

Industrial Ethernet: The Death Knell of Fieldbus?

By Perry Sink

A year ago, a guy walked up to me at my spiffy new Fieldbus display at a trade show and proclaimed to me that the days of Fieldbuses were numbered. He stood boldly in his \$500 suit and proclaimed a new gospel to me, in the tradition of the ancient prophets. The wrath of the marketplace was fallen upon the heads of Profibus, DeviceNet, Interbus and ControlNet, he said. No longer would customers strive with the wayward inclinations and collective confusion of Fieldbuses. The writing was on the wall: the king of TCP/IP and the pagan armies of Ethernet were gathered outside the walls of the city, he said. Our banquet feast was about to come to an abrupt and bitter end.

Woe was me. My Dream of DeviceNet and the Promised Land of Profibus would wither away under the scorching sun of Ethernet. The unfortunate part, I thought, was “Gee, this ‘banquet feast’ we’ve been having hasn’t even been much of a banquet feast anyway. It’s been a more like an all-you-can-eat buffet at Kentucky Fried Chicken. Most people haven’t exactly made a killing in this Open Control game yet.”

The Case For Ethernet and a Single Universal Standard

He did have a point. Ethernet is EVERYWHERE. Matter of fact, millions people use Ethernet when they rise up, when they sit down, when they log in and when they log out. And half of ‘em don’t even know they’re using it. You can go to an office supply store and throw Ethernet cards, software, switches and routers in your shopping cart. The guy at the checkout lane who takes your money doesn’t know the difference between a packet and a pita pocket. But when you take the stuff to your office and install it, it works anyway.

It logically follows that the same benefits could be applied to automation systems. Then all this chaos over protocols, proprietary networks, open standards etc. would evaporate. Machine wiring would be as ‘open’ as the Internet itself. 20+ popular networks and hundreds of proprietary ‘homebrew’ protocols would crumble away, and a single universal standard would emerge

triumphant. The next step, of course, would be one-world government. I think there’s a committee working on that, too.

...But Then There’s Reality

Many manufacturers have already realized this, and new Ethernet I/O products are appearing on a monthly basis. And it almost seems that everybody’s got a different way of doing it. I heard of one company who actually reverses the position of two wires on the cable to make sure the customer only uses *their* products on his network.

The biggest issue is this: Ethernet itself is a physical layer specification, which defines the basic electrical characteristics of the network. And TCP/IP is a way of packing data into messages, arbitrating transmissions from multiple sources, and ensuring complete reconstruction of a message at the other end of the wire. *It says nothing about what that packet of data contains or what it means.* It could be a picture or a web page or a text document or an encrypted message or 1 bit of data that makes your front porch light turn on. And yes, it could be I/O data from your conveyor system. But there’s no rule or standard as to how that data is put on TCP/IP and taken off. Several methods that are being used right now come to mind: putting the Modbus RTU, ControlNet, DeviceNet, Profibus, or HPIB (Hewlett Packard Interface Bus) protocols ‘on top of’ TCP/IP and packing bits and bytes inside *those* protocols. Plus others have ‘rolled their own’ entirely.

It *is* possible to put a dozen different protocols on one network and have them all talk to one host at the same time, just as it’s possible to put a dozen different brands of printers on the same network, and print to any one you choose. The problem is, you simultaneously need a dozen *drivers*. Ain’t that fun? I’m sure all of the software vendors are looking forward to writing them!

A Dozen Proprietary Protocols With The Same Name?

So the current situation is this: Industrial Ethernet, in reality, is a dozen different proprietary designs, which are all called "Industrial Ethernet." So far, it doesn't really solve the problems that a single universal standard would solve. And it certainly doesn't lessen the confusion.

Industrial Ethernet Association to the Rescue

To solve this problem, we've formed the Industrial Ethernet Association, whose purpose is to define and promote the use of Ethernet in manufacturing and process equipment. The following are among the issues which IEA will address:

- A method of packing digital and analog I/O data on TCP/IP with its associated parameters and units
- Standards for interfacing other complex devices: drives, motion controllers, operator interfaces, PLC's, barcode readers, etc.
- Adopting an industrial-grade connector. Everyone agrees that those plastic 'telephone' style connectors used in office equipment won't survive the factory floor.
- Adopting a deterministic architecture.
- Identifying and clarifying the proper interface between your machine's Ethernet and your company's intranet. Odds are your I.S. Manager will start tossing bricks into your cubicle if you mess with his network!

Industrial Ethernet Association was founded by Synergetic Micro Systems, Hirschmann, Grayhill, HMS Fieldbus Systems, Hilscher GmbH and Contemporary Controls. It was launched in March 1999 has over a dozen members now. The membership fee of \$500 is being waived for the first year. For more information and a whitepaper on Industrial Ethernet, visit www.IndustrialEthernet.com or call (630) 434-1770.

