Flying cars. The promise was SCADA.

SCADA (Supervisory Control And Data Acquisition) is the go-to control system for all major manufacturing systems, whether building airplanes or cars. SCADA is used in an automobile plant to insure that the red upholstered seat meets up on the assembly line with the red interior body. SCADA is designed so that a central, onsite SCADA PC-based server connects with radios or cables to Remote Terminal Units or RTU's.

SCADA is used in the water industry in order to Supervise multiple sites such as wells, reservoirs, filter plants, valve stations or disinfection. When the level of a tank or reservoir reaches a value, a pump can be called to run. SCADA is designed to manage these RTU's and also provide alarms and alerts. And hopefully, some degree of built-in reports.

The Promise of SCADA

With SCADA, a water operator should receive alarms when things go wrong such as low tank level, low system pressure, high turbidity or low chlorine residual. A graphical user interface in the control room allows the water operator to "see" tank levels and pump operation. All of this can be done without getting in the truck and driving out to the water site.

Typical Old SCADA System Showing Control Room and PC Server, all Eliminated with New, Cloud-based SCADA

What Old SCADA Actually Delivers

Here at XiO, we have carefully reviewed dozens of conventional, Old SCADA systems installed at rural water sites. These characteristics are common:

- the SCADA system has minimal features in order to reduce the cost. For example, no electrical Time-Of-Use (TOU) and no flow meter totalizers.
- the SCADA system is at end of life since the useful lifetime of a PC-based SCADA system is about five years before extensive upgrades are required. Upgrading a SCADA system every five years is cost prohibitive, so SCADA systems are kept "on life support" for a long time and therefore most Old SCADA systems are at end of life and often running insecure PC software.
- the SCADA system often has defects that are not corrected, "Because it costs too much to fix the defects."
- the rural water operator often complains of the "extremely high cost of keeping the SCADA system running". Onsite technical support is very expensive and is needed frequently but often without any advance notice.

Against this backdrop—ten years ago—XiO began the design of an entirely new reinvented SCADA system. This new SCADA system is different all the way from the sensor to the user. XiO included the Cloud, since we knew that it would transform our lives. XiO has perfected the Cloud SCADA® Control System and for seven years now XiO has been shipping hundreds of SCADA systems mostly into rural water systems in California.

How the Cloud Makes SCADA the Water Operator's Dream Solution

We Eliminate the Costly PC Server

I heard a presentation from a large SCADA vendor two years ago. He was pitching to rural water operators. One of the rural water operators raised his hand. "Where do I put the PC server for the SCADA system you are trying to sell me?" The SCADA vendor did not miss a beat. "In your control room." The rural water operator smiled, and nearly everyone in the room knew, "We don't have a control room! Our well is outdoors. We do have a pump house but we don't want to put a PC server in there and then maintain it 24x7!" Many rural water systems do not have an office, let alone a control room. Setting up a server room with climate control and access control is really expensive. You also need radio masts on the office and the RTU's for the PC Server to RTU radio connection. You need Uninterruptible Power Supplies with their batteries to maintain. If you want a reliable system, it should have a backup server ready to go. This is rarely done because it is so expensive to maintain just a single server.

Today—in 2018—it costs 100 times more money to host your own PC server than it does to go to IBM, Microsoft, Google or Amazon and buy server performance from them. One hundred times! And for 1% of the cost you get from these major providers you get more performance, better reliability and far better security.

But, you can't run your SCADA software on a cloud server. It will not run and would be completely insecure in any event.

When you have an Old SCADA system, you have to install a PC server system. You own the PC server and all its software. Anti virus. Updates. Patches. SCADA software interface to the RTU modems. You provide a climate controlled room with access control to avoid someone playing around with the SCADA computer. All of this is very expensive.

XiO completely eliminates the PC server and the office antenna and radio. Any location can be "the control room" because mobile is the goal today. XiO has created an "agnostic environment" in which a computer, tablet or smartphone can be used in precisely the same way. A smartphone and tablet provide easy mobility and can provide an excellent view into a water system from anywhere.

We Eliminate the Need for Onsite Technical Support

A conventional, Old SCADA system consists of much more than the PC server. There are all the RTU's that

Fixing the Failure Continued

contain Programmable Logic Controllers (PLC's), modems and amplifiers. These RTU's have to communicate typically via Modbus to the PC servers. Programming and then supporting the hundreds of possible parts with software written in at least three languages requires constant onsite technical support that lasts for the life of the Old SCADA system.

