INTO THE FUTURE

With Anybus CompactCom

TRENDS & TECHNOLOGIES ACCORDING TO HMS

HOW HMS ENABLES IIOT

OPC UA, MQTT AND OTHER TECHNOLOGIES

SECURITY AN ONGOING PROCESS

HMS Connecting Devices™

How can you make your products ready for the factory of the future?

Anybus is today the industry standard when it comes to connecting industrial equipment to different networks and systems. Since the very first Anybus modules were created in the early 1990ies, the key to our success has been to stay close to the prevailing network technology trends.

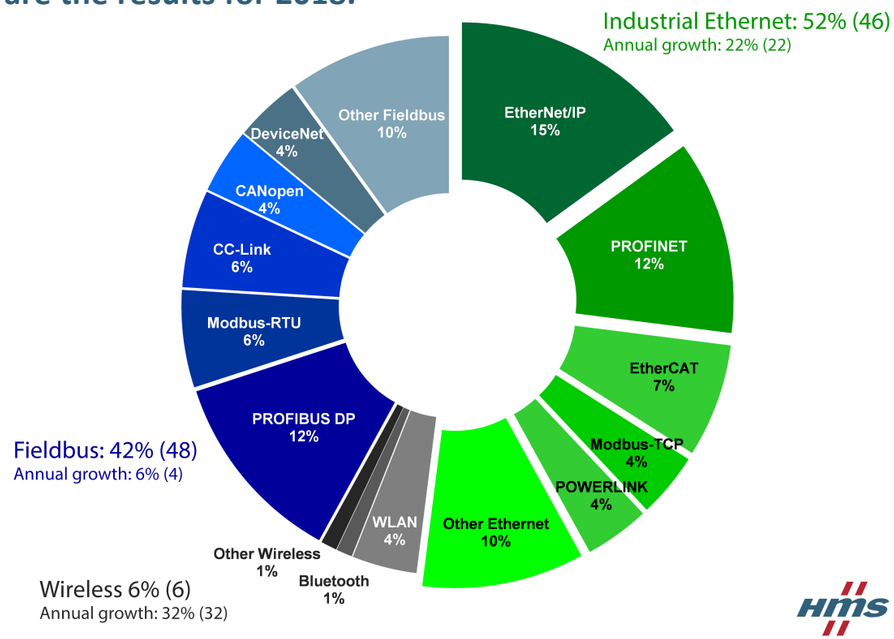
The success of Anybus has been based on evaluating technology trends and make sure we invest development time into the right technologies for our customers. So far, we have been pretty good at this and today, more than 5 million industrial devices use Anybus to get connected.

But which trends and technologies will be key in the future? In this publication, we have a look at the technologies we see as important for the future, and explain how we address them.

Happy reading,
Christian Bergdahl, Product Marketing Manager, Anybus
HMS Industrial Networks

Industrial network market shares 2018

Every year, HMS publishes a study of the industrial network market. Here are the results for 2018.



Industrial Ethernet has overtaken traditional fieldbuses in terms of new installed nodes in factory automation. This is the main finding in HMS Industrial Networks' annual study of the industrial network market. Industrial Ethernet now accounts for 52% of new installed nodes (46% last year), while fieldbuses are on 42% (48). EtherNet/IP is now the most widely installed network at 15%, followed by PROFINET and PROFIBUS, both at 12%. Wireless technologies are also coming on strong with 6% market share.

Industrial Ethernet – growth powered by IIoT

Industrial Ethernet has been growing faster than traditional fieldbuses for a number of years and has now overtaken fieldbuses. With a growth rate of 22%, Industrial Ethernet now makes up for 52% of the global market compared to 46% last year. EtherNet/IP has emerged as the largest network with 15% of the market. Ethernet runners-up globally are PROFINET, EtherCAT, Modbus-TCP and Ethernet POWERLINK.

