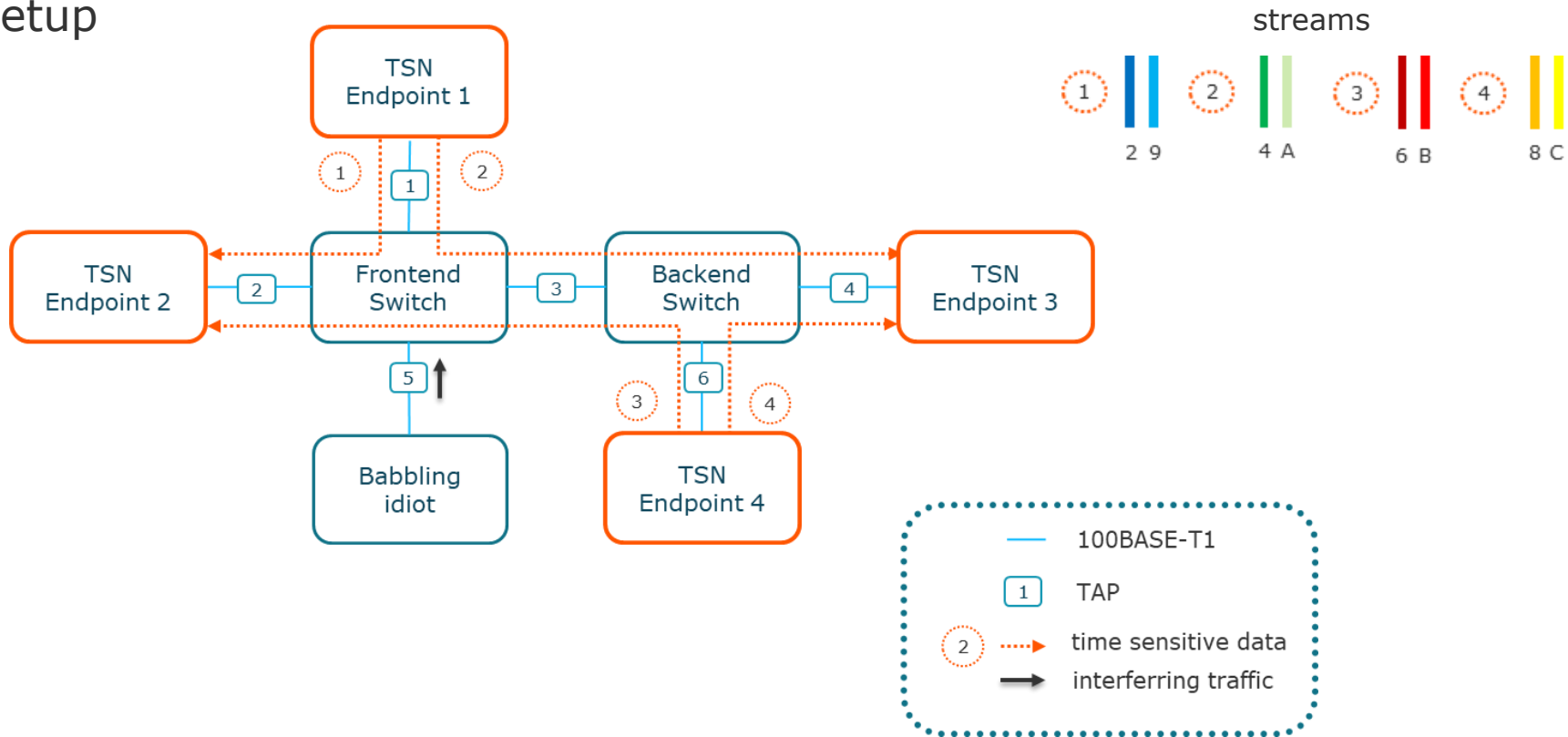


Comparison of traffic delay measurements
for a simple automotive topology
Munich 28-MAY-2021

