The Sage Advisor

SCADA, SECURITY & AUTOMATION NEWSLETTER

Sage Designs presents Control Microsystems' Innovators award to Cal Water SCADA Crew, left to right: Dena Cornett (Sage Designs); Jeff Ammons, SCADA Technician, Tony Sannella (Sage Designs); Jeff Eidemiller, SCADA Technician; Clyde McMorrow, SCADA Program Manager; Don Sillert, SCADA Technician; William Michot (front), SCADA Intern; Brian Nance (back), SCADA Operator; Jan Kooy, Electrical Engineering Manager; Ray Fong, Tessernet SCADA Consultant , (not pictured) Dave Donovan, SCADA Engineer.

SCADA Innovators California Water Service Company Presented with the 2009 Innovators Award from Control Microsystems

Recognizing Excellence in Water and Wastewater Application Engineering, Control Microsystems Inc. (CMI) awarded their 2009 Water and Wastewater Innovators Award to California Water Service Company (Cal Water). Cal Water was formed in 1926 and now serves more than 460,000 customers through 28 Customer and Operations Centers throughout the state. Their latest project involves installing a state-wide SCADA system that will continue to provide customers with the highest level of quality and service. Following a comprehensive review of all major SCADA projects, Cal Water was the obvious choice to receive the 2009 Innovators Award in water and wastewater application engineering.

The complex SCADA system includes four primary operations centers, twelve district operations centers, a state-wide microwave backbone, a variety of data acquisition radios (950MHz licensed, spread-spectrum, IP), and 1200 PLCs. In addition to traditional SCADA functions for remote monitoring and control of pumps, valves, and tanks, Cal Water will implement state-wide metering of power consumption and water flow to provide a real-time measure of operational efficiency.

Control Microsystems SCADAPack 32 and SCADAPack 300 Series controllers were selected for their reliability and advanced features. The local pump efficiency calculations in the SCADAPack controllers are the basis for Cal Water's remote terminal units,

MAY SEMINARS

Sage Designs is hosting two free SCADAWise seminars in May: one in Irvine on May 5th, and one in Livermore on May 6th. These seminars are on the subject of Wireless Ethernet and will feature factory personnel representing Control Microsystems Trio Radios, Teledesign Systems radios and Firetide wireless mesh networks. Sign up for a seminar using the form on page 3 or the one on the events page of our website, www.sagedesignsinc.com/events.

Narrowband Ethernet Radio Solves IP Delivery to Remote Applications

The use of Ethernet based Programmable Controllers and Data Loggers has become very commonplace over the last few years for controlling a wide variety of SCADA systems. Key advantages of using Ethernet based products include the ease of use of a standardized data network interface, global access to data and systems connected through Ethernet networks to the internet, a vast amount of readily available application programs designed for Ethernet networks, and the familiarity of IT departments with Ethernet based systems for process control and distribution of information.

Following this trend, manufacturers of Programmable Controllers and Data Loggers have enhanced their product offerings to take advantage of the flexibility of the Ethernet interface. This allows their products to be more open and accessible to users whether across the room or across the continent. These devices now allow complete reconfiguration, reprogramming, recalibration, remote firmware upload and remote installation of enhanced process control algorithms via a single Ethernet port and communications medium.

Since most SCADA systems used to control the collection, processing and distribution of water, wastewater, electric power, oil and natural gas cover geographically large areas, wireless communications, as opposed to wired based communications, is typically used to interconnect all of the key points in the system. For Ethernet based SCADA systems, terrestrial wireless networks supporting Ethernet IP data traditionally operate in the 900MHz, 2.4GHz and 5.8GHz frequency bands. Several wireless technologies including WiFi, Bluetooth and Zigbee share these bands with wireless SCADA Ethernet. These frequency bands were set aside years ago by several different RF spectrum

regulatory agencies around the globe specifically for low transmit power operation, and were set up to allow medium to high transmission bandwidths to support a variety of higher throughput wireless applications. Within these bands, the higher the frequency band, the higher the available bandwidth to support larger amounts of data. Today, these higher throughput systems support not only command and control data but also relay graphical images and high definition (HD) video.

Although the 900MHz, 2.4GHz and 5.8GHz frequency bands provide high throughput for handling large amounts of data, their high bandwidth, combined with low transmit power restrictions, limits the communications range to fairly short distances. In many cases, true Line of Sight (LOS) conditions must exist to achieve usable communications. For SCADA systems covering a small geographical area these limitations can normally be overcome by using a few secondary wireless nodes to relay data between the primary nodes in the network. However, for SCADA systems covering a large geographical area, installing a large number of secondary nodes solely to relay data between the active nodes in the network can be impractical, as well as expensive. In many cases the site locations needed
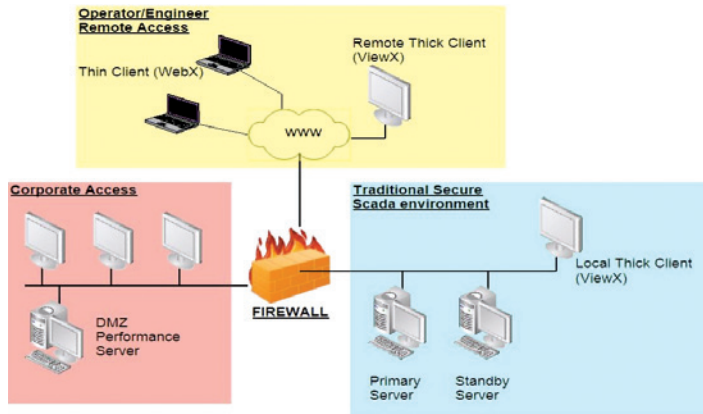
Inside This Issue

