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Time Sync in 10BASE-T1S networks

Pdelay mechanism in multidrop topology

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CTO

Motivation

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Needs for automotive use cases with 10BASE-T1S

- IEEE Std 802.1AS shall be included seamlessly
- Implementations (stacks/apps) shall be able to use time sync independently of the underlying network
- If possible, differences to other profiles (industrial, etc.) should be avoided
- Parametrization is a good tool to harmonize between differences

Motivation

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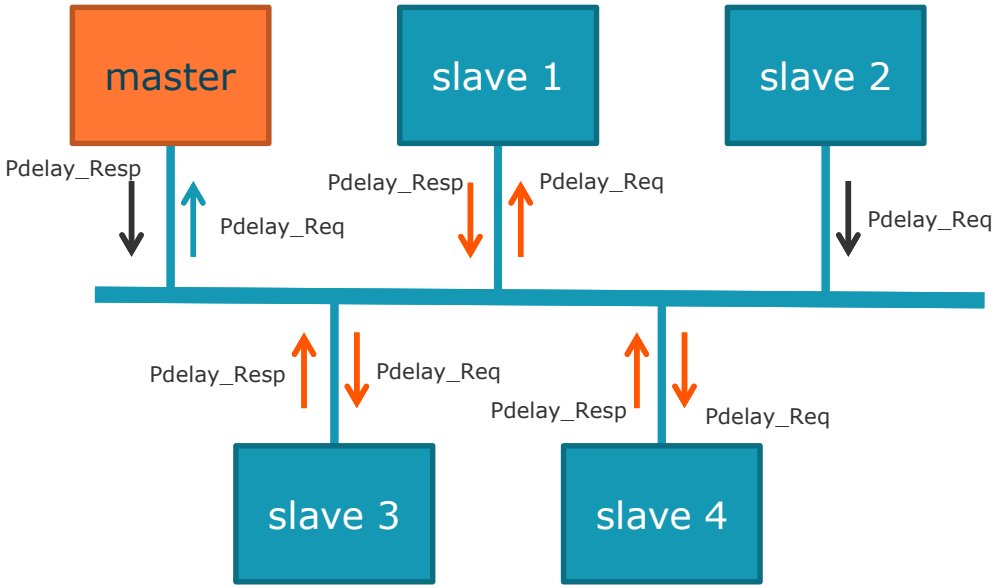
The challenge

- 10BASE-T1S has a multidrop topology
- IEEE Std 802.1AS uses MAC group addressing, assuming a switched network with distinct P2P links

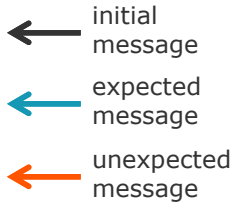
Motivation

how to avoid unexpected Pdelay_responses



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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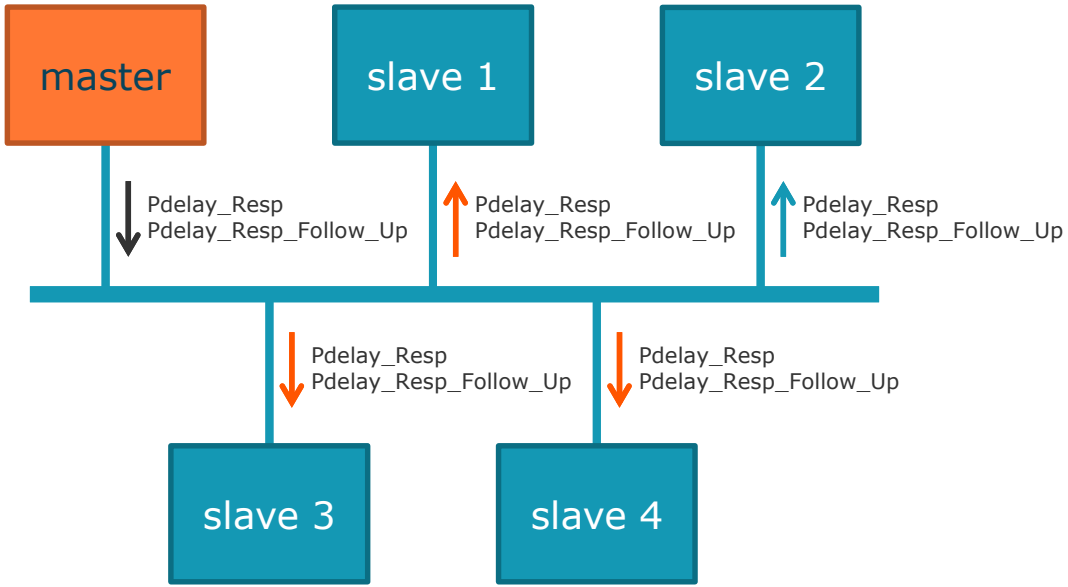
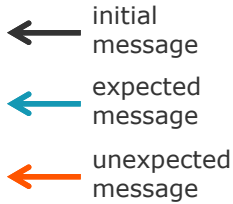
Pdelay_Resp/Pdelay_Resp_Follow_Up:



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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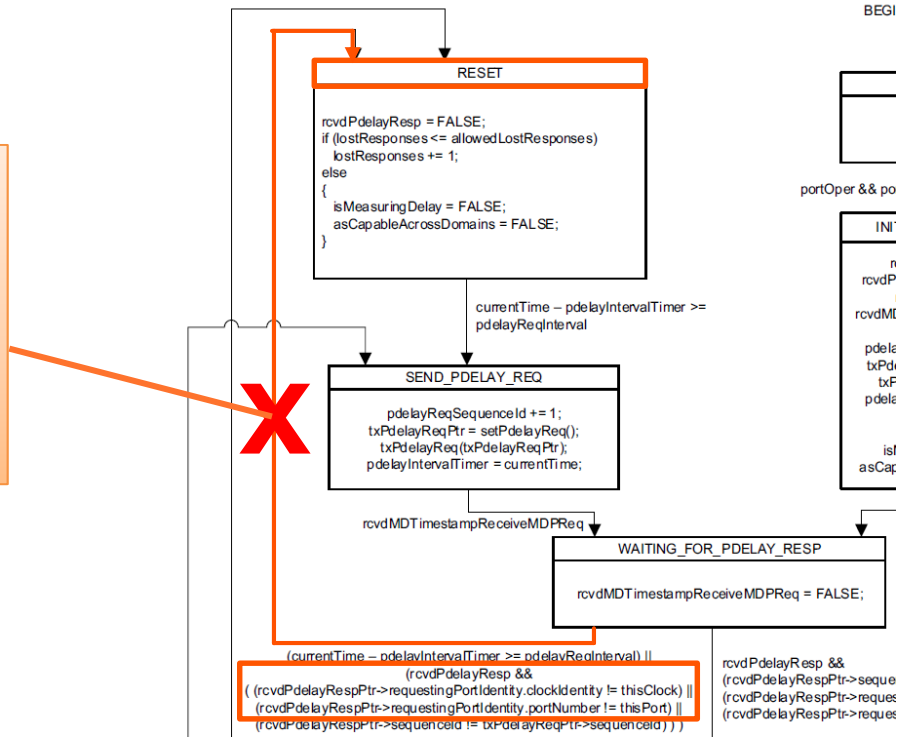
Proposal

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

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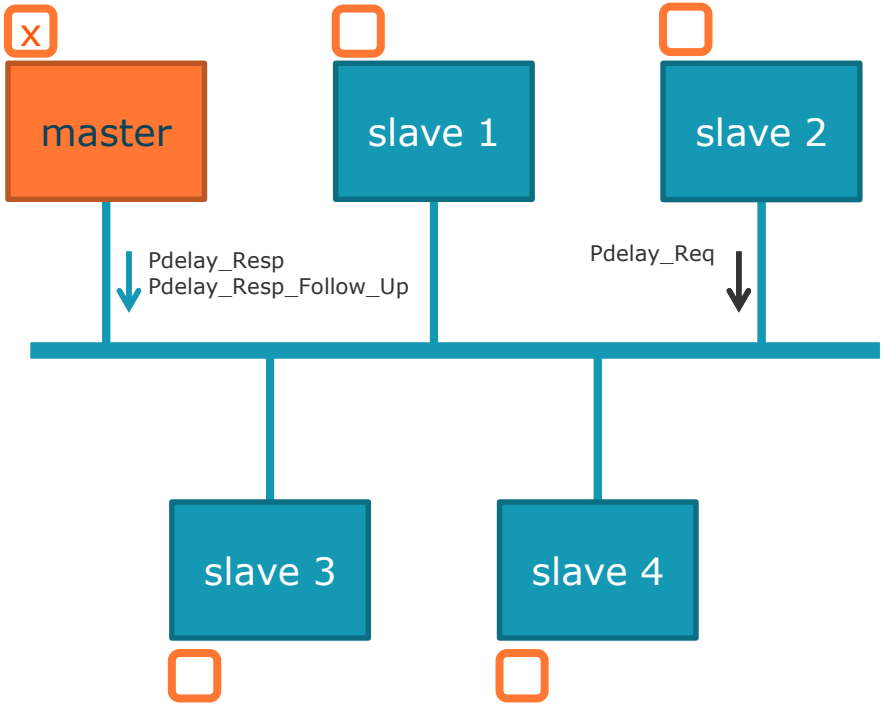
enable /disable nodes from responding to Pdelay_Req

