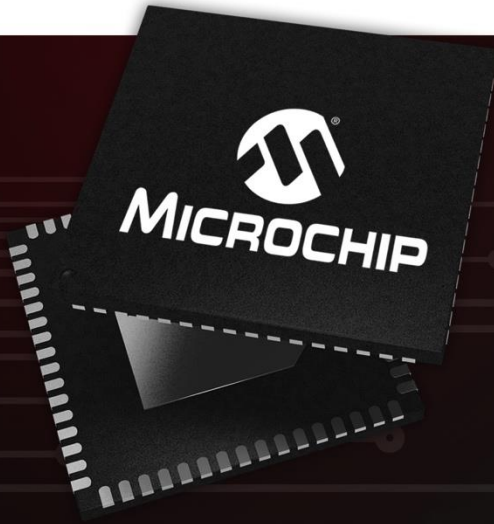




# MICROCHIP

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



***Transitioning to Automotive Ethernet – 10 Mbps to 10 Gbps and beyond***

*Mike Jones, Bernd Sostawa  
24<sup>th</sup> September 2019*

# Overview

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- **Brief Introduction to Microchip Automotive**
- **Service Orientated Architecture (SoA)**
- **Example of Zonal System Architecture**
- **Case Study**
  - Service-orientated communication – Sensor cluster example
  - Migration to 10BASE-T1S technology

# Microchip Overview

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- **Leading Total Systems Solutions provider:**
  - Microcontrollers, Digital Signal Controllers and Microprocessors
  - Mixed-Signal, Analog, Interface and Security
  - Clock and Timing
  - Wireless and Wired Connectivity
  - FPGA
  - Memory
- **~ \$6 Billion revenue run rate**
- **~19,000 employees**
- **HQ near Phoenix, AZ**



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# Microchip in Automotive

- Top 10 worldwide automotive semiconductor supplier
- 25+ years proven track record delivering global solutions



# Automotive Connectivity

## Proven Track Record

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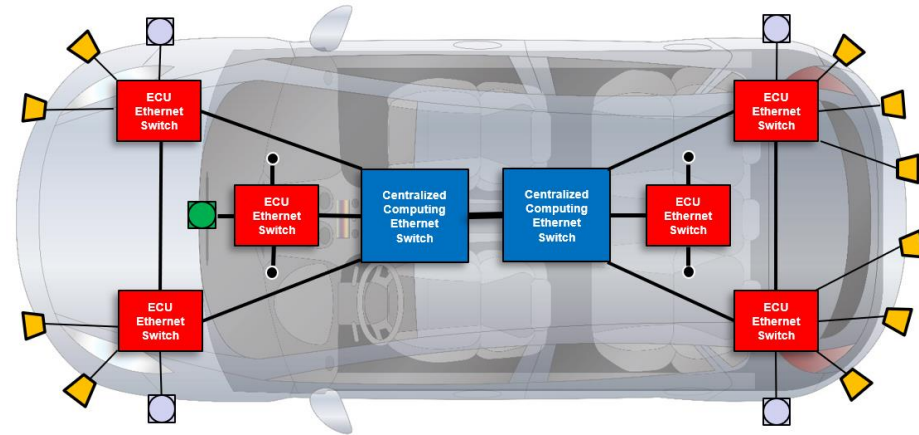


- **>1 Billion CAN & LIN devices shipped**
- **>600 Million total shipped**
  - MOST INICs
  - Ethernet ports
  - USB media boxes deployed

**>1.7 billion devices shipped to more than 220 car models**

# Service Orientated Architecture (SoA)

- Zonal ECUs with centralized computing
- Any service can be accessed anywhere in vehicle (SDN)
- Increases the need for Ethernet in-vehicle networking

