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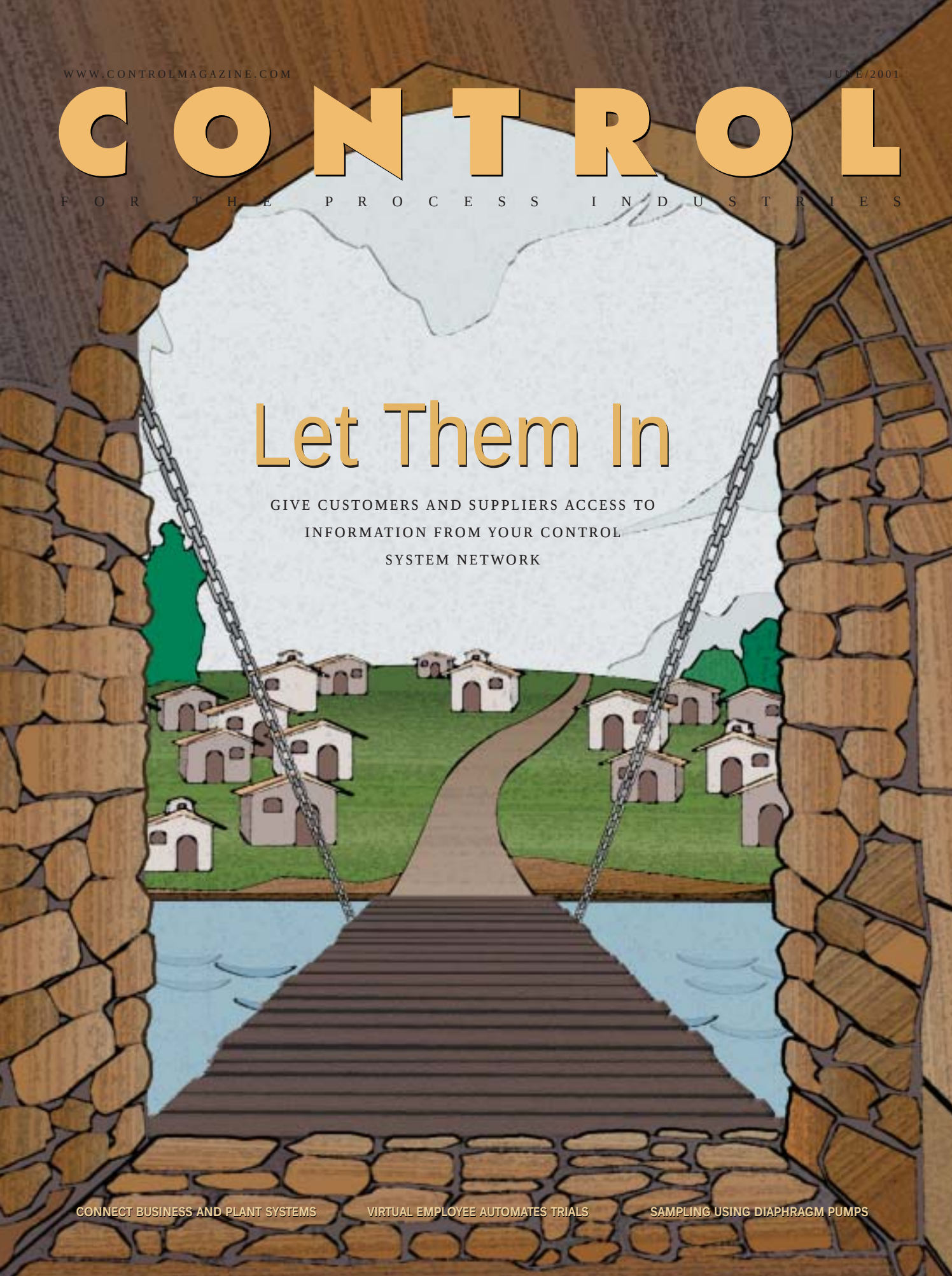
CONTROL

FOR THE PROCESS INDUSTRIES



Let Them In

GIVE CUSTOMERS AND SUPPLIERS ACCESS TO INFORMATION FROM YOUR CONTROL SYSTEM NETWORK

CONNECT BUSINESS AND PLANT SYSTEMS

VIRTUAL EMPLOYEE AUTOMATES TRIALS

SAMPLING USING DIAPHRAGM PUMPS

Let Them In

By Bob Waterbury, Senior Editor

Depending on your viewpoint, it could be your best dream or your worst nightmare. The dream is to provide an Internet port on the automation network of your plant or company. With the proper security, this would allow engineers and managers to log on to the web site from anywhere in the world and access the process controls for your polyethylene plant in Houston, for example. It could also allow your customers and business partners the same type of controlled, selective access to production, quality, and delivery data. All that is needed is a standard web browser.