Pdelay mechanism

[x] respond to Pdelay_Req



Discussion

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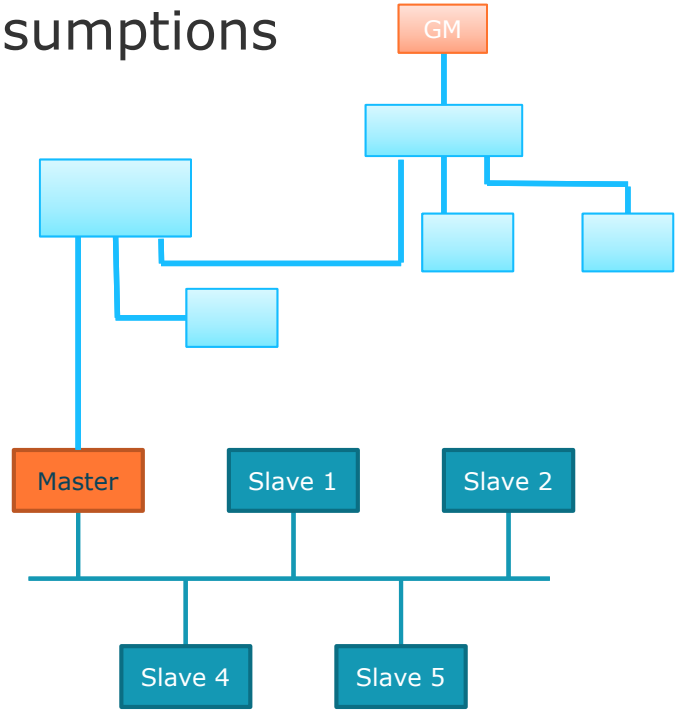
Discussion

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

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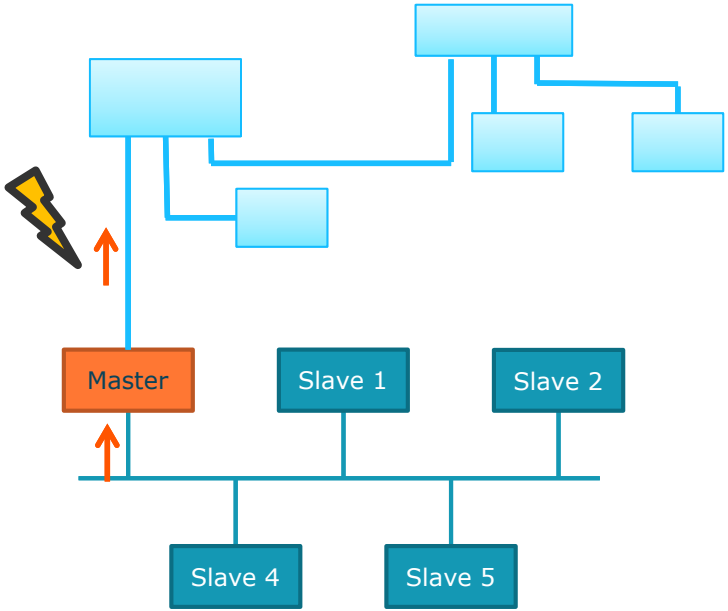
MAC addressing

Q: Why not 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.

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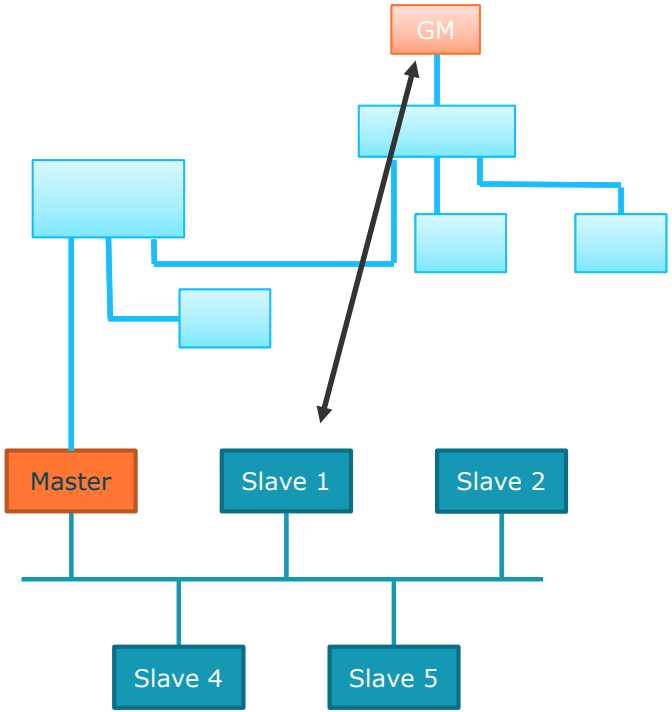
Neighbor Rate Ratio



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

A1: It‘s not the initial intention to do this with Sync messages!

