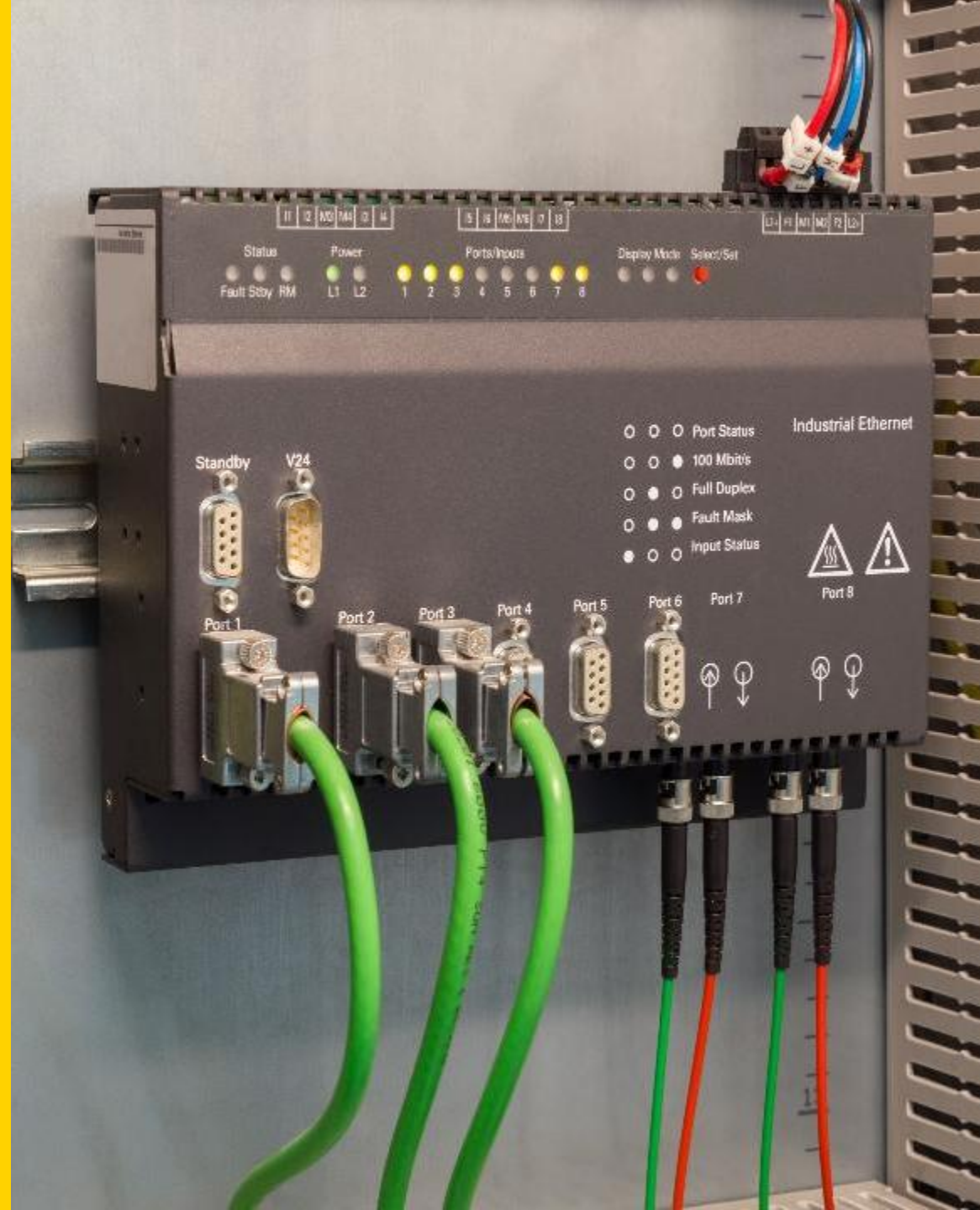




Industrial gateway applications

Agenda

1 Introduction

2 An STM32MP2-based solution

3 A look into our design

4 Key ICs on X-STM32MP-IGTW1

5 A WSN application of industrial gateway

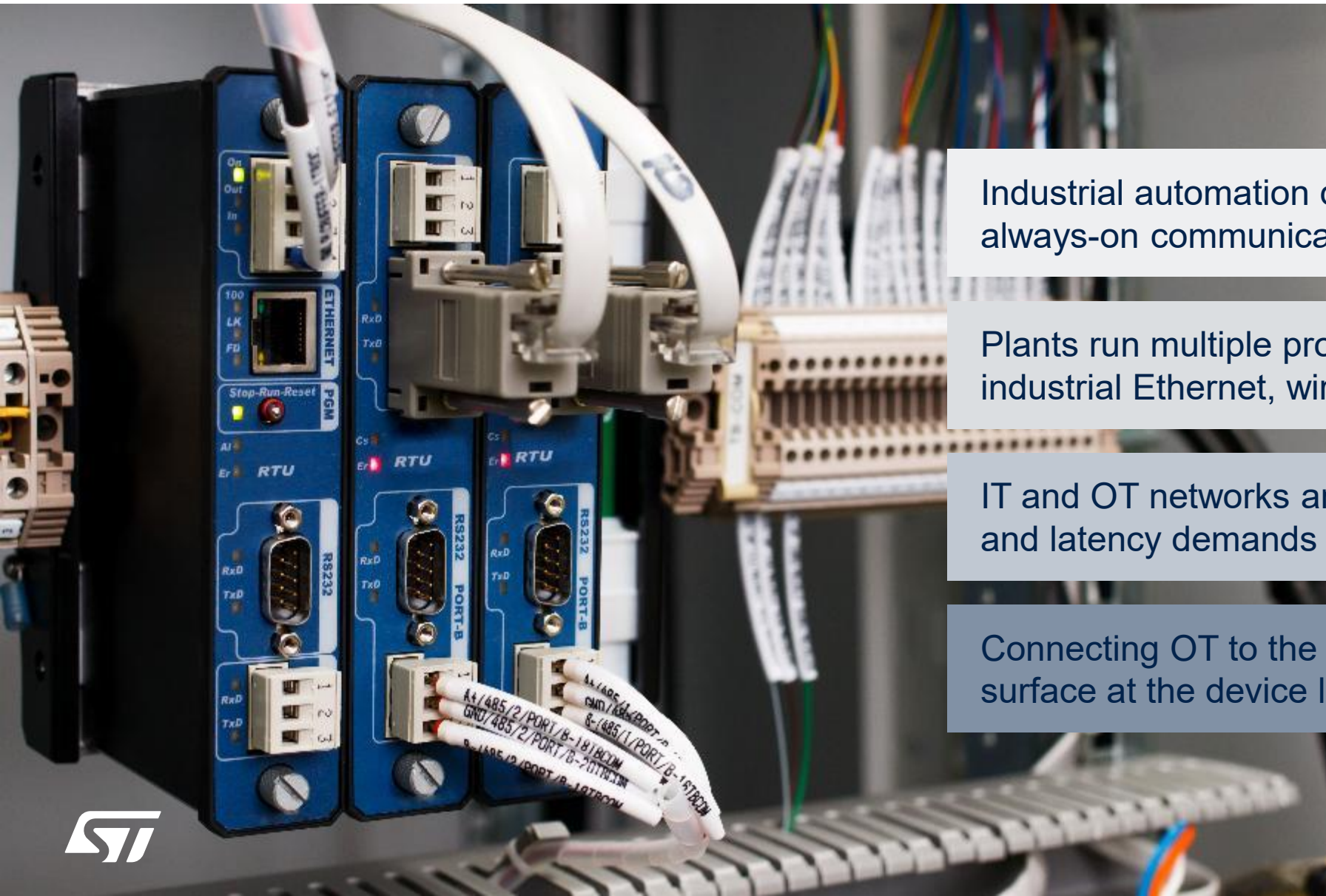
6 Takeaways



Introduction



Industrial communication context



Industrial automation depends on deterministic, always-on communication

Plants run multiple protocols in parallel: fieldbus, industrial Ethernet, wireless