Georg Janker
CTO

TSN Demonstrator

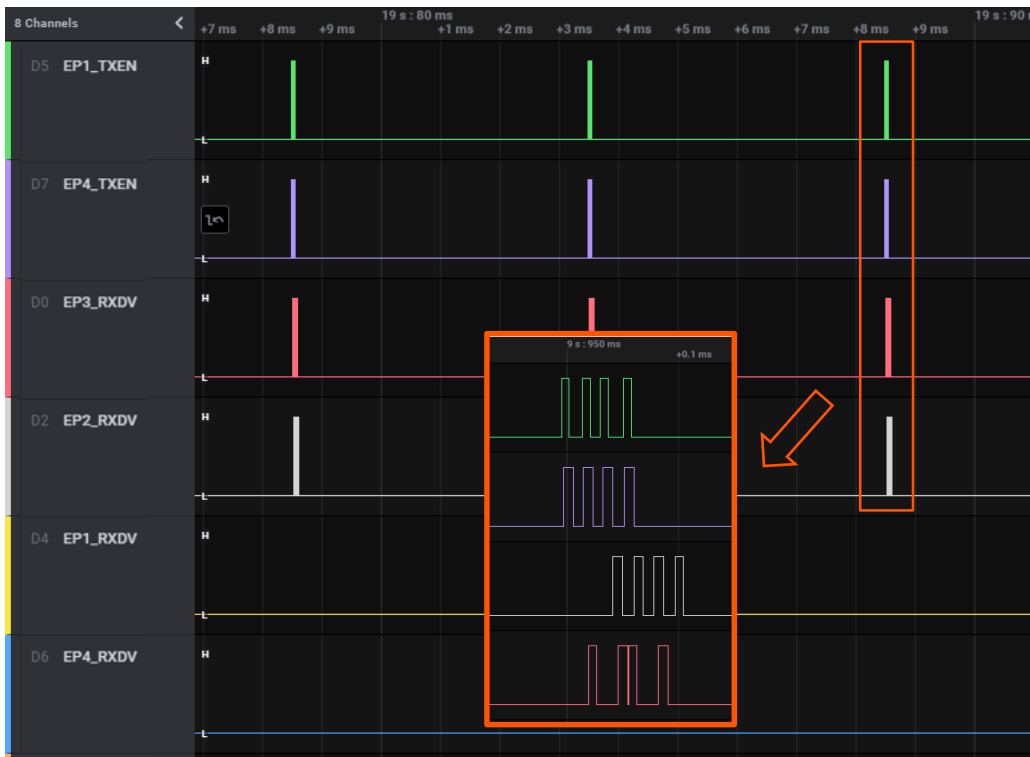
setup



Evaluations with Logic Analyzer

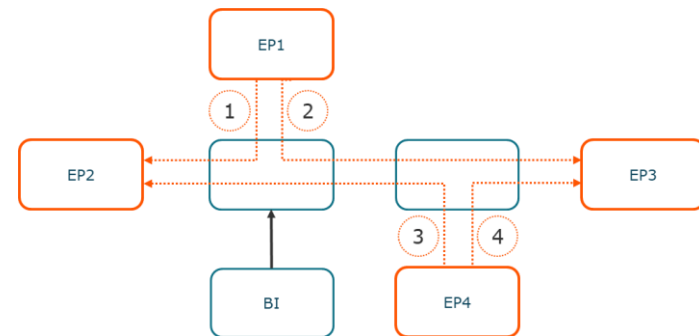
TSN Demonstrator

overview



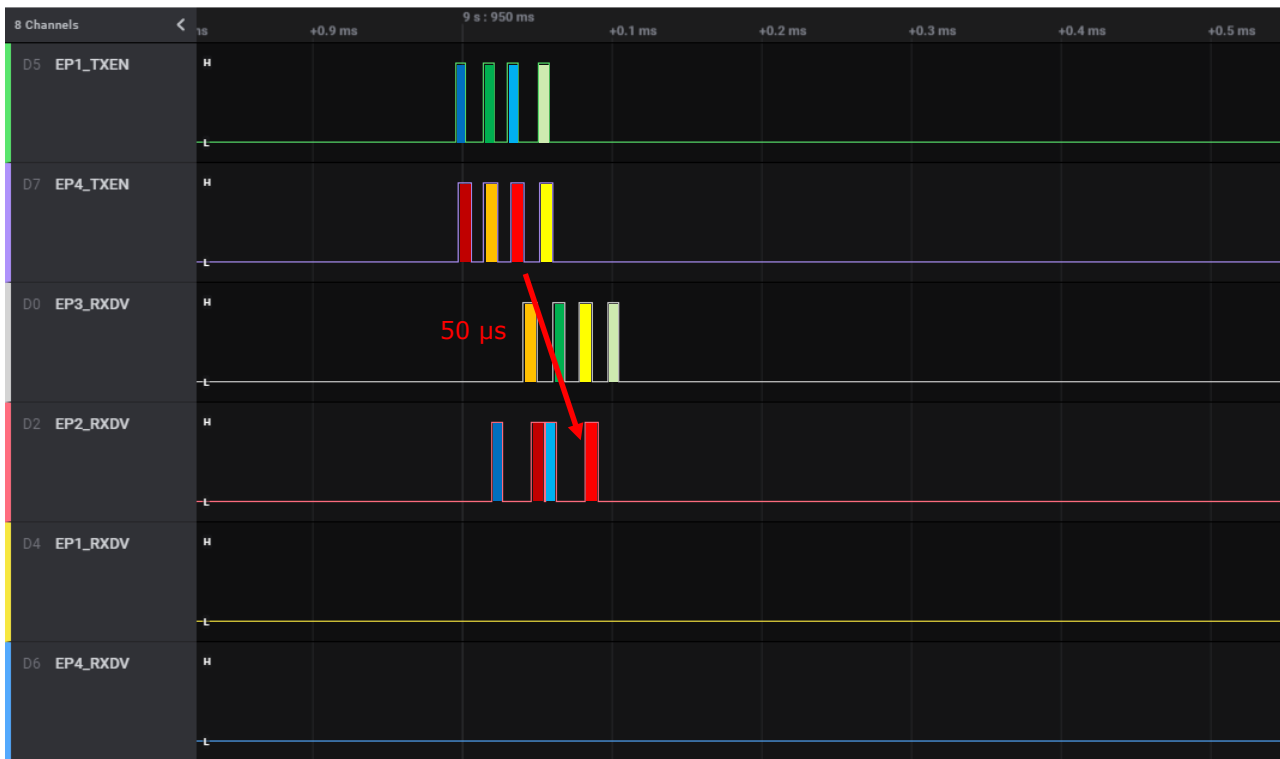
EP1 and EP4 send out:

- 4 packets each
- cyclically, every 5 ms
- Packet size: 64bytes

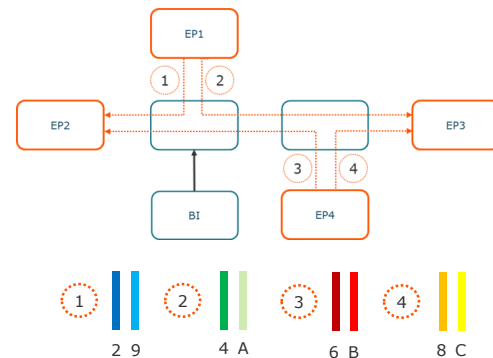


TSN Demonstrator

strict priority without interfering traffic

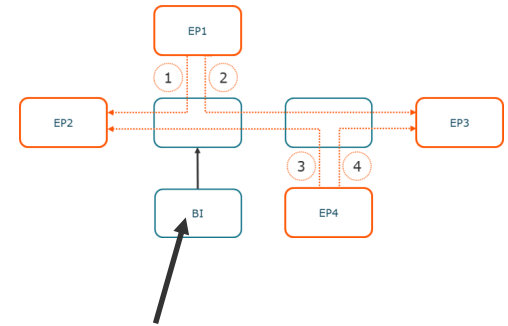
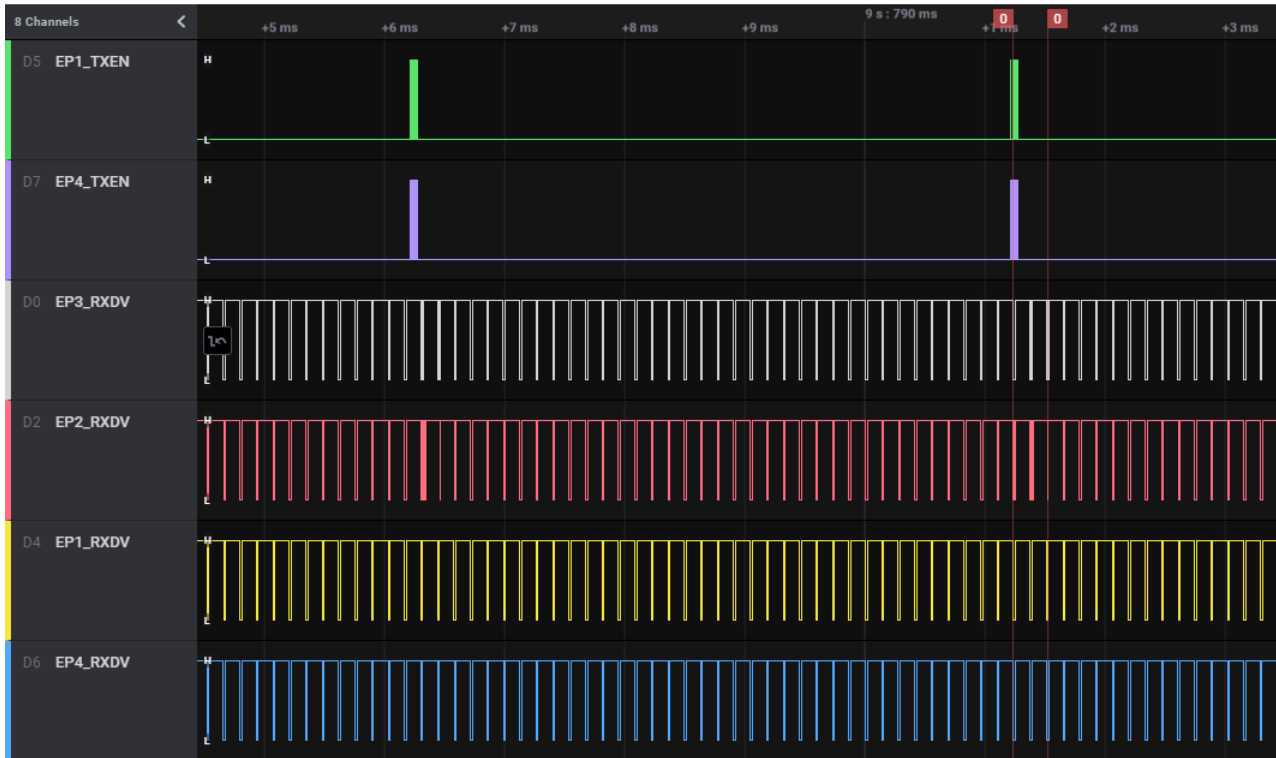


→ expected behaviour



TSN Demonstrator

overview – adding interfering traffic

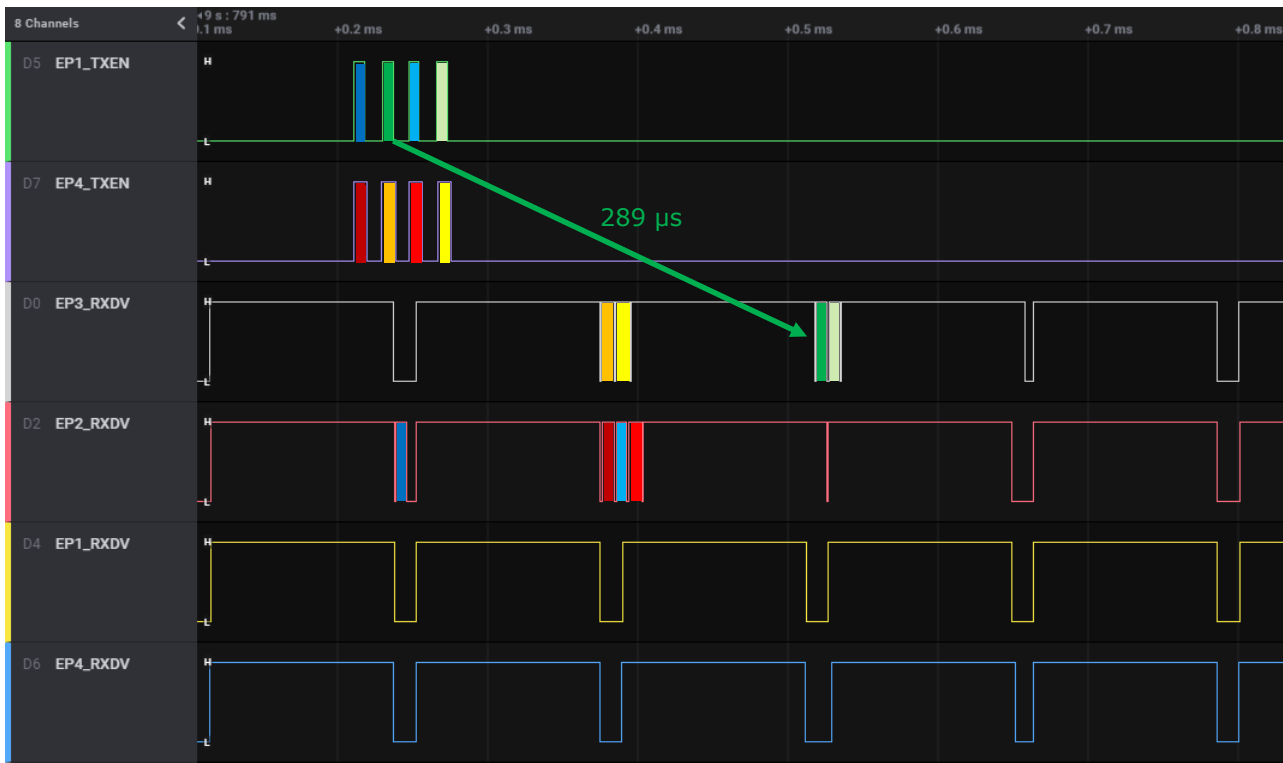


Babbling Idiot (BI) sends:

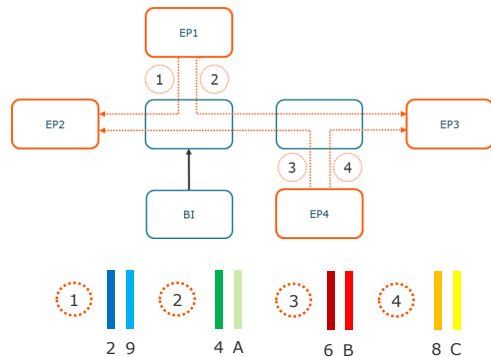
- 1492 byte packets
- 90% line rate
- priority is lower than time sensitive traffic

TSN Demonstrator

strict priority with interfering traffic



- interfering traffic causes delay
- worst case: 1 interfering packet per hop

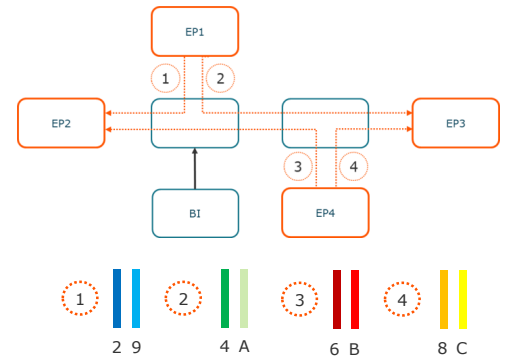


TSN Demonstrator

802.1Qav with interfering traffic



- Credit Based Shaper does not improve the situation

