



# MiFID II and beyond.

In depth session on a slightly different approach to compliance validation.

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ITSF 2017

# MiFID II clock sync

Global traceability of financial events

100 [us]



Precise timestamp of a specific offset within IP packet.



macro scale  
meets  
micro scale



# Compare and contrast

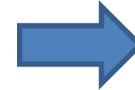
## Telecommunications Industry



physical reality



core business

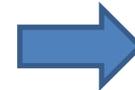


abstracted reality

Entirely acceptable, part of the package  
e.g. connection dropped

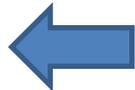


failure

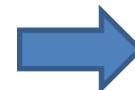


NOT acceptable  
huge reputation risk

no big deal



100 [us]

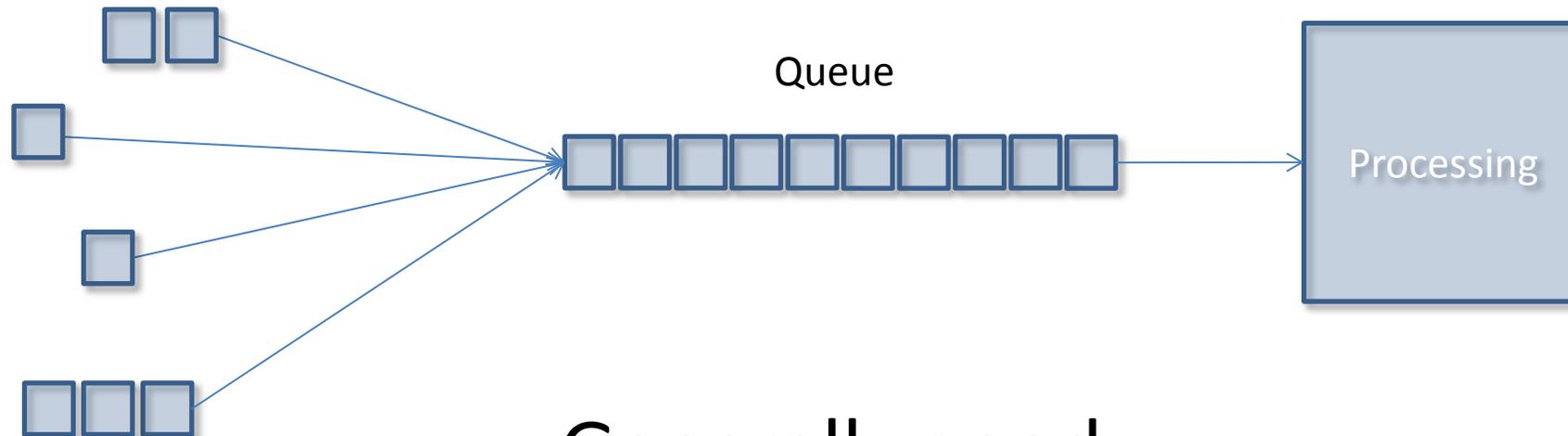


what is a microsecond?



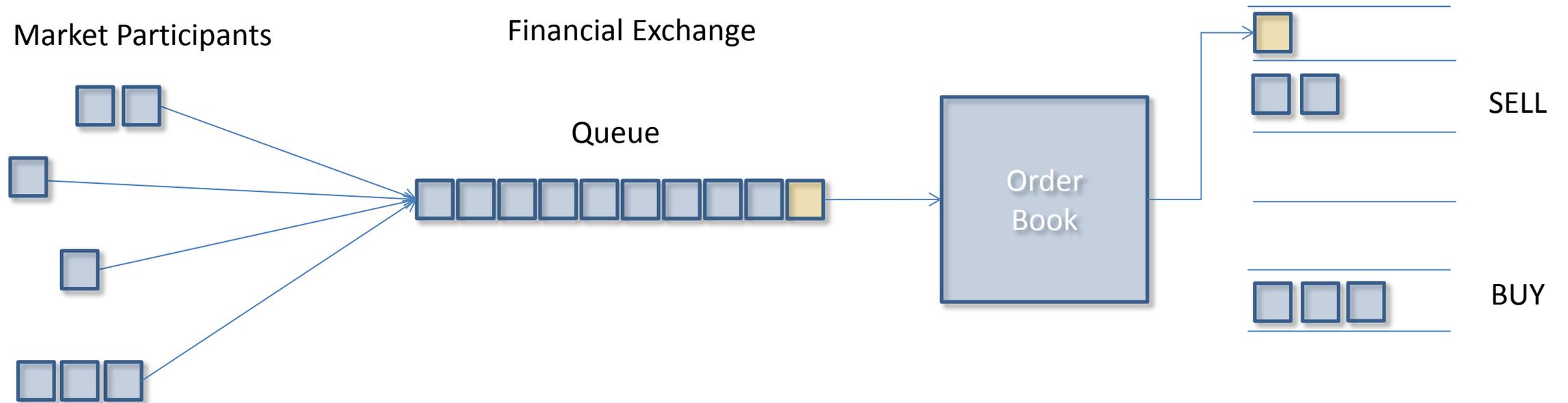
## A short introduction to market abuse

# Loose coupling – good or bad?

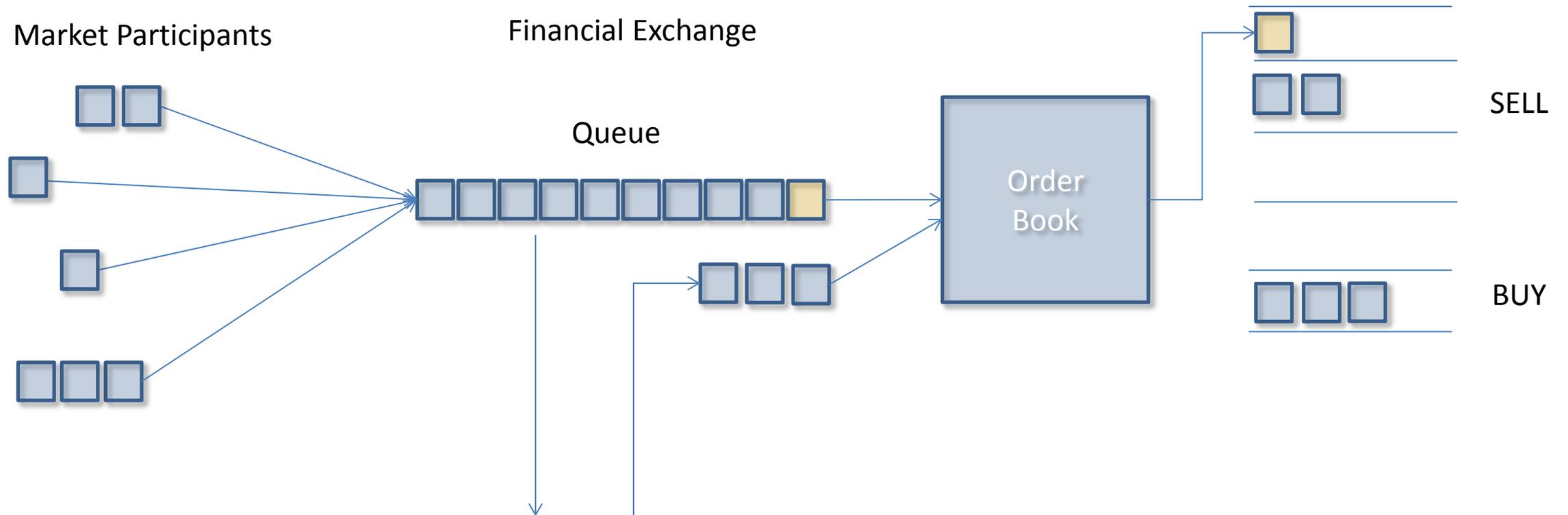


Generally good,  
it can even help you to print money  
**(but don't try this at home)**

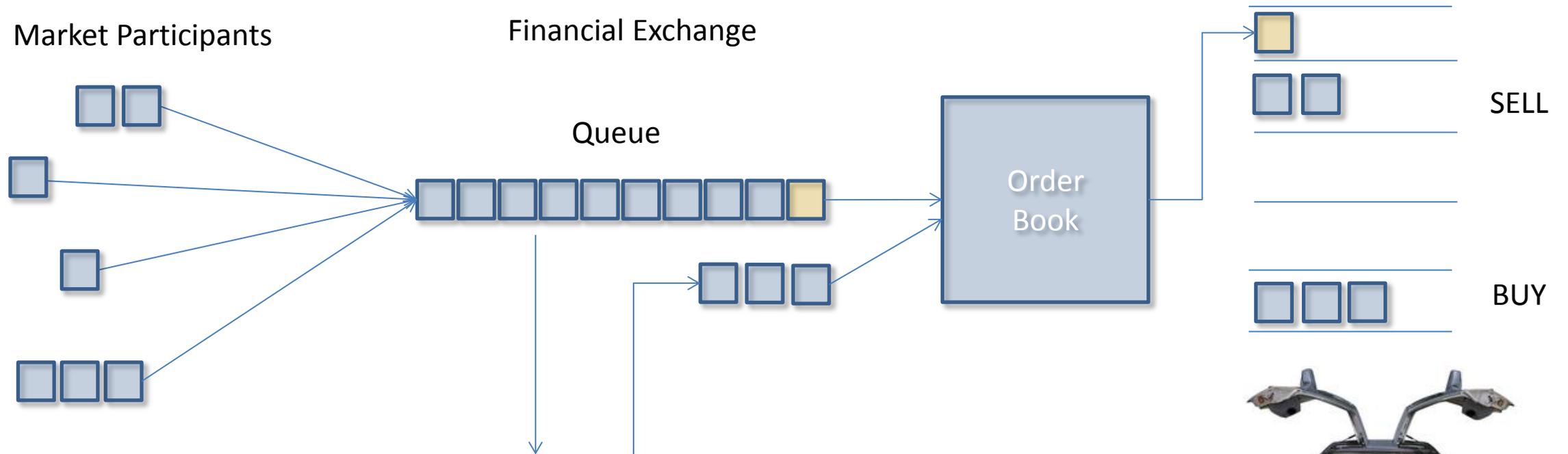
# How?



# Just add another queue



# Knowing the future will make you rich



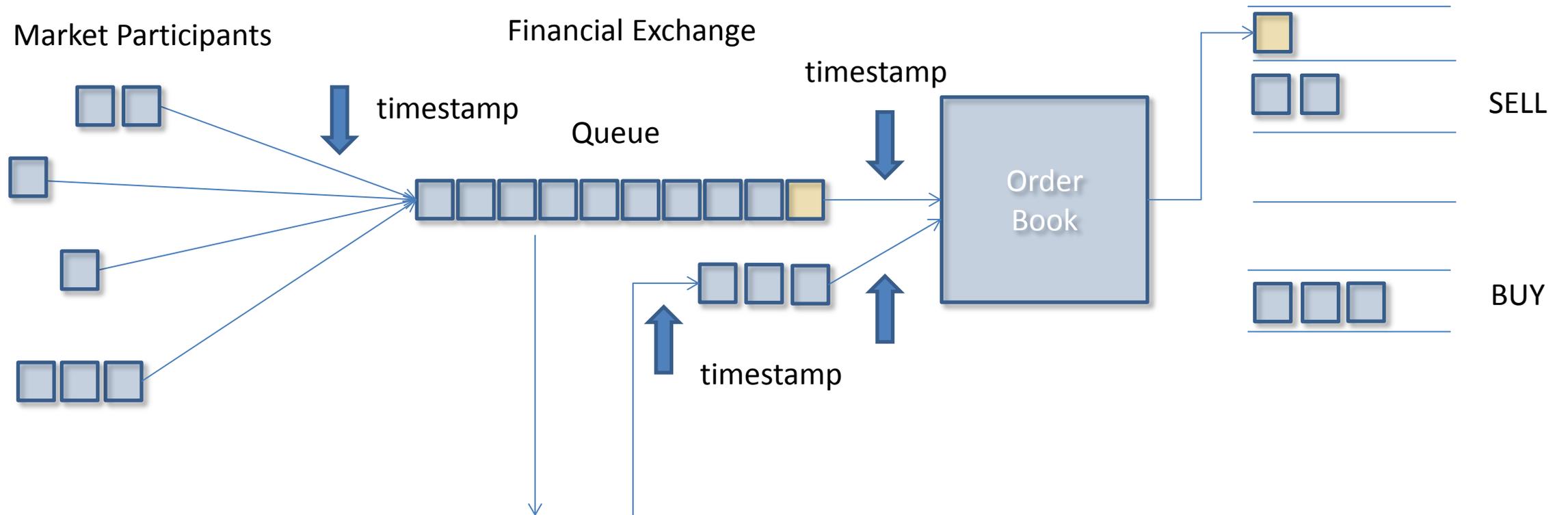
If you can see the queue and have the ability to place orders  
then  
you have both the ability to **time travel** (Back to the Future)  
and **print money** (riskless profit)



