Buses 102

Understanding Ethernet

- Overview

- Connecting to the business network

- Connecting automation subsystems

- FOUNDATION fieldbus HSE

- Ethernet as a fieldbus?

- Using multiple networks

Overview

What's the role of Ethernet?

Because it's widely used in office networking, Ethernet is familiar and inexpensive. But the plant floor isn't an office, and requirements for process automation aren't the same as for business applications.

Even so, in the right applications — and with the right extensions — Ethernet can reduce costs and improve performance.

This course examines the role of Ethernet in process automation.

Hint: As you go through the course topics, watch for answers to these questions:

- *Is today's Ethernet technology appropriate for process control?*

- *How is FOUNDATION fieldbus high-speed Ethernet different from standard Ethernet?*

Connecting to the business network

Ethernet is the dominant business network technology worldwide, and it's standard practice for automation systems to provide Ethernet connectivity for business integration. Depending on the automation system backbone, the connection can be as simple as a network switch, or as complex as a full gateway.

Connecting automation subsystems

Most automation systems are a collection of subsystems — including controllers, operator interfaces, and application processors. While some use a proprietary network to connect these subsystems, the increasingly common approach is to use Ethernet with proprietary extensions.

These extensions typically make the network more suitable for process automation by adding redundancy, enabling more deterministic behavior, or allowing Ethernet to carry data from other protocols.

The most common method used to carry data from other protocols is tunneling. Tunneling ignores most of the services of Ethernet protocol, essentially "packaging" the data and sending it from point to point underneath the protocol.

FOUNDATION fieldbus HSE

The FOUNDATION fieldbus HSE (high-speed Ethernet) protocol uses Ethernet in an open, interoperable way. With support for redundancy and the FOUNDATION fieldbus User Layer, HSE has the attributes to become a standards-based automation system backbone.

The PlantWeb advantage

PlantWeb architecture uses Ethernet and fast Ethernet — with appropriate extensions to improve reliability and performance — as the backbone for the DeltaV and Ovation systems. FOUNDATION fieldbus HSE is also being added to PlantWeb. When this addition is complete, your investment in Ethernet cabling, switches, or hubs will be preserved and carried forward.

Ethernet as a fieldbus?

Interest in using Ethernet to network field-level devices comes from the desire to combine high-performance connectivity and low cost. For discrete manufacturing, this idea has merit. For process automation, the issue is more complex.

Tough requirements. A process-automation fieldbus has requirements very different from those for an office-automation network, including
- Extreme environmental conditions
- Intrinsic safety
- Power and signal over the same wires (for two-wire devices)
- Compatibility with existing instrument wiring.

Commercial, off-the-shelf Ethernet can't meet these requirements. Industrial Ethernet — with environmentally hardened components, different memory requirements, and greater robustness — comes closer.

The down side. But the cost of adding those capabilities reduces the economic advantage of Ethernet. And industrial Ethernet doesn't provide intrinsic safety, power and signal over the same wires, or compatibility with standard instrument wiring.

The right choice today. Ongoing work with industrial Ethernet is aimed at resolving these issues. Until that happens, the best approach is to use each technology where it's appropriate: FOUNDATION fieldbus for process automation, and Ethernet with appropriate extensions as an automation-system backbone and link to business systems. If you wait for an Ethernet-based fieldbus, you'll miss the reduced project costs and increased operational benefits available with FOUNDATION fieldbus today.

Using multiple networks

Many plants use multiple networks, including Ethernet where appropriate. That's reasonable, because no one bus can meet all needs.

But each added layer increases the number of tools, parts, and training — as well as overall implementation and maintenance complexity. That's why there's a trend to simplify or flatten the overall hierarchy of networks in a plant.

For new plants or plant expansions, using the following four types of networks offers a realistic balance of simplicity and capability:
- FOUNDATION fieldbus for basic and advanced regulatory control and for discrete control associated with regulatory control
- One type of device or sensor bus for motor control and machine control
- An Ethernet-based automation-system backbone, such as FOUNDATION fieldbus HSE
- A switch or gateway to the Ethernet business network

Existing plants may have to include other networks for legacy equipment. But in general it's best to avoid buying devices or systems that require different or proprietary buses.