Time Sensitive Networking Tools and Software

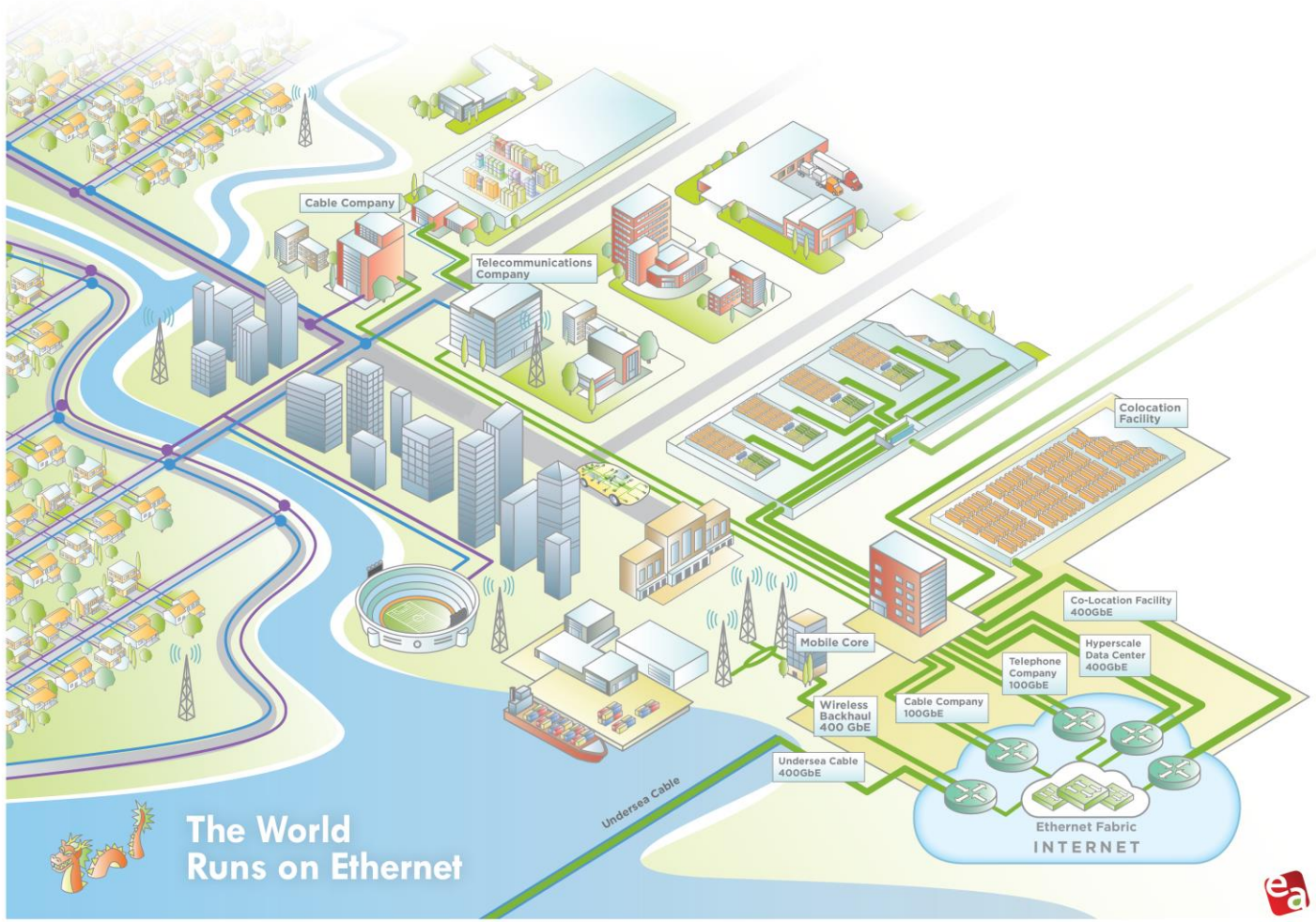
A Leading Provider of Smart, Connected and Secure Embedded Control Solutions

SMART | CONNECTED | SECURE

September 2025

Ian Saturley

The Connected Ecosystem



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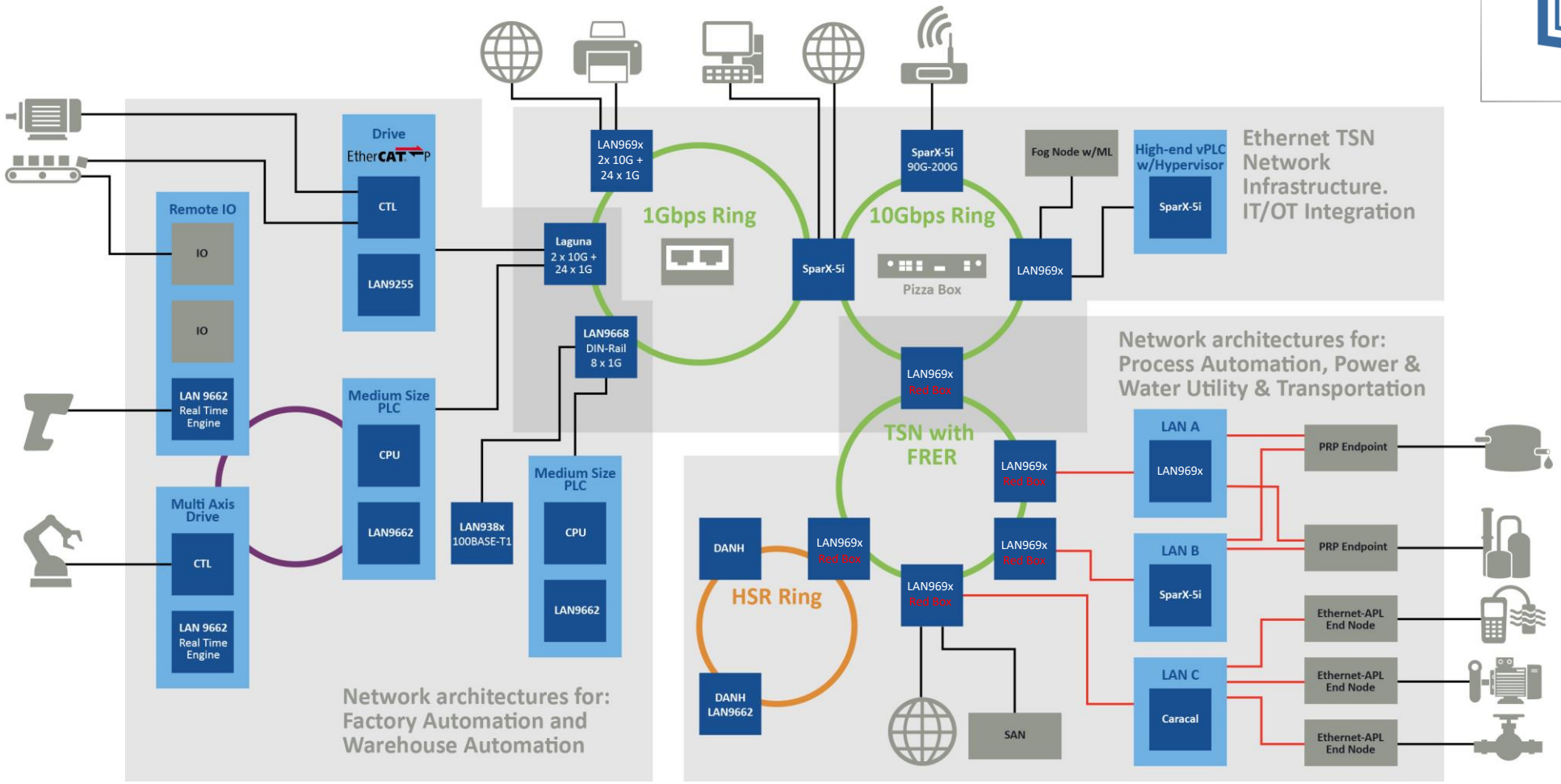
Solutions in Automation Networks