In some instances, customers and business partners may even demand this type of access. Those instances are ones in which the customer or business partner owns or has a strong interest in the chemicals that your company stores or processes under the auspices of the automation network in question. Examples might include bulk storage terminals, toll processing plants, and captive or dedicated plants that are owned or operated by one company on behalf of another under various arrangements.

The degree of Internet openness goes far beyond dial-up access via telephone modem, which has been a reality for at least 10 years in some quarters. The advantage over private dial-up arrangements is that any number of remote users can access the network from any computer by familiar procedures, without special software. In both cases, usage controls specify what data can be viewed and what parameters can be changed by various groups of people. The question is whether such an arrangement is a useful tool or an opportunity for abuse.

E-COMMERCE: HEAVEN OR HELL?

The dream come true, of course, is that the chemical processing or storage firm can not only boost the quality and value of its services, but also save money for itself and its customers. When customers can ascertain the status of their materials directly from the system, it frees up customer service staff for more productive work.

Information obtained by customers can be virtually real-time, delayed by just minutes or seconds instead of days or weeks. Real-time inventory also enhances their ability to promise delivery to their own customers, leading to greater speed, efficiency, accuracy, and convenience in their transactions. All parties involved reduce the costs of idle inventories.

Finally, it represents a big step toward web-based business-to-business connectivity, in which both customers' and suppliers' computer systems are linked to yours via

the Internet for automatic order service, because it begins providing information on which that service is based.

As for the worst nightmare, it is the vision of failures and loopholes in security controls. You may fear that outsiders could peek into details of your plant's operation—invade your privacy, discover your mistakes before you can correct them, learn your proprietary methods, draw wrong conclusions from malfunctioning instruments, find ways to beat down your prices, and so forth. Furthermore, it can be tricky enough for your own people to distill meaningful business data from diverse and often contradictory operational data, so it is difficult to imagine your customers being able to do it right.

These prospects can be frightful enough even when customer access is merely by private dial-up connections; opening a window for worldwide public access may seem downright foolhardy.

Like it or not, this degree of connectivity is not just coming—it is already here, in limited forms. This is a natural development because the Internet is becoming a pervasive universal language and communication medium. Such access by customers is now relatively easy to achieve, it promises great benefits over the alternatives, and there are ways to avert the nightmares. Accomplishing it involves thinking in terms of strategic design of information flow from materials management or the chemical process to the customer.

GIVE CUSTOMERS AND SUPPLIERS ACCESS TO INFORMATION FROM YOUR CONTROL SYSTEM NETWORK

VOPAK VOTES "YES"

At its commercial liquid bulk storage terminal in Galena Park, Texas, Vopak Terminals North America (formerly Paktank Corp.) is upgrading its automation with a new generation of open, field-based intelligence. PlantWeb architecture from Emerson Process Management (previously Fisher-Rosemount) is being used to integrate smart Foundation fieldbus and HART instruments with conventional ones in a growing network that interfaces transparently with a legacy computer system and the Internet. The result furthers Vopak's aim to provide its customers with web-based direct monitoring and control of their inventory.

"Vopak Terminals North America's liquid bulk storage terminal sits on 30 acres fronting the Houston Ship Channel and has 87 tanks with an aggregate capacity of about a million barrels," says Vopak's terminal traffic manager, Marianne Duthu. "At the Galena Park location, we store a wide variety of liquid materials for many different clients on a toll basis. These

chemicals move in and out via rail tank cars, tank trucks, barges, and tanker ships."

Typical of facilities of this sort around the world, the Galena Park terminal does not yet make wide use of remote data acquisition and control. Pumps and valves are turned on and off mostly by hand, according to former terminal manager Edward Lux. Levels, flow rates, temperatures, and pressures are typically read by eye and keyed into computer terminals connected to an HP-3000 mainframe at Vopak's headquarters in Houston.

