



Security, Timing synchronization, and Power saving for Automotive Ethernet

- Functional verification challenges and it's solutions.

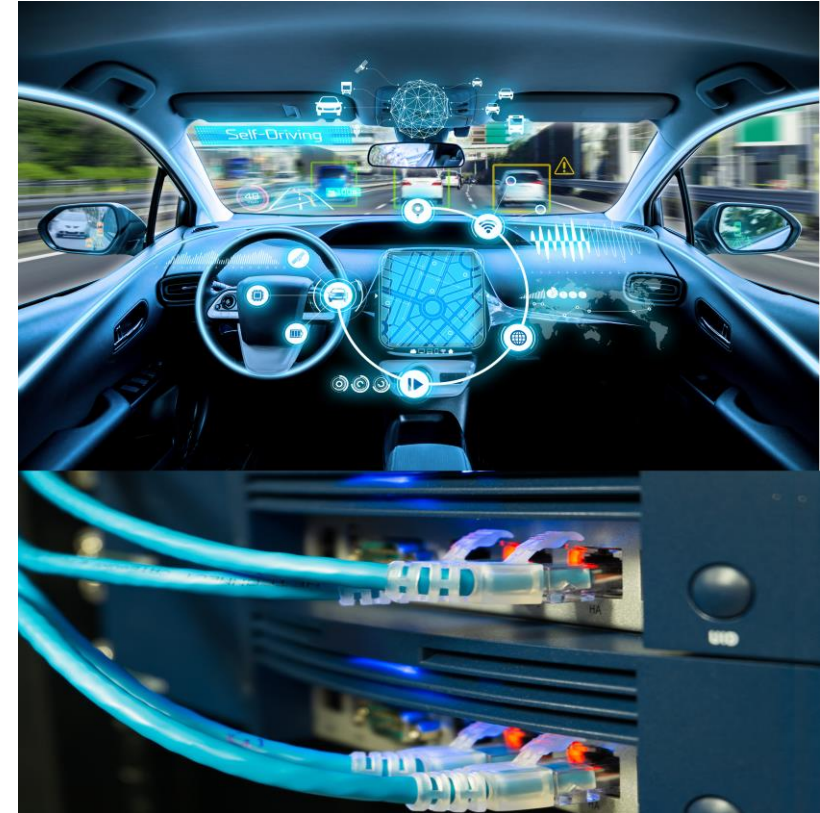
Krunal Patel, Shubham Agarwal
Cadence Design System

cādence[®]



