RUTRONIK EMBEDDED

TechTalk

HMS Distributor

PC Speaks the Language of the Field in the Age of Industry 4.0

Markus Demaria

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Introduction

About HMS

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Trend: Use of (standardized) IPCs

Coming from simple control, today's systems are multi language capable.

3

Solutions for industrial communication on IPCs

How can HMS bring value to your Application

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What use cases can be solved in addition

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HMS stands for Hardware Meets Software™

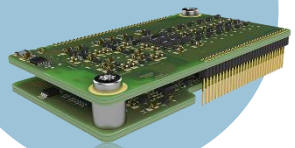
Hardware Meets Software™ with HMS products

Enabling machine communication in many fields

Ixxat® BY HMS NETWORKS

Embedded Control

Functional Safety



Smart Grid

Automotive Testing

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Trend: Use of (standardized) IPCs

Transition in the Industry

- Applications require increased computation or memory perfomance
- IPCs getting more and more compact
- Use of standardized components

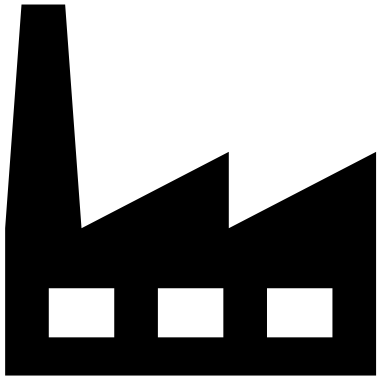
- Operating system available
- More services can be used
- Development cycles are becoming shorter
- Software becomes more important
- …