ClearSCADA Security

Historically SCADA systems have been isolated entities, not connected to other systems, wide area networks, or the World Wide Web, but this is no longer the case. The key is to use proven IT solutions for securing networks and apply them to SCADA networks. Further, like SCADA systems, IT networks systems are only as secure as the responsible people make them.

- The ClearSCADA Server Application.
- ViewX, the main integration development environment and main Operation tool.
- WebX, a self publishing operation tool using standard web technology, Internet Explorer©.

ClearSCADA Server
The ClearSCADA server uses a security model that encapsulates all interfaces to the server requiring a Username and

The performance server has DMZ functionality providing data exchanges between the main ClearSCADA server and the performance standby server that are unidirectional to the permanent standby server. This allows the performance server to reside on the 'outside' of a firewall and protects the main ClearSCADA server and any other standby servers from external threats should the integrity of the performance server be compromised.

ViewX
ViewX is a purpose built application for ClearSCADA. It provides both the integration development environment and the main operations environment. Successful connection with the ClearSCADA Server requires a license which provides a first layer of security. Once a ViewX session connects to ClearSCADA, user names and passwords credentials are required to access the SCADA system.

The ViewX component of ClearSCADA can reside on the same server as the ClearSCADA Server application or it can be placed remotely. This is required by SCADA users on the move or who work remotely from the ClearSCADA server. ViewX has definable ports for accessing incoming data from the ClearSCADA server.

In conjunction with ClearSCADA server definable ports and IT solutions such as VPN connections, remote clients connections can be made that are secure from external influences.

WebX
The use of Web technology is a more recent client connection technology employed by SCADA systems. Due to SCADA systems lagging behind in terms of SCADA security, this is viewed as the most susceptible element of a SCADA system.

The ClearSCADA web server is an innate, integrated part of the ClearSCADA application. It does not require the use of an external web server or a separate server machine. It is not a Windows Service, but part of the ClearSCADA server application.

The web server itself adopts a number of security measures to ensure that the SCADA system is not comprised via its own web server:

- Definable ports for both secure and non secure ports for HTML and XML interfaces.

- Secure Socket layers with private keys and certificates.

These items are standard web technology and functionality that are successful at preventing unlawful access attempts on web servers. This is another example of how ClearSCADA uses integrated functionality with IT solutions to provide a safe operating environment.

User Profiles
The incorrect implementation or the lax security surrounding legitimate users or former legitimate users is the largest cause for SCADA security breaches that have resulted in real world consequences. Like any other system or software tool, if security is not

The way that computers and IT technology have revolutionized our daily lives has affected SCADA systems, although somewhat belatedly. The demand on SCADA systems now is to share data with other parties, enabling remote access while still providing a safe and secure environment.

Modern SCADA should have features and functionality allowing them to integrate into a secure IT environment. This is particularly the case when SCADA systems are responsible for dealing with assets spread over a large geographical area and where stakeholders in the SCADA system (operators, engineers, third-party databases) do not reside in the same location as the SCADA system.

ClearSCADA provides a secure environment on two levels. Firstly, for connectivity between SCADA servers and clients in terms of architecture, this includes SCADA thick clients, web clients and interconnectivity to other SCADA systems or databases. It also provides security through user access to the SCADA environment itself with a user profile.

Security in Architecture
The Architecture of a SCADA system is fundamental to how a SCADA system is deployed, and especially true when security is considered. Traditionally IT departments have not been responsible for catering to IT needs of SCADA systems, mainly due to the specific technology set and standards used by SCADA systems.

The ClearSCADA host software is composed of three core components:

Password from each before allowing a connection to be made. ClearSCADA also uses TCP/IP instead of UDP for communications between redundant server and all clients. This provides a smaller network footprint that keeps the server hidden.

Each ClearSCADA Server has a definable port for external access; this is required so that IT solutions can provide the secure interlinking between the ViewX or WebX and the ClearSCADA server.

Many SCADA system manufacturers require not only products from multiple vendors, but multiple servers to run this patchwork of products. The only time that ClearSCADA requires multiple servers is in the case of redundant or performance servers. When multiple servers are used, each is a complete ClearSCADA implementation, putting much less reliance on Windows Services, which is often the target of security attacks.