Fieldbuses still fighting, but expected to decline

Boosted by a strong industry and cyber-security concerns in the industry, fieldbuses are still growing slightly. However, despite an increased growth rate at 6% (4 last year), the number of fieldbus installations are expected to decline steadily over the next few years. The dominant fieldbus is still PROFIBUS with 12% of the total world market, followed by Modbus-RTU and CC-Link, both at 6%.

Regional network variations

In Europe and the Middle East, PROFINET and EtherNet/IP are leading and PROFIBUS is still widely used. Other popular networks are EtherCAT, Modbus-TCP and Ethernet POWERLINK.

The US market is dominated by the CIP networks, with a clear movement towards EtherNet/IP. In Asia, no network stands out as truly market-leading, but PROFINET, EtherNet/IP, PROFIBUS, EtherCAT, Modbus and CC-Link are widely used, with the Ethernet version CC-Link IE Field also gaining traction.

Wireless is redefining the network picture

Wireless technologies are also growing by 32% (32) and accounts for 6% (6) of the total market. Within Wireless, WLAN is the most popular technology, followed by Bluetooth.
"Wireless is increasingly being used by machine builders and system integrators to realize innovative automation architectures. Users can reduce cabling and create new solutions for connectivity and control, including Bring Your Own Device (BYOD) solutions via tablets or smartphones," says Anders Hansson.

How HMS enables IIoT:

Connecting industrial hardware upstream

Anybus CompactCom offers several ways to connect industrial hardware to IT-systems. This enables you to analyze data from devices and machines while they are running, for predictive maintenance and manufacturing optimization. CompactCom makes device and machine data available to IoT software — the very basis for realizing the Industrial Internet of Things.

What is IIoT? HMS' interpretation

The Smart Operations of the future will not only require device and machine manufacturers to connect to different industrial control systems, they will also need connectivity to IT systems, often cloud-based IoT software platforms such as SAP, Oracle, ThingWorx etc.

Connecting industrial hardware to IoT software is the core of IIoT. By enabling communication between Operational Technology (OT) and IT, it is possible to do on-the-fly analysis of real-time data, for the purpose of e.g. predictive maintenance and manufacturing optimization.

Anybus CompactCom gets your product IIoT-Ready

Available in chip, brick and module format for flexible integration,

Anybus CompactCom makes it possible for industrial machinery to get connected upstream — to IT functions and IoT software.

The CompactCom offering has been equipped with IT functions for almost a decade, but the usage has been limited. Now, more and more users are starting to take advantage of them.

IT-functionality included in CompactCom

- **Integrated web pages**
  CompactCom comes with a built-in web-server that can be used to access data and functionality in your product. The built-in web-pages can be replaced, and thereby customized and tailored to fit your application needs. Customized web-pages can be developed using a flexible JSON API. CompactCom also supports implementation of web services providing a JSON-formatted interface to the application data.
- **FTP**
  CompactCom has an FTP function which is a very easy and straight-forward way to update not only the CompactCom product, but also to the host application.
- **Email**
  Devices and machines love email too. Especially sending it. The built-in email functionality in Anybus CompactCom is very useful for sending information on status, running hours, consumption etc. Since it can be difficult to physically access the equipment, it is often easier to have the device or machine send a simple email instad.

Connectivity to IT communication standards

Anybus CompactCom supports communication standards such as OPC UA and MQTT which greatly facilitates communication with IT systems and IoT software (more on next spread.)

Create a specific IIoT solution with Anybus CompactCom

If there are specific demands for establishing communication between OT and IT, Anybus CompactCom offers several ways for users to do it themselves.

- **Socket interface**
  Anybus CompactCom has a Socket Interface. This is a standard interface which allows easy access to the host application through the CompactCom (via standard TCP/IP communication). The socket interface enables the usage of ready-made protocols to build specific IIoT solutions.
- **Transparent Ethernet**
  Yet another way to use Anybus CompactCom to realize IIoT is to use the Transparent Ethernet function. Here, industrial Ethernet protocol data, for example PROFINET or EtherNet/IP, is processed as usual by the CompactCom while all other Ethernet data passes straight through the module transparently. This speeds up the network communication and allows users to develop own IT-functions.

