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Time Sync in 10BASE-T1S networks

Pdelay mechanism in multidrop topology (updated version)

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Motivation

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Motivation

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The challenge

- 10BASE-T1S has a multidrop topology
- IEEE Std 802.1AS uses MAC group addressing, assuming a switched network with distinct P2P links
- This approach tries to find a short term solution, satisfying the current needs of the automotive industry

Motivation

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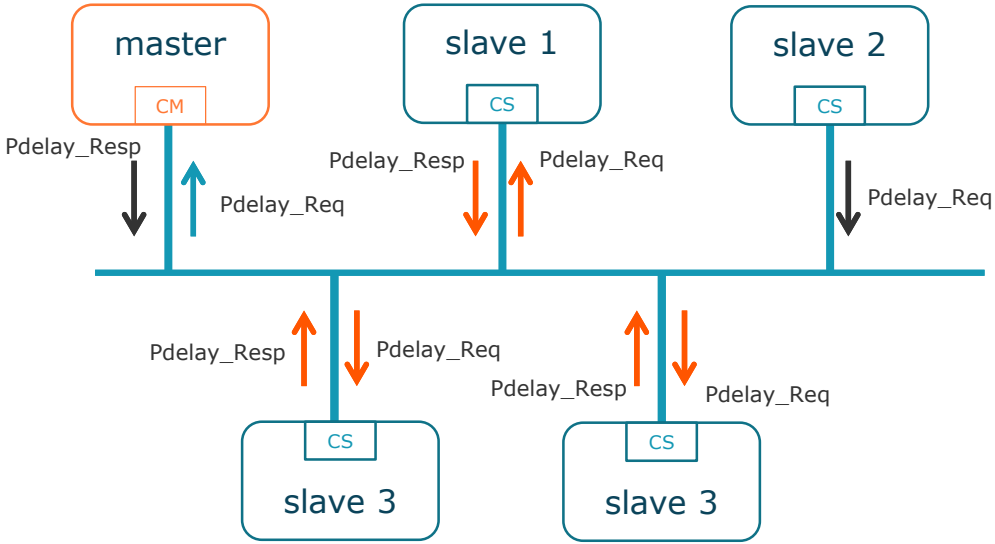
goal: avoiding unexpected Pdelay_resp messages (1/2)



current situation:

- slave 2 sends Pdelay_Req
- Pdelay_Resp / Pdelay_Resp_Follow_Up are expected only from the master node
- unexpected responses from other slaves occur

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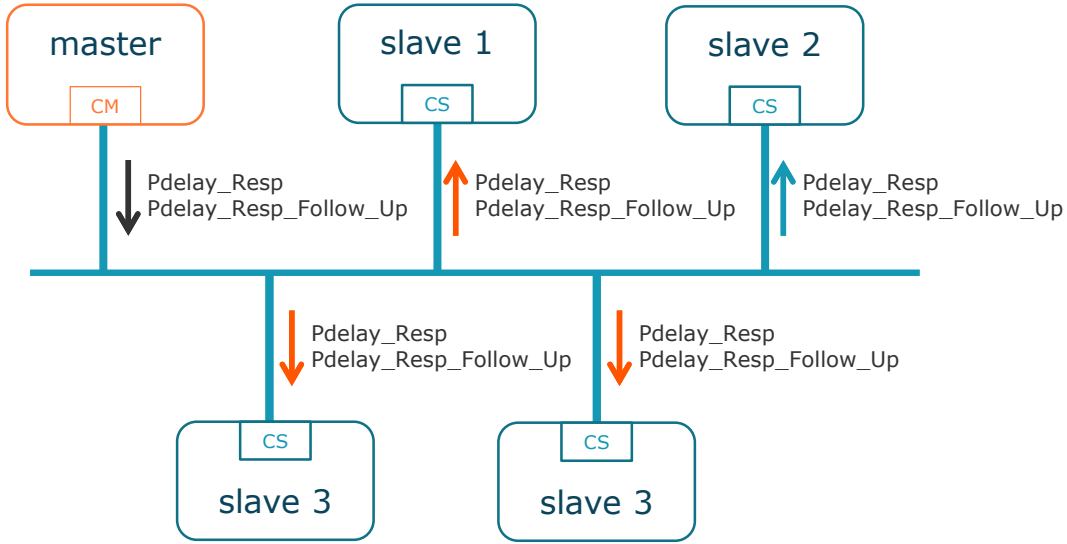
Pdelay_Resp/Pdelay_Resp_Follow_Up:



current situation:

- Pdelay_Resp and Pdelay_Resp_Follow_Up are sent correctly from the master node
- slave 2 receives expected responses
- all other slaves receive unexpected responses

Proposal

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Motivation

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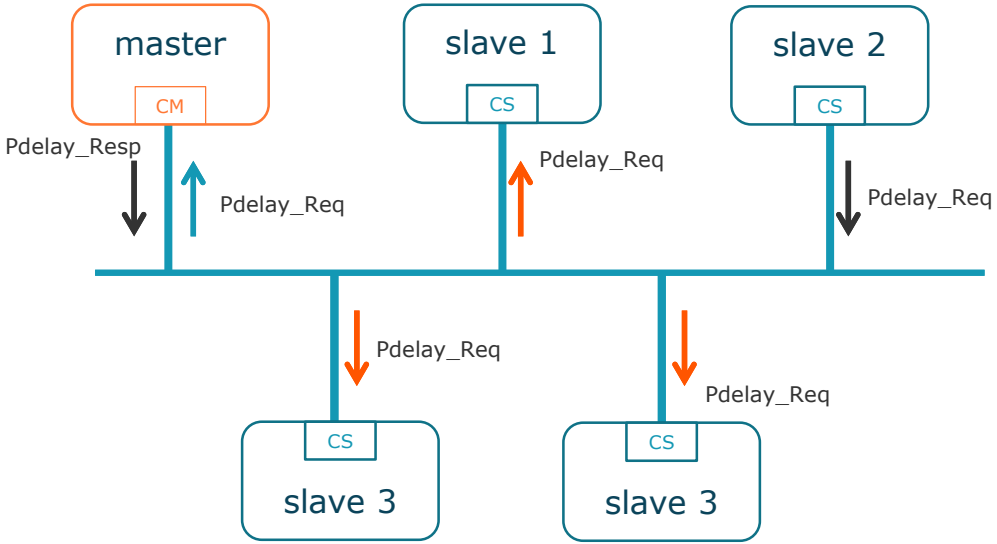
goal: avoiding unexpected Pdelay_resp messages (2/2)



improved situation:

- slave 2 sends Pdelay_Req
- master sends Pdelay_Resp / Follow_Up
- received Pdelay_Req messages are ignored at the slaves
- other slaves are not reacting/responding

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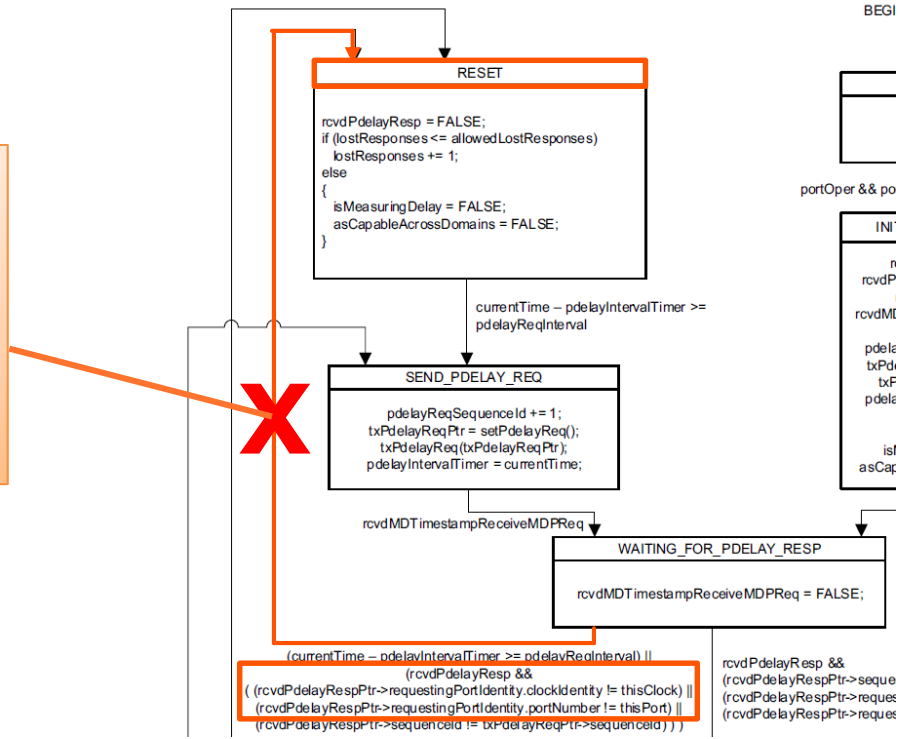
Modification of the MDPdelayReq state machine

Proposal:
Modify the MDPdelayReq state machine so that Pdelay_Resp messages with deviating requestingPortIdentity are **ignored** instead of triggering a RESET of the state machine.