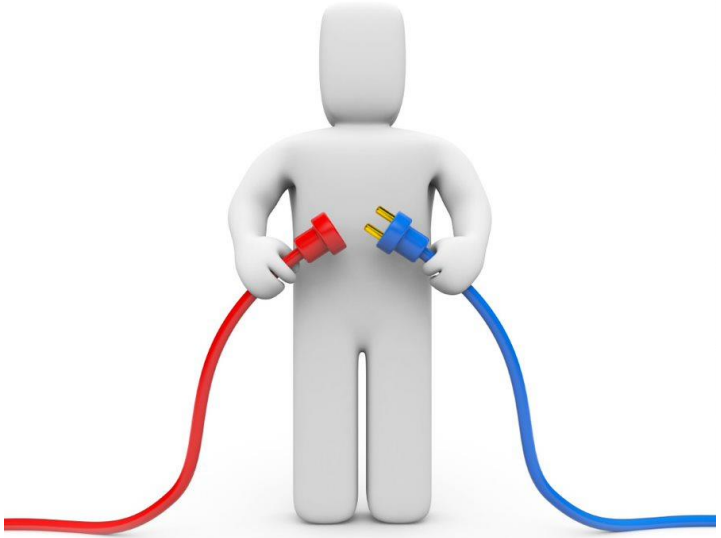
Trend: Use of (standardized) IPCs

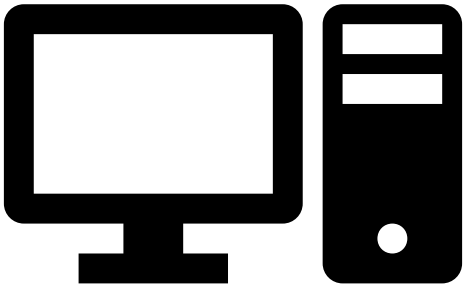
To be found in numerous applications

Trend: Use of (standardized) IPCs

But…







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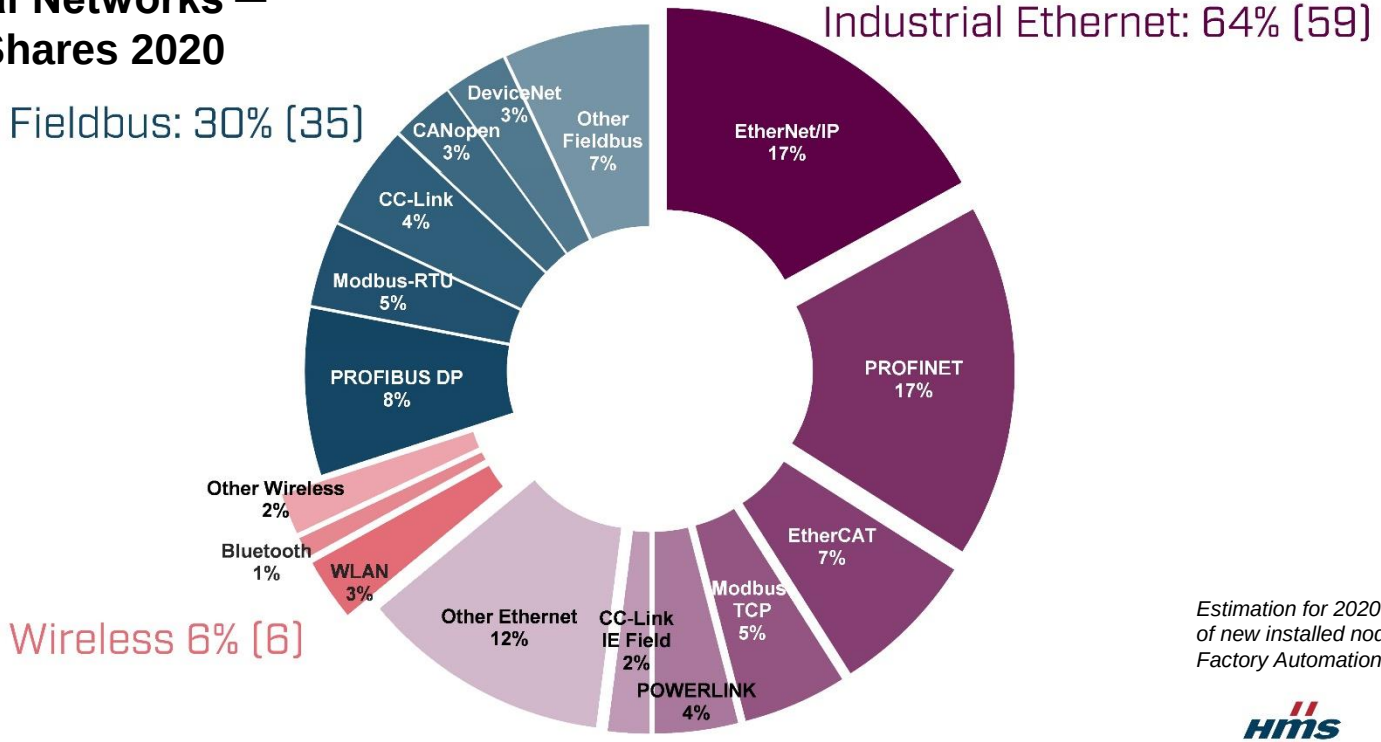
Solutions for industrial communication on IPCs

Industrial Communication

Industrial Networks – Market Shares 2020



Estimation for 2020 based on number of new installed nodes in 2019 within Factory Automation

HMS consolidated view based upon several market studies and our own statistics.

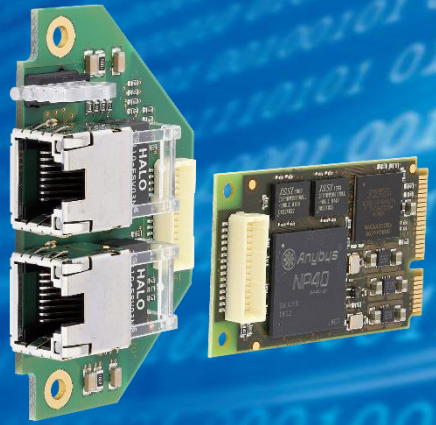
Solutions for industrial communication on IPCs

Manifold industrial networks

One PC-interface

Solutions for industrial communication on IPCs

Ixxat INpact Interface



Solutions for industrial communication on IPCs

Features

- Industrial grade switch / hub features
- Complete real-time capabilities
- De-coupling of PC from real-time task
- High-performance - Low latencies
- Efficient HMS NP40 network technology

Solutions for industrial communication on IPCs

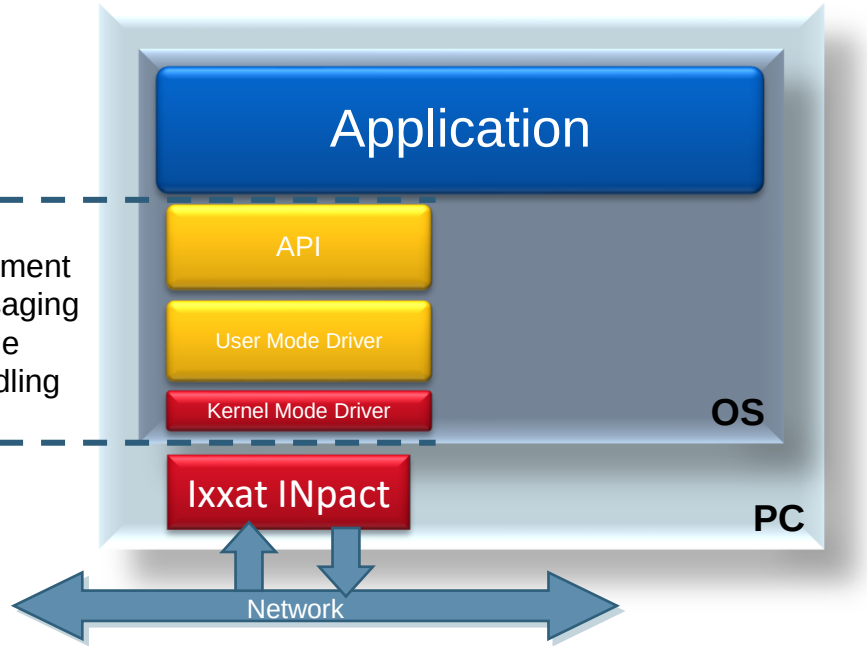
Features

- Multiprotocol support (Anybus NP40)
- Comprehensive C-API based driver package for Windows & Linux