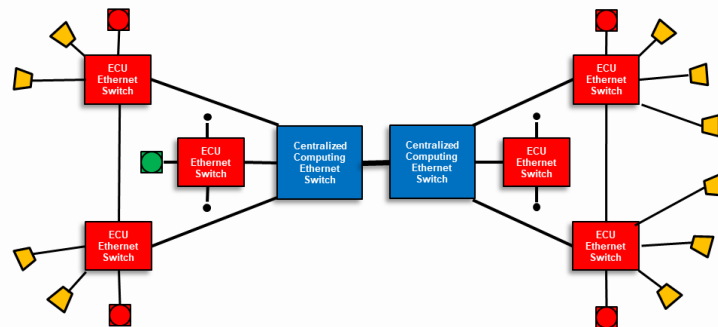


- Ubiquitous Ethernet network 1 Mbps to 10 Gbps

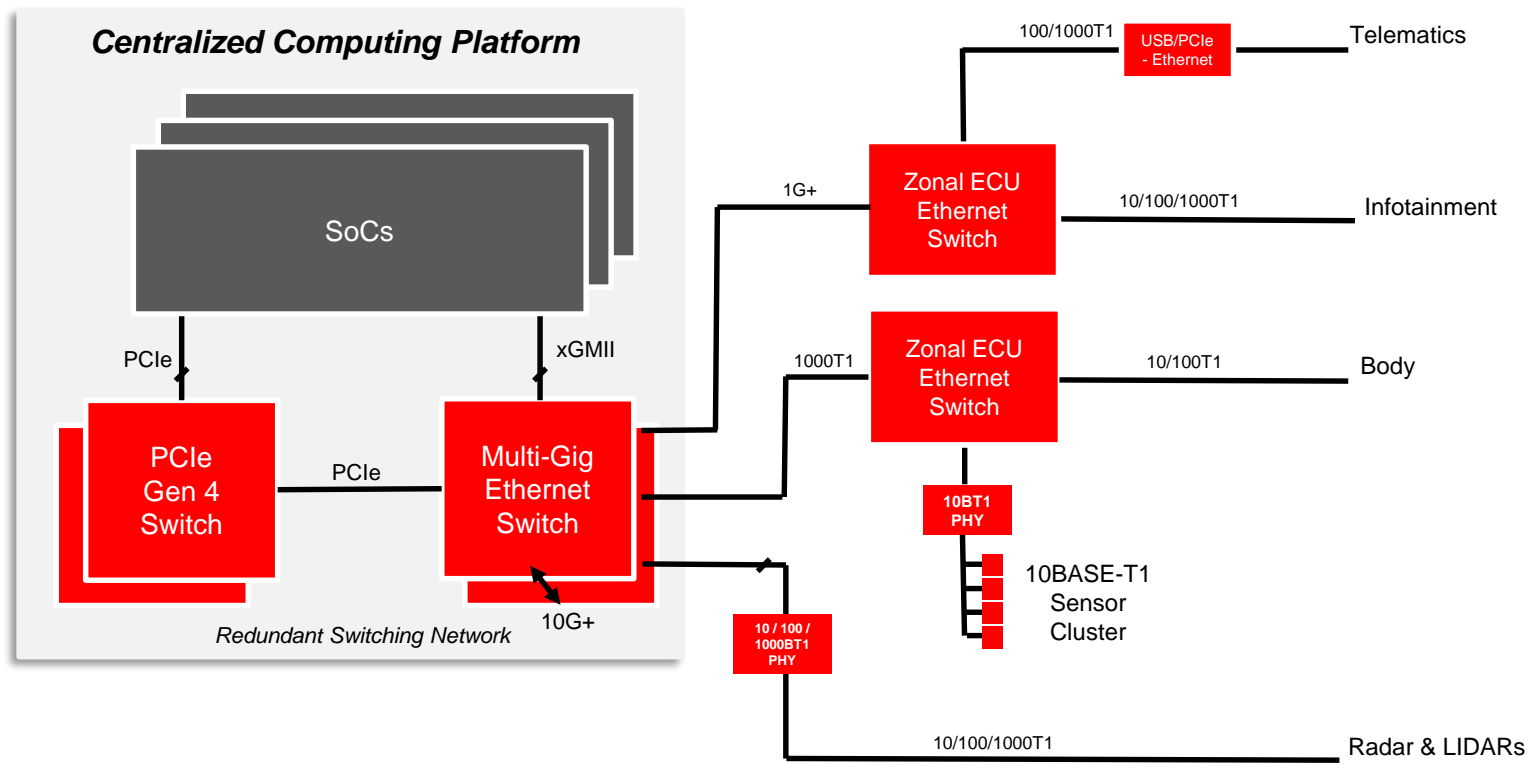
# Benefits of 'All-Ethernet' IVN

- High bandwidth data transfer
- Reduction in need for gateways
- Seamless connectivity cloud to device
- Reduction of software development
- Flexibility and scalability
- Faster time-to-market

• Lower overall cost of ownership



