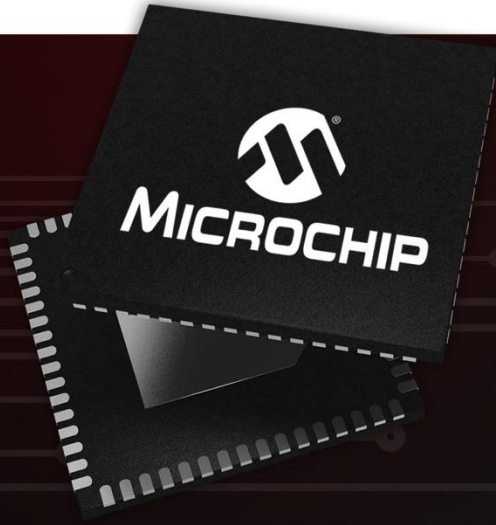




A Leading Provider of Microcontroller, Security, Mixed-Signal, Analog & Flash-IP Solutions



Ethernet & TSN Solutions

presented by Matthias Göing, FAE, North Central Europe

Phytec Update - April 2020

Our Mission

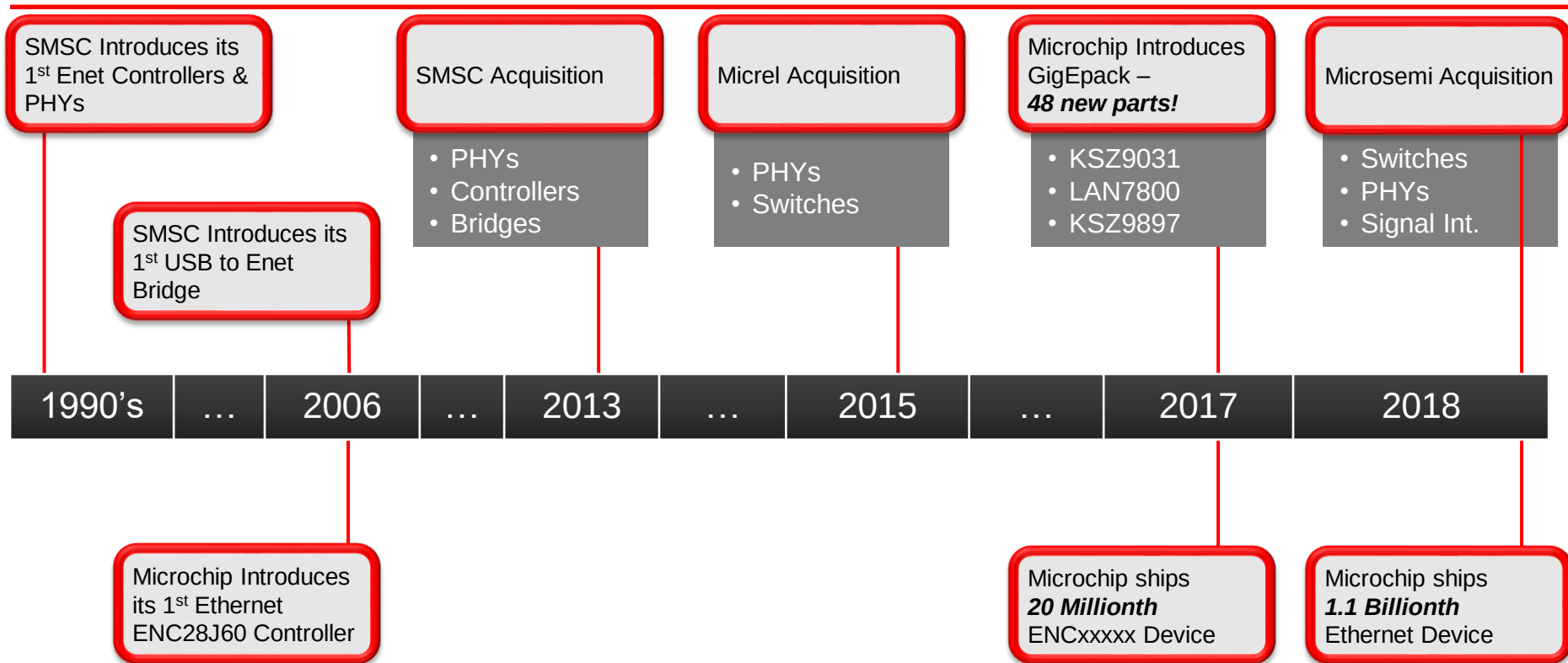
- **Make Ethernet accessible to all**
 - Broad portfolio of solutions
 - Advanced features, compliance tested
 - Comprehensive software & drivers
 - Copy ready Application Examples
 - LANCheck® online review

It just works!

