From Multi-Protocol Chip to Multi-Cloud Connection

netIOT – Industrial Cloud Communication

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The industry is facing a paradigm shift worldwide – and Hilscher has always been a forerunner of significant changes. We were there when fieldbus technology replaced parallel wiring and were instrumental in the breakthrough of the soft PLC with PC cards for industrial communication. With our netX network controller, we developed the first multi-protocol chip for all Real-Time Ethernet systems.

For us, the Industrial Internet and Industry 4.0 are the fourth industrial revolution, one which requires end-to-end communication from the sensor into the cloud. We call this Industrial Cloud Communication, and netIOT is our technology that complements it.

Based on global standards, comprehensive and just as determined, as always when we stand completely behind something. However, this time things will be even more comprehensive and complex – with multiple new technologies, we go far beyond the dissolving classical automation pyramid with all its layers. You can count on our netIOT technology and our netIOT Service: the interaction between mechanical engineering, automation providers and information technology supports new business models, increased productivity and the production of batch size 1.

Join Hilscher and make a successful entry into the future of industrial IoT technology.

Hans-Jürgen and Sebastian Hilscher

Hilscher Gesellschaft für Systemautomaton mbH was founded in 1986. Today, the company has more than 300 employees at 11 locations worldwide. With the philosophy of continuous growth based on our company’s own resources, we are a reliable partner for our customers.

For more than 30 years, our focus has been on industrial communication and our range covers all fieldbuses and all Real-Time Ethernet systems.

Our technology manages the data exchange of encoders, PROF I/O, RFID controllers, drives and valve terminals with the control system via the various Real-Time Ethernet systems. This makes us at home whenever data is generated in the production plant.

Together with the corresponding metadata, this information needs to be transmitted into the cloud or other central IT systems in order to generate added value within the context of the Internet of Things. We are experts in this task and we see it as an extension of our core technology. Depending on the scope, the technology can be implemented in existing designs by means of software and integrated into new designs with additional security functions.

We collect device information on the network via so-called Edge Gateways and transfer it to the cloud using special services, independent of the PLC.

Thus we generate considerable synergies which allow us to develop a single design, all Real-Time Ethernet systems and an end-to-end IoT automation solution in concert with the Edge Gateway.

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HILSCHER IS YOUR PARTNER FOR INDUSTRIAL INTERNET AND INDUSTRY 4.0

“"We don’t know your business models of tomorrow, but we can already provide you with the technology you need for it today.”

Hans-Jürgen Hilscher
CEO
HILSCHER GIVES YOU ACCESS TO THE WORLD OF IT

With netIOT, Hilscher supports three layers of the RAMI 4.0 reference architecture: integration, communication, and information. At these layers, netIOT acquires, forwards and preprocesses data. In terms of the hierarchical layers netIOT covers the field device layer with the netIOT Interface product line. netIOT Edge Gateways are on the same layer as controllers. Together with the offering of netIOT Service, they send information to the station layer and higher layers.

Hilscher considers netIOT to be a central solution over all parts of the life cycle of plants and devices. This view ranges from joint development of solutions together with partners to maintenance of devices based on acquired field information.

A gateway of an industrial Internet system, on one hand, forms a bridge to a higher-level or larger network and, on the other hand, isolates the local network with the corresponding communication nodes. In actual practice, the Edge Gateway ensures connectivity to the access network. This establishes communication to the access layer of the controller layer, on which all production-relevant software packages, e.g. “analytics” and “predictive maintenance”, are consolidated.

This layer is connected to the company layer via the service network. The ERP functionalities and company-wide systems are united in this access layer.

Dr. Richard Soley
Executive Director of the Industrial Internet Consortium

“...the Industrial Internet is steering the next industrial revolution. The IIC is working on testbeds, use cases, and the definition of the reference architecture and frameworks to discover disruptive new products and services, and support future standards to drive this revolution. Hilscher is helping to lead the revolution.”

