SIMATIC IOT2040

The intelligent Gateway for Industrial IoT solutions

siemens.com/iot2000

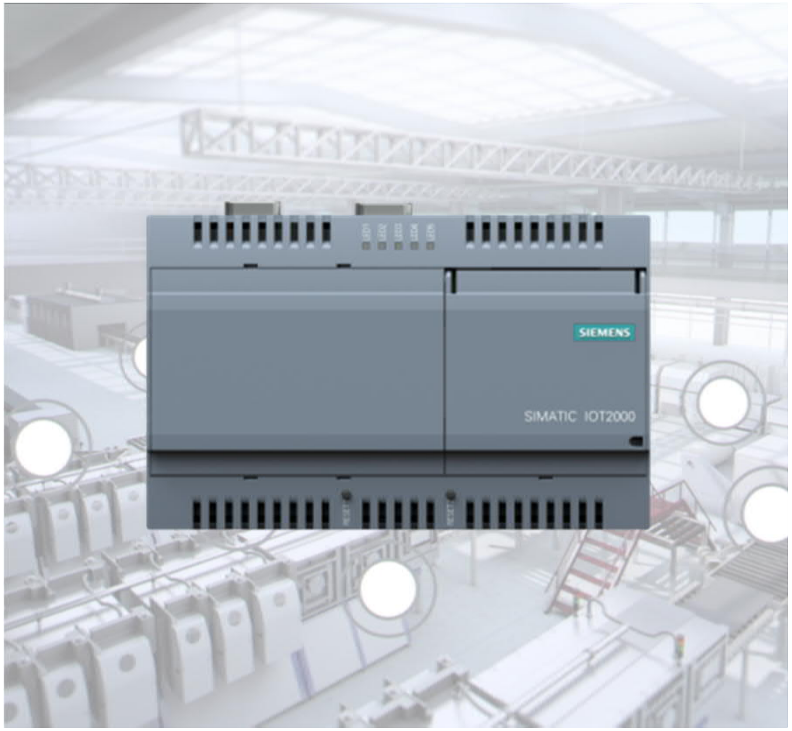
SIMATIC IOT2040 motivation for development

SIEMENS
Ingenuity for life

Increasing data volumes
Capturing and monitoring data from the automation level

Growing performance
Intelligence in the field required for pre-processing and data-handling

Usage of open standards
High-level languages and standard interfaces required



Connecting Automation and IT
Usage of various physics and protocols

Cloud based solutions
- Cloud based analysis requires data flow from and to the field
- Connecting brown-field applications to the cloud via retrofitting

Growing IT influence
Remote monitoring and analysis functionality required

Increasing interconnection and data communication between automation and IT require programmable gateway platforms

Portfolio overview –
SIMATIC IOT2040 is an intelligent data gateway

SIEMENS
Ingenuity for life

Maker Boards

Free programmable boards/single board PCs without housing and certifications with focus on maker market.

Teach. Learn. Make.

SIMATIC IOT2040

Additional features compared to standard maker boards

- Industrial robustness
- 24/7 operation
- Real time clock
- Standard interfaces
- Housing and DIN rail mount

SIMATIC IOT2040:
Intelligent gateway for industrial IoT

Enhancement capabilities:
Expandable by ARDUINO and mPCIe

SIMATIC IPC

Additional features compared to SIMATIC IOT2040

- Windows support
- Performance and mass storage
- Industrial server functionality
- HMI applications
- SIMATIC Software controller
- TIA/PC diagnosis
- Expandability

SIMATIC IOT2040 –
Industrial ruggedness. Openness. Connectivity.

SIEMENS
Ingenuity for life

SIMATIC quality
Designed for 24/7 operation
in industrial environment

Expandability and connectivity
With mPCIe, industrialized IO module and various standard interfaces and available protocol drivers

Performance and Deterministic
Intel Quark® CPU and 1 GB RAM as well as x86-deterministic and battery buffered real time clock

