

Updating Data Acquisition Systems to Utilize Integrated Capabilities

Justin Schmid, Vice President, Mobile and M2M
Sierra Wireless

R.I.P. Analog

The communications industry is undergoing a massive shift from analog to digital transmission. The evolution is happening in all types of mediums, television broadcasts, radio and cellular communications.

For both consumers and enterprise customers moving from analog to digital signal transmission is inevitable. As of March 1st 2008, all major US cellular phone service providers stopped supporting analog coverage. In February of next year, over-the-air analog broadcasts will ride off into the "analog sunset." In fact, manufacturers have not been allowed to ship or import video products with only an analog tuner for over a year now.

Are there valid arguments for this forced migration to digital transmission? In fact many analog enthusiasts argue that analog signal, represented as a continuous sine wave, more accurately reproduces sound. The continuous signal of analog is also free of potential error mechanisms that are inherent in digital signal, which breaks sound into pulses or digits with varied amplitude.

Although analog signals do offer several advantages for sound quality, digital offers many clear benefits of its own. Unlike analog recordings, where the properties of the medium are directly related to the physical quality of the sound, data integrity enabled by digital signal is maintained over time despite the media in which it is captured. Repeaters in a digital signal remove the potential for cumulative transmission problems, allowing digital to transmit over longer distances. Since digital transmissions are translated into binary language, digital signal is more easily encrypted and, therefore, secure. Digital also enables easier multiplexing of large channel capacities. Perhaps the most important aspect of digital communications is that it provides a means for sending integrated voice, data and video over a single transmission.

Integrated Systems in Industrial Applications

The ability for digital communications to provide integrated services is paving the way to the deployment

of sophisticated data acquisition systems. These systems are typically used to gather information about a method or process. Some common applications are environmental measurements for weather, agriculture, wastewater, utilities and traffic monitoring.

Standard equipment comprising a data acquisition system would be a data logger with sensors and some form of stand-alone memory, but they are usually also reliant on a server for additional storage capacity and for hosting software necessary for data analysis and presentation. A data logger works with its sensors to convert physical events into electronic signals, which then must be digitized and converted into binary data in order to be analyzed using the aforementioned software.

Data Loggers: Stand-Alone Capabilities Lack Intelligent Advantage

Because data loggers are developed for use in unattended applications, they are built to be extremely dependable and to withstand harsh conditions. Since the instruments may operate for extended periods with no supervision, reliability is critical. As a reliable power source is paramount for these applications, some data loggers are designed with battery or solar power for backup, so these systems must be extremely power efficient relative to computers.

However, even with the advancements made in data logger technology, the most sophisticated models are still lacking in the areas of remote monitoring and control capabilities. Though data loggers range from single-channel input to more complex multi-channel instruments, with the newest versions able to serve web pages, the bottom line is that data acquired from a data logger and measurements taken from sensors is simply stored for future use. Though the measurements are taken in real-time, the advantage of immediacy is lost when the data trail ends in the data loggers' on-board memory.

Intelligence at the End Point Enables Superior Integrated Communication Systems

Unlike solutions that use unconnected data loggers, data acquisition systems used in conjunction with intelligent communications gateways provide access to the data in real-time and from a centralized point. These intelligent gateways maintain an always-on two-way connection, not only enabling pervasive access to the data but also facilitating remote control, management and maintenance of the remotely deployed solution from anywhere in the network. For obvious reasons, always-connected solutions utilizing intelligent gateways are outpacing data loggers in their power to utilize today's bleeding edge technology.

The utilities, wastewater and agriculture industries, to name a few, manage remote assets deployed throughout expansive geographic areas and increasingly require real-time, two-way communication to more efficiently manage measurement, collection and distribution. Intelligent connectivity devices enable the streamlining of measurement and control of transmission and distribution, automatic meter reading and management of infrastructure. Since legacy measurement equipment often utilizes various forms of serial communication protocols, they are not natively ready to leverage today's vast IP based communications networks. In addition to persistent connectivity, intelligent communications gateways perform complex packet assembly and disassembly (PAD) operations to condition the data so that it can be transmitted over the existing IP backbone. In some cases, modems must also be used to convert analog to digital signals to permit transmission over IP networks, regardless of data source.

Wireless Advantage: Data Access from Anywhere

Since many data acquisition solutions are remotely deployed, cellular-based communications play a very important role and require an intelligent and reliable wireless communications gateway at the end-point. Cellular networks offer a number of advantages over alternative solutions, including increased capacity, portability and better coverage. Most importantly, cellular provides the wireless advantage of being able to transmit data from isolated or distant locations where landline access just isn't feasible.