Factory Diagram



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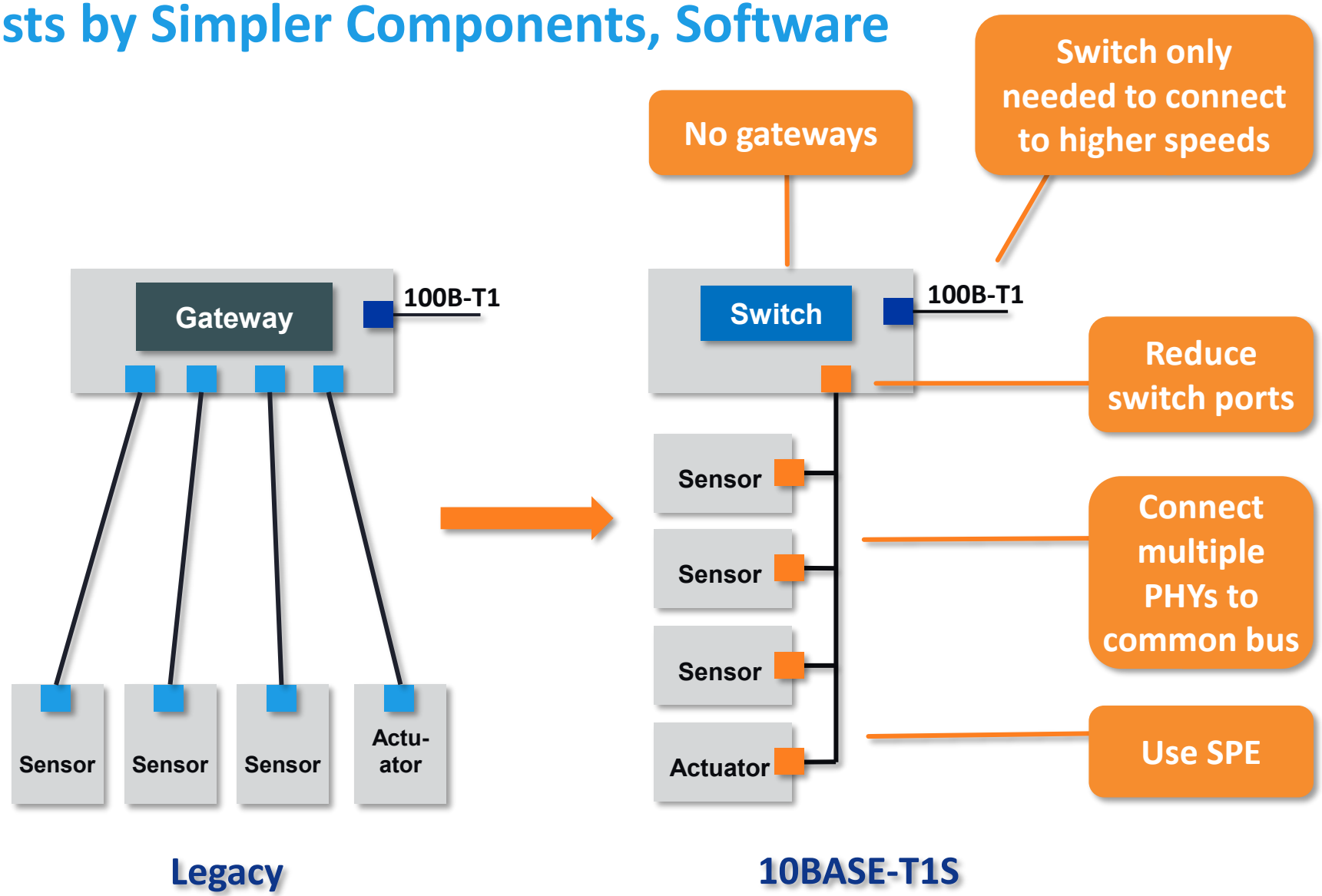
Benefits of 10BASE-T1S

Reduced Costs by Simpler Components, Software and Wiring



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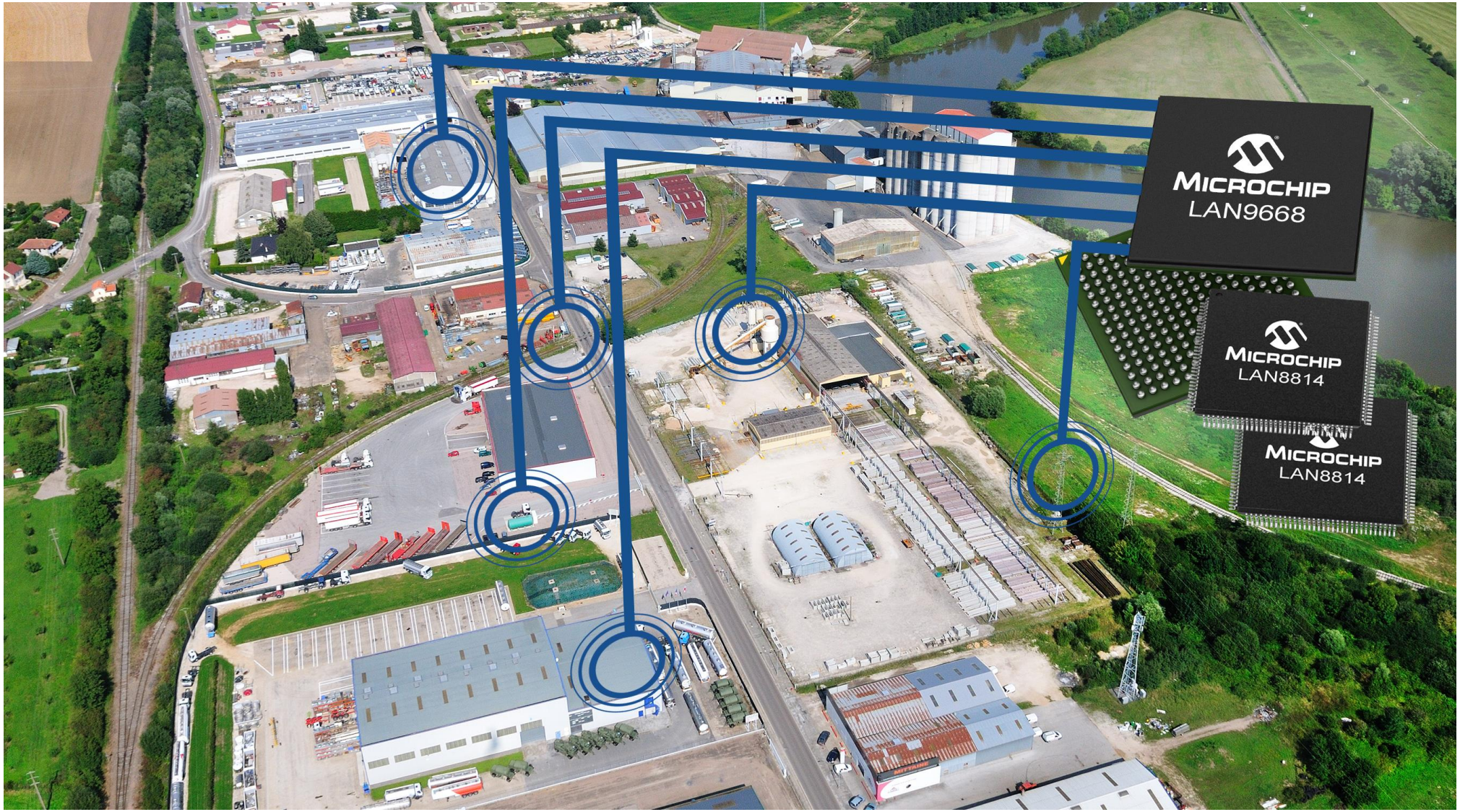
Solutions in Operational Technology Networks



