

HART at the speed of Ethernet



Thomas Hilz discusses HART-IP, and explains why it is a groundbreaking technology and not just one more protocol among many.

The growing importance of predictive maintenance, the increasing possibilities of centralised field device configuration and modern asset management solutions has resulted in increased use of digital communication protocols such as FOUNDATION Fieldbus and HART.

At the same time the use of *WirelessHART* is now established around the world for use in process applications with some plants having up to 1,000 wireless transmitters distributed and managed over multiple gateways.

When *WirelessHART* gateways need to be implemented or HART multiplexers need to be added to

an existing infrastructure, HART-IP ensures tight, efficient integration.

An IMS Research study from February 2013 reported that use of Industrial Ethernet in the process industry will almost double from 2011 to 2016. In response to this trend, FieldComm Group released the HART-IP Ethernet protocol specification which offers integration of *WirelessHART* gateways and HART multiplexers into the control systems of legacy or new process plants. The HART protocol can be run over Ethernet, Wi-Fi, or other network media without sacrificing the detailed device setup or diagnostics information of existing networks. HART-IP allows simplified vertical

data integration from the field device through to the control room. In addition to providing access to the process variables of a device, the protocol also supports device parameterisation and advanced diagnostics. Together, *WirelessHART* and HART-IP will play an important role in enabling the Internet of Things (IoT) in process plants in the future.

System integration

System integration using traditional PLC protocols is increasingly reaching its limits. It can be time consuming and not is suitable for modern device data management. Traditional hardwired transmitters often deliver only a single variable – the process value. Mapping a single variable per device from a PLC or RTU Modbus register to process visualisation software is manageable. However, *WirelessHART* devices provide

multiple measurements, control signals, and feedback; often two, three, or even four dynamic variables per device, each with an associated status. For example, two or more sensors on a temperature transmitter, pressure and differential pressure from a pressure transmitter, noise and temperature from an acoustic transmitter, vibration, acceleration, and temperature from a vibration transmitter. Mapping all the dynamic variables for these multi-variable devices in Modbus registers or OPC groups and items today would be time consuming and error prone.

In many plants, the number of *WirelessHART* devices in use exceeds the capacity of a single *WirelessHART* gateway. Plant-wide applications therefore require a *WirelessHART* gateway in each plant area or segment. These gateways then need to be integrated into the control system. Data also has to be available to applications beyond the control room.

HART and *WirelessHART* transmitters are intelligent devices that should support centralised configuration as well as diagnostics monitoring and battery power monitoring. A handheld field communicator can be used for device configuration and troubleshooting, but is impractical for plant-wide deployment. Intelligent device management software is a better solution for plant-wide networks. Modbus registers and OPC items work for process variables, but are not suitable for intelligent device management (IDM) software as part of asset management systems.

The HART-IP solution

With the growing importance of *WirelessHART* and with increasing digitisation at the field level in process plants, more users and system providers are moving their focus to HART-IP, which has been part of the FieldComm Group (previously the Hart Communication Foundation) Network Management Specification since June 2012. HART-IP enables complete plant-wide large-scale solutions and provides a high degree of interoperability between devices and applications. The protocol can be run over IP-based networks such as Ethernet and Wi-Fi, and works over UDP and TCP using IPv4 or IPv6. The HART-IP application layer is based on the same application layer commands as 4-20 mA/HART and *WirelessHART*. Industrial Ethernet offers a range of benefits compared to serial data transmission. Process data and IT data, for example, can be transmitted over a common medium. There is a large address space with an almost unlimited number of participants available and by cascading switches large network expansions are possible. Furthermore, larger amounts of data can be transferred efficiently and a combination of different transmission media is possible.

HART-IP works over standard Ethernet (IEEE 802.3), both copper and fibre, as well as Wi-Fi (IEEE 802.11) equipment so it is suitable for use with standard infrastructure > p32



Football teams win with safe passing.

SSX/SST Functional Safety Isolators and Splitters ensure that valuable HART® data safely passes between your Safety Instrumented System (SIS) and basic process control or monitoring systems.

The exida® certified, SIL 3 capable SSX and SST isolate and protect your SIS from inadvertent disconnections or failures on the non-safety side of the loop.

Make the SST/SST the next great addition to your winning SIS team.

Contact Us at +44(0)1293 514488

MOORE INDUSTRIES WORLDWIDE
Demand Moore Reliability



Visit our website and learn more about our SSX/SST HART Functional Safety Series Isolators and Splitter