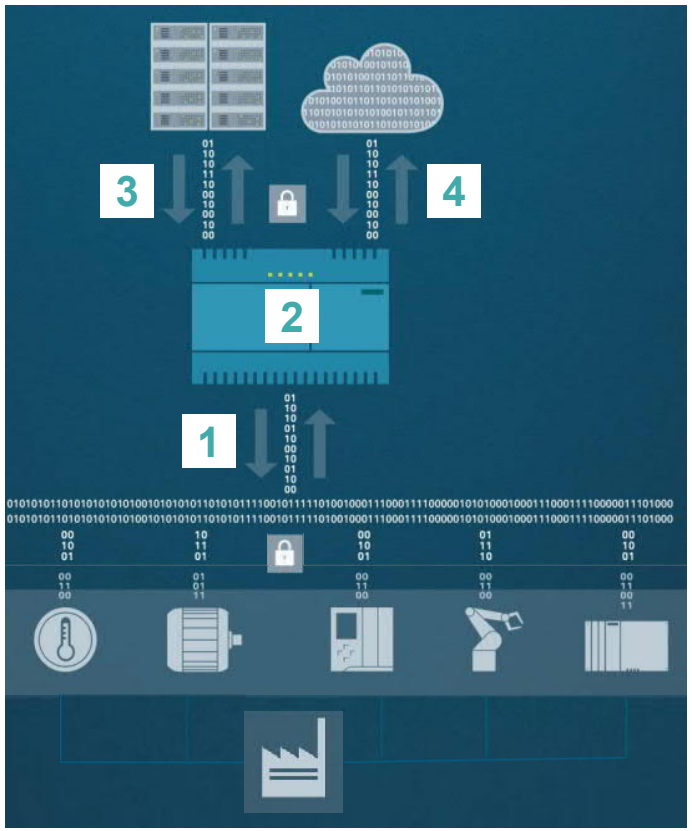
Openness
Free programmable in high-level languages (e.g. Java, C++) via various IDEs (e.g. Eclipse) and compilers for Yocto Linux

Automat!on.C!nnec!ed
Easy connection to automation level with PROFINET[1]) and openness to cloud based solutions

1 Planned

Application example SIMATIC IOT2040 – The intelligent gateway to connect the field level to the IT level/cloud

SIEMENS
Ingenuity for life



1 **Collecting and concentrating** relevant production data of several sources

Flexible connection to sensors/actors via serial communication, Ethernet or Arduino shields. Communicating with PLCs, drives and motors with e.g. PROFINET[1] or OPC OA[2]

2 **Protocol conversion/customer programmed control**

Data aggregation, conversion of different communication protocols and pre-processing programmed in high-level language e.g. Java, C++

3 **Secure transfer** to connected company **IT systems or cloud applications**

Converted data can be transmitted to IT systems/ cloud solutions using e.g. OPC UA, MQTT or AMQP[2]

4 **Production monitoring, analysis and optimization**

Cloud based analytics to detect optimization potential

1 Planned; **2** Application examples will be provided at IOT2000 forum

Application example SIMATIC IOT2040 – The intelligent gateway to connect the field level to the IT level/cloud