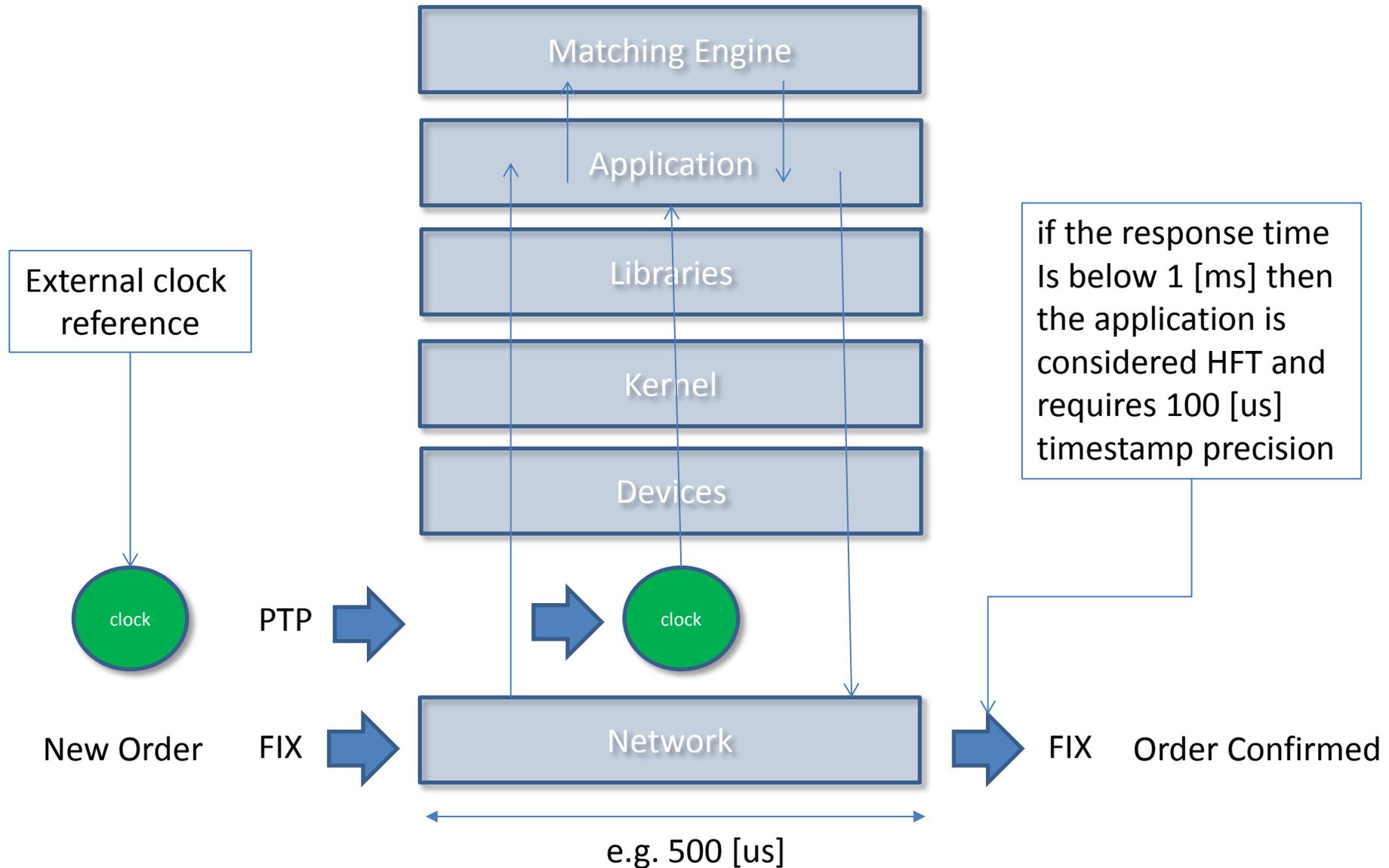


## Market Surveillance and MiFID II

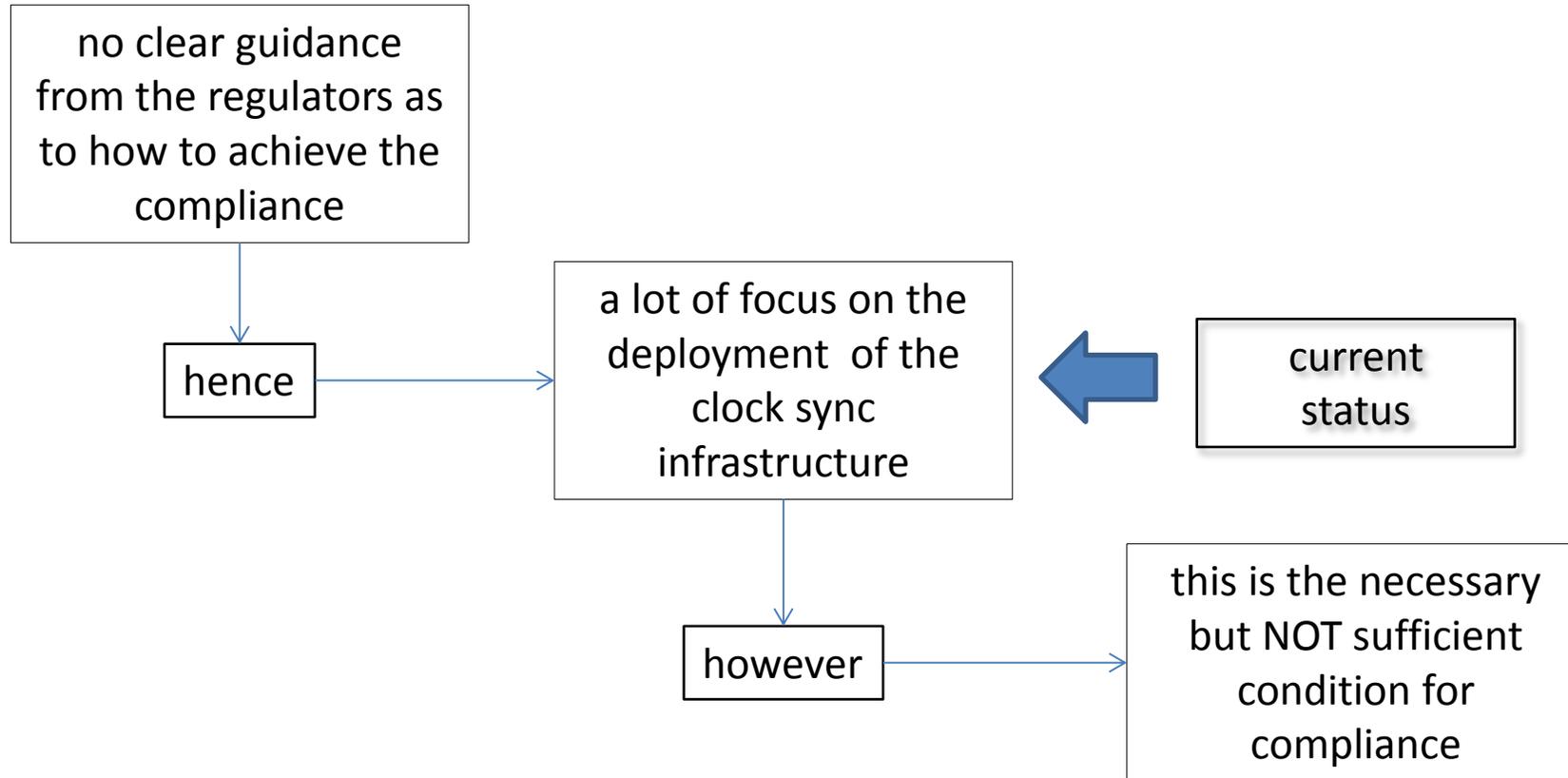
# Timestamp to recreate the sequence of events



# Traceable event example (big picture)



# MiFID II compliance



# Burden of proof

The directive states RTS 25, Article 4:  
... operators of trading venues [...] shall evidence that the crucial systems components used meet the accuracy standard levels ...

so in order to  
mitigate the risk of  
non-compliance

the focus for  
the rest of this  
presentation

the obvious

the not so obvious

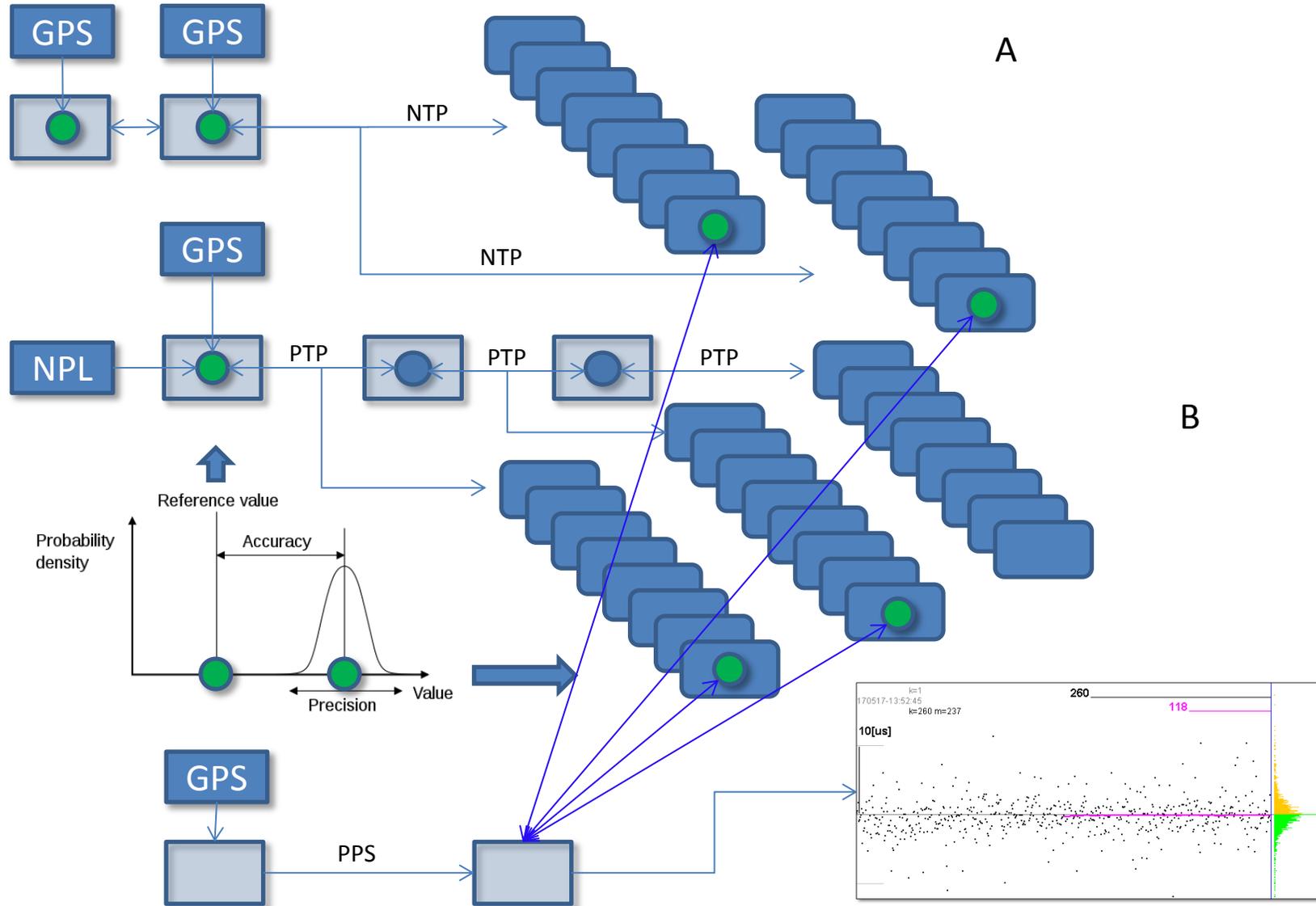
clock sync infrastructure

understand the dynamics of the  
entire system, and identify  
factors that really matter

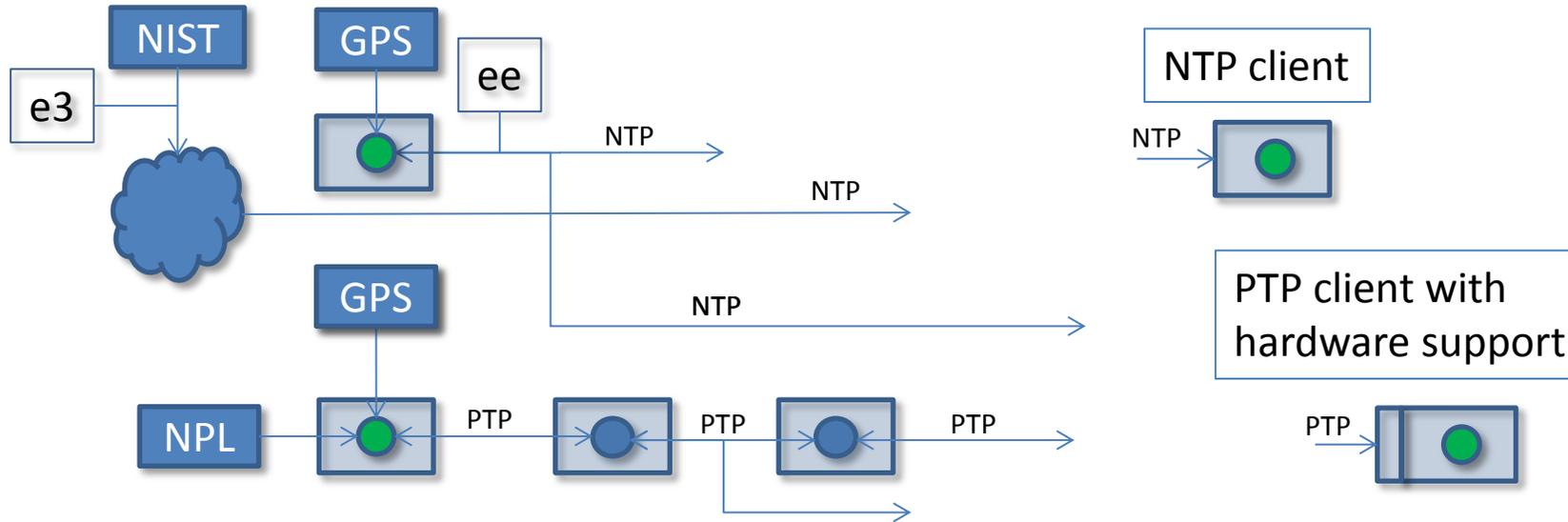


Clock sync  
in practice

# Clock sync infrastructure



# A lot of decisions to make



Precision		
e3	1.9	[ns]
ee	3.8	[us]

Time distribution mechanism:

## **NTP**

Simple but dated and regarded as inferior to PTP (a view not always justified). Straightforward to implement without capital expenditure.

