

From Multi-Protocol Chip to Multi-Cloud Connection

netIOT – Industrial Cloud Communication



HILSCHER IS YOUR PARTNER FOR INDUSTRIAL INTERNET AND INDUSTRY 4.0

Hilscher Gesellschaft für Systemautomation 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 to 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, IP67 I/Os, RFID controllers, drives and valve terminals with the control system via the various Real-Time Ethernet systems.

This makes us at home wherever data is generated in the production plant.

Together with the corresponding metadata, this information needs to be transported 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 retrofitted in existing devices 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 deliver, in 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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OUR SOLUTION

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INDUSTRIAL CLOUD COMMUNICATION FROM FIELD DEVICE INTO THE CLOUD FOR INDUSTRIAL INTERNET AND INDUSTRY 4.0

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



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“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.



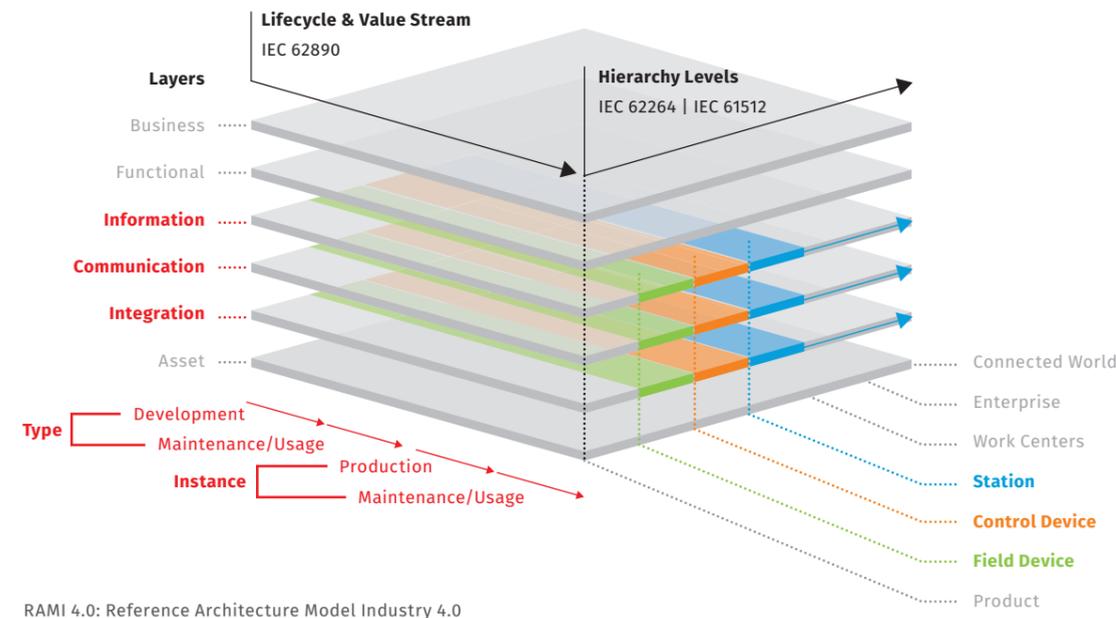
RAMI 4.0 und IIRA are reference architectures for the Industrial Internet / Industry 4.0 which have established themselves in USA & Germany.

A gateway of an Industrial Internet system, on the 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.

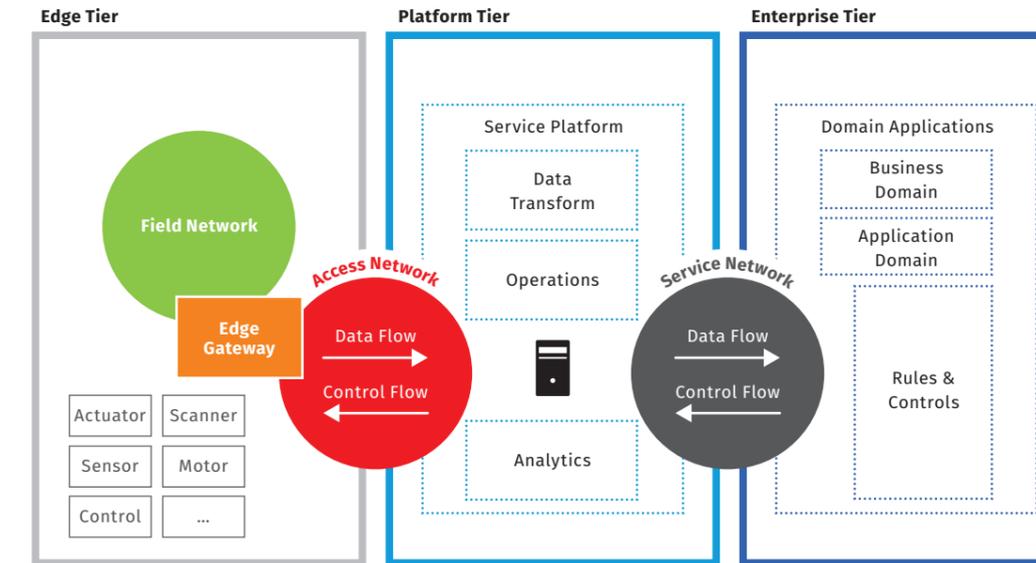
In actual practice, the Edge Gateway ensures connectivity to the access network. This establishes communication to the access layer of the controller layer, on which all production-relevant software packages, e.g. "analytics" and "predictive maintenance", are consolidated.

