THE AMERICAN OIL & GAS REPORTER®
AUGUST 2011
The "Better Business" Publication Serving the Exploration / Drilling / Production Industry

Component Technologies, Workflow Management Drive Automation's Benefits

By Mark Rodgers

GREENSBORO, N.C.–As onshore exploration and production continues to shift to costlier shale plays and enhanced oil recovery projects, operators increasingly are seeking the benefits of automation to maximize production and lower operating costs. Mirroring the trends in high-cost, high-value offshore and subsea developments, operators of onshore fields are deploying automation technologies to prevent problems and equipment failures, minimize lost production, and enhance the overall economic performance of producing assets.

Essentially, production automation programs help operators bring more hydrocarbons to the surface at a faster pace and for less money. Oil and gas companies that successfully implement production automation programs can realize these benefits while also better positioning themselves to undertake new production projects.

Two crucial steps in implementing a production automation initiative are identifying the appropriate key technology components of an automation system and formulating an implementation "road map" to help operators achieve measurable results.

The single most important component of a production automation program is the remote monitoring and control system. Remote monitoring and control systems interface with field sensors, evaluate and store sensor measurements, and securely transmit the information over wired or wireless networks to a centralized database. From this database, the information is immediately available to all end-users through a graphical user interface for further reporting, graphing and analysis.

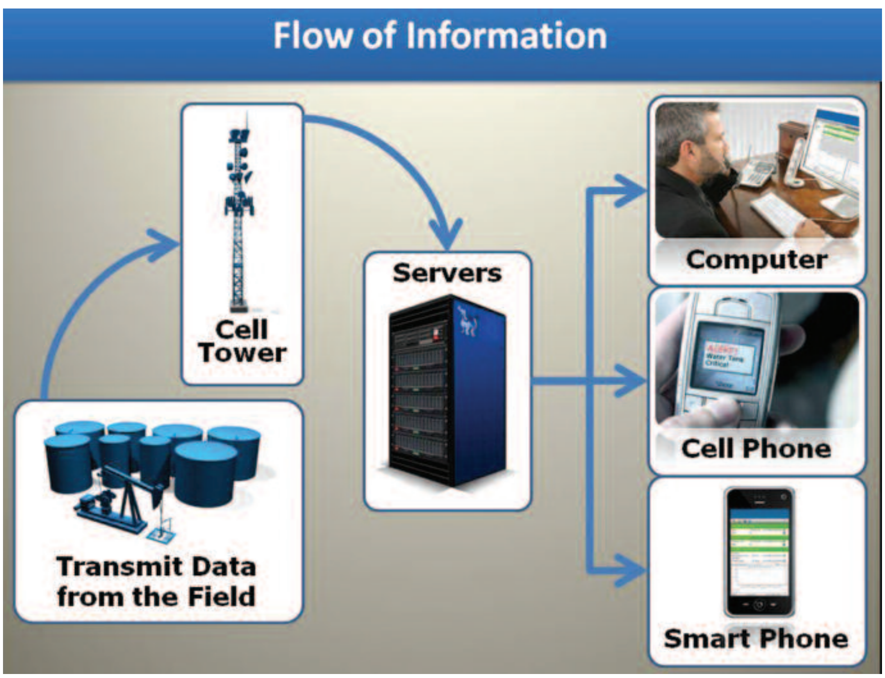
Remote monitoring systems provide new and valuable information to the operations staff on a continuous basis. For example, engineers can access pump cards, flow rates and other key measurements in real time to maximize well performance. They can graph pressures and temperatures to identify potential problems before they become critical and lead to costly repairs. Similarly, field staff can focus on new production and preventive maintenance, knowing they will be alerted of any sites that require their attention. The result is improved equipment run times, enhanced production, and lower operating and capital costs.

Key Requirements

Because the remote monitoring and control system largely determines whether operators will achieve these benefits, there are a number of key requirements that should be considered when evaluating a system. First, the remote monitoring and control system must have an open architecture that allows it to interface with the most commonly used sensors and protocols. This interface is regulated by the remote monitoring field hardware, which must provide sufficient analog and digital input/output (I/O) to accommodate multiple sensors.

For example, a well site installation may include a pump-off controller, casing and tubing line pressure and temperature transmitters, flowmeters, and liquid level sensors in tanks. The field hardware must have sufficient I/O for each of these sensors and be able to interface to them physically through cables or over a wireless connection.

