Industrial Ethernet protocol stack: PROFINET

Established in 1989, PROFIBUS is a widely used fieldbus system for industrial automation. PROFIBUS is a serial communication protocol. To meet the growing need for Ethernet-based communication, the PROFIBUS and PROFINET International (PI) organization developed PROFINET. As a result, PROFINET is often considered the successor to PROFIBUS. PROFINET supports real-time communication, leverages IT standards such as TCP/IP, and enables the integration of fieldbus systems. It is standardized under IEC specifications IEC 61158 and IEC 61784.

NXP offers a PROFINET IO device protocol stack as a binary image for evaluation on the i.MX RT1180 evaluation kit and a combination source code/compiled object library for integration in an end-product based on i.MX RT1180.

Benefits of NXP's PROFINET protocol stack

- Provides a complete PROFINET IO device reference implementation
- Requires no external RAM
- Handles network protocol on the real-time Arm® Cortex®-M33 core, with inter-core communication to the high-speed application Arm® Cortex®-M7 core
- Offers low resource consumption (memory and power)
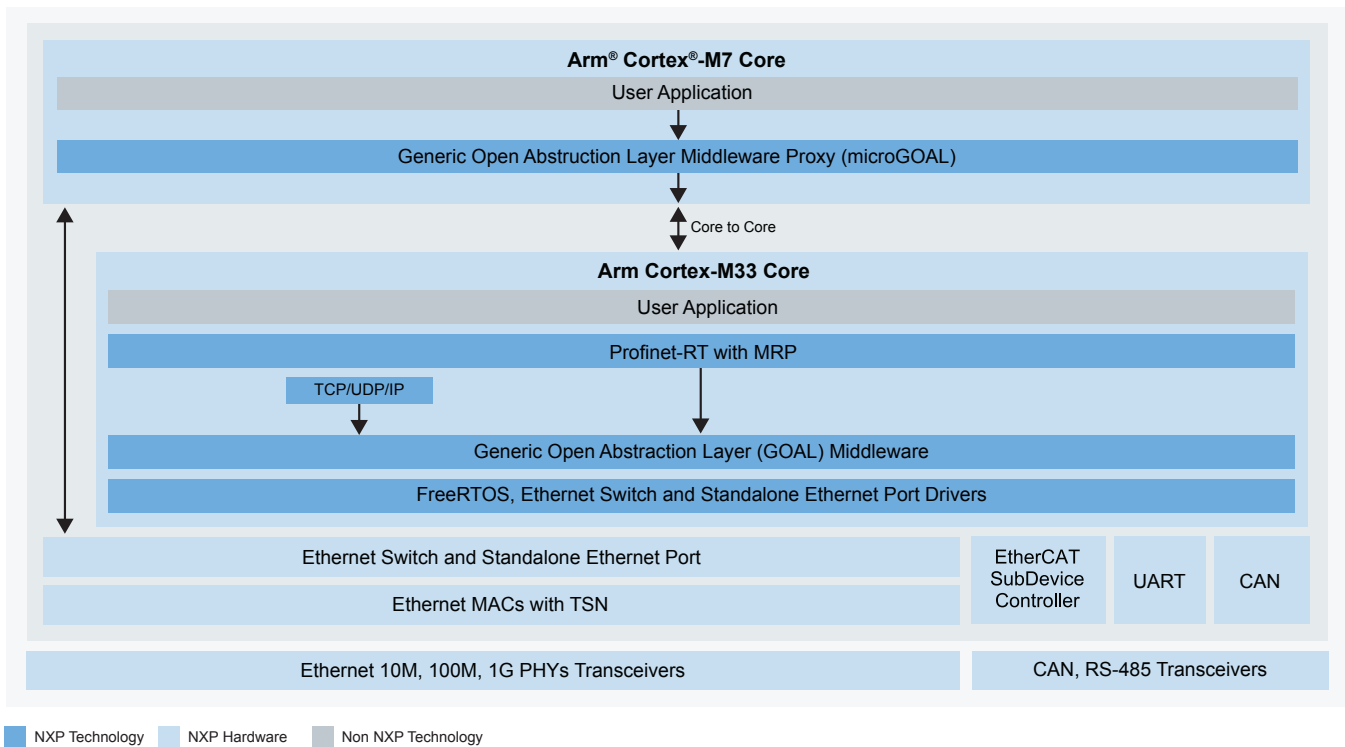- Ensures excellent conditions for conformance testing
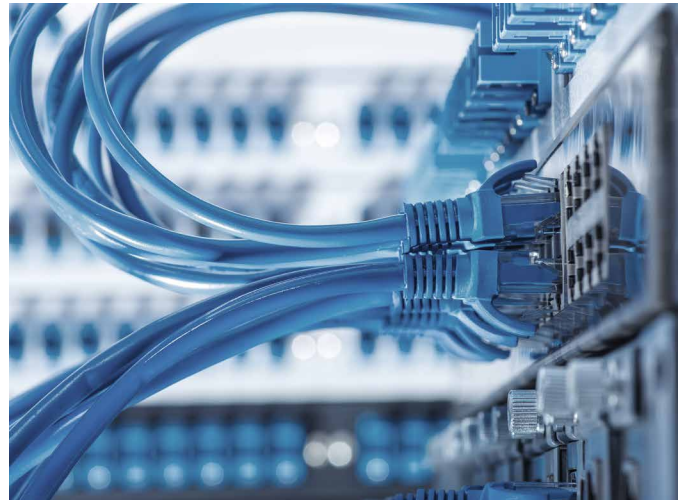
- Integrates with NXP's Industrial Communications Creator (ICC) tool to simplify protocol data structure configuration
- Part of the Industrial Protocol Suite, underpinned by the GOAL Framework, enabling easier application migration across multiple protocols and NXP SoCs

