Buses for Business

The “Fieldbus Wars” were resolved in Ottawa over a decade ago with the adoption of the “8 headed” version of IEC 61158. At that time everyone involved thought this compromise was a bad solution and it did stop the fighting in the Standards community though the market share battles in the different industries and to some extent across industries continue to this day.

As indicated in previous columns, all national and international standards need to be reaffirmed at least every 5 years and since the original approval of this standard in the late 90’s it has been updated on a more regular basis than that – in large part because the technology has continued to evolve so quickly and also because of the addition/subtraction of various protocols. An example of the evolution include the additions of eEDDL (enhanced EDDL to support a limited graphical environment) and of course the changes to HART between versions 5 and the present version 7. Many of the additions are to include Ethernet versions of the ‘serial’ or ‘twisted wire’ versions of the protocol. The present version of the IEC 61158 now has 18 different protocols included, and at the IEC meeting in November 2009 notice was given by Germany that they wish to add a nineteenth protocol I/O link as part of the next update cycle.

Enough history, there must always be an economic incentive for development of a new product or protocol and the same is true for fieldbuses. In this case, the drive is from different vertical segments or industries that use industrial automation and see the benefits of all digital communications.

The following figure shows a subset of the fieldbus options available on the market today and the approximate niches in which they fit. The “simpler” buses, by which we mean they have fast update times and very small (typically on or off type) messages are in the lower right while more complex buses with larger data packet sizes are in the upper left side of the figure.

The bottom horizontal access lists the type of sensors and controllers typically associated with each of the protocol in the diagram while the vertical axis provides an indication of the type of I/O associated with the bus. The horizontal axis along the top describes the type of bus by colour and protocols below and as we will see by examining a few of these protocols, each of these buses target a different type of communication and industry.

Starting with a ‘simpler’ bus, AS-interface, http://as-interface.net/ connects simple sensors and actuators including the power supply over a two leader bus. AS-Interface is a Master/Slave protocol and every AS-Interface Slave is freely addressably and can get connected to the bus cable in any arbitrary place. This makes modular construction possible with no limits to the structure and hence any network topology can be used: e.g. bus, star, or tree topologies. Cable and hence network range 100 m but this is scaleable by repeater to up to 300m. A single AS-i message typically has a 4 bit data load the repetition of a single telegram requires only 150 µs and this time period is already taken into account in the specified cycle time of the network. As-i because it is primarily an on/off protocol (though it can support analog signals) is predominantly found in Factory Automation.

Devicenet and Controlnet are part of the to Open Device Vendors Association (ODVA http://www.odva.org/) and this protocol is typically used in Factory Automation as well to connect Motion Controllers and PLCS. Many of our readers will associate this protocol with Allen Bradley/Rockwell Automation. Devicenet which is based on the CAN (Controller Area Network – the same network use in automobiles so certainly a large installed base) supports both branched and daisy chain networks. It uses CSMA/CA (collision Sensing Multiple Access/Collision Avoidance) with an arbitration scheme to prevent secondary collisions if a collision is detected. Devicenet uses a unique 5 wire (4 conductors + ground) cable to provide both signal and power and depending on data transfer rate (125 – 500 kbps) and cable type networks of up to 500 metres (1640 feet) can be installed.