Pssst, did you know...
HMS stands for Hardware Meets Software. Connecting industrial hardware to IoT software is exactly what Anybus CompactCom enables you to do.

Anybus®

What you can do with Anybus CompactCom in terms of IT and IIoT

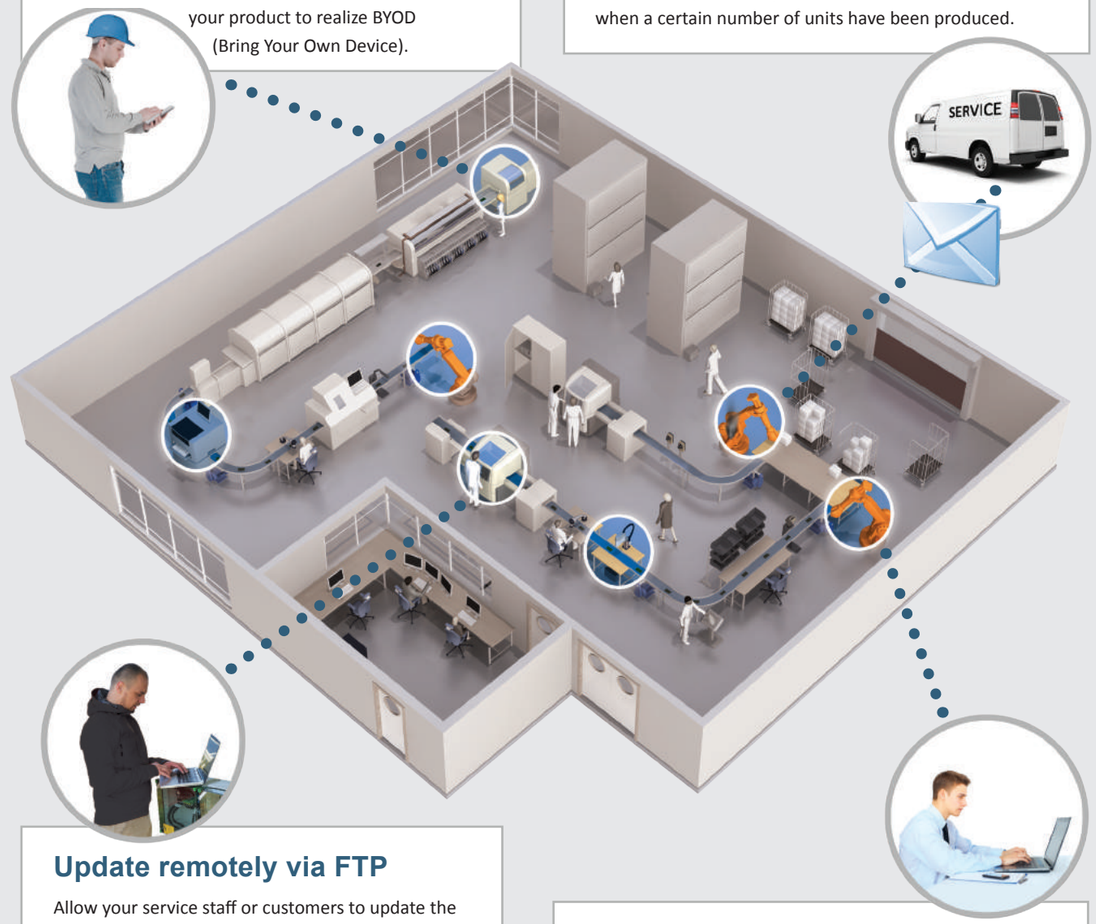
Anybus CompactCom has extensive functions for connecting to IT systems. By connecting Operational Technology (OT) with Information Technology (IT) you enable users to access data — on premise or remotely, to be monitored and analyzed for e.g. predictive maintenance and production optimization.