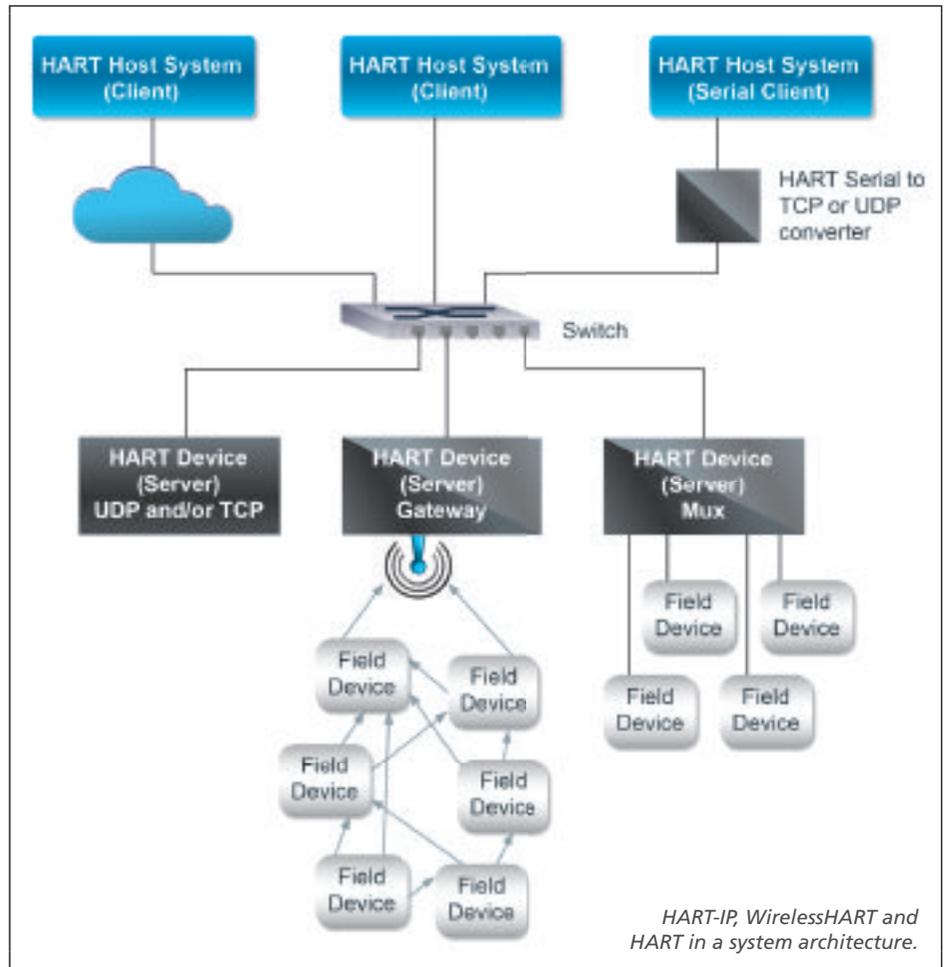
www.miinet.com/safetyseries

components such as LAN switches, routers, access points, cables and connectors. In addition, HART-IP can utilise existing network structures with redundant Ethernet media as well as mesh or ring topologies, or Power over Ethernet (PoE). Various speeds like 10 Mbit/sec, 100 Mbit/sec and 1 Gbit/sec are supported.

IP-based communication enables multiple protocols to share the same network, each protocol with a specific application. So, HART-IP can coexist with IT protocols and other industrial Ethernet-based protocols. There is no need for dedicated infrastructure. The use of multiple clients and servers is also supported, enabling multiple controllers and software applications to access the data in one or more gateways or multiplexers over the same network.

HART-IP can be employed for devices using Ethernet and for HART-IP backhaul networks in *WirelessHART* gateways and HART multiplexers. It is used in Intelligent Device Management (IDM) software as part of asset management systems as well as in OPC servers to access data in *WirelessHART* and 4-20 mA/HART field devices. Specialised applications, such as steam trap monitoring software and machinery health monitoring software, are already using HART-IP to get device data and it is expected that, in the future, control systems and automation solutions will provide HART pass-through over HART-IP. HART-IP devices for seamless vertical integration in the plant are also conceivable.

There are many legacy devices in plants that do not have Ethernet connectivity. These devices will continue to use 4-20 mA/HART, fieldbus or *WirelessHART*. It is not anticipated that HART-IP will take the place of these protocols at the device level. Indeed, it would not be suitable because the distances reached by copper Ethernet are too short; fibre optic Ethernet provides no power;



Power over Ethernet (PoE) so far 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; Fibre optic Ethernet makes device removal/connection for replacement and calibration impractical; and TCP/IP requires IT department involvement for cyber security.

Predominantly, it is expected that HART-IP will be used within the plant perimeter. If the protocol is used beyond the plant perimeter, such as across the public Internet etc, or if HART-IP 'spills over the fence' such as in the case of using Wi-Fi, then security measures should be employed to protect the data during transport (firewalls, VPN tunneling, Secure Socket Layer (SSL), and remote authentication). The standard encryption protocols will continue to evolve and HART-IP is designed to adapt to new versions.

Conclusion

HART-IP is the most suitable backhaul network for *WirelessHART* gateways and HART infrastructure components since the application layer is the same, and therefore time consuming and error-prone data mapping is eliminated.

HART-IP is easy to deploy because it uses the Ethernet infrastructure already available in most plants. Existing intelligent device management software can be upgraded to the latest version supporting HART-IP and the underlying *WirelessHART* gateways.

HART-IP might not revolutionise the entire process industry. But it will make a significant contribution to promoting and, above all, simplifying the exchange of data and information in process plants.

Thomas Hilz is market segment manager at Softing Industrial Automation.