Wireless, industrial remote monitoring solutions provide real-time data access monitoring capabilities to quickly detect and fix issues or inefficiencies across vast territories. For example, unlawful removal of copper at remote transmission towers or downed wires from natural or man-made disasters can cause a domino effect, including large-scale service interruption to customers and destruction of transformers. Undetected gas leaks can cause massive environmental damage and revenue loss. The May 2007 leak at the BP Prudhoe Bay field was reported to have stopped nearly 100,000 barrels of oil production per day. With an associated revenue loss at 3 days x 100,000 bbl x \$65, that equals a three-day revenue loss of almost \$20 million.

Reducing Costs and Increasing Efficiency with Analog to Digital Migration

Not only does wireless connectivity provide immediate access to data from anywhere to help improve process efficiencies, but it is also a requirement for the growing demand for mobile or portable monitoring solutions. One such company faced with this dilemma is Progress Energy Florida (PEF), a subsidiary of Fortune 250 energy company Progress Energy. PEF was faced with the need to upgrade its analog data logger solution without incurring the exorbitant costs of replacing legacy equipment. PEF provides electricity and related services to 1.7 million customers and serves a territory encompassing more than 20,000 square miles. The company is pursuing a balanced approach to meeting the future energy needs of the region, including increased energy efficiency programs, investments in renewable energy technologies and a state-of-the-art electricity system.

PEF recently undertook an end-use load research study to better understand its customers and plan accordingly for future consumption trends. Customers willing to participate in the PEF study agreed to a detailed analysis of their energy consumption, by having equipment in their homes (e.g. washer, dryer, air conditioner, water heater) monitored with a data logger installed near their panel box. To collect the recorded data, the project used a circuit switched device connected to the customer's phone line. During the implementation phase, PEF began to encounter many homes that had migrated to digital communications utilizing DSL and Voice over IP (VoIP), or simply did not have landline access in the proximity of their panel box.

To secure a dedicated connection for the data logger, PEF considered installing new landlines to customers' homes. Since the devices must be connected to the data logger, which was most commonly located in a home's garage, not a customary location for a jack, the majority of homes would require a new RJ-11 phone jack be installed next to the device.

Installing a landline and jack was not only exceptionally costly up front, but also included a recurring monthly usage fee and additional fee for disconnecting the line at the completion of the study. Since, the study consisted of temporary installations in a series of customers homes, deploying a portable solution was a key deliverable. This requirement

Remote 2009

CONFERENCE AND EXPO

SCADA, Device Networking, M2M, Wireless Technology, Onsite Power, And Security for Remote Sites and Equipment

SAVE THE DATE

October 29th - 30th, 2009

Grand Hyatt San Antonio, Texas

For more information about sponsoring/exhibiting contact Jessi Albers at JessiA@infowebcom.com

For more information about speaking contact Nick Depperschmidt at NickD@infowebcom.com

WWW.REMOTEMAGAZINE.COM

Feature

caused a great deal of concern at PEF, since the landlines could not be used from project-to-project or from customer-to-customer.

PEF discovered a wireless data solution that performed the same function as the current circuit switched, dial-up application. Through the use of an RJ-11 IP gateway device integrated with intelligent, wireless gateways running on a 3G cellular network, PEF was able to effectively monitor load demand without interfering with other communication services and without installing any new landlines.

The RJ-11 IP gateway and intelligent wireless gateway solution inherently eliminates the need for a landline, eliminating the cost of installation and usage fees. The RJ-11 IP gateway device has the unique ability to connect legacy circuit switched devices to the public Internet by encapsulating the analog signal to internet protocol (IP) for transmission over digital cellular networks, seamlessly migrating from analog to digital without replacing system infrastructure.

Another advantage of the intelligent wireless gateway solution is the feature-rich intelligence enabling remote configuration, packet-level diagnostics and reliable network session persistence. By using an intelligent device at the end-point instead of a traditional circuit switched landline, PEF has the ability to communicate with and configure their remote gateways with a suite of easy to use remote management software. Finally, since the solution is portable, it allows PEF to re-use the technology in future programs.

After a pilot program using a small batch of wireless gateways, PEF conducted an analysis. The analysis confirmed that the ease of installation, accuracy and efficiency of data transmission and cost savings provided a sufficient business case to continue with a wide scale deployment. PEF currently has the portable wireless solution installed in more than 80 percent of participating customer homes. In addition to a greatly simplified installation process, PEF has reduced cost by avoiding visits from field technicians needed to support the unreliable landline devices and eliminating landline installation and usage fees.

Enhancing Data Logger Solution with Remote Monitoring Via Intelligent, Wireless Gateway

Another company that has enhanced its data logger solution using an intelligent wireless gateway for transmission and management is Western Weather Group (WWG). WWG furnishes accurate and personalized weather solutions through its weather forecasting and environmental monitoring systems. The company comprises professional meteorologists and scientists who have been working together for over 20 years, acquiring extensive experience in the field of meteorology and weather technology.