Solutions for industrial communication on IPCs

System Architecture

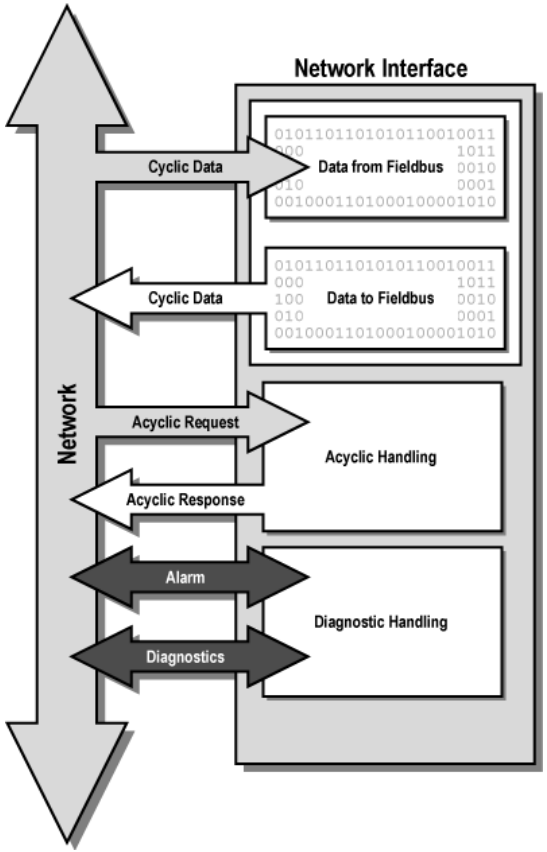
- Card Management
- Mailbox/Messaging
- Process Image
- Interrupt Handling



Solutions for industrial communication on IPCs

Industrial Communication Today

- In a fieldbus / Industrial Ethernet network the following data are exchanged between a field device and a controller
  - Cyclic process data
  - Network and system status messages
  - Acyclic parameter data
  - Device diagnostics information



Solutions for industrial communication on IPCs

Industrial Communication Today

- The major PLC vendors each have specified their own fieldbus and/or Industrial Ethernet variants and implemented in their controllers
- These are supported by the respective network user organizations
- Here is a table of the most important ones:

Controller Manufacturer	User Organization	Fieldbus	IE-Network
Siemens	PNO / PI	PROFIBUS	PROFINET
Phoenix	Interbus Club / PI	Interbus	PROFINET
B&R	EPSG		POWERLINK
Beckhoff	ETG		EtherCAT
Bosch	CiA	CANopen	SERCOS III
Rockwell / Allen Bradley	ODVA	DeviceNet ControlNet	Ethernet/IP
Mitsubishi	CLPA	CC-Link	CC-Link IE
Schneider	Modbus Organisation	Modbus RTU Modbus Plus	Modbus TCP

What does “Industrial Communication” mean?

Industrial Communication Tomorrow

- Interconnection is increasing
  - within a production plant (from equipment to equipment)
  - in between production plants (from facility to facility)

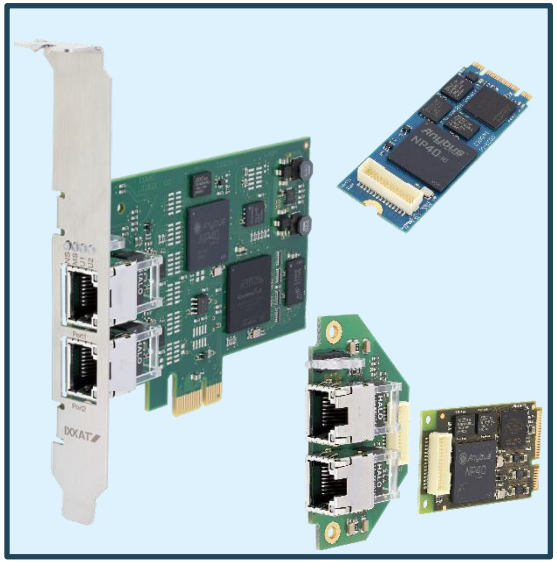
- More communication tasks will be added to control the system
  - Quality assurance
  - Preventive maintenance
  - Production planning (ERP(Enterprise Resource Planning) + MES(Manufacturing Execution System))
  - Visualization (SCADA(Supervisory Control and Data Acquisition))
  - …