View live data from your product in a web interface

Give service staff web-based access to the status of your product via Anybus CompactCom's built-in web server. Want wireless access? Attach an Anybus Wireless Bolt to your product to realize BYOD (Bring Your Own Device).

Stay informed with email notifications

CompactCom has a built-in email function that can send notifications, for example when it is time for service or when a certain number of units have been produced.



Update remotely via FTP

Allow your service staff or customers to update the CompactCom or the host device using the built-in FTP functionality in CompactCom.

Bridge industrial data to IT systems

Enable your product to communicate with IT-systems using communication standards such as OPC UA and MQTT.

A look into the future:

Upcoming technologies

There are a number of technologies that will shape the future industrial communication landscape. Perhaps the strongest trend is that IP (Internet Protocol) will emerge as the main information carrier in tomorrow's smart and interconnected industry. Furthermore, several new communication protocols will be used in parallel with existing networks. Here are some of the communication technologies that will shape the communication landscape of the future, and how HMS will support them.

OPC UA

OPC Unified Architecture (UA) is a service-oriented industrial communication standard for secure and reliable data exchange. OPC UA is platform-independent and ensures a seamless flow of information among devices from multiple vendors. It defines services for data exchange between Clients and Servers including access to real-time data, monitoring of alarms and events, access to historical data and other applications. The standard is managed by the OPC Foundation.

OPC UA is today applied in a wide range of applications and solutions stretching from straight-forward M2M communication to new upcoming solutions like IT/OT bridging and cloud connectivity. As any other IP based communication protocol, OPC UA can co-exist with other industrial protocols on the same network, complementing real-time control with a secure and service-oriented data channel.

HMS has recognized OPC UA as one of the most important protocols for data and information exchange within the smart industrial solutions of the future. As a result, OPC UA will be supported by industrial Ethernet modules within the CompactCom series, starting with EtherNet/IP and PROFINET.

MQTT

MQTT (Message Queue Telemetry Transport) is a publish/subscribe messaging protocol ideal for IT/OT bridging and IIoT solutions. Based on its light-weight and straight forward approach, it has become one of the most popular protocols enabling industrial data and information exchange.

MQTT is based around a message broker to which industrial devices (clients) connect. The clients exchange information via the broker based on topics with a flexible syntax. The broker uses the topics to decide which clients to receive a message.

Compared to OPC UA, MQTT is more flexible and easier to implement. On the other hand, it lacks the data, service models and security schemes provided by OPC UA.

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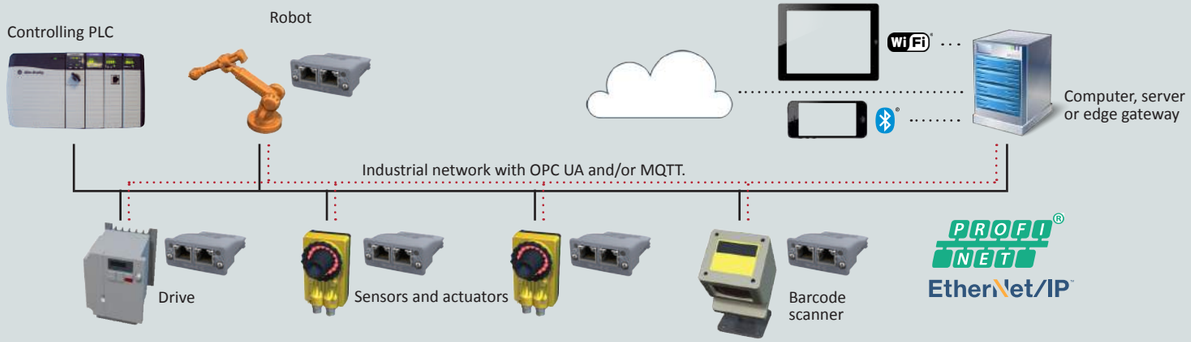


With OPC UA or MQTT communication on the factory floor, it is possible to use a computer, server or edge gateway to relay information to IT systems and clouds. Anybus CompactCom enables devices and machines on the factory floor to communicate with any industrial network using OPC UA or MQTT.

