For generations electric utility professionals have kept a close eye on their electrical equipment, traveling from substation to substation reading instruments and opening and closing circuits to keep systems running optimally. In the 1960s and 70s Supervisory Control and Data Acquisition (SCADA) systems were just beginning to enter the market. But only large utilities could fund the multi-million dollar price tags that came with their convenience. These early SCADA systems often consisted of hard-wired Remote Terminal Units (RTUs) communicating with large main frame style master station computers on copper communication networks.

Each analog signal (volts, amps, watts, etc.) required a separate transducer to convert the measured quantities into signals that could be interpreted by the RTUs. A pair of interposing relays was required in the RTUs for each open and close operation. Along with its bulky infrastructure, early SCADA was littered with proprietary hardware and software, often developed by companies that might or might not be available when upgrades were needed.

“SCADA has gone through quite a metamorphosis,” said George Owens, PE, president of Downes Associates, Inc., an engineering and consulting firm that has been providing SCADA engineering and technical services to municipal utilities and rural electric cooperatives for 20 years. SCADA’s metamorphosis has resulted in a streamlined, communications system that taps Internet, microwave, satellite and fiber-optic technologies, making it the most powerful,

“TODAY’S SYSTEMS AND COMPONENTS ARE HIGHLY COMPATIBLE AND EVEN INTERCHANGEABLE, GIVING UTILITIES A WIDE VARIETY OF CHOICES AND OPPORTUNITIES FOR CUSTOMIZATION”

George Owens, PE, President of Downes Associates, Inc.
customizable and – current providers say – affordable, SCADA ever.

With the help of the Institute of Electrical and Electronics Engineers (IEEE) the hundreds of proprietary SCADA communication protocols developed by early providers have been whittled down to three open protocols. There are, however, as many different operating-equipment options as there are computer-hardware manufacturers.

Along with advancements in microprocessor technology, the development of nonproprietary “open” communication protocols served to promote increased competition in many sectors of the SCADA industry. The most popular open protocols used today are Distributed Network Protocol (DNP 3.0), Utility Communications Architecture (UCA 2.0), and Modbus.

DNP and UCA are very powerful, object-oriented protocols developed specifically for the electric-utility industry. Modbus is an application layer messaging protocol originally developed for Programmable Logic Controls (PLCs) in industrial control systems and as such have some limitations including the inability to support time stamping. Although all of these protocols were developed as serial protocols, they have been adapted for network applications such as Ethernet and TCP/IP. Additionally, some SCADA vendors now are licensing their once proprietary protocols as open protocols to other vendors.

All SCADA systems perform the same basic functions. They control equipment from a remote location and provide equipment monitoring at many remote stations from one central location. Staff view system information through the SCADA software’s graphical user interface (GUI), a user-friendly software interface that’s available in many different forms including a Microsoft Windows-based environment. Advancements in hardware and software technology now allow some SCADA master stations to exist on PC-based platforms. The end result is a SCADA system that is more robust, user friendly and scalable to smaller utilities that have found it difficult to justify the costs of SCADA.

“SCADA is like a car dashboard and controls for a utility,” said Bill Rambo, vice president of business development for the Survalent Technology Corporation. “It gives staff a way to measure, gather data and control their systems.”

SCADA software and hardware is installed on a main computer called a master station that usually is housed in a utility’s central office. Remote computers, often the size of small cell phones, are imbedded into devices at substations through the utility’s service area...
or the areas they want to control remotely. The SCADA software sends pulses of digitally encoded information including commands to remote computer systems in the field. Remote computers receive the digital commands, complete the request and send data back.

“Today’s systems and components are highly compatible and even interchangeable, giving utilities a wide variety of choices and opportunities for customization,” said Mr. Owens.

According to SCADA providers, the opportunities to streamline utility operations are endless, depending only on the equipment available, the utility’s budget and their imaginations. Common SCADA uses include opening and closing breakers, capacitor switches and line current switches; metering and monitoring voltage currents and kWh hours. Other functions include data logging and archiving, integrated load management systems and automatic generator control (AGC), alarm reporting to off-duty staff via phone dialers or Internet, distribution automation and auto-restoration schemes.

According to Mr. Owens smaller cities and towns usually start with a master station and five or six substations and then add to their system over a period of years.

“Utilities operating without SCADA really are operating in a costly, very tedious manner,” said Mr. Owens.

“They must rely on staff getting to remote sites, and establishing that they are at the correct site and performing the correct function. All of that can be done in microseconds electronically if the system is in place.

“It’s probably the easiest system improvement any utility can make and it’s right at their fingertips.”

Effectively Maintain & Manage Systems

REMOTE MONITORING

HMI and SCADA screens allow operators to monitor, control and troubleshoot local or remote systems.

- Data Acquisition
- Synchronizing
- Starting
- Changing load-control setpoints
- Stopping
- Unattended site monitoring

Implement remote monitoring on an engine-by-engine basis; HMI screens are scalable building blocks for developing SCADA systems for embedded instrumentation and control applications.