Overview of ClearSCADA Architecture deployment
The performance server is used on large ClearSCADA systems where there is a requirement for large numbers of client access via ViewX, WebX or third-party databases. It is itself a full implementation of ClearSCADA, except that it is always a standby ClearSCADA server to a Main ClearSCADA server.

It protects the main and redundant server's performance by providing the resources to maintain large number of client connections and third party database access at a cost to the main ClearSCADA server of synchronizing the data to the permanent standby server.

SAGE DESIGNS, INC.
SCADA & Security Products

SCADAWise

Free SCADA Seminar
Wireless Ethernet: A Spectrum of Possibilities

May 5, 2010
8AM – Noon
Irvine Marriott
18000 Von Karman Avenue
Irvine, CA 92612

May 6, 2010
8AM – Noon
Doubletree - Livermore
720 Las Flores Road
Livermore, CA 94550

CONTROL MICROSYSTEMS
SCADA products...
for the distance

firetide
Reliable connectivity anywhere™

TELEDESIGN SYSTEMS, INC.

8:00 – 8:15	**Continental Breakfast & Introductions**
8:15 - 8:45	**A Spectrum of Possibilities** From narrow-band to broadband mesh networks, Tony Sannella, President of Sage Designs, will discuss the relative merits of various wireless Ethernet solutions and what they will and won't do for you.
8:45 – 9:45	**Narrowband Ethernet Radio Advancements** Mark Hubbard, President of Teledesign Systems, will discuss the long range communications capabilities of new narrowband Ethernet radio solutions used to enable wide area networks to provide Ethernet level support to IP-based devices at very remote locations.
9:45 – 10:00	**Break**
10:00 – 11:00	**900 MHz Spread Spectrum Ethernet Radios** Jim Quist, Water/Wastewater Sales Manager for Control Microsystems, will discuss how Trio 900 MHz spread spectrum Ethernet Radios can fill the gap between the long-range capabilities of the narrow-band Ethernet solutions and the broad band capabilities of the high-frequency mesh network solutions.
11:00 - Noon	**Broadband Wireless Mesh Technology** Jeff Butler, Systems Engineer for Firetide, will discuss: Taking your system architecture to the next level of performance. How a broadband infrastructure mesh topology can provide both the scalable and cost effective solution required to support your future application requirements of Video surveillance, VOIP, and high throughput WAN.

Pre-registration Required

To Register: Call 1-888-275-7243 to reserve your seat. Then complete the information below and send to us via fax to 1-888-329-7243 or by email info@sagedesignsinc.com. A confirmation will be emailed to you. Hotel Directions can be found on the Events Page of our website: http://www.sagedesignsinc.com/events.

☐ **Register me for the free seminar in Irvine on Wednesday, May 5, 2010**

☐ **Register me for the free seminar in Livermore on Thursday, May 6, 2010**

Name (*please print*):	Title:
Company:	Phone:
Address:	Fax:
	Email:
City/State/Zip:	Dietary Restrictions:

* * * Registration Deadline: April 30, 2010 * * *

There is no charge for this event, but we would appreciate notification if you must cancel your reservation.

150 Shoreline Hwy., Suite #8A • Mill Valley, CA 94941-3634 • 1-888-ASK-SAGE (1-888-275-7243) • 1-888-FAX-SAGE • www.SageDesignsInc.com

SCADAWise™ Training Classes

ClearSCADA

SCADAPack

ClearSCADA Training Course

May 24-27, 2010 - Mill Valley, CA
Fall 2010 - Mill Valley, CA (TBA)

Day 1 (8AM– 4PM)	Installing ClearSCADA, Introduction to ClearSCADA, Components, Using ViewX, Using WebX, ClearSCADA Help
Day 2 (8AM - 4PM)	Configuring using ViewX, Database Organization, Basic Telemetry Configuration, Creating Mimics, Creating Trends
Day 3 (8AM - 4PM)	Configuring using ViewX, Templates & Instances, Logic Languages, Security, Communications Diagnostics
Day 4 (8AM - 4PM)	Reports, System Configuration, System Architecture, Questions

Cost: ClearSCADA Training Course $1,800

SCADAPack TelePACE Studio Training Course

May 10-12, 2010 - Mill Valley, CA
August 10-12, 2010 - Reno, NV
Fall 2010 - Mill Valley, CA (TBA)

An optional SCADAPack 350, SCADAPack 334 or SCADAPack 32 is available at a special price* with the course—an excellent way to get started using Control Microsystems' Controllers.

Day 1 (8AM - 4PM)	SCADAPack controller operation, Series 5000 I/O, TelePACE Studio introduction
Day 2 (8AM - 4PM)	TelePACE Studio advanced programming techniques and advanced functions
Day 3 (8AM - 2PM)	Controller communications, Modbus Master/Slave protocol, Diagnostics, Modems

Cost: SCADAPack TelePACE Studio Course $1,275

    * Optional SCADAPack 350 Training Kit – adds $990
    * Optional SCADAPack 334 Training Kit – adds $990
    * Optional SCADAPack 32 Training Kit – adds $1,060

August 17 (Northern CA)
August 19 (Southern CA)

ClearSCADA Test Drive

Free Hands-On Test Drive
Call to Register or Schedule your Own
Call 1-888-ASK-SAGE
email: info@sagedesignsinc.com

Instructors: ClearSCADA & SCADAPack TelePACE classes will be taught by Tony Sannellla, Sage Designs, a Control Microsystems' Factory-Certified Instructor. The ClearSCADA Test Drives will be conducted by Ian Metcalfe, US ClearSCADA Sales, Control Microsystems.