# Example Zonal System Solution





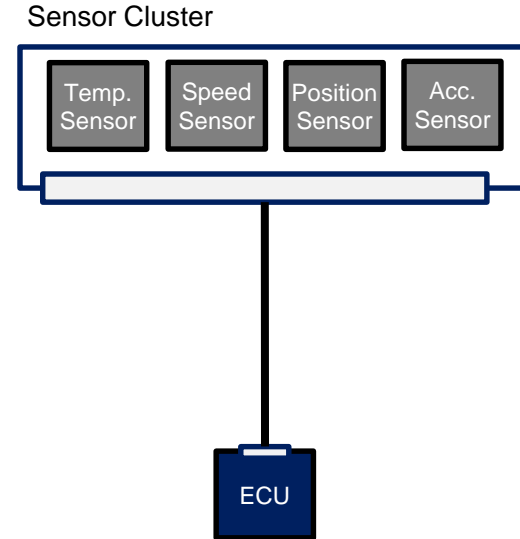


# **Service-oriented Communication, Sensor Cluster Example**

# Sensor Cluster Introduction

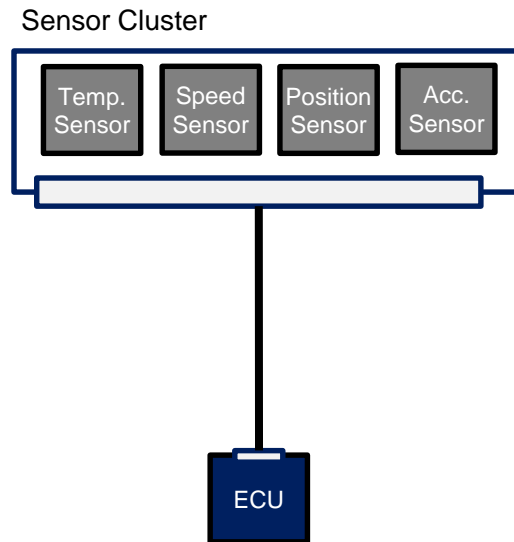
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- **Today, there are multiple sensor clusters in a car**
  - Seat
  - Bumper
  - Door
  - Gearbox
  - Etc.