IT and OT networks are converging, raising bandwidth and latency demands

Connecting OT to the internet expands the attack surface at the device level

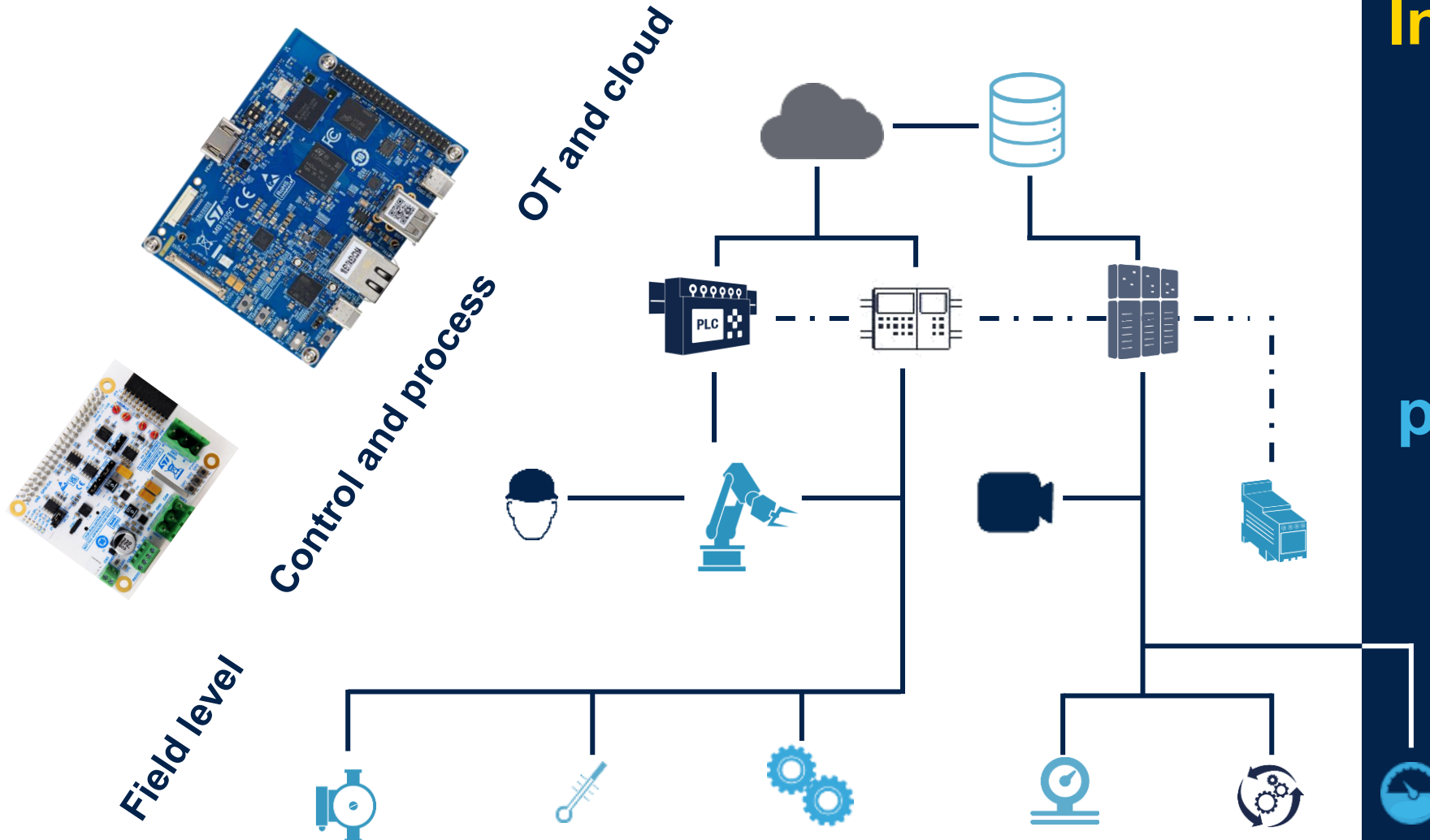
The context and how our solution plays a role

Industrial gateway solution

Device connectivity + protocol handling

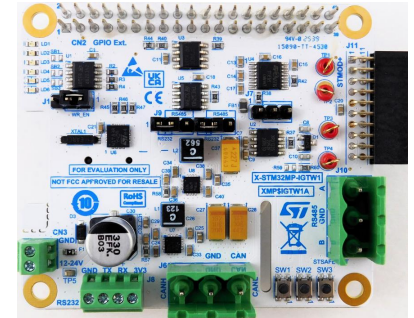
Data routing from different PLCs to Cloud

Security of data



ST ICs and solutions for industrial communication

Implement communication protocols over the factory floor with the STM32MP2 family and industrial communication transceivers



Field devices → Control → Supervisory → Enterprise → Cloud



A STM32MP2-based solution



STM32MP257F for industrial gateways



Industrial qualification combining both:

