

SCADA Alternatives For Remote Monitoring

By Barry Ceci

SCADA can be utilized for remote data acquisition, but because it is primarily a real time control system, the user must make significant compromises to use it for this purpose. These compromises include cost, data integrity, flexibility, convenience and control of the task.

A substantial portion of a utility's operation is out in the distribution or collection system: pipes, pumps, valves, tanks, meters etc. Utilities have an operational need to know how things are working throughout their system to manage it properly. In addition to customer usage billing, operational efficiency and maintenance concerns, utilities are being driven by tougher government regulations and customer demand for improved quality, safety and security. These factors exert pressure on utilities to better understand and document the operation of their network.

Why SCADA

Most utilities employ a SCADA (*Supervisory Control and Data Acquisition*) system or DCS (*Distributed Control System*) to operate and monitor their process plants. It seems logical and almost obvious that extending the SCADA network into the field is the appropriate method if new investment in remote monitoring is required.

A SCADA system requires a huge up-front investment in centralized computer equipment, software, training and personnel time resources to initially implement. Once the utility has sunk this investment, expansion of the system per point is relatively inexpensive, providing additional justification for the initial investment.

Furthermore, the SCADA system manager and operators are reluctant to add alternative systems, particularly if they do not seamlessly integrate with the SCADA system they have operating at the plants. SCADA is the safe investment for management reviewing the options; personnel are trained in its use, the utility has committed substantially to its implementation and it is not something new.

The SCADA argument is compelling and for many remote sites it is the best solution, particularly sites that need to be remotely controlled or where real-time mission critical data is required on the big screen in the operations center. For most other remote sites where only data acquisition is required, a data acquisition system offers superior cost, reliability and versatility.

System Comparison

Consider first that Data Acquisition and SCADA systems are architecturally different types of systems. SCADA is a real time polling system; it requires a continuous channel of communications between the host computer and each remote RTU (*Remote Terminal Unit*). In data acquisition applications, the RTU responds to requests for real-time measurements from the host computer. If it is important to monitor a field parameter e.g. flow or pressure once every 5 seconds, the host computer sends a request for these parameters every 5 seconds.

SCADA systems operate in this fashion because when performing their primary function, which is control, decisions are made at the host based on real-time data collected from all sensors. However when a SCADA system is used for data acquisition only, particularly for remote

monitoring applications this approach is not optimum or even practical because of system complexity, cost and data reliability exposure.

A Remote *DAS* (Data Acquisition System) however is optimized for remote monitoring. A DAS RTU (Recording Telemetry Unit) may be independently configured to sample each sensor or instrument at the optimum rate for that parameter. For a flow meter this might be once every second; for sanitary sewer overflow (SSO) level maybe once every 15 seconds. The RTU then performs data reduction on these data samples to produce information that has optimum value to the user. This might be the total flow at 15-minute intervals, the amplitude and time stamp of water hammer events, or the severity, time of day and duration of a SSO event.

The Remote DAS system may then upload the resultant information to the host on a programmable schedule and/or on exception as specified by the user. The total amount of data transferred by a DAS compared to SCADA is typically smaller by two orders of magnitude. The communications link is active only occasionally, and for short periods for example once per day for 30 seconds.

Data Integrity

Data Integrity refers to the assurance that the data transmitted from the remote site to the host is not corrupted or lost. A SCADA system can provide perfect data integrity only if and when the host computer is running and the communications channel is functional.

Reality demonstrates that computers crash and remote communication networks fail. Whenever this happens and for the period of time this happens, remote site data sourced by SCADA will be lost forever.

A DAS utilizing RTUs that are data recorders maintains its measured data at the remote site typically for many months even when data is being transferred frequently to the host. If the communications channel goes down or the host computer crashes, remote data collection continues and is automatically recovered when the computer or network problems are fixed.

The typical SCADA system approach to improve data integrity for remote monitoring is redundancy. The thinking is that by adding redundant communications channels, computers and fault tolerant computer drives, system reliability is improved. This is of course true but instead of the user buying one real expensive data acquisition system, the user ends up purchasing two.