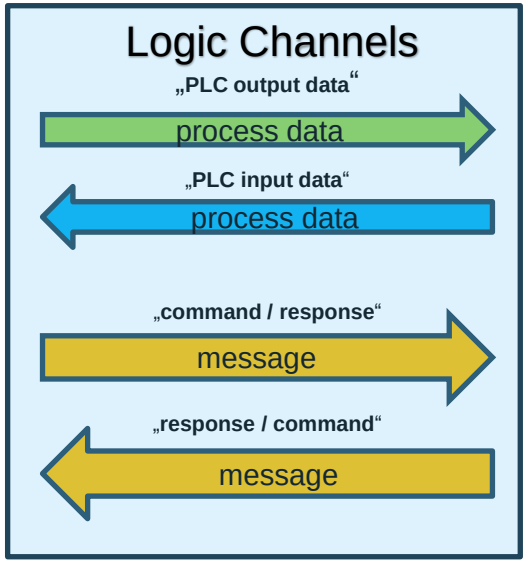
- IIoT (Industrial Internet of Things)
  - Direct communication between machines / devices among themselves

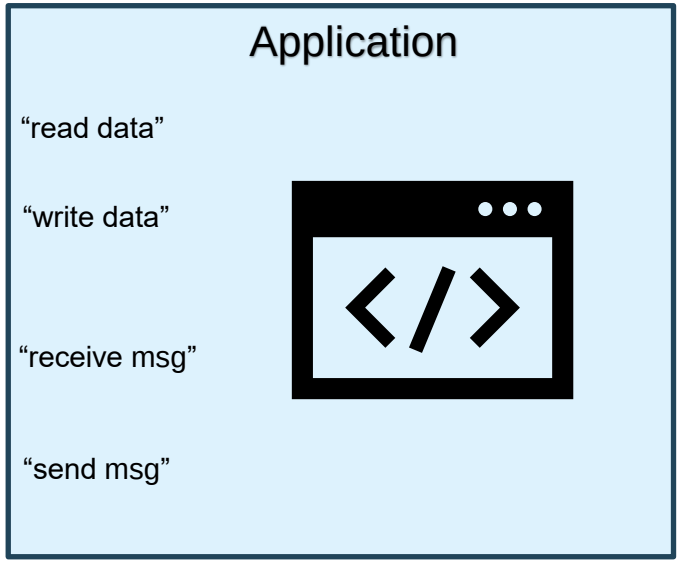
Solutions for industrial communication on IPCs

The communication concept

- Four logic channels between Ixxat INpact and Application





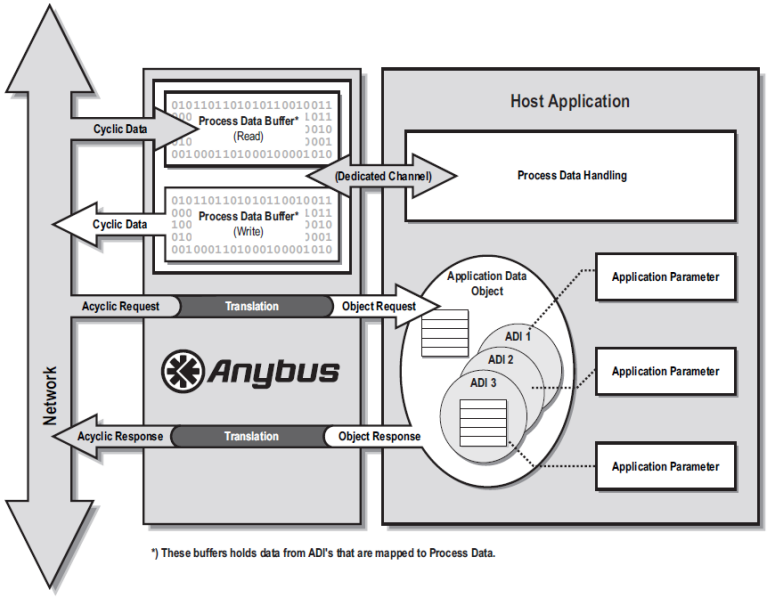


- Except for process data, **all** data (including parameters and diagnostics data) are transmitted by means of **command / response messages**

Solutions for industrial communication on IPCs

The communication concept

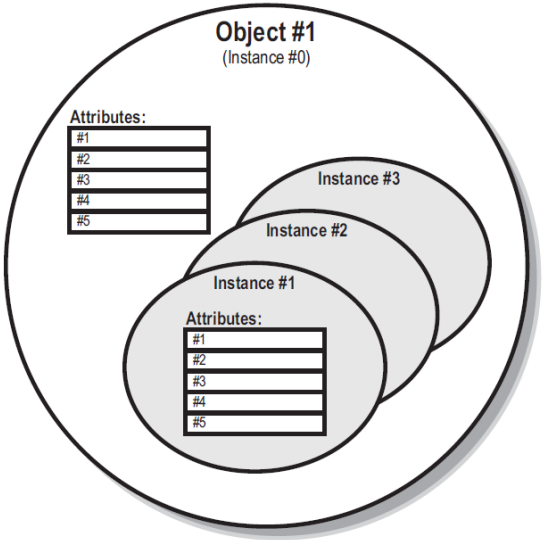
- **Input process data** (from host application) stored in the module as the **process image**
- **Acyclic read and write commands** by the to uniform messages (**messages: commands and responses**) between Ixxat INpact and host application