TSN

Time-Sensitive Networking (TSN) is a set of IEEE 802 Ethernet standards that enable deterministic real-time communication over standard Ethernet infrastructure.

TSN extends Ethernet with functions like time synchronization, network scheduling and time-based queues which provide guaranteed latency and delivery of scheduled real-time traffic in a network.

TSN addresses important topics like redundancy, bandwidth reservation, preemption and network topology/path functions. A major driving force behind the development of these new TSN standards is the automotive Ethernet market.

HMS R&D is evaluating and testing different solutions for TSN.

Security technologies

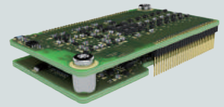
Security is one of the main challenges within IIoT as connecting "things" to the Internet also means that they are subject to increased security risks. Many of the major industrial network organizations are currently underway with developing security standards. HMS follows and takes active parts in many of these developments.

For example, we are currently developing and evaluating support for technologies such as:

- **TLS** (Transport Layer Security)
- **HTTPS** (Secure version of HTTP)
- **FTPS** (Secure version of FTP)
- **CIP Security™** (An initiative from ODVA defining security-related requirements and capabilities for CIP devices, specifically EtherNet/IP devices. CIP Security is currently under development and HMS is working with ODVA to develop support.)

Safety networks

Safety networks has been a hot topic on the industrial network market for some time and is now becoming increasingly adopted on factory floors around the world. Anybus CompactCom is equipped with a Black Channel which enables transfer of safe signals over PROFINET (PROFIsafe), EtherNet/IP (CIP safety) and Functional Safety over EtherCAT, FSoE.



HMS offers a specific safety module, the IXXAT Safe T100, which substantially speeds up the integration of safety into an industrial product. Also, HMS has safety stacks for CIP-Safety and FSoE.

This means that HMS offers several ways to implement integrated safety depending on how much customization you want.

Different intiatives for smart manufacturing

Today, there are several major ongoing initiatives around the world about how to bring IIoT into factories and how to connect operational technology on the factory floor with enterprise systems.

Examples of these include Industry 4.0 (Germany), The Industrial Internet Consortium IIC (North America), Industrial Value Initiative IVI (Japan) and Made in China 2025 (China).

These initiatives focus on improving quality and reliability as well as increasing flexibility in manufacturing, and this will also enable new, innovative business models in the future.

What is the basis for this?

A data pipeline is established to harvest data from the factory floors so that it can be analyzed in the outside world. The data is transferred via the existing standard industrial network cabling, but bypasses the traditional control system, using new IIoT protocols like OPC UA and MQTT to syphon the data up. This means that the existing industrial networks do not only provide normal day-to-day control but also serve as a backbone for the data and the IIoT functionality.

Security

SECURITY IS AN ONGOING PROCESS

"Everybody who works with security knows that the work is never completed — it is an ongoing activity. HMS works continually with keeping our products secure and up to date with the latest standards, trends and technologies."

Magnus Hansson
Global Systems and Security Manager, HMS Industrial Networks

How we keep data safe

As more and more machines go online, security is perhaps the biggest challenge of industrial networking. That's exactly why it is important to work with solid and secure communication solutions like Anybus. Here is how HMS works with security in Anybus CompactCom. Now and in the future.

A changing view of security

Traditionally, security in industrial control systems has been based on the fact that these systems are isolated and not connected to other systems (including the Internet). Therefore, there has not been a great need to add security to the control network itself. Until now.

The control networks are undoubtedly getting increasingly connected to the outside world — and thereby also a target for hackers, espionage, sabotage and data manipulation. Hence, it becomes increasingly important also for the devices and machines on the factory floor to defend themselves. This is why several industrial networks now are developing security standards.