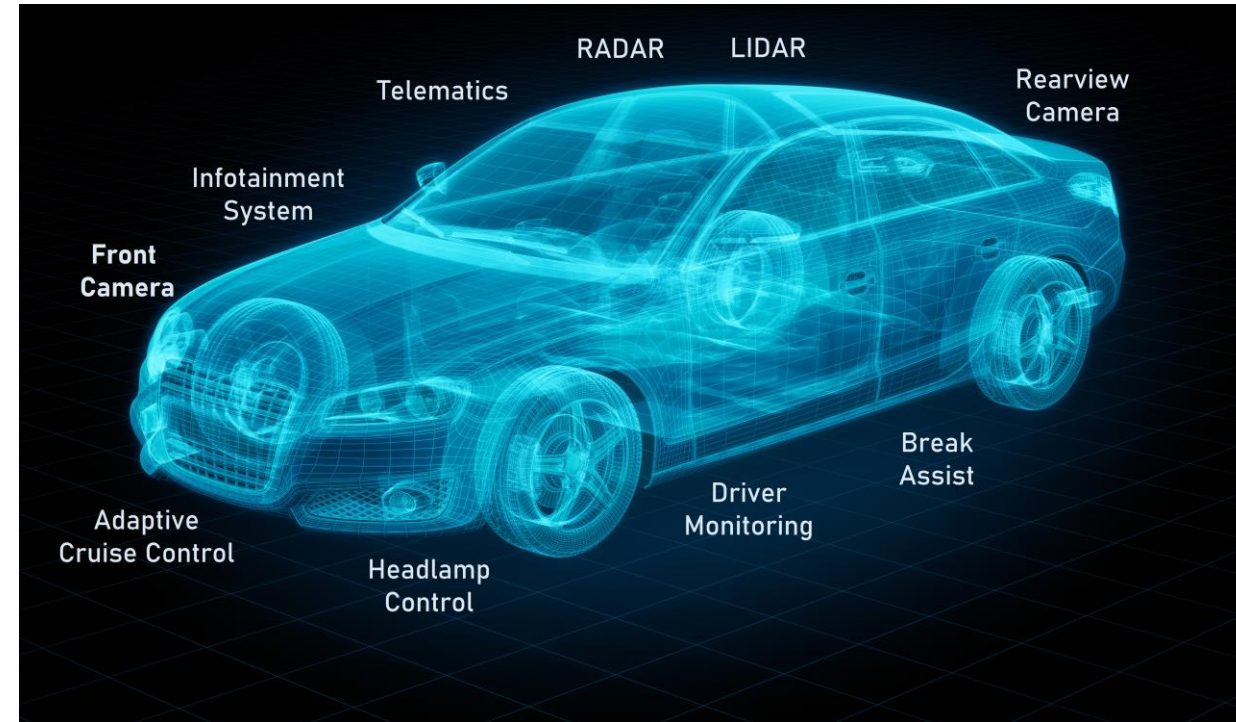
Motivation

- Rapid adoption of Ethernet in the Automotive industry.
- Automotive BaseT1 Phys.
 - 10BaseT1s, 100M/1G/2.5G BaseT1 Phys.
- Time Synchronization and Security Protocols.
 - PTP & MacSec



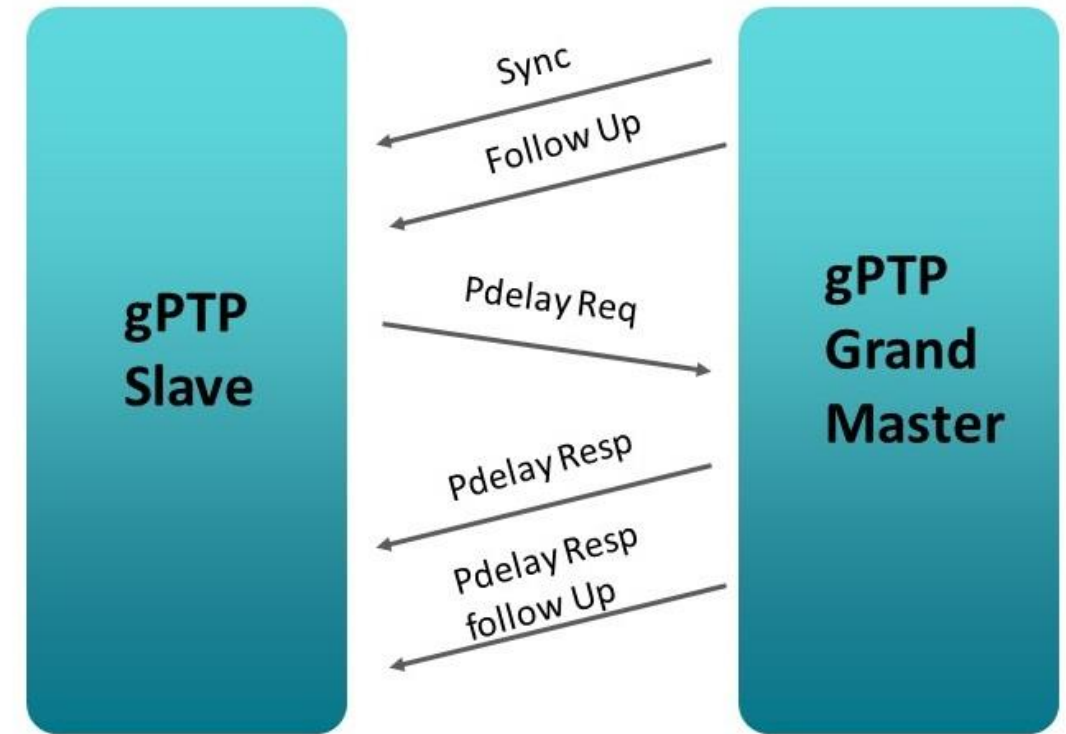
Ethernet BaseT1 Phys for Automotive industry