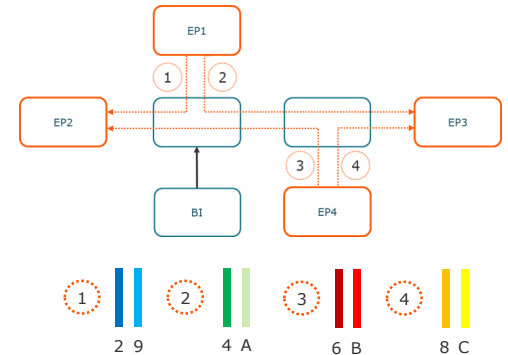


TSN Demonstrator

802.1Qbv with interfering traffic

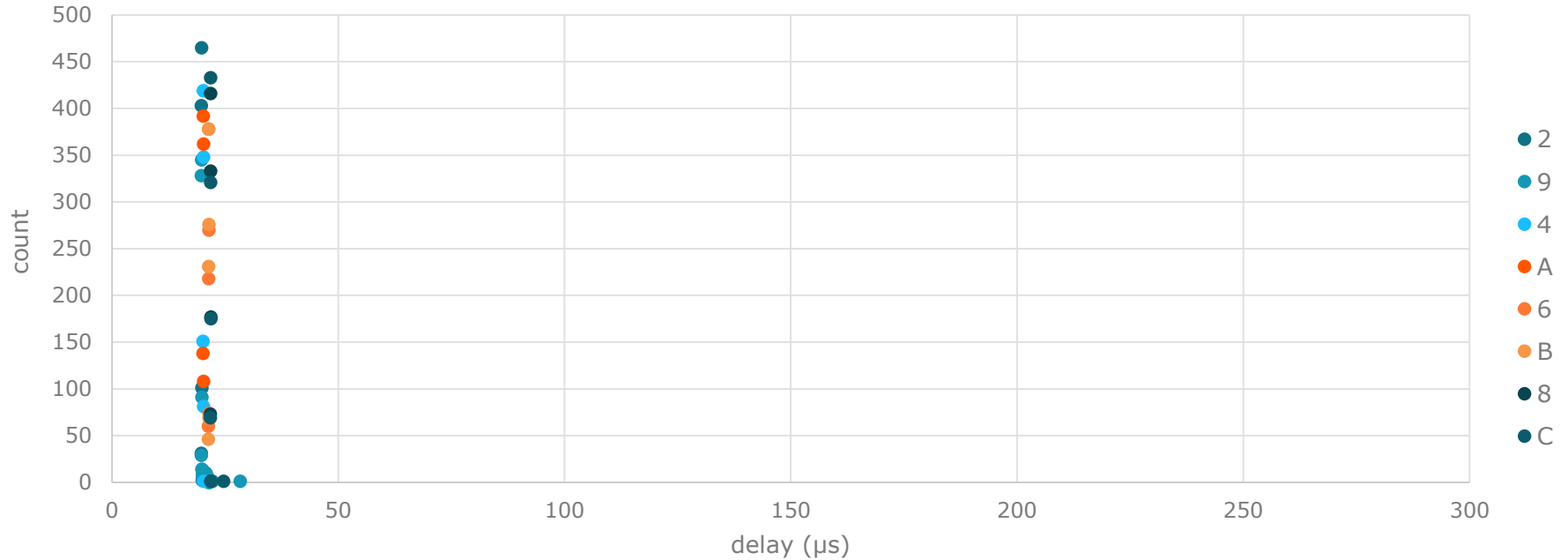


- Time Aware Shaper re-establishes initial situation within timeslot

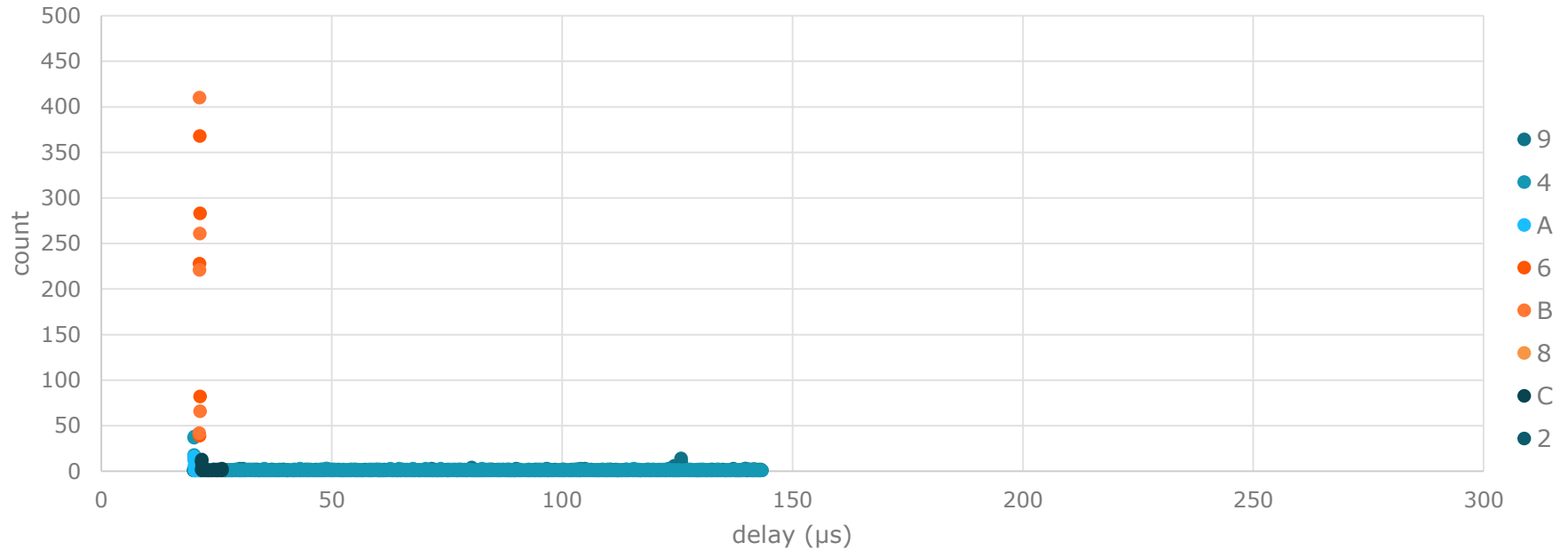


Delay measurements for 1 hop

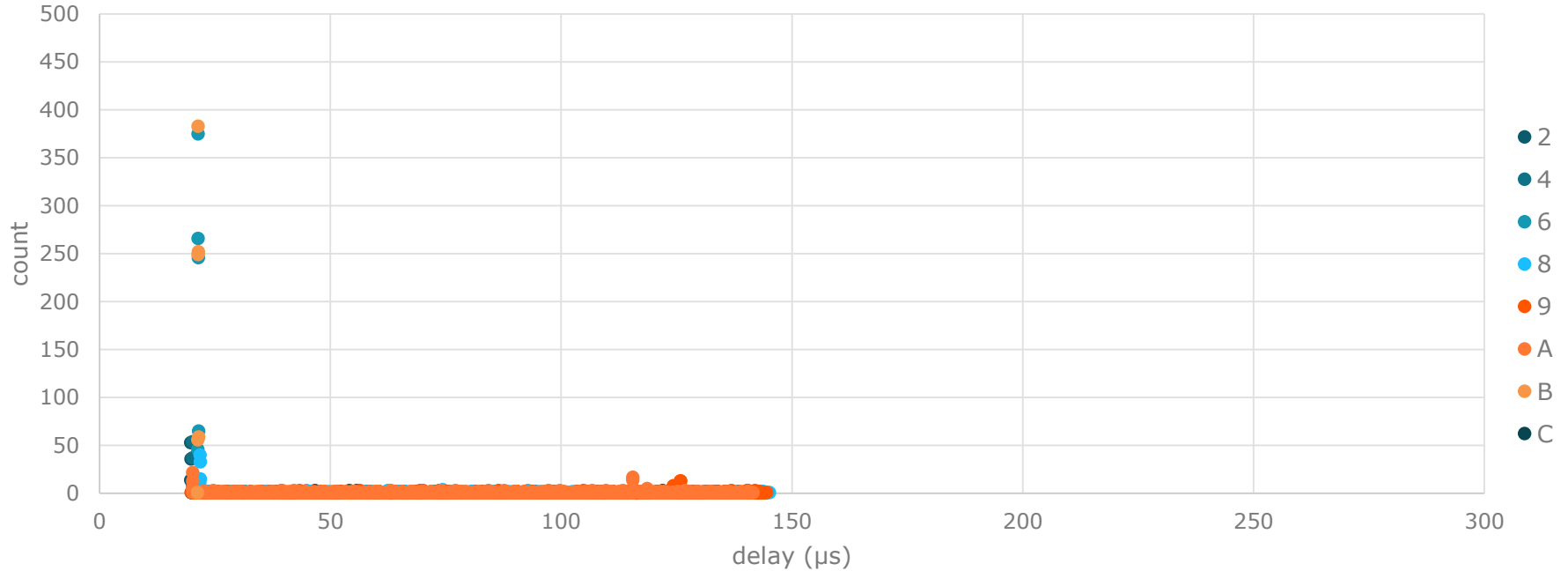
strict priority without interfering traffic over 1 hop



