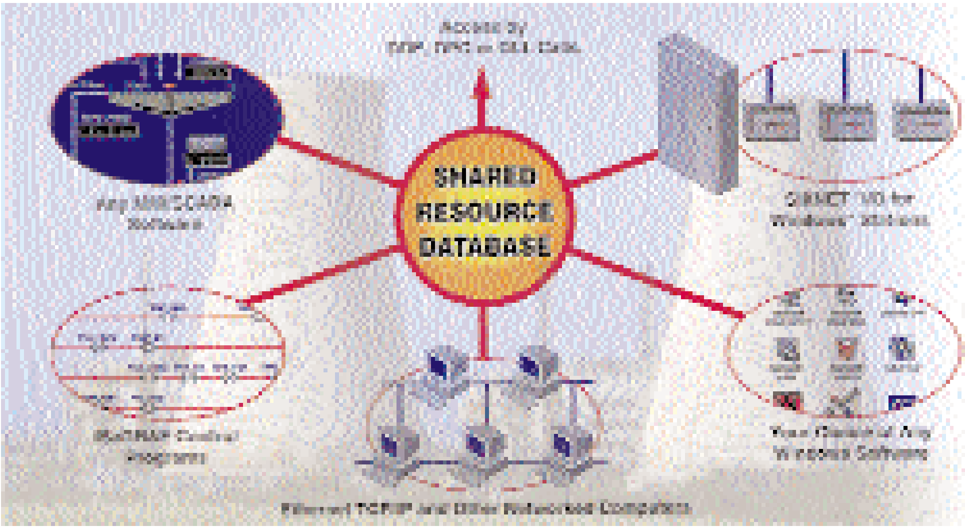

Visibility is the Key

Imagine a powerhouse the size of a football field that provides energy for a major manufacturer of gas turbine engines. A powerhouse filled with boilers, chillers, air compressors, generators, cooling towers, motor control centers, pumps, and fans. Add to this a second plant owned by the same company located nearby with a powerhouse of similar size and design. The two powerhouses must coordinate with each other to share the load of providing energy for the manufacturing facilities.

The equipment that runs these powerhouses, having been installed over a period of time by various OEM providers, had little to no ability to interface with each other. Most of the equipment possessed no communications capability and the pieces of equipment that did have the ability to communicate are very proprietary in nature. This made interfacing to a single software-based monitoring system very difficult.

Due to the need to improve operating efficiencies and maintenance scheduling, the customer desired a "total monitoring tool" to be implemented that would allow for all assets to be viewed within one system. "Visibility is the key. We have to be able to monitor our assets in order to manage them." was stated by the powerhouse manager.

The customer planned to monitor various values such as operating temperatures, running times, and number of starts of their motors. This would become the basis to implement a preventive maintenance program. Also, the ability to view information and alarms conditions from a central control centre would allow the customer to capitalize on their maintenance and operational staff. Ultimately, they planned to implement an asset lifecycle

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- Rex Crane

management program to help with predictive maintenance of their assets.

The customer had a master vision on how to implement such a system. The plan called for traditional PLC systems to be installed in a number of locations around each powerhouse. Multiple remote IO racks were to be connected to each PLC and strategically placed in an effort to reduce field wiring. Where possible, serial communications would be utilized to interface directly to a proprietary device such as variable frequency drives. In the envisioned architecture, the PLC would act solely as a data concentrator. The plan called for Ethernet to be used as a method to communicate the data back to an existing supervisory control and data acquisition (SCADA) system that had been installed on a previous project.

The customer targetted one of the powerhouses as a place to begin the project. Thirty-one IO "nodes" of various IO point counts were identified. Since phase I of the project required monitoring only, the IO points were primarily inputs and evenly divided between analog and discrete signal types.

It was suggested to the customer that perhaps a PLC-based system would not best serve their needs. PLCs tend to be proprietary in nature and not well suited for a highly distributed application such as this. While open forms of communication such as TCP/IP over Ethernet are common among PLCs, it typically extends only as far as the main processor and not out to the IO. One can certainly distribute the IO through the use of networks like DeviceNet or Profibus but the communication to the actual IO network is still proprietary and commonly allows for only one master device, typically the PLC, to address it. At best, it is more costly and less flexible when compared to Ethernet.

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With thirty-one nodes in one powerhouse and a similar number in the second, this project was obviously highly distributed over a wide area. The number of Ethernet-based PLC processors required to connect this many nodes made the project cost prohibitive.

After reviewing a white paper titled "Breaking the Programmable Terminal Strip Syndrome" which discusses the advantages of using an Ethernet-base distributed IO system over traditional PLC systems for monitoring applications, the customer agreed to entertain other options.

The customer was introduced to a concept called EtherTRAK manufactured by a company named SIXNET. The product consists of DIN rail mounted IO modules with Ethernet communications built in. The modules come in a variety of point counts and signal types. Some models have a mix of both analog and discrete or both inputs and outputs. There is an expansion port on the EtherTRAK module that allows up to 512 IO points to be configured on one IP address. This, coupled with the ability to address up to 16000 module addresses allows for virtually unlimited expansion. An estimate was done for the initial project and it indicated a total installed cost far below that of the PLC system.

The customer was reluctant to break the tradition they had lived with for many years of using PLC systems for automation projects. They agreed to test the IO on a small scale to evaluate the ease of implementation and reliability. They chose a small motor control centre with only six starters for the test. They wanted to read the motor current and running status on each of the six motors. Six analog inputs and 6 discrete inputs required just one combination EtherTRAK module with eight IO points of each type for this test.