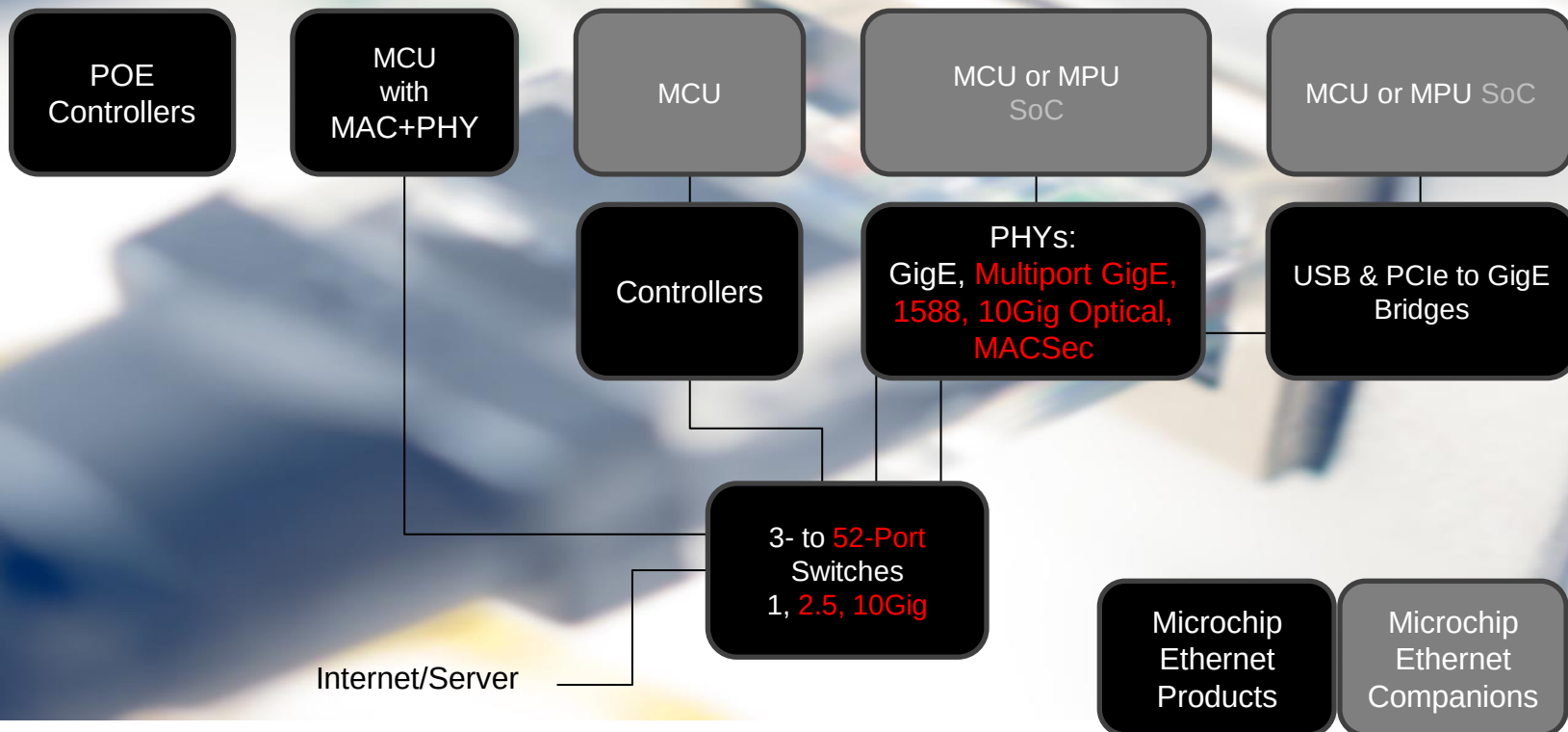
We Focus on Robustness

- 
- **Designed for Industrial and Automotive applications**
 - AEC-Q100 Automotive qualified solutions
 - Extended temperature ranges (up to 105°C)
 - Advanced Technology Solutions:
 - Deterministic Networking (AVB, TSN), Security (MACsec) Advanced Cable Diagnostics, Signal Quality Indicator

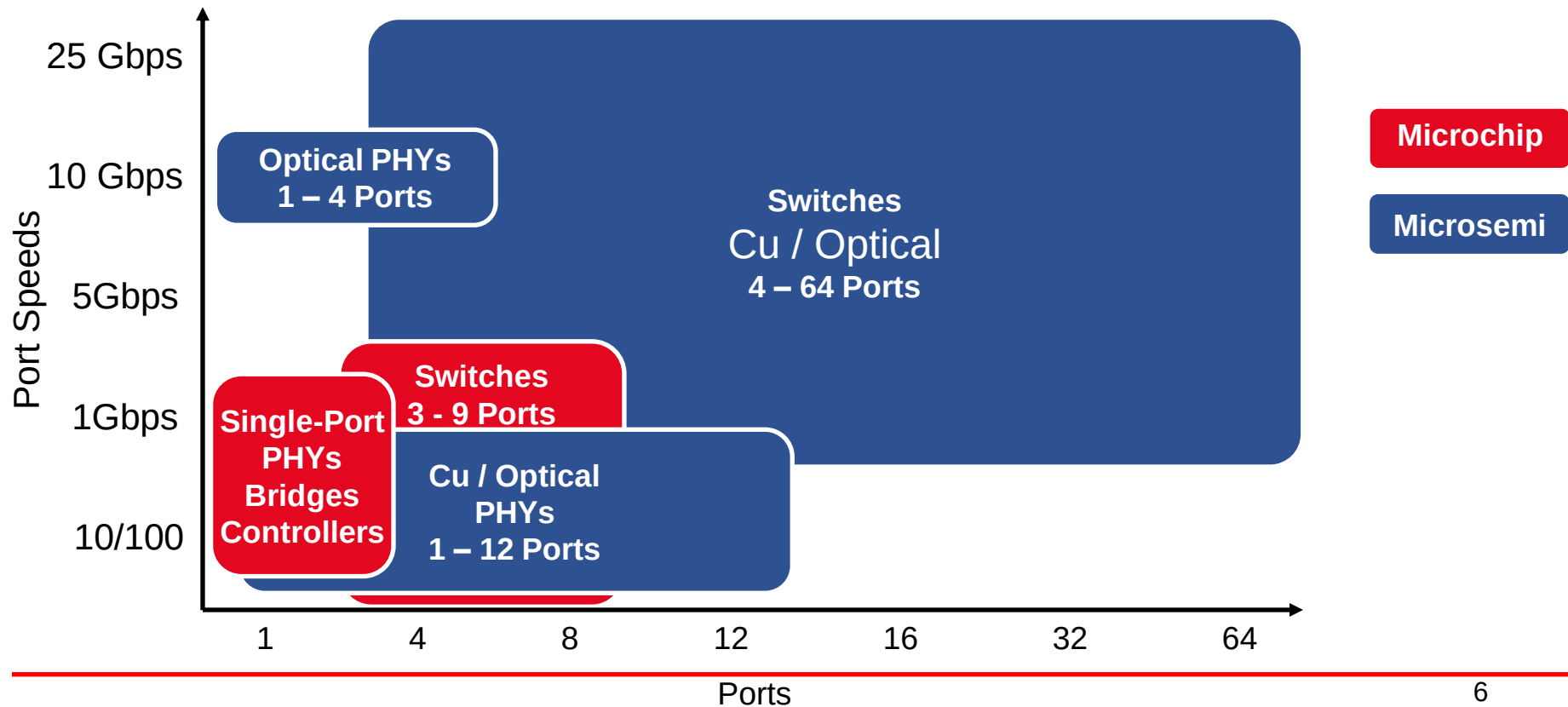
Our Heritage



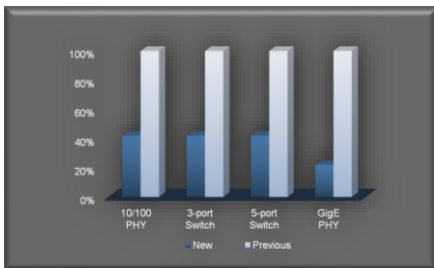
Ethernet Portfolio



Microchip / Microsemi Ethernet

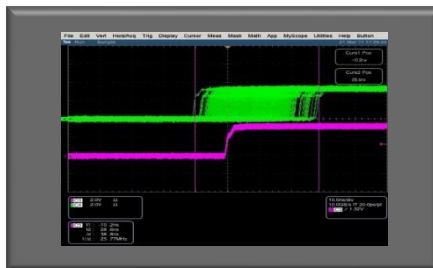


Ethernet Technology Differentiators



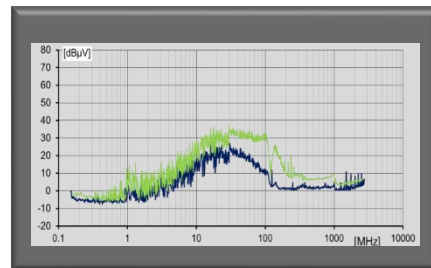
Energy Efficient

- Ultra-low power Ethernet PHY
- **EtherGreen™** Advanced Power Management
- **Ultra Deep Sleep** uA Standby
- Highly Integrated, Reduced BOM, Small Packages



Deterministic

- **EtherSynch®** IEEE 1588v2 / 802.1AS synchronization
- Fixed / Low Latency transmission
- AVB / Time Aware Traffic Scheduling