SIEMENS
Ingenuity for life

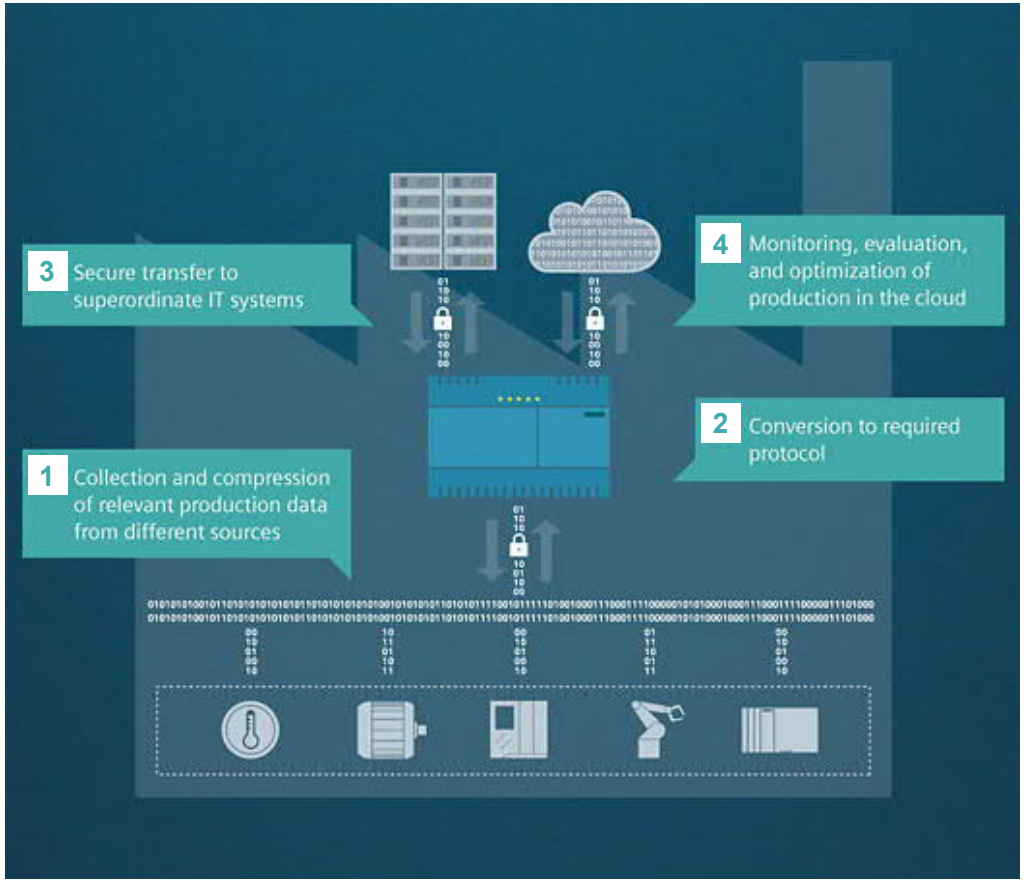
Data acquisition and processing 1

Data extraction for legacy- and greenfield systems via

- Siemens S7-Connection w. Node-Red and C++ Library Snap7
- OPC UA Client w. Node-Red
- Integrated I/O shield for easy retrofitting with Node-Red and C++

Data compressing, processing, visualization and storage on IOT2000 1

- Datapoint Long-Time Storage with SQL Database in C++
- Connection to external Database via Node-Red and C++ to store collected data
- Visualize process- and system data with Apache Webserver and Webserver Application



Secure data transfer to IT- and cloud systems 2 3

Protocol conversion and mapping of data to IT-Infrastructures and clouds

- OPC UA Server using XML Modelling for standardization
- Data Acquisition and Transfer to Microsoft Azure Cloud
- Predictive Maintenance using IBM Bluemix Cloud
- Transferring data to 3rd party clouds via open standards e.g. MQTT

Success Stories

- Industrie 4.0 gateway including protocol conversion, webserver visualization, cloud connection and email notification
- Energy Metering with Sentron PAC2200
- Controlling a 7 segment display for Shift-KPI visualization in factory floor
- Printer server on IOT2000

IOT2000 Application Example Overview – In IOT2000 Online Forum!

SIEMENS
Ingenuity for life

Protocol Conversion

- OPC UA Client with node-red
- S7 communication with node-red
- S7 communication with Snap7 C++ Library
- OPC UA server model via Nodeset XML
- Access input pins, user button and multi-colour user LED from node-red
- Access I/O Shield with Node-Red on IOT2000

Database Applications

- SQL server creation and connection on IOT2000
- How to use SQlite3 in C++ in Eclipse
- How to setup and administrate a database

Cloud Connection

- Collect data via OPC UA and transfer to Microsoft Azure
- Connection to IBM Bluemix IoT Platform
- Predictive maintenance example with IBM Bluemix
- Connect with Node-RED to Cloud/IT via MQTT

Other Applications

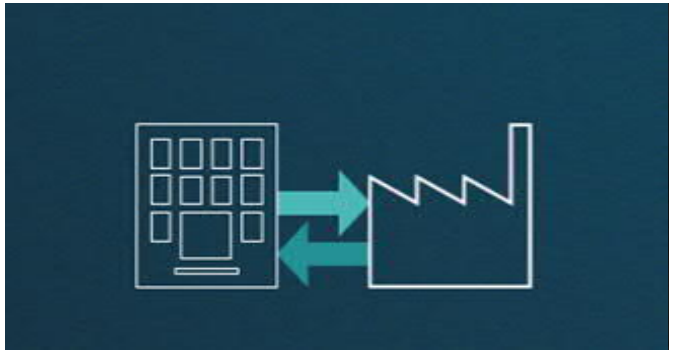
- How to create shared libraries (.so files)
- Example to control remote sockets with IOT2000
- Using the SIMATIC IOT2000 I/O Module in several languages
- IOT2040 in private Building Automation - FHEM

Webserver Applications

- Ready to use Webinterface for IOT2000
  - Watch the state of digital and analog inputs and userbutton, set ditigal outputs and userled
  - Get information about the RAM, CPU and disk usage
- Installing Apache web server with Perl support from sources

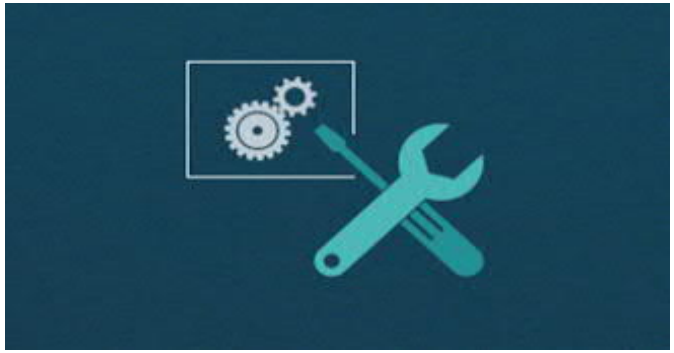
Target applications – Focus on brown-field applications IOT2040 for production data processing, conversion & transfer