- Data is structured into **objects, instances, and attributes** and accessed by messages

Object / Instance / Attribute

- Every object has its own object attributes and consists of at least one instance (01h)
- Every instance has 1..n instance attributes
- All instances within an object have the same set of attributes
- Read and write operations to attributes are done by messages

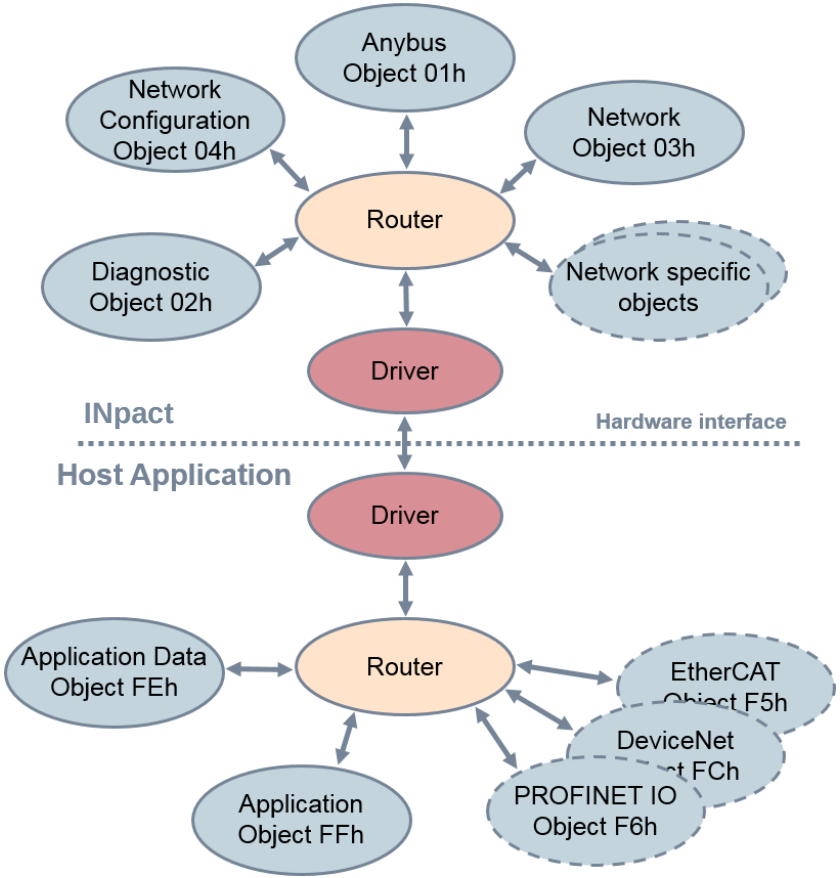


Solutions for industrial communication on IPCs

There are…

- Objects inside the ABCC:
  Anybus Objects (01h, 02h, …..)

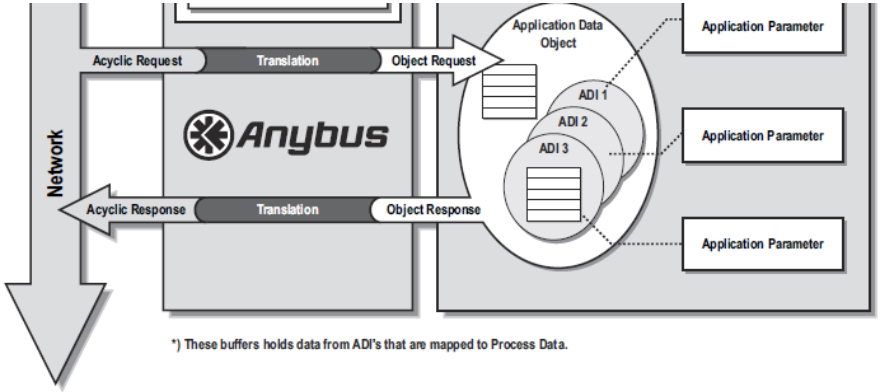
- Objects inside the Host Application:
  Host Application Objects (FFh, FEh, ….)