Instead, only Pdelay_Resp messages with a matching requestingPortIdentity, but with deviating sequenceId should trigger a RESET.

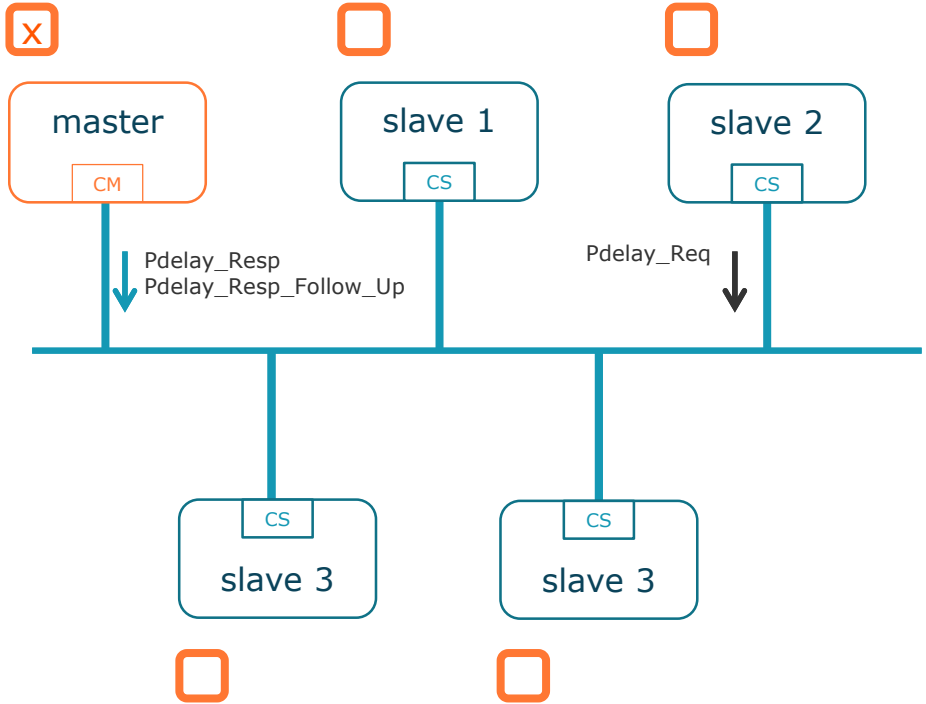


Proposal

Enable/disable nodes from responding to Pdelay_Req

Pdelay mechanism

- [x] respond to Pdelay_Req



Discussion

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Intention

The following slides should be helpful to understand and discuss the use cases for automotive with 10BASE-T1S and to design the susbset feature list in 802.1DG.

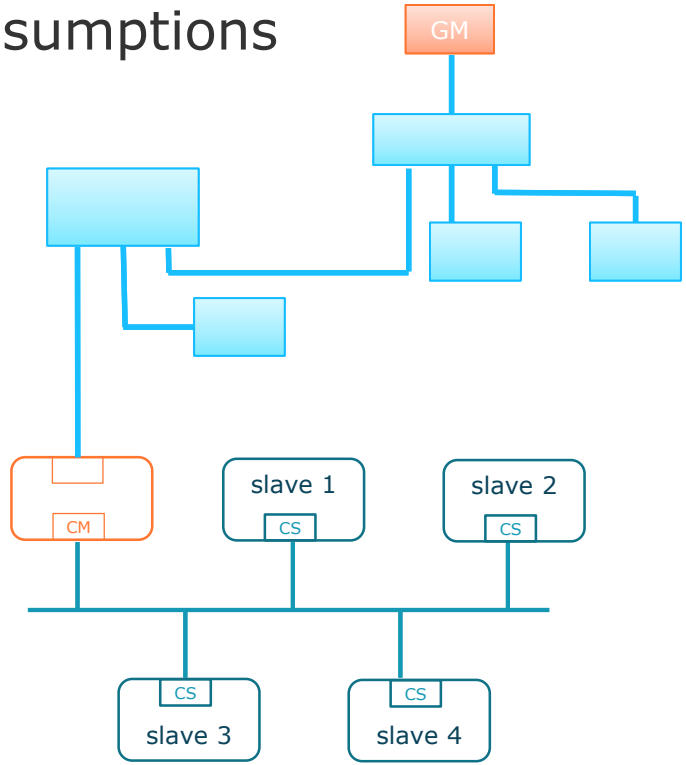
Comparing the overall approach of 802.1AS-2020, we have a chance to focus on the needs of automotive and might get a smaller impact and subject to change for other specifications.

