

# WirelessHART Device Types - Gateways

TECHNOLOGY



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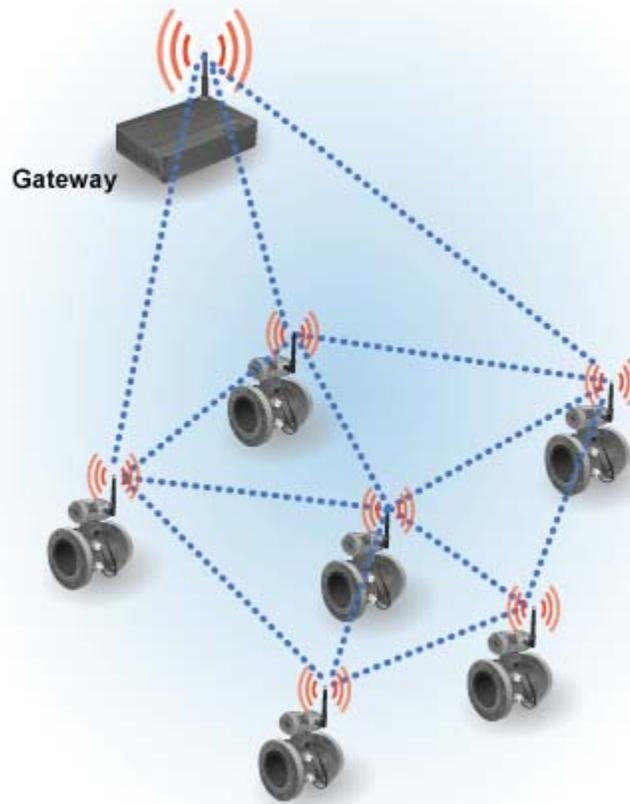
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## Introduction

WirelessHART Networks must be managed and connected to the wired world. Therefore as a central component, the WirelessHART Gateway provides these functionalities.



*The Gateway is the central component of a WirelessHART Network*

This document will answer following questions:

1. What are the elements of a WirelessHART Gateway and their function
2. How do these elements work together
3. Which Information are stored and routed through a Gateway
4. How does a user interface of a Gateway look like
5. How to commission a WirelessHART Gateway to form a WirelessHART Network and connect it to a HOST system
6. Maintenance of a WirelessHART Gateway

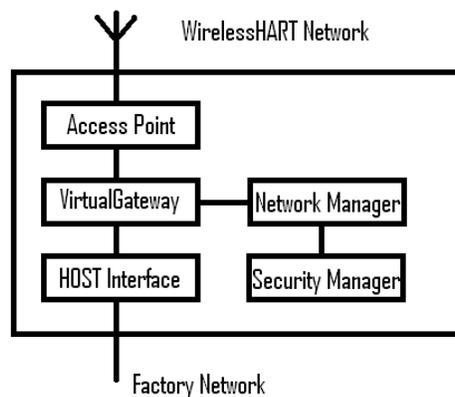
## Elements of a *WirelessHART* Gateway

A Gateway consists of 5 core elements:

Access Point, Network Manager, Security Manager, Virtual Gateway and HOST Interface:

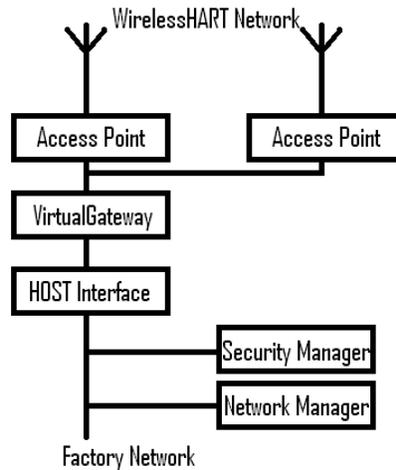
- **Access Point:** The Access Point is basically the radio which provides the connectivity to the WirelessHART Network
- **Network Manager:** The Network Manager forms, organizes, monitors and extends the network. It takes care for distributing Join and Network Keys as well as communication slots and channels for all participants.
- **Security Manager:** The Security Manager is responsible for generation, storage and management of the encryption and authorization needs.
- **Gateway:** The Gateway is the central component in the WirelessHART Gateway. It distributes the information to all other elements, caches data and provides access to the Network Manager
- **HOST Interface:** The HOST Interface forms the connectivity to the wired world. It can consist of several physical interfaces like RS485 or Ethernet. Over these interface several protocols can be driven like HPort, Modbus, Ethernet/IP etc. to gain flexible integration into different HOST systems.

These five elements could be either bundled in one enclosure or distributed in a network running on different Hardware. Today concepts aim for the integrated solution.



### *Integrated WirelessHART Gateway*

A future concept of a distributed architecture could allow a more flexible layout with multiple Access Points and a backbone network.



### *Distributed WirelessHART Gateway*

#### **How do the elements work together?**

The workload of providing the functionalities is shared among the elements. The exact sharing may differ from implementations, but generally some major aspects are the same.