Call 877-659-6328 to discuss your systems needs, or visit www.govconsys.com.
Many SCADA providers are specifically reaching out to smaller utilities offering bundled customizable packages including hardware, software, project management and training for utilities that may not have a large technical staff. They are working hard to destroy the myth that SCADA is only for large utilities with deep pockets.

According to Mr. Rambo many small utilities have taken advantage of the company’s SmartSCADA package, importing their entire GIS into the package. SmartSCADA, he says, enables staff to view the entire service area with a one-line diagram that includes all substation equipment. They then overlay their substations where their distribution and transmission lines are, then pinpoint any circuit breaker and transformer from an electronic device such as a relay or a meter.

According to Governor Control Systems Inc. engineer, Richard Pitt, utilities often find it cost-effective to start with a Human Machine Interface (HMI) system and then build HMI systems into a full blown SCADA system later. According to Mr. Pitt, HMI systems are much simpler than SCADA, offering one stand alone control system with an operator panel that can run simple controls such as start and stop commands and a small amount of historical logging. Utilities often opt for an HMI system that services one specific control.

“HMI systems are the building blocks of SCADA many times,” said Mr. Pitt.

Downes Associates, Inc. offers utilities a wide range of engineering and technical services for their SCADA systems. Mr. Owens says Downes starts by addressing utilities’ basic needs paying close attention to budget constraints, then assists staff to design, specify and build their custom system over several years. He recommends utilities start with the

CASE STUDY:
UTILITIES REDUCE MANPOWER AND IMPROVE EFFICIENCY WITH SCADA SYSTEM

SITUATION
Washington Electric Utilities had been running a VMS-based SCADA system since the early 1980s. By 2005, the contract with the old vendor was expiring, and the utility was looking for improved functionality and support. The staff wanted to modify and change the SCADA display screens, use more detailed and sophisticated graphics, and work with a Microsoft Windows interface. None of these capabilities were available from the previous vendor.

The City of Washington owns electric, water, and sewer utilities to provide these services to residents, businesses and industries of Washington, locally-owned and operated, these publicly owned utilities provide local families, farms, businesses and industries with safe and reliable public services at a reasonable price. Washington Electric Utilities serves 13,000 customers. The Public Works Department provides Water and Wastewater utilities through its Water Resources and Water & Sewer Divisions. In 2005, Washington Utilities upgraded to a SCADA system from Surlent Technology to help reduce costs and improve service reliability.

SELECTION
Washington Utilities, N.C. needed to select a SCADA package capable of reading the proprietary protocols of the remote terminal units (RTUs) already installed throughout the distribution system. The company was licensed to read Washington Utilities’ existing RTUs.

The solution allows the utility to access the SCADA system anywhere on the local area network, and remotely, providing access to many users. The old system restricted access to a limited number of users. The new system provides access for remote viewing and operation of the distribution system to myriad staff members through laptops.

The customer support offered by the previous vendor was considered poor, and the cost of purchasing an extended maintenance contract from the vendor would have been
greater than the cost for purchasing a brand new Windows system. Washington Utilities decided to purchase a new SCADA system for monitoring and controlling the electric and water systems.

For the electric service, Washington Electric Utilities uses the SCADA system to monitor the distribution network. For the water service, the utility uses the SCADA system to control the operation of the fresh water and waste water treatment plants, and 30 sewer lift stations and the City’s flood control pump station.

According to Edmund J. Pruden, III, Substation and Controls Supervisor for Washington Electric Utilities, “The Windows system is secure, offers an excellent user interface, was very easy to install, and immediately began to reduce our manpower costs. Our fresh water operating plant must be manned by a 24-hour dispatch system, per state law. By relying on the SCADA system for monitoring and dispatch support, the utility is able to maintain fewer operators on staff during nights and weekends.”

Mr. Ed Pruden was able to download, set up and test the SCADA software with their existing RTUs on his laptop after attending factory acceptance testing at Survalent Technology, prior to the scheduled install and start up. “The system is plug-and-play, like any Windows applications,” Pruden said. “Survalent copied our previous database, including drawings and diagrams. This helped with user familiarity during the transition period. After a very smooth startup, the system was up and running 100 percent within four days.”

An important application being used by Washington Utilities is the power factor control program, which is part of the load-management system. Pruden reports this application worked from day one. The command sequence application functionality allows both electric and water utilities to automate many of their control systems. The Excel add-in application allows the staff to export data from the SCADA historical database into Excel spreadsheets, for powerful and flexible reporting.

basics such as electrical distribution systems and substations including circuit breakers, power transformers, voltage regulators, capacitor banks, switches and kWh and voltage meters to monitor and report power flow conditions.

“The new systems are a great deal more powerful than systems created just a few years ago,” said Mr. Owens. Examples of SCADA are all around us from communication systems in hotel convention halls to the United States 911 system. SCADA technology can be used for almost anything. The imagination of the human mind is the only limiting factor.”