Terminal management software in the computer serves all 13 of Vopak Terminals North America's facilities, says Duthu, keeping track of customers' materials, issuing invoices, etc. Using a feature called "Plug in to Vopak," customers may log onto the Vopak mainframe via dial-up modem to read inventory levels, utility usage, and other information about their accounts for efficient demand supply planning and management.

"At the beginning of 1999, an opportunity appeared to begin a terminal-wide data acquisition and control system on a piecemeal, bootstrap basis," says Lux. "We would be storing two related petrochemical products in 30,000-barrel API-650 tanks for a major customer. In addition, this customer wanted us to remove traces of certain impurities—a process known as scrubbing.

FIGURE 1.

STATUS RAPPORT

USING THE WEB, A CUSTOMER MONITORS THIS PRODUCT TREATMENT SYSTEM LOCATED AT VOPAK TERMINALS NORTH AMERICA'S COMMERCIAL LIQUID BULK STORAGE FACILITY IN GALENA PARK, TEXAS.

"The alternative was to barge the material to and from a toll processing plant somewhere along the ship channel at a rate of about 3,000 barrels per day," Lux continues. "By installing a treatment unit on-site, however, we could save a great deal of money for the customer and earn a little more ourselves."

A product treatment system was built consisting of three beds regenerated by hot nitrogen. This unit and its four associated tanks (Figure 1) would need more remote monitoring and control than traditional terminal operations (Figure 2). It required advanced remote control and incremental expansion throughout the terminal.

IMPLEMENTING WEB ACCESS

After evaluating the alternatives, Vopak chose to implement the latest generation of process automation architecture, called open field-based architecture. The architectural version selected was Emerson's PlantWeb—successor to its earlier SCADA and DCS products.

In these older concepts, programmable intelligence is located primarily in PLCs, RTUs, or DCS controllers. Such controllers exchange discrete and analog signals with field devices such as valves, switches, and transmitters. They also communicate with operator stations and one another via networks called data highways.

"A field-based architecture, by contrast, pushes as much of the intelligence as possible out to the field devices themselves," says Lux. "In other words, it uses the capabilities of smart field instruments that contain computer circuitry and the ability to communicate as one computer to another."

In this application, PlantWeb field-based architecture implemented with DeltaV process automation devices uses the capabilities of smart field instruments and also communicates with conventional devices. It includes a PC-based DeltaV operator station running standard Windows NT connected via an optical fiber Ethernet local area network (Figure 3).

The term "open" refers to the use of operating systems and communications methods that are standard and not proprietary to specific suppliers. Open standards employed by PlantWeb architecture include PCs running on Microsoft Windows NT; local area networks based on Ethernet with TCP/IP Internet protocol; and field device communication via 4-20 mA signal, HART, or Foundation fieldbus.

Fieldbus is a multidrop data link for field instruments. Foundation fieldbus is a widely accepted standard, and its H1 version carries all-digital data serially at 31.25 kbaud on ordinary twisted-pair wires over paths as long as 6,200 ft. One segment serves as many as 16 instruments. The bus also provides power to all field devices, which are typically designed to draw no more than about 20 mA each at a nominal 20 volts.

"The open field-based architecture allows smart instruments to assume many of the control and communication tasks normally performed by PLCs, DCSs, and other controllers," says Chris Gross, sales representative for Puffer-Sweiven, La Porte, Texas, an Emerson distributor and system integrator. "This opens up possibilities for improved plant

performance, reliability, economy, and responsiveness to customer requirements.

"Devices can be set up, configured, and programmed using highly automated plug-and-play and drag-and-drop procedures," Gross continues. "And the web-based field architecture allows many of these same activities to be accomplished remotely, either on site or at great distance. Likewise, operational data such as tank levels and utility usage rates can be passed to management computer systems; and production, quality, and delivery data is made accessible to partners, customers, and suppliers via the web [Figure 4]."