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.

RAMI 4.0 PROVIDES A POWERFUL CONCEPT VIEW



RAMI 4.0: Reference Architecture Model Industry 4.0



IIRA: Industrial Internet Reference Architecture

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“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.”

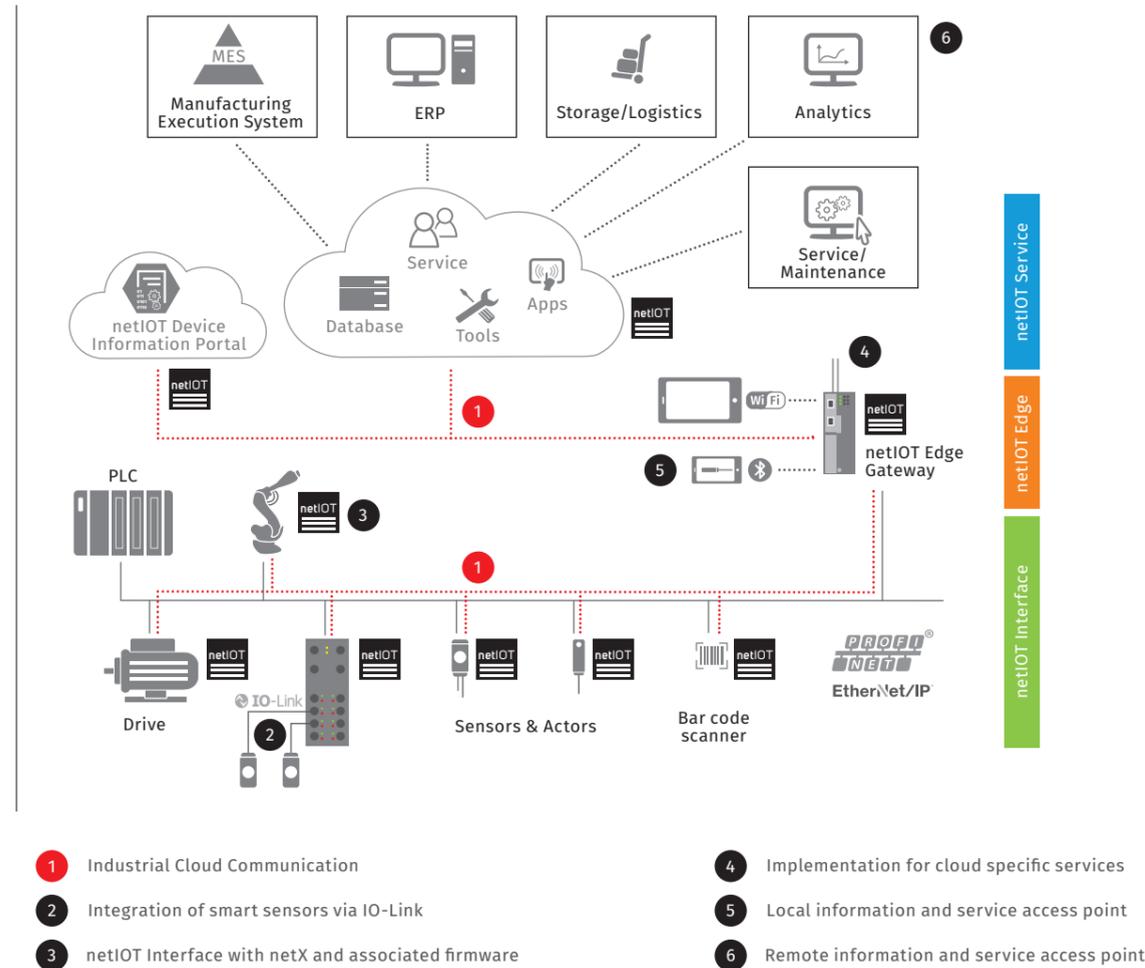
— Dr. Richard Soley
Executive Director of the Industrial Internet Consortium

netIOT includes the interface in the field device, the Edge Gateway and secure communication from the IO-Link sensor into the cloud.