## **PTP**

sophisticated, but needs hardware and infrastructure support to fully deliver on its promise.

# Compare and contrast

Telecommunications Industry



G.8261.1

G.8273.2

G.8273.3

G.8275

MTIE

TDEV

Financial Industry



NTP



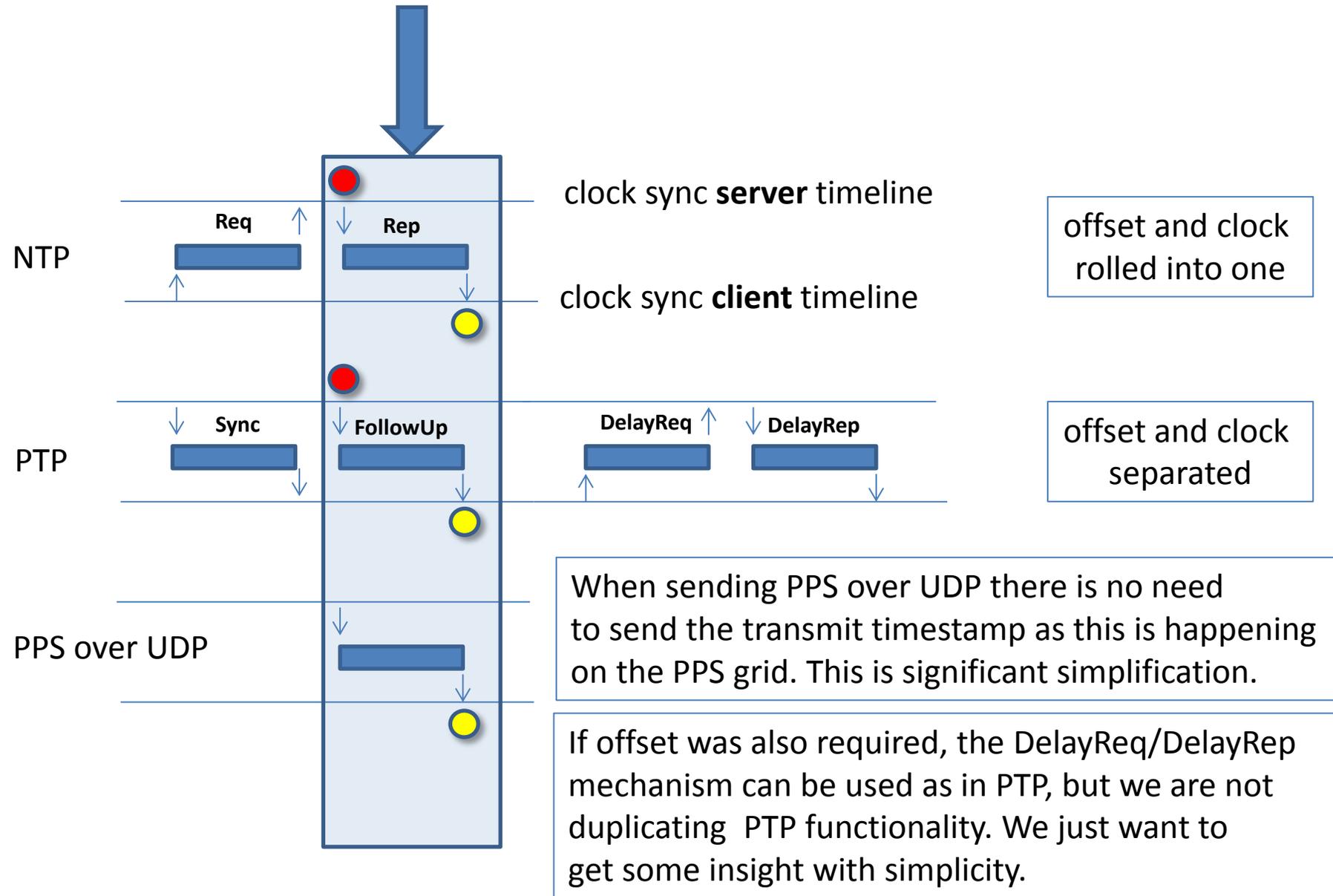
PTP



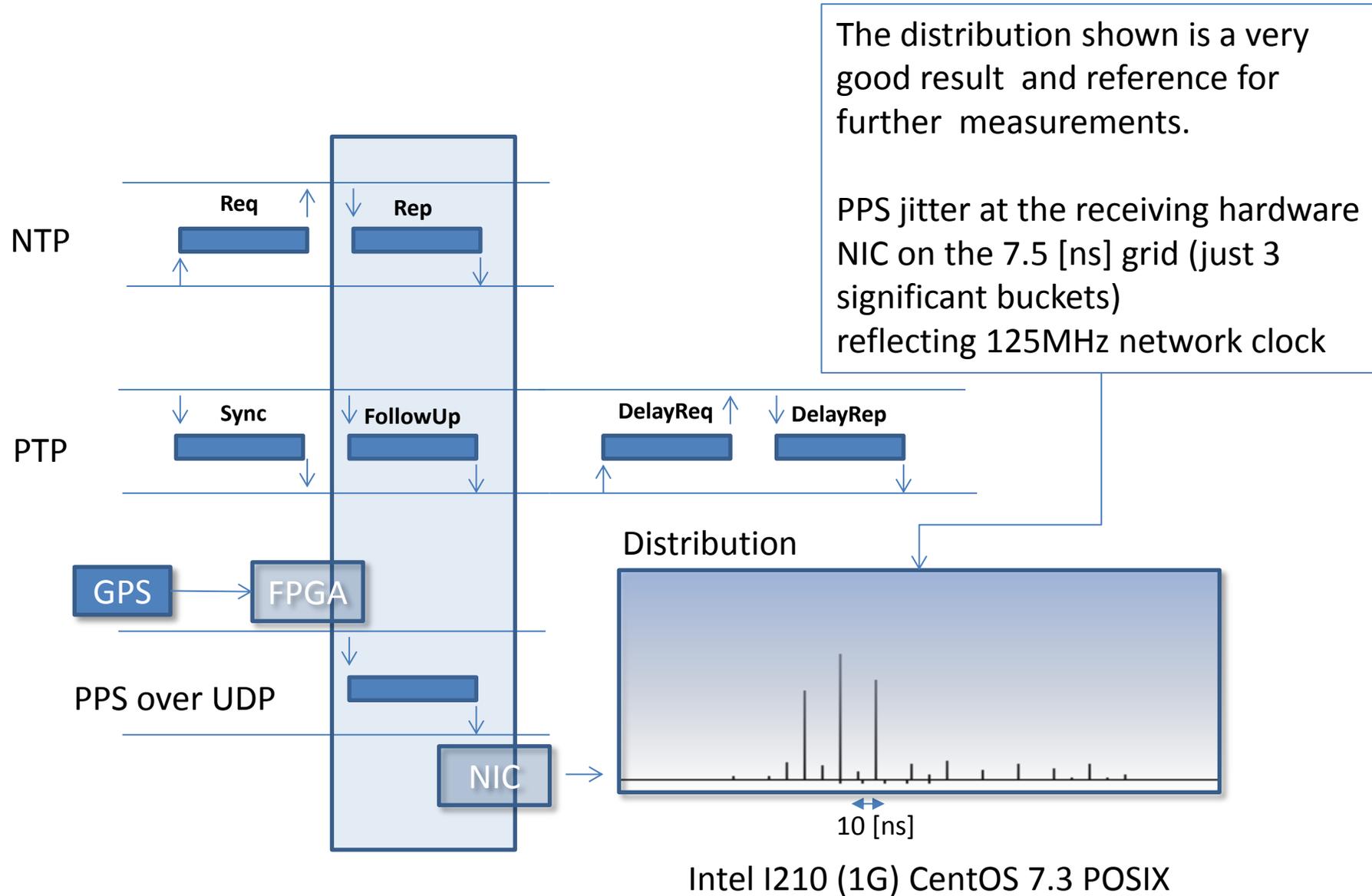
PPS over UDP



# Why is PPS so useful (in absence of a proper lab)?

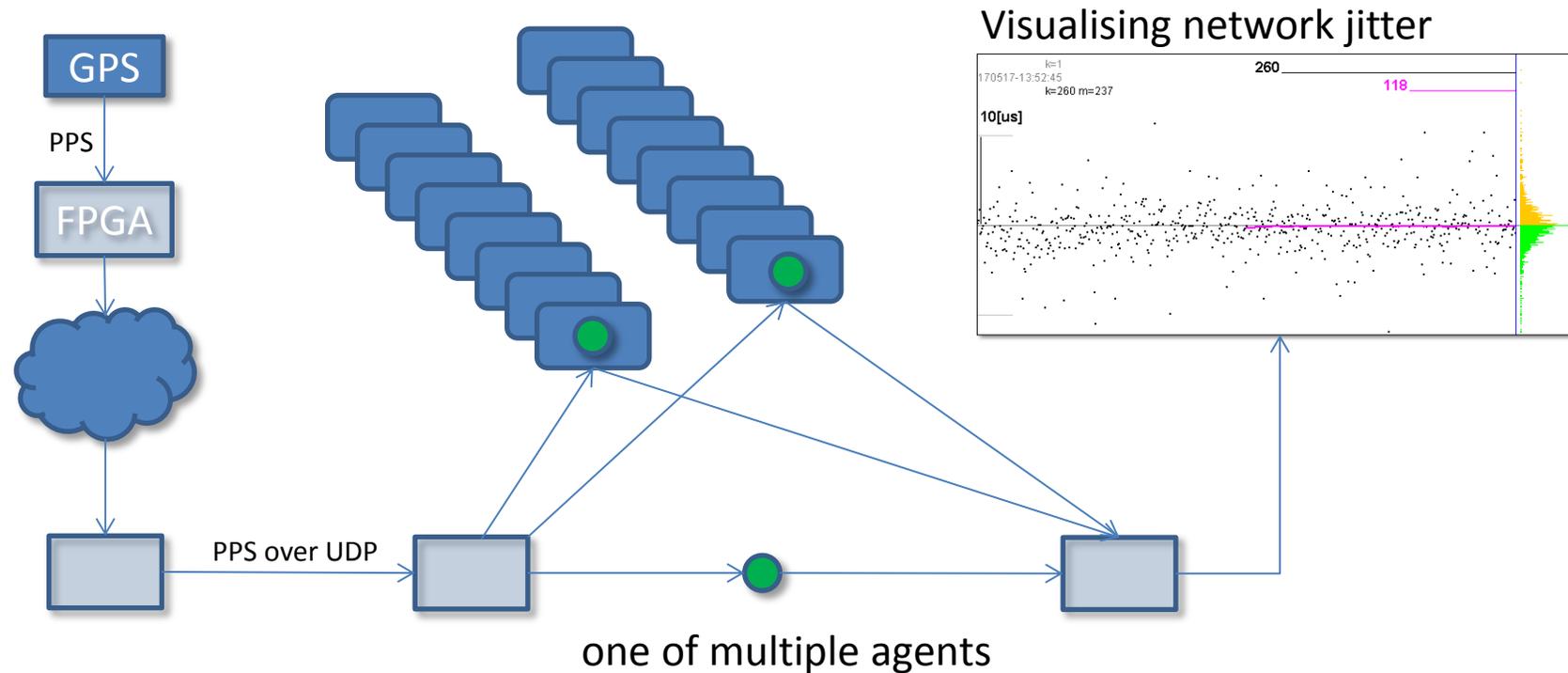