A2: You won‘t measure the ratio to the neighbour, but the ratio to the GM.

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Open items

- what is the best approach to be compatible to other industries?
- what about robustness against implementation failures?
- do we need two syncs to calc GM rate ratio?
- do we have a problem if the master gets too many Pdelay_Req messages in a certain period of time to be computed?

Thank you for your attention!

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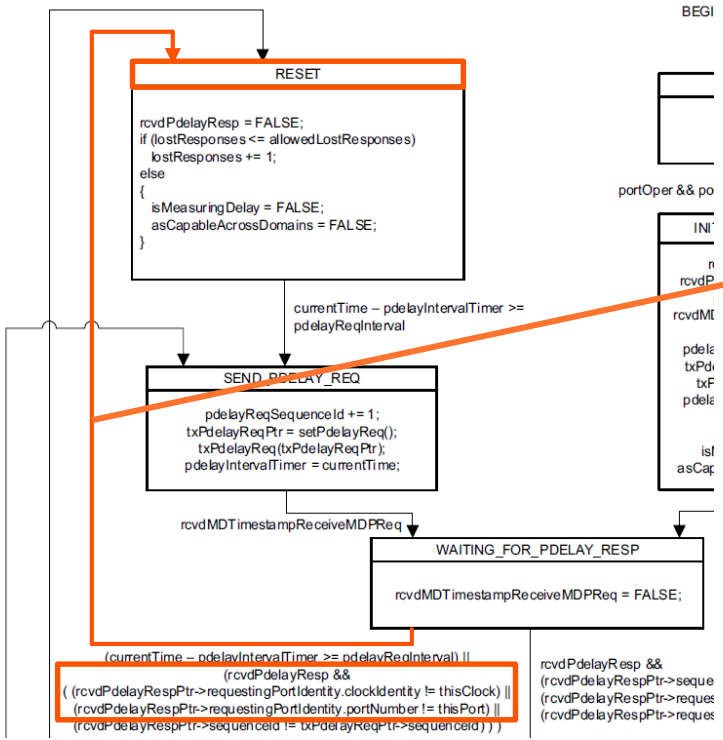
Challenge: Pdelay_Req addressing



Behavior upon reception of a Pdelay_Resp message with deviating requestingPortIdentity:

Currently specified behavior:
802.1AS-rev-d8-0 Figure 11-9
→ **Resetting the MDPdelayReq state machine**

Proposal: Modification of MDPdelayReq state machine

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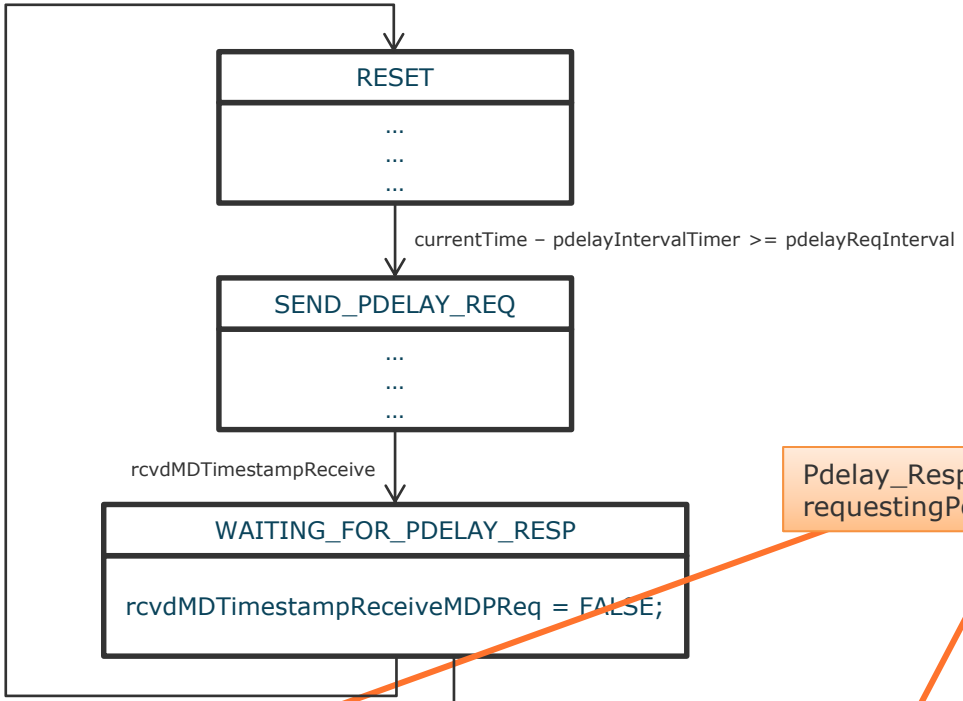
Proposal:



Proposal: Modification of MDPdelayReq state machine

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