Transmission of Parameter Data

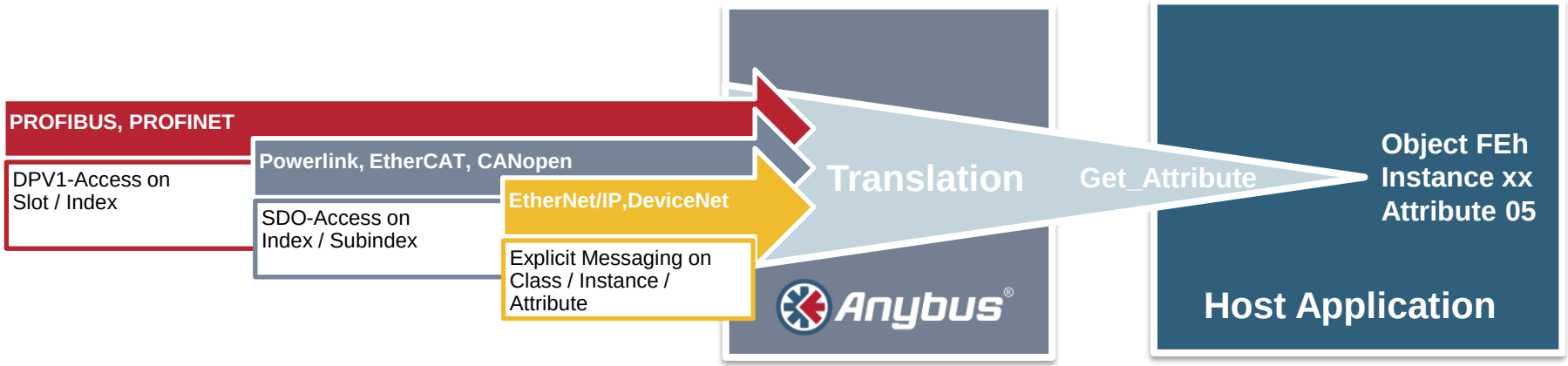
- **Acyclic accesses** by different PLCs (Siemens, Rockwell, …) with different networks (PROFINET, EtherNet/IP, …) to an application parameter are translated into the same **network independent** command towards the Host Application:

Get_Attribute (**Application Data Object (FEh), Instance xx, Attribute 05h)**



Transmission of Parameter Data

Example: acyclic access to parameter data for different networks and the Ixxat INpact‘s translation into a network independent command towards the host application



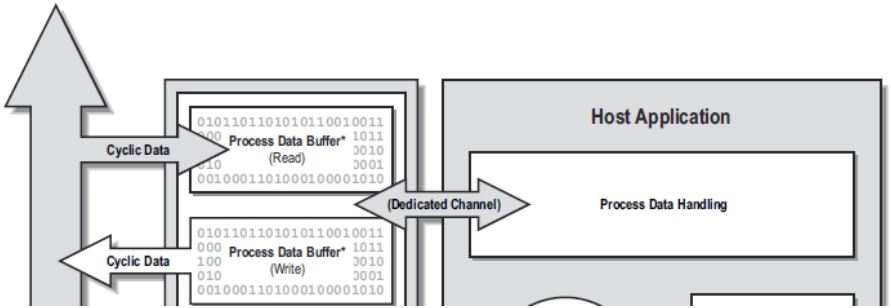
Solutions for industrial communication on IPCs

The only data NOT being transmitted by messaging

- **Only process data** (“I/O data”, “fast data” , “cyclic data”) are **NOT** being transmitted over messaging
- The host application sends its input process data (target: PLC) as a byte stream to the Ixxat INpact
- The Ixxat INpact sends its output process data (target: host application) as a byte stream to the host application
- Process data transmission is unacknowledged, i.e. the sender does not check if the receiver has received the data. The receiver also does not notify the sender if data were transmitted correctly, with errors, or not received at all.

Transmission of Process Data

- **Cyclic process data** are stored inside the Ixxat INpact as a process image



Solutions for industrial communication on IPCs

Implementation Steps at a glance

- Specify the device’s (hard- and) software
- Implement (hardware and) software
- Setup a test environment
- Create configuration files for supported networks (e.g. GSDML file for PROFINET)
- Create user manual (for all supported networks) (also necessary for certification tests)
- Perform EMC tests (on the device with integrated Ixxat INpact)
- Perform certification tests
- Staff training (sales, tech support)

