

# Will Web services replace HMI?

BY JIM STROTHMAN

Partly, perhaps.  
But not for high data,  
near-real-time needs.

Low-cost technology to make data available "from the plant floor to the top floor," as the old, overused saying goes, may finally be emerging.

It's coming in the form of Web services, and its promise extends beyond the boardroom to possibly also help manufacturers' sales departments and other business decision makers.

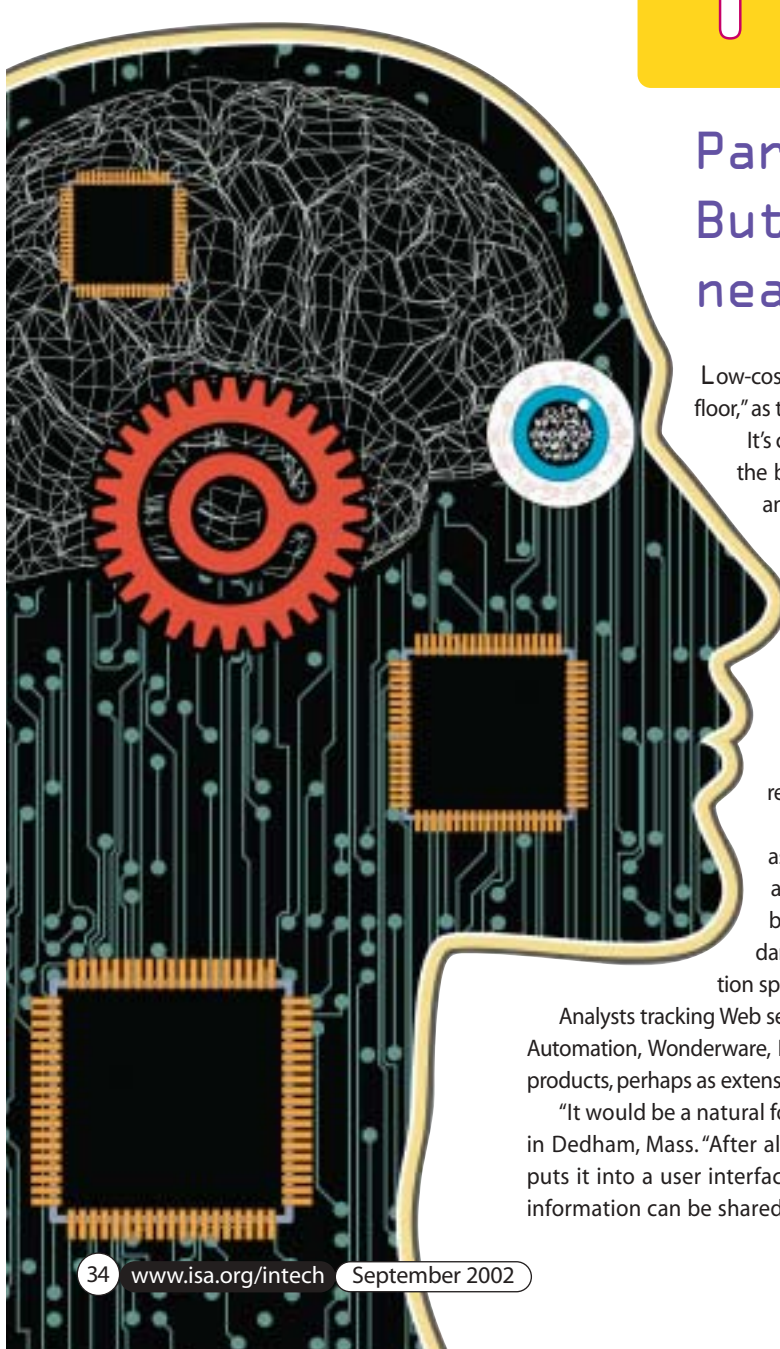
However, Web services technologies are not yet "ready for prime time" by plant floor operations and maintenance personnel, a major human-machine interface (HMI) supplier cautioned. Web-based software simply can't compete with today's HMI systems when it comes to satisfying HMI users' demands for rich, responsive animation, high-data throughput, and close to real-time screen control.

Broadly speaking, a Web service is a URL (browser)-addressable resource that provides data to people or machines wanting it.