SIEMENS
Ingenuity for life



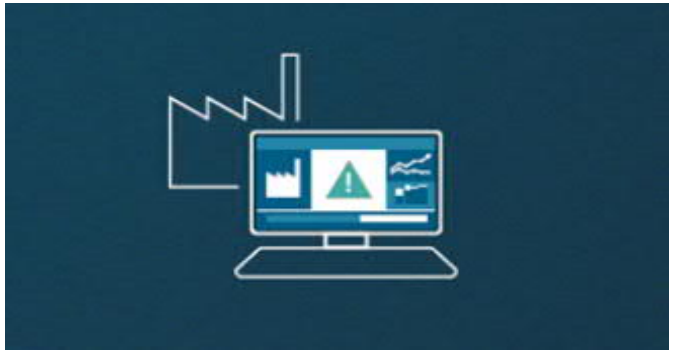
Connecting IT/cloud and automation

- Secure communication between ERP/IT systems or cloud applications and production
- Production optimization with vertical data integration from shop floor to cloud



Predictive maintenance

- Capturing and analyzing production data like e.g. speed or operation hours in order to identify the best maintenance interval
- Optimize machine downtimes



Optimized shop floor management

- Data transfer in case of undercut of minimum stock levels of consumables
- Automated alarming in shop floor management system in order to avoid production downtimes

IOT2000 as open platform to connect legacy systems, additional sensors and IT level

SIMATIC IOT2000 forum – Managed forum with getting started, application support and FAQs

SIEMENS
Ingenuity for life

Getting Started
Getting started and setting up to start with IOT2000 application development

- Hardware setup
- System console and driver for debugging
- Development environment
- (Arduino IDE or Yocto Linux Eclipse IDE)

Base image as download
- µSD Card base image for download
- Usage of all onboard interfaces possible

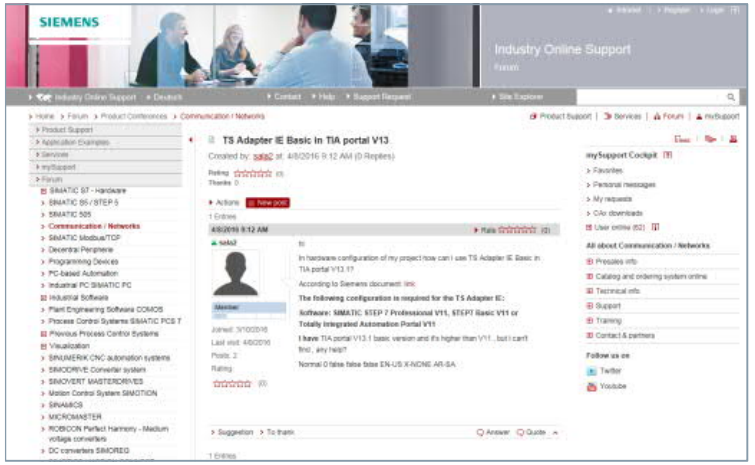
Initial content provided by Siemens

Application examples
- Cloud connect use case
- Sensor connection
- ...

Q&A
FAQs (e.g. sampling rate analog inputs using Arduino shield, max. current feed GPIOs using arduino shield)