Push not Pull

SCADA systems poll remote sensors typically at the highest rate necessary to facilitate control loop dynamics or to capture upset events that occasionally occur in the process. This might be a sample rate of every few seconds. Although necessary for the plant floor environment where events occur quickly and sensor power and networking access is convenient, real-time information is not often necessary or even appropriate for remotely deployed sensors and instruments.

In most remote monitoring applications it is desirable to upload information to the host computer at a rate useful to the user; this might be every 15 minutes, once per day or on exception. For example, it is only necessary to upload data from a remote rain gauge when it is actually raining or a CSO overflow event when it is overflowing. The pressure history of a remote water main might be useful information daily unless pressure goes out of range, in which case real time alarms may be desired.

Consider for example monitoring the level and flow of wastewater under the streets of a major city. Plumbing power into a sewer to service a SCADA RTU is an expensive ordeal. Deployment of antennas for a real-time radio communications system is also a further challenge.

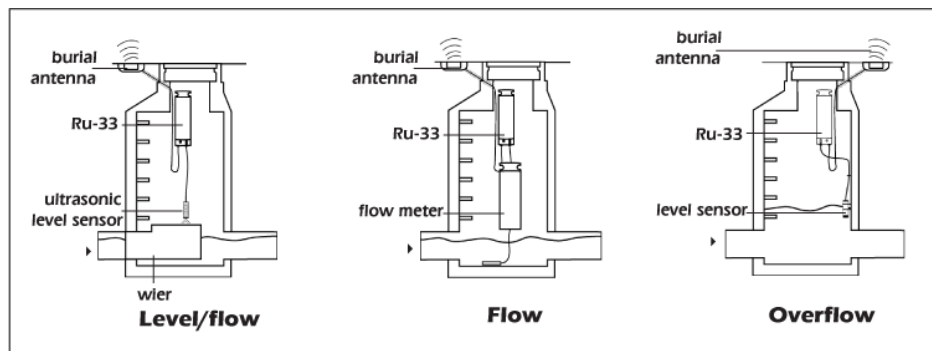
Alternatively, a battery powered remote DAS RTU utilizing cellular packet communications can be deployed underground, in the sewer with the sensors. In Push mode, the RTU makes the decision when to initiate the data call. This permits shutting down the radio modem between calls, allowing DAS RTUs to be battery powered.

Pushing data also allows the RTU to transmit data optimally for the application, for example, when it is raining or when the sensors are dynamically changing. This generally reduces data traffic at the host by one or two orders of magnitude, reducing computer resources and communication cost.

Installed Cost

For a host of reasons, SCADA systems for remote monitoring are quite costly when compared to a DAS approach. A remotely installed SCADA RTU may range in cost from \$6,500 to \$20,000. Much of this has to do with the fact that SCADA RTUs are designed to be installed on the shop floor where the climate is predictable, power is available, communications is a simple plug-in and installation is easy. Installing this same RTU in an underground vault is a bit more daunting: the climate is hostile, the vault might occasionally flood, closest utility power is up a pole hundreds of yards away and there is no Ethernet cable or phone line connection anywhere in site.

A DAS RTU is designed for this environment. For example, the Telog Ru-33 Recording Telemetry Unit is supplied with a 6 volt lantern battery intended to operate the RTU for many months including making regular though infrequent data calls to the host over the cellular infrastructure. It is supplied in an enclosure that anticipates the worst possible site conditions, e.g. a sewer containing corrosive gases that from time to time floods.



Typical installed cost of the Telog RTU including burial cellular antenna is less than \$3000 and takes an experienced crew less than an hour per site to install.

DAS + SCADA

DAS is superior to SCADA for remote monitoring applications and in some cases the only practical option. It is often desirable that remote data be integrated into the user's SCADA/HMI platform. This provides system operators and management a complete view of their systems.

Moving data from the host computer DAS application to the SCADA/HMI application is today a simple IT task, particularly if both systems are employing industry standard data protocols (e.g. relational databases). This methodology provides the user the best of all data worlds; the cost, versatility and reliability of a remote DAS system, and all their plant and field data on a common platform.