Web services are based on widely accepted open standards, such as hypertext transfer protocol, extensible markup language (XML), and simple open access protocol (SOAP). Future versions will also be based on compatible emerging standards being developed by standards groups, such as the universal description, discovery and invocation specification and Web services description language.

Analysts tracking Web services technologies expect HMI vendors such as Siemens, Rockwell Automation, Wonderware, Intellution, U.S. Data, and Citect to roll out additional Web-based products, perhaps as extensions of their HMI systems.

"It would be a natural for them," said Dick Slansky, senior analyst at ARC Advisory Group in Dedham, Mass. "After all, what does HMI do? It collects information, aggregates it, and puts it into a user interface. A Web service would act like a portal to the Internet so that information can be shared."



However, Daryl Walther, a product manager in Rockwell Software's visualization business, cautioned, "Web services does not have real-time response built into it. It won't replace existing visualization systems because Web services is, plain and simple, not fast."

Rockwell offers a Web server extension to its Windows-based RSView32, an integrated, component-based HMI for monitoring and controlling automation machines and processes. Called RSView32 WebServer, the software enables RSView32 users to check access graphic displays and tags via any standard Internet browser.

"If you want to call in from home and get a status update, it's good for remote access—but not for real time and certainly not for control," Walther said.

### MICROSOFT, IBM LEAD PUSH

Microsoft and IBM, longtime leaders of the global efforts to standardize Web services, are both aggressively pushing software incorporating the technology. Microsoft's .NET (pronounced dot-net) architecture includes a flavor called .NET for Manufacturing.

Last February, Microsoft and IBM were among a broad group of technology leaders who formed the Web Services Interoperability (WS-I) Organization ([www.ws-i.org/](http://www.ws-i.org/)), a cross-industry initiative designed to accelerate developing interoperable Web services across a variety of platforms. Other WS-I founders include Accenture, BEA Systems, Fujitsu, Hewlett-Packard, Intel, Oracle, and SAP.

Since then, a host of other vendors have jumped aboard the WS-I bandwagon, as have some major users, including Daimler/Chrysler AG, Ford Motor Co., and United Airlines.

While Java—particularly J2EE—dominates enterprisewide systems, "Microsoft owns the factory from the server on down," Slansky observed.

"Those who have invested in a Microsoft platform will be more inclined to add .NET," said Sophie Janne Mayo, director of wireless and e-commerce implementation services research for high-tech market research firm IDC in Framingham, Mass. "If they are a Sun Microsystems shop, more than likely they'll stay with that [J2EE] strategy."

HMI experts warn .NET for Manufacturing has weaknesses, however. Microsoft positions Web services' SOAP as .NET's principal remote messaging technology. SOAP's polling strategy may be alright for low-

bandwidth requirement markets and for the general use Web. However, it falls short in performance for high-end HMI and real-time data acquisition, they say.

"Users and manufacturers alike are trying to identify what .NET's benefits are, what elements are usable, and what .NET elements are not usable," said ARC's Slansky.

XML and SOAP add complexity and, by definition, don't lend themselves to real time, Walther said.

The Rockwell product manager said one of the company's customers, a West Coast electric generation utility, provides Web extensions to its customers—but strictly for read-only information.

### EARLY ADOPTERS MUM

Several major manufacturers are known to be testing Web-based systems, probably including Web services, but details are hard to come by. Boeing's Wichita, Kan., commercial airplane plant is reportedly implementing IBM's WebSphere to enable collaborative manufacturing with its supply chain. Honeywell and Siemens are both developing .NET-based systems internally, sources said.

Computer build-to-order pioneer Dell successfully implemented Web-based technologies, including Web services, to fix a supply side problem.

Hewlett-Packard's printer division reportedly uses eRoom, an application enabled for Web services delivery, as an exception management tool for supply chain coordination. When a stock out or other exception is detected, eRoom alerts those charged with managing the exception to "meet" in the eRoom environment.

eRoom Technology said more than 650 companies use its digital workplace software, including Airbus, A. T. Kearney, Aventis Pharmaceutical, Bausch & Lomb, Compaq, EDS, Flextronics, Ford, HP, Pharmacia, Pfizer, Siemens, Solectron, and Sony.

General Motors Corp., which already uses Lotus Notes and the Internet to connect its employees, suppliers, and customers, has reportedly begun pilot Web services tests conducted by its main outsourcer, EDS. By year's end, the effort could enable employees to access and aggregate

vast stores of GM data via the company's 130,000-seat Lotus Notes installation.