- 100% operation time for 10 years
- Junction temperature: - 40°C to 125°C

10-year longevity commitment renewed every year

Flexible resource allocation between cores

- Dual or single Arm Cortex®-A35 up to 1.5 GHz
- Arm Cortex®-M33 up to 400 MHz

Advanced security for Industry 4.0



STM32MP257 block diagram



Processing

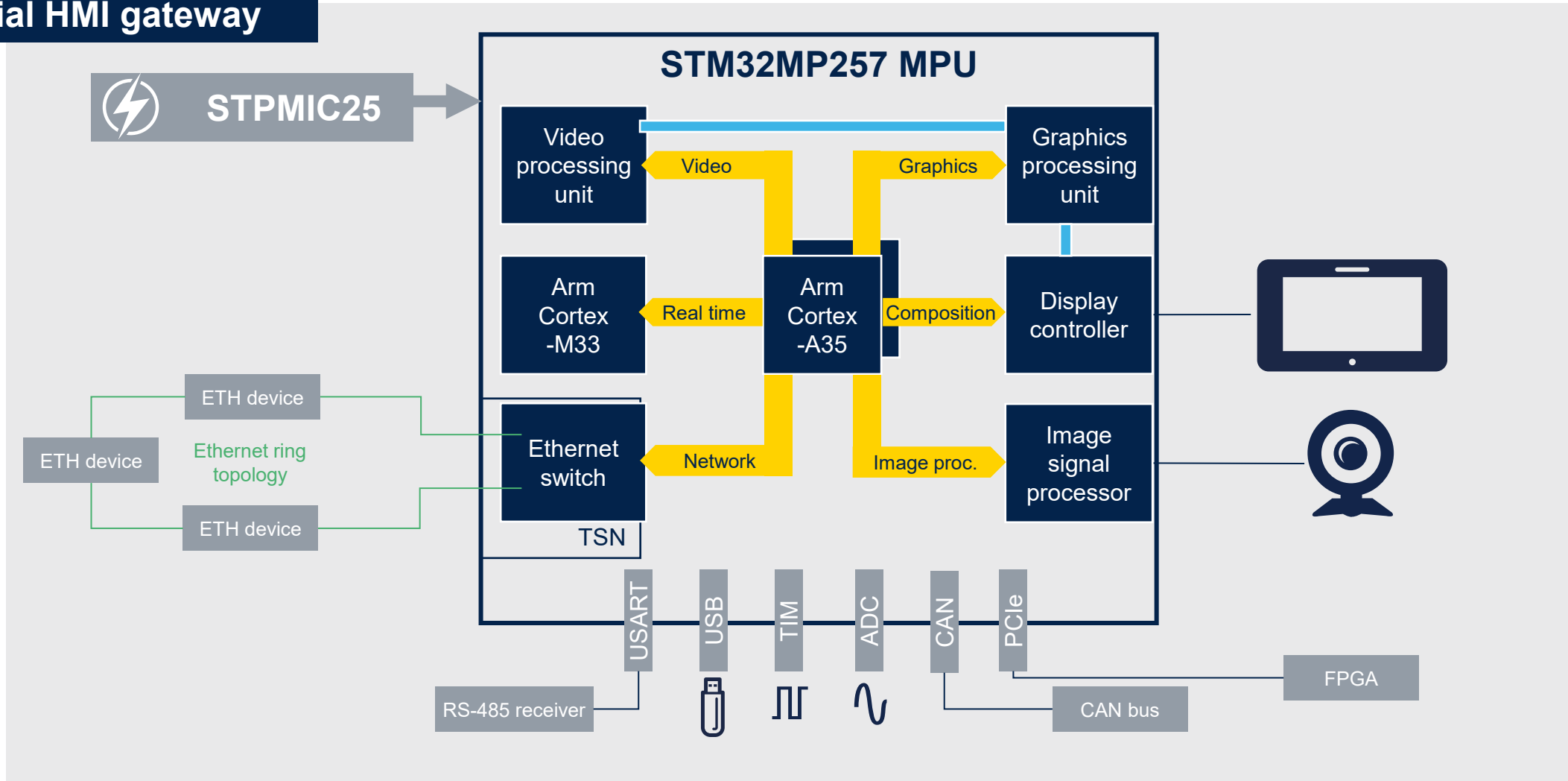
Enhanced security

Edge AI and multimedia

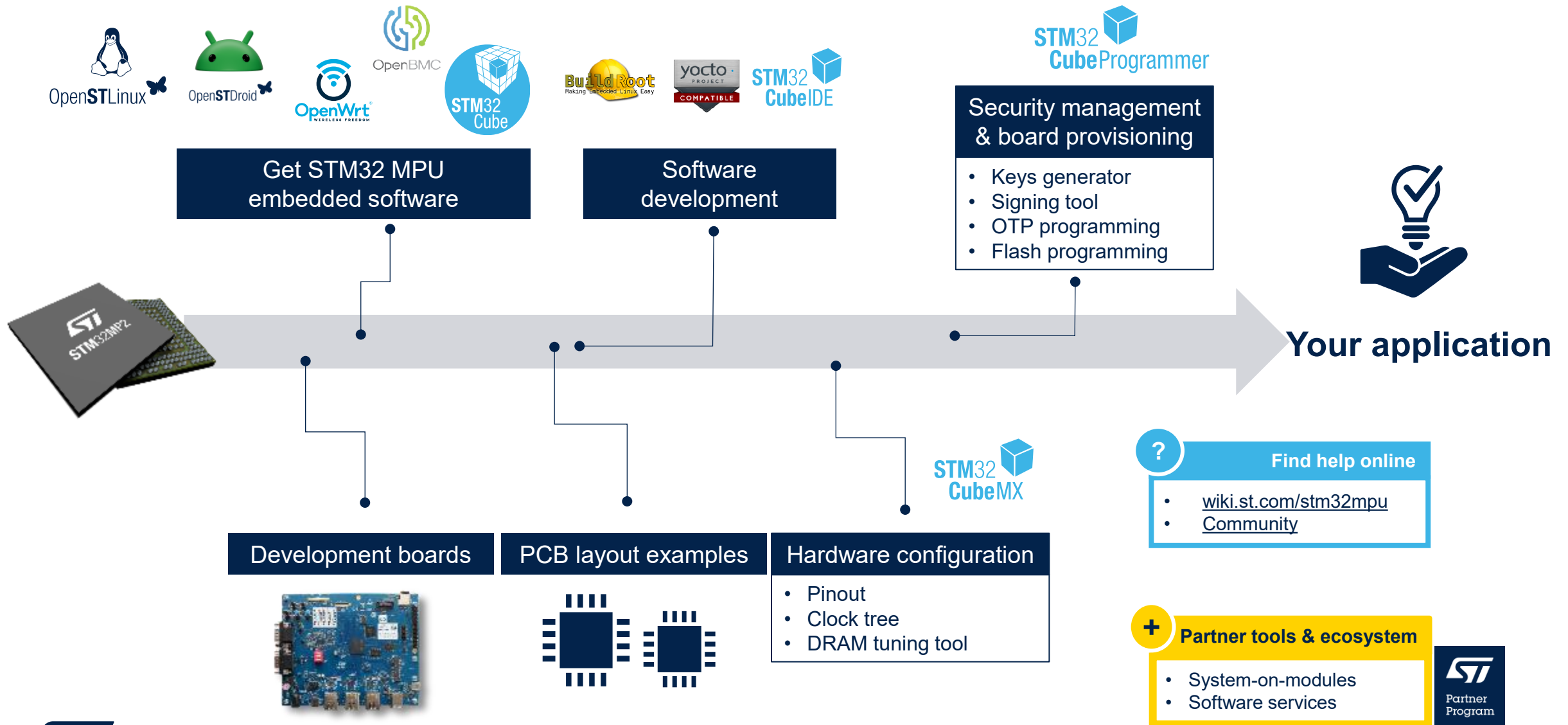
Connectivity

One MPU for real-time control, TSN networking, and HMI graphics

Industrial HMI gateway

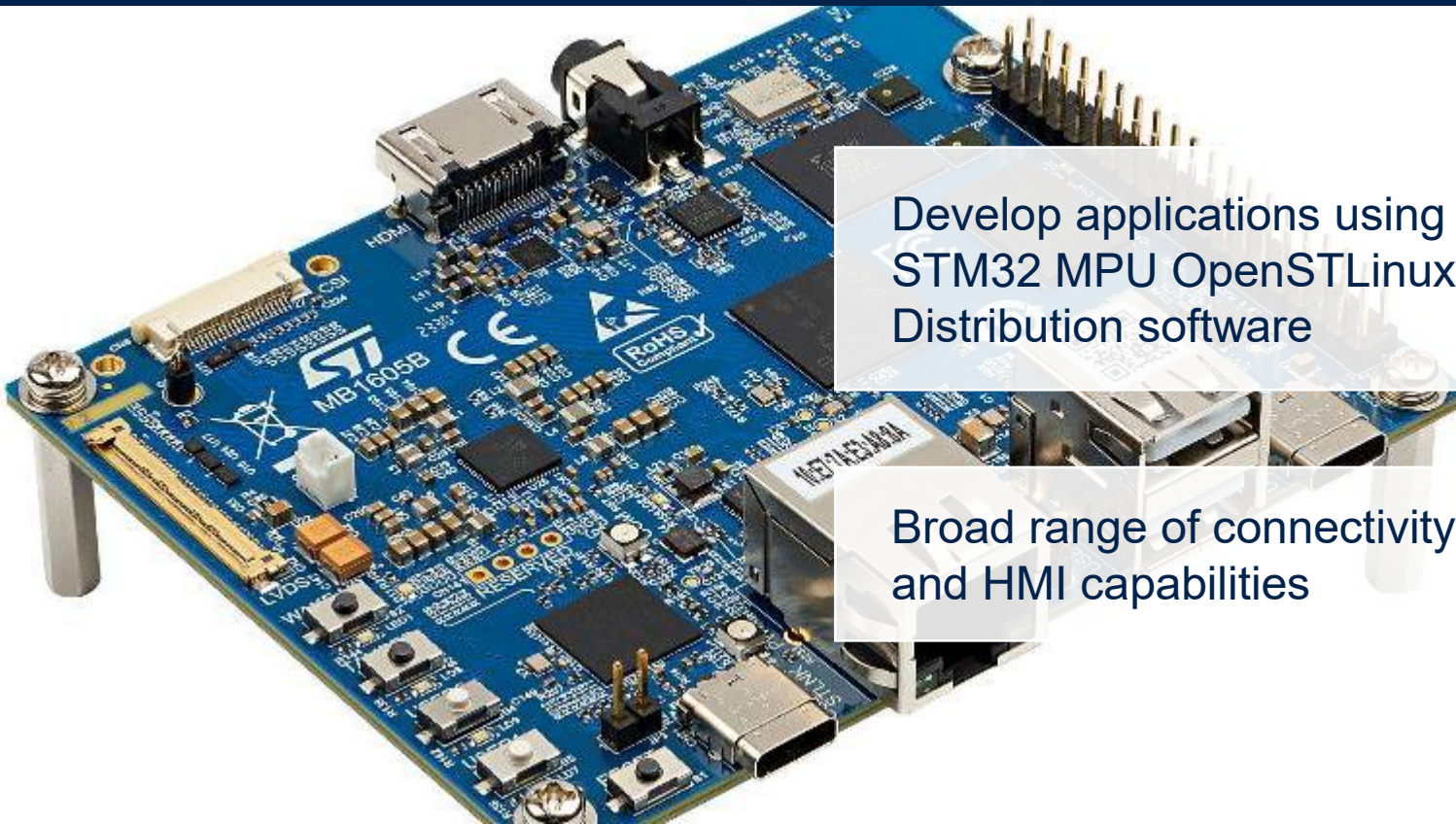


Accelerate your time to market



Discovery kit with STM32MP257F MPU

Our industrial gateway solution is based on this DK



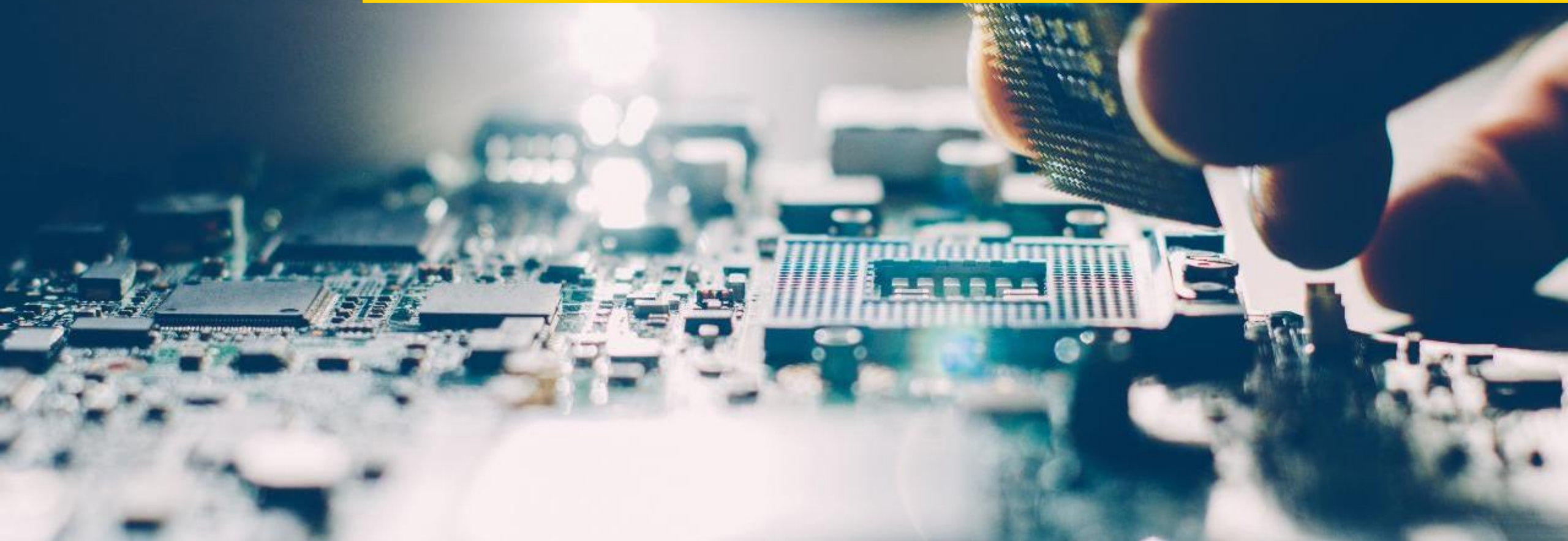
Develop applications using
STM32 MPU OpenSTLinux
Distribution software

Broad range of connectivity
and HMI capabilities

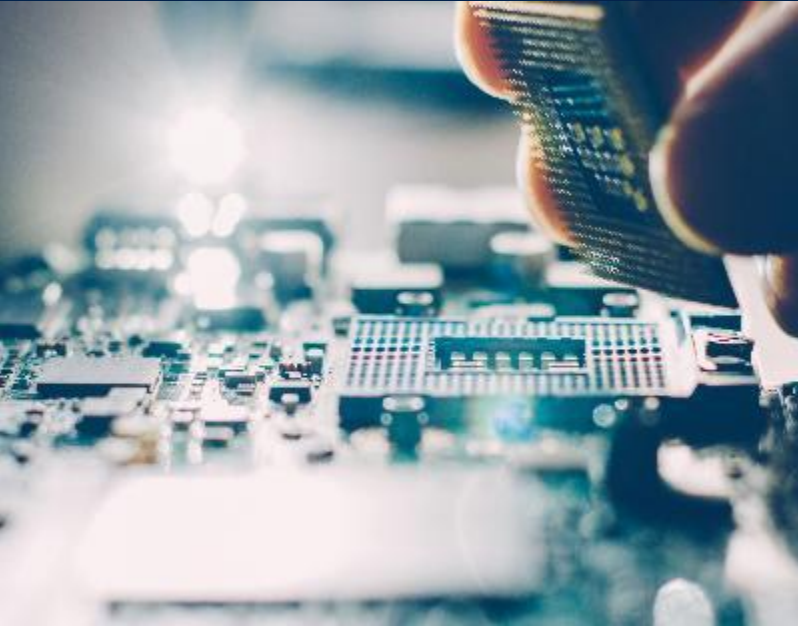
STM32MP257FAK3 MPU with dual-core Arm Cortex-A35 at 1.5 GHz and Cortex-M33 at 400 MHz in a VFBGA424 package:

- 32-Gbit LPDDR4 DRAM
- 1-Gbit/s Ethernet (RGMII)
- Two USB 2.0 high speed
- USB 3.0 SuperSpeed PD (DRP/DRD)
- Wi-Fi® 802.11b/g/n
- Bluetooth® LE v4.1