Location: See individual course registration form. Those requiring overnight accommodations should call the hotel directly for reservations.

What should I bring? Laptop computer with minimum of Win 2K or XP with 15mb free disk space, CD ROM, mouse with a scroll wheel, working serial port, and necessary permissions to install software on your computer.

What is provided? Lunch and coffee, soft drinks and snacks each day.

*Optional Training Kits at special course pricing (TelePACE class only): *Limit one (1) for every two (2) students per organization. Training Kits will be shipped N/C to training facility, provided your registration is received approximately 4 weeks before the first day of the course, or shipped to you after the course when available. Training kits include a SCADAPack 350, SCADAPack 334 or SCADAPack 32 Controller, TelePACE Studio Software, Hardware Manual (on CD-ROM), I/O Simulator board, AC/2 Transformer, & programming cable. Prices do not include applicable California sales taxes.*

- - - - Download the Registration form at: http://www.sagedesignsinc.com/events/index.htm - - - -

Please send me the Registration Form

SAGE DESIGNS, INC.
SCADA & Security Products

ClearSCADA: ☐ May 24-27, 2010 ☐ Fall 2010 (TBA)
SCADAPack TelePACE: ☐ May 10-12, 2010 ☐ August 10-12, 2010 ☐ Fall 2010 (TBA)

Name (*please print*):	Title:
Company:	Phone:
Address:	Fax:
	Email:
City/State/Zip:	

* * * Registration Deadline: 3 weeks before 1st day of course * * *
All registrations are subject to cancellation fees. A confirmation notice will be sent to all registrants on or before the deadline date.

Speed Matters

The Otay Water District has about 125 square miles of service area and 60,000 customers and has been in business serving our customers for more than 50 years.

Many of our more than 50 remote facilities, reservoirs, pump/hydro stations, county connections, etc., are in geographically isolated and non-densely populated areas. As a result, options for getting land method communications to these sites (T1, DSL, Cable etc) was realistically cost prohibitive, with some bids coming in as high as nearly $100,000 a month.

radios and antennas were mounted at 4 sites in a linear mode to accomplish the link from Treatment Plant to the Administration Building. Once the installation was complete, Firetide provided Linux Laptops to perform industry standard iPerf testing.

For some of the Water Well and Booster Stations where trees make it impossible to use the upper frequencies 5.2MHz and 5.8MHz, we have used the Firetide 6200-900. This dual Radio has one radio at 900Mhz and one radio at the higher frequencies. The more forgiving 900Mhz
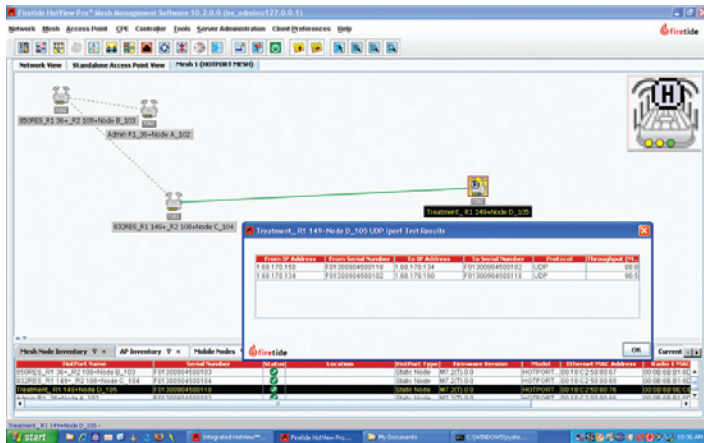
During a very difficult trial phase with another wireless vendor, we stumbled around for a year or more trying to get an acceptable bandwidth. Our goal was 30MB+ to each of our sites, enough to handle SCADA, security including video surveillance, and local WiFi access at each site for our operators and other staff. As it turns out, we abandoned our original vendor and called upon Sage Designs in partnership with Firetide to provide us with a demo. Without any hesitation, Ken VandeVeer from Sage Designs and Jeff Butler from Firetide were working within our district, climbing tanks and ladders and installing a proof of concept design for Otay. Within about 3 weeks, we had achieved real speeds in the 100MB range utilizing 802.11N technology. Sage Designs recommended the new Firetide 7200 MIMO outdoor radios for the demonstration. The

frequency is used to help overcome the obstacles such as vegetation and trees, and will be used to send the data to higher elevations at the reservoirs. Once the 900Mhz reaches the Reservoirs, the second radio on the 6200-900 which uses the upper frequencies 5.2 and 5.8 to send the data back to the control room.