Another important consideration is the operating environment, or firmware, that operates on the field hardware. The firmware will dictate the sensor protocols that can be supported (e.g., Modbus), the type and frequency of data collected from sensors, and all information processing functions that occur in the field hardware.



The remote monitoring and control system is central to any production automation solution, interfacing with field sensors, evaluating and storing data measurements, and securely transmitting data over wired or wireless networks to a centralized database. From the database, the information is available immediately to all end-users for further reporting, graphing and analysis, as illustrated in this overview of information flow with automated production and remote monitoring technology.

Accordingly, operators should ensure that they select remote monitoring and control systems with firmware that meets their known requirements and can be expanded for new sensors, protocols and features that may be required at a later time.

The system also should provide the ability to modify and enhance this firmware "over the air" (OTA), through the wireless network, which connects the field hardware to the centralized database. Accomplishing firmware upgrades remotely also eliminates the expense of a field visit.

As an example, consider a monitoring application in which a well is producing sour gas, and the operator wants to install a hydrogen sulfide sensor to measure ambient air quality. Firmware with OTA capabilities would allow the H_2S sensor interface protocol to be downloaded, define the data to be sampled and stored (e.g., H_2S in parts per million), and determine how often to transmit this information to the central database.

Intelligent Alarming

This example also highlights another important feature when selecting a remote monitoring and control system: intelligent alarming capabilities. A remote monitoring and control system constantly reads and transmits sensor data. Providing this information to the operations staff allows analysis that can predict problems in time to address them before they lead to production downtime and costly repairs. However, it is also important for the remote monitoring and control system to provide a wide range of alarming features, or intelligent alarming, when sensor measurements are out of tolerance.

Most monitoring systems allow the operator to establish thresholds for key measurements, and equipment status and alarms, when these thresholds are out of tolerance. Intelligent alarming extends this capability by directly allowing operator staff to create and update alarm thresholds (such as minor, major and critical alarms). Furthermore, intelligent alarming should allow the operator to create alarm rules based on simultaneous evaluation of multiple measurements.

This capability requires conditional "if/then" and "and/or" logic operators for each measurement. For example, the operator should have the capability to create alarms such as "if measurement A exceeds X and if measurement B is less than or equal to Y, then do C." Operators also should en-

Fully integrating workflow management with remote monitoring and control capabilities allows operators to realize significant economic, operational, environmental, regulatory compliance and safety benefits with automation technology. As shown here, a variety of equipment and processes can be automated on any production site, ranging from pump controllers and tank battery levels, to ambient air quality monitors and compressor operations.

sure that they can implement intelligent alarms OTA, so that as conditions change, new or updated rules can be downloaded immediately to the field hardware. These powerful intelligent alarming features provide the best line of defense for operators to diagnose and address equipment problems that otherwise could lead to production downtime and expensive repairs.

For example, maximizing production often requires optimizing compressor run time. Simply monitoring overall compressor status would alert staff only when a compressor went off line. In many cases, by the time this alarm is generated, damage to the compressor already has been done. However, a remote monitoring and control system can continuously evaluate each compressor's interstage temperatures and pressures, engine vibration and oil level. Each measurement then can be analyzed to provide detailed alarms to staff in advance of actual compressor downtime. The alert also can be targeted to the right staff with the tools and experience to rectify the problem before it negatively impacts production.

Another major consideration is the remote monitoring and control system's ability to identify when network connectivity has been lost. Once the system identifies a loss of network connection, it should automatically alarm the operator of this off line status. These alerts instruct staff to manually inspect those sites affected to ensure normal operations. Furthermore, the field hardware should be capable of continuing to read and process sensor data even in a network outage, and to transmit the data once the connection has been re-established.

A final consideration for evaluating the intelligent alarming capabilities of a remote monitoring and control system is the actual distribution of alarms. Call-out systems must ensure the alarm is communicated expeditiously to the right person or persons. As such, the call-out system should include the ability to define the specific personnel to be alerted for each alarm as well as allowing for alarm escalation until the problem is addressed. Additionally, the means to alert operations staff through a cellular short message service as well as e-mail are important capabilities.