A look into our design



STM32MP2-based gateway



STM32MP257F-DK

The **STM32MP257 Discovery kit** exploits all features of our dual Arm® core microprocessor



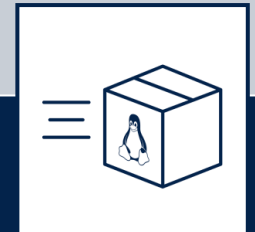
X-STM32MP-IGTW1

A new **expansion board** has been released to augment the protocol handling capabilities of STM32MP257



X-LINUX-IGTW1

Linux-based expansion software package designed for industrial application development on STM32MP257 and other microprocessors



Linux industrial gateway on STM32MP257

Routes protocols between heterogeneous nodes (PLC, DCS, field devices) in the most complex layer of the factory network

ModBus RTU

The most popular serial protocol for PLCs, deployed over the ST4E1240 RS-485 transceiver.

CAN bus

With CANopen profile for reliable operation in harsh environments.

Security + authentication

Device authentication and secure key storage via STSAFE-A110.

Cloud

LTE cloud connectivity via STEVAL-STMODLTE on the STMod+ connector.



X-LINUX-IGTW1



X-STM32MP-IGTW1



STM32MP257F-DK

TSN

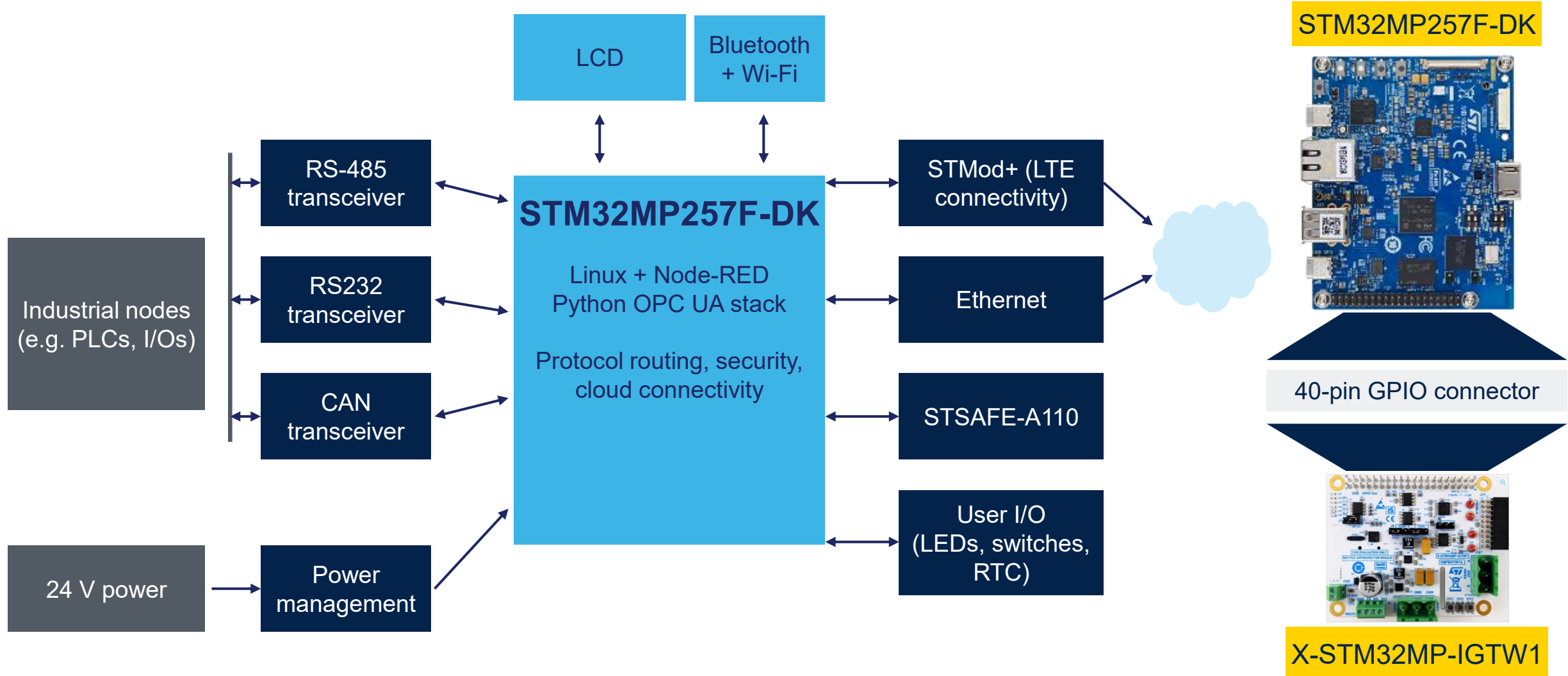
TSN support for time-critical traffic, delivered as a separate application in the package.

