WHITE PAPER

How Cellular Technology Transforms Remote Monitoring Systems

Daniel Liu

Business Development Manager

Moxa Inc.

MOXA®

Remote, unmanned facility monitoring systems have long been constrained by the limitations of the long range communication interfaces available to system integrators. Traditionally, these long-haul communications interfaces were serial-based and used a polling architecture. Transmitting I/O data over the air presents a big challenge since wireless communications imposes a long response time, and systems that cover a wide area could experience data loss.

The limited amount of bandwidth (or data throughput) available using older technology imposes significant limitations on remote monitoring systems. Often, throughput is so low that the application can only deliver alarm point data acquisition. Instead of transmitting all the serial and analog data from the remote site, onsite intelligence was used to process this data and condense it into simple alarm points that were sent to the central monitoring site.

The advent of advanced cellular communications technology has freed system integrators from these limitations and unleashed new potential in remote monitoring systems. This white paper explores how system integrators can close the performance gap between cellular and wired communications.

IP-based Cellular Technology Grows Up

The beauty of cellular technology is that it is an IP-based technology. The vast majority of field monitoring devices are now IP-enabled, so it is possible to get all the data from field devices over a cellular network. However, just using IP-based communication media is not enough to create an ideal remote monitoring system. Bandwidth and latency are also important.

Fortunately, cellular technology has recently seen dramatic advances in performance. The transition from "2.5G" GPRS technology to "3.5G" HSDPA technology has unlocked substantial improvements in bandwidth and network latency. Now, cellular uplink bandwidth can reach 384 Kbps and downlink bandwidth can reach as high as 7.2 Mbps. Cellular latency has also been improved dramatically, now reaching as low as 100 ms. The bottom line is that cellular performance now exceeds most of the other long-range communications technologies available today.

Active Data Transmission Optimizes Bandwidth Usage and Avoids Communication Timeouts

Cellular technology is clearly at the head of the pack when it comes to long-range wireless communications, but it still can't compare to hard-wired LAN or WAN communications technologies. Most Ethernet devices are designed to communicate over LAN or high-speed WAN networks, which have more bandwidth and a

Released on April 15, 2012

Moxa manufactures one of the world's leading brands of device networking solutions. Products include industrial embedded computers, industrial Ethernet switches, serial device servers, multiport serial boards, embedded device servers, and remote I/O solutions. Our products are key components of many networking applications, including industrial automation, manufacturing, POS, and medical treatment facilities.

How to contact Moxa

Tel: 1-714-528-6777
Fax: 1-714-528-6778
Web: www.moxa.com
Email: info@moxa.com

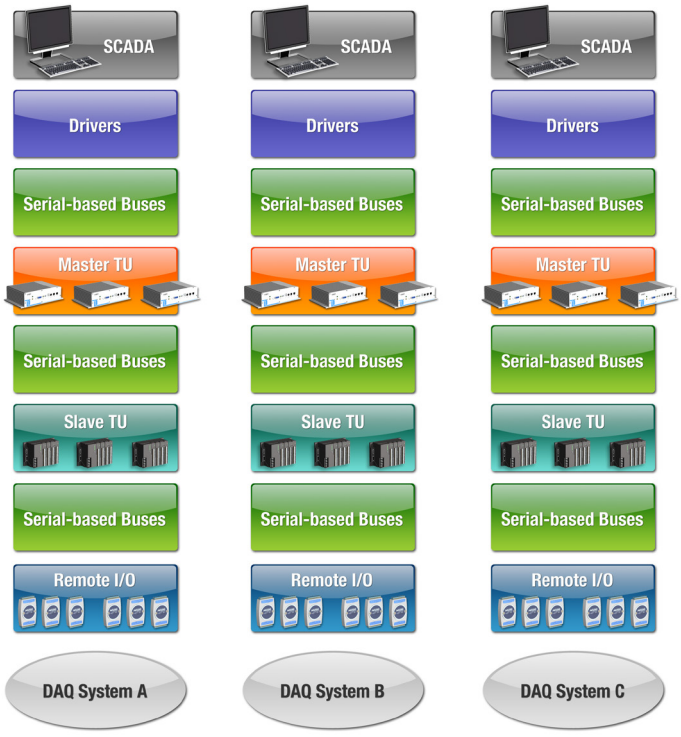
response time well under 100 ms. This disparity creates some potential problems when deploying Ethernet devices on cellular networks. One such problem is data communication timeouts.