These standards enable machines to:

- Reject data that has been altered (Integrity)
- Reject messages sent by untrusted people or devices (Authenticity)
- Reject messages that request actions that are not allowed (Authorization)
- Protect sensitive data (Confidentiality)
- Be robust against high traffic loads and malformed packets (Availability)

Methods HMS uses to keep data safe

Security is a key integral part of product development and maintenance at HMS. We continually test our products using industry standard test suites to check resistance against packet storms (to prevent, for example, denial-of-service attacks), known security holes and malformed packets (fuzzing attacks).

In this process, we use tools like **Achilles, Netload** and **Nessus** for our Ethernet-based products.

Also, all Anybus CompactCom 40-series firmware files are validated with **signed firmware certificates**, ensuring that the firmware is authentic and unmodified.

Access control is another important security feature, giving only selected users access to Anybus CompactCom features such as webservers, FTP, firmware updates, etc. Access can also be shut down completely.

Unused protocols and functionality can be disabled as necessary by the host application.

In full technology control

Using our own technology, we are in full control of the design, allowing us to optimize performance and fix possible vulnerabilities easily.

Furthermore, HMS participates in the network user organizations and work together with leading customers on cyber security.

Security in product development

HMS has a well-established development process that is ISO9001 certified. HMS internal security guidelines make sure the security aspect is included from start.

All source code is reviewed by programmers trained in secure coding technologies.

Hardware meets software — More IIoT solutions from HMS

**Edge gateways from HMS take data from machines to the cloud.
Wireless solutions add to the flexibility.**

IoT software

NETBITER ARGOS

PREDIX

AMAZON

MICROSOFT AZURE

ORACLE

TALK2M

THINGWORX

Edge gateways

Access OT machinery remotely

eWON Cosy: An industrial remote access router allowing you to remotely troubleshoot and program PLCs on the factory floor.

eWON®

Collect data from OT machinery to any cloud

eWON Flexy: A programmable industrial router allowing you to gather data from OT machinery.

eWON®

Remote management of OT machinery

eWON Netbiter: An edge gateway allowing you to monitor and control field equipment online.

eWON®

Create your own edge gateway

OEM Toolbox: An open development platform that offers developers the possibility to create their own IIoT applications.

Wireless machine access

Anybus wireless: Connect a machine to a cloud service via Bluetooth or WLAN. Also great for BYOD (Bring Your Own Device). Use a laptop or iPad instead of a machine HMI.

Anybus®

Industrial hardware

Enabling IIoT

Technologies

Security

More IIoT

Work with HMS.
The number one choice for industrial communication.

Network connectivity expertise at your service

With millions of communication solutions installed globally, HMS Industrial Networks is undisputedly the world's number one provider of industrial communication solutions.

Customers include most major industrial automation companies such as Siemens, Mitsubishi, Yaskawa, Rockwell Automation, Schneider Electric, Toshiba, Panasonic, ABB and Hitachi, as well as thousands of small and medium-sized companies in a variety of industries all over the world.

Technical services — with you all the way through your project

By partnering with HMS, you get access to the knowledge of some of the world's leading experts in industrial communication — experts who are with you all the way from the design project and throughout the product life cycle.

With HMS as your communication partner, you will not have to worry about network upgrades, new technologies or conformance testing. HMS handles all connectivity issues, so that you can focus on your core business.

Facts about HMS

- Operations in 13 countries: Sweden, Germany, Belgium, USA, Switzerland, Japan, China, Italy, France, UK, Finland, Spain and India.
- Leading product brands in Anybus, IXXAT and eWON
- Customers in more than 50 countries.
- Head office in Halmstad, Sweden.
- Founded in 1988.
- More than 500 employees.
- Listed on NASDAQ-OMX Nordic Exchange in Stockholm.
- Free technical support from HMS experts.

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