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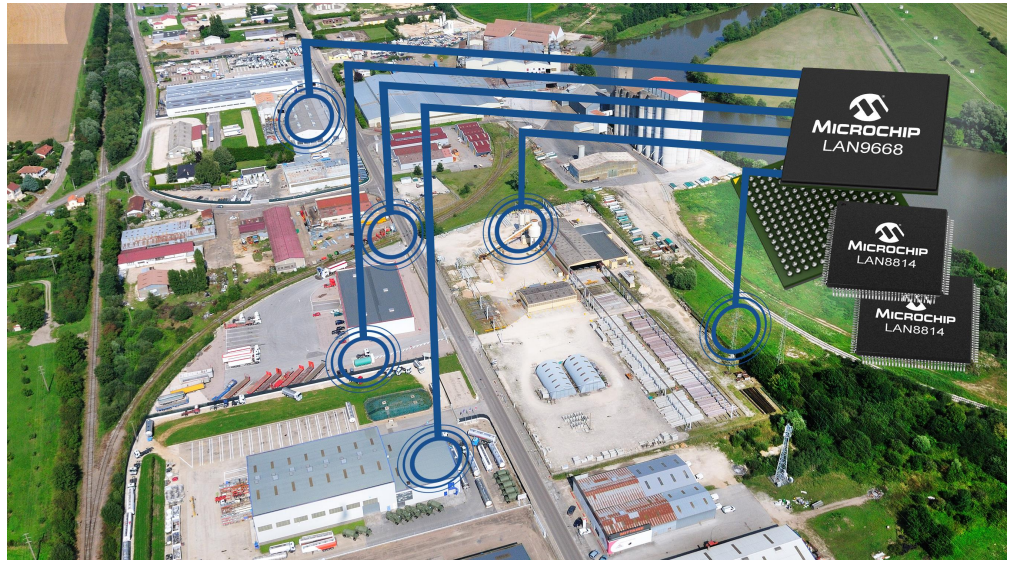
Profinet® Industrial Solution



Profinet, Profinet@TSN
Accurate timing
Best in class data delivery

Ratified and compliant
TSN feature set

Silicon level enhancements
“Real Time Engine”

Differentiating

- **Profinet switching fabric**
- **Profinet device**

PROFINET®

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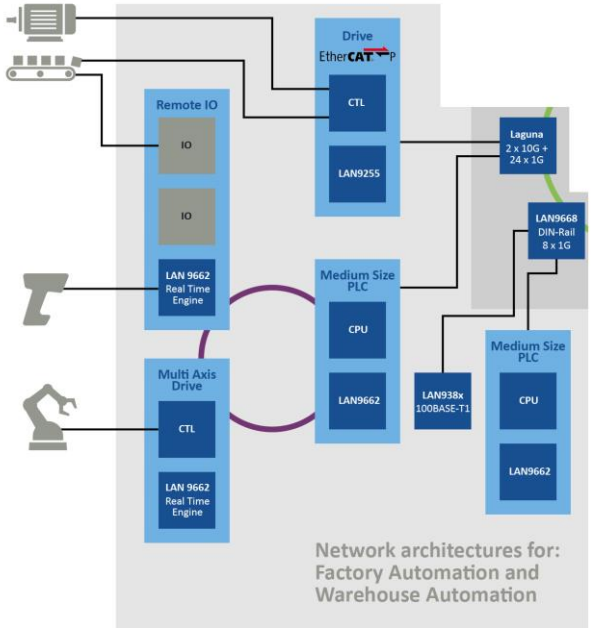
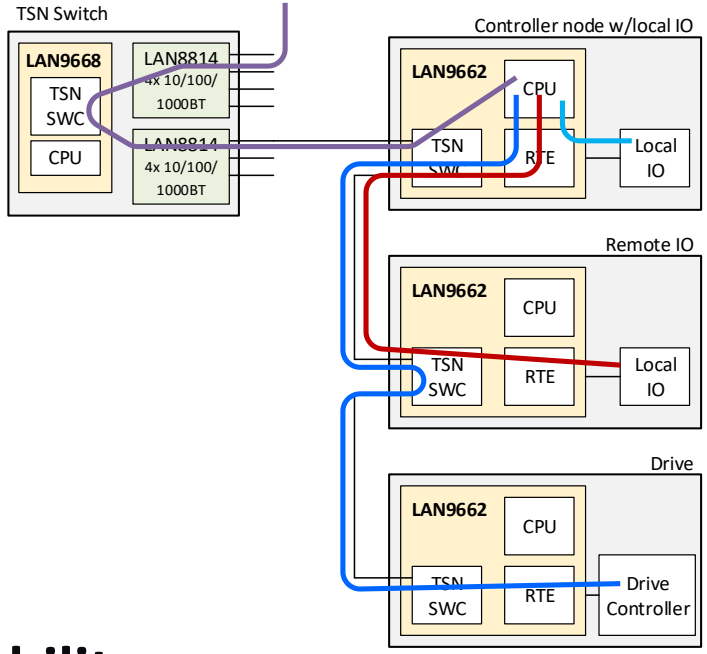
Solutions in Automation Networks

Switch Fabric and End Point



- Fast cyclical timing
- Motor and motion control
- On-the-fly data flows



- Coherent
- Resilient
- High availability
- Standards compliant
- HW deterministic

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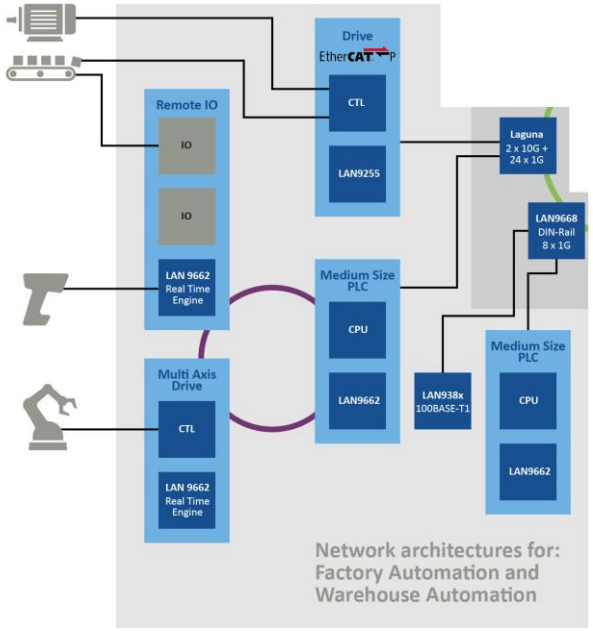
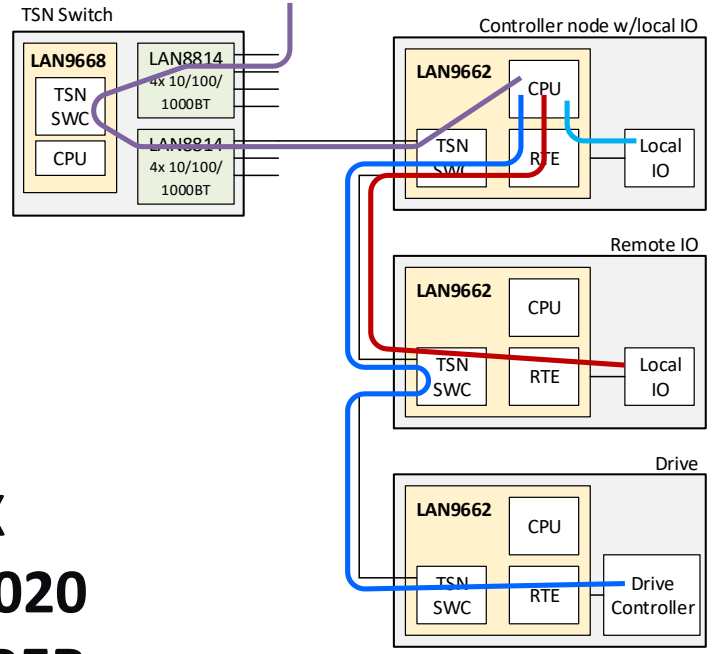
Solutions in Automation Networks

Enabling Rapid Frame Processing



- **Fast cyclical timing**
- **Motor and motion control**
- **On-the-fly data flows**



- **OPC UA FX**
- **802.1AS-2020**
- **802.1CB FRER**
- **802.1Qbv Time Aware Shaper**
- **802.1Qbu/802.3br Preemption**
- **Ultra low latency**