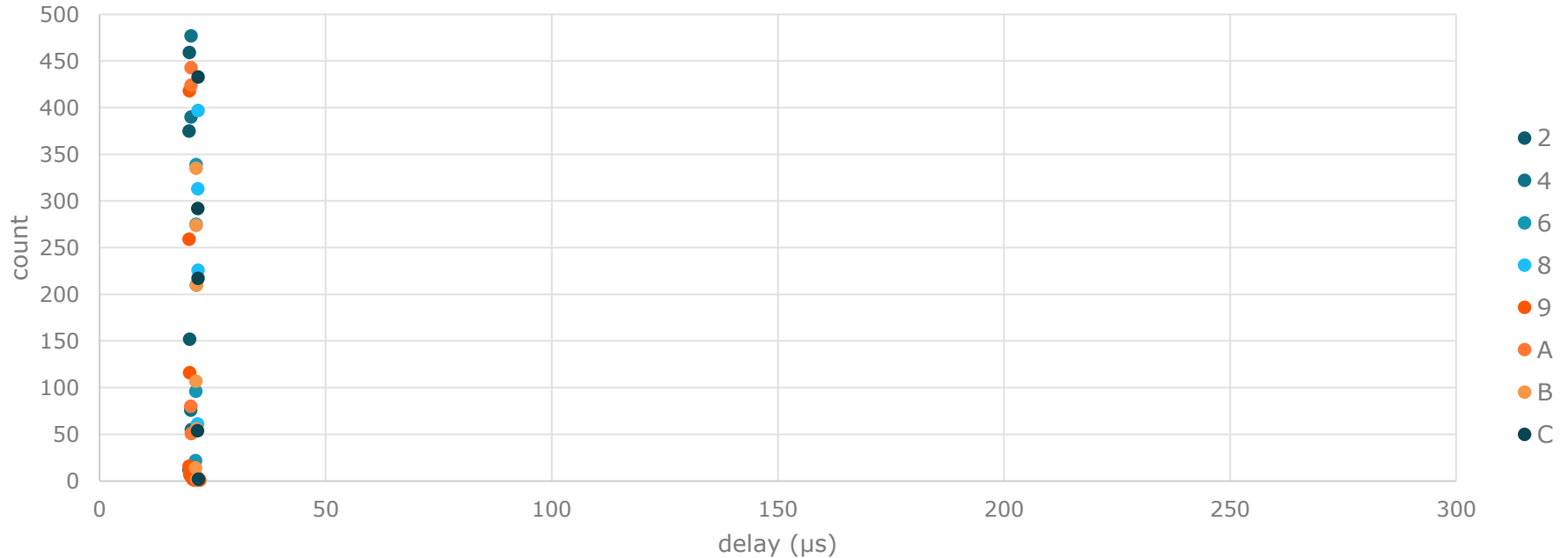
strict priority with interfering traffic over 1 hop



802.1Qav with interfering traffic over 1 hop



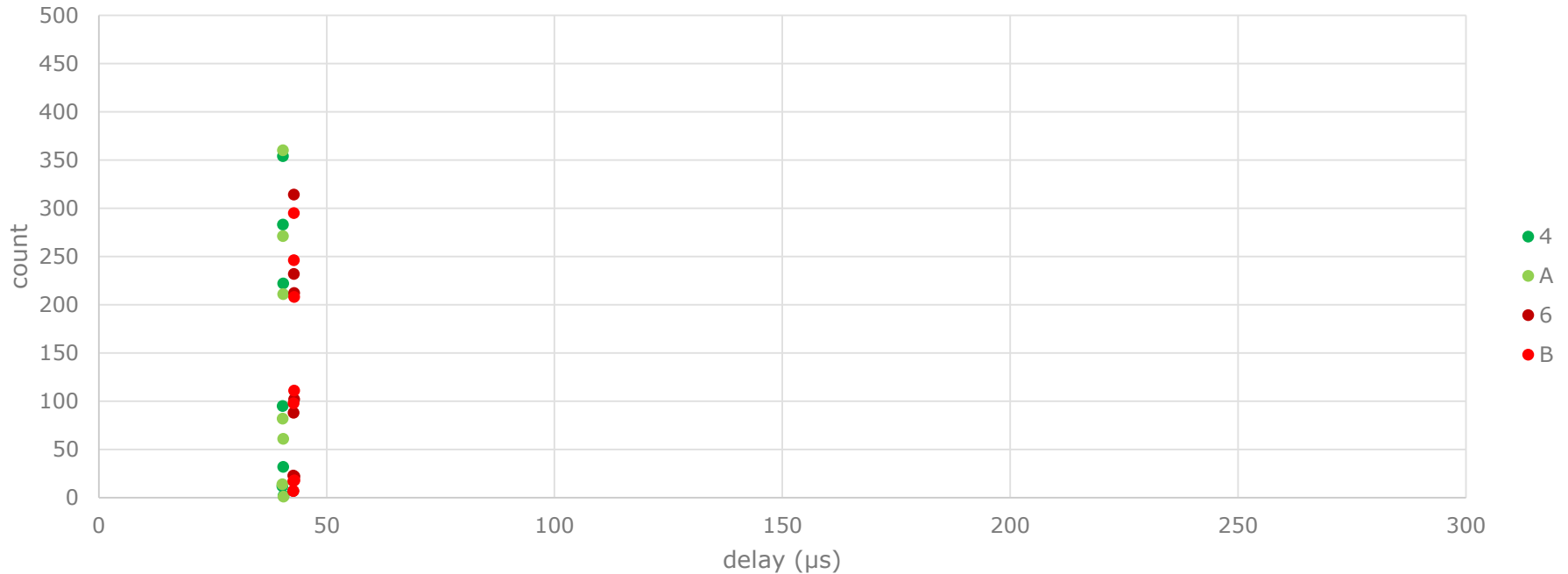
802.1Qbv with interfering traffic over 1 hop