Further content provided by IOT2000 community and Siemens

SIMATIC IOT2000 Online Forum

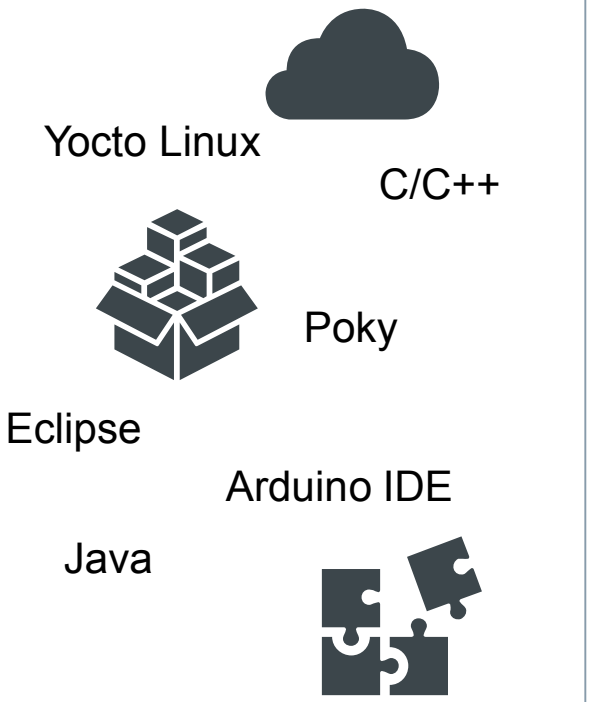


www.siemens.de/iot2000-forum

Openness to realize modern solutions – Efficient programming

SIEMENS
Ingenuity for life

Openness



Feature/function

- Programmable in various High-level languages like C/C++ or Java
- Arduino IDE or Eclipse for
- Open-source application examples and libraries

Benefits

- Efficient programming with high-level languages
- Using community know how and open-source code for fast success

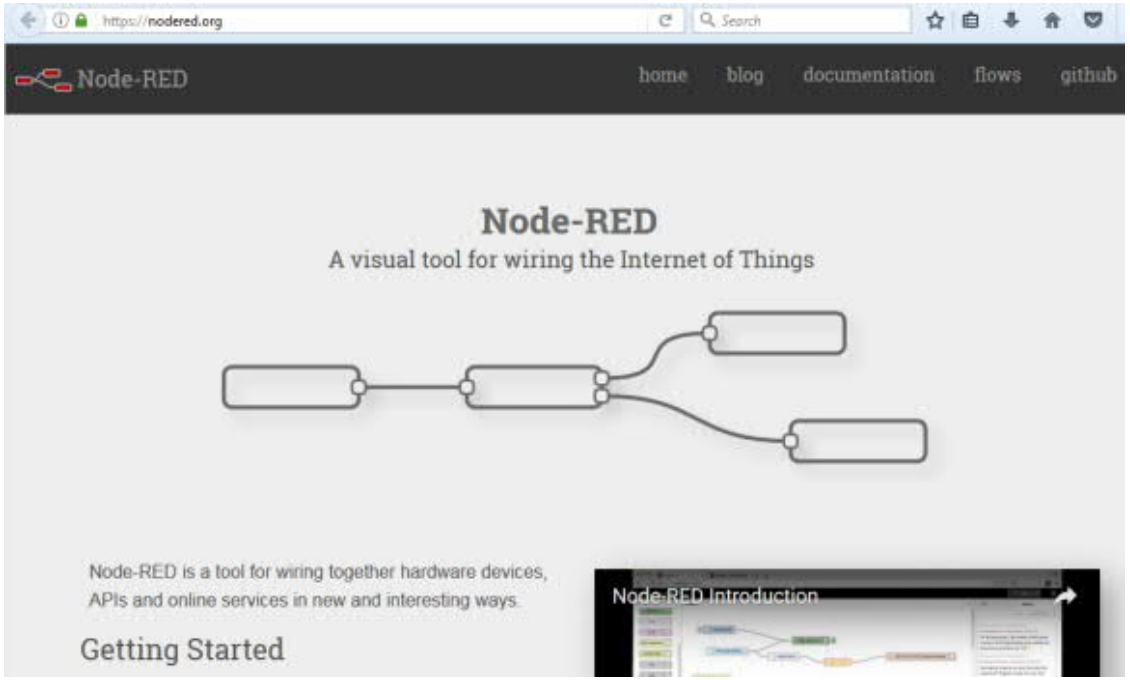
SIMATIC IOT2000 – Benefit from open-source – Node-RED – Introduction

SIEMENS
Ingenuity for life

> **Node-RED is a tool for wiring together hardware devices, APIs and online services in new and interesting ways."[1]**

Executable on mini computers (IOT2000, Raspberry Pi) or cloud based (IBM Bluemix, Amazon Web Services, Microsoft Azure)

