

# TLM Standard for Serial Interfaces

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# Agenda

- Introduction & Motivation
- Serial TLM Status
- Presentations:
  - GreenSocs: Analysis of TLM-2.0 and it's Applicability to Non Memory Mapped Interfaces
  - ST: TLM-2.0 Limitations for Serial Protocols
- Discussion
  - Which protocols?
  - Level of abstractions?
  - Which scenarios?
- Wrap-up
  - Summary
  - Next Steps

# Introduction

## Motivation:

- Early & efficient SW development on Virtual Prototypes of Electronic Control Units (ECU)
- ECU (network) is assembled from IP of different vendors communicating via serial protocols e.g. **SPI, CAN, I2C**, LIN, FlexRay, Ethernet etc.

**Avoid effort when connecting simulation models**

## Goal:

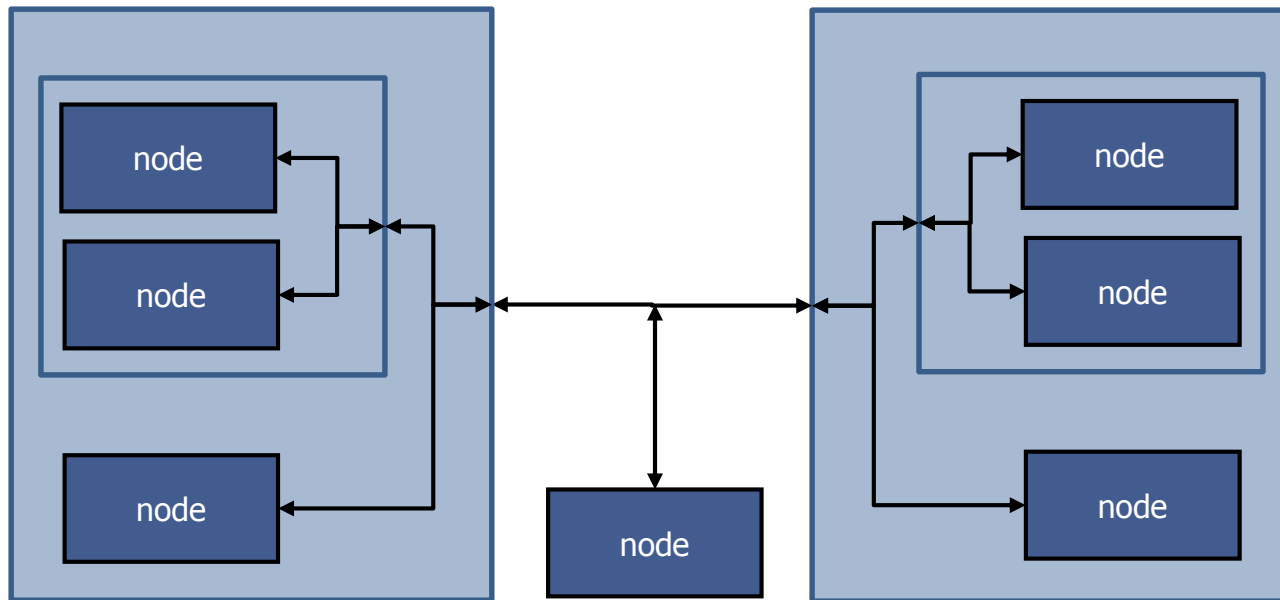
- Establish SystemC TLM modeling standard for serial protocols



# Serial TLM Status

- Initial discussions within accellera TLMWG
- Draft of CAN, SPI scenarios under [http://workspace.accellera.org/apps/org/workgroup/tlmwg/download.php/14231/SerialTLM\\_requirements\\_and\\_scenarios.doc](http://workspace.accellera.org/apps/org/workgroup/tlmwg/download.php/14231/SerialTLM_requirements_and_scenarios.doc)
  - CAN: Scenarios aligned with existing standard
  - SPI: Not a standard hence difficult to gather all user scenarios