FROM THE FIELD LEVEL INTO THE CLOUD – VERTICAL INTEGRATION

INDUSTRIAL IOT COMMUNICATION

WITH THE EXISTING COMMUNICATION INFRASTRUCTURE, INDUSTRIAL INTERNET AND INDUSTRY 4.0 INFORMATION IS TRANSMITTED WITHOUT SIDE EFFECTS AND IN PARALLEL WITH REAL-TIME ETHERNET DATA AND COLLECTED, COMPRESSED AND PASSED ON TO A HIGHER-LEVEL CLOUD VIA THE NETIOT EDGE GATEWAY



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 horizontally 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, webservers, MQTT or OPC UA allow access to the device data transmitted into the cloud from the Edge Gateway.

The netIOT Interface automatically integrates sensors with an IO-Link interface in this functionality. A netIOT implementation in the device enables communication via various Real-Time Ethernet systems and provides access to the cloud via the Edge Gateway. Successful pilot applications are in place for integrating into IBM Bluemix, Microsoft Azure and the SAP Asset Intelligence Network. Further IT infrastructure interfaces are already planned out.

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.

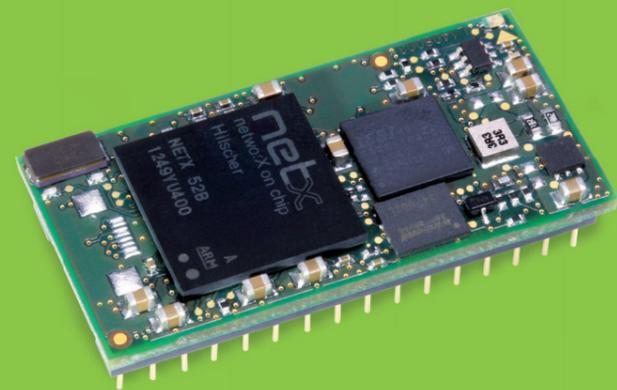
The device and system information as well as analysis and diagnostics programs are available in the cloud as a part of netIOT Service. This requires the corresponding security functions to be available and enabled. Our netIOT Edge Gateway provides a closed security architecture based on a Linux OS specifically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

This meets all the prerequisites for implementing future market requirements in new business models. Industrial Internet / Industry 4.0 makes it possible for manufacturers of automation components to develop devices and services that make life easier for the user and production more efficient.

Those able to fulfill the wishes of their customers with greater ease and individuality with transformed or new digital offerings, products and services will be more successful in the future.

netIOT Interface

DATA ACQUISITION ON THE "LAST MILE"



Industry 4.0 starts in the field device

Industry 4.0 has two clear demands on field devices: To connect them to a cloud and to generate data that goes beyond pure I/Os, 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.



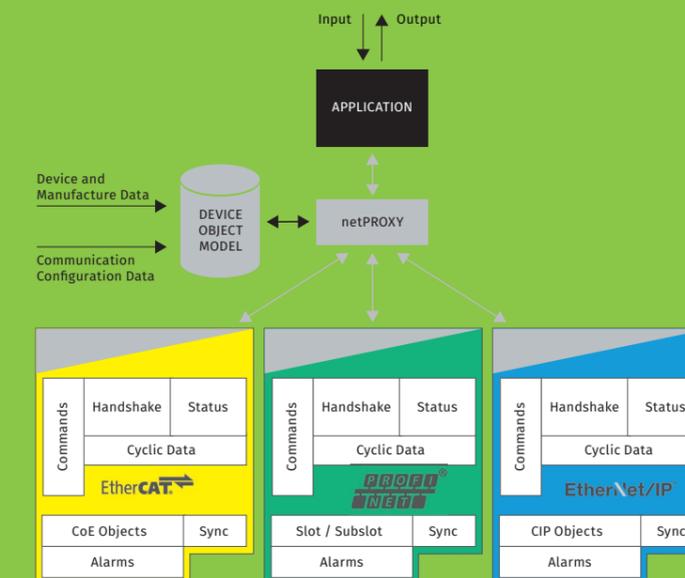
DIL-32 communication-IC with generic object interface

Hilscher has equipped its DIL-32 Communication IC with essential IoT functionality. Besides Real-Time Ethernet, the netIC IOT contains an integrated OPC UA server and MQTT client for IoT communication. Exchange of the I/O-data well as IoT-data with the host application will be done using the joint generic object interface netPROXY. 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 separated from any protocolspecific requirements.

