

Industrial IoT

Can we make it? Yes we can!

PRODUCTIE PROCES
AUTOMATISERING

PPA18



06-02-18 • Hart van Holland in Nijkerk

Industrie 4.0 Cyber Security
Industrial Internet of Things Data
Cloud IT/OT Integration

Digital revolution Smart Farming View



- drive tractor
- determine route
- predict weather
- connect equipment
- operate seeding process



Human integrat



<https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition>

PRODUCTIE PROCES
AUTOMATISERING

PPA18



06-02-18 • Hart van Holland in Nijkerk

Industrie 4.0 Cyber Security
Industrial Internet of Things Data
Cloud IT/OT Integration

Future

Digital revolution Smart Manufacturing View



- drives forklift
- determine route
- develop plan
- identify goods
- determine locations



Human inte



PRODUCTIE PROCES
AUTOMATISERING

PPA18



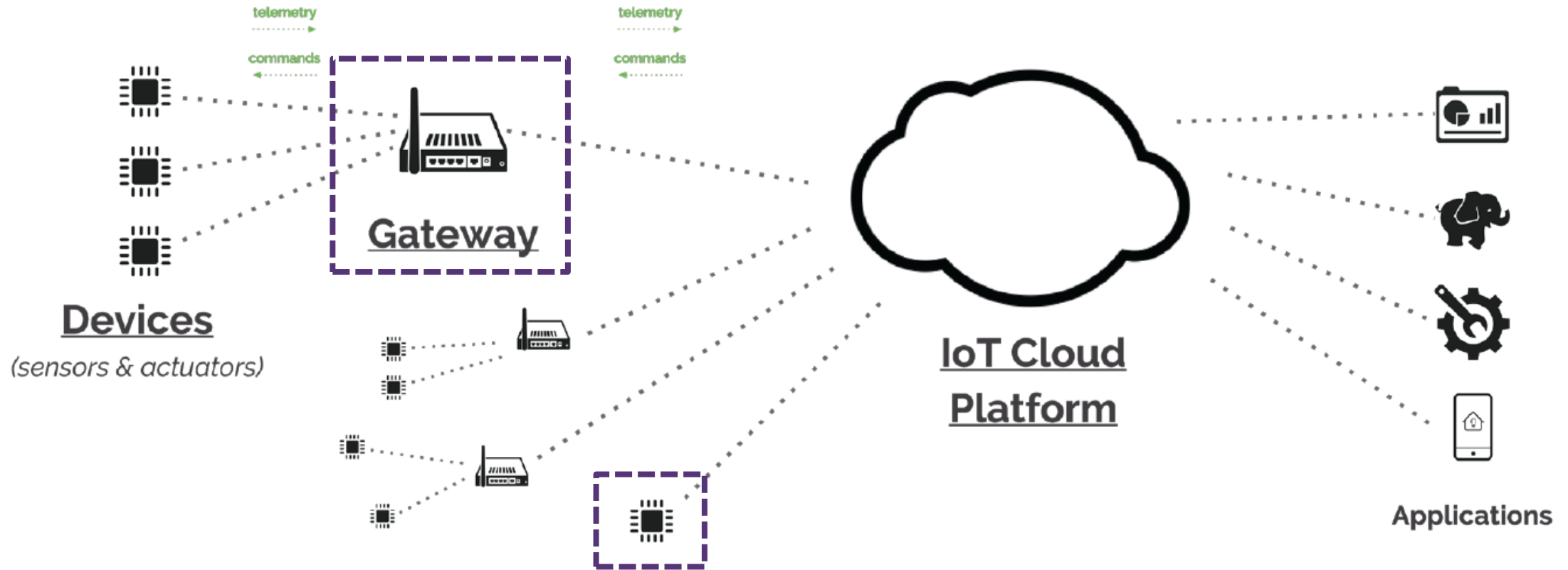
06-02-18 • Hart van Holland in Nijkerk

Industrie 4.0 Cyber Security
Industrial Internet of Things Data
Cloud IT/OT Integration