GM also hopes to use Web services standards to deliver new customer services. Behind this is the fact that any application incorporating Web services standards can discover and connect with any other Web service. GM is said to be testing Microsoft's .NET Web services software, IBM's WebSphere, and Sun Microsystems' J2EE Java software.

### SERVER CENTRIC TO DEVICE CENTRIC

According to ARC Insights, written by Slansky, Web-based technology coupled with embedded intelligence at the device level will combine to change next-generation factory architectures from today's server-centric systems to becoming "device centric" systems.

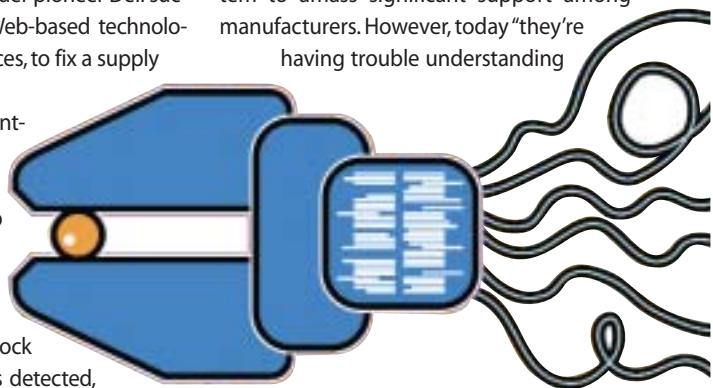
"Only in recent years, with the advent of Web-based technology and advances in embedded intelligence, has information been accessible from low-level devices such as sensors, gauges, motors, drives, and valves," according to the report.

With Windows-based PC systems dominating plant floors below the server level, Slansky said he expects Microsoft's .NET system to amass significant support among manufacturers. However, today "they're having trouble understanding

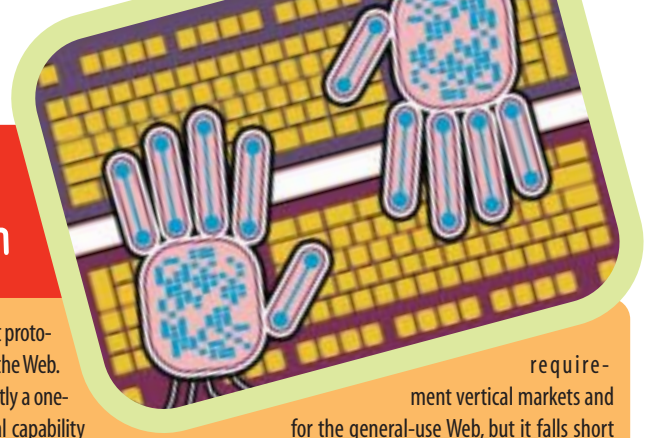
what .NET for Manufacturing is. How does it differ from DNA for Manufacturing and tiered architecture?"

The analyst said discussions with manufacturers led him to believe they really don't understand what's involved enough to move to a .NET environment. "Microsoft is saying it's a major evolution—akin to moving from DOS to Windows. If so, [.NET] will be hard to sell to manufacturers based on Windows. They'll have a lot of code to rewrite."

IDC predicted professional services around Web services-related projects will generate \$7.1 billion in the U.S. by 2006, representing a spectacular compound annual growth rate of 116%. IT



## Web-based HMI: Beware of the fiction



With all the hoopla around the Internet, there is a growing belief among many that the World Wide Web can take the place of almost any network. However, at least one major human-machine interface (HMI) software supplier, Rockwell Automation, has begun cautioning HMI users to look hard before putting all their eggs in that Web basket.

"If all you need to do is to look at a snapshot of historic information, then yes, the Web can do that. But if you need real-time plant floor monitoring and control, if you need to know immediately when some aspect of your system changes, if you need an alarm system that will notify you the instant something goes wrong, the Web is not yet able to provide that solution," Rockwell Automation said in a white paper expected to soon be released.

Rockwell Automation acknowledged the Web's benefits, especially cost savings. For example, the Internet requires only nominal client administration—often just a browser and a network connection; enables distribution of business logic to servers anywhere on the Internet; and allows access to data from any computer with an Internet connection, anywhere in the world. The Web also pushes resources to the server side, resulting in low-cost ("thin") clients.