Western Weather Group's monitoring solutions act as a warning system, measuring set parameters (e.g., temperature or movement) and then proactively notifying the end user through email/text communication. WWG environmental monitoring systems are typically used in businesses such as farming and agriculture, as well as meteorology and environmental research projects. Applications include temperature monitoring to alert vineyard or orchard owners when frost point has been reached and a sensor-based security system that detects unauthorized access.

A WWG solution consists of antennas, sensors and a data logger. Units are solar-powered, with an additional small, 12 volt battery. WWG customizes each solution by programming the data logger to recognize specific parameters and take action once a threshold is reached, such as opening flood gates to depress water levels, turning fans off or on to regulate temperature, controlling

irrigation pumps to reduce or increase pressure and initiating visual or audible alarms with suspicious movement.

Many of WWG's implementations involve weather stations connected to analog cellular telephones, utilizing voice synthesizer modems that allow farmers and agricultural producers to remotely view current weather conditions. With the sunset of analog networks, WWG was forced to convert its analog cellular solutions to digital.

WWG considered many options, including radio telemetry and hardware telephone lines. Radio telemetry requires line-of-sight communication, which is not always available at weather station locations. Telephone lines require installation of new wires into locations that aren't already serviced, which is expensive and time-consuming.

WWG found the answer to its conversion question with the integration of intelligent cellular gateways into its monitoring solution to provide reliable two-way connectivity and enhanced remote monitoring capabilities. The wireless gateways access the expansive cellular networks and have embedded intelligence that simplifies installation, operation and maintenance of any solution. These reliable communications platforms provide the "always-on" and "always-aware" connection management required for unmanned applications. In addition, the use of sophisticated software tools allows WWG to remotely configure the wireless gateways and troubleshoot problems from a single location. Remote management capabilities drastically reduce the cost of total ownership and lead the way to a rapid ROI (return on investment).

"The combination of new data logger technology and the digital gateways enables us to send out text messages directly to a cellular phone or email address based on measurements in the field," said Don Schukraft, CEO of WWG. "This enables one to be immediately notified when environmental parameters exceed a specific threshold."

The WWG monitoring solution takes only a few hours to install and bring online. Western Weather Group currently has about 25 digital wireless gateways in use by a dozen customers. Additionally, ROI is realized in as little as one to two months depending on the application.

"If you can save grapes from a pending frost, you prevent revenue loss worth many times the cost of the system," explained Schukraft.

Intelligence is the Answer

As the world moves toward integrated communication systems, industries dependent on consistent data acquisition need an efficient way to provide the intelligence necessary for advanced capabilities like remote monitoring and infrastructure management, as well as the connectivity requirement to see and act on acquired data in real-time. While an analog data logger is a reliable source to capture measurements, it is simply a storage facility unless enhanced with an intelligent device that can transform the instrument into a solution. By implementing intelligent wireless gateways with legacy analog equipment business owners can monitor mission critical parameters in real-time, and can troubleshoot equipment issues remotely. Having two-way wireless communication with remote equipment drastically reduces operating and maintenance costs and generally leads to a rapid return on investment.

The remote nature and often geographically disparate deployments of monitoring solutions lends itself to the use of cellular data networks as a communications medium. Many deployments are located in areas with no landline access, and even when landline access is available, wireless has clear advantages. With a cellular solution customers can utilize one provider for deployments across wide geographic areas, instead of negotiating contracts with several regional providers.

There is no doubt that wireless communications are evolving towards digital transmissions, yet it can't be ignored that legacy equipment is very often designed to communicate with an analog device. Companies that cross the chasm from analog to digital communications with the least amount of capital investment will be in the best position to serve their customers.

Justin Schmid is Vice President for the Mobile and M2M Group at Sierra Wireless.

Sierra Wireless modems and software connect people and systems to mobile broadband networks around the world. The company offers a diverse product portfolio addressing enterprise, consumer, original equipment manufacturer, specialized vertical industry, and machine-to-machine markets, and provides professional services to customers requiring expertise in wireless design, integration, and carrier certification. For more information, please visit www.sierrawireless.com.

Everything you need to know about the industry. Right in your Box.

Subscribe to the Remote Site & Equipment Industry Report for full industry coverage:

Industry News New Products
Exclusive Features Applications
Market Research Industry Events



Other Webcom Industry e-Newsletters include:

e-Drive, Equipment Protection, Organic & Printed Electronics, Antenna Systems & Technology, Instrument Design & Technology, Materials Engineering News, Magnetics Business & Technology, Software Business, Thermal News, TeleHealth World, Software Investor News, LED Journal GreenTech News, Battery Power Products & Technology

Visit www.infowebcom.com/newsletters_form.php
To Subscribe to all Webcom industry e-newsletters