Web browser based editing Based on node.js



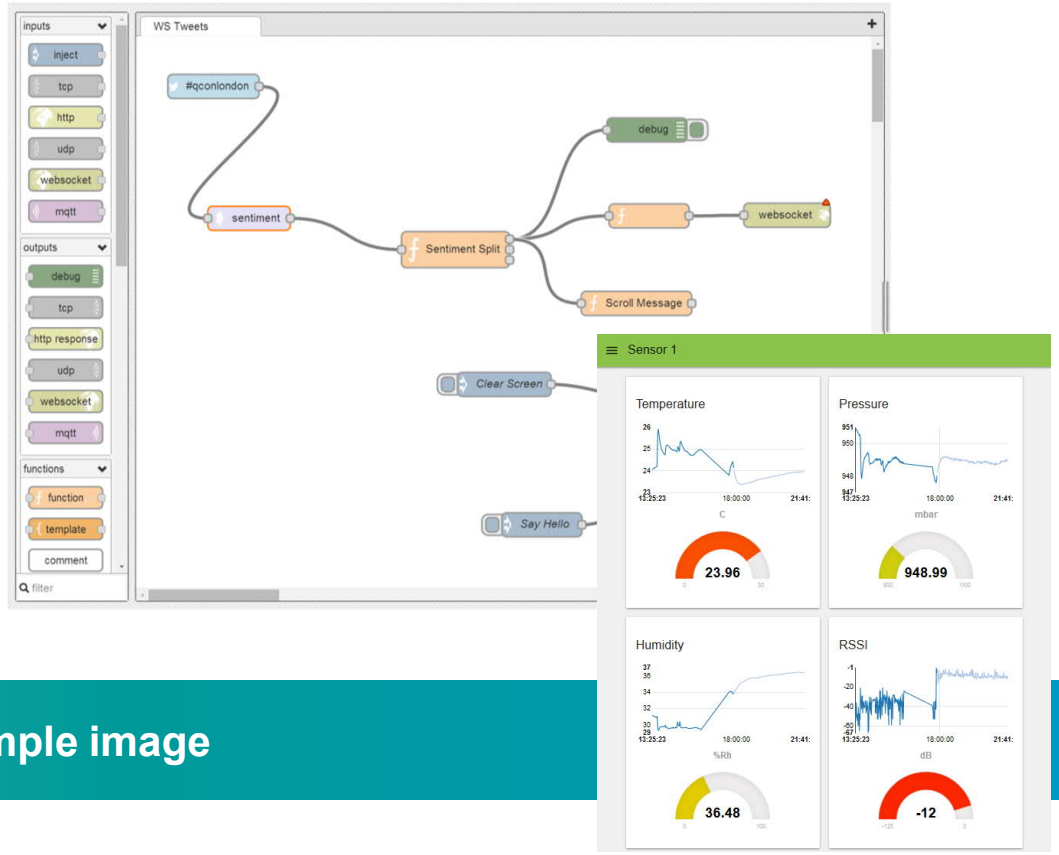
1 Source: https://node-red.org/

SIMATIC IOT2000 –
Node-RED – Introduction

SIEMENS
Ingenuity for life

Available nodes

- MQTT
- Twitter
- Modbus
- GPIO
- OPC UA
- S7
- IBM Watson IOT
- Microsoft Azure
- IOT2000
- …

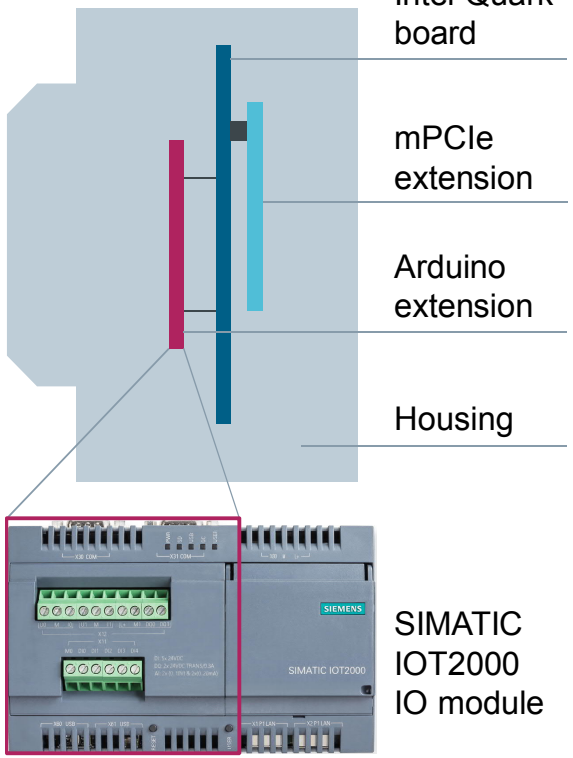


Node-RED is included in our IOT2000 example image

Expandability to realize cost-efficient solutions – Flexibility to connect various data sources

SIEMENS
Ingenuity for life

Connectivity



Feature/function

- Expandable with certified Siemens IO module or with Arduino shields for IO/sensor connection
- mPCIe slot suited for radio communication like WLAN or LTE
- 2 independent Ethernet ports
- 2 serial interfaces (RS232/422/485)

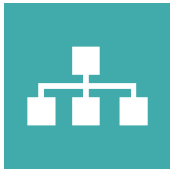
Benefits

- Benefitting from the variety of expansion possibilities of Arduino
- Realizing mobile communication concepts
- Various possibilities to connect to legacy systems, sensors and different communication networks