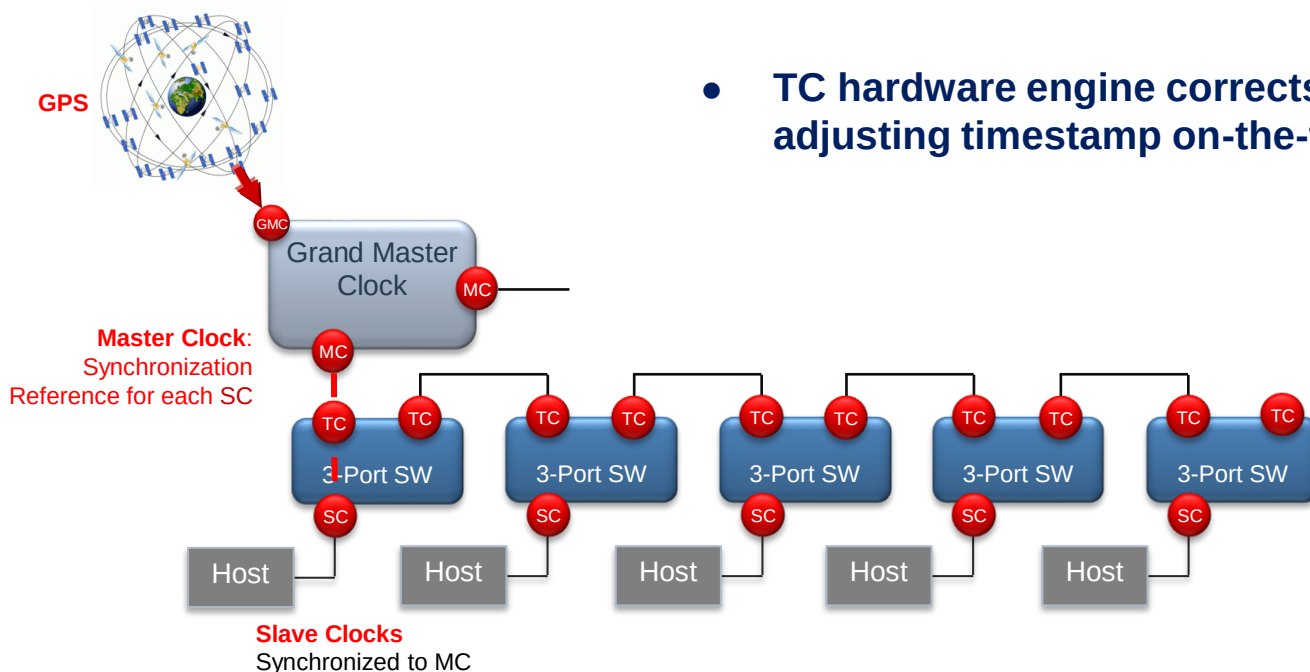


Reliability

- **Quiet-WIRE®** Enhanced EMC
- **LinkMD®+** Diagnostics (SQI*)
- Network Fault Recovery

- **Robust energy efficient Ethernet for time sensitive networks**

* SQI – Signal Quality Indicator



- TC hardware engine corrects for switch delays by adjusting timestamp on-the-fly

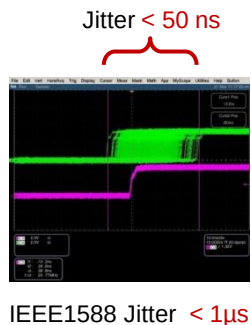
EtherSynch™ Time Synchronization

Deterministic

- Ethernet communications and IEEE 1588v2 / 802.1AS network synchronization
 - Single media, reduces cabling complexities
- Hardware-assisted protocol support, reducing CPU overheads
- Significantly reduces size, power consumption and BOM cost
- Superior jitter performance (10x specification)
- Device-layer Precision GPIO support
- Pre-qualified license-free PTP software stack



Synchronization made
Simple!



EtherSynch[®]

Deterministic Switch Engine

Deterministic

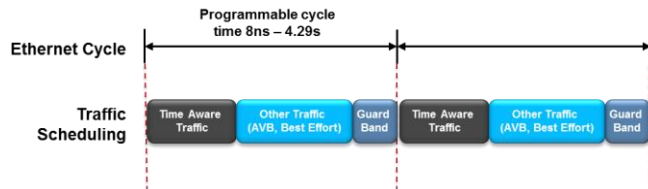
- **Full AVB / IEEE1588v2 Support**

- Time synchronization acc. IEEE 1588v2 / 802.1AS
- 802.1Qat Stream Reservation, 802.1Qav Traffic Shaper



- **Time Aware Traffic Scheduler IEEE 802.1Qbv**

- Periodic scheduling reserved for time-critical class traffic
- Time sensitive Control



- **Low Latency**

- 'Smart' **cut-through** Time-Aware traffic forwarding
- 64-byte 'store-and-stream'
- 10X Switch latency reduction
 - Eg. <1uS for GigE

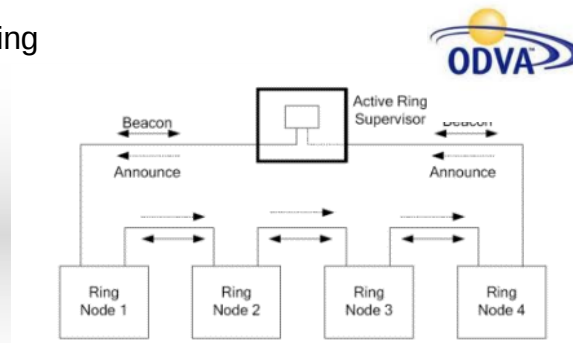
**Time-Sensitive
Networks (TSN)**

EtherREL™ Fault Recovery

- **Hardware support for common Redundancy protocols**
 - Reduces CPU burden, reduces / eliminates downtime
 - Support methods such as RSTP, MSTP and Source Address Filtering

- **Device Layer Ring (DLR)**

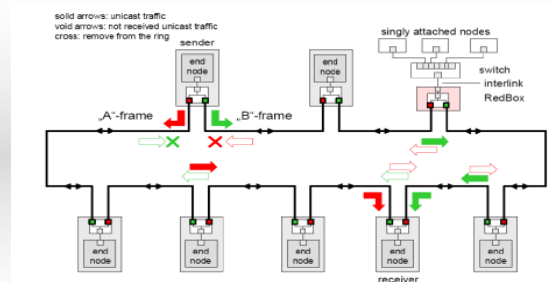
- Beacon based fault detection for ring
- Single fault switchover redundancy
- Ethernet/IP



IEC 62439-3

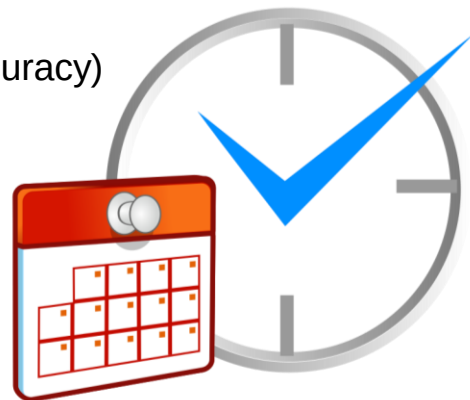
- **High availability Seamless Redundancy (HSR)**

- Duplicate packet based redundancy
- Single fault seamless (instant) switchover
- IEC 61850 substation automation



TSN Standards Supported in SparX-5i

- **Shapers**
 - 802.1Qbv (Time Aware Scheduling)
 - 802.1Qch (Cyclic Queuing and Forwarding)
- **TSN Stream Policing**
 - 802.1Qci (Per-Stream Filtering and Policing)
- **High Precision Time Synchronization**
 - 1588 (target timestamping performance: 10 pS resolution, 1 nS accuracy)
 - 802.1AS-Rev
- **Redundancy**
 - 802.1CB (Seamless redundancy, FRER)
 - Also standard Linear and Ring protection
- **Delay reduction**
 - 802.1Qbu (pre-emption)
 - Cut-through