We have since sent two of our engineers to Firetide headquarters for training and happily settled upon Firetide radios partnered with Sage Designs Inc. as the solution for connecting Otay Water District facilities. We have rolled this out to more than 12 sites to-date, creating a point to multi-point design that has exceeded our expectations.

—*Bruce Trites, Network Engineer, Otay Water District, Spring Valley, CA*

New California Water Bills Require More Monitoring

Five new bills were passed by the California Legislature which will have far-reaching effects on monitoring practices in water and irrigation districts throughout the state. While one of the measures is for the issuance for over $11 Billion of bonds to fund water conveyance, storage and conservation projects, accurate measurement of water diversions, groundwater drawdown, deliveries and drainage are all addressed in these 5 bills. While $11 Billion sounds like a lot, it is clear that additional fees and increased water rates are going to be necessary to fully fund the ambitious plans laid out by the State.

In a review of some of the language of these bills, it is easy to see that accurate

measurement and reporting of water supplies and usage are key to the plan successes. Without accurate reporting, there would be no way to gauge progress or compliance with the provisions of the bills and failure to accurately measure and report this information can result in ineligibility of water retailers to receive state grants or loans.

None of these measures by themselves will mean an end to the water crisis in California, but good planning requires good data and these bills acknowledge the need for more detailed and accurate gathering of information.

SAGE ADVICE

Wireless Ethernet A Spectrum of Possibilities

With demands for not only more information from your SCADA system, but for the ability to move data around your system without the constraints of traditional SCADA communications media, more and more users are looking to Ethernet radios for solutions. Not only can an Ethernet system allow your PLC/RTUs to exchange data directly, but you can use multiple programs, such as programming/configuration software over the same channel as your SCADA host software. As remote equipment, whether drives, analyzers, sensors or treatment equipment, become more and more sophisticated, it is becoming rare not to see an Ethernet connection available on whatever processor the equipment includes. These interfaces allow you to collect more detailed information about the health and performance of your equipment, as well as your processes, helping you make better decisions about controls and allocation of resources.

Fortunately, the variety of wireless Ethernet systems is growing, providing a solution to almost any situation. For radio-based systems, you can choose from narrow-band VHF and UHF systems, traditional Spread Spectrum or high performance microwave equipment, each of which may, or may not, work in a given application.

How to Choose:

The most obvious way to select the proper Wireless Ethernet system is by looking at your terrain and finding a frequency which will perform in your application. While it is true that lower frequency systems such as VHF and UHF have much better signal propagation, you'll find that the narrow-band systems such as these will have pretty limited throughput. If you consider that the serial versions of these radios generally run at 9600 baud or less, Ethernet with its additional overhead will make things even slower. On the other hand, a VHF signal from a system such

as Teledesign Systems' can punch right through heavy foliage including Redwood or Pine forests and still get over or around hills, leap tall buildings and other obstructions, to reach out several miles to connect to a remote site, and while the speed may be limited, you still get the advantages of an Ethernet based system.

The next move up the spectrum takes you to the traditional 900 MHz Spread Spectrum where you get 500 times more speed. The range and ability of these systems to shoot through trees or over hills is pretty limited, although a true line-of-sight path is not necessary in many cases. With a product like the Trio J-Series radio, you will find that the throughput is more than adequate for your SCADA system's needs, with very fast poll times and plenty of bandwidth for on-line programming of remotes.

The problem with the traditional Spread Spectrum performance is: even 500 Kbps to 2 Mbps speeds offered fall far short of what you will want to have if you plan to transmit video with your system. If this is the case, you will want to take a look at the truly high-speed radio systems such as what Firetide offers. With over the air throughput in the range of 30 – 200 Mbps, even high-resolution video can be supported without noticeable degradation of your SCADA system's performance. The two limiting factors to this solution are the need for a true line-of-sight path (except in the rare circumstance), and the increased cost of taller and more expensive antenna structures and hardware, and the need for more repeaters in a typical system.
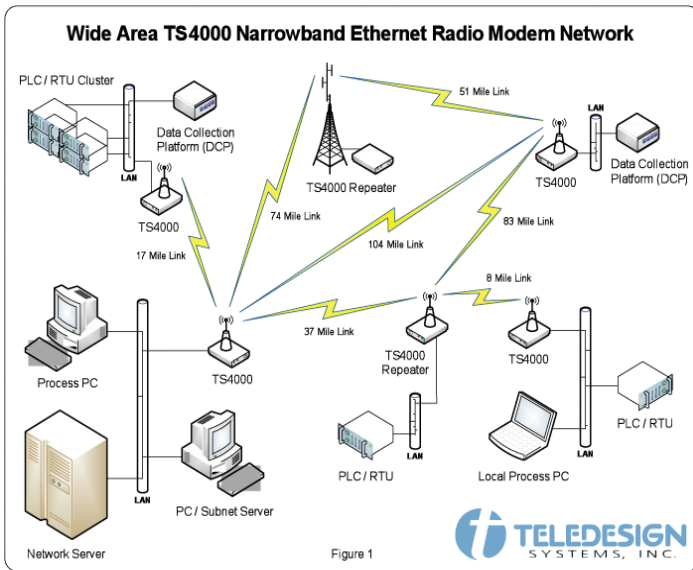
If none of these products offer a solution, there are still satellite and cellular-based solutions, if you don't mind recurring fees and making your system reliant on things beyond your control. In any of these cases, a careful analysis of your application and conditions on the ground will point to one or more solutions.