PROFINET®

- IEC-62439-2 2016 Media Redundancy Protocol (MRP)
- Multiple 802.1AS clock domains

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TSN Evaluation and Development Platforms

Broad Array of Existing Proven Designs

BoardID	Part #	Board Description	Platform	Functional Description
UNG8290	EV18W53A	EVB-LAN9668	Maserati	8-port Switch EVB
UNG8291	EV09D37A	EVB-LAN9662	Maserati	CPU Board
UNG8309	EV44Z97A	EVB-LAN9662-Carrier	Maserati	Carrier for CPU Board
UNG8314	EV53U25A	EVB-LAN9662-NIC	Maserati	PCIe® NIC
	VSC5640EV		SparX-5i	12x SFP+ and 8xSFP28
	VSC5641EV		SparX-5i	48Cu + 4x 2.5G Cu + 4 SFP
	EV23X71A	VSC5641EV	Laguna	24x1G Cu and 4xSFP
UNG8420			Laguna	8x1G Base-T + 5x1G Base-T1 + 4xSFP
UNG8422			Laguna	10x SFP

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LAN9668/2 Materials

What and Where

- **Core Materials**

  - To obtain the LAN9662 register file, click here
  - VSC6803 (MESA) API and associated documentation is available here
  - Switchdev support available via Linux® mainline. BSP documentation is available here
  - MERA (Microchip Ethernet Real Time Engine API) and P-NET are available here and here
  - TFA (ARM Trusted Firmware) v2.8.8 is available here
  - Introduction to BSP :: Microchip UNG BSP Documentation (microchip-ung.github.io)

- **Knowledge Based Articles**

  - Step-by-step guide in building a standalone image for LAN966x and programming it to EVB-LAN9662
  - https://microchip.lightning.force.com/lightning/r/Solution__c/a2JV4000000EU33MAG/view

  - Step-by-step guide in preconfiguring a buildroot-based embedded Linux board for SSH (dropbear)
  - https://microchip.lightning.force.com/lightning/r/Solution__c/a2JV4000000C7SMMA0/view

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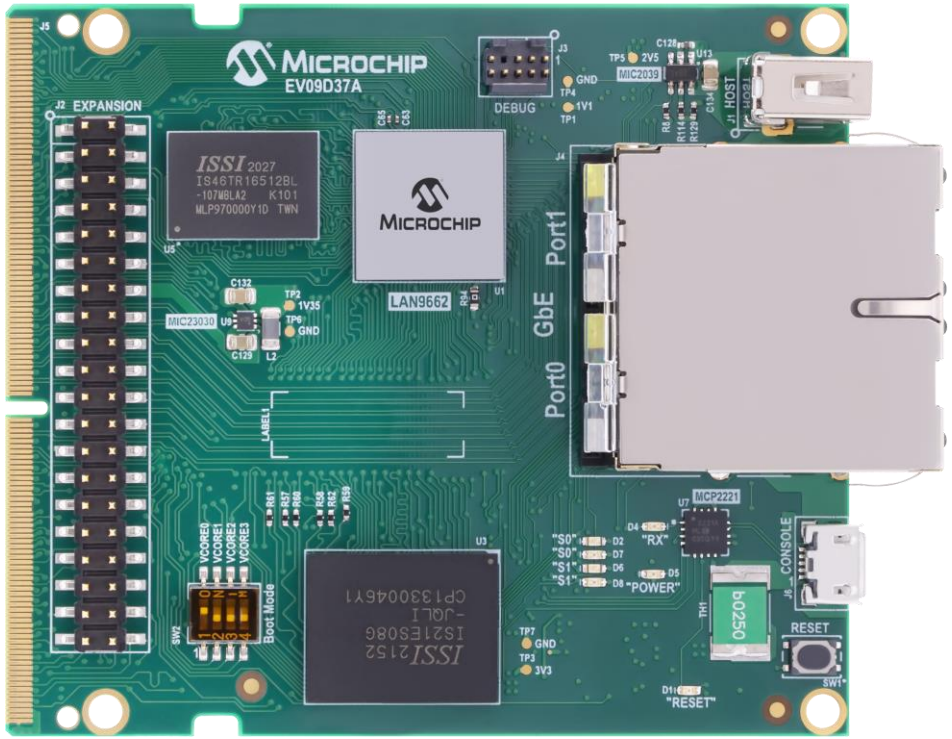
Edge and CPU Platform Development

Platforms for Rapid Prototyping



UNG8291 / EVB-LAN9662
End Node

LAN9662	Ethernet TSN switch LAN9662
SST26VF016B-104I/SM	SERIAL FLASH 16M 104MHz
MIC6315-26D2UY-TR	SUPERVISOR 2.63V MIC6315-26D2UY-TR SOT-143
MCP2221A-I/ML	USB I2C/UART
MIC23201YML-TR	Buck 0.95V to 3.6V 2A
MIC23030-AYMT-TR	8MHz PWM 0.4A BUCK REGULATOR
MIC23050-SYML	SWITCHER Buck 3.3V
MIC5377YC5-TR	LDO 5.3V
MIC2039EYM6-T5	POWER SWITCH 2.5V to 5.5V 2.5A
VXM7-9013-25M0000000	Microchip® CRYSTAL 25Mhz

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Platforms for Rapid Prototyping

UNG8290 / EVB-LAN9668 - 8-port Switch Chipset

LAN9668i/9MX	Eight port TSN Switch
LAN8814/ZMX	Quad 1G PHY
LAN8814/ZMX	Quad 1G PHY
ZL30772LFG7	Clock
VT-803-0060-25M0000000	Oscillator
VCC1-1537-114M285000	Oscillator
MIC23303YML-TR	Voltage Regulator
MIC28303-1YMP	Voltage Regulator
MIC5377YC5-TR	Voltage Regulator
MIC23050-GYML	Voltage Regulator
MIC23030-AYMT-TR	Voltage Regulator
MIC6315-26D2UY-TR	Voltage Supervisor
SST26VF016B-104I/SM-ND	16M Serial Flash

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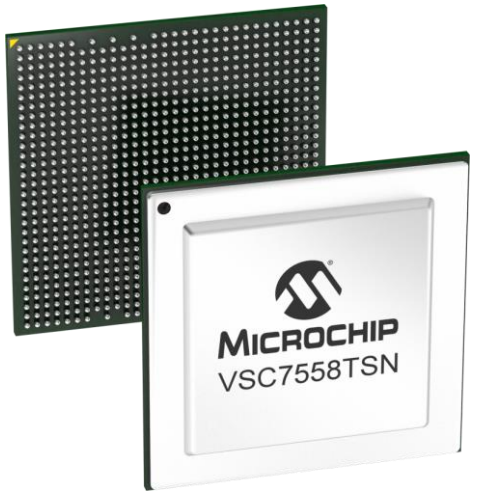
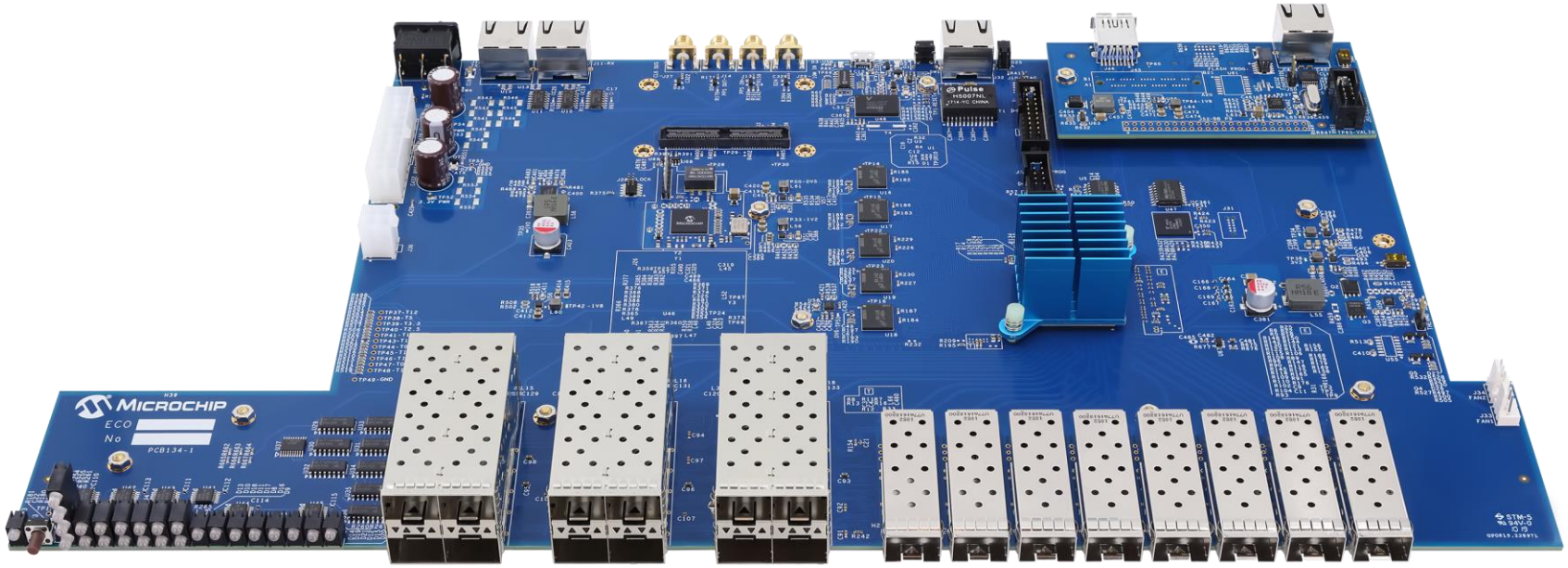
Example MESA HW Targets