Answering the Prophets of Doom: Ethernet is Just Another Fieldbus

The prophets proclaim the death of Fieldbus. It's a free country, so let them talk. But if

you've ever researched or installed a network of any kind, you know it's just like everything else in engineering: there are tradeoffs at every turn. Tradeoffs between speed and determinism, noise immunity and distance, bit-level data vs. large message capability, flexibility vs. ease of use, etc. etc. We all know that no one approach is a cure-all for everything. And no one networking standard can address all needs in the marketplace. There will always be multiple standards, and when Industrial Ethernet is fully defined, it will be another Fieldbus.

Finding Ethernet's Proper Place among the Fieldbuses

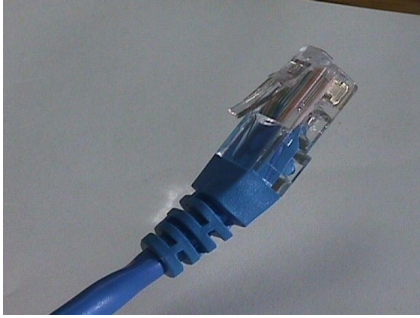
Ethernet has the following advantages:

- It's universally accepted.
- The huge market for Ethernet products and components makes them inexpensive, widely available and thoroughly tested.
- At 10 or 100 Mbit/sec, it's "fast."
- Most engineers are already at least somewhat familiar with it.
- It's used in corporate LANs so it's a natural fit in the 'Sensor to Boardroom' connectivity scenario.
- TCP/IP is also used on the Internet, so it makes 'Web Enabled' applications easier to implement

Ethernet has the following disadvantages:

- It's not as practical to use it at the very lowest level, i.e. embedding it in single sensors, as it is with DeviceNet or ASi.
- Its universal acceptance tempts users to try to do too many things on one network and presents security issues.
- The connectors that are currently standard do not meet the physical demands of production equipment.
- It is collision-based and not inherently deterministic.
- It's not as immune to noise as other Fieldbuses.
- It has a large amount of 'overhead' and doesn't use its bandwidth as efficiently as other buses.

So when it's time to design a control system, Ethernet will go on the list and be examined on the basis of its merits just like every other bus. May the best man win! Certainly, different networks will win in different applications.



This Ethernet RJ45 'telephone' connector is great for the office, but would you put it on a robotic welder?

Ethernet Perception vs. Reality:

In the general consumer market, perception *is* reality. In the electronics world, perception eventually *becomes* reality with the inevitable progress of technology. But here are some general observations about putting Industrial Ethernet connectivity in factory floor products:

- *It's 'Dirt Cheap'*: When you embed Ethernet into a product, you'll find that it's not necessarily any less expensive to implement than other buses. As a matter of fact, it's considerably *more* costly per node than CAN based protocols like DeviceNet. It requires a fair amount of 'horsepower.' Ruggedizing the physical connections will also raise the cost.
- *It's Totally Open and Universal*: This is the perception, but as I discussed earlier, such is not actually the case today. Eventually confusion will give way to order and it *will* be open and universal.
- *10 or 100 Mbits/sec is so blazing fast, speed is no longer a problem*: When you do actual comparisons taking all factors into account, this is often *not* true. At high speeds, noise becomes a problem and the way out is to use

fiber optics. But then the cost advantages go out the window!

Prophetic Chrystal Ball

It's anybody's guess what will actually happen, but here's what I expect to see in the next 2-4 years with Ethernet and the other Fieldbuses:

- Ethernet will become a popular format for "rack" and "cell" level networking and above. It will not replace bit-level sensor buses, though. It may actually stimulate their growth by complementing them.
- While the standards are being defined and a cloud of confusion still surrounds Ethernet, the existing Fieldbuses will continue to grow and become less expensive.
- 'Web Enabled' controls products will proliferate and software that runs on a web browser will be the rage.
- Some 'fringe' networks will fall away (this is already happening) and a half dozen standards will be widely used, Ethernet being one of them.
- The cost of networking will continue to drop, familiarity will become nearly universal, and everyone will use networks to connect everything.

So let the Ethernet armies march into our banquet feast! And tell 'em all to bring a bottle of champagne when they come. There'll be enough Food, Fun and Fieldbus for everyone.



Available on request: The 24 page white paper, "Industrial Ethernet and 8 Popular Fieldbuses." Email sales@synergetic.com to receive a copy.

Perry Sink is Training Manager at Synergetic Micro Systems in Chicago (www.synergetic.com) / (800)600-0598, a manufacturer of industrial networking hardware, software and tools including Ethernet.

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