ETHERNET SWITCHES

Ethernet Switch Portfolio

Performance

- EtherSynch[®] IEEE 1588v2 / 802.1AS Time synchronization
- Full AVB support with Time Aware Traffic Scheduler
- Extensive packet processing using ACL Filtering & 802.1x
- Synchronous Ethernet (SyncE) Clock support

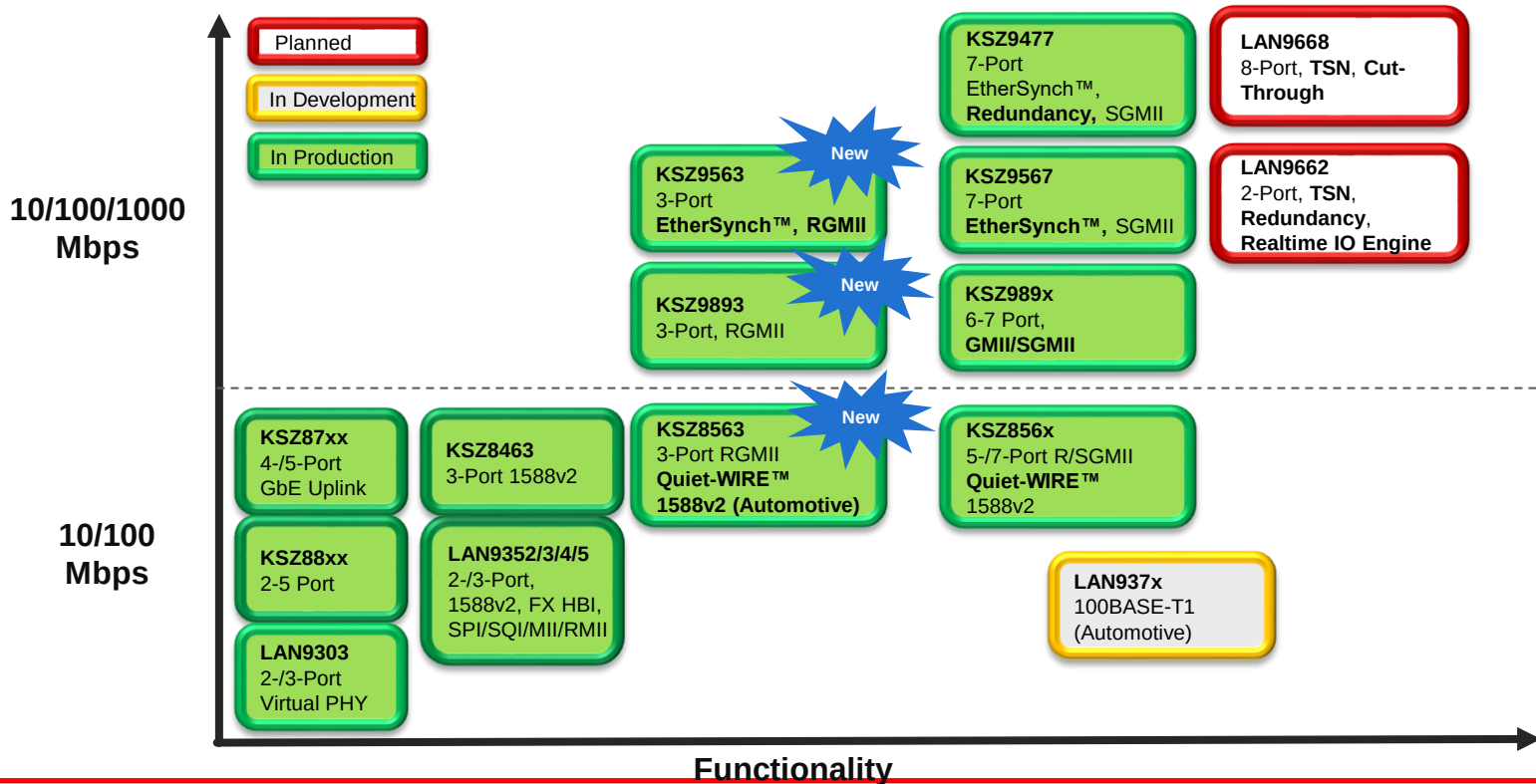
Integration / Flexibility

- Small Package (64-QFN, 128-LQFP, 176-LQFP)
- GMII / SGMII / RGMII / MII / RMII Processor MAC interface
- In Band / SPI / I2C / MII Management
- Precision GPIO

Energy Efficiency

- Low Power integrated Gigabit Ethernet PHYs
- Energy Efficient Ethernet (EEE) & Wake-on-LAN (WoL)
- Device, Per-Port & Energy Detect Power Down
- Flexible IO Power supply

Industrial Switch Roadmap



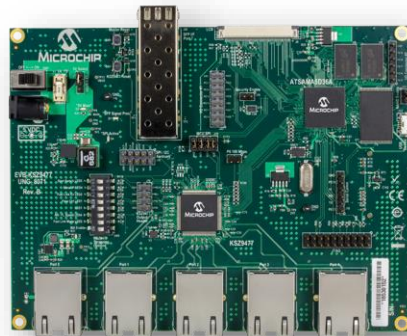
'KSZ' Ethernet Product Family Overview

	KSZ8081/81		KSZ9031		KSZ8061		KSZ86xx		KSZ84xx		KSZ87xx		KSZ856x		KSZ989x		KSZ956x		KSZ947x	
Description	Single-Port 10/100 PHY	Single-Port GigE PHY	Single-Port 10/100 PHY	3-5 Port 10/100 Switch	1-3 Port 10/100 Switch/Ctrl	4-5 Port 10/100 Switch w/ GigE uplink	3,5,7 Port 10/100 Switch	3, 6, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch	3, 7 Port GigE Switch
I-Temp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
802.3az EEE	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wake-on-LAN	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fixed PHY Latency	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fast Link Up			✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
LinkMD™	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
LinkMD+™			✓				✓													✓
Ultra Deep Sleep			✓																	
Quiet-WIRE™			✓					✓												✓
1000Base-FX								✓						✓	✓	✓	✓	✓	✓	✓
In Band Managment								✓						✓	✓	✓	✓	✓	✓	✓
SNMP/RMON	N/A	N/A	N/A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Port, 802.1p, Diff Serv QoS	N/A	N/A	N/A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
802.1q VLAN	N/A	N/A	N/A	16	16	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
802.1x & ACL Authentication	N/A	N/A	N/A			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EtherSynch™ IEEE1588v2					✓		✓								✓	✓	✓	✓	✓	✓
Precision GPIO					✓		✓									✓	✓	✓	✓	✓
AVB							✓									✓	✓	✓	✓	✓
Time Aware Scheduler							✓									✓	✓	✓	✓	✓
Low Latency Cut-Through	N/A	N/A	N/A				✓									✓	✓	✓	✓	✓
Synchronous Ethernet							✓									✓	✓	✓	✓	✓
RSTP / MSTP	N/A	N/A	N/A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EtherREL™ Redundancy																				✓
	PHY Transceivers			Fast Ethernet Switches						GbE Switches										

GigE Evaluation Boards

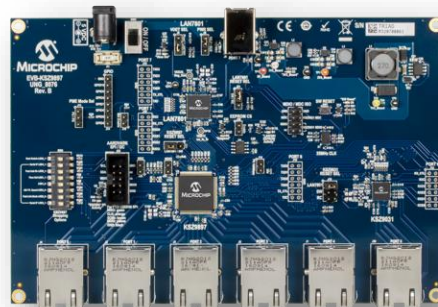
- **Host and Switch EVB**

- SAM A5D3 Processor
 - Demonstrates advanced features
- SGMII Connector
- 5-Ports RJ-45
- \$250 (#EVB-KSZ9477)