SparX-5i





lStaX
SMBStaX
WebStaX

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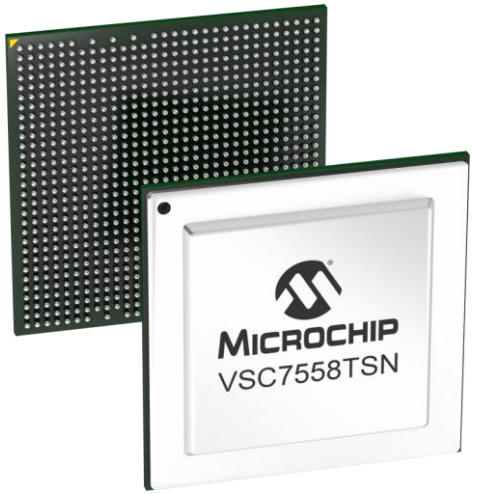
TSN Ethernet Switch

Factory Level Time Sensitive Networking



Management I/F
- MCP2221A — UART<->USB
- VSC8211 — 1G PHY

Memory
- IS43TR85120AL — DDR3 SDRAM
- MX66L1G45G — SPI NOR FLASH
- SST26VF080A — SPI NOR FLASH
- MX35LF2GE4AB — SPI NAND FLASH
- SST25PF040C — SPI NOR FLASH

Temp. Monitoring
- EMC1182 — Temp. Sensor

- MIC6315 — RESET GEN
- VSC7558TSN — SparX-5i-200
- MIC5166 — DDR Termination

Power Supplies
- LX7167A — Step-Down Converter
- PAC1934 — Quad Power Monitor
- MIC2128 — BUCK
- MIC5504 — LDO
- MCP1725T — LDO
- NX9548 — BUCK
- MIC22400YML — BUCK

Clock Circuitry
- VCC1-1545 — 49M152 Osc.
- ZL30251 — Clock Gen.
- VXM7-1363- — 57M1425000 Xtal.
- OX-6011/5021 — 25MHz OCXO
- ZL30772 — DPLL

Buffers/Mux
- SY89113U — Clock Buffer
- ZL40251 — Buffer

LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	LAN8814 4 × 1G Cu PHY	GPY241 4 × 2.5G PHY
PD69208 8 × PSE		PD69208 8 × PSE		PD69208 8 × PSE		PD69208 8 × PSE		PD692088 8 × PSE		PD69208 8 × PSE		PD69210 POE Ctrl

ISta X
SMBSta X
WebSta X

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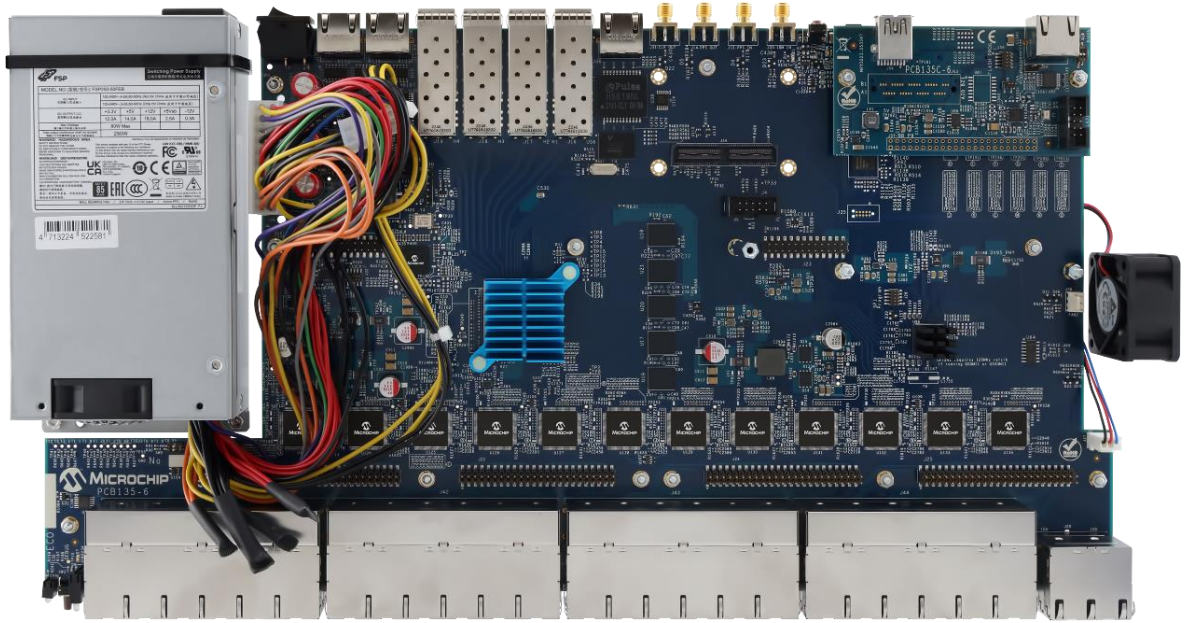
TSN SparX5i Evaluation Platforms

VSC5641EV



VSC7546,49,52,56,58TSN	Ethernet TSN switch
MIC6315-31D3UY	Analog IC
MCP2221A	Digital IC USB-TO-UART/I2C BRIDGE
MIC5504-3.3YM5	LDO 3.3V fixed out
VSC7546,49,53,56,58	Ethernet TSN Switch
ZL30772	2-channel IEEE 1588&SyncE Packet Clock
VSC8211 (Qty 12)	Ethernet Phy
LX7302	SMPS regulator for 2 N-ch. FETs
LX7167A	Analog Step-Down Converter 2.4A
NX9548ILQ	Analog 8A Synchronous Buck Regulator
LX7104	Analog 1.4MHz 1.5A Async Buck Converter
ZL30251	4-input, 3-Output Any-to-Any Clock Multiplier
OX-5011 25.0MHz	Oscillator 25.00MHz 3.3V LVCMOS OCXO no pull
OX-601 25.0MHz	Oscillator 25.00MHz 3.3V HCMOS OCXO no pull
VCC1-1545-49M152	Andet Oscillator 49.152MHz XO
57.1425MHz	Crystal 57.1425MHz 30ppm 10pF SMD