Deterministic and performance for industrial IoT gateway applications – Designed for industrial use

SIEMENS
Ingenuity for life

Performance and deterministic



Low power consumption and deterministic

Battery buffered real time clock

Industrial grade

Feature/function

- Intel Quark® X1020 CPU and 1 GB RAM
- Security features, e.g. secure boot
- Battery buffered real time clock
- Industrial design and rugged components

Benefits

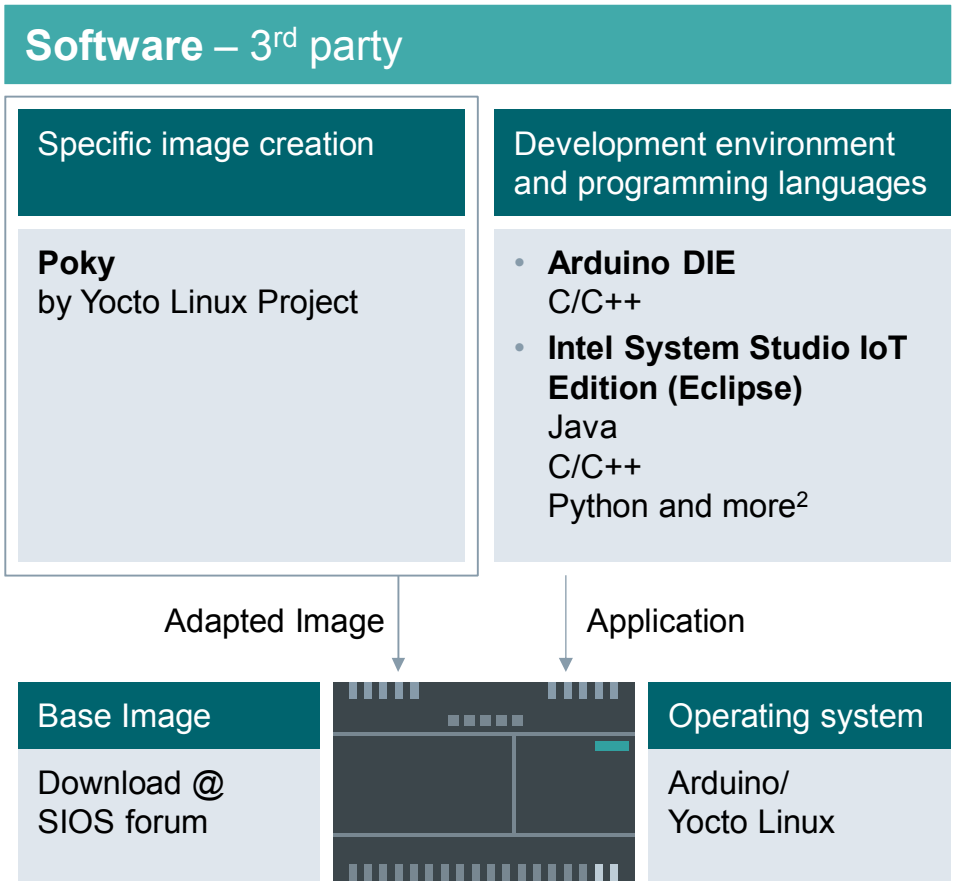
- Performance optimized for data aggregation, conversion and communication tasks
- Protecting the data and application
- Time stamp vital for data analytics
- Designed for 24/7 operation in industrial environment