However, the goal should be to satisfy the market with this specification for the next couple of years.

Therefore, the following slides are ment to show up scenarios to initiate the discussion about needs.

Discussion

assumptions

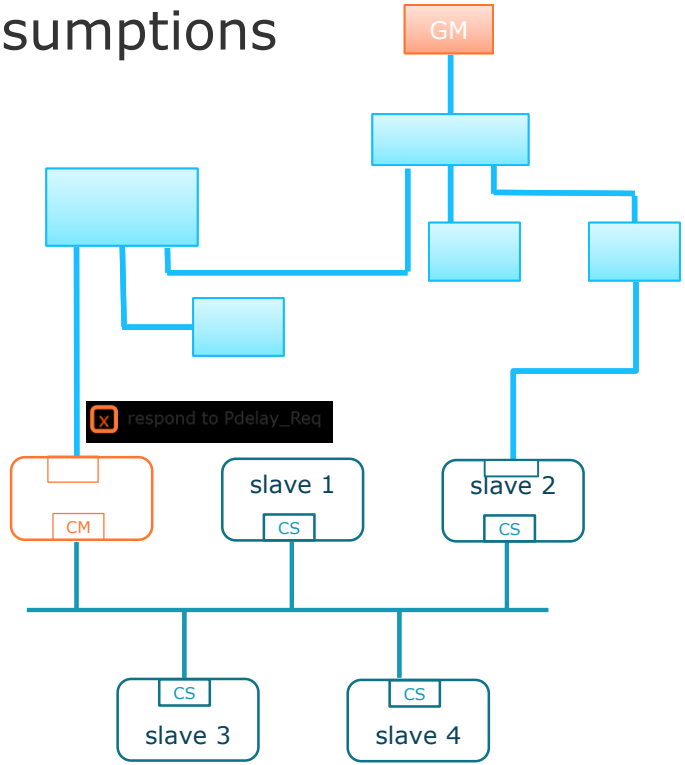


10BASE-T1S networks in automotive

- are subnets of other in-vehicle networks
- have their timing master node in the bridge to the connected topology
- build the last subnet branch
- the 10BASE-T1S slaves do not have any need to calculate their neighbour rate ratio except to the master node
- do not carry the GM

Discussion

assumptions

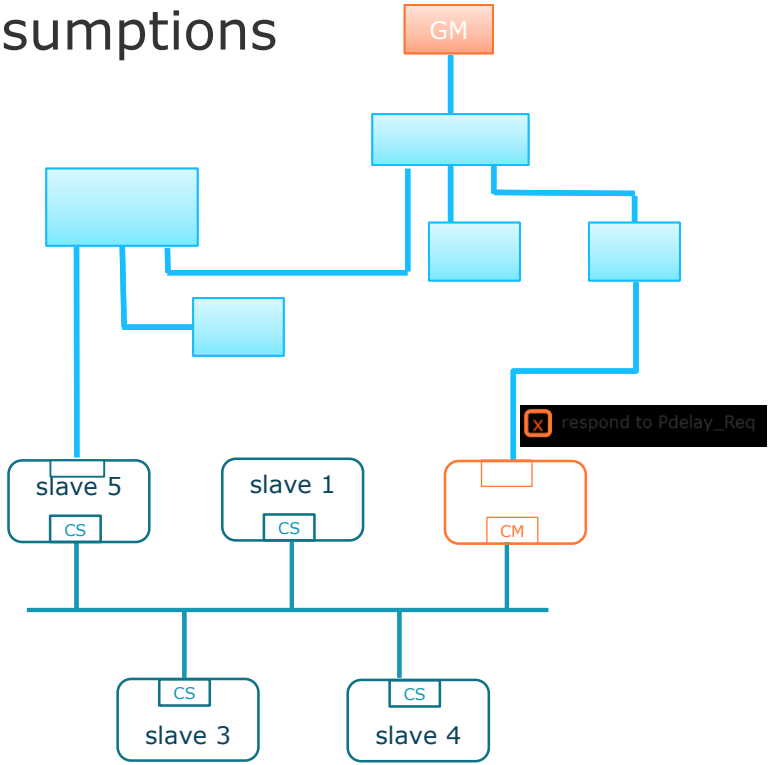


10BASE-T1S networks in automotive

- even if necessary:
  reconfiguration of the network is possible
  ...