Both Ethernet-based and serial-based field devices often use remote polling to acquire data. Polling, however, must take communication timeouts into account. A device whose communication timeout value is set to accommodate LAN communication speeds will face communication timeout issues when it is deployed on a cellular network. Repeated communication timeouts will crash the system and often, additional fees are incurred for each reconnection attempt.

Active data reports are the solution to this problem. Replacing constant data polling with active reports allows systems to overcome communications timeouts. With active reporting, the central monitoring server does not need to constantly interrogate field devices for data. Instead, the central server just waits for incoming data. Not only does this reduce bandwidth usage, it also makes real-time alarms possible. Most importantly, with active reporting it's possible to dynamically adjust communications margins to accommodate the network's timeout tolerance and prevent timeouts from occurring at all.

Active Reports Streamline Data Acquisition Layers and Reduce Maintenance Costs

Traditional polling data acquisition and alarm systems often require multiple data acquisition layers. This multi-layer architecture is designed to spread the system load and shorten the polling cycle. However, multi-layer systems are difficult to manage since a lot of equipment is required on each layer. In such a large system, a problem that occurs at one node will take a lot of time to locate and troubleshoot. In addition, a large multi-layer system is often cobbled together by different system integrators, each using different equipment and different protocols. Protocol unification alone can cause enough problems to cripple the entire system.



A system with too many data acquisition layers is costly and time-consuming to deploy and maintain

The development of cellular data acquisition and alarm systems that use active reporting technology has made it possible to eliminate data acquisition layers. Since cellular networks are IP-based, they have essentially no distance limitations compared to traditional radio or microwave communication interfaces, and the required number of communication relay nodes is reduced. Since the system uses the communication infrastructure created by the cellular provider, there are almost no infrastructure costs. What's more, the cellular network's bandwidth is significantly wider than RF and less vulnerable to outside interference, so fewer data acquisition relay points are required.

Utilizing Programming Capability to Make a Difference in Remote Monitoring

For complex algorithms, nothing provides greater flexibility than the programming platform. The programming platform is used for applications that require the highest level of programming versatility, such as custom protocols, complex calculations, and data logging. Moxa's C/C++ programmable cellular RTUs, which include Linux toolchain, can be used to easily customize user's applications to meet different needs. The programming environment helps users economize installation and configuration time by reducing programming overhead for key areas, such as I/O control, alarms, and network communication controls, which in turn include cellular connections and SMS, as well as interoperability with current SCADA/DB systems.

To save time and effort, users can now take advantage of the active reporting technology supported by Moxa's Active OPC Server and toolchain API to actively transmit data collected locally by cellular RTUs to a SCADA system. Compared to other programming platforms, this Linux-based cellular RTU delivers maximum coding flexibility in ready-to-use SDKs, making I/O control and alarming easier and faster through cellular communication.

Cellular Technology Makes More Advanced Remote Monitoring Systems Possible

With the advent of cellular communications, remote monitoring systems are changing. Simply put, remote monitoring systems can do more at a lower cost thanks to IP-based cellular technology, and system complexity can be reduced by eliminating data acquisition layers, which reduces management and maintenance costs. Even greater advances will be possible as 4G cellular technology is rolled out and more and more devices migrate to IP-based solutions. The future is bright for remote monitoring systems.

Moxa's next generation cellular RTUs deliver cellular technology in a robust, industrial-strength package, and programming capability and support tools make it possible to put this technology to use in a relatively short period of time. For more information, visit Moxa's website at www.moxa.com.