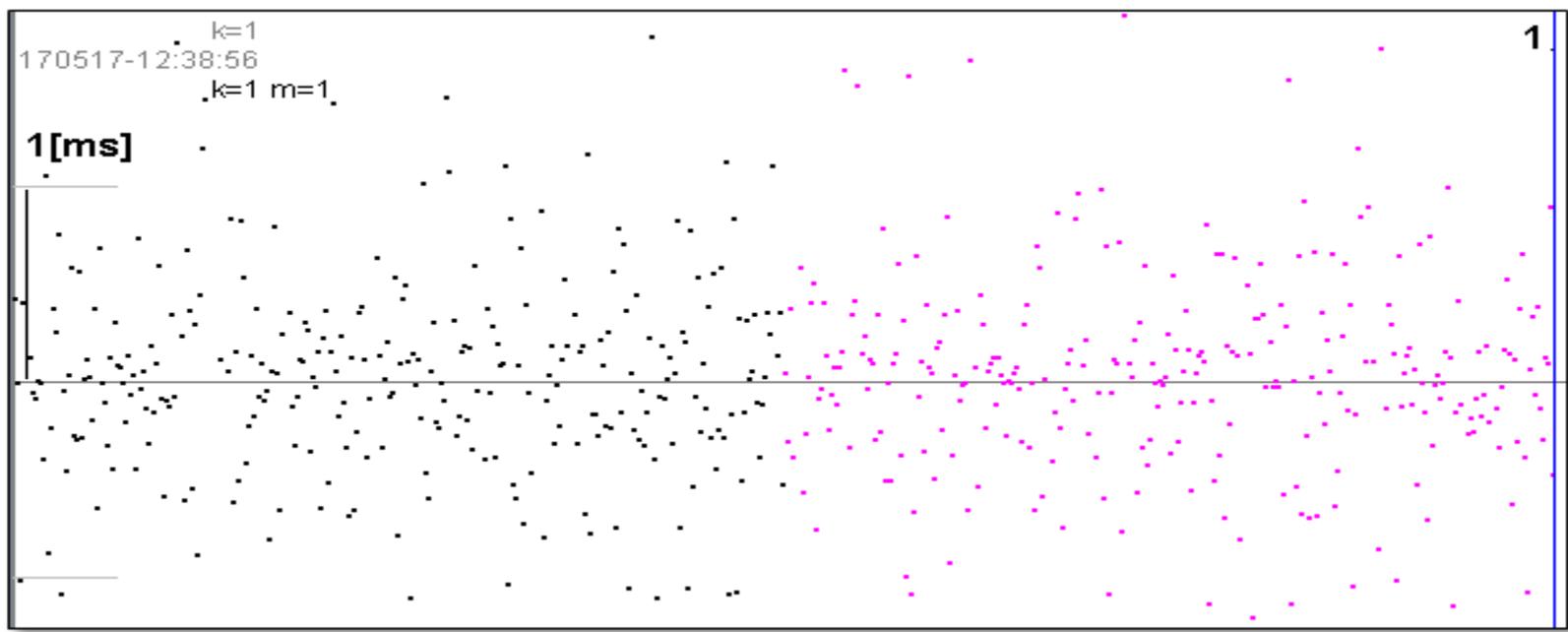
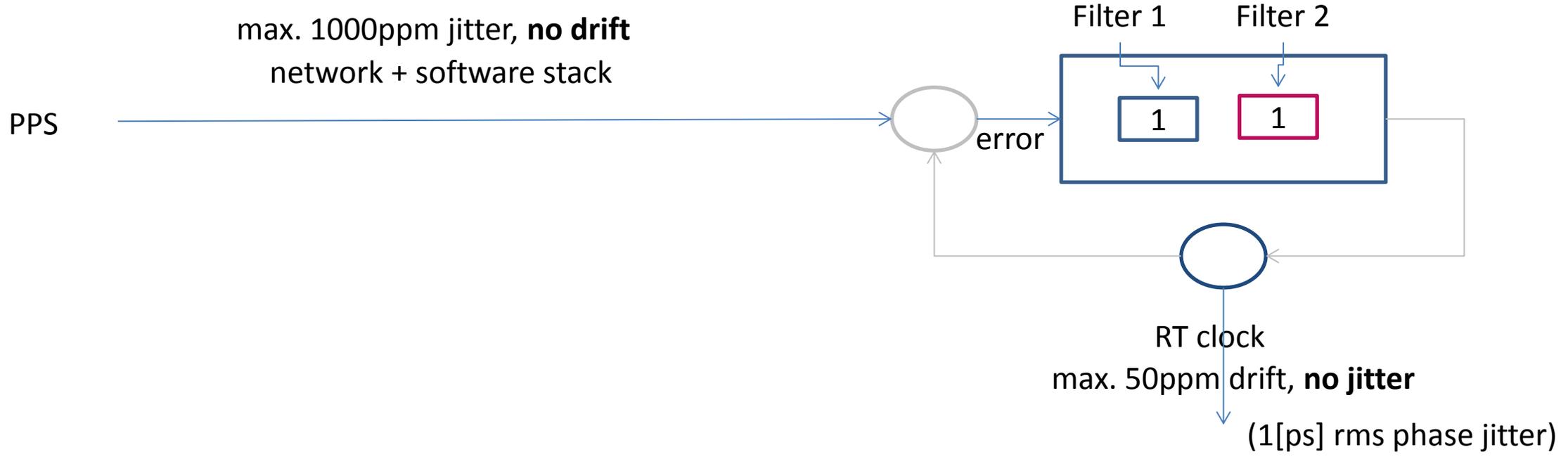
# Calibrating test fixture PPS FPGA NIC



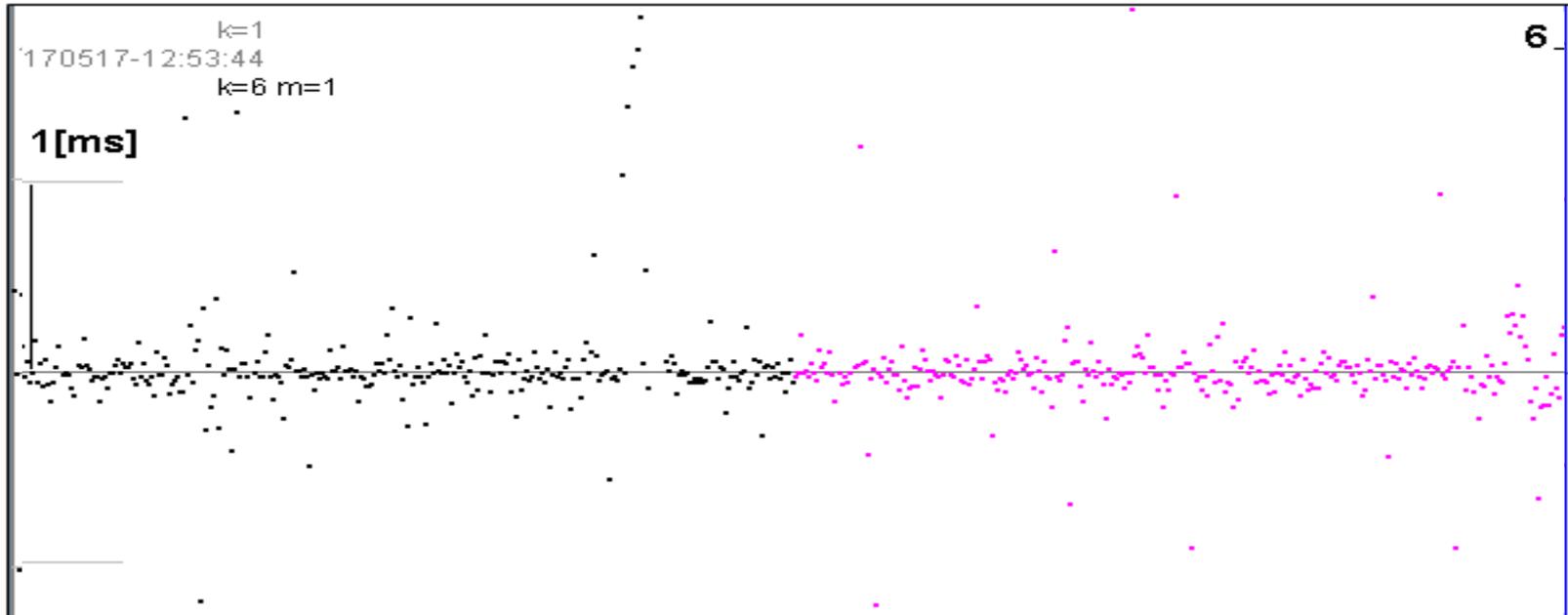
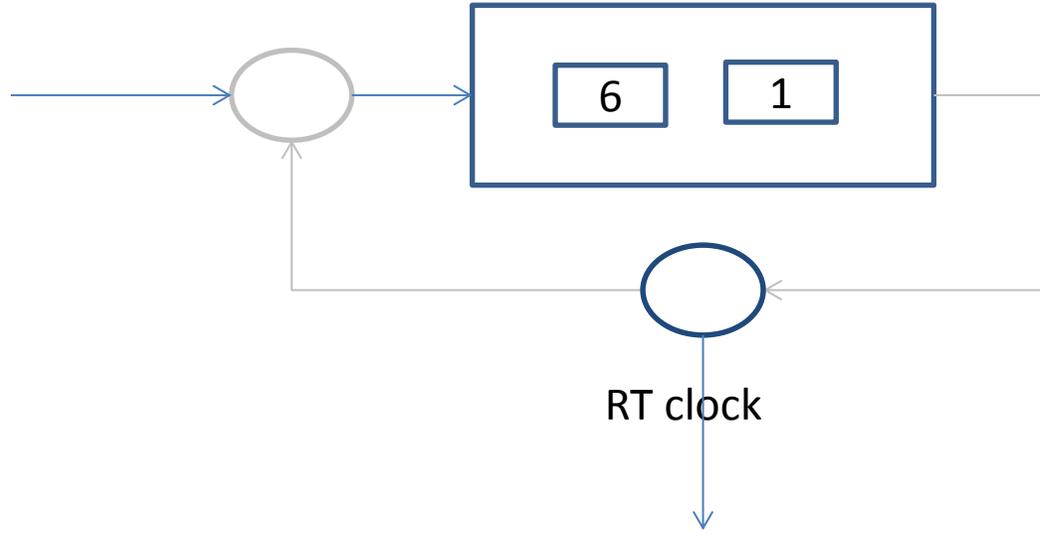
# PPS over UDP

- **NOT** an alternative to NTP or PTP !
- **BUT** very useful in gaining the insight

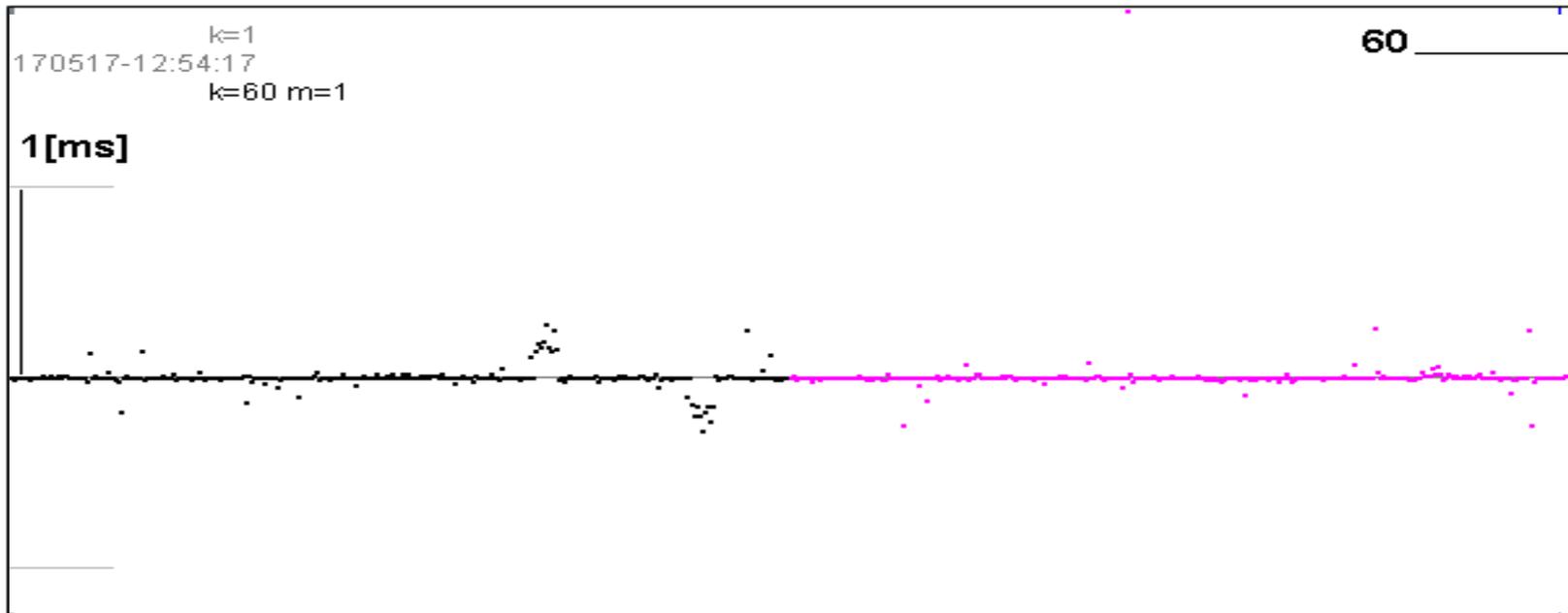
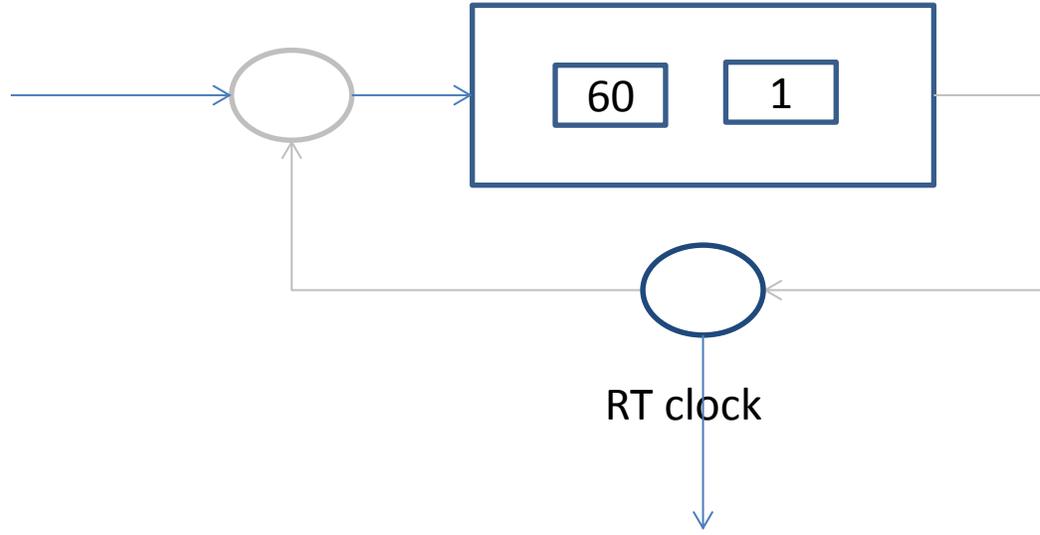


