Hart-IP: Large Scale System Integration

Jonas Berge *introduces Hart-IP, the technology that allows for effective integration of WirelessHart networks in plant installations.*

I EC 62591 (WirelessHart) is gaining rapid acceptance the world over as the protocol of choice for wireless transmitters in applications across all process industries. WirelessHart is improving maintenance planning, reducing energy consumption, minimizing operator rounds, and gets timely data from remote sites. Some plants and fields are quickly approaching 1,000 wireless transmitters distributed over multiple gateways.

A new technology was required to tie all these gateways together with the control system and to enable intelligent device management from a central location. This is known as Hart-IP. The new Hart-IP network technology uses the familiar Hart application protocol over common Ethernet or Wi-Fi media using the well established TCP/IP transport and networking protocols. A Hart-IP backhaul network enables software to get direct access to information in WirelessHart devices without having to perform any data mapping through intermediate Modbus or OPC.

Systems can provide seamless integration of WirelessHart devices. Note that contrary to popular belief, Ethernet media and TCP/IP alone do not provide interoperability. A standard application protocol like Hart-IP is required for products to work together.

Going beyond the process variable

WirelessHart applications fall into the broad categories of Essential Asset Monitoring (EAM), Energy Conservation Measures (ECM), Health, Safety & Environmental (HS&E) improvements, as well as remote application solutions (RAS) like wellhead monitoring.

A few years ago installations typically deployed fewer than 100 devices and used only a single gateway. Today, WirelessHart installations regularly feature hundreds of wireless transmitters distributed across several wireless gateways throughout the site.

WirelessHart transmitters are intelligent devices that all have to have the correct configuration for the application, with sensors that will eventually need calibration trim, and diagnostics to detect sensor failures and low battery, etc.

With a Hart-IP backhaul network, configuration of WirelessHart transmitters can be done from the control room, rather than via handheld communicators in the field.

Hart-IP is the underlying technology that facilitates plant-wide deployment of WirelessHart networks.

A Hart handheld field communicator can be used for configuration and troubleshooting, but is not practical for large sites. Intelligent device management software is a better solution for large scale deployments. Modbus and OPC are ideal for process variables, but don't support intelligent device management software part of asset management systems.

The Hart-IP technology is a new multi-vendor interoperable

protocol used for the backhaul network between WirelessHart gateways and the control system and intelligent device management software, which provides the ability to access all the configuration and diagnostics information in the underlying WirelessHart transmitters, not just the process variable.

The Hart-IP protocol shares the same Ethernet hardware as other industrial Ethernet protocols such as Modbus/TCP, EtherNet/IP, as well as the embedded web servers for setup found in most Ethernet devices. WirelessHart gateways can also share the network with other equipment such as CCTV cameras and RTUs, etc. WirelessHart is compatible with commercial and industrial grade LAN switches, fiber optic media converters, and Wi-Fi access points, etc.

Many gateways and software applications like device configuration software, intelligent device management software, and steam trap monitoring software from multiple suppliers already support the Hart-IP protocol and can therefore work together. WirelessHart gateways thus work with third-party systems without native support for WirelessHart. It should be noted that hardwired 4-20 mA/Hart multiplexers using Hart-IP backhaul are already available too.

Why not Ethernet?

A recent study (February 2013) by IMS Research reports use of Ethernet and TCP/IP in the industry is growing faster than H2 fieldbuses for distributed peripherals like remote I/O, motor drives, and gateways at Level 1-1/2 of the Purdue reference model. Ethernet can be considered as an alternative to RS-485 in some of these applications, such as in marshalling rooms and MCC panels.

So for every fieldbus protocol, a new generation of corresponding industrial Ethernet protocol is now available; for example, Profinet for Profibus-DP, Modbus/TCP for Modbus/RTU and EtherNet/IP for DeviceNet. Hart skipped the RS-485 generation, going straight to Ethernet media with Hart-IP.

