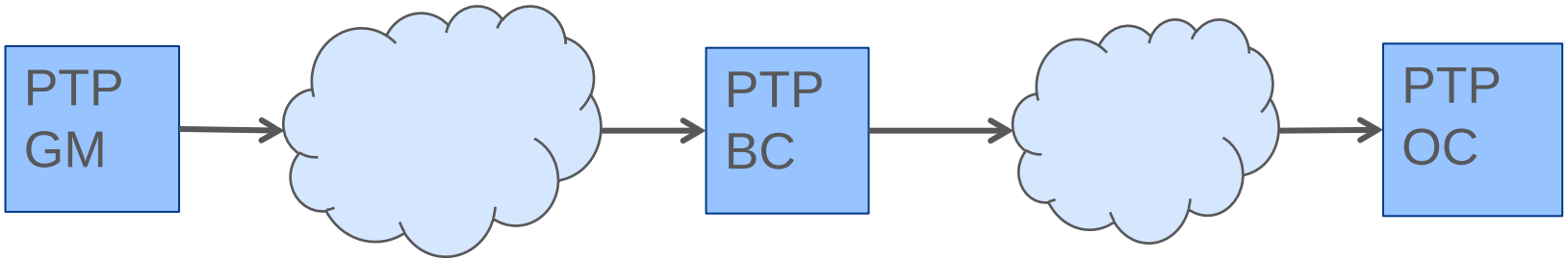
ERICSSON

LIGHT SW-TC

Effective Software upgrade option to simplify PTP slave operation

PARTIAL TIMING SUPPORT

Partial Timing Support

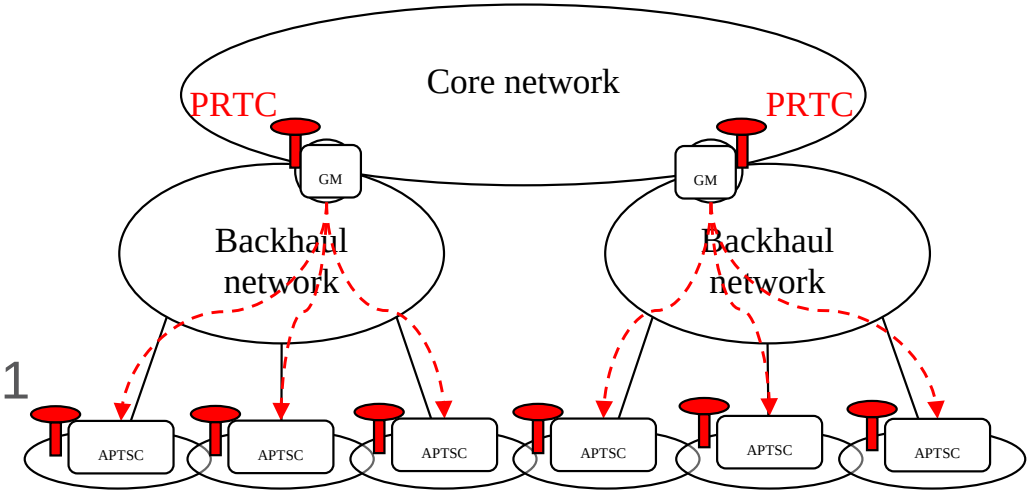


Full Timing Support

PTS - STANDARD

- Ongoing work in ITU-T concerning “Partial Timing Support” Architecture
- ITU-T G.8275 recently amended (“Assisted” PTS as first step)

From G.8275 Amd1



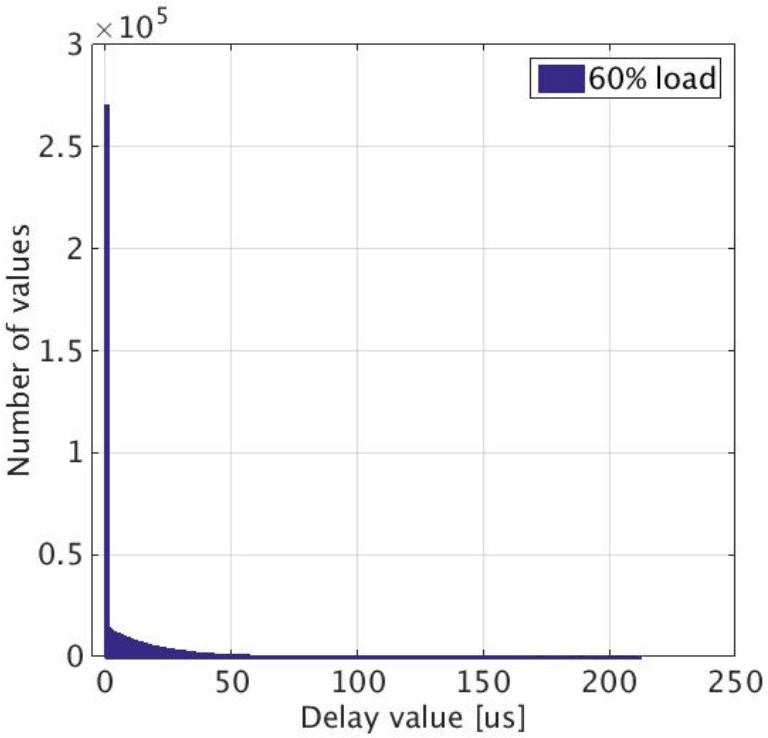
Note: T-GM are connected to the PRTC in this architecture