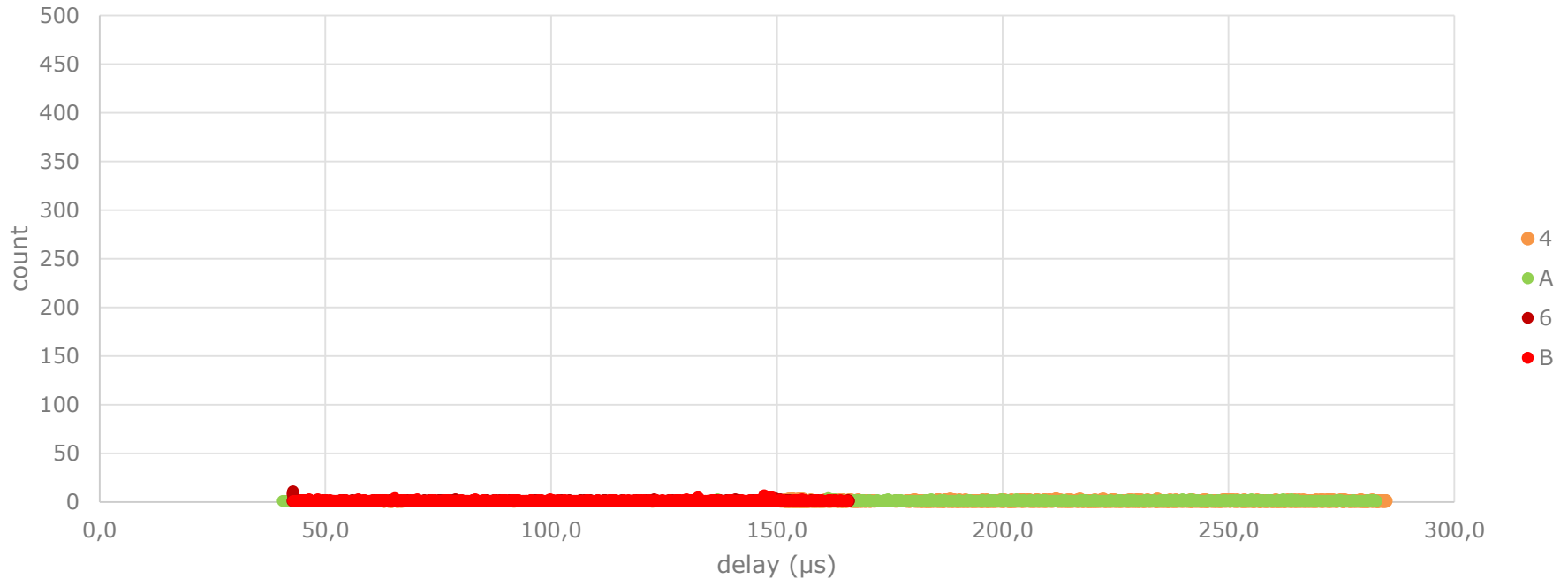
TSN Demonstrator

2 hops

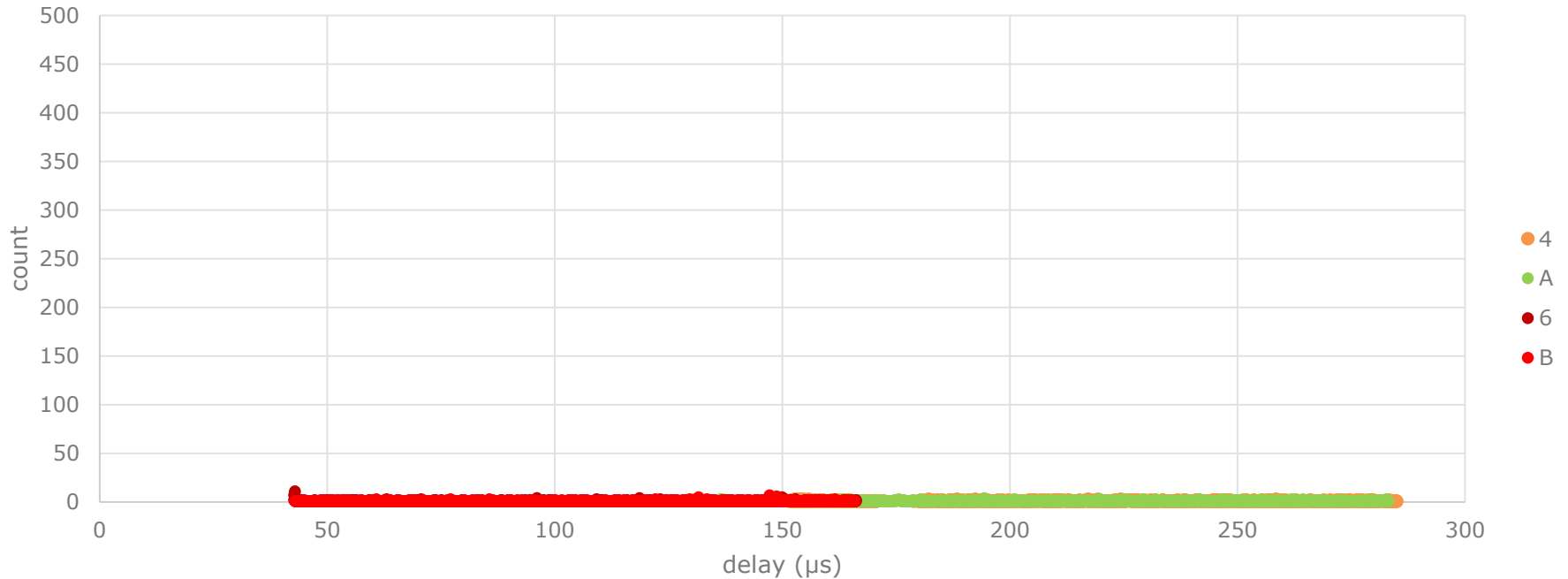
strict priority without interfering traffic over 2 hops