However, not all components in the plant will offer Ethernet connectivity. Ethernet is not able to take the place of H1 fieldbuses such as 4-20 mA/Hart, Foundation fieldbus (H1), or Profibus-PA running into the field connecting directly to transmitters, analyzers, and valves, etc, at Level 1 of the Purdue reference model. There are several reasons why Ethernet is not taking the place of H1 fieldbuses:

- Copper Ethernet is too short distance
- Fiber optic Ethernet provides no power
- Power over Ethernet (PoE) is not intrinsically safe
- There are thousands of transmitters and valves in a plant so the number of LAN switches mounted in field junction boxes would be impractical
- Fiber optic Ethernet makes device removal/connection for replacement and calibration, etc impractical
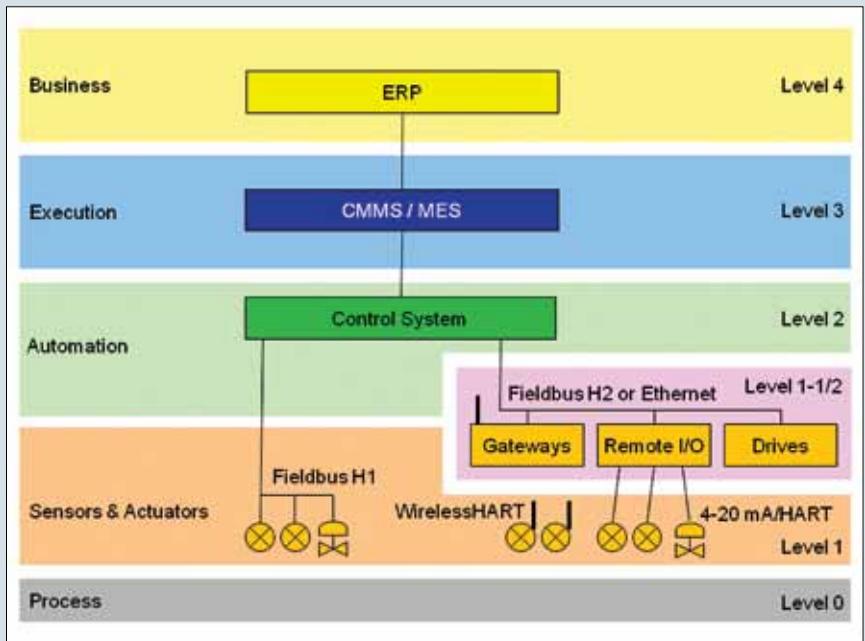
Because the H1 fieldbuses and Ethernet network layers complement each other in the control system, 4-20 mA/Hart, WirelessHart, and Hart-IP will continue to coexist.

- TCP/IP requires IT department involvement for cyber security

In other words, the H1 fieldbuses and Ethernet network layers complement each other in the control system just like USB and Ethernet complement each other on a computer – because one size does not fit all. Therefore, 4-20 mA/Hart, WirelessHart, and Hart-IP will all coexist for years to come.

Plant-wide deployment

Plants use WirelessHart to improve maintenance planning, reduce energy consumption, reduce operator rounds, and get timely data from remote sites. The result is lower maintenance cost and increased production. Hart-IP is the underlying technology that allows WirelessHart to be deployed plant-wide, not just on a single unit operation.

Hart-IP is easy to deploy because it can use the existing Ethernet infrastructure already available in most plants. New Ethernet networking can easily be added using the plethora of industrial grade Ethernet hardware available. Existing intelligent device management software can be upgraded to the latest version supporting Hart-IP and the underlying WirelessHart gateways.

Hart-IP is the backhaul network best suited for WirelessHart gateways and 4-20 mA/Hart multiplexers because the application layer is the same, and therefore time consuming and error- prone data mapping is eliminated.

For al these reasons, Hart-IP backhaul network support should be specified for the gateways when deploying wireless infrastructure to modernize the plant and to keep new plants evergreen.

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