Richard Soley
Executive Director of Industrial Internet Consortium

RAMI 4.0 and IIRA are reference architectures for the Industrial Internet / Industry 4.0 which have established themselves in USA & Germany.
FROM THE FIELD LEVEL INTO THE CLOUD – VERTICAL INTEGRATION

Real-Time Ethernet systems have replaced fieldbus technology. They connect intelligent components with the controller and further, via the cell level, with control and company levels. Parallel to hard, real-time communication, these systems allow for time-uncritical transmission of TCP/IP or UDP telegrams via the same cables. The Industrial Internet uses this for the transfer of information via MQTT. In the case of Industry 4.0, the OPC UA protocol is frequently used. Current standardisation efforts in the field of time sensitive networks (TSN) aim at furthering this mixed traffic on the data networks and allow for better data rates and reliability of communication.

The Edge Gateway forwards the information from these different source protocols to the cloud and makes it available for authorised access worldwide. This information level establishes itself without side effects and in parallel with the control level – vertically and horizontal- ly across all intelligent sensors, actuators, I/Os and further automation components.

With Hilscher’s netPROXY technology, the manufacturer defines the device data and passes it on to the netIOT Interface. Here it is mapped to various Real-Time Ethernet systems and transmitted to the controller. Parallel to this, web servers, MQTT or OPC UA allow access to the device data transmitted into the cloud from the Edge Gateway.

With this architecture, netIOT creates two main access points to the field level as a whole which are dependent neither on the network nor on a special controller: remotely via the cloud using Internet and firewall or locally via USB, Ethernet, WiFi or Bluetooth directly at the Edge Gateway.

The netIOT Edge Gateway makes it possible for OEMs to configure and diagnose their devices, as well as access device and system data and optionally brand-label this via a customer-specific app.

The device and system information as well as analysis and diagnostics programs are available in the cloud as a part of netIOT Service. This requires the corresponding security functions to be available and enabled. Our netIOT Edge Gateway provides a closed security architecture based on a Linux OS specifically configured to cover security requirements.

The netIOT Edge Gateway makes it possible for OEMs to configure and diagnose their devices, as well as access device and system data and optionally brand-label this via a customer-specific app.
Industry 4.0 has two clear demands on field devices: To connect them to a cloud and to generate data that goes beyond pure IOs, e.g. diagnostic, analysis and state data. This information serves as basis for further business models.

For information transfer to the cloud, the IoT communication, netIOT Interface solutions will be additionally equipped with an OPC UA server and a MQTT client. Thus, the data of the field device can be accessed via the TCP/IP channel of the Real-Time Ethernet protocol using the same physical cable.

Hilscher has equipped its DIL-32 Communication IC with essential IoT functionality. Besides Real-Time Ethernet, the netIOT Interface contains an integrated OPC UA server and MQTT client for IoT communication. Exchange of the I/O-data as well as IoT-data with the host applies to the joint generic object interface netRPROXY. Thereby the device manufacturer arranges all data in objects and netPROXY independently translates these objects in corresponding network services. Thus, the application is built completely independent from any protocol-specific requirements.

The core of netIOT Interface solutions is Hilscher’s netPROXY technology, which forms a protocol-independent object interface between application and communication. The application layer behaves like the different protocol APIs and defines data exchange with a few simple services.

The I/Os will be arranged in generic objects and at the same time enriched with analytics, diagnostics or state information.

“netIC IOT is the first IoT-enabled communication module for field devices.”
Christof Hunger
Product Manager

The firmware of netRAPID 51 offers three separate channels to the host application. Channel 0 contains cyclic and acyclic Real-Time Ethernet data, which is accessed using standard protocol APIs. Channel 1 offers a transparent Ethernet channel with TCP socket or Raw Ethernet interface. Moreover, via Channel 2 the application can access the IoT-data using the generic netPROXY object interface. This solution is especially advisable for existing netX-based applications, which need to be enhanced with IoT communication.

“netRAPID 51 can easily be enhanced with IoT communication just with a software upgrade.”
Christof Hunger
Product Manager

The netX Chip Carrier netRAPID 51 is optimized for advanced features. Besides Real-Time Ethernet communication there is an integrated Webserver as well as an additional transparent Ethernet channel available, to realize own IT solutions in the host processor of the automation device. Moreover, netRAPID 51 can easily be enhanced with a software upgrade to an integrated OPC UA server and MQTT client just with a software upgrade.