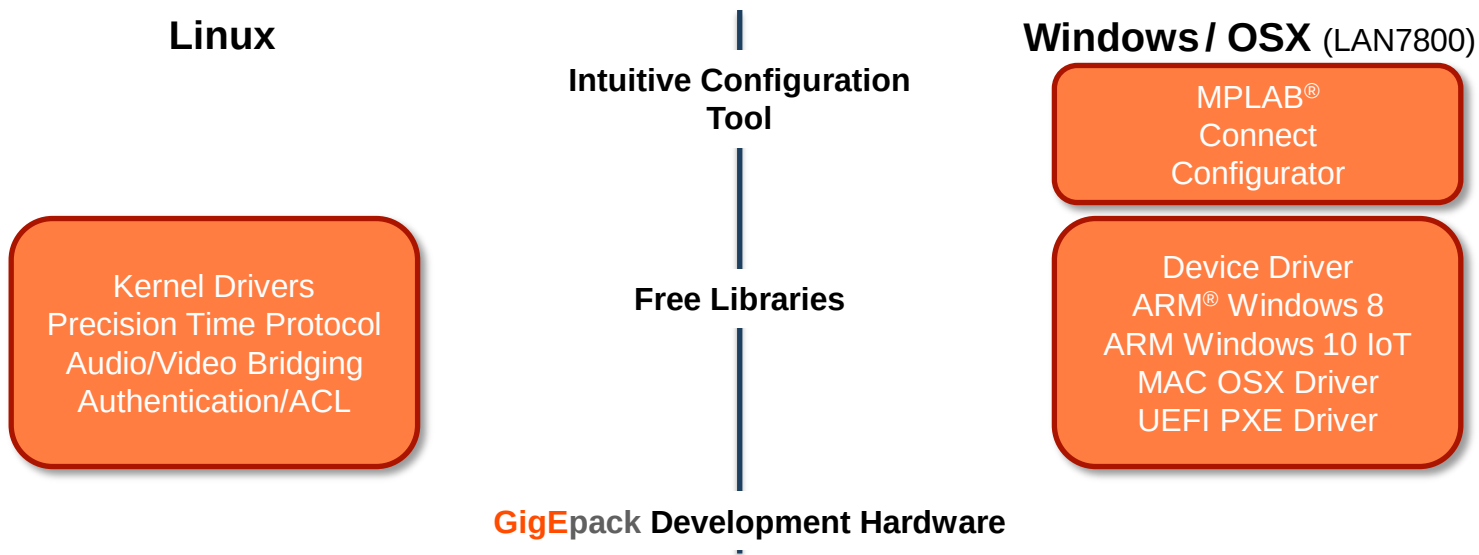
- **Unmanaged Switch EVB**

- Also includes:
 - LAN7801 (USB-to-GigE Bridge)
 - KSZ9031 (GigE PHY)
- 6-Ports and USB
- \$250 (#EVB-KSZ9897)