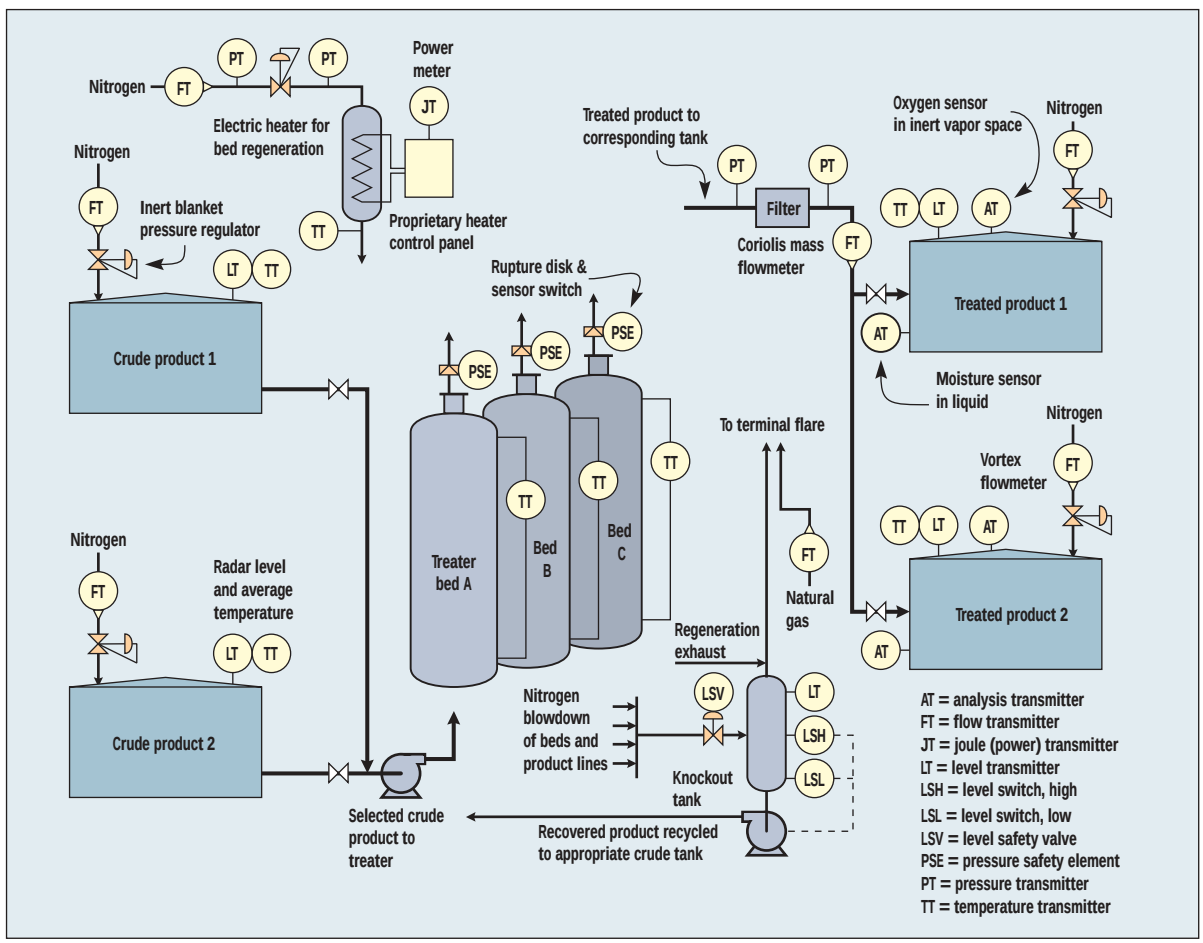
The most direct way to implement Internet access to automation data by customers (including business partners) is the same way one would provide it for remote users within your company, says Gross. Simply install web server software right in the plant automation network, which is the source of the information. This example is based on the latest in open, field-based architecture. It is a readily available, off-the-shelf solution.

In this example, an off-the-shelf web server software suite is provided as part of the open field-based architecture. Web servers of various kinds are becoming available for most automation systems. This one runs in a PC station that also happens to be used as a link between the automation network and the plant's information-systems LAN. The web server suite includes Microsoft's Internet Information Server, which is included in the standard NT Server 4.0 package.

Physical connections to the Internet can be achieved in several ways that are routine for information technology people, but not yet familiar to all process automation technicians. In this example, the plant's information-systems LAN is equipped with an Internet server that handles all Internet traffic for the plant. It is linked to the

FIGURE 2.