OPC-UA

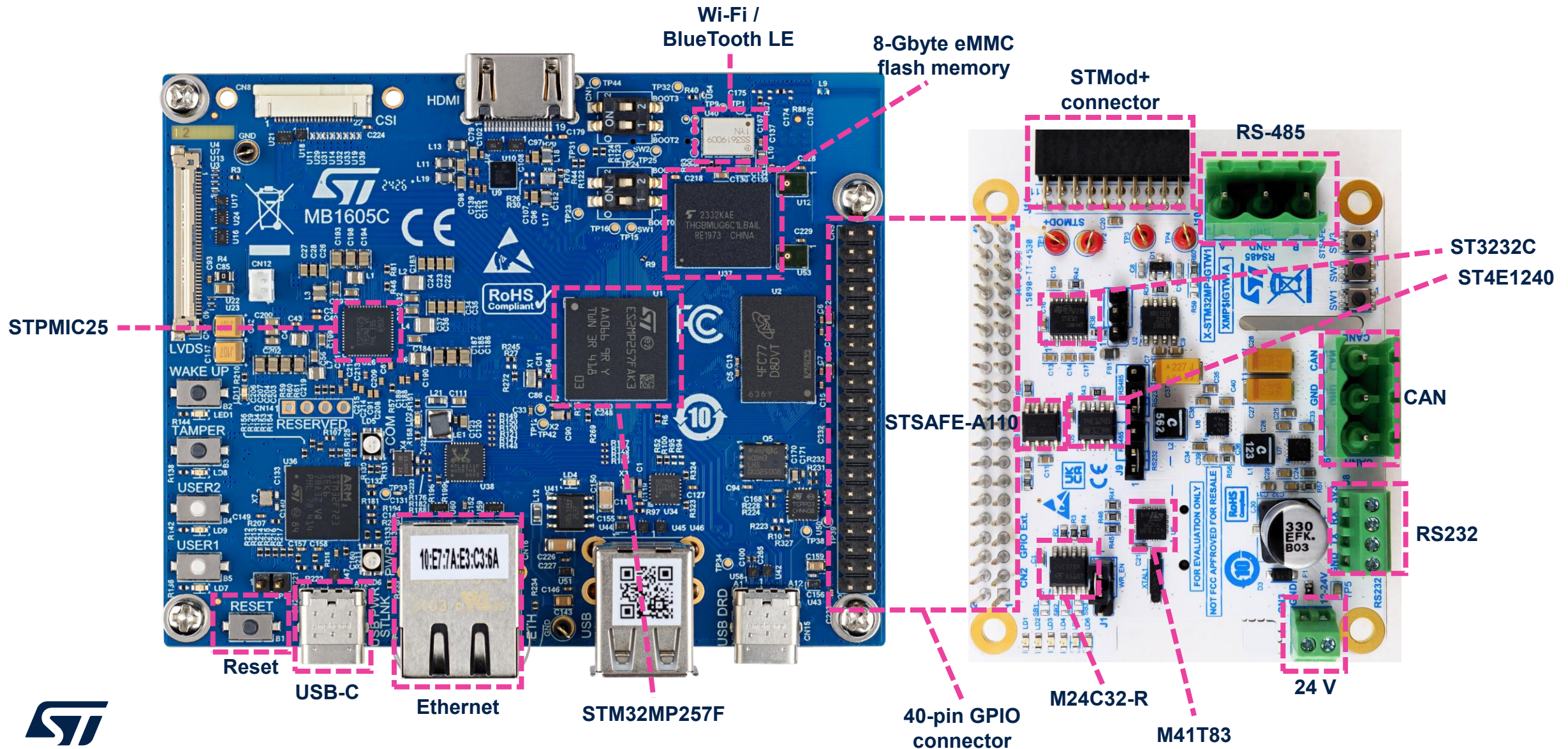
Python-based OPC UA stack for node and data management, OS and transport-independent.

Node-RED is integrated in the package — a browser-based visual flow editor for JavaScript functions, with 4000+ connectors covering Modbus, OPC UA, Siemens S7, and more.