XiO has not visited most of our customers' sites. This is because the XiO Cloud SCADA system was designed from the very start to enable remote support. XiO can see just what our customers can see, so we can lead our customers through diagnoses and solutions. Remote support is vastly less expensive than onsite support, and XiO includes this unlimited support as a standard part of its cloud service.

Eliminating Hundreds of Possible Parts from Dozens of Manufacturers is a Key to XiO's Success

A modern PLC—Programmable Logic Controller—by Siemens, Rockwell/Allen-Bradley or Schneider has 100 part numbers in its catalog. Backplanes, CPU's, Power Supplies, Modules. Input modules. Output modules. Analog. Digital. Sourcing. Sinking. Counter Timer. PID. The list goes on and on.

> ## EVERY OPERATOR I KNOW CARRIES A PHONE AND WANTS TO USE IT TO RECEIVE ALARMS AND SEE THEIR SYSTEM WITHOUT DRIVING TO SITE.

XiO replaces the PLC with a single part number configured product. I once heard an Intel engineer say, "Your Soft-I/O. It is a magic box!". Our Soft-I/O® control module—and there is only one of them—can replace the 100 PLC parts. Our FIU (Field Installable Unit) can handle a 4—20mA input or output to pace chemical pumps or precisely measure reservoir level. We can sense or produce sinking or sourcing digital inputs or outputs to turn on pumps and actuate valves. We do full PID inside our module. All included standard.

The XiO FIU field hardware is delivered ready to install by an electrician. No computers. No software. No drivers. No debugging. A licensed electrician can easily install an XiO Cloud SCADA Control System. When it is powered up, XiO is there to support startup and hand it off to you for long-term operation and maintenance.

Mobile Connectivity!

Every operator I know carries a phone and wants to use it to receive alarms and see their system without driving to site. Every water agency should be thrilled because it will save them a lot of money! Unfortunately, to use a mobile device with Old SCADA is a security nightmare. Even using a computer that is not physically connected to your in-house SCADA server is dangerous.

XiO employs world-class security experts, and they are on-staff working constantly to keep XiO secure. "We are never done!" is the mantra of XiO's security group. These experts know Old SCADA well and confirm that Old SCADA is fundamentally insecure. Remember the Stuxnet virus in Iran? Remember the huge Target Store hack two years ago? These attacks gained entry via the SCADA industrial control systems. Our security experts say that attacking an Old SCADA system "provides a very wide attack surface." They are sitting ducks. You cannot safely connect Old SCADA to mobile devices!

With XiO, we have taken an entirely different approach to mobile connections. There is no server computer that you maintain. Your smartphone—or any computer with a browser—connects securely to XiO cloud servers that are very similar to those of your bank or credit card company. When you are authenticated, you can use your

smartphone, mobile device or computer to securely get alarms, reports, updates and change setpoints. If your chorine residual is trending high, you can securely lower the dose rate—within limits. When you do, there is an audit trail kept telling who did what, when.