Powerful Tool Chains

Linux®, Windows® and OSX Development Paths



SAM A5D2 Xplained



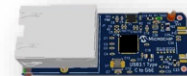
EVB-KSZ9477



EVB-KSZ9897



EVB-LAN7800



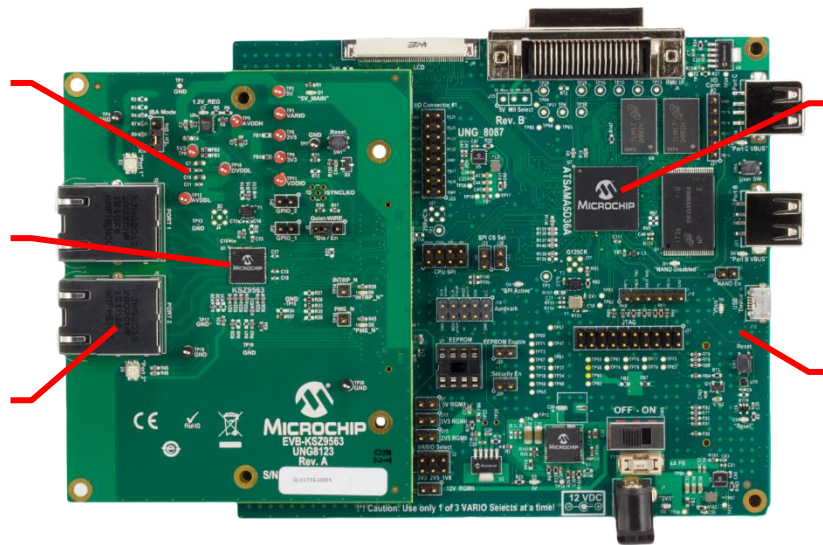
EVB-LAN7800LC

Ethernet Development System

Variety of
Low-Cost
Ethernet Cards

EVB-KSZ9563
3-port Switch
Card

2 Gigabit PHYs
1x RGMII

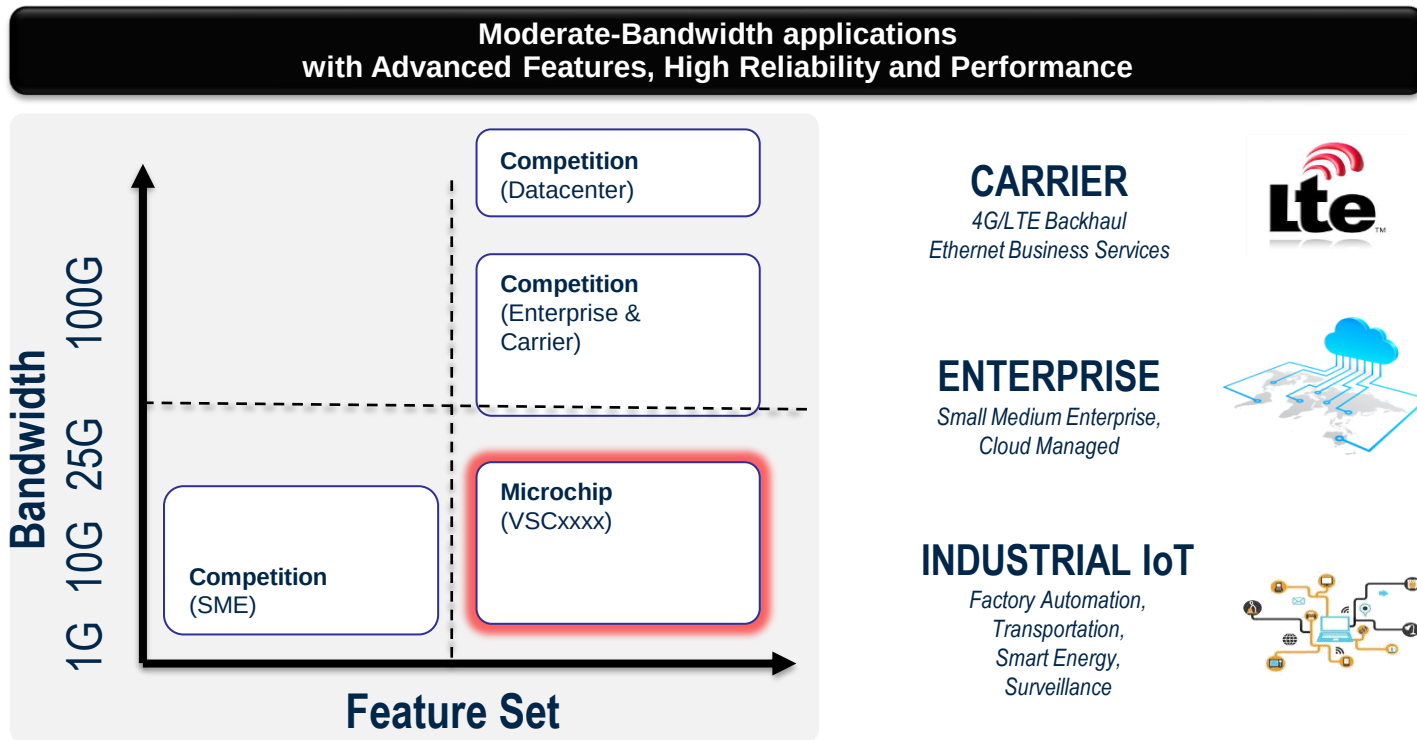


SAMA5D3
Linux®
Host Processor
Basic
Driver
AVB
IEEE1588
Security

Low Cost, Reusable
Ethernet
Development System
Base Board
SAMA5D3-EDS

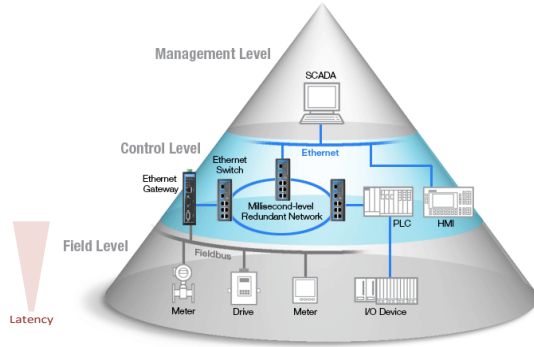
ENTERPRISE & INDUSTRIAL SWITCHES

Optimized Architecture for Target Markets



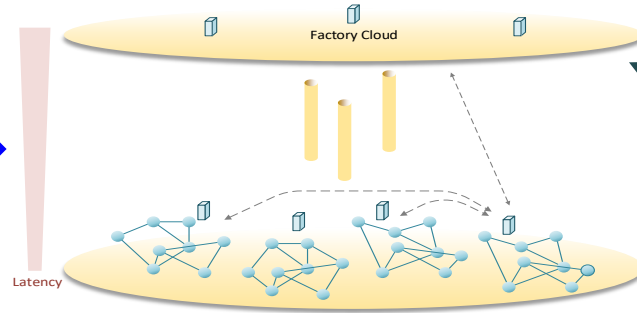
MCHP IIoT Product Strategy

Industrie 3.0



- Hierarchical network, strict separation between OT and IT
- OT dominated by field busses
- Ethernet, in different flavours

Industrie 4.0



- Increase in number of IoT devices
- IT/OT-distinction blurring
- Local cloud-nodes (Fog) and in-factory data centers for low latency, distributed processing

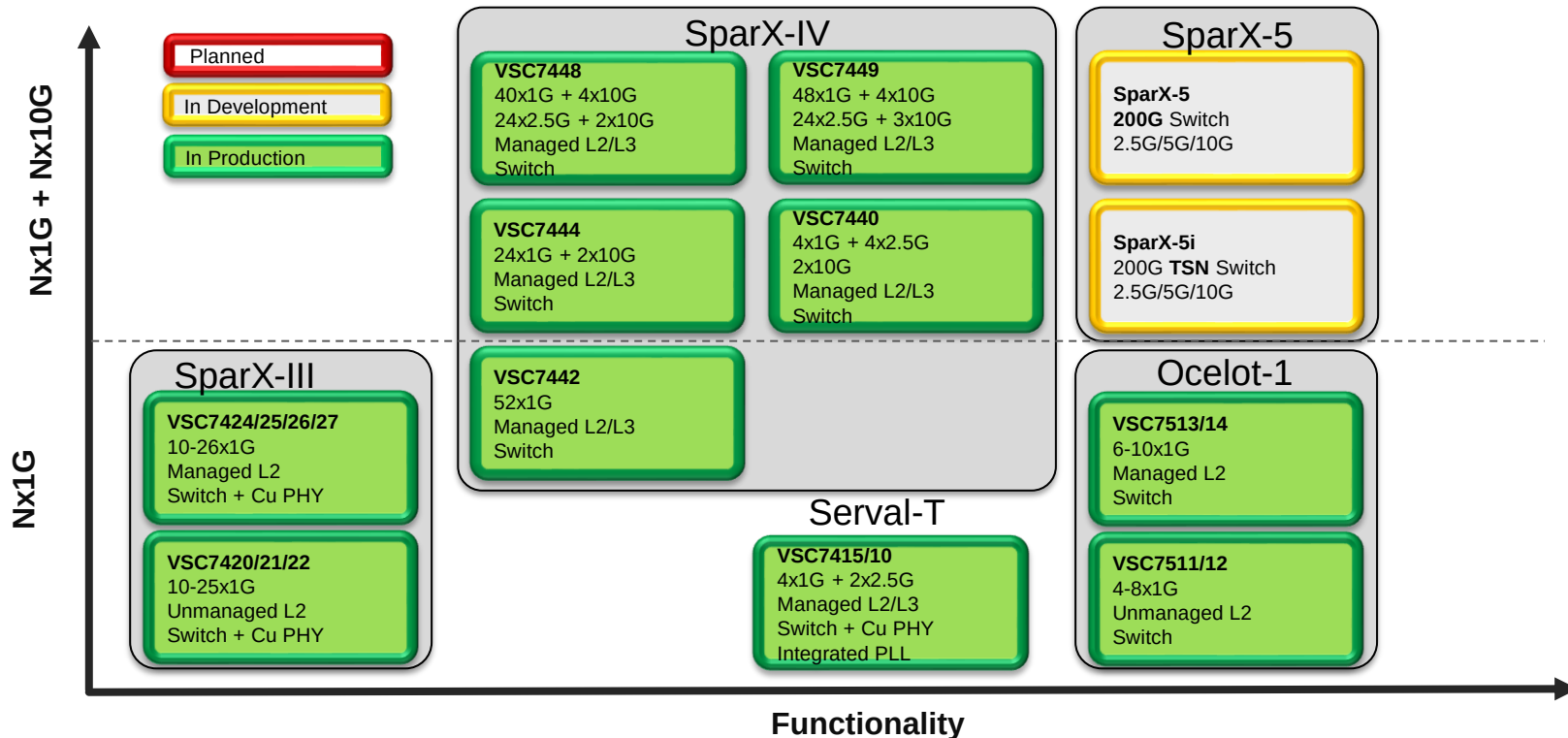
SparX-5i
8x25G, 16x1G
32x2.5G/5G

Laguna
24x1GE
2x10GE

LAN9662/8
2/8x 1G End
Node

**Same TSN
across
platforms**

Enterprise/Industrial Switch Roadmap



SparX-5

Next Gen Enterprise Ethernet Switches

- **Various Configurations Supported**
- **Limiting Factors:**
 - Bandwidth
 - Number of SerDes