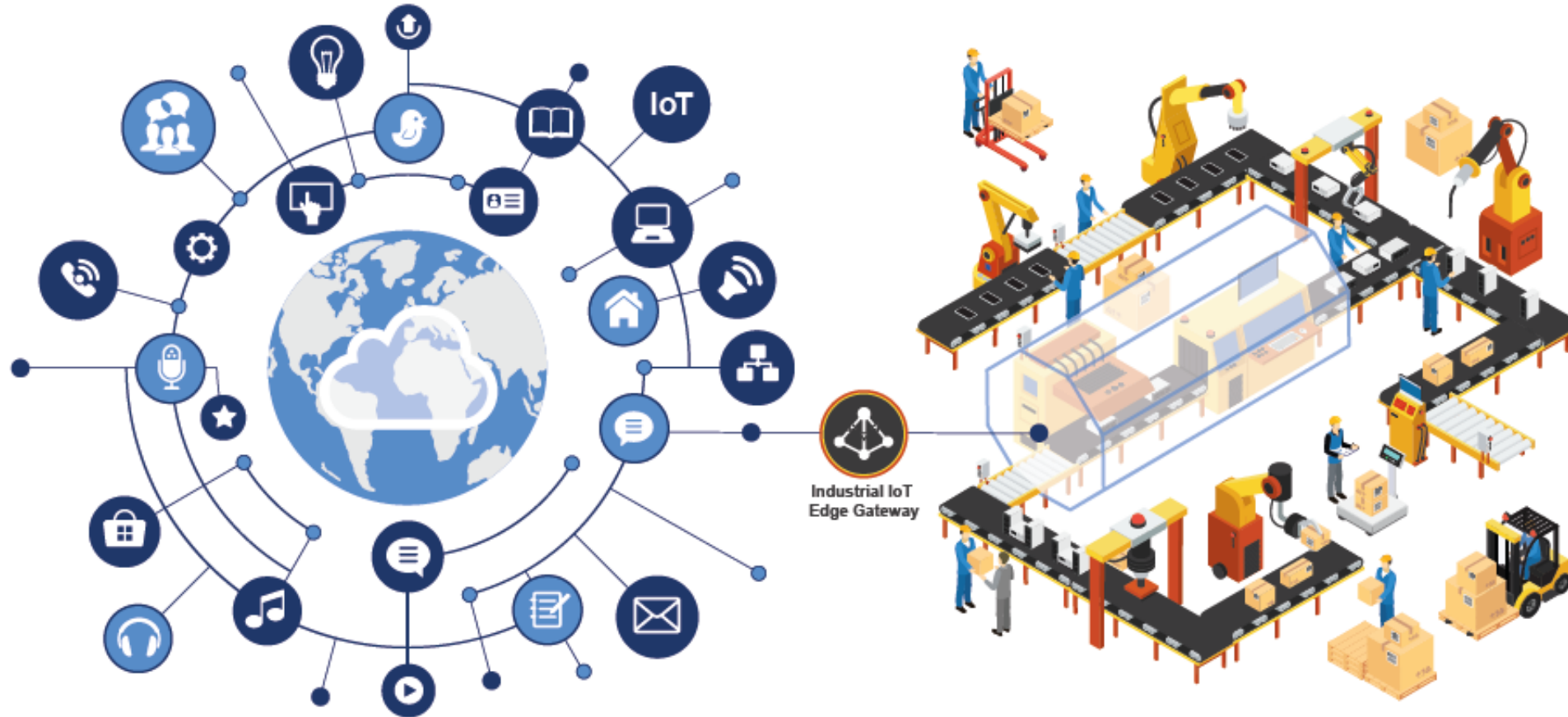
Future

3

Industrial IoT Need and Essence



Industrial IoT (Edge) Gateways Introduction



PRODUCTIE PROCES
AUTOMATISERING

PPA18