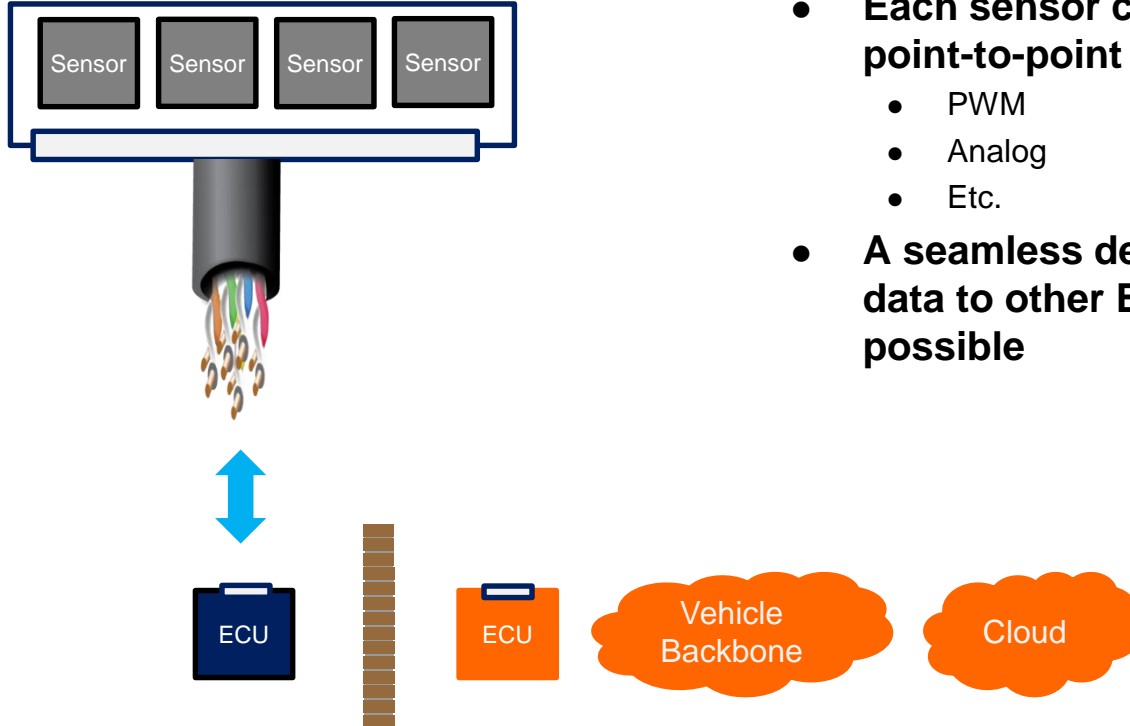
# Sensor Cluster Introduction

- A sensor cluster today is part of a fixed application defined during the car's design
- On PCs, tablets or smartphones new applications can be added during entire device life cycle
- Why don't we see this in cars today?