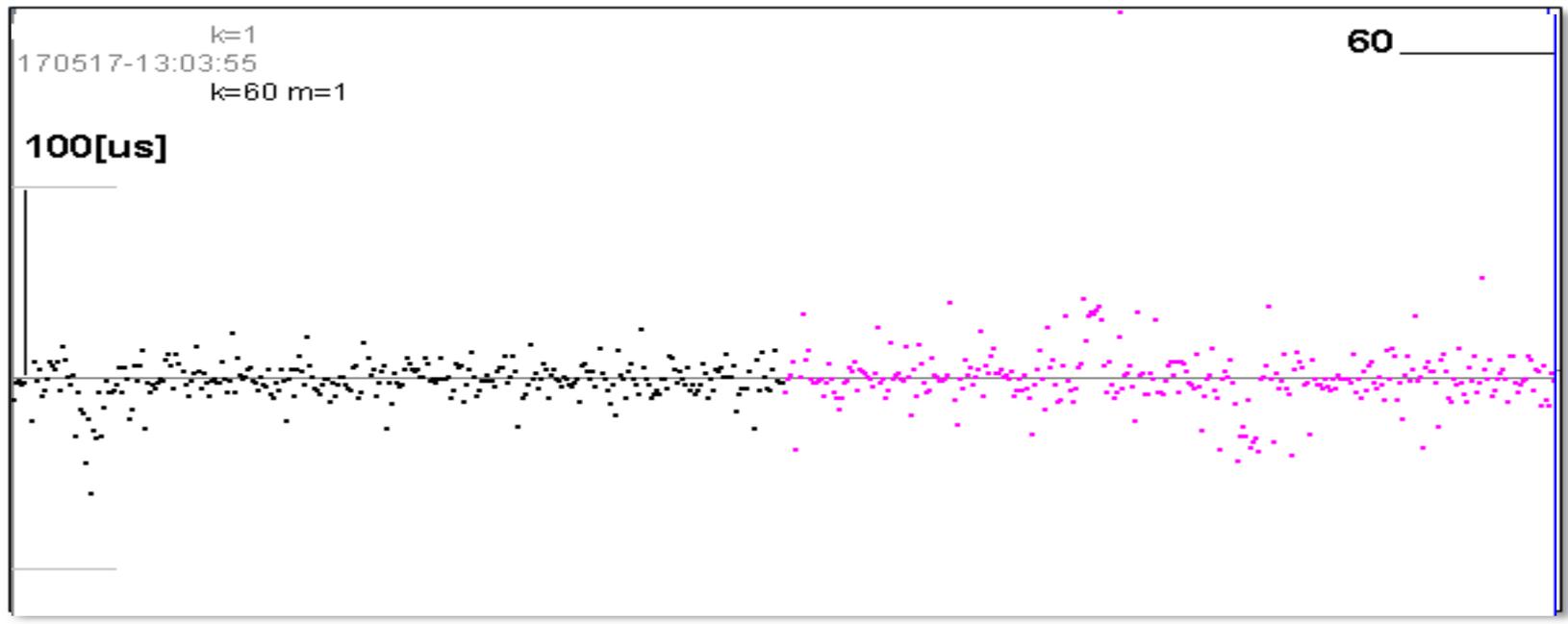
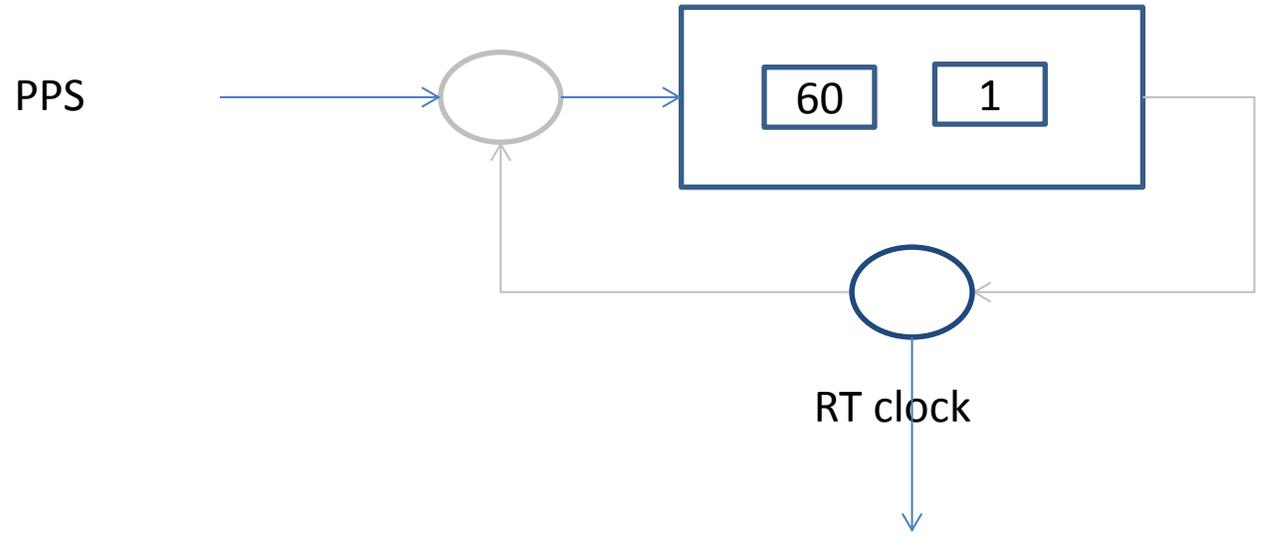


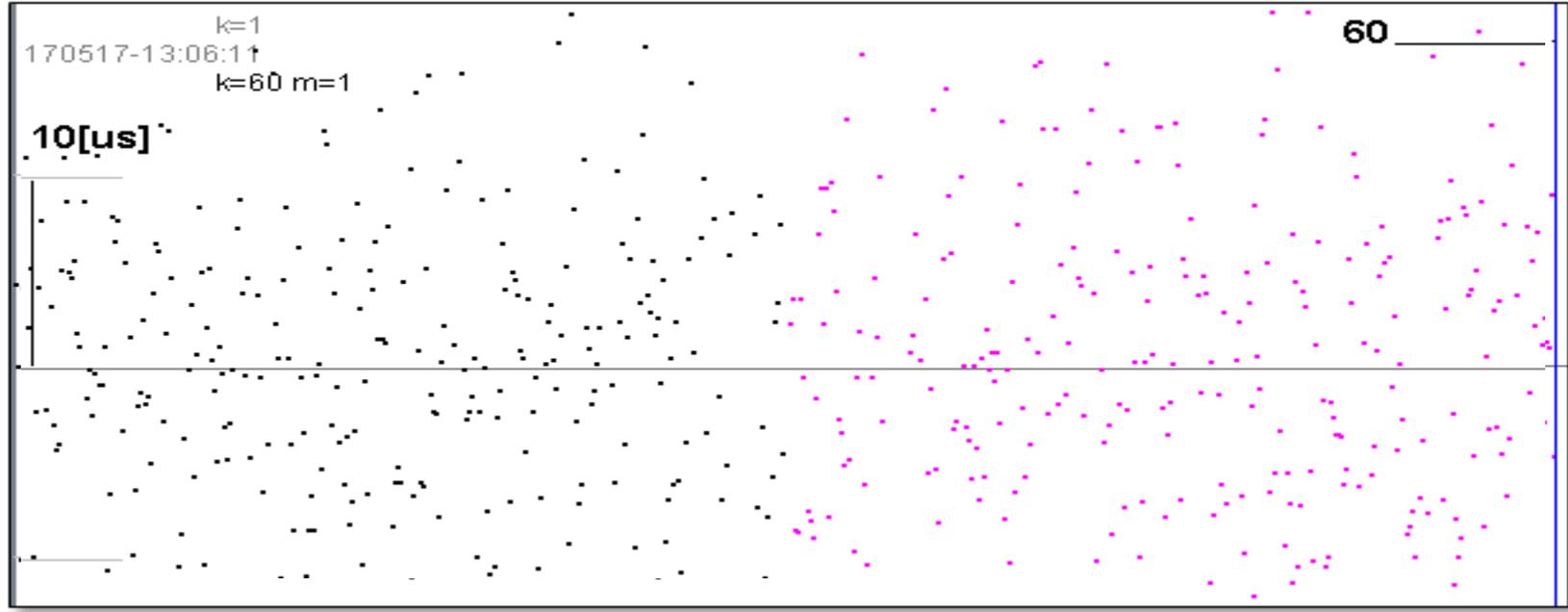
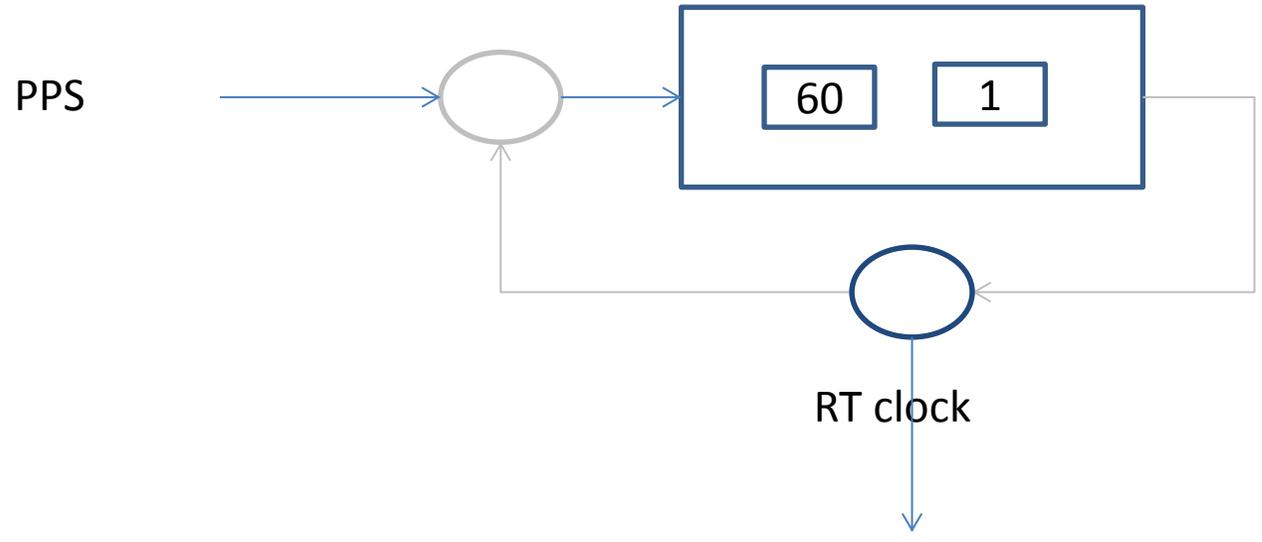
PPS