06-02-18 • Hart van Holland in Nijkerk

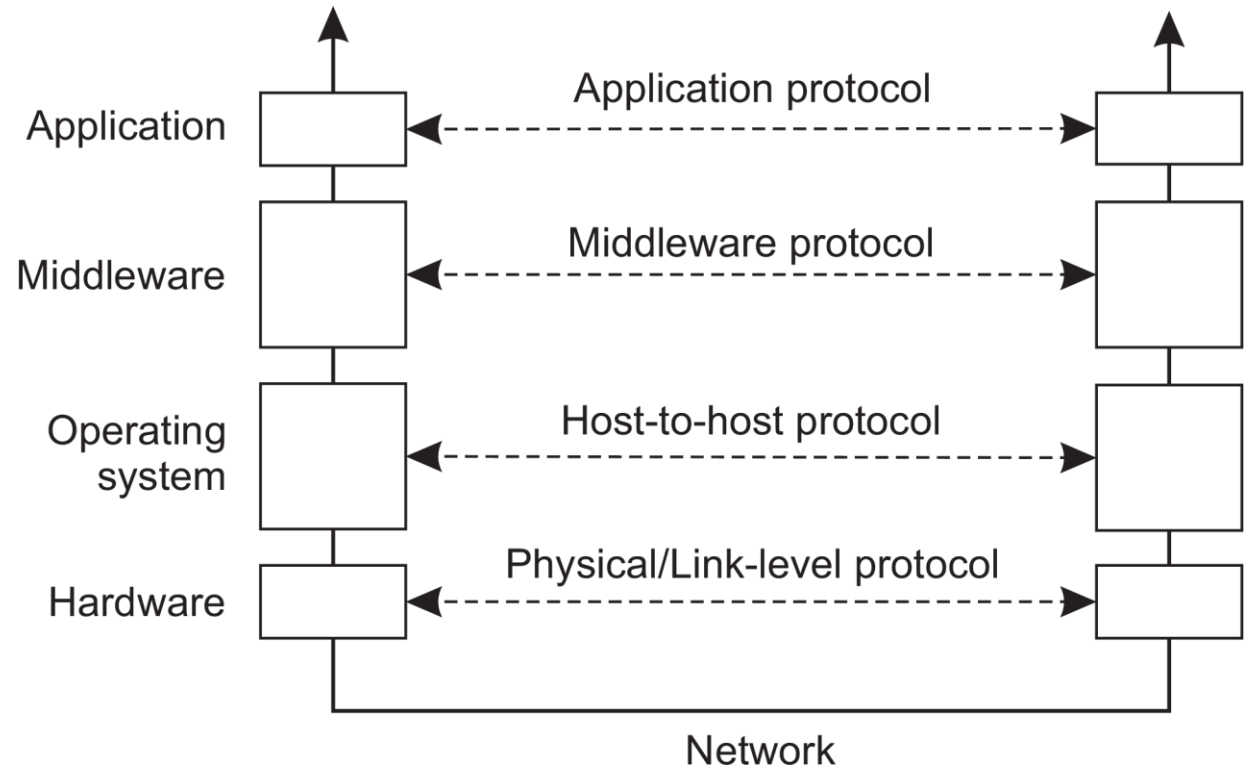
Industrie 4.0 Cyber Security
Industrial Internet of Things Data
Cloud IT/OT Integration