Transforming simple data into information

The core of netIOT Interface solutions is Hilscher's netPROXY technology, which forms a protocol independent object interface between application and communication. This abstraction layer balances the complexity of the different protocol APIs and allows data exchange with a few simple services.

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



netX Chip Carrier for IT functions and IoT

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 an integrated OPC UA server and MQTT client just with a software upgrade.

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 API. 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



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

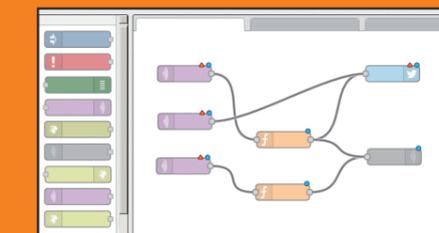
Integrated security mechanisms such as physical separation of the OT network and the IT network, a trusted operating system, the execution of signed firmware and packets only and the usage of encryption techniques of the latest standards are securing the data integrity and protecting against any kind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



netIOT Service

THE INTERFACE

FOR ADDED VALUE

IN THE CLOUD



Connecting the physical object with the digital twin

netIOT offers a broad range of cloud and IT 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 twins' 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 utilise the software package IBM ODM (Operational Decision Management), which offers rule-based decision systems to be implemented directly on the shopfloor. Another example for utilising 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

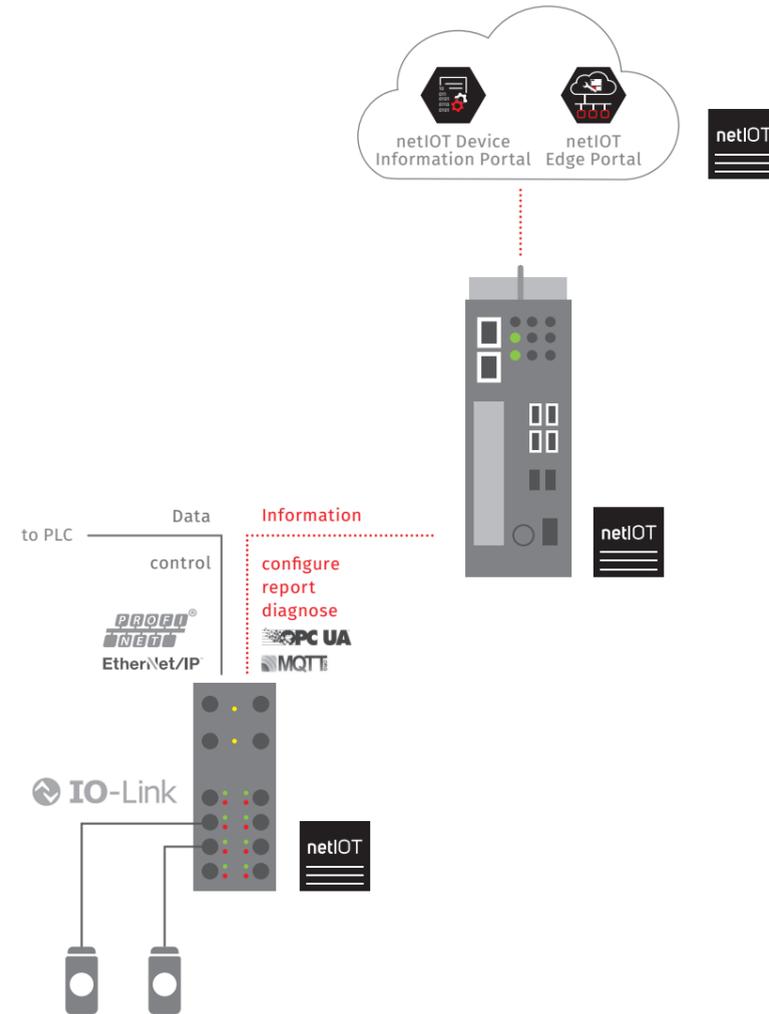
A reliable network infrastructure is a key prerequisite for stable and safe operation at the shop floor. The netIOT Edge Gateways enable continuous monitoring of the entire network. Important events such as an imminent failure and other sources of faults are automatically detected and reported.