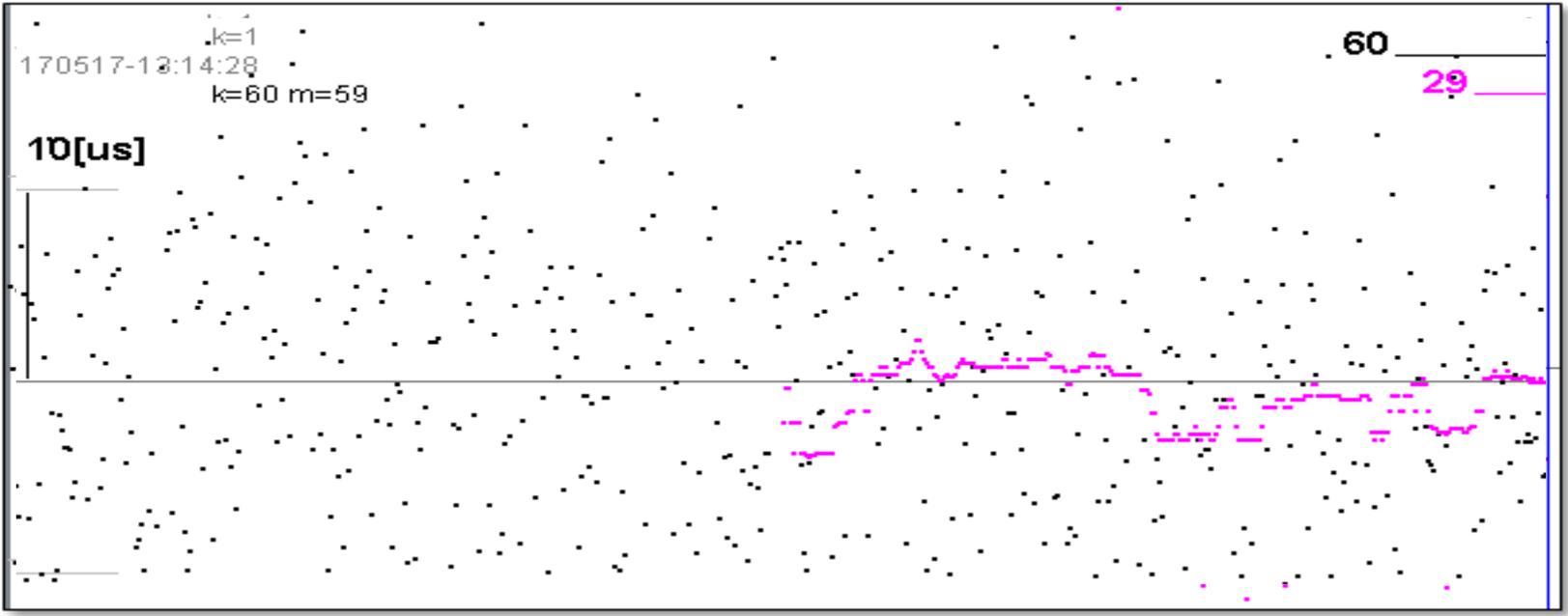
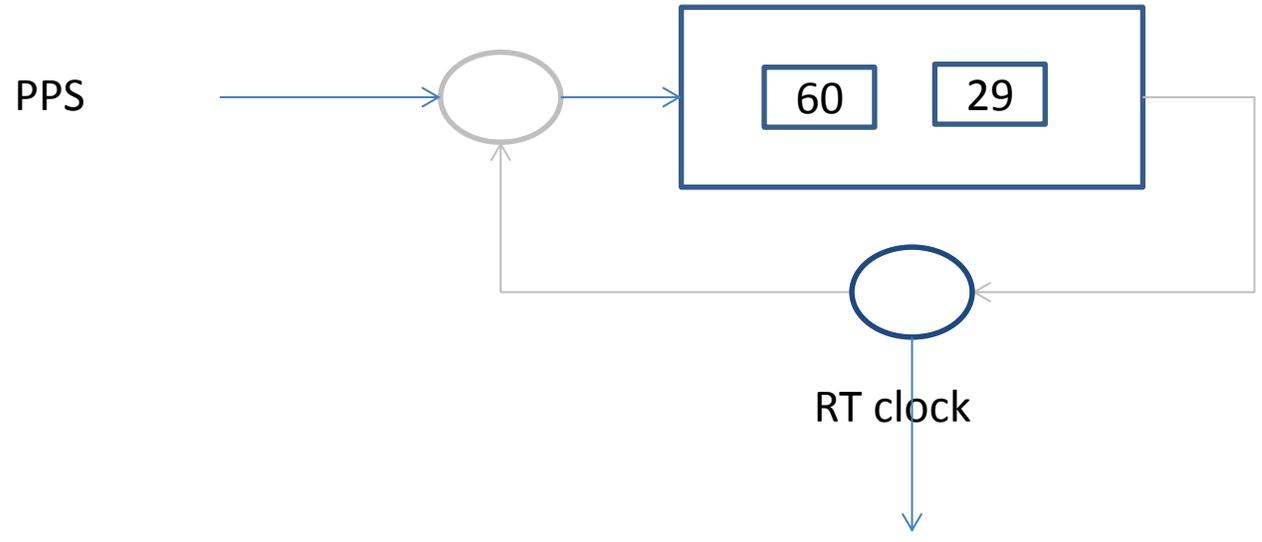


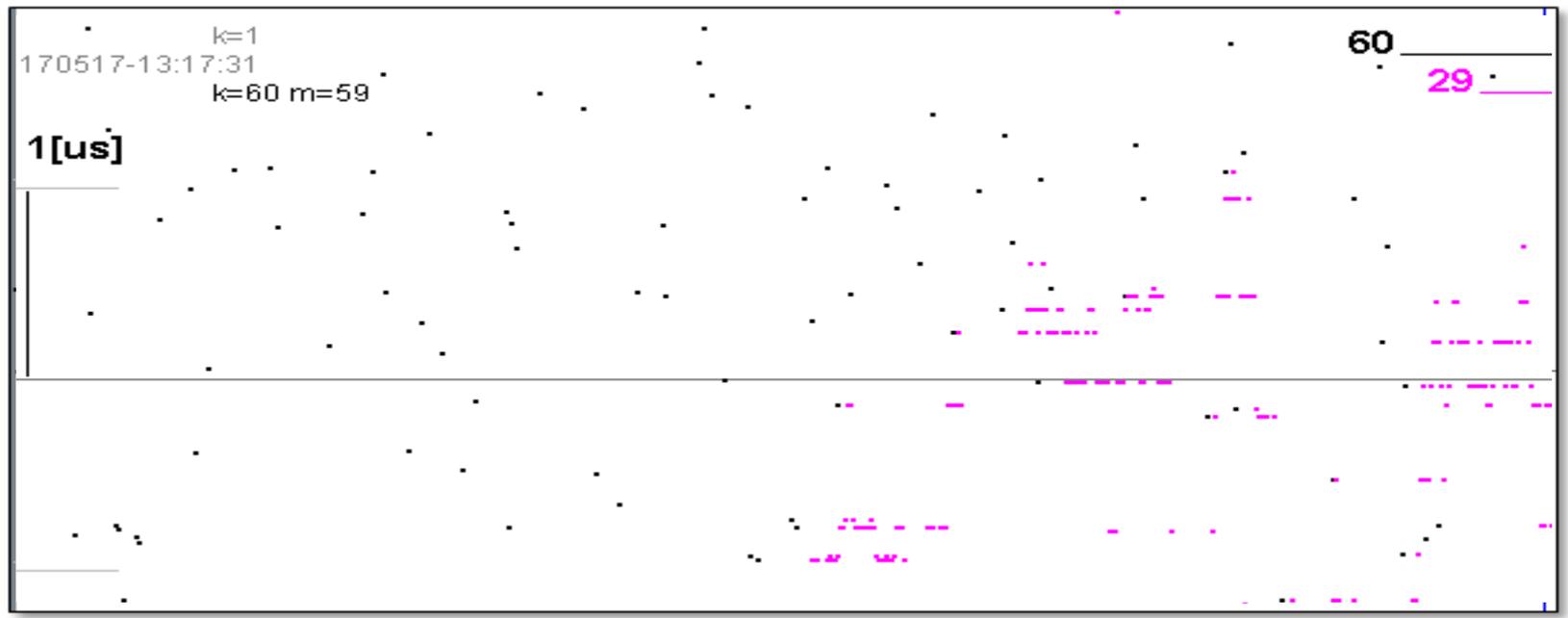
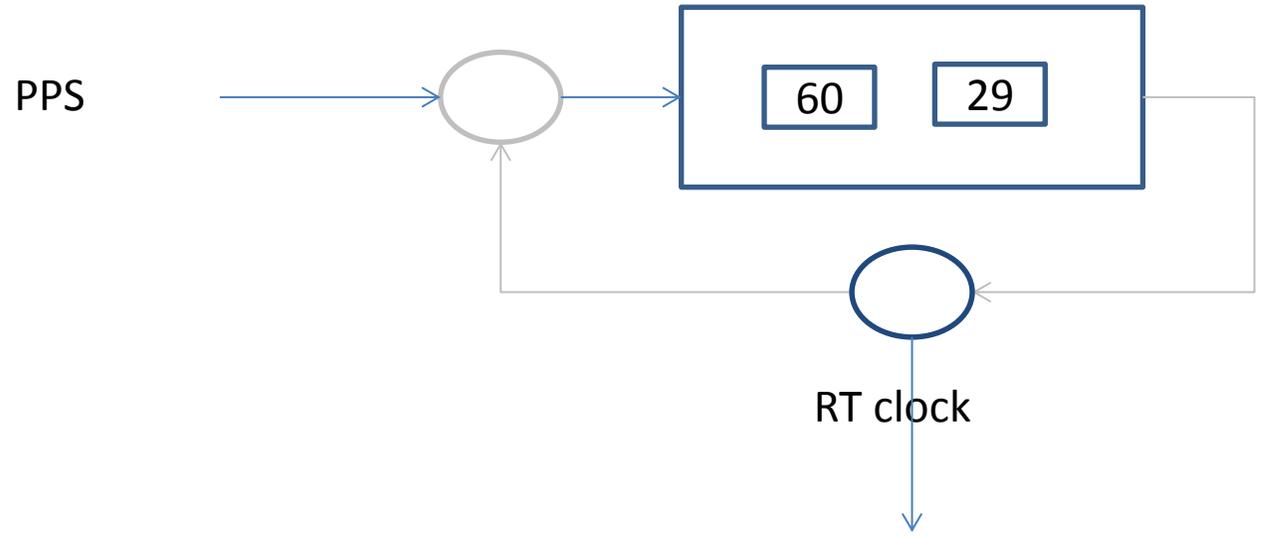
PPS