TERMINAL TREATMENT PLAN



THE PRODUCT TREATMENT SYSTEM PICTURED IN FIGURE 1 CONSISTS OF THREE BEDS AND FOUR ASSOCIATED TANKS, WHICH REQUIRE MORE SOPHISTICATED REMOTE MONITORING AND CONTROL THAN VOPAK'S TRADITIONAL TERMINAL OPERATIONS.

Internet via a high-speed router that includes a firewall. Customers gain access by logging on to a web site at a host name within the company's domain.

If the plant did not already have an Internet connection, one could be arranged with a local Internet service provider or telephone company. It would use a modem or other interface device of the desired speed at the control network's web server station.

This particular web server software connects to the automation network using the industry standard OPC. To prevent remote users from affecting the plant's operation, the software is designed for view only. It is a thin-client application in which customers do not need any special software, drivers, or custom applications. Using a web browser such as Microsoft Internet Explorer or Netscape Navigator, customers or business partners can view process graphics, process-variable trends updating on a real-time basis, historic trends, and summaries of events and alarms. Documents can be viewed with MS Word and MS Excel.

The web server software allows security to grant or deny access to individual modules, so that customers get only the information needed. This arrangement also provides a fringe benefit to the company, in that the plant LAN serves as an intranet for the automation network's web server station. Personnel at any computer on the plant LAN can use a web browser to access the automation system without having to run automation software.

THE VOPAK WEB SOLUTION

"We secured approval to build the treater unit in the middle of March, and the unit had to be operational at the first of June to meet the customer's requirements," says Lux.

The design was a close copy of an existing unit owned by the customer, according to Lux, and the equipment was readily available. A conventional PLC-based SCADA system or DCS would have been impractical due to the time required for wiring, programming, and training of operators and technicians.

"Emerson and its local representative company, Puffer-Sweiven, were helpful in our decision to use open field-based architecture and in making sure we received the hardware, software, and technical assistance in a timely fashion," says Lux. "All engineering, construction, and startup work was bid out to independent contractors."

Many of the field instruments are intelligent devices that use H1 Foundation fieldbus. There are two fieldbus segments, both served by one I/O module. The only 4-20 mA analog signals are inputs from the four analyzers and the knockout tank level transmitter. The particular instruments used for those purposes do not have computer intelligence. The radar level gauges and related temperature transmitters on all four tanks communicate on a multidrop serial data link being polled by a field communication unit (FCU).

The system's main function is to gather data and store it in a database that is accessible to the legacy computer system. For this purpose, the operator station has a second Ethernet port connected to the plant LAN. Until OPC capability is implemented within the legacy system, data are passed by an equally simple and open method based on Windows: flat files generated by Excel spreadsheets that are automatically linked to the DeltaV database.

FIGURE 3.

EYES ON THE PRIZE

A PC-BASED OPERATOR STATION RUNNING STANDARD WINDOWS NT IS CONNECTED TO THE CONTROL SYSTEM AND PLANT TERMINAL SERVER VIA ETHERNET LOCAL AREA NETWORKS.

"Periodic self-diagnosis and self-calibration by intelligent transmitters not only eases the maintenance burden considerably, but also makes instrument readings much more accurate and trustworthy," says Vopak instrument technician Mike Chalpowski. "We are able to present customers with data items that are accompanied by a number indicating the degree of confidence in the validity of each item.

"Needless to say, the treater unit instrumentation performs as expected," Chalpowski continues. "When the customer makes an online request for the latest figures on its inventory and utility usage at this terminal area, what is received is no longer based on hand measurements made at the end of last month or even yesterday. Instead, the data came from electronic instruments just a few minutes ago."