Wide Area TS4000 Narrowband Ethernet Radio Modem Network

Figure 1

Managing your SCADA Software Purchases

One of the things about bid specifications that has become a sore point for me is that all too often, they fail to require software support licenses to be included in bid prices for projects. This can result in significant additional costs for the end user, as most of the manufacturers add charges to their support fees if there has been a lapse of support coverage. This is often the case if the integrator purchases the license to develop the project and is not required to spend the roughly 15% extra to get a year's coverage. Without continuous coverage, most of the manufacturers will charge up to 50% of the license price to reinstitute the support, mainly to prevent someone from buying support every third year in order to get upgraded to current versions for cheap. The end result is that the end user must scramble to get an unexpected PO together to the manufacturer so that they can have continuous support and avoid reinstatement charges.

Another related issue is that the specification should be sure to call for the registration of all software used in a project, be licensed in the end-user's name. This includes; HMIs, PLC programming software and other software products used in the project as the transfer of these licenses can be difficult and should not be overlooked.

In very rough detail, below are the terms of the major providers of HMI/SCADA host software:

• Support is not included in the purchase of SCADA software with few exceptions

• For most, there is no grace period between the lapse of support and reinstatement fees
• Support for most includes both Tech Support and Version Upgrades.
• License is often assigned to integrator and must be transferred to end user which can be a difficult process.

For a comparison, you can see that ClearSCADA has roughly similar policies:

• Support not included in purchase price with the exception of CS Integration Partners who get 90 days of support with every new license.
• No formal lapse grace period but your Representative can get you some time to process paperwork if needed.
• Support includes version upgrade and tech support although tech support is generally available even to those with lapsed or no support contracts.
• License is always in end-user's name, no transfer is required.

As you can see, failing to allow for support and proper license registration in bid specifications can result in extra work and hefty fees. In my experience, fingers get pointed in a number of directions and no one goes away happy. Be sure that your bid specifications call out for support contracts for any software to be supplied as a part of the work and that all licenses be registered in the end-user's name.

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for the secondary relay nodes are not controlled or owned by the network owner. The cost to negotiate land grants or lease tower space, prepare construction permits, and then install and maintain the secondary nodes can sometimes be more costly than the primary network itself. To solve this problem, a new class of wireless Ethernet communications, commonly referred to as Narrowband Ethernet Radio, has emerged as a long range communications solution for wireless Ethernet networks.

Narrowband Ethernet Radio takes its name from the RF spectrum where it operates. Several frequency bands below 900MHz, 2.4GHz and 5.8GHz are allocated strictly for narrowband operation. These lower frequency bands have advantages that allow them to support longer range communications. First, the RF propagation characteristics of these lower frequencies allow their signals to penetrate foliage, hilly or mountainous terrain, and urban environments much better than their high frequency counterparts. Because of these characteristics, these lower frequency bands can provide stable and reliable communications in non-LOS conditions. Second, the low transmit power limitations of the higher frequency bands do not apply to these lower frequencies. The transmit power levels allowed on these lower frequency bands can, in some cases, be more than 200 times greater than the power allocations allowed on the higher frequency, wide bandwidth bands. And third, the lower frequency bands require less transmit energy per byte of data to communicate the same distance as a byte of data transmitted on the higher frequency bands. These advantages add up to

the ability of these lower frequencies to support node to node radio links in excess of 100 miles for some bands.

The tradeoff for long range communications on these lower frequency bands is network throughput. The narrowband nature of this spectrum limits the speed at which the Ethernet nodes can communicate. For some wireless Ethernet applications, where high throughput is a must to support streaming video or bulk data transfers, the speed provided by the narrowband spectrum is inadequate for practical operation. However, for Ethernet based SCADA systems controlling the movement of natural resources, monitoring weather conditions, relaying remote stream gage measurements or providing backup monitoring of wide area control systems, the throughput speed of these narrowband networks is very adequate for reliable system operation. For many of these applications, data update rates are measured in seconds, where as tolerable delays in streaming video and high speed file transfers are measured in microseconds.

An example of a SCADA system that directly benefits from the advantages of a narrowband Ethernet network is a wide area flood control system based in California and operated by the US Army Corps of Engineers. This system consists of several flood control dams, numerous weather stations, stream flow gages, dam monitoring and control sites and data collection points. The weather stations are used to track short term and annual rain and snow levels and to estimate potential flood conditions based on temperature and weather variations. The stream flow gages sense normal and abnormal flows along rivers feeding

into and out of the dams. Many of the monitoring and control sites are in very remote locations only accessible by foot, horseback or helicopter. These sites are located in canyons, mountainous watershed and back country valleys where LOS communications is impossible. And, since many of the monitoring sites are located within national parks, the concept of installing dozens of secondary nodes to relay high speed Ethernet into these regions is not possible due to the regulations and permit requirements levied by the park service to preserve the parks.