Industrial IoT (Edge) Gateways Introduction

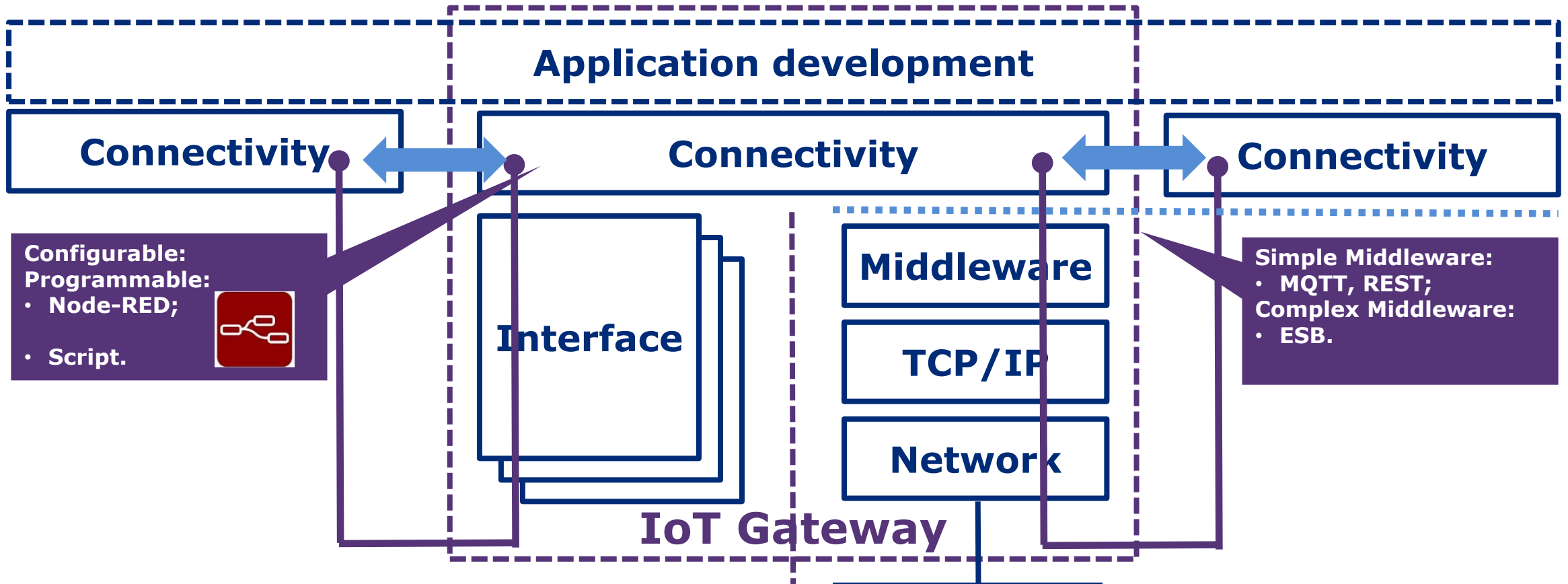
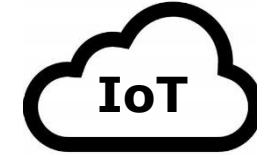
- A gateway supports modularisation and fast evolution.
- Slow evolution through backwards compatibility and standards.
- A gateway is complementary to standards.

Gateways:

- Internet gateway;
- Middleware gateway;
- Application gateway;
 - Common Gateway Interface;



IoT Gateway General structure



Configurable:
Programmable:
• Node-RED;
• Script.



Simple Middleware:
• MQTT, REST;
Complex Middleware:
• ESB.

IoT Gateway Functionality

Traditional

Local (Network) connectivity

- Signal interface
- Point-to-Point (RS232)
- General Bus (USB)
- Fieldbus (RS485, PROFIBUS, Devicenet,..)
- PAN (Bluetooth);
- Ethernet
- ...

Network and protocol (Middleware) bridging:

- Asynchronous (e.g. MQTT/AMQP);
- Streaming;
- Event-based;
- Store-and-forward,

Intelligent

Local data processing:

- Aggregation;
- Transformation;
- Filtering;
- Consolidation;
- Storage;
- Analytics

General

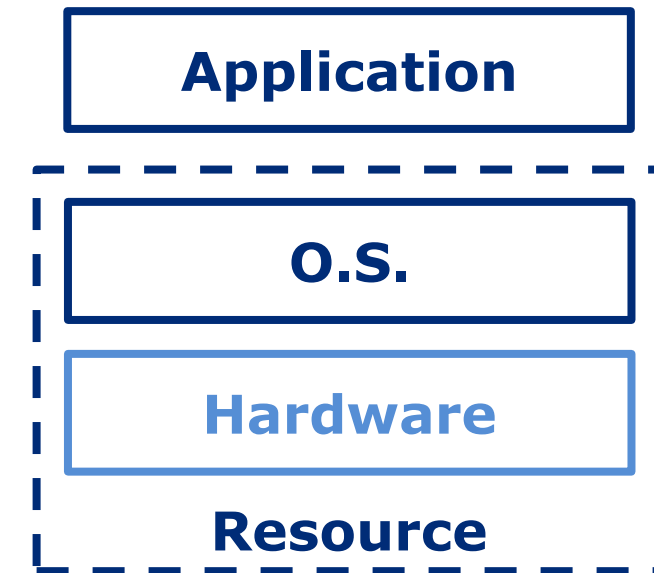
- Device and asset control and management (act as agent)
- Containerisation;
- Application logic (Microservice Architecture);
- Gateway management.