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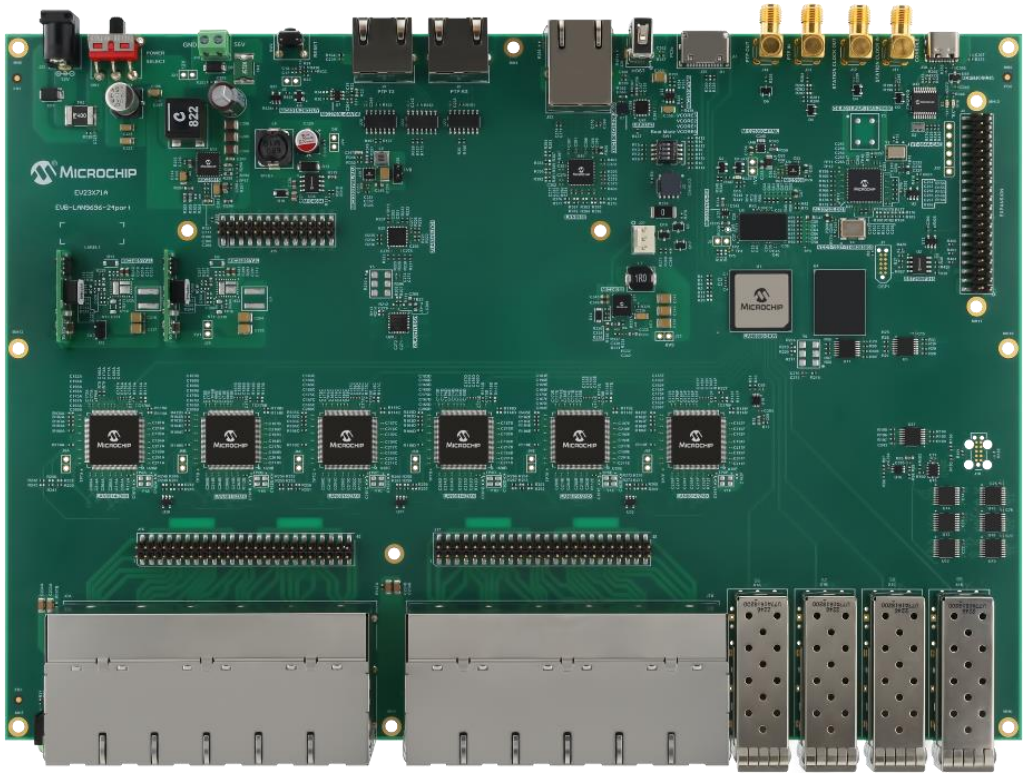
TSN Laguna Evaluation Platforms

VSC5641EV (EV23X71A)



LAN9694,96,98TSN,RED	Ethernet TSN switch
SST26WF016	MEMORY SERIAL FLASH 16M
MIC6315	ANALOG SUPERVISOR 2.63V
MIC2790L	ANALOG SUPERVISOR 0.4V to 5.5V
MIC5166	ANALOG HIGH-SPEED DDR TERMINATOR
LAN8814 (Qty6)	QUAD 10BASE-T/100BASETX/1000BASE-T PHY
ZL30732	CLOCK DISTRIBUTION 5 CHAN SyncE+1588
ZL40217	CLOCK DISTRIBUTION 1:6 LVDS O/P
ZL40241	CLOCK DISTRIBUTION 3:10 LVCMOS BUFFER
MIC24051	ANALOG SWITCHER BUCK 0.8V-5.5V
MIC28515	ANALOG SWITCHER Buck 0.6V to 32V
MIC4684	ANALOG SWITCHER Buck 1.25V to 28.3V
MIC24055	ANALOG SWITCHER Buck 0.8V to 5.5V
MIC5377	ANALOG LDO 5.3V
MIC23303	ANALOG SWITCHER ADJ
MIC23050	ANALOG SWITCHER Buck 1.2V
USB3343	INTERFACE USB PHY
MIC2039	ANALOG POWER SWITCH 2.5V to 5.5V
MCP2200	INTERFACE USB UART
MCP1700T	ANALOG LDO 3.3V
LAN8840	INTERFACE ETHERNET
VT-804A-EAE	CLOCK OSCILLATOR SNGL 25Mhz
VCC1-1537	CLOCK OSCILLATOR SINGLE 114.285MHz
DSC1001CI5	CLOCK OSCILLATOR SINGLE 26MHz ±10ppm

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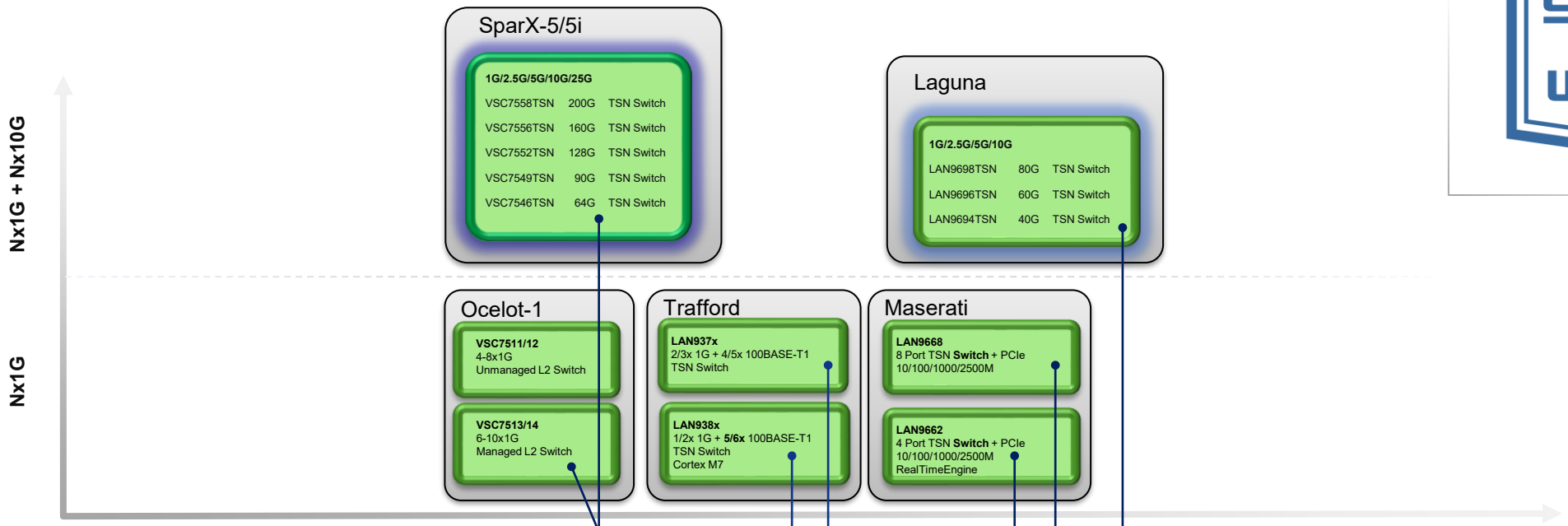
Industrial TSN Switch Portfolio



Application SW

WebStaX
SMBStaX
IStaX
MPLAB

API/Driver/Stack

MESA/MERA
Driver
Profinet

Linux

Switchdev

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Product Journey

Solutions for Rebranding Through to Industrial Protocol Support

BoardID	Ordering Part #	Board Description	Functional Description
UNG8290	EV18W53A	EVB-LAN9668	8-port Switch EVB

"Allowing freedom to implement a fully featured industrial switch with rapid time to market"

IStaX **Feature rich industrial solution L2/L3, Precision Time, TSN**

Software License fee and annual Software Maintenance fee
VSC6817SDK - https://www.microchipdirect.com/product/VSC6817SDK
VSC9990-SWLWEB - https://www.microchipdirect.com/product/VSC9990-SWLWEB

SMBStaX Midrange L1/L2

Software License fee and annual Software Maintenance fee
VSC6816SDK - https://www.microchipdirect.com/product/VSC6816SDK
VSC9990-SWLSMB - https://www.microchipdirect.com/product/VSC9990-SWLSMB

WebStaX Entry level L1

Software License fee and annual Software Maintenance fee
VSC6819SDK - https://www.microchipdirect.com/product/VSC6819SDK
VSC9990-SWLWEB - https://www.microchipdirect.com/product/VSC9990-SWLWEB