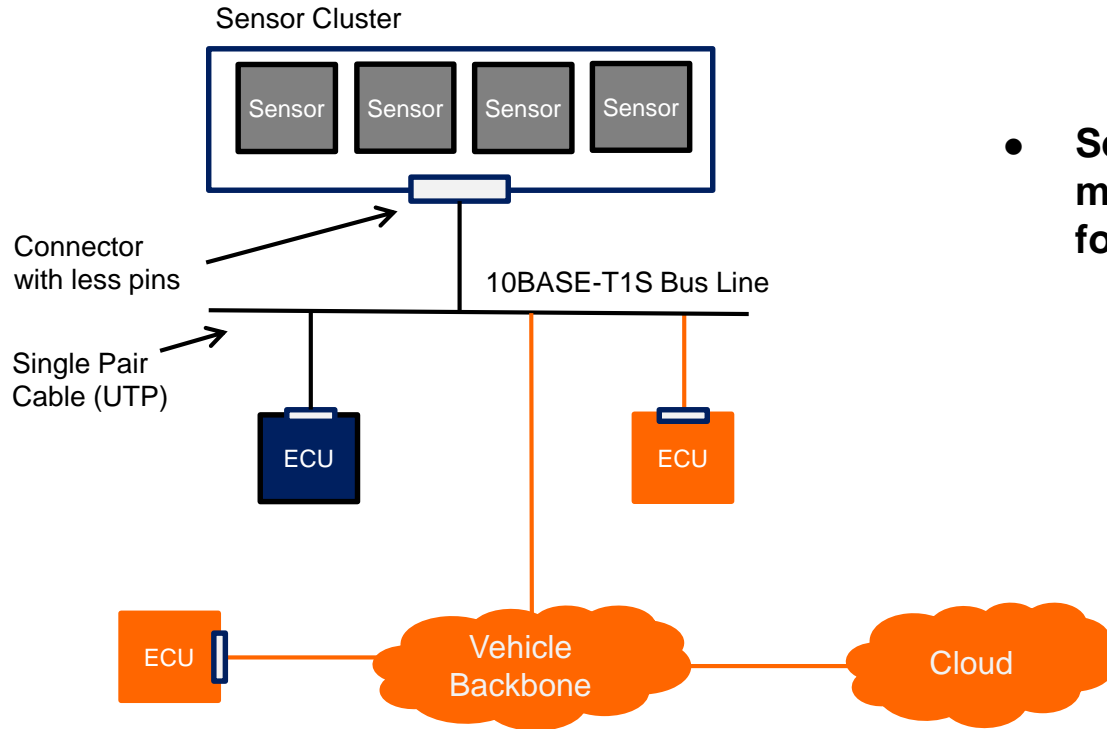
# “Classic” Sensor Cluster

Sensor Cluster



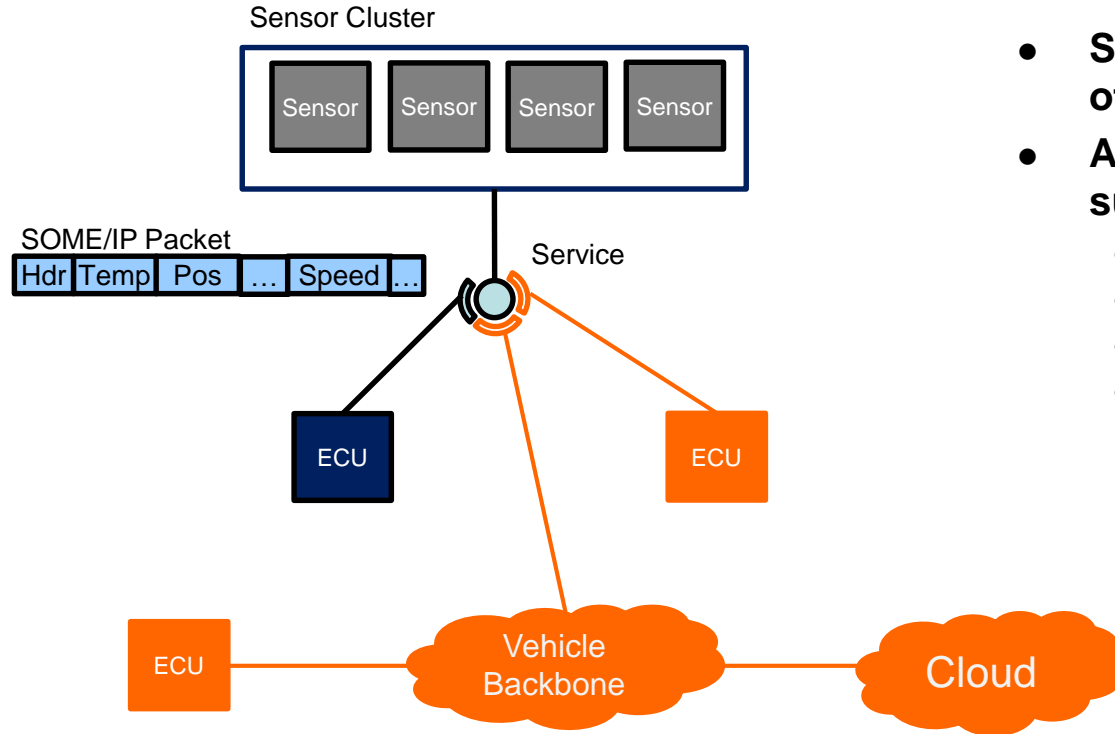
- **Each sensor cluster uses heterogeneous point-to-point connections**
  - PWM
  - Analog
  - Etc.
- **A seamless delivery of the sensor cluster data to other ECUs or the cloud is not possible**