With the demands of this type of SCADA system, the benefits of using remote IP based data loggers and monitoring equipment that can be remotely updated and reconfigured via an IP based wireless network pays huge dividends in not requiring expensive trips to the back country for operational changes to the equipment. The narrowband Ethernet network utilized by the Corps will provide IT level networking to all of the remote sites and users in the system.

—*Mark Hubbard, President, Teledesign Systems*

ClearSCADA Security

correctly defined and administered, it is no security at all.

Although it is impossible for any SCADA product to come up with an all encompassing security that resolves no or low security standards, ClearSCADA has employed many security user credential tools to help a system administrator define and set security standards across the SCADA system and to always be in control of who access the system and how.

User profiles identify and define legitimate users on a SCADA system. The user can be defined as a person (Operator or Engineer), or a process such as a third party database that requires data from the SCADA system. The system Administrator can also easily remove the privileges set out for any user.

ClearSCADA uses the following tools to define a user and his access:

- In terms of access, a user is provided with a series of privileges that will grant them a specific level of access to the SCADA system. It also provides access or restriction to particular areas of the ClearSCADA database. So access is defined as a series of privileges to specific areas of the database. Further, users can have different security privilege sets for different parts of the database.

- The User profile also defines how a user or stake holder gains access to the ClearSCADA system, via ViewX, WebX or phone dial in. If a user tries to access the ClearSCADA server via a method they are not permitted by their user profile, they will not be able to gain access via that interface.

- There are a series of tools within

ViewX that provide a user with functionality within ClearSCADA:

- Access and using Alarms.
- Access and using engineering and operational toolbars.
- Rules and functions for user passwords.

These items are normally configured by a system administrator. Using these tools limits access to functionality encapsulated by ViewX. So security of the ViewX application itself is provided in part by configuring user functionality.

Security Standards
SCADA security is under the microscope following high profile SCADA system failures, discussion at high political levels and the threat of espionage by foreign agencies. As a result, confusion reigns over what SCADA security is. SCADA system operators are confronted by an arrangement of standards that offer solutions to SCADA security. This leads to confusion on what security really is and the real dangerous claim that a particular SCADA product is compliant to a particular SCADA security standard.

No matter what security standard is discussed, it is not a SCADA host product itself that is compliant to a standard but the whole SCADA system itself. Security is applied to a SCADA system from not just the SCADA host software but in combination with IT solutions, system administrators and users. It is defining a process or a series of processes that dictate how the SCADA Host software, network and users work together to produce a secure SCADA environment. This also extends into training and planning that are often forgotten elements of a SCADA system.

— Ian Metcalfe, US ClearSCADA Sales, Control Microsystems

Innovators Award

efficiency-constrained unit commitment for pumps, and a state-estimator for detecting transducer failures.

"*The Cal Water SCADA staff are pleased to be recognized for design and implementation of the California State-wide SCADA system*", said Clyde McMorrow, Secure SCADA Program Manager at Cal Water. *"Among numerous critical suppliers, Control Microsystems was chosen as radio advisors and PLC suppliers, collaborating in a solution to provide Cal Water customers with the highest level of available technology, security, and service."*

The Cal Water team can program the SCADAPack controllers remotely from their main offices and ensure that the pumps are running at optimum speeds

for increased efficiency and reduced operating costs.

About California Water Service Company
Cal Water is the largest investor-owned American water utility west of the Mississippi River and the third largest in the country. They are the largest subsidiary of the California Water Service Group, which also includes Washington Water Service Company, New Mexico Water Service Company, Hawaii Water Service Company, and CWS Utility Services. As a whole, the Group provides high-quality regulated and non-regulated utility services to approximately 2 million people in 100 communities. For more information, visit www.calwater.com.

Solar Systems
UNDER THE HOOD

The other day I was asked a question about a shunt controller. It got me thinking that many people do not know what is "under the hood" of the myriad of charge controllers currently on the market. So here is a quick run-down on the most common types and their primary uses.

The most basic charge controller is an on/off switch and a human hand. When the battery is full, the human turns the solar modules off. The downfall of this method is the human. They are expensive to maintain, unreliable and hard to keep focused.

The second most basic controller is the SHUNT controller (like the ASC line from SCI). The SHUNT is basically an electronic switch. When the battery reaches the high voltage set point, the switch is engaged to short circuit the solar array, stopping the flow of current to the battery. These units are very reliable and inexpensive but not very efficient in the last 20% of the charging cycle.