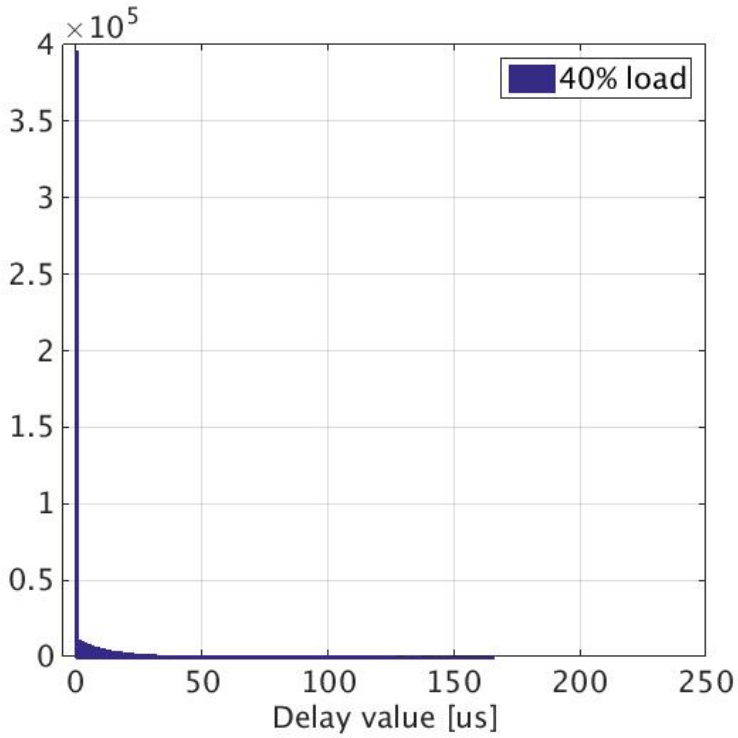
Backup

APTSC : APTSC

PROBLEM WITH PTS PACKET DELAY VARIATION

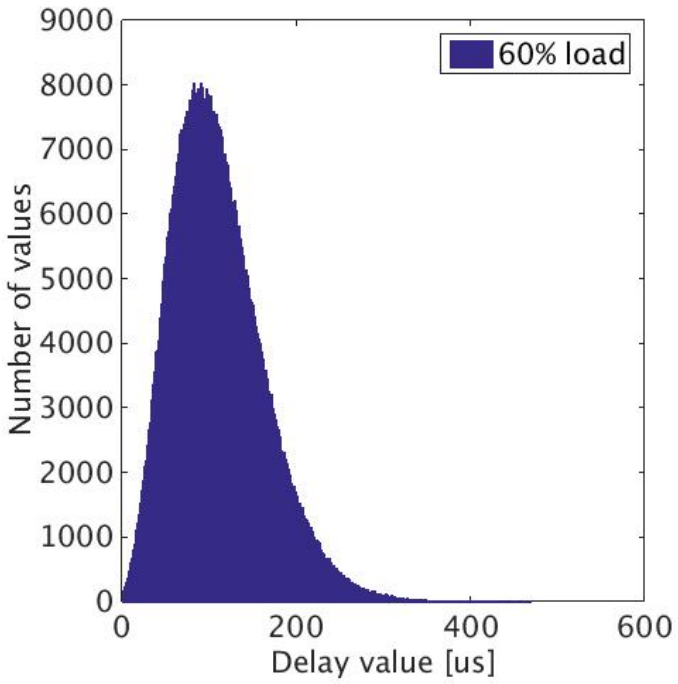
Simple queue model

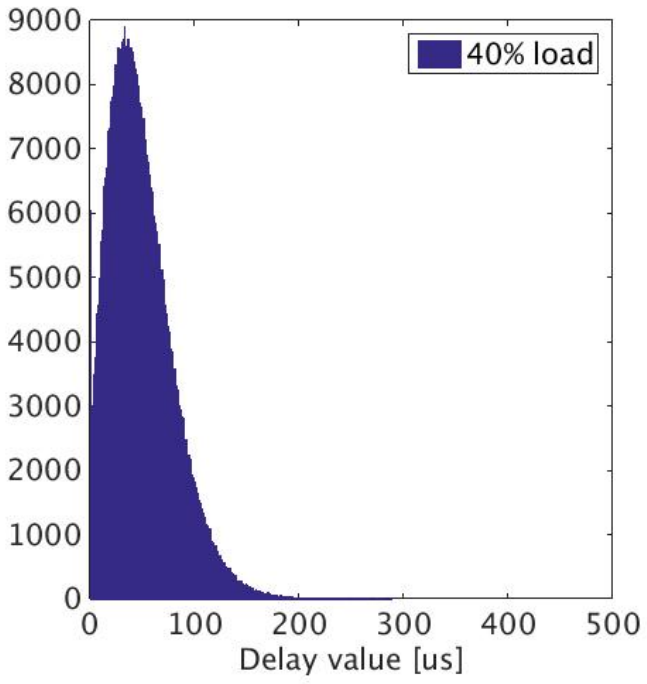




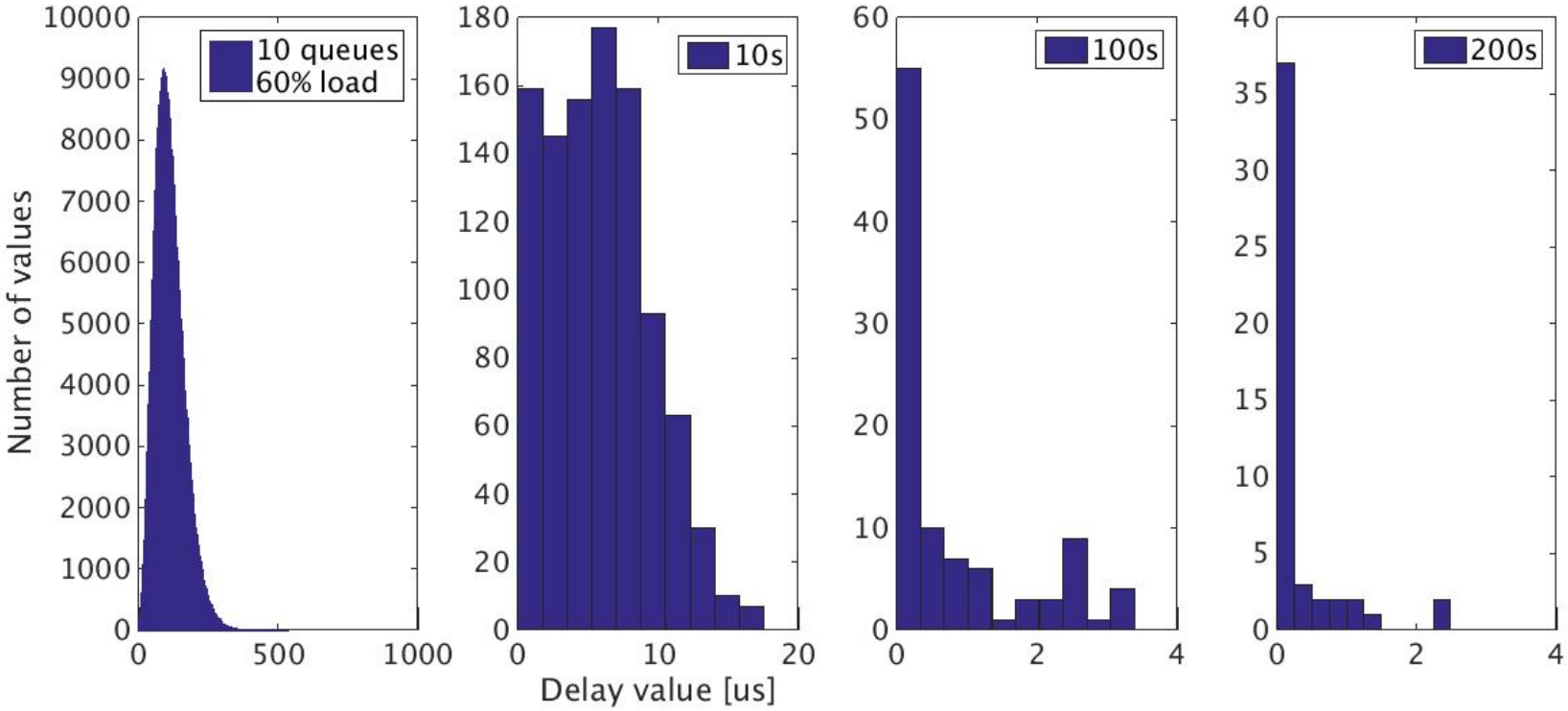
PROBLEM WITH PTS PACKET DELAY VARIATION

10 queues





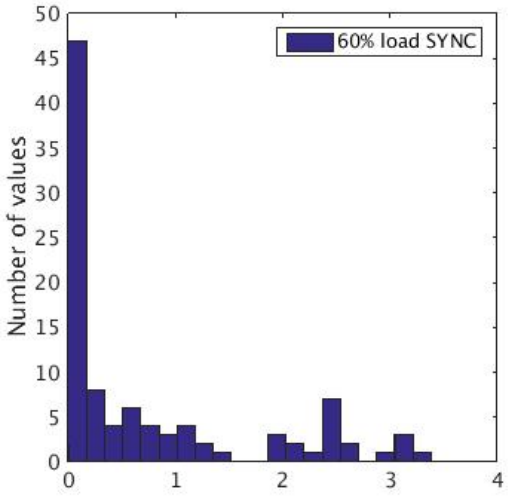