Constant Release of the Latest Wow Technology with the Cloud

With a cloud solution such as XiO has, new features are rolled out as you want them. This is far different than Old SCADA where you pay for everything all the time. With Old SCADA, you get what you get in that whatever was delivered and signed off at acceptance is all that can be expected in the future. Out of support contract fixes and enhancements can be very expensive and lead some Old SCADA users to l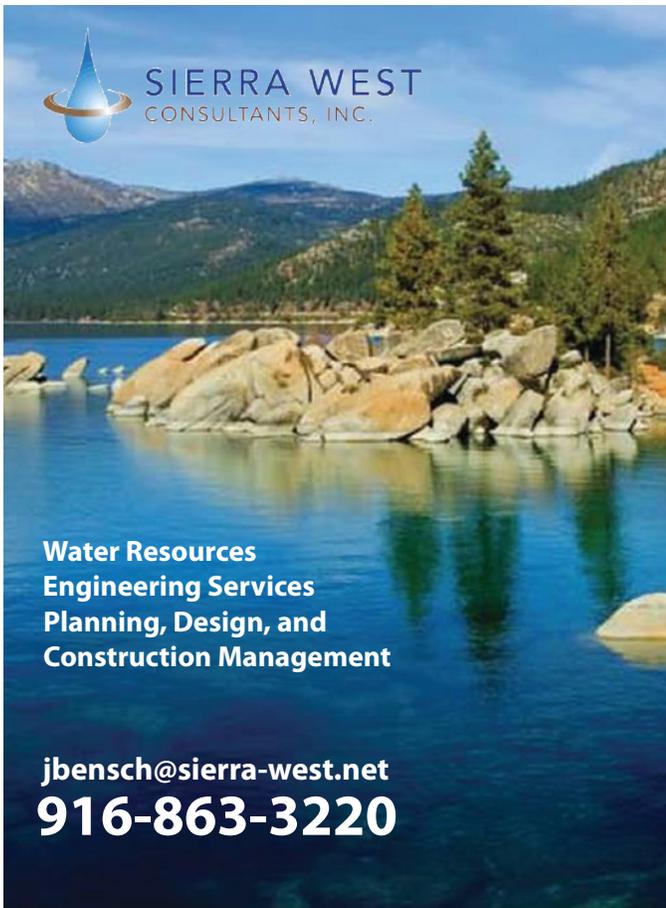ive with defects. XiO constantly releases new features that our customers can enable and use. Recently, XiO released a unique creation that is a new class of alarms called Correlation Alarms™. For example, any XiO user can set up an alarm to be sent via SMS text or e-mail or both that detects pump failed to start. Our cloud servers are able to detect when the water system exhibits a correlation violation such as the pump is running but the SCADA system has not called it to run. Many other Correlation Alarms are available. All XiO Correlation Alarms can be set up without writing software. All included in the XiO standard, low cost cloud service.

Rural Water Systems Need to Reduce Driving Around

When I started as a water operator, driving around in my new 4-wheel drive truck was fun. However, I didn't have the reports to do that I have today.

I think we need to face the reality that we must reduce driving around just to learn what is happening. The technology XiO has developed over the past ten years changes the equation. Today, you can carry a smartphone knowing that you will hear if there is a problem. You will be responsive rather than driving around. You will use your time more effectively, and that will be a step forward from the past.
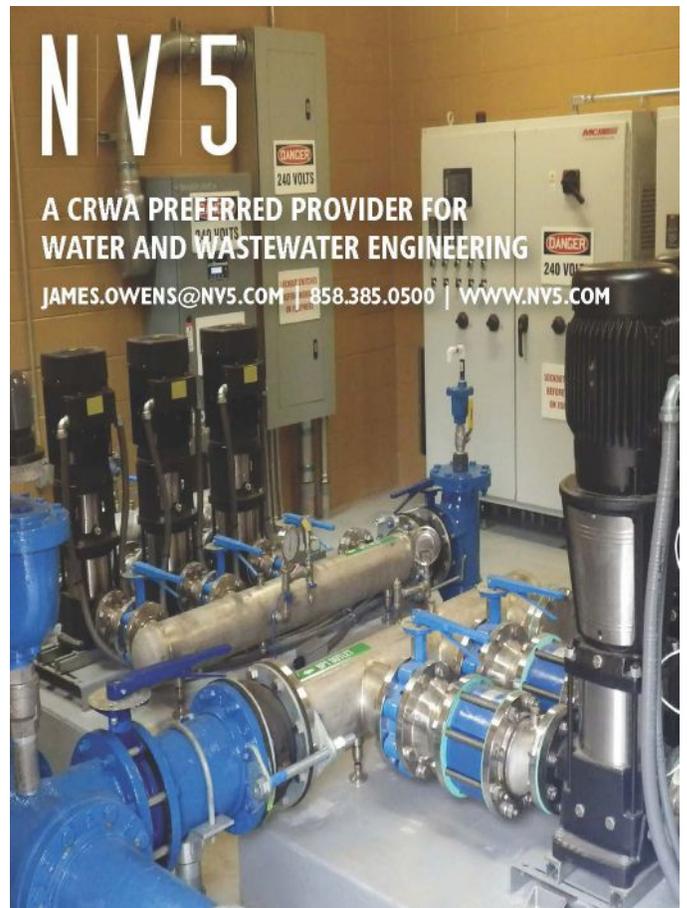
Old SCADA was designed in a different era for large factories. When Old SCADA is applied to rural water systems, the inappropriateness of the onsite PC server, RTU's, programming and constant need for on-site technical support becomes very clear. For years, there was no good SCADA solution for rural water. After seven years of delivering hundreds of systems, XiO can say it has fixed SCADA and saves rural water companies money and improves the rural water operator's life. ◉