Transforming simple data into information

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Christof Hunger
Product Manager
netIOT Edge

THE BRIDGE BETWEEN AUTOMATION NETWORK AND CLOUD

"netIOT Edge Gateways not only raise the simple automation network to the level of cloud computing, but are also the main configuration element of netIOT field devices – this makes it possible to parameterize sensors and actuators after installation."

Armin Beck
Product Manager

netIOT Edge Gateways securely couple automation networks to a cloud. As I/O devices, they cyclically exchange data with the PLC and also communicate directly with IoT-enabled field devices. This key field-level data, exchanged in real time, can be transmitted from and to the cloud.

Device security
INTEGRATED DEVICE SECURITY BY DESIGN

Integrated security mechanisms such as physical separation of the OT network and the IT network, a trusted operating system, the execution of signed firmware and packets only and the usage of encryption techniques of the latest standards are securing the data integrity and protecting against any kind of data theft.

Easy wiring of applications
EASY PROGRAMMING OF APPS AND DATA COLLECTION VIA DRAG & DROP

Thanks to the integrated Node-RED installation, there is no need for coding, just configuration and wiring. It considerably decreases the construction time as a result of preassembled function blocks.

Direct access to the field level
DIRECT COMMUNICATION WITH THE FIELD DEVICES VIA IOT PROTOCOLS

- netIOT Edge natively supports devices using the protocols MQTT and OPC-UA – past the PLC and in parallel via a direct communication channel.
- Data semantics simplify further processing in the cloud.
THE INTERFACE FOR ADDED VALUE IN THE CLOUD

Connecting the physical object with the digital twin

netIOT offers a broad range of cloud and IIoT connectors. Cloud infrastructures like IBM Bluemix and Microsoft Azure can be implemented flexibly with standard software on a netIOT Edge Gateway. The netIOT SAP AIN Connector is an example for a more complex but therefore also more powerful connector. It uses standardized software interfaces and allows the effortless integration of the SAP Asset Intelligence Network.

With the netX powered netIOT Edge technology, device manufacturers will be able to access the digital twin’s data regardless of the PLC and production network. This enables new business models such as pay-per-use and function-based billing.

Edge Computing on netIOT Edge Gateways

In addition to connector packages, the netIOT Service Portfolio allows for solving complex Edge Computing tasks. For example, the netIOT Edge Gateway solution On-Premise makes it possible to utilize the software package IBM ODM (Operational Decision Management), which offers rule-based decision systems to be implemented directly on the shopfloor. Another example for utilizing Edge Computing Solutions is the IBM Informix package. With this package, data aggregation and data preprocessing can be performed right next to the machine that is being monitored.

netIOT infrastructure diagnostics

A reliable network infrastructure is a key prerequisite for stable and safe operation at the shop-floor. The netIOT Edge Gateway enables continuous monitoring of the entire network: Important events such as imminent failure and other sources of faults are automatically detected and reported.

The web-based dashboard provides easy access to important diagnostic information. This helps minimizing downtimes and reducing costs.

In addition to connector packages the netIOT Service Portfolio also offers complex Edge Computing tasks. For example, the netIOT Edge Gateway solution On-Premise makes it possible to utilize the software package IBM ODM (Operational Decision Management), which offers rule-based decision systems to be implemented directly on the shopfloor. Another example for utilizing Edge Computing Solutions is the IBM Informix package. With this package, data aggregation and data preprocessing can be performed right next to the machine that is being monitored.
netIOT FOR DEVICE MANUFACTURERS

Hilscher paves your way to “intelligent” field devices and thus ensures end-to-end networkability for your components.

• Implement your device solution with a high-performance Hilscher netX network controller or complete network module.
• Report important telemetry data on your device in addition to classical I/O data via the IoT protocols MQTT and OPC UA.
• Provide your customers with the foundation for cloud-networked data management.
• Become a part of groundbreaking data infrastructure innovation as a partner in the Device Information Portal.