Because most large integrated automation applications require many HMI stations connected to a few programmable controllers and databases, it's logical to make HMI stations browser-based and connect them through the Internet, right?

Wrong, Rockwell Automation warned. That's because current Internet and Web technologies cannot yet provide what most existing HMI users need: high data rates, high animation capability, and sub-second screen changes.

### Won't meet needs

"Unless and until technology changes dramatically, Web-based solutions will only satisfy a portion of the current market for HMI: those whose applications can tolerate low bandwidth and duty cycle, moderate to low data transfer, and primitive graphical animation capability," the white paper cautioned. "For the existing customer base, most of which is used to rich, responsive animation, high data throughput, and close to real-time screen control, Internet and Web technologies, when used alone for HMI architectures, will not satisfy their requirements."

Standardized Web protocols are the problem. The International Organization for Standardization's seven-layer open systems interconnect standard dic-

tates that hypertext transport protocol (HTTP) is the language of the Web.

However, HTTP is inherently a one-way protocol. HTTP's principal capability is a command called "GET." When a user running an application in a Web browser requests a page, the system launches the HTTP GET command. It contacts the appropriate Web server. The server accesses the requested page and sends it back to the browser. The user then views this page. However, the page is static, and the data on it doesn't change.

If the user wants a new page of information, the system must fire off the HTTP GET command again and again and again—at rates probably on the order of one per second to even attempt to mimic current HMI systems' animation capabilities. Basic HTTP and hypertext markup language (HTML) were never really designed for page animation.

Extensible markup language (XML) improves the situation only marginally for high-throughput applications because, Rockwell Automation said, there are at least two problems: First, "XML requests" still depend on HTTP GET. Second, XML markup is done in text format. As formats for data transfers go, it is one of the "fattest" yet invented. Each time XML data is transported, network overhead is spent transporting both the true data and the XML markup formatting.

"Again, this overhead may be completely adequate for low-bandwidth HMI applications, but the overhead and the polling certainly present an unfortunate upper bound for high animation rate, Web-based HMI," cautioned Daryl Walther, product marketing manager for Rockwell Software's Visualization business unit.

"This limitation of XML is well known to the OPC Foundation," added Walther. Rockwell Software played a key role developing the Microsoft-based OPC technology, now widely accepted by manufacturing industries.

"The OPC technical committee on XML has identified that using XML on top of HTTP will limit the throughput, for all the reasons stated earlier, and so the technical committee is looking into the possibility of eliminating the need for and use of HTTP and other protocols," Walther said.

XML's throughput limits on HTTP also applies to a more recent Internet protocol, simple object access protocol (SOAP), which sits on top of HTTP3. Soap uses XML to provide client applications and their servers with an object-oriented abstraction. SOAP's "polling strategy may serve well in low-bandwidth

requirement vertical markets and for the general-use Web, but it falls short in performance for high-end HMI and real-time data acquisition," Walther added.

"This inadequacy of the SOAP protocol is truly disappointing for another major reason: The next major technology initiative from Microsoft, called .NET, positions SOAP as the principal remote messaging technology. Microsoft and .NET are not currently meeting the manufacturing and automation markets' higher performance requirements," noted the Rockwell Automation white paper.

HMI users lack political clout with the Internet and Web software community because "HMI users simply do not command a large enough market share to force Internet technology to conform to their needs," it added.

### Event-driven protocol needed

"High-throughput tasks, particularly data acquisition and alarm annunciation, will not perform well enough in a polling environment. For these, an interrupt, or event-driven acquisition protocol, is needed. Event-driven protocols will be required even if HMI continues to use HTTP for low-bandwidth features and tasks," the white paper continued.

In an event-driven protocol, rather than polling a server to get new data, a client connects to the server and "subscribes" to the data of interest. Whenever data on the server changes, it will "publish" or "advise" that data to the subscribed clients, showing only the data a client is interested in rather than all the data, as is the case in polling.

"Two segments of the HMI market will emerge, and it is very important that users understand what segment they belong to prior to committing to a solution," the white paper said. "There will be those who find that the standard existing Web protocols [Rockwell Software RSVIEW32 Web Server, for example] provide an adequate solution for their needs. These users will not require high throughput or close to real-time animation.

"The rest of the HMI market will not find this low-throughput solution acceptable. . . . Other protocols that support high-throughput, event-driven strategies will be required to complete the promise of the next generation of high-performance HMI. These protocols are available."