- 10BaseT1s and Transceiver for low-cost/low-speed/low-power
- 10BaseT1s for automotive sensor network
 - Multidrop topology, PLCA, Transceiver
- 1G/2.5G/5G BaseT1 Phys for high-speed requirement
 - Info entertainment system, Camera, Internet, and Other applications



Time Synchronization in Automotive Ethernet Networks

- Time-critical Ethernet applications in the automobile
- Critical and time-sensitive components should be synchronized and have deterministic latencies
- Ethernet network should be synchronized with other Physical systems like CAN and FlexRay



MacSec & Common security threats for Automotive Ethernet Networks

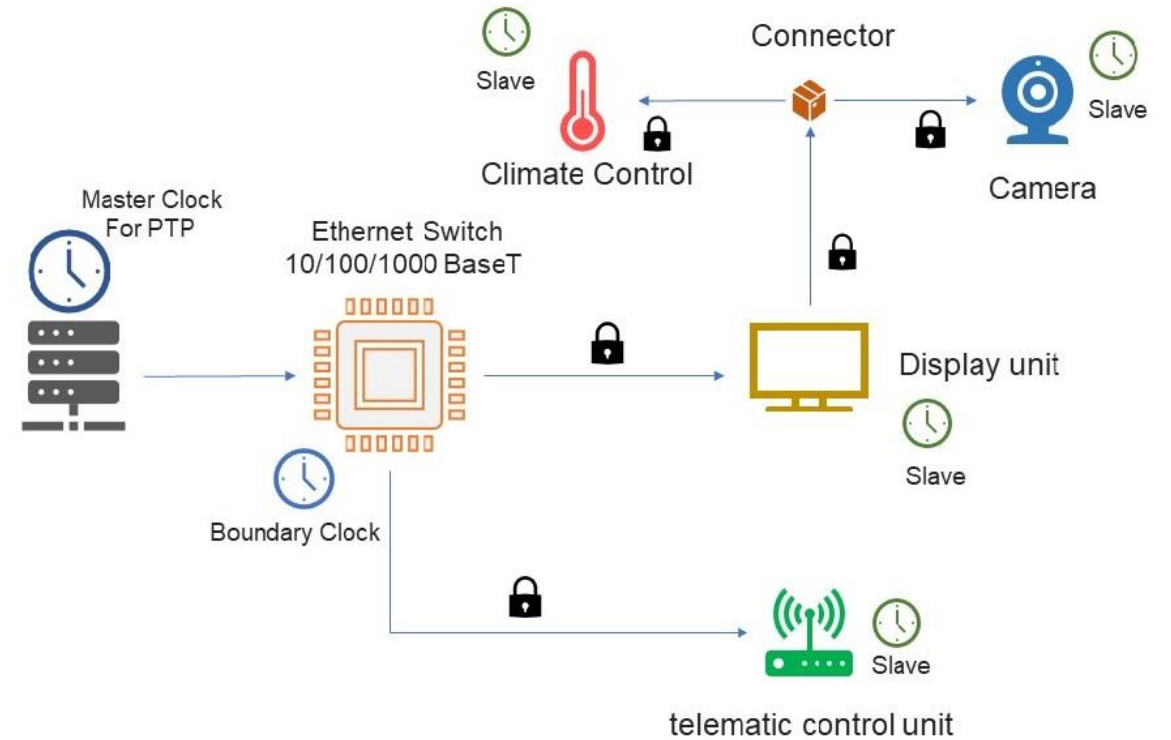
- Modifying frames/messages
- Sending random messages
- Replaying recorded messages
- Snooping data/messages and corruption
- Exploiting software bugs for attacks
- Installing harmful software/code



How PTP with MacSec Protects the Automotive Network.

when an attacker/ Hacker tries to snoop the data from the connector or tries to attack the device by pushing the false data/modify the information, MacSec will protect the network by,

- Data Integrity Check
- Reply protection
- The Authenticity of the link partner
- Data encryption