# Sensor Cluster with 10BASE-T1S



- **Sensor cluster data is available in multiple ECUs and can be forwarded to the cloud**

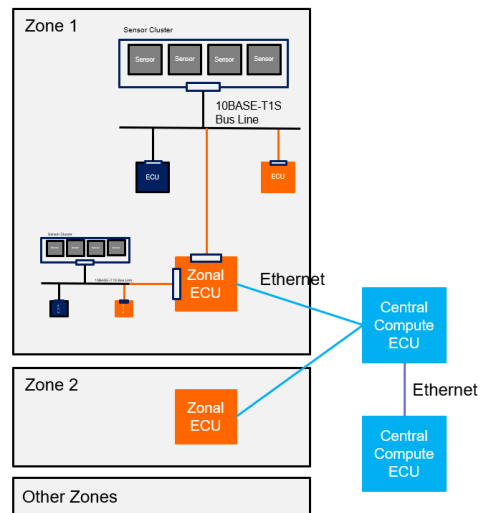
# Service-oriented Communication



- **Sensor cluster acts as server offering services**
- **Applications on different ECUs subscribe for required data**
  - Temperature
  - Speed
  - Position
  - Etc.

# All-Ethernet Vehicle

- **Common security mechanisms in all network speeds**
- **Common time base in all nodes**
  - Sensor synchronisation
  - Cruise recording
- **Supports all common network architectures**
  - Zonal
  - Domain
- **Service-oriented communication**
  - Common protocols
  - No gateways needed (switching)



# How to migrate?

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- **Identify existing or new applications**
- **Simulate system based on**
- **Optimize communication to take full advantage of Ethernet**
- **Implement**



# Simulation Configuration

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- **Imported AUTOSAR XML file with CAN cluster**
  - ECUs
  - Messages
  - Timing
- **Manually added Sensor Cluster**
- **AUTOSAR PDU Optimization (Container PDUs)**
- **Optional 10BASE-T1S features**
  - Burst
  - Multiple PLCA IDs
  - Etc.

# Simulation Result

- **Timeline**



Imported  
CAN ECUs

Messages  
from  
imported  
CAN ECUs

Sensor  
Cluster

SOME/IP  
messages

# Simulation Result

- Bandwidth
- Avg. Jitter
- Max. Jitter
- Queue Size

Frame	Bandwidth (Bit/s)	Avg Jitter (%)	Max Jitter (%)	Avg Jitter	Max Jitter	Max Queue Size
▶ Node: ECU 012	106.379	0,05 (0,13..0,01)	0,11 (0,42..0,01)	0,0172 (0,04..0,01)	0,0342 (0,08..0,01)	1
▶ Node: ECU 013	8.070	0,01 (0,01..0,01)	0,02 (0,02..0,02)	0,0084 (0,01..0,01)	0,0204 (0,02..0,02)	1
▶ Node: ECU 035	316.204	0,03 (0,11..0,00)	0,09 (0,54..0,00)	0,0130 (0,02..0,01)	0,0265 (0,11..0,02)	2
▶ Node: ECU 075	84.370	0,05 (0,08..0,01)	0,14 (0,28..0,02)	0,0118 (0,02..0,01)	0,0321 (0,06..0,02)	1
▶ Node: ECU 081	117.384	0,02 (0,07..0,01)	0,05 (0,17..0,01)	0,0155 (0,03..0,01)	0,0396 (0,09..0,02)	2
▶ Node: ECU 089	68.963	0,03 (0,06..0,00)	0,05 (0,10..0,01)	0,0134 (0,02..0,01)	0,0227 (0,04..0,02)	1
▶ Node: ECU S. Cluster	88.428	0,11 (0,11..0,11)	0,31 (0,31..0,31)	0,0106 (0,01..0,01)	0,0310 (0,03..0,03)	1
	789.799	0,03	0,54	0,0141	0,1076	2

**Thank You!**



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