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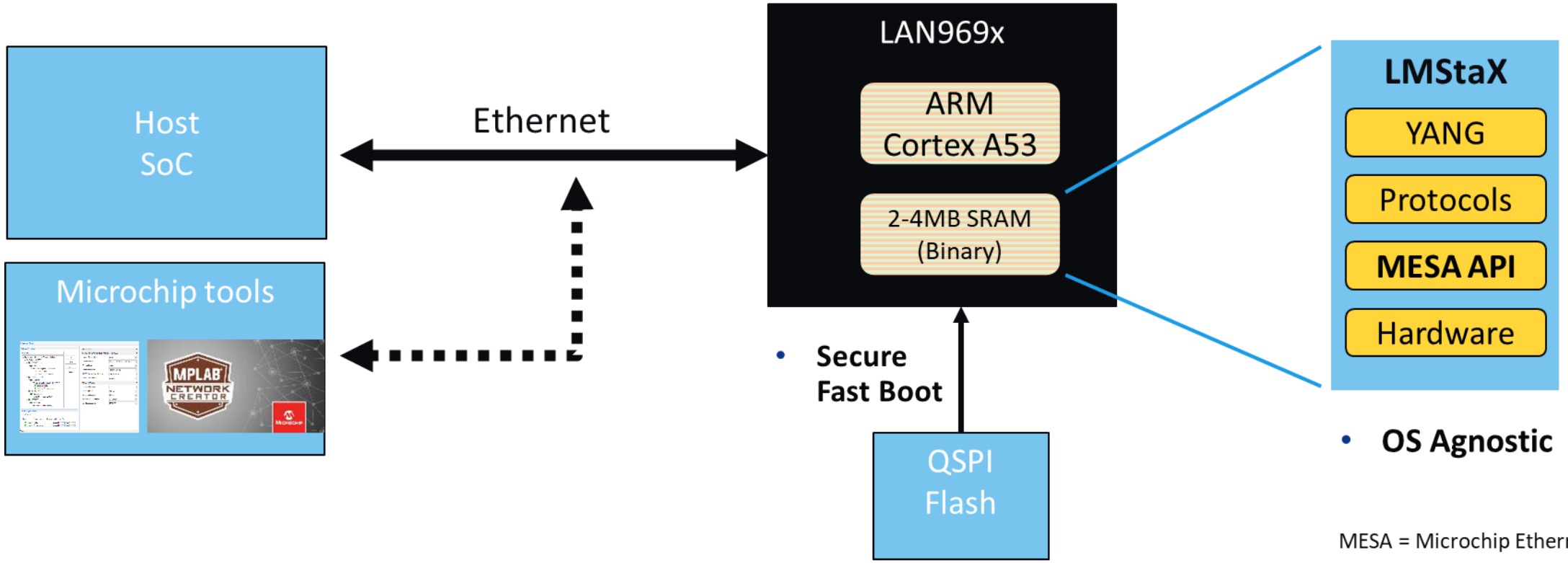
Software Defined Networking

VelocityCT



MESA = Microchip Ethernet Switch API

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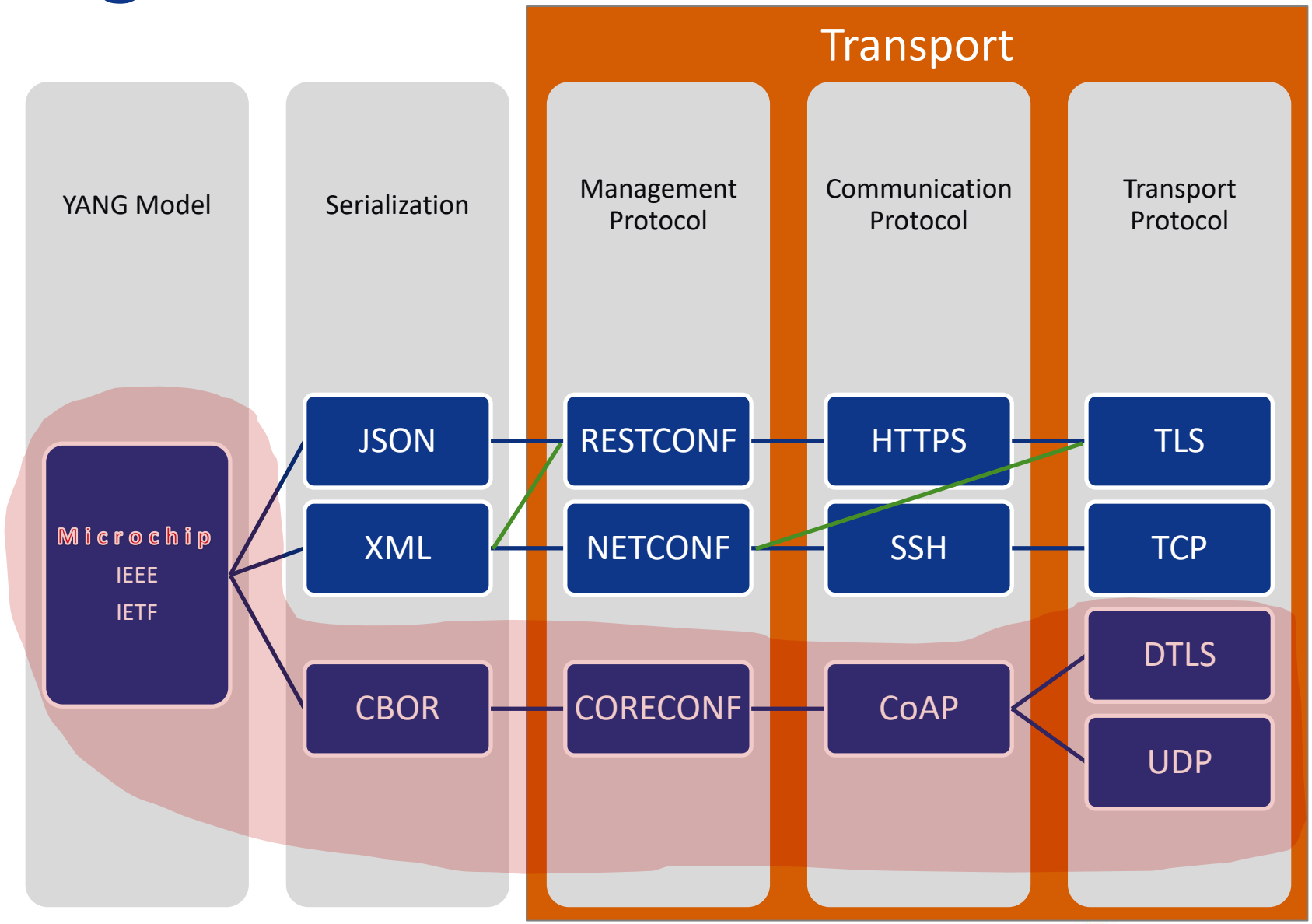
YANG-Based Configuration Protocols

- **YANG Model**
  Model of the interface to communicate with device
- **Serialization**
  Machine-readable data format used to encode application data
- **Management Protocol**
  Application-level protocol to configure and monitor devices
- **Communication Protocol**
  Underlying common protocol to communicate with device
- **Transport Protocol**
  Underlying standard protocol to transfer the data