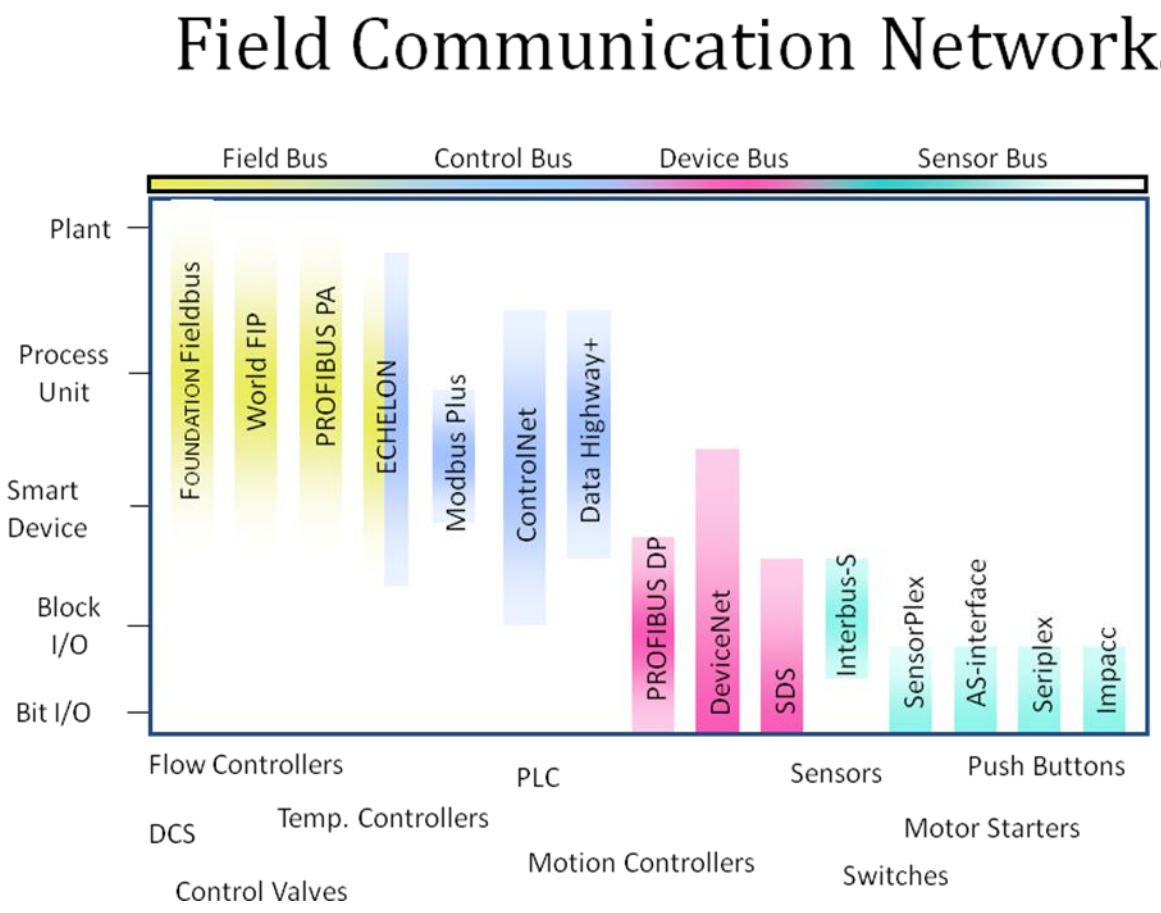
The two field level versions of Profibus http://www.profibus.com/ DP (Decentralized Peripherals) and PA (Process Automation) are each targeted to different industries though the two are closely linked because ALL Profibus PA messages are transferred through a gateway to the Profibus DP protocol. Up to 126 I/O devices can be connected to a PROFIBUS DP cable while Profibus PA uses the same physical layer as Foundation Fieldbus H1. Profibus DP uses 4-wire RS-485 as the physical layer and like Devicenet the cable length depending on the bit rate used (bit rates range between 9.6 kbit/s to 12 Mbit/s can be used) between two repeaters is from 100 to 1200 m.

Lonworks http://www.lonmark.org/, developed by Echelon Corporation is one of the protocols in the BACnet standard for building automation and it is building automation where Lonworks is most commonly used (including the elevator your road in on the way to work today). The most common deployment of this protocol uses twisted pair signal wires operates at 78 kbit/s using differential Manchester encoding. The Lonmark organisation uses profiles (a similar concept is used by Profibus) to provide a basic set of generic functions (open and closed -loop sensors and actuators, and a controller) from which a broad set of applications are implemented.

WorldFIP was one of the protocols on which Foundation Fieldbus was based and today has limited use, predominantly in France. Lastly, readers are familiar with Foundation Fieldbus, which is targeted to the process automation market – just like Profibus PA, as Fieldbus is the topic most often covered in this column.

As you can see, just like a carpenter has more than a hammer in their tool box, automation professionals have a range of tools and protocols matched to the task and associated industry for which it is intended.

If you would like to see us cover some of these other buses in future columns please let myself and/or the editor know and we will work to schedule it in with the editorial calendar.



Wireless Wars to follow suit?

Creation of the "all in one" standard has set a precedent as it appears a similar outcome will now result in the Industrial Wireless area as well, with three or more protocols likely getting adopted. WirelessHART have already submitted their standard and it is well on its way through the process as is the Chinese WIA standard. I have no reason to doubt that ISA-100 once approved by ANSI will not submit in 2011, and it is likely that Zigbee (basis for SmartGRID) will also likely submit – if it has not done so already. The IEEE 6LoWPAN standard will in all likelihood also be added to the mix.

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