From PLC to cloud on a single hardware stack

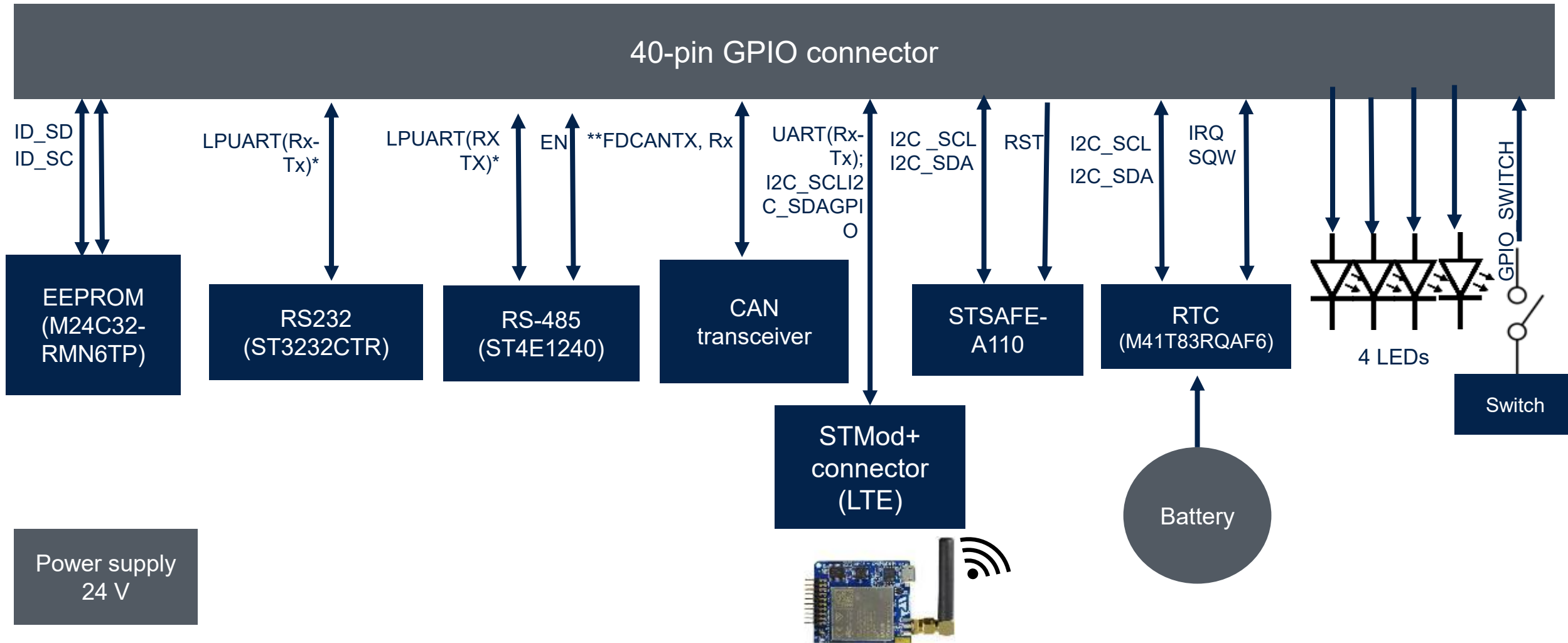


ST inside: the gateway BOM



X-STM32MP-IGTW1 expansion board

40-pin GPIO connector



X-LINUX-IGTW1

Companion expansion software package



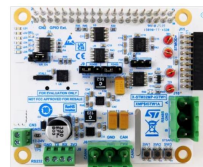
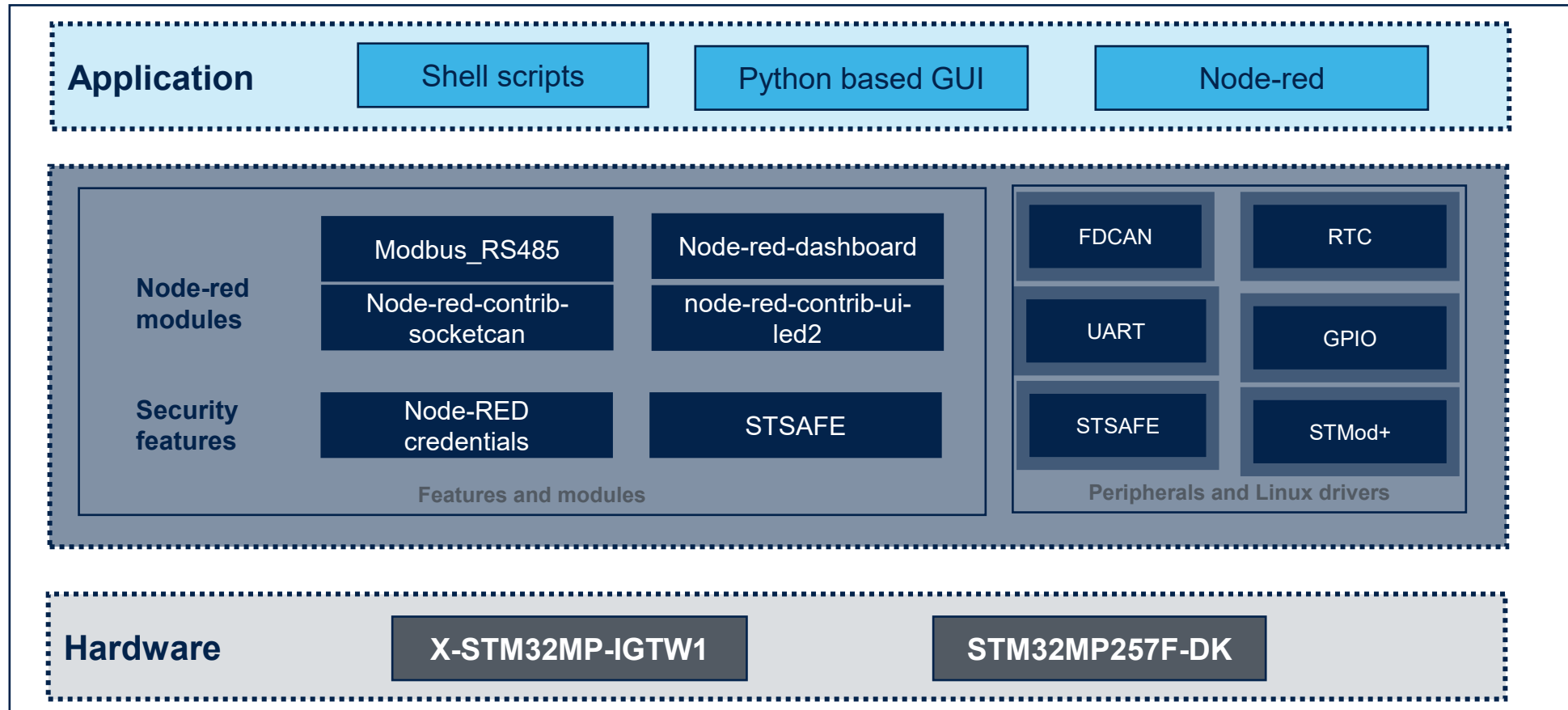
X-LINUX-IGTW1

Linux-based expansion software package designed for industrial application development on STM32MP and other microprocessor platforms.

Includes two sample applications

- Python based GUI application to test all peripherals individually
- Node-RED based application, which is a low-code, browser-based editor that allows users to drag and drop nodes to create flows. These user-friendly flows can be deployed with a single click. One sample flow is shared in each release

X-LINUX-IGTW1 drivers, APIs, and applications for the X-STM32MP-IGTW1 board

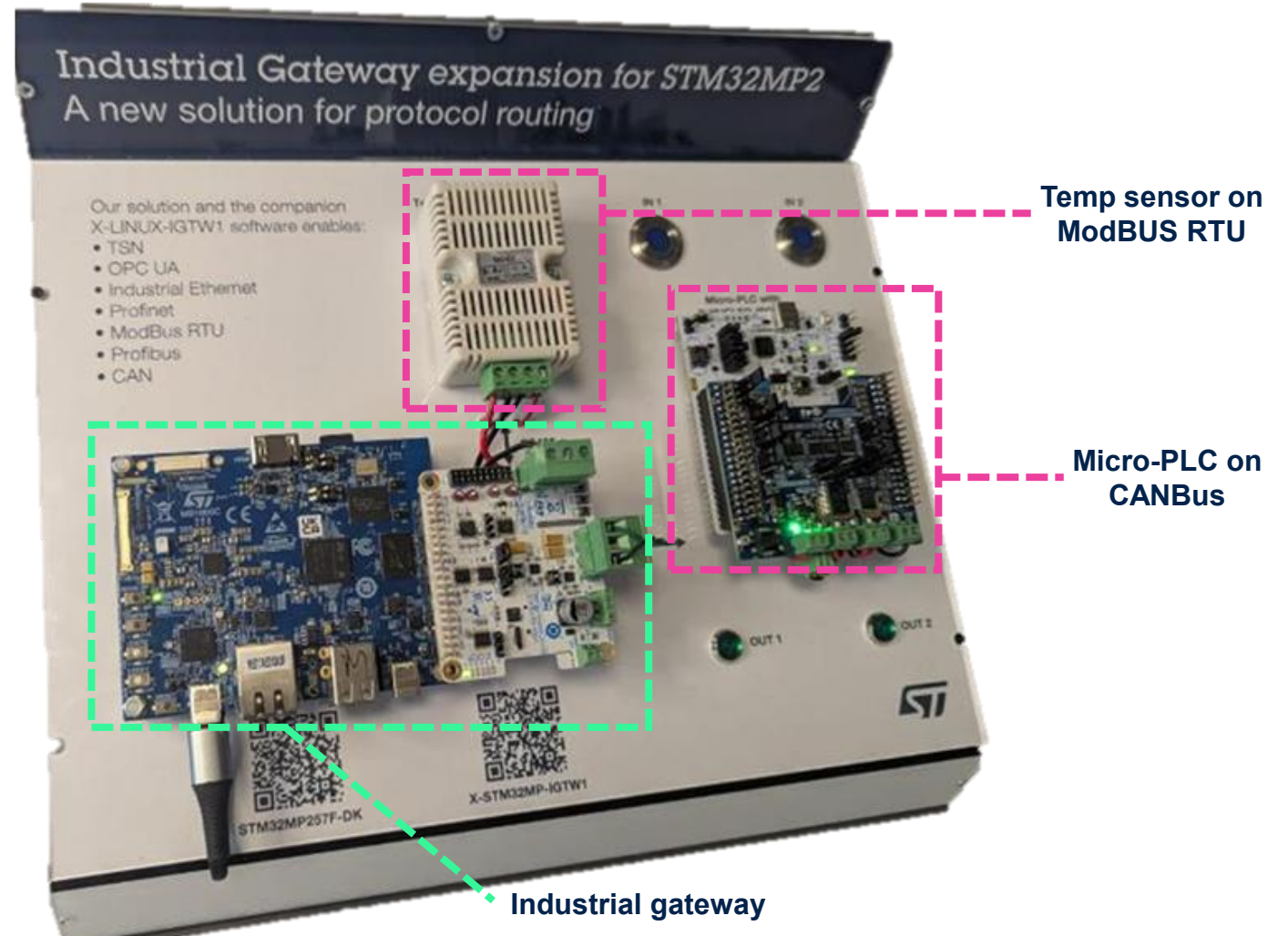


Showcased at SPS and Embedded World

▶ The gateway handles 2 peripherals, one over **ModBus RTU** and one over **CANBus**