Discussion

assumptions



10BASE-T1S networks in automotive

- even if necessary:
  reconfiguration of the network is possible
- management of reconfiguation shall be defined in higher layers

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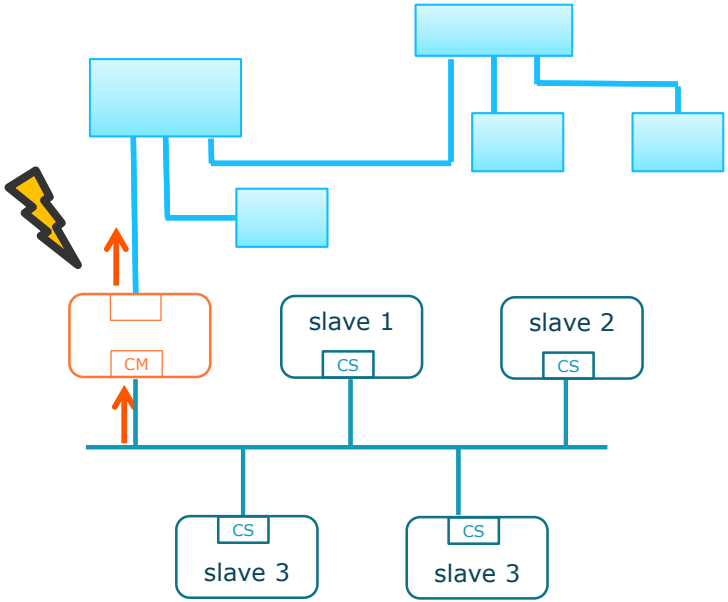
MAC addressing

Q: why not simply changing the MAC addressing to unicast?

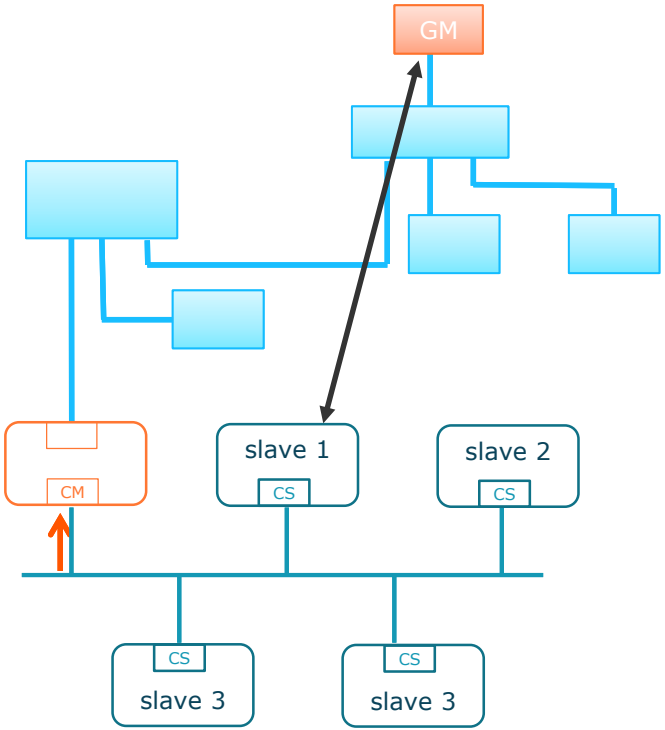


A1:
Let's keep it simple as it is. 802.1AS implementations do not have to cope with MAC addressing so far.

A2:
We would have to add failure tolerance to the connected networks, because 802.1AS packets could be accidentally forwarded over one hop.

Discussion

Neighbor Rate Ratio



Q: Why not just simply omit Pdelay and measure neighbour rate ratio with successive Sync messages?

A1: You won`t measure the ratio to the neighbour, but the ratio to the GM.

A2: The startup time to a stable syntonization will be bigger and might exceed therefore the automotive requirements.

Discussion

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Proposed next steps

- Define the automotive needs for the mid term future in 802.1DG
- Calculation of bandwidth needs for Pdelay messages.
- Decide if there is a need to introduce a new media dependent layer for PLCA into the 802.1AS standard or reach the goal with minor changes with an existing layer
- Discuss the robustness against implementation failures and functional safety requirements

Thank you for your attention!

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