CUSTOMIZING CUSTOMER DATA

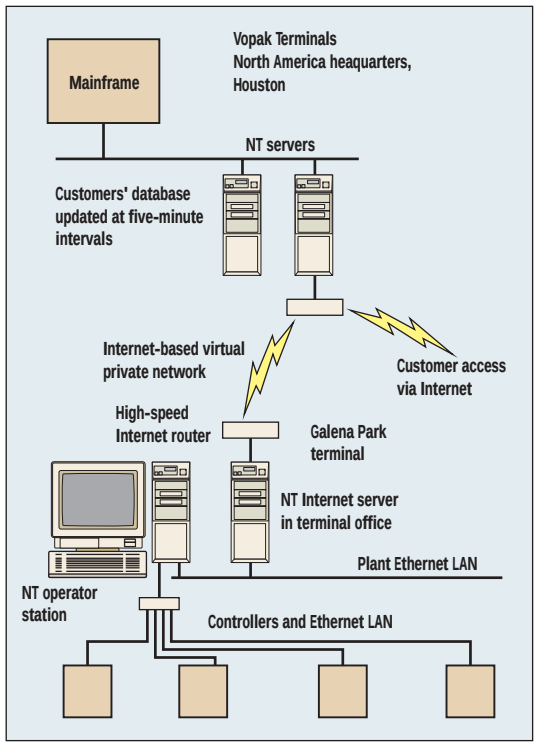
For some companies, the greatest challenge in making operational data available to customers via the Internet may not be collecting the information and arranging for access, but putting the information in a form that is genuinely useful to customers.

"The easiest problems to address here are the mechanical ones—but even they may require considerable creativity," says Duthu. "For instance, identical material belonging or committed to several different customers may be commingled in the same storage tank, and each customer wants real-time

gauging of its own material. Such a situation requires an algorithm that takes into account not only the signal from the level transmitter on that tank, but also the history of inputs and withdrawals on each customer's account. Thus, the quantity that each customer reads on its own screen is not an actual instrument signal but a computed variable."

FIGURE 4.

OPEN-DOOR POLICY



OPERATIONAL DATA SUCH AS TANK LEVELS AND UTILITY USAGE RATES CAN BE PASSED TO MANAGEMENT COMPUTER SYSTEMS; AND PRODUCTION, QUALITY, AND DELIVERY DATA IS MADE ACCESSIBLE TO PARTNERS, CUSTOMERS, AND SUPPLIERS VIA THE WEB.

The toughest problems are those pertaining to sorting and presenting data. Here, the design should be based on polling customers about the current and expected future requirements of their various employees and representatives who will be looking for information.

Customers typically say that if the data is not real-time, don't bother—and that raises the question as to how frequent "real-time" is in each case. It depends on whether the variables involved are changing, and how rapidly. When material is flowing in or out of a tank, half an hour is too seldom for updating the liquid level, but five minutes seems to satisfy most people in the chemical industry today, according to Duthu. However, when nothing is flowing in or out, a monthly update is sufficient.

When the latest available data were first provided to customer personnel on a private dial-up basis about 10 years ago, ("the latest" meaning anything more frequent than once a month), they were pleased to be given a general, comprehensive tabulation. It included all of their company's materials, unclassified with respect to fine details such as material identity, location in the world, final destination, or units of measure.

Customers were happy to sort through the data and convert the units themselves. Now they are likely to expect you to do all the sorting they need, plus convert the units if that is what they like. Furthermore, some representatives want to look at data running back six months or a year, or organized according to their own end-user customers. Expectations are getting more specific. And changes continue because the businesses keep changing.

"Currently, our latest innovation for Vopak terminal automation is an NT Internet server on the plant's main Ethernet LAN, to which the DeltaV operator station is connected," says Duthu. "Located in the terminal office building, this computer provides access to the corporation's new Internet-based virtual private network via a high-speed router operating at 1.54 megabits per second. Real-time customer data passed up from the DeltaV controller updates files in the main Houston office every five minutes. Customers will now be able to access their account data through a Vopak web site, using appropriate privacy features such as passwords."

Open field-based automation at this bulk terminal is advancing Vopak Terminals North America's plans for eventual business-to-business integration of supply-chain management via the Internet. "We are installing the same technology at the company's other terminals," says Chalpowski. "Moreover, we expect that this automation will interface very efficiently with the J. D. Edwards ERP [enterprise resource planning] system that is being globally implemented by Royal Vopak."

For a large company handling chemicals at many locations, making useful real-time data available to customers via the Internet can be complex and expensive, especially if the implementation involves interfacing with a legacy system based on proprietary custom software. This example, however, shows the importance of putting the information-systems back office in shape to keep the executive front office moving in the direction of the company, and maintaining leadership in its field.

Chances are, not every company will choose to enhance its full-service offerings with affordable state-of-the art web technology. But perhaps your competitors in the global e-marketplace will. The choice is to make web technology work for you or against you: your best dream, or your worst nightmare.