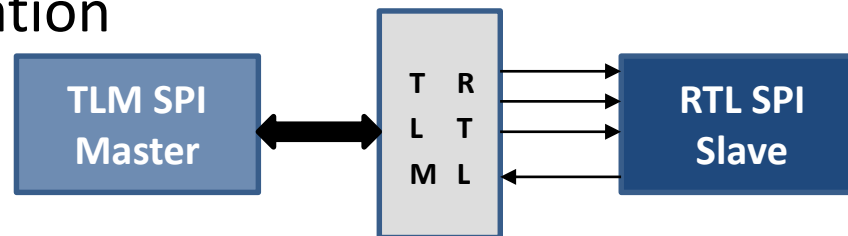
# Scenario Hierarchy Support



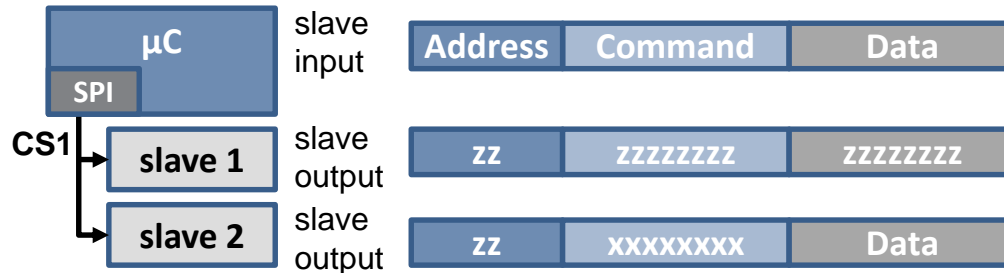
Typical hierarchy of an automotive system e.g. CAN network

# Scenario SPI RTL Co-Simulation

- Reuse HDL code converted to SystemC (legacy IP)
- Outcome:
  - Start of frame (SOF) needed so adapter can start RTL transfer
    - E.g. CAN SOF bit has to be created right away
  - Transaction update mechanism needed as TLM master gets slave data bit by bit and preferably first bit ASAP
- Implementation:
  - SOF and Update „phase“ introduced for TLM implementation



# Scenario SPI Broadcast

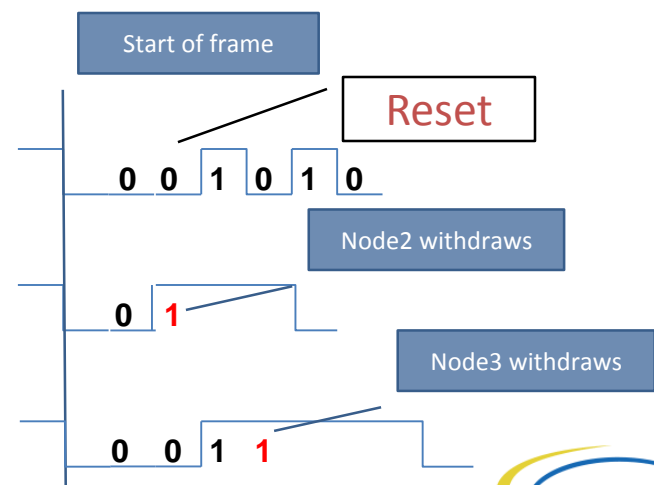


- μC has less chipselect (CS) ports than slaves to connect
- Multiple slaves are addressed with the same CS line
- Outcome: No slave shall block
  - Blocking does not allow „next“ slave to receive frame with Start Of Frame (SOF) hence can not reply on time
- Implementation: Use of non-blocking calls



# Scenario CAN Reset

- Reset:
  - During arbitration -> winning node changes when node with lowest ID is reset
  - During frame transmission -> results in error frame sent by detecting node
- TLM: When to arbitrate? Start/end of arbitration field?
- Implementation:
  - Interface supports cancellation of transaction that did win
  - Send arbitration field @ beginning, allow updates for RTL co-sim
  - Determine winning node @ end of arbitration field



# Presentations

- GreenSocs: Analysis of TLM-2.0 and it's Applicability to Non Memory Mapped Interfaces
- ST: TLM-2.0 Limitations for Serial Protocols

# Discussion

- Prioritize serial protocols to standardize
- Level of abstraction that shall be supported
- Complete and add existing scenario doc
  
- What else?

# Wrap-up

- Summary
- Next steps