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

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.



The Industrial Internet and Industry 4.0 live on data. And acquisition has to happen at the data source: on the “last mile”, right in the field devices.

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.

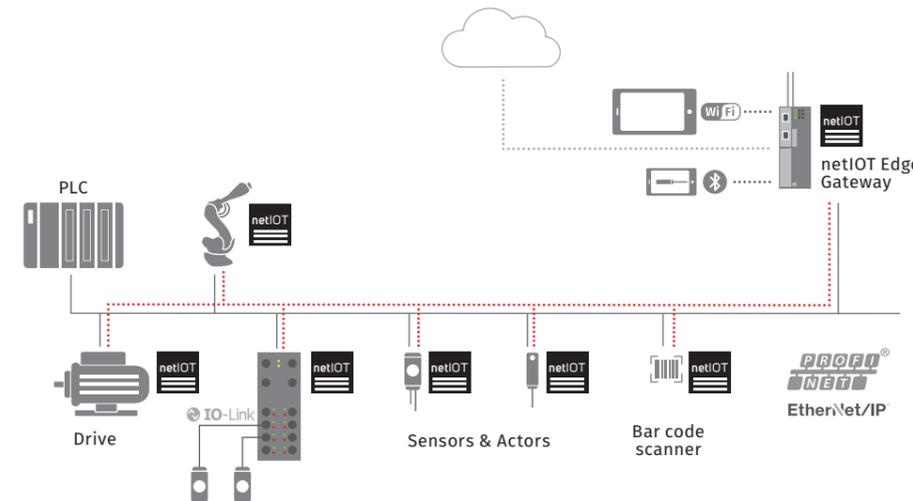
For manufacturers of larger automation equipment, e.g. large drives, new business models are possible that open up new offerings and clientele. The ability to access device data via netIOT, independent of the active controller program, makes it possible for such devices to also be marketed with leasing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

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“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

netIOT FOR MECHANICAL AND PLANT ENGINEERING



As a mechanical or plant engineering company, you benefit directly from the new IoT functionality of netIOT Edge Gateways. All information belonging to the coupled PLC network can be accessed via the usual and cost-effective IT infrastructure. The diagnostics data and bus topology are read from the field devices by the Edge Gateway and transmitted to tablets or smartphones with a WiFi connection via browser or app.

Starting now, you have the opportunity to deliver your machines with the basis for cloud connection that will be required for future automation.



From existing communication infrastructure to Industrial Internet / Industry 4.0 connectivity.

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 utilises open standards and interfaces to ensure maximum future proofness of any netIOT based solution.



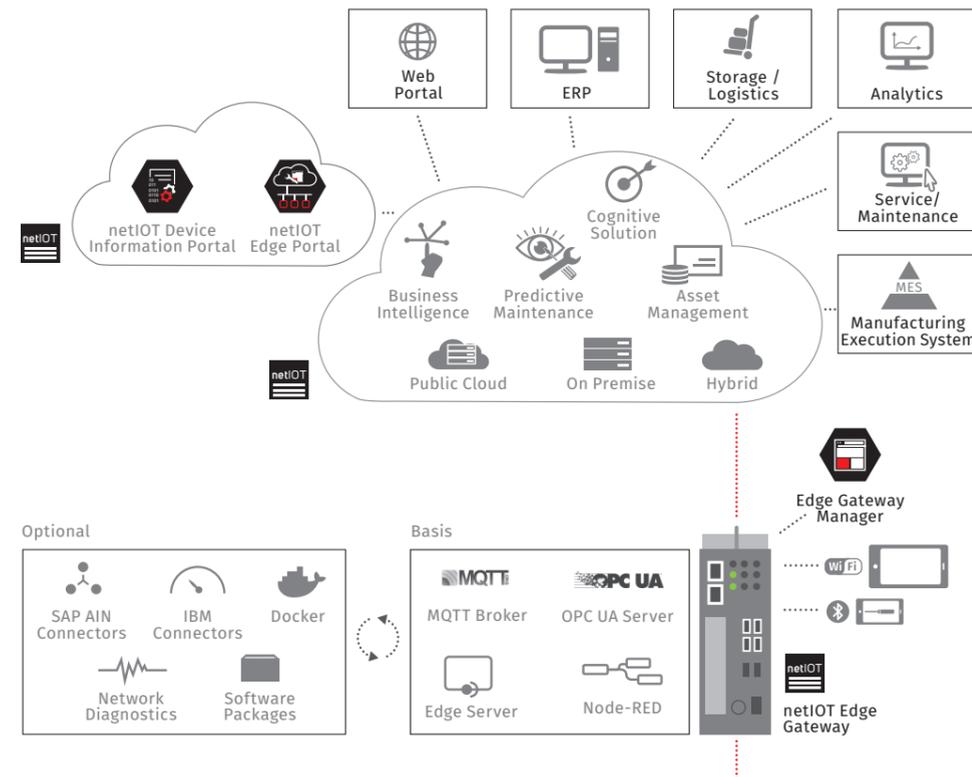
“For Mechanical and Plant Engineers, flexibility and sustainability of solutions are critical for new concepts in the field of the Industrial Internet of Things. With the netIOT portfolio we laid a foundation that allows the development of IT solutions that can be migrated to a new technological platform 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