The EtherTRAK module was installed and configured in a short amount of time. It was temporarily connected to a SCADA computer via a cross-wired Ethernet cable and configured to communicate through SIXNET's Control Room software. After thirty days of evaluating without any problems, it became evident to the customer that EtherTRAK is a viable option for this type of monitoring. The decision was made to proceed with engineering based on the use of SIXNET products.

A detailed list of assets to be involved in phase I of the project was created and an IO list was generated from that list. Network architecture drawings were produced detailing network routes and strategically place Ethernet distribution points. Work simultaneously proceeded in the second plant using identical concepts. One-by-one the IO nodes were installed, configured, and integrated into the customer's SCADA system. In most cases, the customer's own maintenance personnel installed and configured the modules.

The small form factor of the EtherTRAK modules required less panel space than PLC IO racks. In many cases the modules were incorporated into existing control panels thereby eliminating additional panels, conduits, and wiring.

After integrating all of the initially targetted items into the SIXNET system the powerhouse manager was asked to comment on SIXNET. He replied, "The true beauty behind the SIXNET solution, aside from the affordable cost, is we can accomplish the installation in-house connecting one system or machine at a time."

The customer's increasing appetite for data combined with the ease of integration of the SIXNET products soon caused the project to grow well beyond the original scope. Items such as air compressors, chillers, boilers, and rooftop air handlers were targetted to get the same treatment as the motors. There were even two special IO panels designed to interface with legacy hard-wired alarm panels. Previously, the SCADA software could not log alarms generated in the alarm panels due to the lack of communication.

At this point there was sufficient data integrated into the SIXNET system to begin development on a program to manage their assets. SIXNET IPm controllers were installed in each powerhouse. The function of these controllers is to communicate with all of the IO from the individual devices and perform calculations such as running hours, number of cycles, current alarms for motors, totaling of power consumption, etc. Since the SIXNET EtherTRAK products are Ethernet-based and run in a shared resources environment, it allowed the IPm controllers to be connected wherever it was convenient. All assets were instantly available for them via the network. A fiber optic cable connecting the two powerhouses on one common network allowed operators in one plant to view alarms and power demands from the other plant.

The SIXNET IPm is a multi-tasking Linux-based industrial processor that has the ability to not only provide traditional PLC and DCS control functionality but also the ability to share its resources to all other nodes on the network. A very strong programming environment allows for sophisticated programming that previously could only be deployed in a PC or more expensive DCS systems.

An IPm running a custom application called The Consultant TM was installed. This application monitors numerous process values pertaining to the customer's boilers. Every two seconds it runs an efficiency calculation and returns 0 - 100% efficiency for each of their boilers. This application also runs a calculation to determine the efficiency of the steam loop to the manufacturing plant. It accounts for all BTUs generated, used, and lost. A base line was developed for the efficiencies of each boiler system. The Consultant TM monitors the efficiency and sets alarms when it deviates from that base line.

In phase I the SIXNET system had been restricted to monitoring only and no responsibility for control had been given to it. However, there were a number of processes that were controlled by a proprietary control system. That control system had become "mature" and costly to maintain. Because the customer's maintenance personnel were not equipped to service the existing system it was necessary to maintain an annual support contract for that equipment. The contract ensured a timely response in the event of a failure as well as availability of spare components. The powerhouse manager knew that if they replaced the proprietary control systems in both plants it would save his maintenance budget $25,000 per year. Also, they wanted to integrate those systems into the SIXNET network so they would have the same visibility as the other processes. The decision was made to replace the proprietary control systems with SIXNET in phase II of the project. The customer's maintenance staff was trained in programming IPm controllers and the task of implementing full control into the SIXNET system began.

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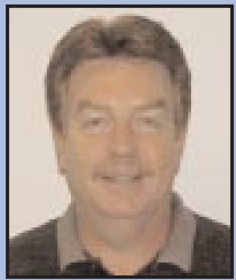
Over the next few months the existing proprietary control systems were replaced with SIXNET in both plants. Among the type of control projects that were converted are process water supply, condensate return pumps from manufacturing, exhaust fans, air makeup units, electrical power demand monitoring, and cooling towers. At this point the commitment to SIXNET control products has become significant enough that all new projects are specified to have SIXNET control equipment.

When asked to comment on his opinion of SIXNET control products, the powerhouse Chief Engineer offered the following response. "I never dreamed there could be control system as flexible, cost effective, and reliable as SIXNET. We have been using SIXNET products for more than three years without so much as a single IO point failing. I have used PLC systems for many years and have never seen that type of reliability."

Phase II of this project is an ongoing effort with small projects emerging on a routine basis mixed with larger capital projects. Among the capital projects underway at the time of this writing are a full air handler control project for one of the manufacturing plants, fuel distribution project, and a boiler rebuild project. The boiler project will replace an old DCS system. Another company attempted to promote a prominent DCS system for the boiler control project but was denied.

A full asset lifecycle management program is planned for the future using a controller-based custom application. Of course, implementing an asset lifecycle management program is more than just controllers and software programs that run calculations. It requires a commitment from management and operations alike to a disciplined predictive and preventive maintenance effort. But, as the customer stated, "We have to be able to monitor our assets in order to manage them" so in essence, visibility is the key. ■



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