LUCKY PACKET FILTER

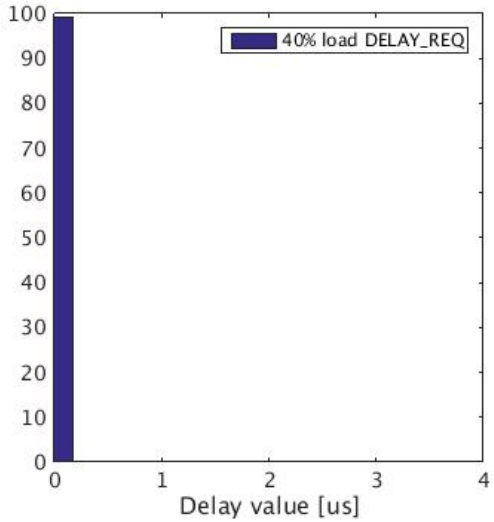


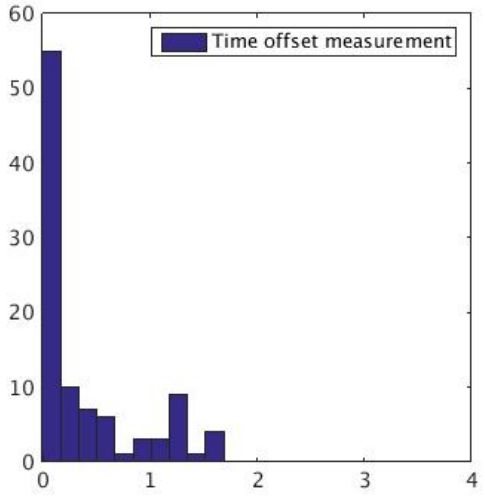
Picking the quickest packet with different observation interval (10s, 100s, 200s)

LOAD ASYMMETRY

Combining Sync and Delay messages selected from 100s observation intervals to Time Offset measurements:

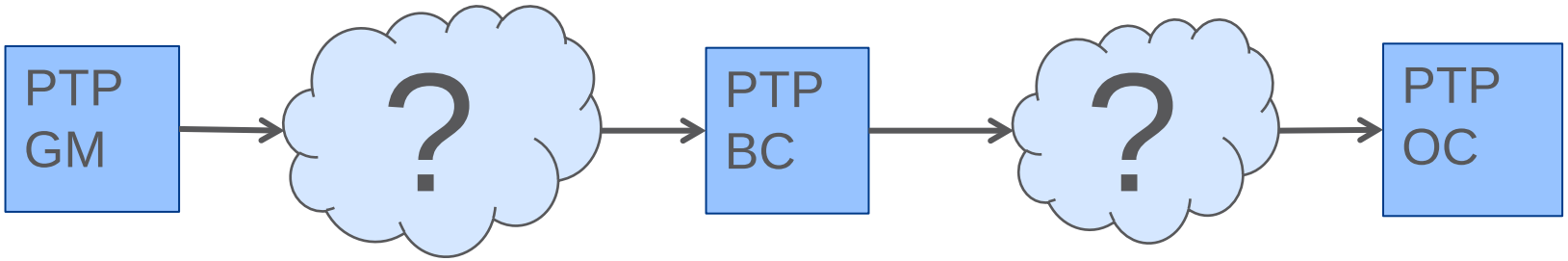






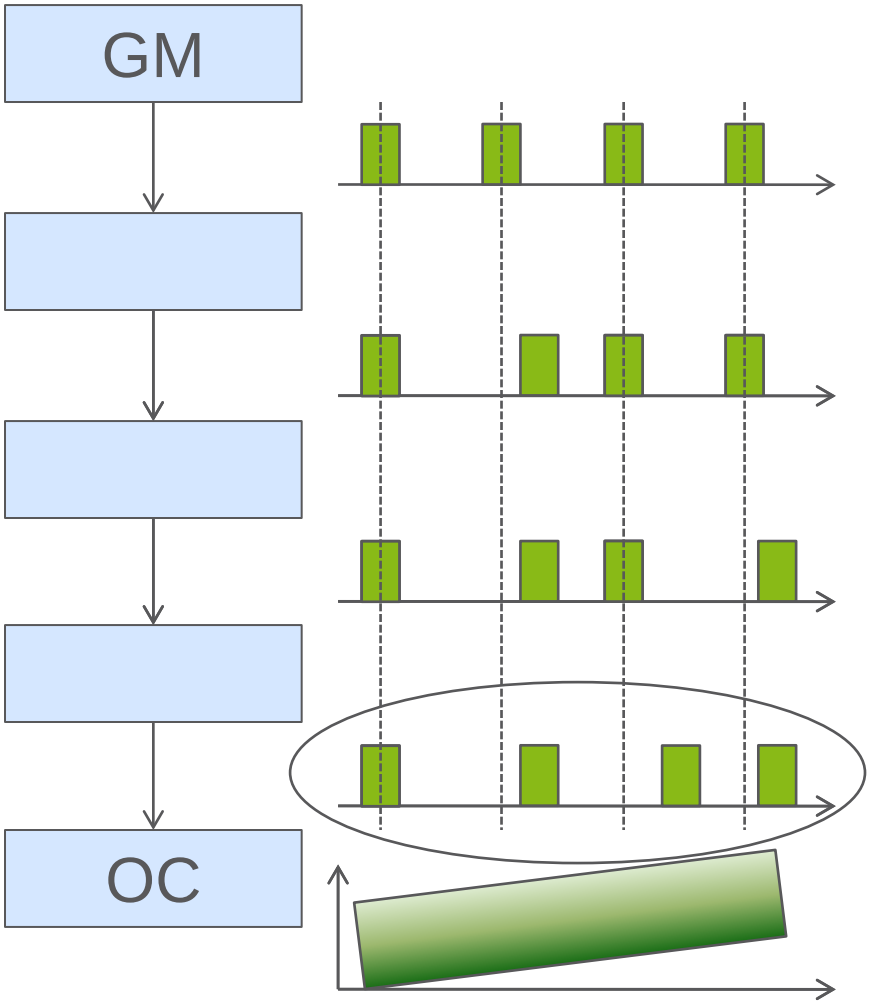
The Time Offset measurements has an offset!

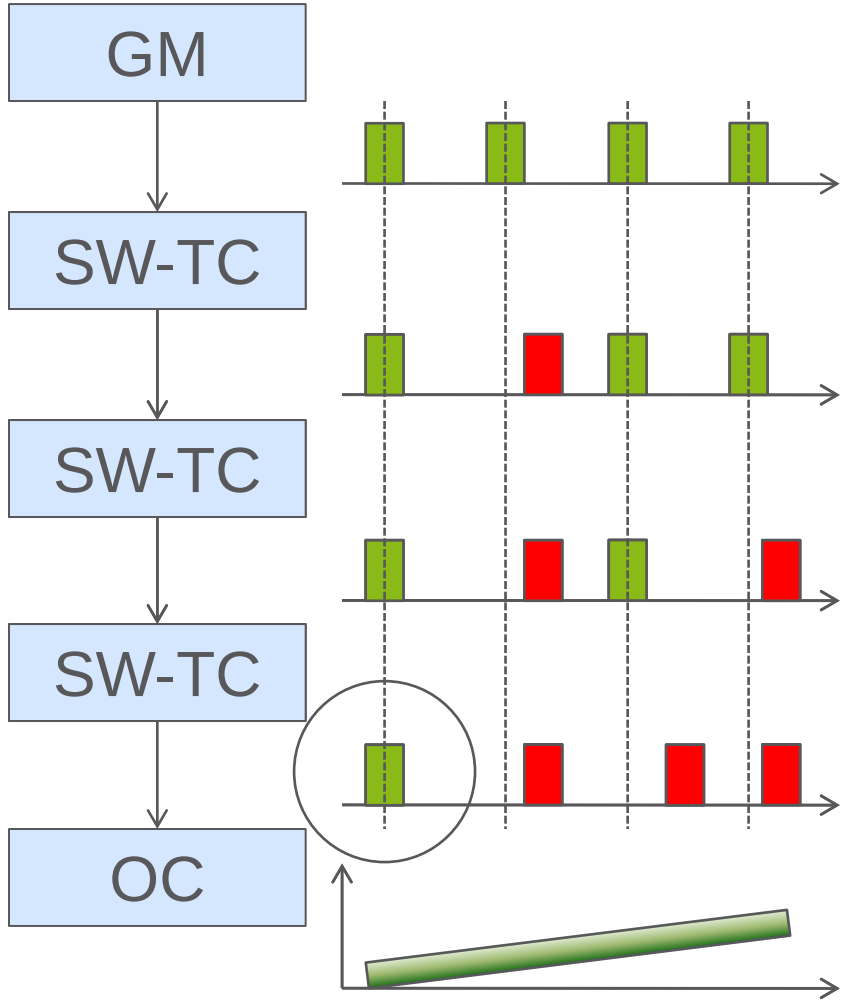
WHAT CAN BE DONE?



- We DON'T want to change all HW in the network
- We want to simplify the slave operation

WHAT IF?





ADDING DELAY INFO TO PACKET

Common Message Header

Bits								Octets	Offset
7	6	5	4	3	2	1	0		
transportSpecific				messageType				1	0
reserved				versionPTP				1	1
messageLength								2	2
domainNumber								1	4
reserved								1	5
flagField								2	6
correctionField								8	8
reserved								4	16
sourcePortIdentity								10	20
sequenceId								2	30
controlField									
logMessageInterval									

Preferred

2^{63}-1 =

“Too big to represent”

Alternative:

- timeTraceable = False

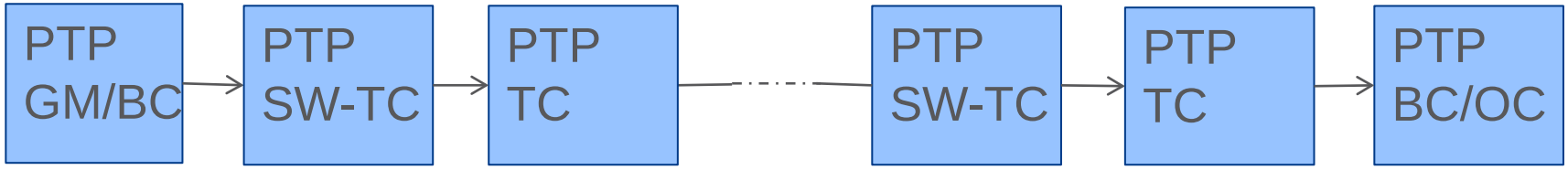
- profileSpecific

Add a suffix TLV to the PTP packet

LIGHT SOFTWARE TRANSPARENT CLOCK

PTS network with SW-TCs

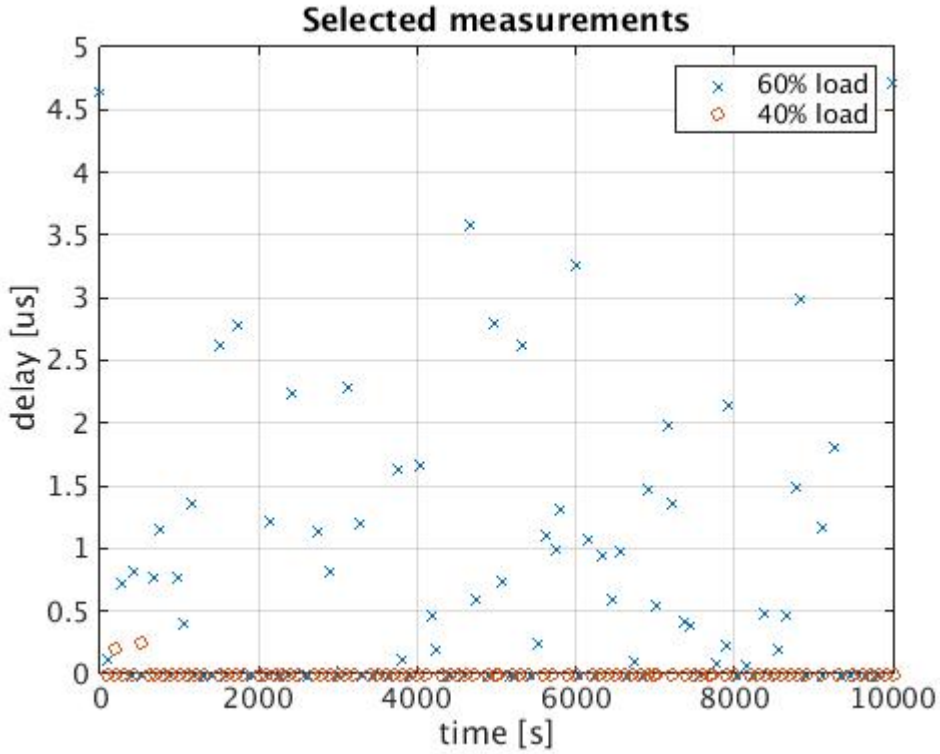
Mixed TC and SW-TC



SIMULATION SETUP

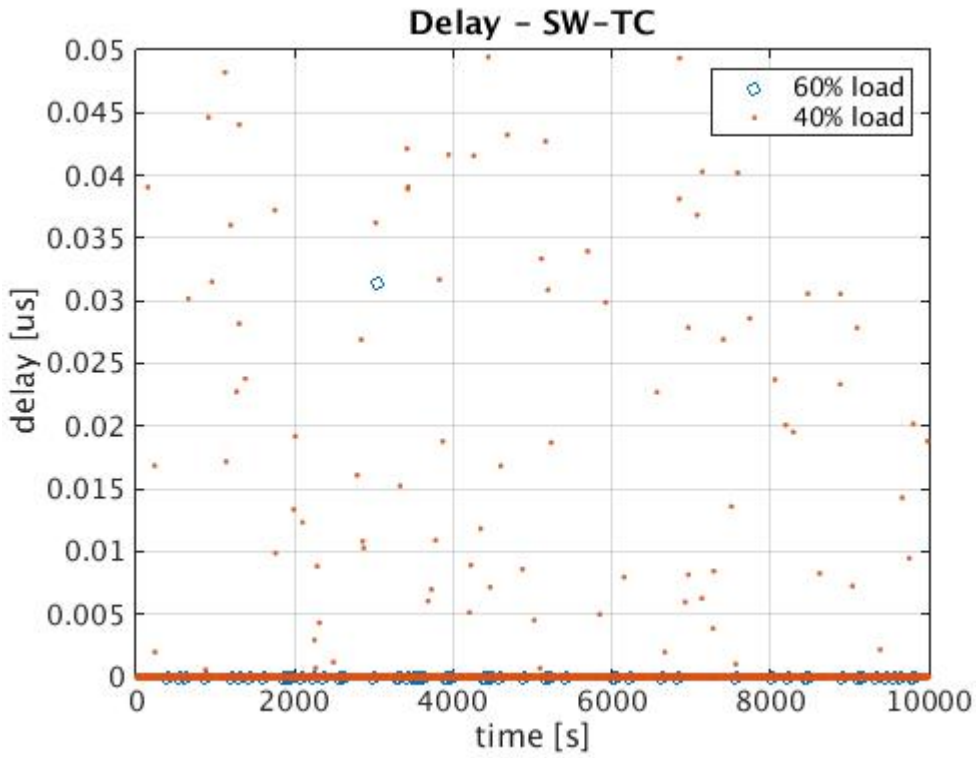
- Simulations in Matlab
- PDV – 10 queues with 60/40% load
- Packet rate is 64pkt/s
- Slave starts with 200ppb frequency offset
- Two different selection methods:
  - ”Lucky packet filter” with 100s observation interval
  - SW-TC network

SIMULATION SELECTED PACKETS "LUCKY PACKET FILTER"