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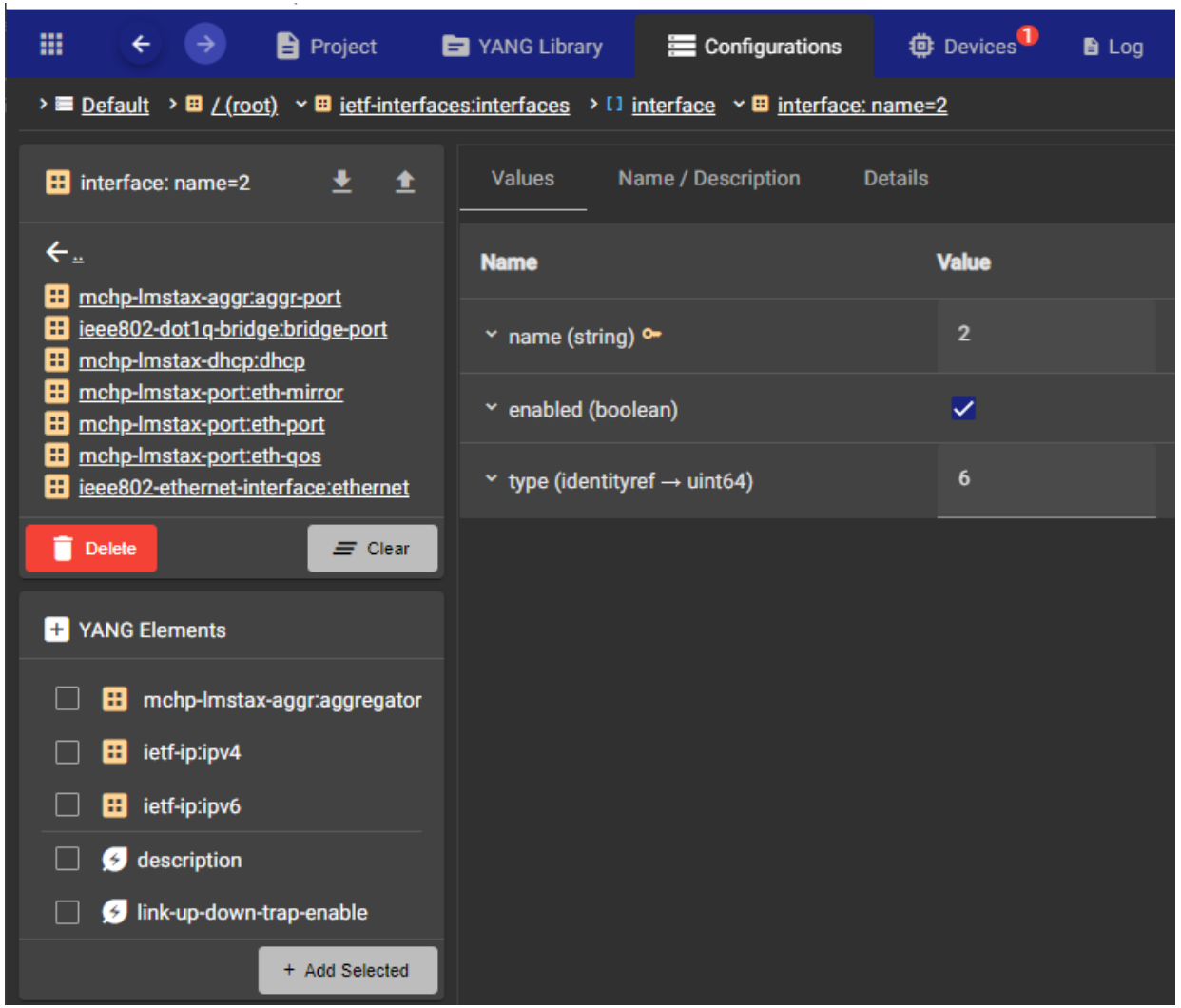
VelocityCT Yang

Navigation Panel Explained



- VelocityCT uses CBOR and CORECONF protocols to configure our devices
- The Navigation panel on the left is used to browse between containers and lists [ ]
- The Values on the right side are used to display leaves (properties), references to configuration items (click dropdown) and information about the current container
- The key icon on the name (string) leaf is a navigational aide. Similar to a key in a database schema, it is a unique identifier of containers in the list
- The lists [ ] and containers are shown in the path (bread crumb) navigational control starting with Default > /root
- + Yang Elements list on bottom left represents containers and leaves automatically removed via Introspection from the Yang model due to small footprint, constrained devices

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YANG-Based Management Interface

- **YANG-based management interface for constrained devices**
- **Follow RESTfull methodologies (like RESTCONF)**
- **Simple design using UDP and CoAP (no TCP)**
- **Secured by DTLS**
- **Standard offers different datastore models**
- **Use standard YANG where possible**
  - Extend existing YANG modules when needed and use private YANG modules when no public are available

	CORECONF	NETCONF	RESTCONF	SNMP	JSON-RPC	Web	CLI
Protocol stack (security, session and transport)	CoAP (via UDP, IP, ETH) (via DTLS, UDP, IP, ETH) (via DTLS, MUP1, RS232) (via MUP1, RS232)	SSH/TLS (via TCP, IP, ETH)	HTTPs (via TCP, IP, ETH)	UDP (via IP, ETH)	HTTP(s) (via TCP, IP, ETH)	HTTP(s) (via TCP, IP, ETH)	Telnet (via TCP, IP, ETH) (via SSH,tcp,ip,eth) (via UART)
Encoding	CBOR	XML	JSON or XML	BER	JSON	Various (xml, json, custom)	Just ASCII
Schema	YANG	YANG	YANG	MIB	Various…	N/A (documentation)	N/A (documentation)
Friendly to	Machines	Machine	Machines	Machines	Machines	Human	Human

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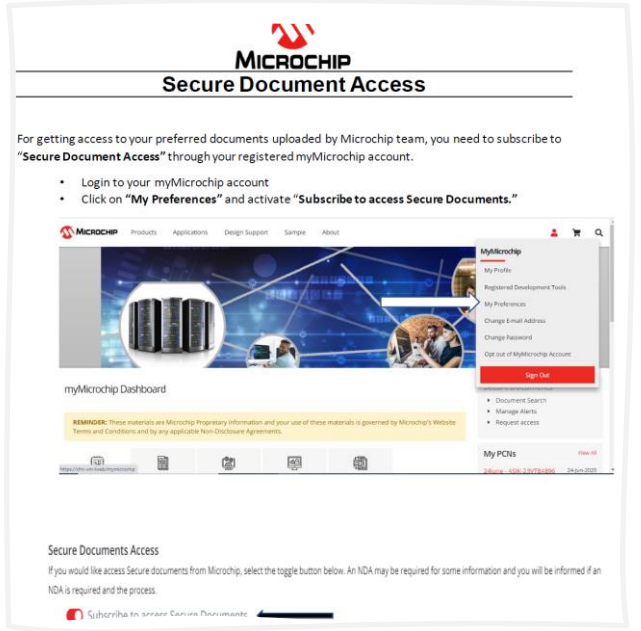
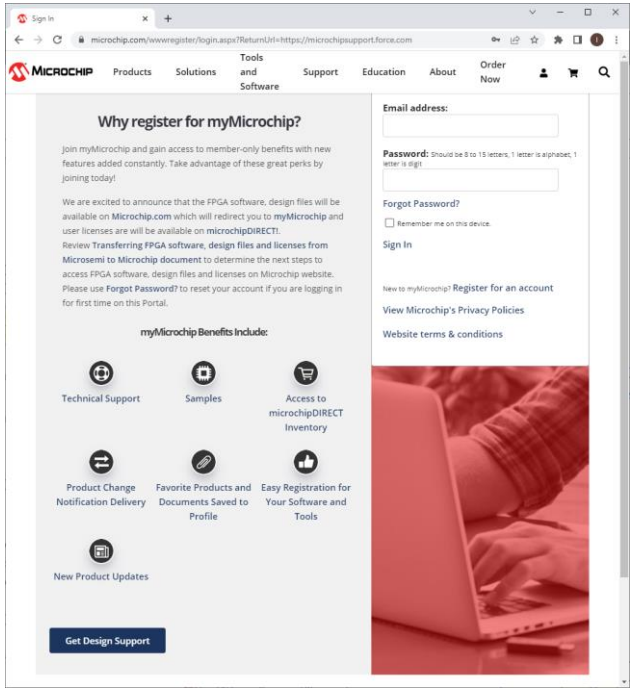
Where to Get More Information

Collateral	Databriefs	Microchip Web Pages
	Datasheets	Secure Document Extranet (SDE)
	Reference designs	
	EDA Symbols	
	Applications notes	
Commercial	Evaluation platforms Samples	DigiKey
Technical	Support requests	FAEs / Salesforce Ticket System
	Design reviews	





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