MCUXpresso developer experience

Designed to simplify and accelerate embedded system development and optimization, the MCUXpresso ecosystem delivers high-quality, comprehensive enablement for NXP's general-purpose, crossover, and wireless-enabled Arm Cortex-M-based MCUs. It supports easy migration and scalability across MCU families, helping developers streamline workflows and reduce time-to-market.

PROFINET industrial Ethernet protocol block diagram

Arm® Cortex®-M7 Core
User Application

Generic Open Abstraction Layer Middleware Proxy (microGOAL)

Core to Core

Arm Cortex-M33 Core
User Application

Profinet-RT with MRP

TCP/UDP/IP

Generic Open Abstraction Layer (GOAL) Middleware

FreeRTOS, Ethernet Switch and Standalone Ethernet Port Drivers

Ethernet Switch and Standalone Ethernet Port

Ethernet MACs with TSN

EtherCAT SubDevice Controller

UART

CAN

Ethernet 10M, 100M, 1G PHYs Transceivers

CAN, RS-485 Transceivers

NXP Technology NXP Hardware Non NXP Technology

NXP's PROFINET protocol stack features

- PROFINET specification V2.4
- Conformance Class (CC) A and B
- Real-time Class 1
- Media Redundancy Protocol (MRP)
- DCP, LLDP, SNMP
- Topology recognition
- Physical device record objects
- Diagnostic entries
- I & M 1-4
- Multiple alarm types
- Integrated switch management
- FreeRTOS implementation

NXP enhancements

- Hardware-independent and hardware-dependent components communicate via message queues
- The application interacts only with the hardware-independent layer, simplifying migration to other protocols and NXP SoCs

- Incoming communication from other devices is validated by the stack before reaching the user application
- Modular PROFINET service groups allow tailoring the memory footprint to application requirements
- Evaluation binary images and the Industrial Communications Explorer tool are available on nxp.com

Getting started with PROFINET:

1. Download the i.MX RT1180 PROFINET binary evaluation image.
2. Download the Industrial Communication Explorer evaluation tool.
3. Access the Industrial Networking Protocols Knowledge Base on the NXP Community for installation and evaluation instructions.

Additional resources:

1. i.MX RT1180 evaluation kit
2. PROFINET training: i.MX RT1180 setup, integration and industrial networking
3. NXP support and technical community

nxp.com/PROFINET