netIOT FOR SYSTEM PROVIDERS



The Industrial Internet and Industry 4.0 are key drivers for further development for smart factory automation technology.



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.

IoT Communication with MQTT, AMQP and OPC UA supports extension of Real-Time Ethernet communication at field level. In the cloud, with IBM, Microsoft, Oracle and SAP as well as Amazon, providers have established themselves with their platforms and will thus shape a multi-cloud landscape in the future.

netIOT therefore realises a multicloud strategy with close integration to different cloud ecosystems. Our partnerships with IBM, SAP and Microsoft are proof of this strategy.

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 extensive 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

HEADQUARTERS

Germany

Hilscher Gesellschaft für
Systemautomation mbH
Rheinstraße 15
65795 Hattersheim (Frankfurt)

Phone.: +49 (0) 6190 9907-90
Fax: +49 (0) 6190 9907-50
E-Mail: netIOT@hilscher.com
www.hilscher.com
www.netiot.com

BRANCHES

China

Hilscher Systemautomation Co. Ltd.
Huaihai China Tower 2208
Ren Min Road No. 885
200010 Shanghai

Phone: +86 (0) 21-6355-5161
E-Mail: info@hilscher.cn
www.hilscher.cn

France

Hilscher France S.a.r.l.
12, Rue du 35ième Régiment d'Aviation
Miniparc du Chêne
69500 Bron (Lyon)

Phone +33 (0) 4 72 37 98 40
Fax: +33 (0) 4 78 26 83 27
E-Mail: info@hilscher.fr
www.hilscher.fr

India

Hilscher India Pvt. Ltd.
Office No. 402, Ganga Collidium-1
Near Gangadham Bungalows Phase-1
Bibwewadi-Kondhwa Road
Market Yard
Pune-411037

Phone: +91 20 24243777
E-Mail: info@hilscher.in
www.hilscher.in

Italy

Hilscher Italia S.r.l.
Via Grandi, 33
20090 Vimodrone (Milano)

Phone: +39 02 25007068
Fax: +39 02 25029973
E-Mail: info@hilscher.it
www.hilscher.it

Japan

Hilscher Japan KK
YKB Shinjuku-Gyoen Bldg. 3F
1-3-8 Shinjuku, Shinjuku-ku
Tokyo, 160-0022

Phone: +81 (0) 3-5362-0521
Fax: +81 (0) 3-5362-0522
E-Mail: info@hilscher.jp
www.hilscher.jp

Korea

Hilscher Korea Inc.
#S/707-1, H-Square, 231,
Pangyojeok-ro, Bundang-gu,
463-400
Seongnam, Gyeonggi

Phone: +82 (0) 31-789-3715
Fax: +82 (0) 31-789-371
E-Mail: info@hilscher.kr
www.hilscher.kr

Switzerland

Hilscher Swiss GmbH
Hans-Huber-Strasse 37a
4500 Solothurn

Phone: +41 (0) 32 623 6633
Fax: +41 (0) 32 623 6632
E-Mail: info@hilscher.ch
www.hilscher.ch

USA

Hilscher North America, Inc.
2525 Cabot Drive, Suite 200
Listle, IL 60532

Phone: +1 630 5055301
E-Mail: info@hilscher.us
www.hilscher.com