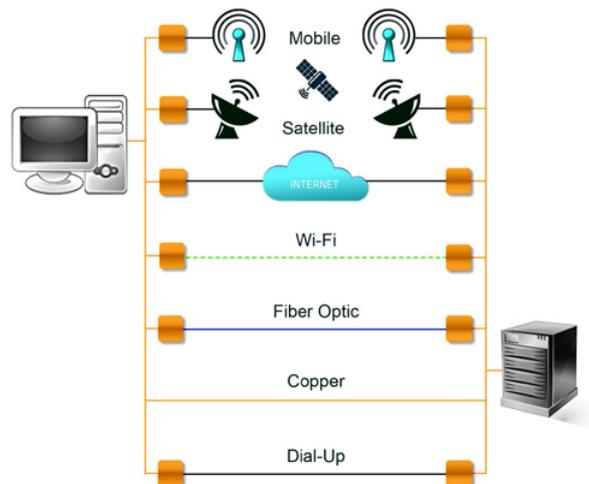


HART-IP solution communicates at Ethernet speed

HART-IP can be run on Ethernet or WiFi, and enables vertical data integration for field devices all the way to the control room. Access to process variables allows support for device parameterization and advanced diagnostics. It will also play an important role in the Internet of Things for process plants in the future.



HART can be run over Ethernet, Wi-Fi, or other network media without sacrificing setup or diagnostics information.

WITH THE DIGITIZATION OF FIELD DEVICES and the growing importance of predictive maintenance, and with the increasing possibilities of centralized field device configuration as well as modern asset management, the use of digital communication protocols like fieldbus and HART is on the rise.

At the same time, WirelessHART has established itself around the world as the leading wireless protocol for process applications. Some plants have up to 1,000 wireless transmitters which are 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 provides a new standard protocol ensuring tight, efficient integration.

Even though the process industry is renowned for being slow to adopt new technology, an IMS Research study from February 2013 reports that use of Industrial Ethernet in the process industry will almost double from 2011 to 2016. In response to this trend, the HART Communication Foundation (HCF) has released the HART-IP Ethernet protocol specification. HART-IP offers the possibility to tightly and efficiently integrate 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 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 supports device parameterization and advanced diagnostics. WirelessHART and HART-IP will play an important role in enabling the Internet of Things in process plants in the future.

Features of HART-IP technology: At A Glance

- Easy implementation through use of existing Ethernet infrastructure
- Standardized use throughout the process plant
- Intelligent device management via Ethernet or Wi-Fi
- Company-wide access to device data and condition-based diagnostics information as well as process data with no mapping required
- Support of proactive maintenance strategy through fast access to diagnostics data
- Compatibility with standardized encryption protocols for data transport

The system integration challenge

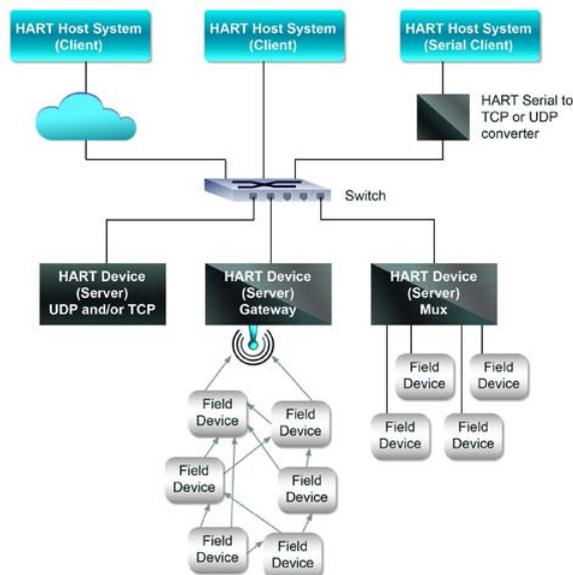
System integration using traditional PLC protocols is increasingly reaching its limits. It is time consuming and not suitable for device data management. Hardwired transmitters often deliver only a single variable – the process value. Mapping a single variable per device from a PLC or RTU Modbus register to process visualization 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 instance, 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, etc. 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 centralized 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.



HART-IP is a suitable backhaul network, in part because it eliminates error-prone data mapping (e.g. Modbus or OPC).

With the growing importance of WirelessHART and with increasing digitization 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 HCF Network Management Specification since June 2012.

HART-IP enables plant-wide large-scale solutions and provides a high degree of interoperability between devices and applications. The protocol runs over IP 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. Ethernet offers a wide range of benefits compared to serial data transmission. For instance, process data and IT data 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. Larger amounts of data can be transferred efficiently and the combination of different transmission media is possible (copper, optical fiber, radio).

HART-IP is a high-level application protocol independent of the underlying media and works over standard Ethernet (IEEE 802.3), both copper and fiber, as well as Wi-Fi (IEEE 802.11) equipment. It is suitable for use with standard infrastructure components like LAN switches, routers, access points, cables and connectors. HART-IP can utilize existing network structures with redundant Ethernet media, mesh or ring topologies, or Power over Ethernet (PoE). Various speeds like 10 Mbit/s, 100 Mbit/s and 1 Gbit/s are supported.

IP-based communication enables multiple protocols to share the same network, each protocol with a specific application. That is, HART-IP coexists with IT protocols and other industrial Ethernet protocols such as HTTP, Ethernet/IP or PROFINET. 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. HART-IP 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. Specialized applications such as steam trap monitoring software and machinery health monitoring software etc. today already use HART-IP to get device data. In the future, control systems and automation solutions are expected to provide HART pass-through over HART-IP. HART-IP devices for seamless vertical integration in the plant are also conceivable. Some devices already supporting Ethernet today, such as flowmeters, may adopt HART-IP. Many plant devices do not have Ethernet connectivity, and will not in the foreseeable future. These will continue to use 4-20 mA/HART, fieldbus or WirelessHART. HART-IP is not anticipated to replace these protocols for many reasons:

- Distances reached by copper Ethernet are too short.
- Fiber 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.
- Fiber optic Ethernet makes device removal/connection for replacement and calibration etc. impractical.
- TCP/IP requires IT department involvement for cyber security.

HART-IP is expected to be predominantly used within the plant perimeter. If the protocol is used beyond the perimeter such as across the public Internet or if HART-IP "spills over the fence" such as 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, etc.). Standard encryption protocols will evolve and HART-IP is designed to adapt to new versions.

Conclusion

HART-IP is a suitable backhaul network for WirelessHART gateways and infrastructure components since the application layer is the same, and time consuming and error-prone data mapping (e.g. for Modbus or OPC) 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 revolutionize the entire process industry. But it will make a significant contribution to promoting and simplifying the exchange of data and information in process plants. It also fulfills the basic requirement for the implementation of Industry 4.0 – the vision of an "Industrial Internet of Things".

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