Network Considerations

Next are the network considerations for a remote monitoring and control system. Operators should carefully assess the network connectivity options with emphasis on coverage, capacity, security and availability. Before remote fields had cellular coverage, satellite networks were used primarily to transmit data. However, satellite communications can be very expensive, especially compared with cellular networks, and may have limitations on the size and frequency of data transmissions.

Cellular networks are deployed very widely now and are available in most remote locations. Cellular networks also provide compelling economics, best-in-class security features, excellent uptime, and high capacity to allow transmitting large amount of data.

Wired solutions can meet monitoring requirements, but are feasible only where Internet connections exist, which is a rarity in most producing fields. Also, wired solutions can be prohibitively expense, such as the cost of installing and maintaining fiber optics. Similarly, individual radio systems are expensive to build and maintain, and can have bandwidth and security limitations.

A remote monitoring and control system will dramatically increase the data available to field staff. As such, operators should carefully evaluate the system's ability to transform these data into actionable intelligence. The continuous, time-stamped data transmitted by a remote monitoring system literally can be a treasure trove, providing the information required by field staff to undertake continuous production improvement.

A case in point is pump-off controllers, which many operators use to maximize pump efficiency, lower energy costs and extend rework time frames. However, many controllers are not remotely monitored, requiring a site visit to collect pump cards and controller data. By making pump-off controller data available 24 hours a day, seven days a week over any Internet connection or mobile phone, field engineers can undertake detailed analyses of surface and downhole cards to optimize performance.

The remote monitoring and control system also should become the foundation for collaboration. For example, an engineer may not have the experience to evaluate a fluid pound condition. However, if he calls a company expert, they can collaborate to evaluate and optimize the pump-off controller.

Accordingly, the remote monitoring system should allow simultaneous viewing of the data across the enterprise. The collaboration supported by a remote monitoring and control system provides an effective means of institutionalizing enterprise knowledge and sharing experience with newer staff.

Implementation Road Map

Once all the key requirements for a remote monitoring and control system have been considered, the operator's attention can turn to establishing an implementation road map to fully achieve the benefits of increased production and lower costs. This road map requires integrating the remote monitoring and control system with workflow management.

Without a production automation system, field staff workflow is route-based and provides limited visibility to equipment status. A good example is the workflow management of compressor technicians.

Traditionally, technicians have been assigned routes based on the geographic locations of the compressors. The route is driven daily, beginning with the nearest compressor and ending at the farthest, even if these sites are operating normally and do not require any attention. This limits the number of compressors assigned to each technician and may lead to extended downtime before a site is even visited. And once on site, there is no guarantee that the technician has the right experience or tools to fix the problem, requiring additional trips and even more downtime.

With a remote monitoring and control system, the same technicians can access the system from any Web browser, prioritize sites that require attention, and collaborate with other technicians for problems they are not equipped to handle.

By avoiding nonproductive drive time and site visits, they can spend their time on preventative maintenance or work on new production programs. These same benefits can be achieved for all field staff, creating an effective, efficient and intelligent workforce that is focused on improving production, eliminating costly repairs, and planning requirements for new production programs.

Remote monitoring and control systems fully integrated with workflow management allow operators to realize the unique benefits of production automation initiatives. These systems help ensure production assets operate longer between expensive rework and repairs, and efficiently bring maximum hydrocarbons to the surface. Additionally, environmental monitoring with intelligent alarming enhances safeguards, regulatory compliance and safety. Meanwhile, staff collaboration extends expertise across the enterprise and strategically prepares the next generation of field staff.

While estimates of these benefits justify the initial investment in production automation, operators also must measure actual results. In this endeavor, vendors and operators work collaboratively to ensure that quantifiable results and the targeted return on investment are achieved. This leads to continuous improvement and expansion of the production automation program across the entire enterprise. ❐

MARK RODGERS

Mark Rodgers is the manager of sales and marketing for Bluetick Inc., a Greensboro N.C.-based supplier of digital oil field solutions, including remote monitoring and control systems for mature fields, enhanced recovery projects, and shale plays. He has been active in remote monitoring and control systems for 20 years, with particular emphasis on the digital oil field, smart grid technologies, and telematics. Several of his patents focus on end-to-end remote monitoring systems and architectures. Rodgers earned a double major in chemical and petroleum engineering from Mississippi State University.