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Outlook

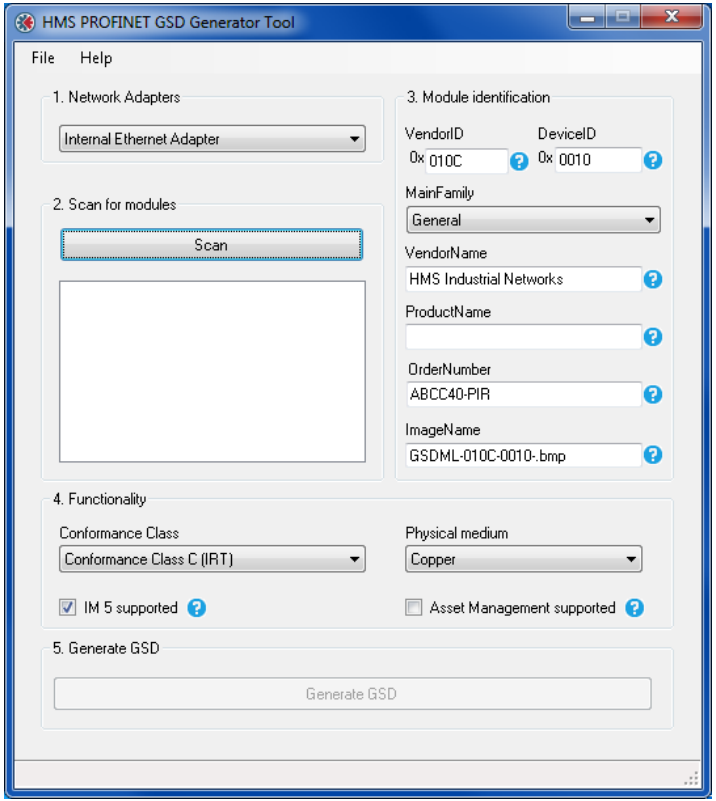
Additional advanced features

- Socket Interface
  - Allows additional types of communication to different devices over TCP or UDP socket connections (like configuration, diagnostics data, and log files to other communication partners)
- Energy Measurement
  - Allows the transmission of energy and power values to the PLC over the network.
- Energy Control
  - Allows switching the device to different operating and energy saving modes over the network.

Allows the implementation of **PROFIenergy** profile

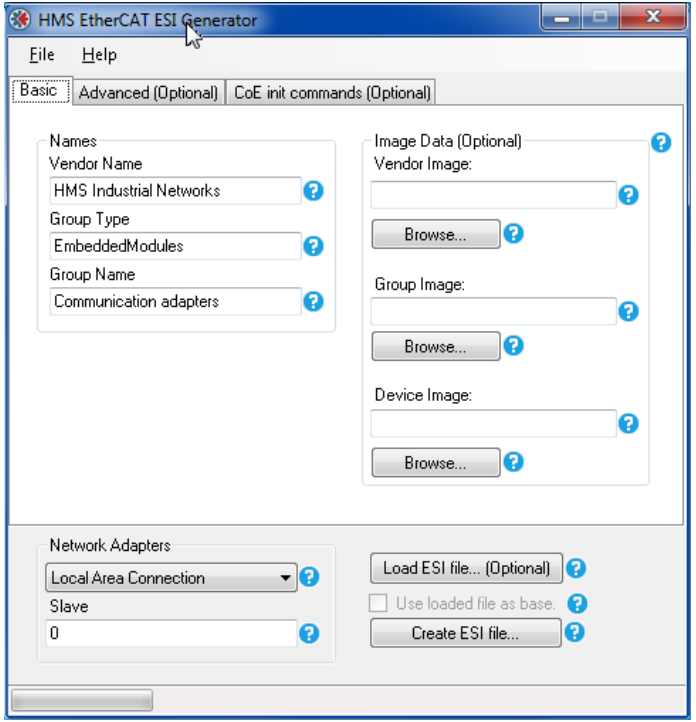
Example: GSD Generator Tool

```
<ProfileBody>
    <DeviceIdentity VendorID="0x010C" DeviceID="0x0010">
        <InfoText TextId="T_ID_DEV_DESCRIPTION"/>
        <VendorName Value="HMS Industrial Networks"/>
    </DeviceIdentity>
    <DeviceFunction>
        <Family MainFamily="General" ProductFamily="Device ABCC 40 PIR"/>
    </DeviceFunction>
    <ApplicationProcess>
        <!-- ============================================================================== -->
        <!--  List of Device Access Points (DAP)                                            -->
        <!-- ============================================================================== -->
        <DeviceAccessPointList>
            <DeviceAccessPointItem ID="DAP" PhysicalSlots="0..64" ModuleIdentNumber="0x80010000" MinDeviceInterval="8"
                <ModuleInfo>
                    <Name TextId="T_ID_DAP"/>
                    <InfoText TextId="T_ID_DAP_DESCRIPTION"/>
                    <VendorName Value="HMS Industrial Networks"/>
                    <OrderNumber Value="ABCC40-PIR"/>
                </ModuleInfo>
                <CertificationInfo ConformanceClass="C" ApplicationClass="" NetloadClass="III"/>
                <SubslotList>
                    <SubslotItem SubslotNumber="32768" TextId="T_ID_SS_INTERFACE"/>
                    <SubslotItem SubslotNumber="32769" TextId="T_ID_SS_PORT1"/>
                    <SubslotItem SubslotNumber="32770" TextId="T_ID_SS_PORT2"/>
```