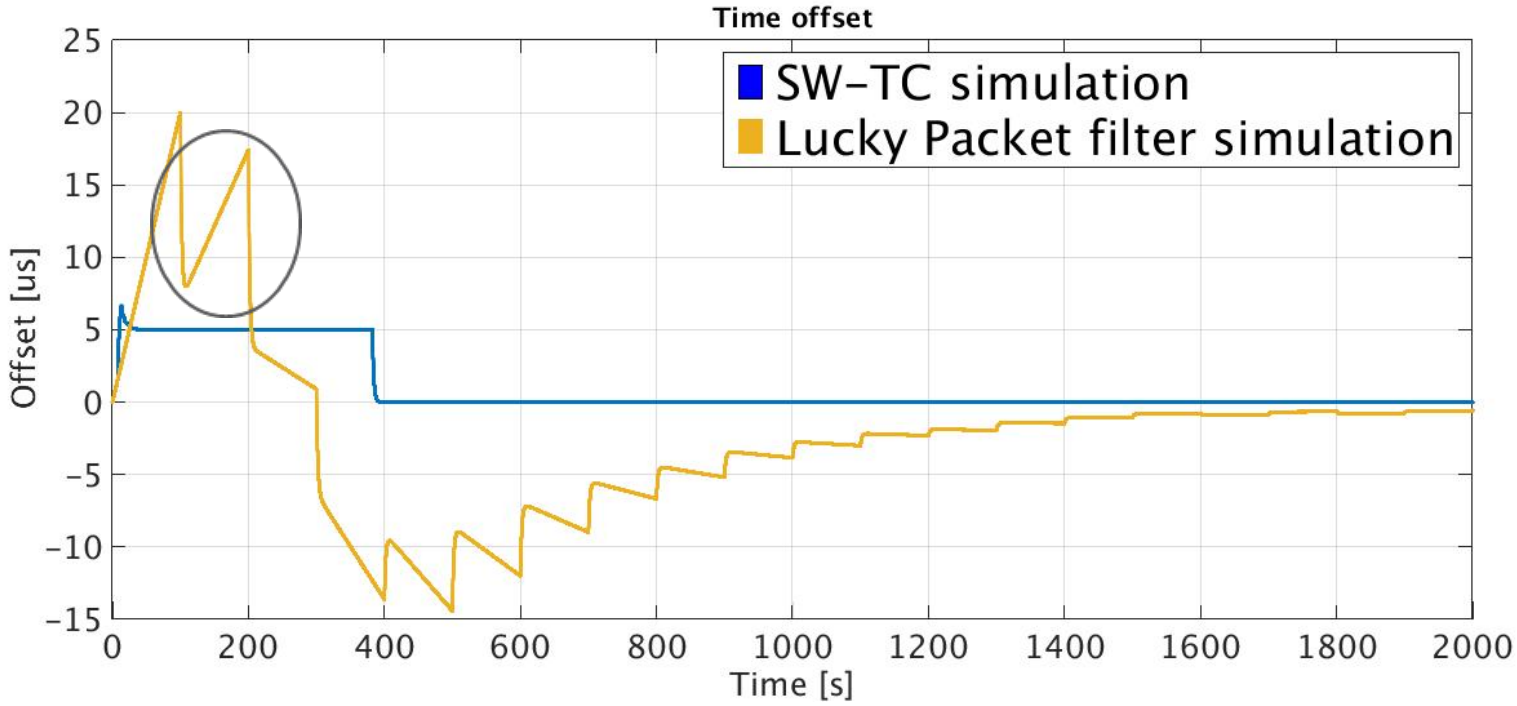


SIMULATION
REAL LUCKY PACKETS !!
SW-TC NETWORK

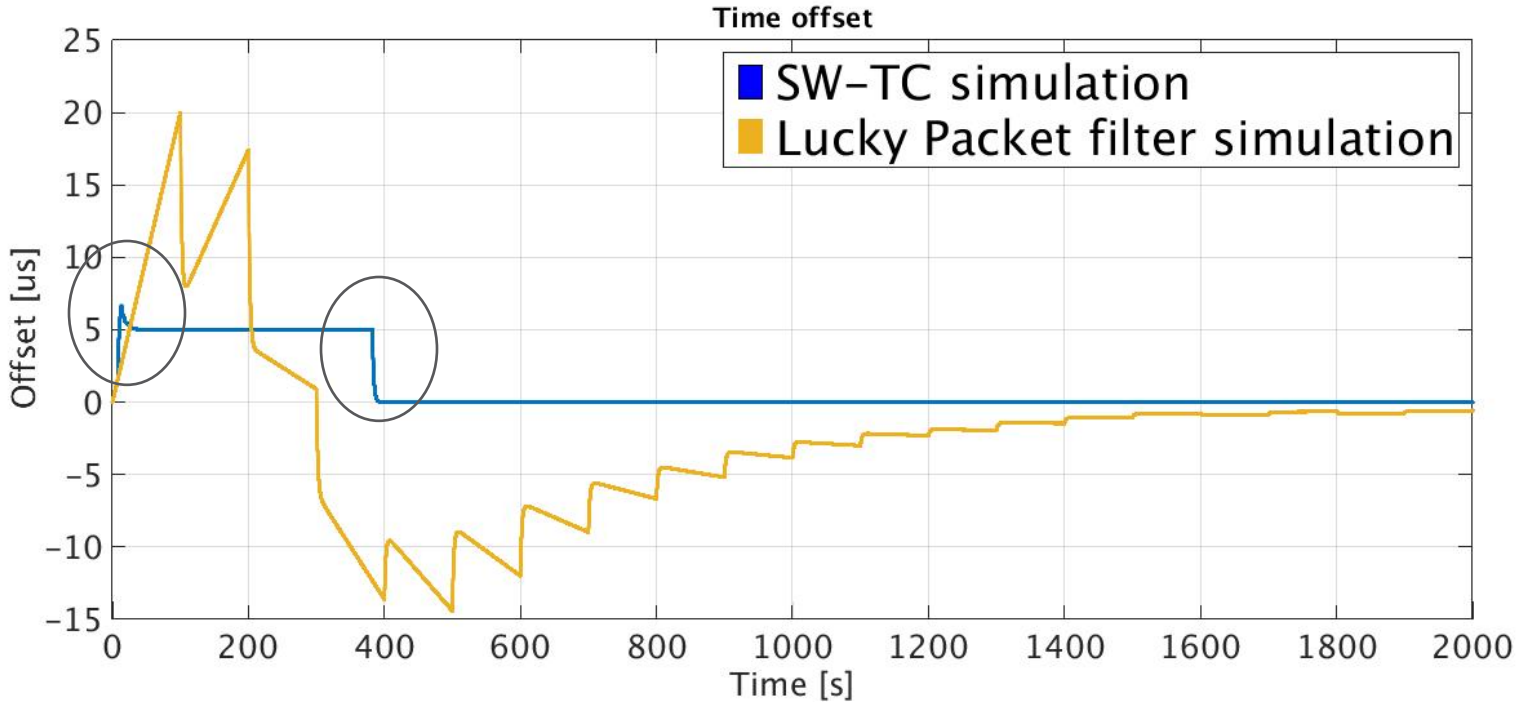
Obs! Scale



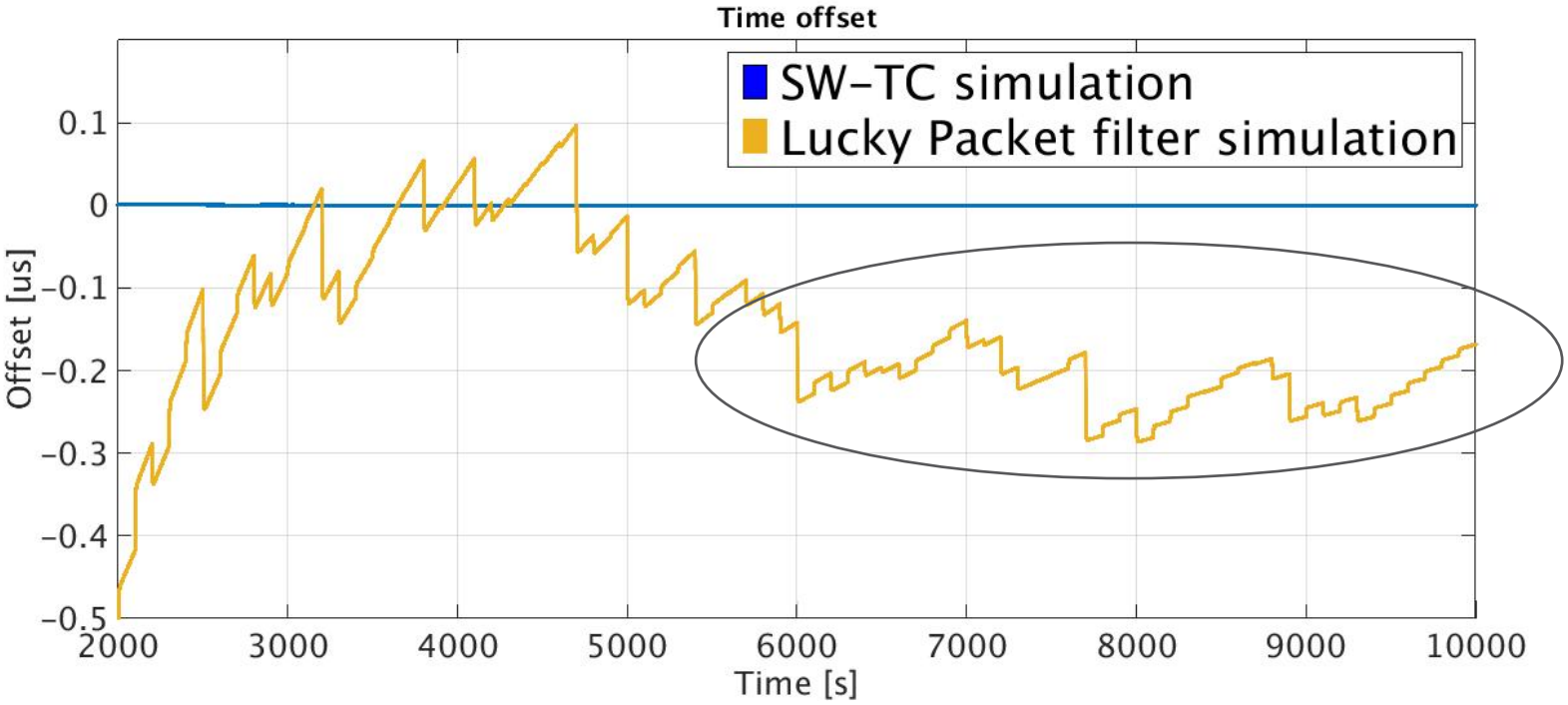
SIMULATION TIME OFFSET



SIMULATION TIME OFFSET



SIMULATION TIME OFFSET



CONCLUSIONS

- Partial Timing Support scenarios are important for several operators
- Not always feasible to meet the most stringent requirements
- Software updates in the transport network can provide significant help
  - No new HW; SW upgrade sufficient!
  - Fits into available standards
- Simplifies the slave operation
  - All Lucky Packets are easily identified
  - Insensitive to initial frequency offset
  - Less sensitive to load impairment
- It would be beneficial to define standard practices

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EXTRA SLIDES

SIMULATION THE MODEL

- Three states in state vector $\hat{x}$: downstream offset [s], upstream offset [s], fractional frequency offset [-]
- Kalman filter is used as state estimator
- Control Value (change in frequency) is a function of the three states:

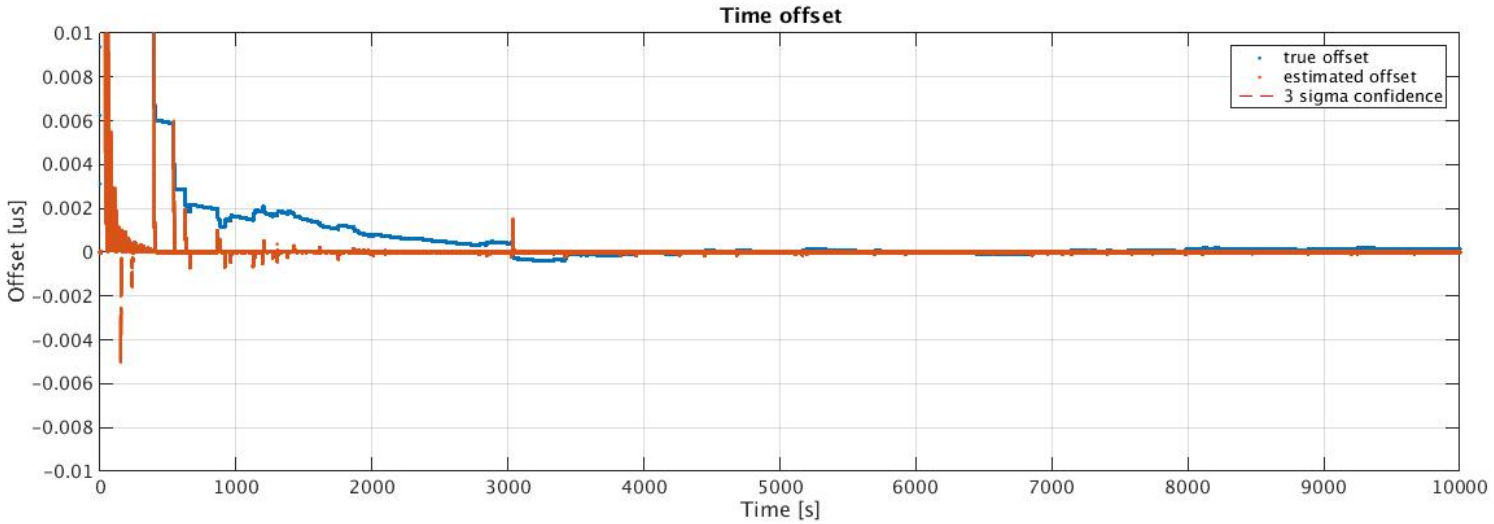
$$t = {}^{100ns}/_{50ppb}$$

$$c = -[{}^{1}/_{2t} \quad {}^{-1}/_{2t} \quad {}^{Ts}/_{t} + 1]$$

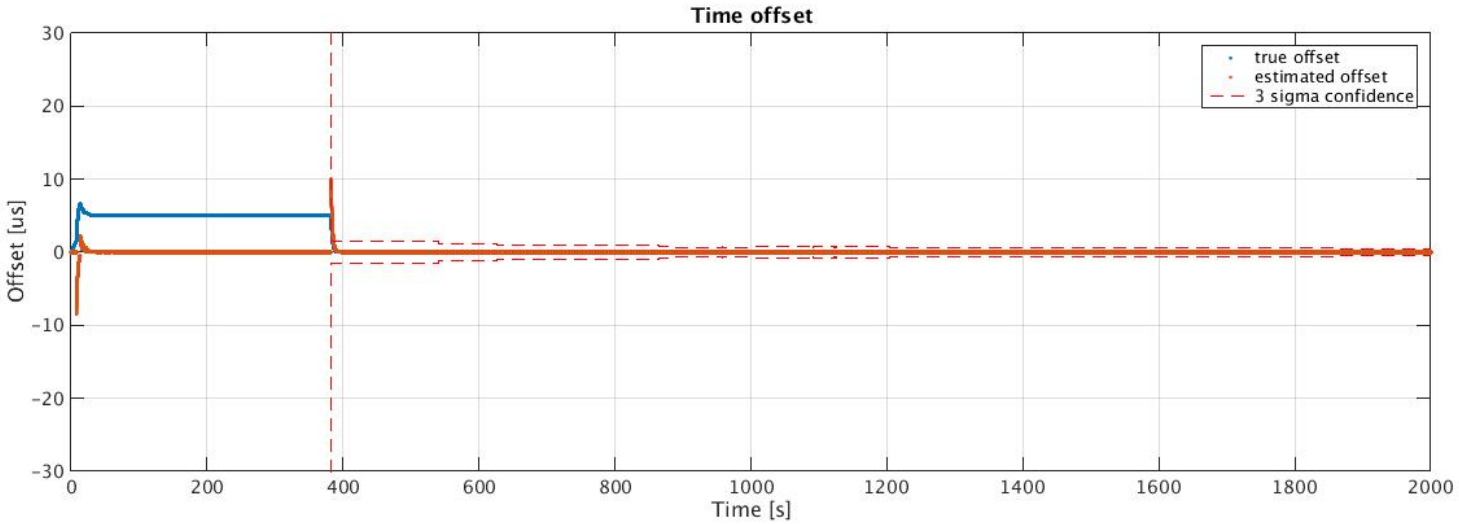
$$cv = c\hat{x}$$

- Static Measurement noise, $\mathrm{R} = (1us)^2$

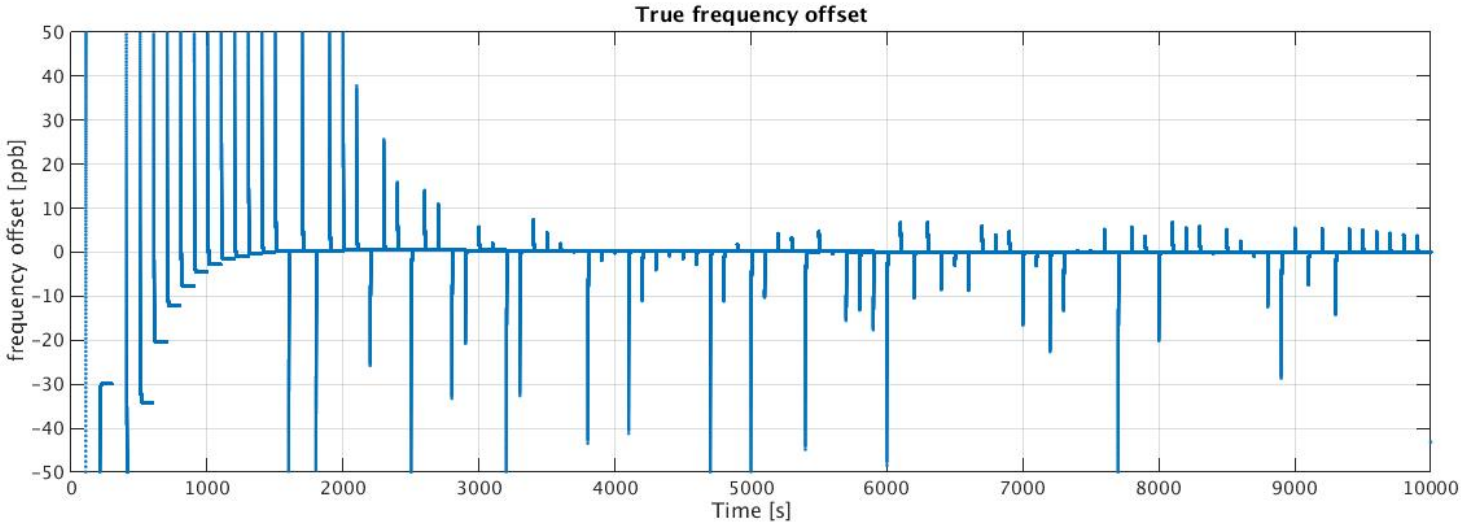
SIMULATION
TIME OFFSET - SWTC



SIMULATION
TIME OFFSET - SWTC



SIMULATION FREQUENCY OFFSET "LUCKY PACKET FILTER"



SIMULATION FREQUENCY OFFSET "SW-TC"