Security threat aversion using
PTP Over MacSec for Automotive Ethernet

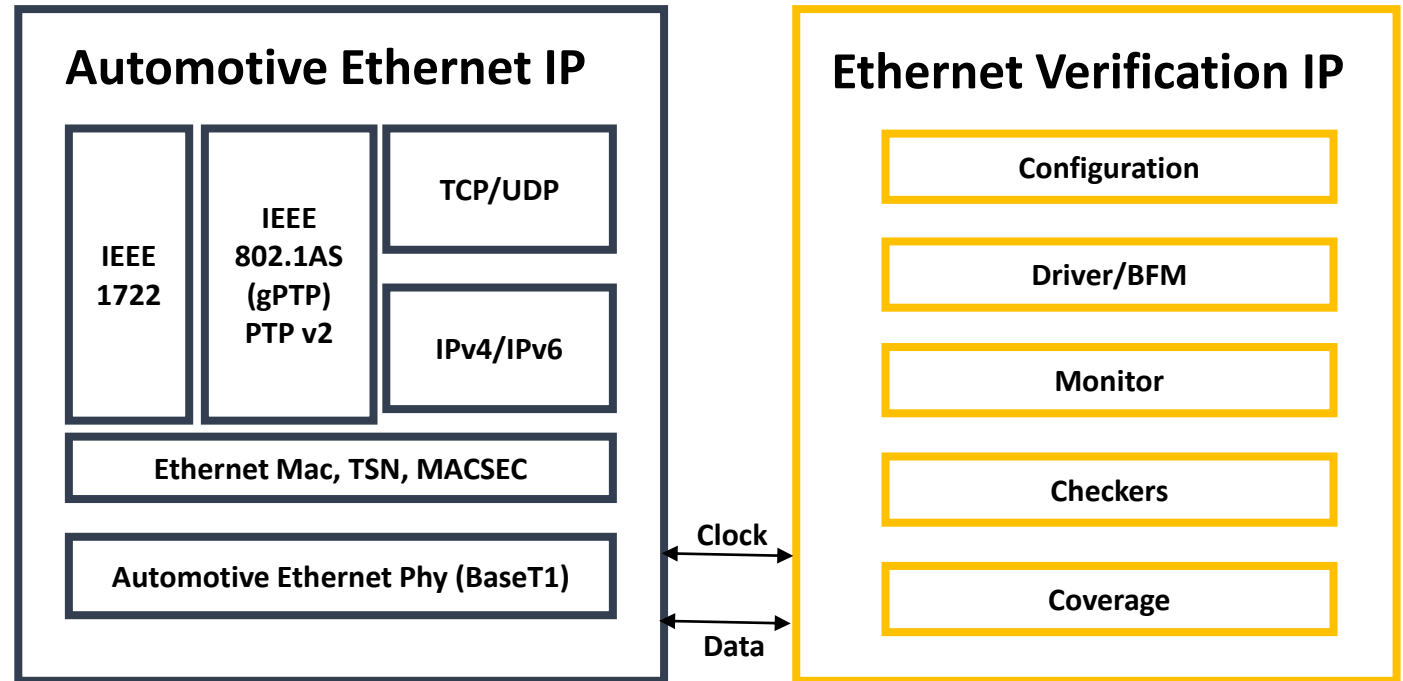
Functional Verification challenges for Automotive Ethernet

Considering data security and Time sensitivity, PTP with MacSec & BaseT1 Phy IP are crucial components of the Ethernet network, and flowless functional verification is expected.

- Impact of MacSec algo on the accuracy of PTP time stamp prediction and debugging
- Dual Length type issue for PTP with MacSec
- Placement and boundary identification of PTP frame within encrypted MacSec Ethernet frame
- Large training time impact the simulation of BaseT1 Phys
- Transformation of line-encoding in the same simulation for BaseT1 Phys
- Bidirectional pins and self-clocked interface of transceiver-10BaseT1s Phys (3-Pin)

Solution

- Utilize frame payload for length type issue
- Phy time stamping for latency prediction.
- Probes with complete control over frames for integrity checks and debugging
- Configurability in counters and timers
- Protocol Checkers over respective layers.
- Cover groups & automated coverage report generation



Summery

With the Rapid adaptation of PTP over MacSec in Automotive Ethernet, a mature, competent and compliance verification solution for Automotive Ethernet helps reduce time to test, accelerate verification closure, and ensure end-product quality.

THANK YOU