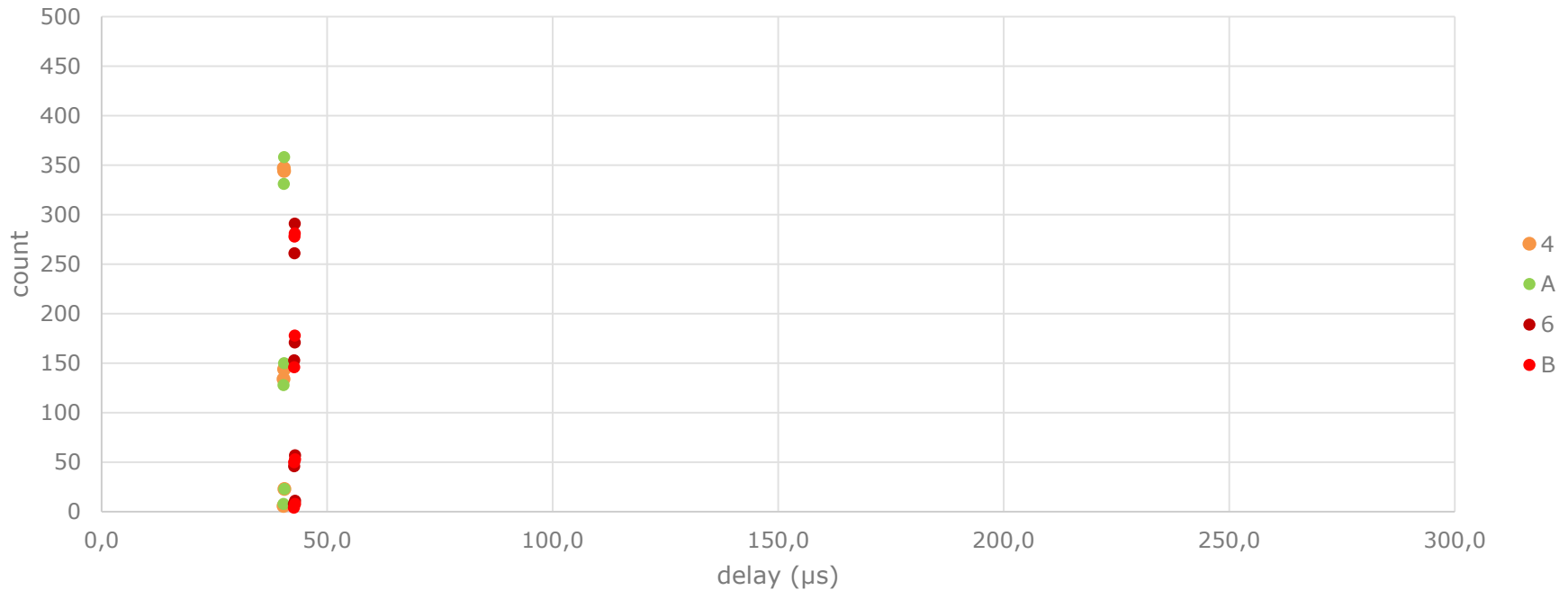
strict priority with interfering traffic over 2 hops



802.1Qav with interfering traffic over 2 hops



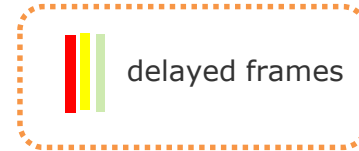
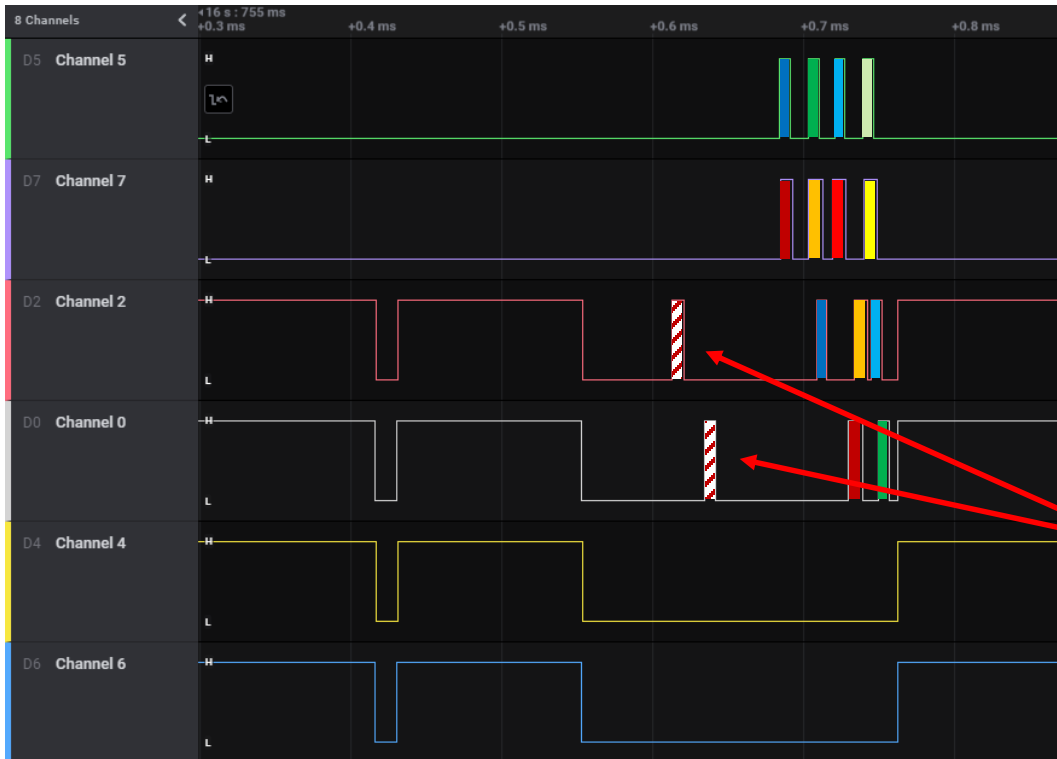
802.1Qbv with interfering traffic over 2 hops



Discussion

TSN Demonstrator

potential 802.1Qbv issues (1/2)



if application sends frames too late:



- frames are delayed to the next slot
- delay > 5ms !!!
- they will be dropped at the listener, because too late
- delayed frames from the previous cycle may reduce effective bandwidth within timeslot

TSN Demonstrator

potential 802.1Qbv issues (2/2)



- frames within a 802.1Qbv timeslot interfere as well among each other

• example:  causes delay to: 

→ Maximum delay within a timeslot per hop has to be calculated.

Important parameters are:

- max number of interfering frames in a timeslot
- max size of the frame.

Thank you for your attention!

RUETZ
SYSTEM SOLUTIONS

Oskar-Schlemmer-Straße 13
80807 München
Germany

T +49 / 89 / 200 04 13-0
F +49 / 89 / 200 04 13-99
info@ruetz-system-solutions.com