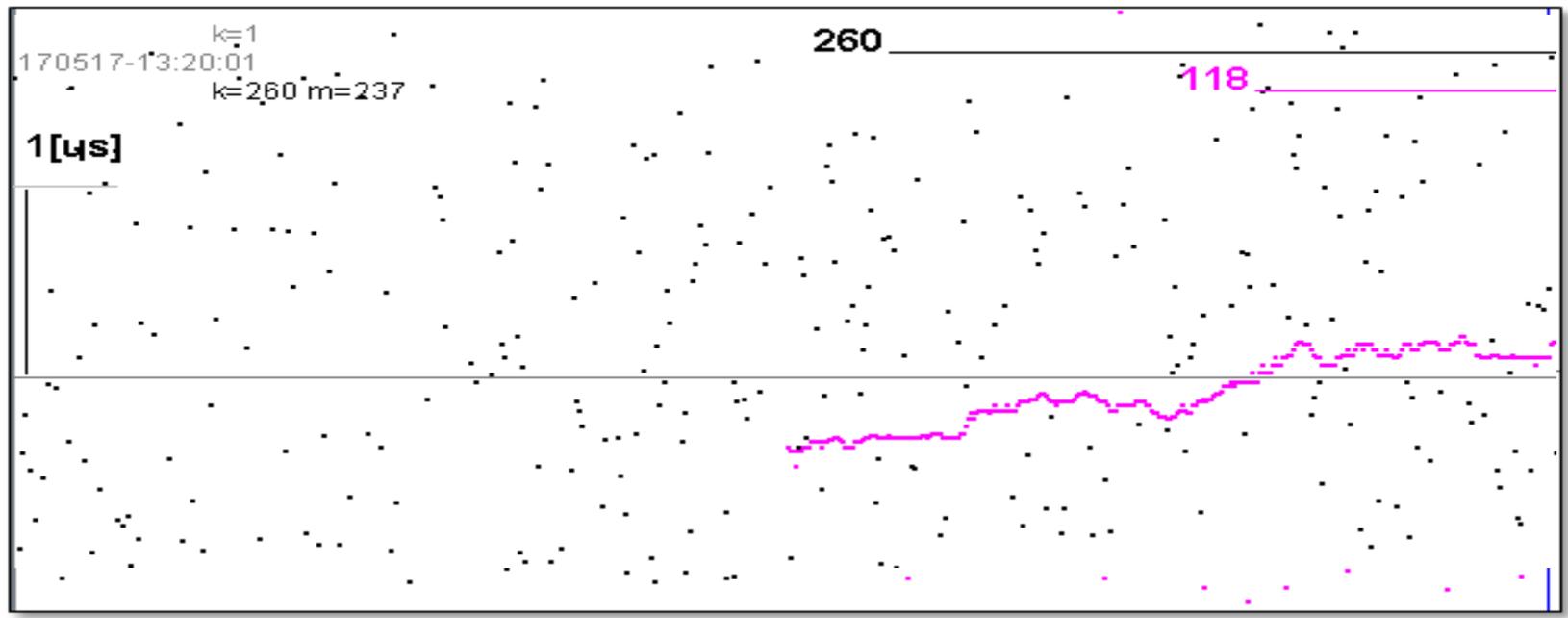
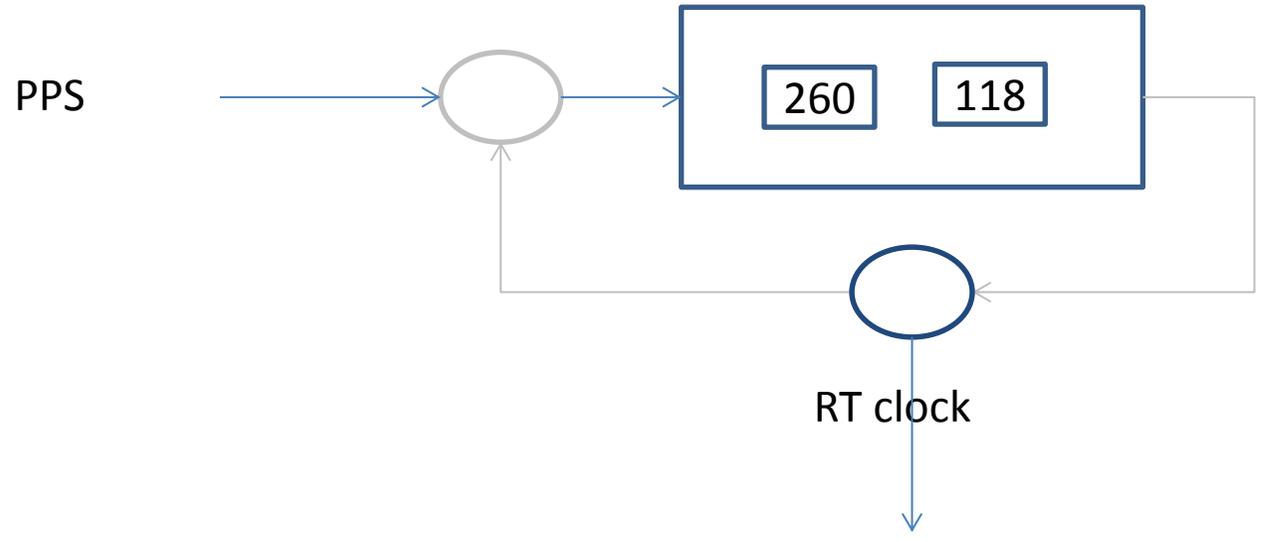




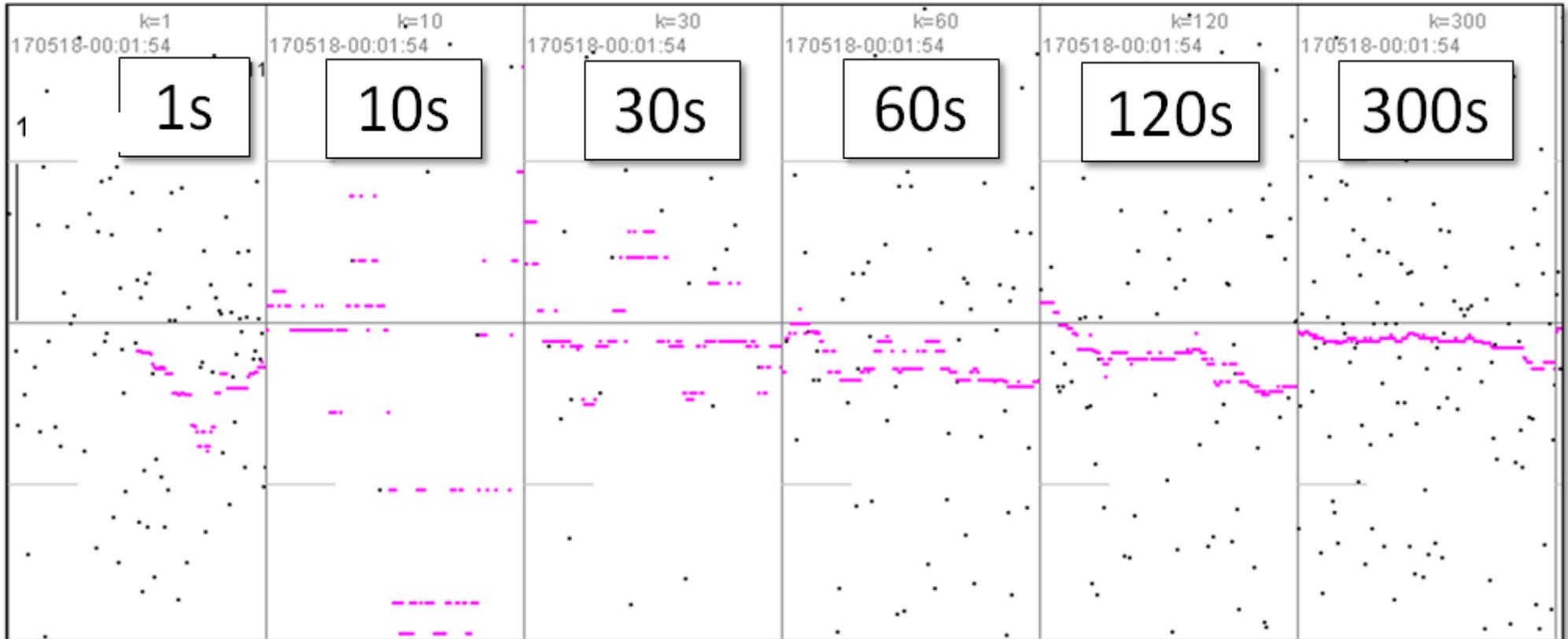
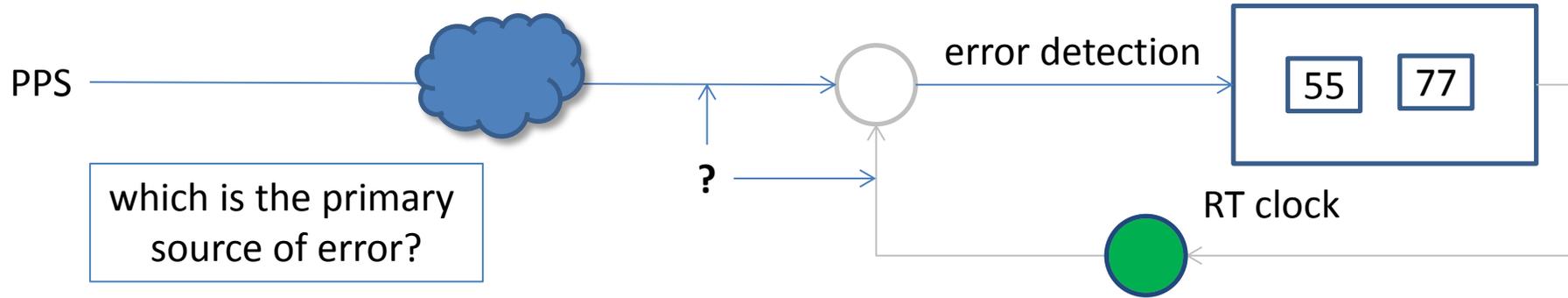




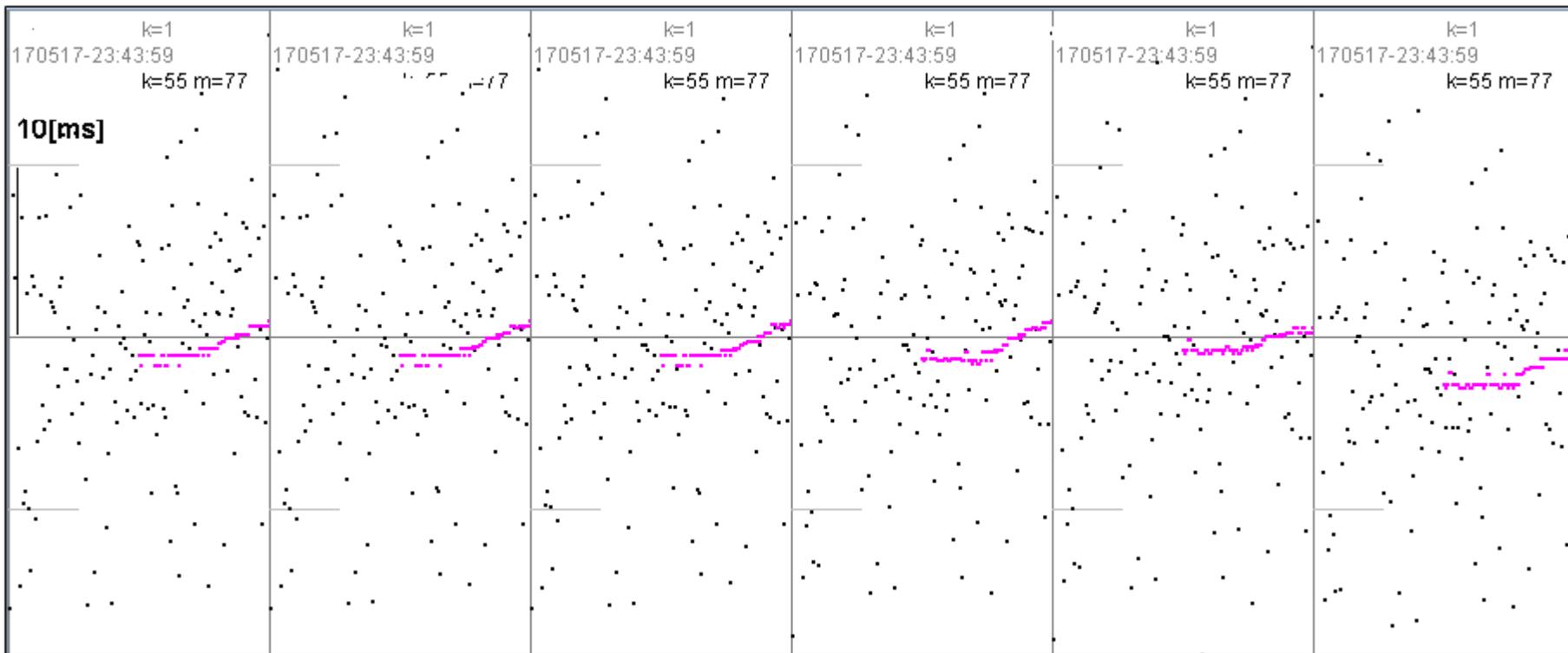
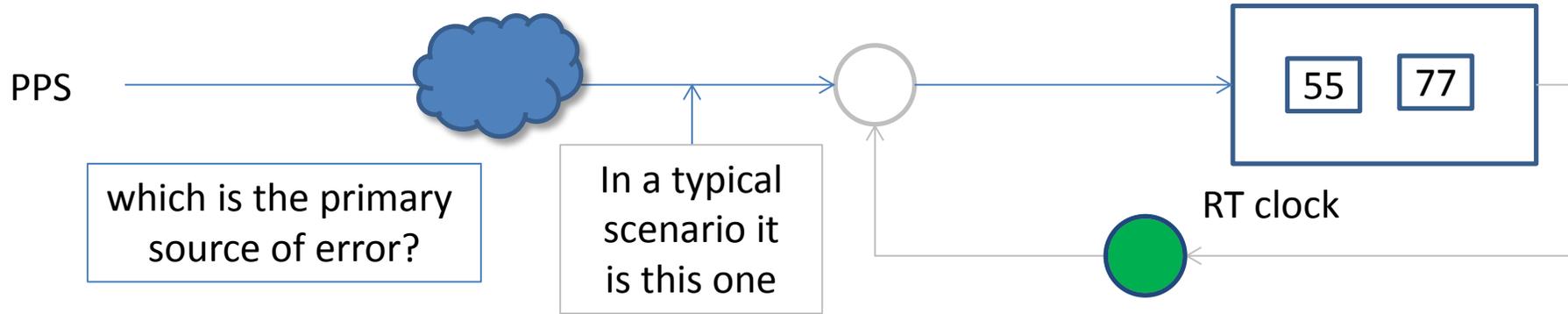