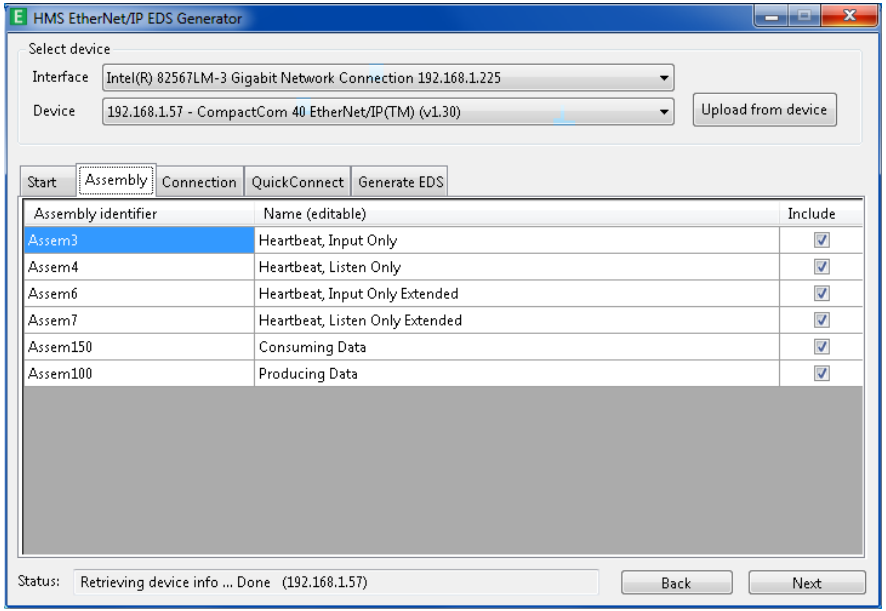
Example: ESI Generator

```
<Vendor>
    <Id>#xE000001B</Id>
    <Name>HMS Industrial Networks</Name>
    <ImageData16x14>424DE60000000000000076000000280000001000000000E0000000100040000000000700000000C40E00
</Vendor>
<Descriptions>
    <Groups>
        <Group>
            <Type>EmbeddedModules</Type>
            <Name LcId="1033">Communication adapters</Name>
            <ImageData16x14>424D7C0100000000000007A000000280000001000000000E0000000100080001000000020100
        </Group>
    </Groups>
    <Devices>
        <Device Physics="YY">
            <Type ProductCode="#x00000036" RevisionNo="#x00010004">Anybus CompactCom 40 EtherCAT</Type
            <Name LcId="1033">
                <![CDATA[Anybus CompactCom 40 EtherCAT]]>
            </Name>
            <Info>
                <Mailbox>
                    <Timeout>
                        <RequestTimeout>100</RequestTimeout>
                        <ResponseTimeout>6000</ResponseTimeout>
                    </Timeout>
                </Mailbox>
            </Info>
            <GroupType>EmbeddedModules</GroupType>
            <Fmmu>Outputs</Fmmu>
            <Fmmu>Inputs</Fmmu>
            <Fmmu>MBoxState</Fmmu>
            <Sm MinSize="34" MaxSize="1486" DefaultSize="276" StartAddress="#x2000" ControlByte="#x26"
            <Sm MinSize="34" MaxSize="1486" DefaultSize="276" StartAddress="#x2800" ControlByte="#x22"
            <Sm StartAddress="#x1000" ControlByte="#x64" Enable="1">Outputs</Sm>
            <Sm StartAddress="#x1800" ControlByte="#x20" Enable="1">Inputs</Sm>
```



Example: EtherNet/IP EDS Generator

```
$ HMS EDS Generator Tool Version 1.0.1.2. Generated Electronic Data Sheet.
[File]
        DescText = "CompactCom 40 EtherNet/IP(TM)";
        CreateDate = 02-07-2017;
        CreateTime = 10:36:19;
        ModDate = 02-07-2017;
        ModTime = 10:36:19;
        Revision = 1.00;
[Device]
        VendCode = 90;
        VendName = "HMS Industrial Networks AB";
        ProdType = 43;
        ProdTypeStr = "Generic Device (keyable)";
        ProdCode = 55;
        MajRev = 1;
        MinRev = 30;
        ProdName = "CompactCom 40 EtherNet/IP(TM)";
        Catalog = "CompactCom 40 EtherNet/IP(TM)";
[Device Classification]
        Class1 = EtherNetIP;
[Params]
        Param1 =
                0,                      $ Reserved (always 0)
                0,                      $ Link path size
                "",                     $ Link path
                0x0010,                 $ Descriptor
                0xC3,                   $ Data type (Signed 16-bit integer value)
                2,                      $ Data size
                "Speed",                $ Parameter name
                "",                     $ Units string
                "",                     $ Help string
                -500,                   $ Minimum value
                500,                    $ Maximum value
                0,                      $ default value
                ,                       $ Scaling multiplier (not used)
                ,                       $ Scaling divider (not used)
                ,                       $ Scaling base (not used)
                ,                       $ Scaling offset (not used)
                ,                       $ Multiplier link (not used)
                ,                       $ Divisor link (not used)
```

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