▶ On the industrial gateway, the **STM32MP257** acts as a **Wi-Fi hotspot**

▶ Data exchanged is displayed on a webpage developed in **Node-RED**

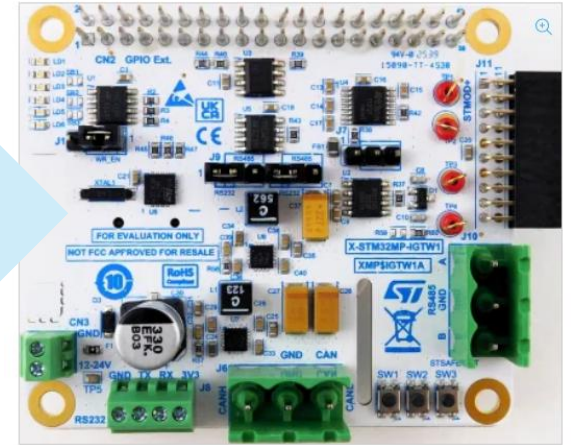


Key ICs on X-STM32MP-IGTW1



Key ICs in our industrial gateway solution

Find them out in the **X-STM32MP-IGTW1** expansion board



ST4E1240

High-speed RS-485 transceiver supporting data rates up to 20 Mbps, integrated ESD protection, and fail-safe mechanisms



ST3232C

Dual RS-232 transceiver supporting data rates up to 400 kbps, featuring integrated charge pump capacitors for low-power consumption



STSAFE-A110

Secure element for hardware-based authentication and crypto services, ensuring data integrity and confidentiality for IoT devices



M41T83

Serial I²C bus real-time clock (RTC) with battery switchover, providing accurate time keeping for embedded systems



M24C32-R

32-Kbit EEPROM with I²C interface, providing nonvolatile memory for data storage, ideal reliable data retention and easy integration



ST4E1240

Enabling robust and efficient industrial gateway

Robustness and protection

Many protections for the bus, excellent noise and interference immunity — critical for reliable gateway operation in industrial environments

High data rate and node support

Supports high throughput and large network topologies, ideal for scalable gateway solutions

Profibus compatibility

Data rate, large V_{OD} and number of nodes

Low power consumption

Reduces energy usage, supporting compact and always-on gateway designs

Solid, future-proof design

Built on optimized IP, ensuring long-term availability and compatibility with future ST RS-485 products.



STSAFE-A110

Security anchor for industrial gateway

Trusted, resilient, and standard-compliant security for industrial IoT gateways

**HW CC EAL5+
certified**

Strong device authentication	Ensures only authorized devices and users access the gateway, preventing unauthorized control or data theft
Secure connection establishment	Protects data in transit between the gateway, cloud, and field devices from eavesdropping and tampering
Secure data storage	Safeguards sensitive credentials, certificates, and cryptographic keys inside the gateway hardware
Firmware and software signature verification	Prevents malicious firmware updates and ensures only trusted code runs on the gateway.
Personalization and flexibility	Supports custom certificates and keys for unique deployments and secure onboarding



A WSN application of industrial gateway



X-LINUX-IGWWSN1 expansion software enabling edge gateway applications

Wirelessly monitoring of the factory floor with a low-cost implementation based on the STM32MP257F

Wireless sensor network (WSN)

2 or more sensor nodes (our STEVAL-PROTEUS1) deployed in the field

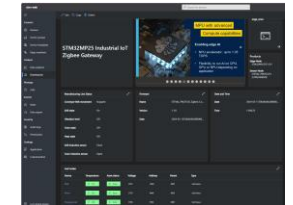
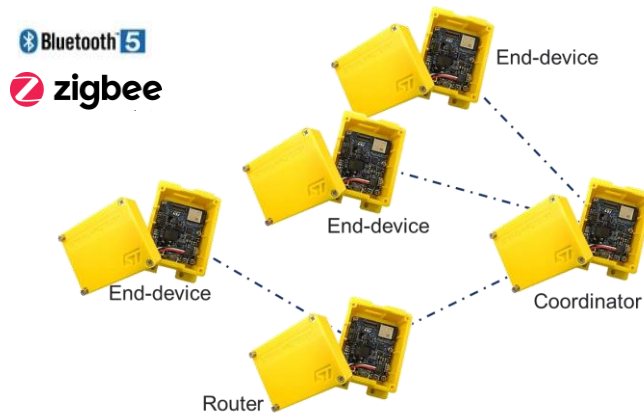
Industrial IoT edge gateway

The STM32MP257F-DK (or STM32MP257F-EV1) powered by:

- Docker/container technology
- OpenSTLinux
- Azure IoT Edge

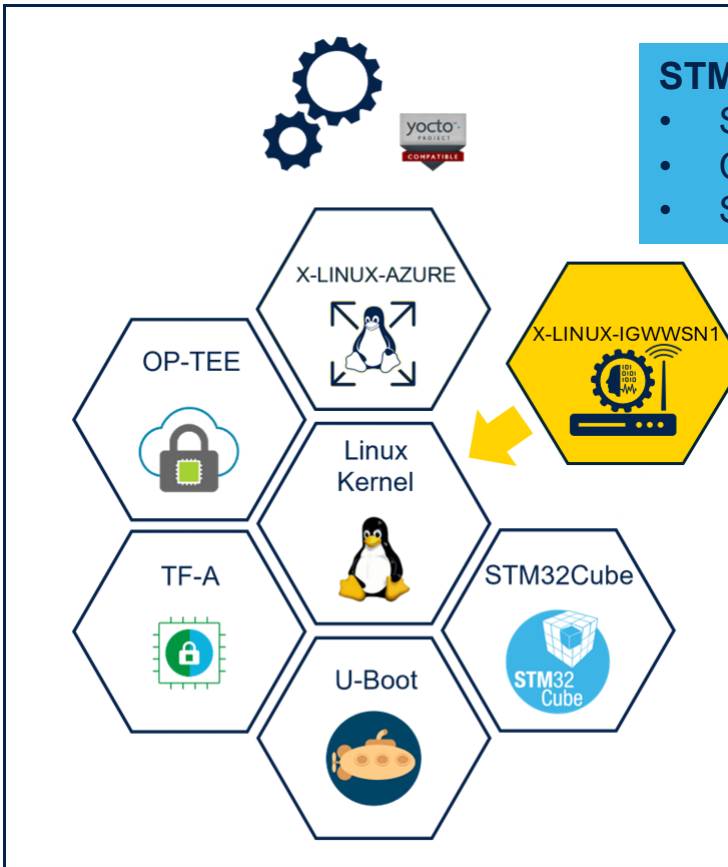
Cloud

A dashboard allows remote monitoring of our WSN



X-LINUX-IGWWSN1

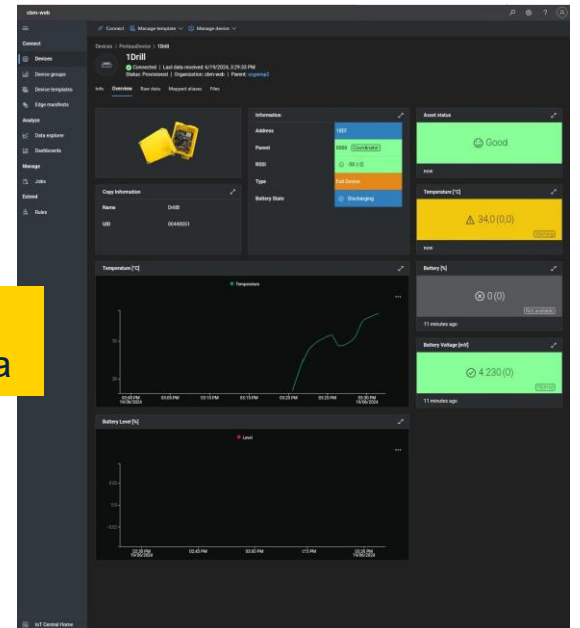
Industrial IoT edge gateway



STM32MP2 OSTL platform allows:

- Sensor connectivity via Bluetooth and Zigbee
- Containerized edge services on OpenSTLinux
- Secure Cloud integration with Azure IoT Edge and Azure IoT Central

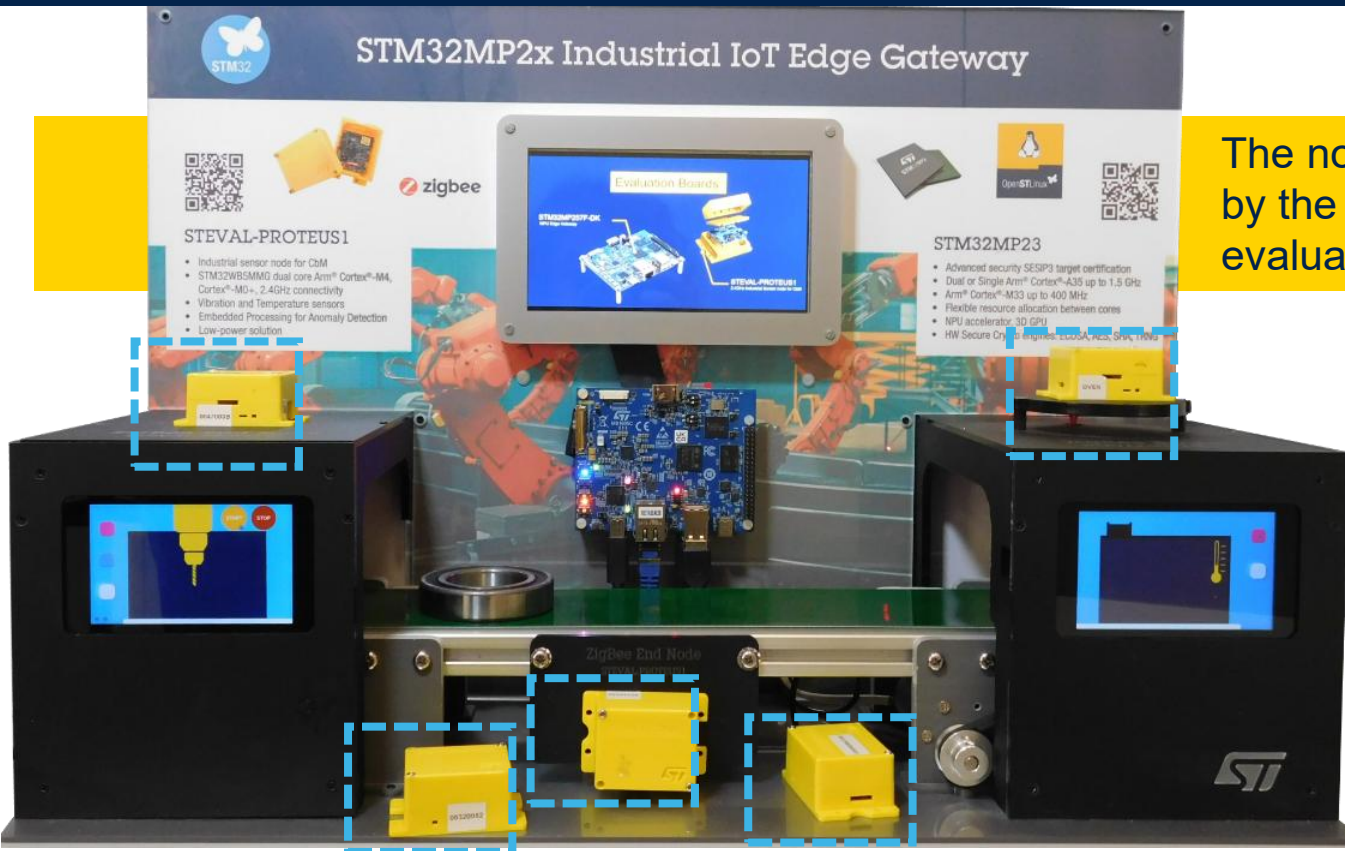
Our browser and mobile dashboard enables unified monitoring of coordinator status, leaf nodes, and process data



Docker is an open-source software technology allowing developers to package applications into containers, which can then be pushed onto a deployment platform (such as on-premises servers or servers in the Cloud) to be executed

Industrial gateway demo

Industrial environment monitored by several STEVAL-PROTEUS1 end-nodes



The nodes communicate with an industrial gateway implemented by the **STM32MP257** hosted on the STM32MP257F-DK evaluation board

A mechanical part is conveyed between two chambers:

- a mechanical process chamber on the left
- controlled temperature chamber on the right



The user can activate a vibration anomaly and a thermal anomaly, which will be detected by the Proteus board and sent to the IoT dashboard, indicating the alerts.

Final remarks



Takeaways

Built for factory automation

All core ICs including **STM32MP257** are industrial grade and guarantee **10-year longevity**

OpenSTLinux expansion package

The **X-LINUX-IGTW1** package serves as a foundational tool for engineers to build industrial solutions

Easy access to STM32MP2 features thanks to Node-RED

Node-RED (low-code, visual programming tool) is a web browser-based flow editor to create JavaScript functions

Supports Modbus, OPC-UA, Siemens S7, and others with 4000+ connectors for wide network applications

From OT down to WSN

ST offers a wide span of ICs and companion solutions

Factory floor Primary communications protocols

Protocol	Logo	Features	Reference standard and construction	Max distance	Max speed	Max no. of nodes
TSN		Deterministic, real-time. Collection of IEEE 802.1 standards, time synch, scheduled traffic	IEEE 802.1, Ethernet RJ45, or others	From 100 m to kms	1 Gbps	10,000
EtherCAT		Ultra hi-speed, low jitter, processing on the fly (no waiting for the full frame to be processed)	IEC 61158, RJ45	100 m	100 Mbps	65,535
Profinet		Topology flexibility, isochronous real-time for MC applications, IT integration	TCP/IP, 2 pairs or quad	100 m	100 Mbps	NA
CC-Link		Vertically integrated from IT down to field, ultrahigh-speed and high-capacity network, TSN support	IEC 61158, 3 conductors + 2 power	100 m	10 Mbps	64
HART		2-way communication: digital and 4-20 mA are handled simultaneously	RS-485, 1 pair	Not specified	1.2 Kbps	30
ModBus RTU		Half-duplex with robust error detection (16-bit CRC), supports RS232, low-cost implementation	RS-485, 2 or 3 pairs	1200 m	9.6 Kbps	31
CAN Open		High reliability and safety, suitable for high speed and low latency applications	RS-485, 1 or 2 pairs	1000 m (at 50 kbps)	1 Mbps (at 20 m)	127

300+ members

The ST Partner Program

Partner	Company logo	webpage	Products offered
Acontis technologies		link	EtherCAT Master stack software solution available for Linux, Windows, VxWorks, FreeRTOS, and many others: → acontis EC-Master software supports the Arm Cortex®-A7 chip as used on the STM32MP135F-DK
ISIT		link	ISIT provides a comprehensive portfolio of embedded software and training solutions focused on CAN and CANopen protocols, supporting industrial safety and security need. FSOE stack: (FailSafe over EtherCAT) certifiable up to Safety Integrity Level (SIL) 3 is one of the services released on STM32MP257 on which we have developed a common demo
RT-Labs		link	T-Labs enables seamless integration of multiple industrial communication standards, including PROFINET , EtherNet/IP , CC-Link , and Modbus TCP for STM32 MCUs
Codewerk		link	Within the ST ecosystem, Codewerk integrates its expertise in connectivity and embedded security for industrial applications, particularly for the STM32H7 , STM32MP1 , and STM32MP2 series. It offers protocol stack integrations such as PROFINET and OPC UA , alongside embedded security services covering secure development, testing, and monitoring aligned with IEC 62443 standards

Our technology starts with You



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