SIMATIC IOT2040 – Product data overview

SIEMENS
Ingenuity for life

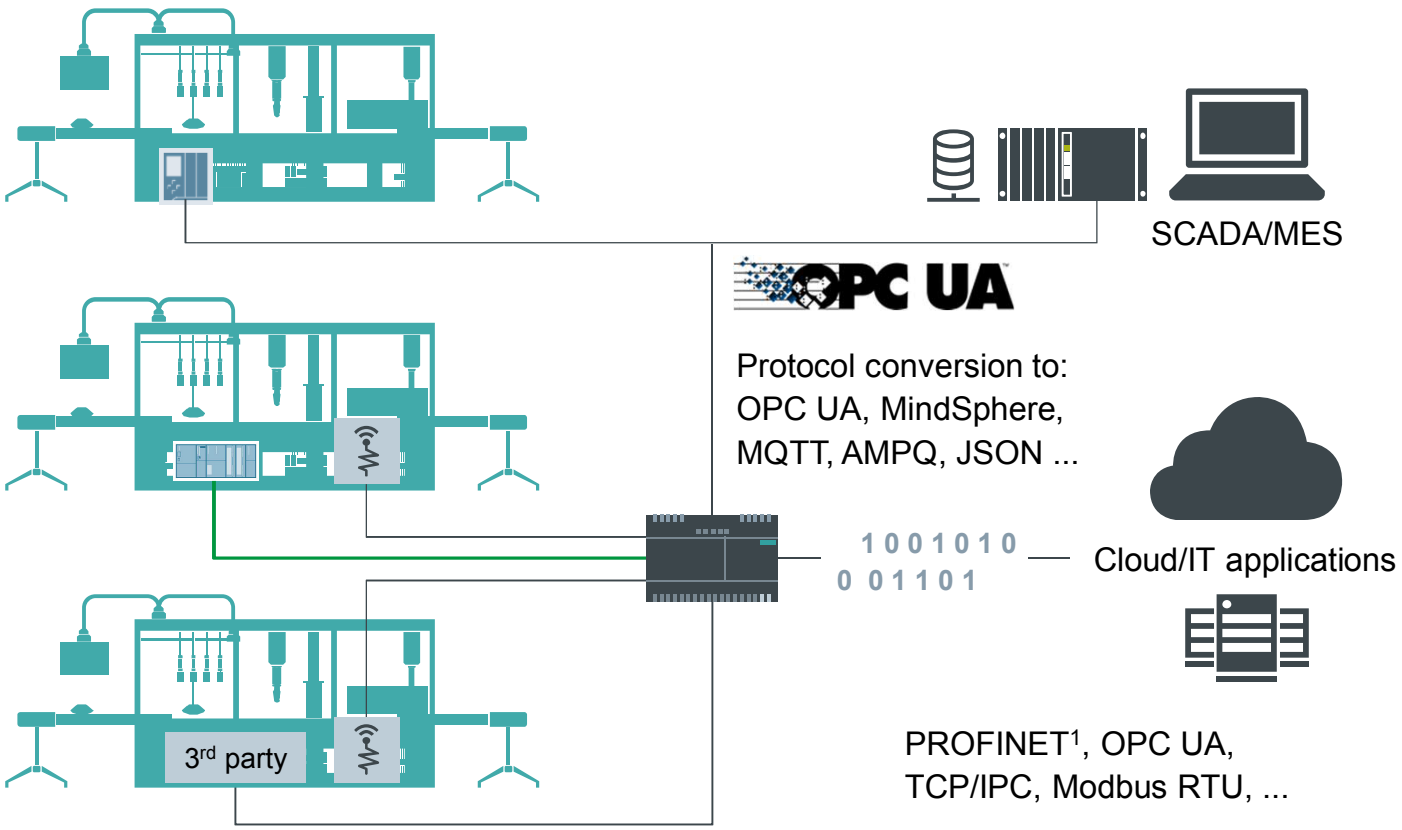
	SIMATIC IOT2040	
CPU technology	Intel Quark® x1020 (x86 400 MHz) + Security	
System memory	1 GB DDR3 RAM, 8 MB Flash, 256 KB SRAM	
Communication interfaces	2x 10/100 Ethernet RJ45	
Serial interfaces	2x RS232/485 switchable	
Media interfaces	1x USB Controller + 1x Device	
Graphic processor	–	
Extension	mPCIe + Arduino	
IO-Module	5x DI, 2x DO, 2x AI	6ES7647-0KA01-0AA2
IO-Module Sink Source	10x DI	6ES7647-0KA02-0AA2
Mass storage	Yes, with microSD card[1]	
Embedded features	5 LEDs (one user programmable), battery buffered real time clock, watchdog	
Power supply	9 … 36 V	
Operating temperature	0 – 50°C	
Certificates	Industry standards (CE, UL)	
Dimensions (w x h x d)	144 x 90 x 53 mm	
Order number	**6ES7647-0AA00-1YA2**	
	Power Supply for IOT2040	
LOGO! Power 24V/1.3A	**6EP3331-6SB00-0AY0**	

1 Not in scope of delivery; **2** Image adaption necessary



SIMATIC IOT2040 complements automation portfolio – Making legacy automation concepts “IoT ready”

SIEMENS
Ingenuity for life



- Inter-connecting various sources and communication networks
- Pre-processing/data acquisition with SIMATIC IOT2040 and data transfer to company network or direct to cloud applications
- No need to change existing automation solution

SIMATIC IOT2040 complements automation portfolio

SIMATIC IOT2040 as cost-efficient and open data gateway for retro-fitting existing concepts and make them “IoT ready”

1 Not released yet

Thank you for your attention

SIEMENS
Ingenuity for life

siemens.com/iot2000