Part	Total Bandwidth	1G Ports	2.5G Ports	5G Ports	10G Ports	25G Ports
VSC7546	64Gb	64x	24x	12x	6x	
VSC7549	90Gb	64x	36x	18x	9x	
VSC7552	128Gb	64x	48x	24x	12x	4x
VSC7556	160Gb	64x	64x	32x	16x	6x
VSC7558	200Gb	64x	64x	32x	20x	8x

Note: up to 24x 100Base-FX ports available on all SKUs

SparX-5i

TSN Enterprise Ethernet Switches

- Various Configurations Supported
- Supports IEEE Time Sensitive Networking (TSN) Protocols
 - (See next slide)
- Limiting Factors:
 - Bandwidth
 - Number of SerDes

Part	Total Bandwidth	1G Ports	2.5G Ports	5G Ports	10G Ports	25G Ports
VSC7546	64Gb	64x	24x	12x	6x	
VSC7549	90Gb	64x	36x	18x	9x	
VSC7552	128Gb	64x	48x	24x	12x	4x
VSC7556	160Gb	64x	64x	32x	16x	6x
VSC7558	200Gb	64x	64x	32x	20x	8x

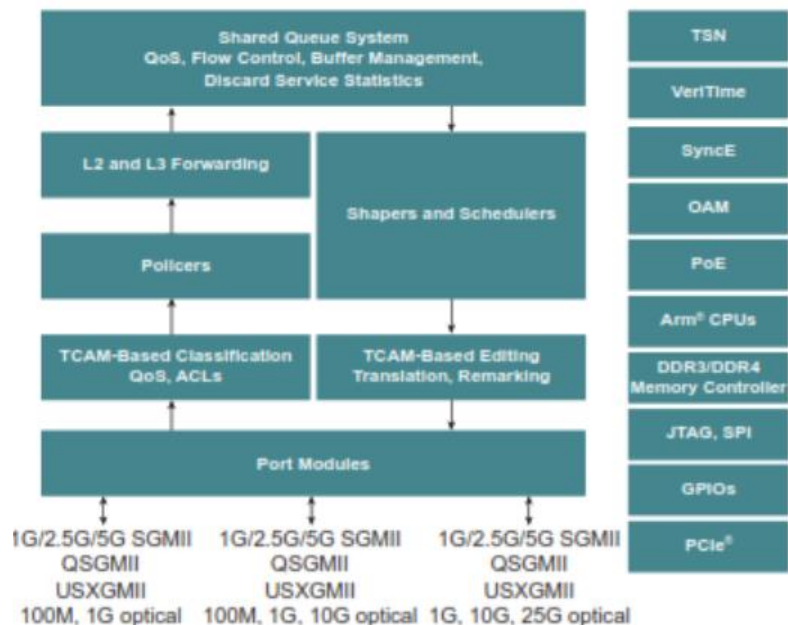
Note: up to 24x 100Base-FX ports available on all SKUs

TSN Standards Supported in SparX-5i

- **Shapers**
 - 802.1Qbv (Time Aware Scheduling)
 - 802.1Qch (Cyclic Queuing and Forwarding)
- **TSN Stream Policing**
 - 802.1Qci (Per-Stream Filtering and Policing)
- **High Precision Time Synchronization**
 - IEEE1588 (Time Stamping)
 - 802.1AS-Rev
- **Redundancy**
 - 802.1CB (Seamless redundancy, FRER)
 - Also standard Linear and Ring protection
- **Delay reduction**
 - 802.1Qbu (Frame pre-emption)
 - Cut-through

24x1G + 4x 10G L2/L3 TSN Switch: VSC7546TSN

Features	Support
Bandwidth	100Base-FX, 1/2.5/5/10/25GbE
MAC Interface	SGMII / QSGMII / USXGMII
Precision Timing	IEEE1588 Precision Timing Protocol 802.1AS-Rev
Advanced Features	Integrated PoE Controller G.8032 Support Full TSN Support
TSN Features	802.1Qbv – Time Aware Scheduling 802.1Qch – Queueing/Forwarding 802.1Qci – Stream Policing 802.1Qbu – Frame Pre-emption / Cut-through 802.1CB – Seamless Redundancy
Power Management	Energy Efficient Ethernet (802.3az) Wake-on-LAN (WoL)
Temperature	-40 to 110°* *Junction Temperature
Packages	888-pin FCBGA (25x25mm)
Applications	Industrial, SMB, L2 switch, L3 Routing
Software	Comprehensive API Turn-key SDKs



ETHERNET SOFTWARE SOLUTIONS

Ethernet Software Product Family

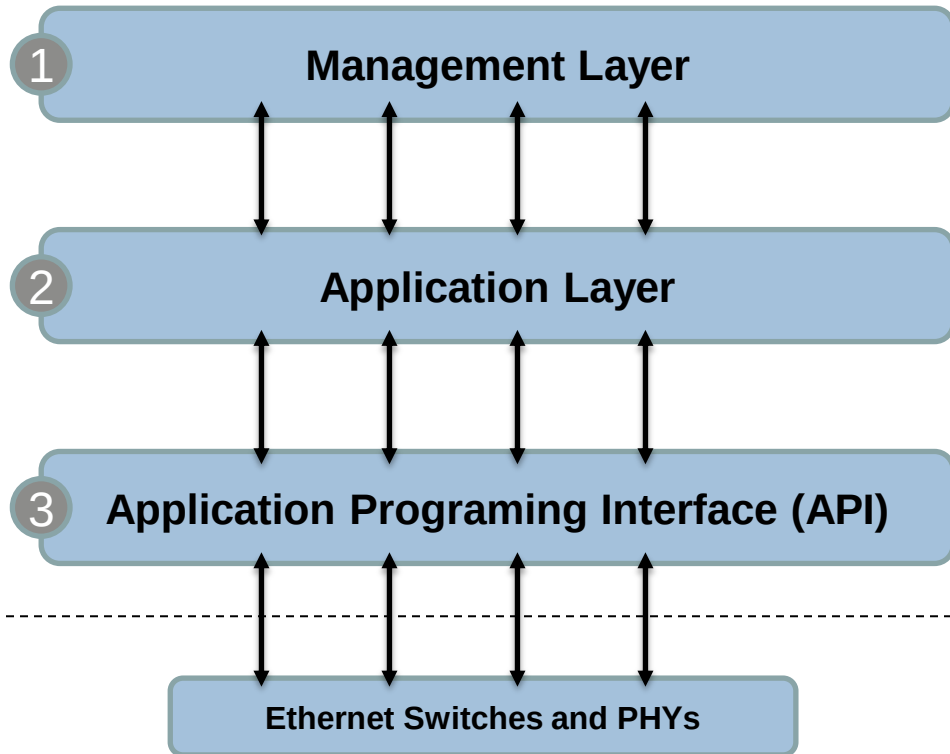
Applications For Managed Switches with Internal Processor



WebStaX Linux: VSC6819	SMBStaX Linux: VSC6816	ISaX Linux: VSC6817	CEServices Linux: VSC6818
Basic Layer 2 Enterprise managed switching for • SMB • Enterprise • Commercial	Advanced Layer 2+ Enterprise managed switching for • SMB, SME • Large Enterprise • Commercial	Industrial Ethernet switching for • Industrial automation • Smart grid • Intelligent transportation	Carrier Ethernet switching for • Tier 1/2/3 Telco • Multiple-system operators (MSOs) • Wireless backhaul
Applications for 8051-based Switches	API (Application Programming Interface) for All Switches/PHYs	Support For Switches	For All Switches/PHYs
WebConfig/Unmanaged VSC6811 For VSC7420/1/2 Switches Click-through licensed	Unified API VSC6802 Click-through licensed	Board BSP LINUX Open Source Board Support Package	Maintenance VSC9990-xxxx Software maintenance
Ocelot Unmanaged VSC6825 For VSC7511/2 Switches Click-through licensed	ETH API VSC6803 Click-through licensed		