IoT Gateway Characteristics

- Middleware accessibility;
 - GPIO (Signal interface);
 - Point-to-Point (Data interface);
 - Fieldbus;
 - Network.
- Middleware protocol conversion;
 - Synchronous, Asynchronous.
- Direct connectivity to IoT platform.
- Bi-directional connectivity.
- More than one interface.
- IoT Gateway software is local process.

IoT Gateways General structure

- Two kinds of components:
 - Commercial Off-the-Shelf (COTS)
 - Custom-made
- Software as IoT Gateways;
 - COTS:
 - KepServerEX (IoT Gateway);
 - Node-RED.
 - Custom-made with SDK.
- Hardware for IoT Gateways;



IoT Gateways Expandable hardware example

Special-purpose Hardware



- Different operating systems available: Windows, Linux...
- Integrated switch;
- GPIO;
- Different communication possibilities (RS232, RS485, Ethernet, CAN/MODBUS/TCP, Wifi).
- Robust housing.

Software

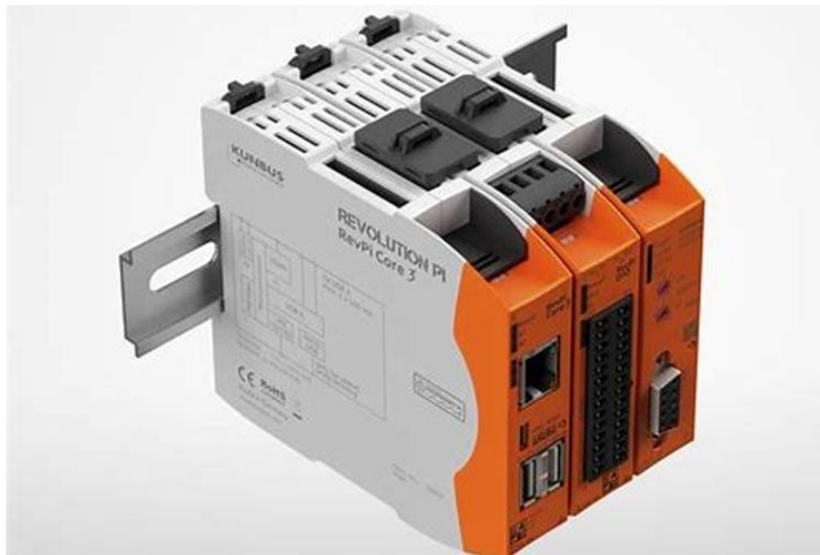


- Kepserver;
- IoT Gateway device;
- REST Web service.
- MQTT Client;

IoT Gateway Modulaire hardware example

Hardware

- RevPi core 3;
- Fieldbus interface;
- GPIO.



Software

- O.S. : Linux;
- Middleware Integration:
 - Node-RED;
 - OR Custom (SDK).

Industrial IoT Gateways Characteristics & Examples

- **Installation:**
 - DIN-rail mounting;
 - Industrial Housing;
 - 24VDC power supply;
 - IP67
- **Interfaces:**
 - Field buses:
 - Ethernet (PROFINET, MODBUS/TCP, ...);
 - Serial-bus (PROFIBUS, CAN, DEVICENET, ...)
- **Environment conditions:**
 - Extended temperature range (-40°C..70 °C)
 - Dust, moisture and vibration possible
 - Risk of mechanical damage caused by chemicals and other influences.
 - High EMC requirements
 - Certificates
 - High MTBF Values

Harting MICA



Simatic IOT2000



Kunbus RevPi



Hilscher NetPi



Industrial IoT Gateways Commercial Off-the-Shelf (COTS)

Nexcom CPS 200



Hilscher netIOT Edge



References

- Bassett, L. (2015). *Introduction to JavaScript Object Notation: A To-the-Point Guide to JSON*. O'Reilly Media.
- Gruner, O. (2017). IoT gateways: Industrial automation's path to Industrie 4.0. Retrieved 04/06/, 2017, from <http://www.controleng.com/single-article/iot-gateways-industrial-.ations-path-to-industrie-40/0ecde6c9b5cb352dcf87aadd03571c66.html>.
- Morrison, J. P. (2010). *Flow-Based Programming, 2nd Edition: A New Approach to Application Development*. CreateSpace.
- Tim, J. M. (2016). A Comparison of IoT Gateway Protocols: MQTT and Modbus. Retrieved 06/06/2017, 2017.