The third type we will cover today is the Pulse Width Modulated (PWM) series type controllers. This class includes the vast majority of controllers available on today's market. Examples of kin-under-the-skin controller in this category are Morningstars entire line, from the little SunGuard to the mighty TriStar. Also in this class are the "C" series controllers from Xantrex, and the entire line of Steca controllers.

PWM controllers work like all other controllers for the bulk part of the charging cycle. They just pass all of the current and watch the battery voltage for their chance to strike. When the voltage reaches a predetermined point, the controller begins to taper off the current flow to maintain that voltage. They do this by switching the circuit on and off, at first they use wider pulses (on for a longer period of time) to pass higher currents. As the battery "tops up" the pulses get narrower, tapering the current flow.

I like the analogy of filling a cup with soda. At first, you let it go full blast, but as it nears the top of the cup you have to stop the flow and wait for the bubbles to settle before pushing the lever and blasting it again. If you are persistent about getting the cup full to the top, you will soon be hitting it with quicker and quicker shots from the tap.

For many years now, PWM was considered the ultimate charging method. And then came MPPT.

Maximum Power Point Tracking (MPPT) takes advantage of crystalline solar module design to get higher performance from a solar array.

In the beginning, the vast majority of solar arrays were used for charging batteries. A 12 volt flooded lead acid battery needs

to have 14.5 volts to be fully charged and at least 15.5 for equalization. This forced the module designers to use 36 cells so that no matter how hot the module got (crystalline modules lose voltage as they get hotter) you could always get enough voltage to maintain your battery. This meant that for a good percentage of the time, you were leaving power (excess voltage) on the table.

Thanks to electronic components getting cheaper, controller manufacturers can now take advantage of any excess array voltage to create usable current at a cost that the buyer of today's large solar systems can afford. Now on those sunny but cool days, you can get significantly more power from your array and get more of the Watts that you paid for.

Examples of this new breed of charge controller are manufactured by Blue Sky Energy and OutBack Power Systems. These controllers have one more big plus to offer. Let's imagine that you have a 12 volt battery bank and you want to increase the size of your array. First you have the problem of your present wire being sized for the amount of current that you are already producing. To add to your array, you will have to run another wire, right? Wrong! If you use an MX-60, you can re-wire your array to a higher voltage, say 60 volts, and when it gets to the MX-60 and your battery bank, the controller will drop the 60 volts back to 12 volts (Ditto Blue Sky but with a smaller voltage range). You have now saved the cost and labor to buy and bury another wire. Ain't technology grand?

By necessity, I have left out things like metering, networking, diversion charging and load control (to name just a few). Today's controllers have more bells and whistles than the Burlington Northern Railroad. So like automobiles, they are all basically the same, and yet each one has features that make them better for a particular job.

This is how you earn your keep by learning all of these features and helping your customers choose the right controller for the job. Hopefully this short article gave you a basic understanding of what's "Under the Hood" of charge controllers.

— Larry Cooper, Senior Associate Engineer, KYOCERA Solar, Inc.

Kyocera is one of the world's largest vertically-integrated producers and suppliers of solar energy products. Our solar division is headquartered in Scottsdale, Arizona, with regional sales centers on five continents, Kyocera Solar, Inc (KSI), our North American solar products subsidiary, services thousands of customers in both the developed and developing world.

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Calendar of Events

March 18, 2010	**CWEA Tri-Counties March Workshop & Exhibit,** Goleta, CA
March 23-24, 2010	**USCID Water Management Conference,** Sacramento, CA
March 31, 2010	**CA-NV AWWA 2010 Spring Conference,** Hollywood, CA
April 13-15, 2010	**ENTELEC 2010 Conference & Expo,** Houston, TX. Visit Control Microsystems' booth.
April 21-22, 2010	**CWEA 82nd Annual Conference,** Sacramento, CA
April 28, 2010	**Cal Rural Water 2010 Expo,** Lake Tahoe, CA
May 5, 2010	**Free SCADAWise Seminar*,** Irvine, CA
May 6, 2010	**Free SCADAWise Seminar*,** Livermore, CA
May 10-12, 2010	**TelePACE Studio Ladder Logic Training Course*,** Mill Valley, CA.
May 13-14, 2010	**ISA/SSJV Section Cajun Feast & Exhibit,** Bakersfield, CA
May 24-27, 2010	**ClearSCADA Training Course*,** Mill Valley, CA.
Aug 10-12, 2010	**TelePACE Studio Ladder Logic Training Course*,** Reno, NV.
Aug 17, 2010	**Free ClearSCADA Test Drive** (Northern CA-TBA)*
Aug 19, 2010	**Free ClearSCADA Test Drive** (Southern CA-TBA)*
September 23-25, 2010	**Tri-State Seminar on the River,** Primm, NV
October 5-8, 2010	**CA-NV/AWWA 2010 Fall Conference,** Sacramento, CA
Fall 2010 (TBA)	**TelePACE Studio Ladder Logic Training Course*,** Mill Valley, CA.
Fall 2010 (TBA)	**ClearSCADA Training Course*,** Mill Valley, CA.

* Download the registration form from our website or call for more information.

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