Interfacing with Ethernet Switches

- **Customer interface with Ethernet switches at three layers:**
 - (1) Management Layer,
 - (2) Application Layer, or
 - (3) API (Driver) Layer
- **Direct register access not supported**



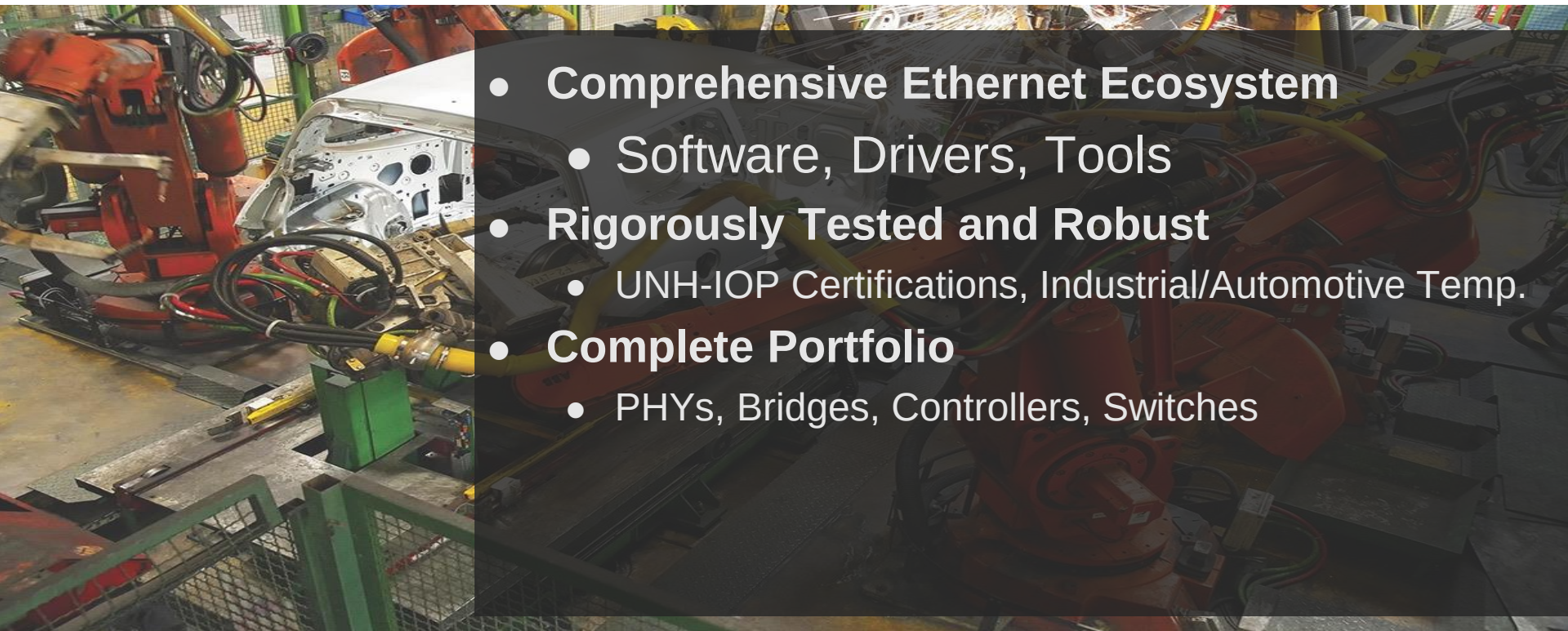
Linux Managed Ethernet Software Applications

Category	Feature	Enterprise		IoT	Service Provider
		WebStaX	SMBStaX	IStaX	CEServices
Port Control	Speed, mode, flow control, frame size, status, statistics, SFP type, PoE	✓	✓	✓	✓
Management	WebGUI, DHCP client, industry-standard CLI and configuration, HTTP server, HTTPS	✓	✓	✓	✓
L2 Switching	VLAN trunking, IEEE-802.1D bridging, IEEE-802.1Q VLANs, IEEE-802.1AD (QinQ), loop guard, IEEE 802.1Q RSTP, IEEE 802.3AD (LAG), IGMPv2 snooping, port mirroring	✓	✓	✓	✓
QoS	Traffic classes, priority, storm control, port policing, shaping, ACLs	✓	✓	✓	✓
Power Management	EcoEthernet™ (ActiPHY™, PerfectReach™, Energy Efficient Ethernet, LED power management, thermal protection and adaptive fan control)	✓	✓	✓	✓
Advanced Management	iCLI Telnet, JSON-RPC, SNMP/Private MIBS DHCP IPv6 client, DHCP server, DNS client, SSHv2, IPv6 management, Radius client, RMON, sFlow		✓	✓	✓
Advanced L2 Switching	MAC, Protocol and IP subnet VLANs, GVRP, MSTP, IGMP v3 snooping, MLDv1/2 snooping, MVR, DHCP snooping, Flow mirroring/Rmirror		✓	✓	✓
L3 Switching	L3 Forwarding, DHCP opt 82, uPnP		✓	✓	✓
Security	Single & Multiple 802.1X, RADIUS Accounting, MAC Limit, IP/MAC binding, TACACS+, IP source guard		✓	✓	✓
Advanced QoS	Queue Policers, DiffServ, tag remarking Service Policers, H-QoS		✓	✓	✓
Synchronization	IEEE 1588.v2, Microsemi Servo compatibility SyncE			✓	✓
Protection	1+1, 1:1, 1:N port protection, G.8032 ERPS			✓	✓
Carrier Ethernet	E-LINE, E-LAN, E-TREE, E-ACCESS				✓
OAM	IEEE 802.3ah, IEEE 802.1ag, Y.1731, RFC2544, Performance Monitoring, Y.1564 (SAT)			(✓)	✓
Transport	MPLS-TP (Serval-1 family only with latest release)				✓

Software Packages

Software Package	eCOS OS	Linux OS	Description
Unified API	VSC6802		API for Switches/PHYs
ETH API	VSC6803		API for Switches/PHYs
WebStaX APPL	VSC6812	VSC6819	Basic L2 managed
SMBStaX APPL	VSC6813	VSC6816	Advanced L2 managed
IStaX APPL	VSC6815	VSC6817	Industrial temp and 1588v2 support, managed L2 IoT software
CE Services APPL	VSC6810	VSC6818	Carrier Ethernet software
Ocelot Unmanaged	VSC6825		For VSC7511/VSC7512 unmanaged
WebConfig/Unmanaged	VSC6811		For 8051 embedded controller ICs
Linux BSP			Runs on the internal CPU

Making the Complex Accessible



- **Comprehensive Ethernet Ecosystem**
 - Software, Drivers, Tools
- **Rigorously Tested and Robust**
 - UNH-IOP Certifications, Industrial/Automotive Temp.
- **Complete Portfolio**
 - PHYs, Bridges, Controllers, Switches

Thank you