In view of the usual service life of intelligent sensors and actuators, today, netIOT makes it possible for device manufacturers to assure their customers that the technology for the Industrial Internet and Industry 4.0 is already integrated in their devices. Thus they can offer their customers the option of using the extended functionality of the cloud any time it is required or desired.

netIOT opens up a wide variety of opportunities to device manufacturers for integrating their own features and information functions in their devices without changing the functions required by the system controller or industrial Ethernet communication. This allows device manufacturers to differentiate themselves from the competition by integrating additional functions in the device software which can be accessed via IoT telegrams.

For manufacturers of larger automation equipment, e.g. large drives, new business models are possible that open up new offerings and clienteles. The ability to access device data via netIOT, independent of the action controller program, makes it possible for such devices to also be marketed with leasing or pay-per-use concepts and reach new target groups with new investment models.

“The information provided by sensors also plays an important role in Industry 4.0. The challenge for us as a sensor manufacturer lies in efficiently making the wide variety of sensors and interfaces ‘ready for Industry 4.0’. OPC UA offers the ideal basis in this case as it ensures secure, reliable and manufacturer-neutral transportation of raw data and preprocessed information. Baumer relies on this scalable, platform-independent solution with its open architecture, which can be adapted to future requirements, for support in the evolution already taking place.”

Dr. Michael Schneider
Head of Product Management, Motion Control, Baumer Electric AG – Frauenfeld
For mechanical and plant engineering, netIOT offers significant benefits. IoT functionality becomes accessible while the established control architecture remains intact. For mechanical engineers, it becomes possible to reuse existing templates and installations with added functionality in the cloud, on local servers or on mobile devices. The netIOT Edge Gateway is a solution that allows data extraction from any communication party for IT solutions without disturbing the PLC and the control program. The accessible devices range from the PLC down to IO-Link sensors.

In the IT side, the Edge Gateway offers a range of IoT protocols and cloud connectors, making application in different customer plants feasible. This makes it possible to connect different plants with different IT solutions through a single type of equipment. The netIOT Edge Gateway portfolio therein allows for scaling of the scenario without a change in configuration handling. Added value can be gained by mechanical and plant engineers from the diagnosis and configuration capabilities of the netIOT portfolio. With an Edge Gateway, it becomes possible to configure field devices down to the sensor to thoroughly diagnose the communication connection. netIOT utilizes open standards and interfaces to ensure maximum future proofness of any netIOT based solution.

For mechanical and plant engineers, flexibility and sustainability of solutions are critical for new concepts in the field of the Industrial Internet of Things. With the netIOT portfolio we laid a foundation that allows the development of IT solutions that can be migrated to a new technological platform tomorrow. Therefore, a mechanical or plant engineer does not tie himself to a solution provider and yet can move forward with full force.

Dr. Andreas Gössling
Department Manager netIOT

From existing communication infrastructure to Industrial Internet / Industry 4.0 connectivity.
netIOT FOR SYSTEM PROVIDERS

Intelligent connection and automation device interaction in machines and plants on a common data basis give IT system providers new opportunities for fast, efficient and considerably more flexible production.

One thing is certain: The Industrial Internet / Industry 4.0 will generate a multitude of useful data from sensors and actuators at field level that then generates added value. Proven technologies are available for IoT Communication with MQTT and OPC UA. Although the actual value creation is a result of MES and cloud software functions, the entire system can only generate added value if it has access to the field device data, independent of current controller cycles.

The real advantage of Industry 4.0 and the Industrial Internet is the result of vertical communication, which enables cloud applications to access their devices locally and from the cloud.

This will improve device availability and the maintainability.

Armin Pühringer
Business Development Manager

netIOT enables the use of further security mechanisms such as “Secure Boot” and end-to-end device identification. Data from the field level is made accessible to the system provider, simply and without complex software development. Cloud applications can use the extension data to generate additional advantages for the user. The user has the security of a complete solution that has been coordinated and tested by Hilscher and the cloud platform provider.

Many manufacturers of automation devices use the netIOT solution and are therefore able to benefit from cloud applications for the configuration and diagnosis of their devices.

“The real advantage of Industry 4.0 and the Industrial Internet is the result of vertical communication, which enables cloud applications that are functionally more enriched as well as new business models. Field device manufacturers now have the opportunity to access their devices locally and from the cloud. This will improve device availability and the maintainability.”

Armin Pühringer
Business Development Manager
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