The easiest part is taken by the Access Point. The only task of this element is to receive and send the WirelessHART Messages. It receives the messages to send from the VirtualGateway and in return provides the Messages received from the WirelessHART Network to it.

The VirtualGateway part will distribute the HART commands depending on which it is:

- HART commands dealing with forming, monitoring and running the network are send over to and received from the Network Manager.
- HART Commands from the WrelessHART Network to the HOST and back are cached, so the HOST has immediate access to the last submitted data and the requests from the HOST to the network are send in coordination with the regular communication pattern as set by the Network Manager.
- All data which must be published away from HART commands to serve the HOST Interface are provided to it.
- To ensure a controlled information flow, all information are cached and transmitted to the respective sub part of the Gateway

The Network Manager is the receiver and distributor of HART commands which deal with forming, organizing and monitoring the WirelessHART Network. It receives status information on all participants as well as their wireless links. Based on this information, the network manager controls the WirelessHART Network with sending HART commands back which control the network For example, the Network Manager assigns a time and a channel on which two participants have to communicate to enable a optimized communication patternThe Security Manager works closely with the Network Manager. It provides authorization and encryption keys to ensure proper encryption of the messages as well as just allowing authorized devices to join the network.

The HOST Interface provides simple connectivity to different network physics and protocols. It is fed by the data cached in the VirtualGateway and provides this to the single networks. Also, it serves a recipient for data from the HOST which must be routed through to the WirelessHART network.

### Information flow through the Gateway

The information flow within the Gateway is controlled and managed by the VirtualGateway. It is the hub for all messages and HART commands going back and forth. The single HART commands are routed in accordance to their origin and recipient through the Virtual Gateway. Some commands are cached since the communication in the WirelessHART network is scheduled by the Network Manager

### User Interface of a Gateway

As all WirelessHART devices, a WirelessHART Gateway must provide a wired interface according to HART at least for first set up. This can either be a RS485 or a HART Modem Interface. Through this the Gateway can be connected as any other HART device with a HART Modem or a serial interface.

On the other side of the HART Modem or serial interface, a software must provide the access to the WirelessHART Gateway. This software can either be a DD or a DTM, both running in the appropriate frame application on a PC or a Hand held (DD only). The user interface does therefore not differ from the look and feel from already existing HART devices

### Commissioning of a Gateway

Commissioning a Gateway means commissioning a WirelessHART Network. This is basically done in several steps.

After mounting the WirelessHART Gateway in the appropriate spot in the plant and wiring all desired HOST connections, the basic parameters must be set in the Gateway. This is the Join Key, and the Network ID. These will identify the Network in a unique manner and just allow authorized devices to join the Network.

Then, after setting those in the Gateway, the start up of a WirelessHART Network can start. The single devices of the Network must be powered up and be supplied with the Join Key, Security Key, Network Key and Network ID. This must happen via a wired interface either with a HART Modem or via a RS485 in accordance to the HART 7.1 Standard.

Now as the devices power up they start the join phase and look for other WirelessHART devices with the same keys and IDs as they have. If they find them, they request to join the network. This message is routed through to the Gateway. The Network Manager then starts to include the new device into the network and transmits the communication parameters of the network to the new found device.

With this procedure, the Network is then formed. The result is an optimized routing of the WirelessHART messages through the network in terms of timing, channels and links.

Now, as the network has been formed all information gathered within the network end up in the Gateway, e.g. Process data, status, statistical data of the network etc. But the Gateways role is to route this information to any HOST system like an Asset Management System, a DCS or a SCADA system for further use.

For this the Gateway must somehow to be connected to the HOST system. The HOST System must know the structure of the Gateway to be able to retrieve the information. The structure of the Gateway is described either in a DTM or an eDD. Depending on the HOST, one of these describing files must be installed on the HOST system.

When this describing file is installed, the HOST is enabled to retrieve the data out of the Gateway in the appropriate and desired manner. The Interfaces and protocols can be set up and the data be addressed so it is available then for further use within the HOST.

### **Maintenance of a WirelessHART Gateway**

Now in regular operation, the Gateway itself does not need much of maintenance. The Gateway will monitor the network and each single participant. If something is starting to fail, e.g. the link quality falls below a certain limit or a device fails, alarm messages are send to the HOST system which then displays the message.

Of course also a message is send to the HOST also if the Gateway itself fails. A failing Gateway would mean that the whole network will break down if the Gateway does not recover in a certain amount of time. This is because the gateway permanently distributes the network time which is important for the network participants in order to coordinate all communications.

### **Summary**

The WirelessHART Gateway as the key component for a WirelessHART network has a complex internal structure. This structure is not obvious to the user since all functionalities are wrapped by user interfaces. These interfaces make it easy to use and implement and a fast commissioning and reliable operation of the Gateway and with this the WirelessHART Network is granted.