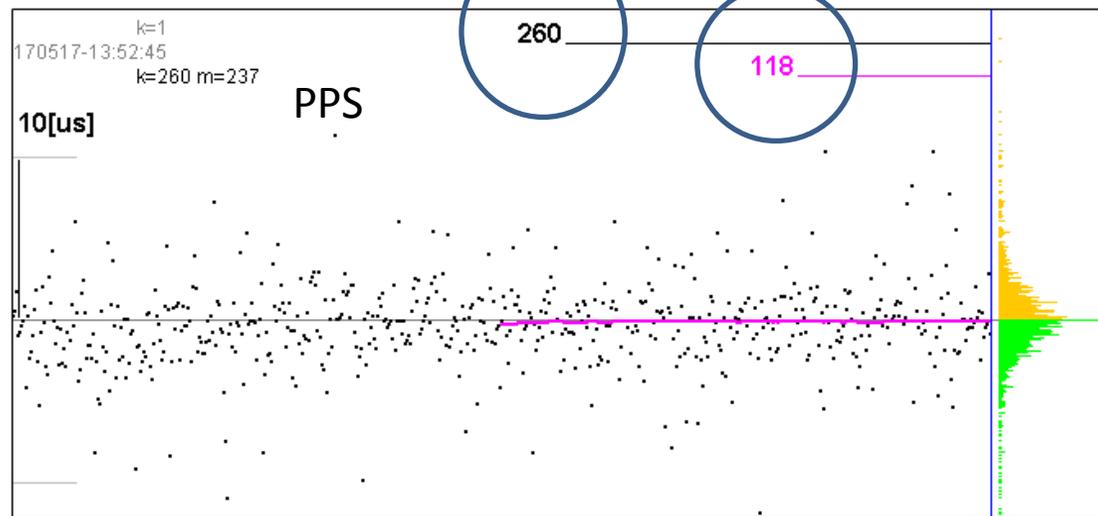
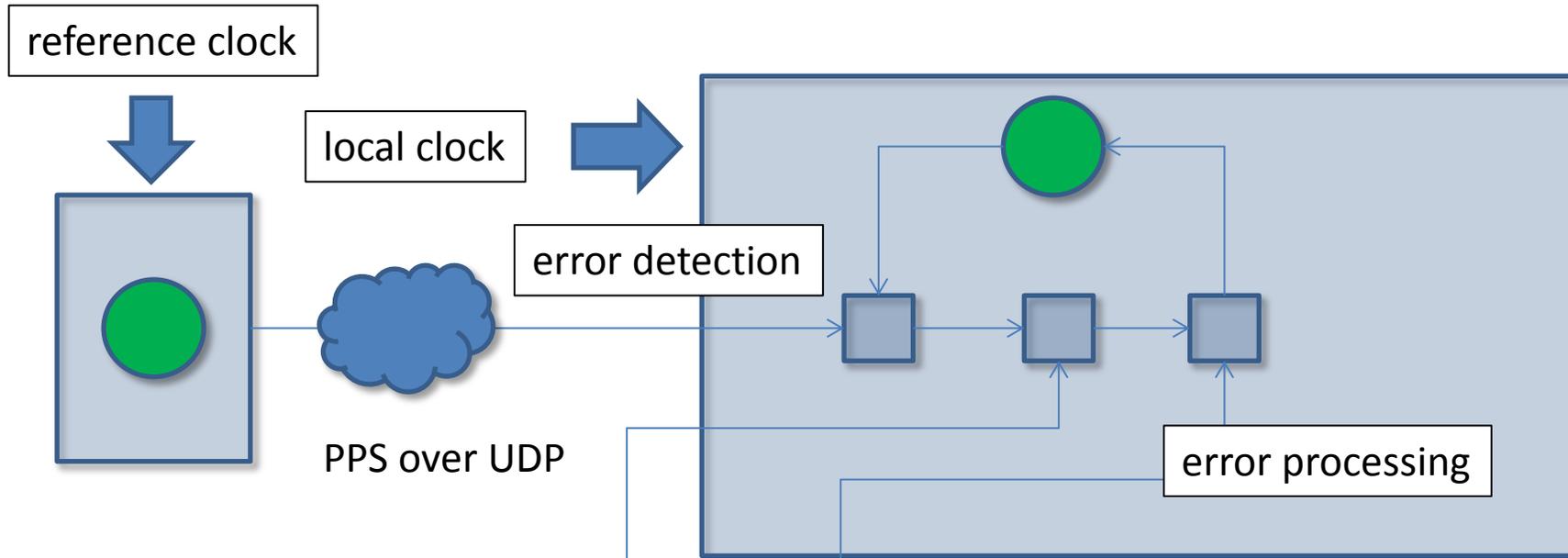
# Effectiveness of smoothing



# Same parameters, multiple clients

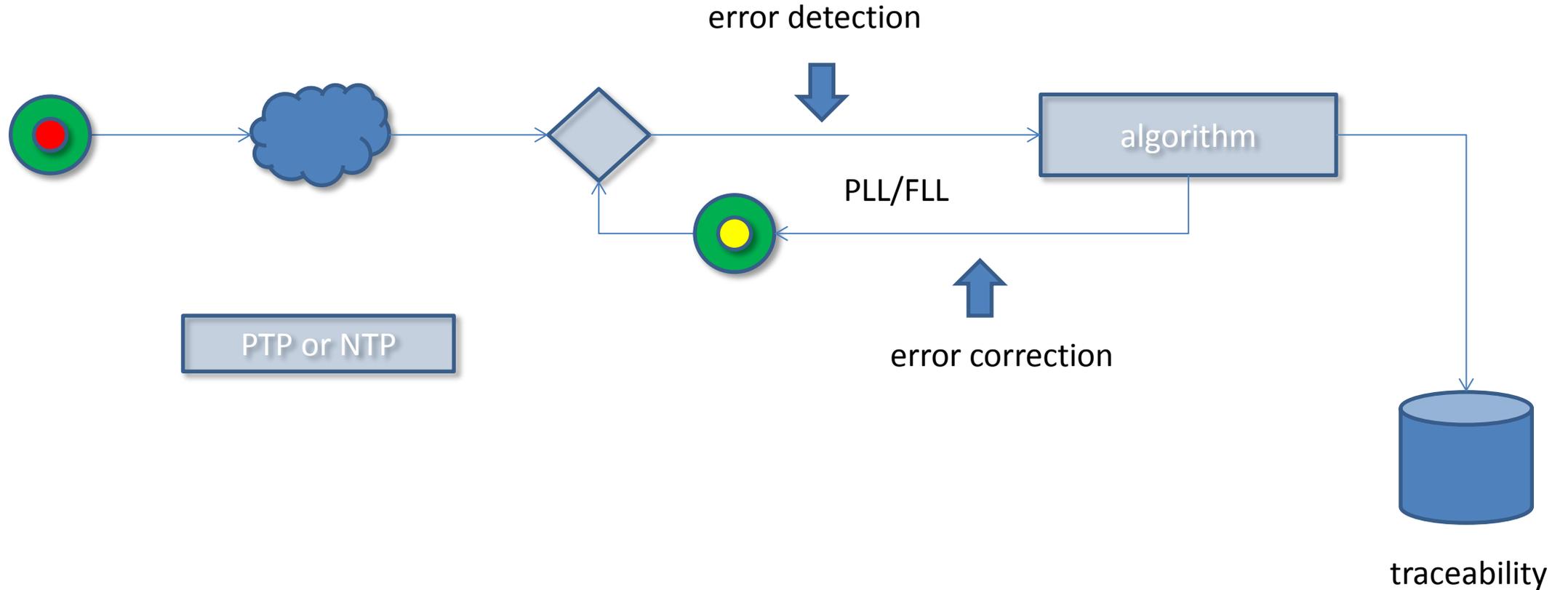


# Time transfer model

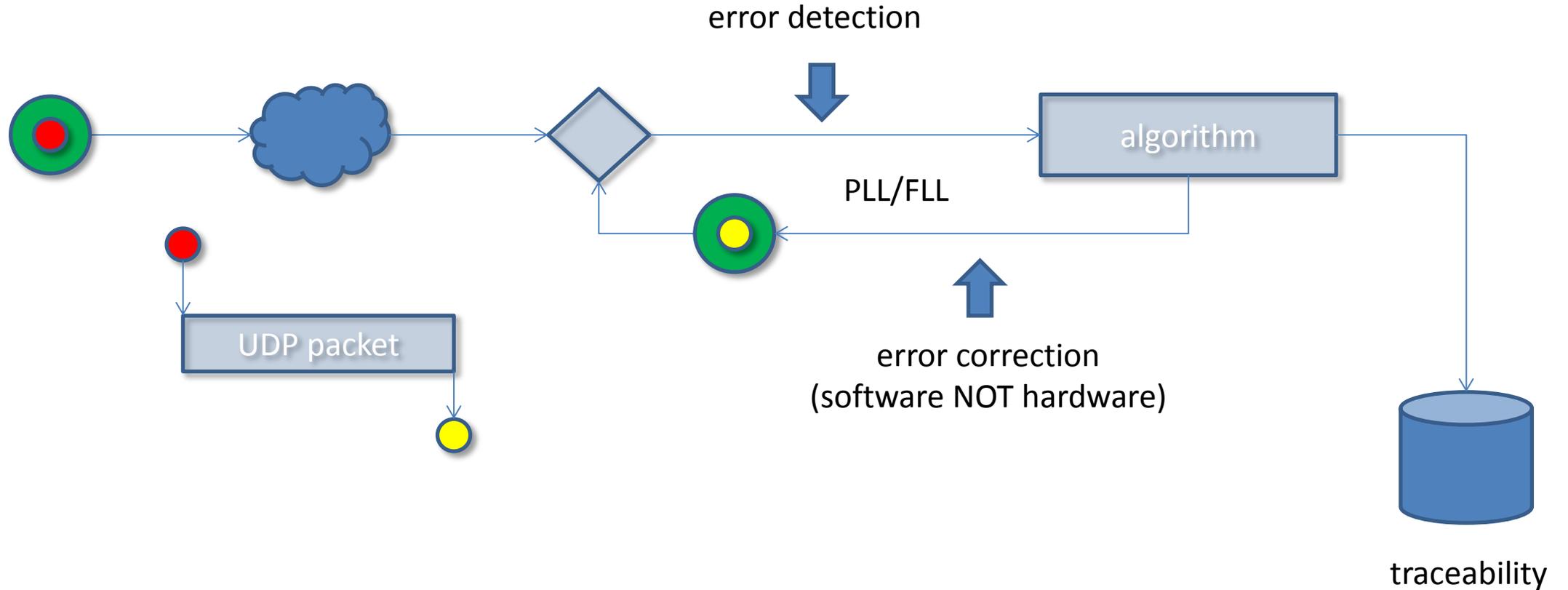


e.g.  
260 sec  
averaging window  
118 sec  
median window

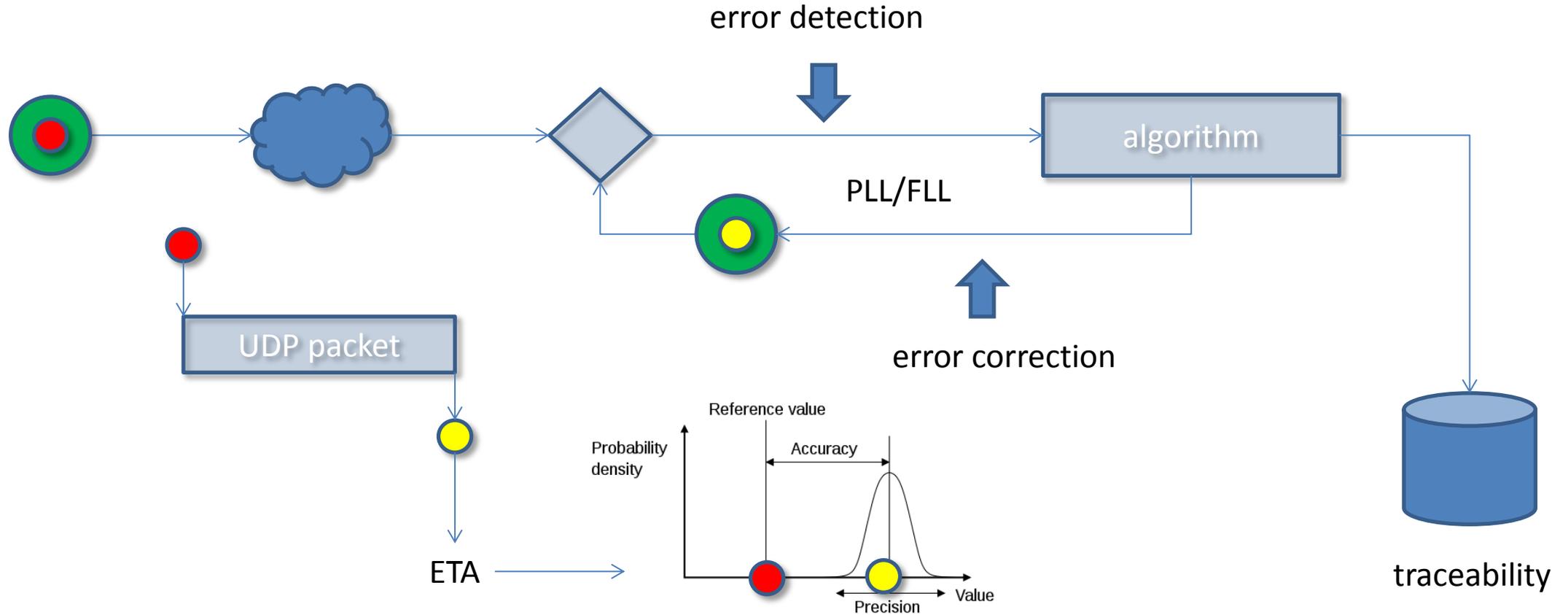
# Clock sync in a nutshell.



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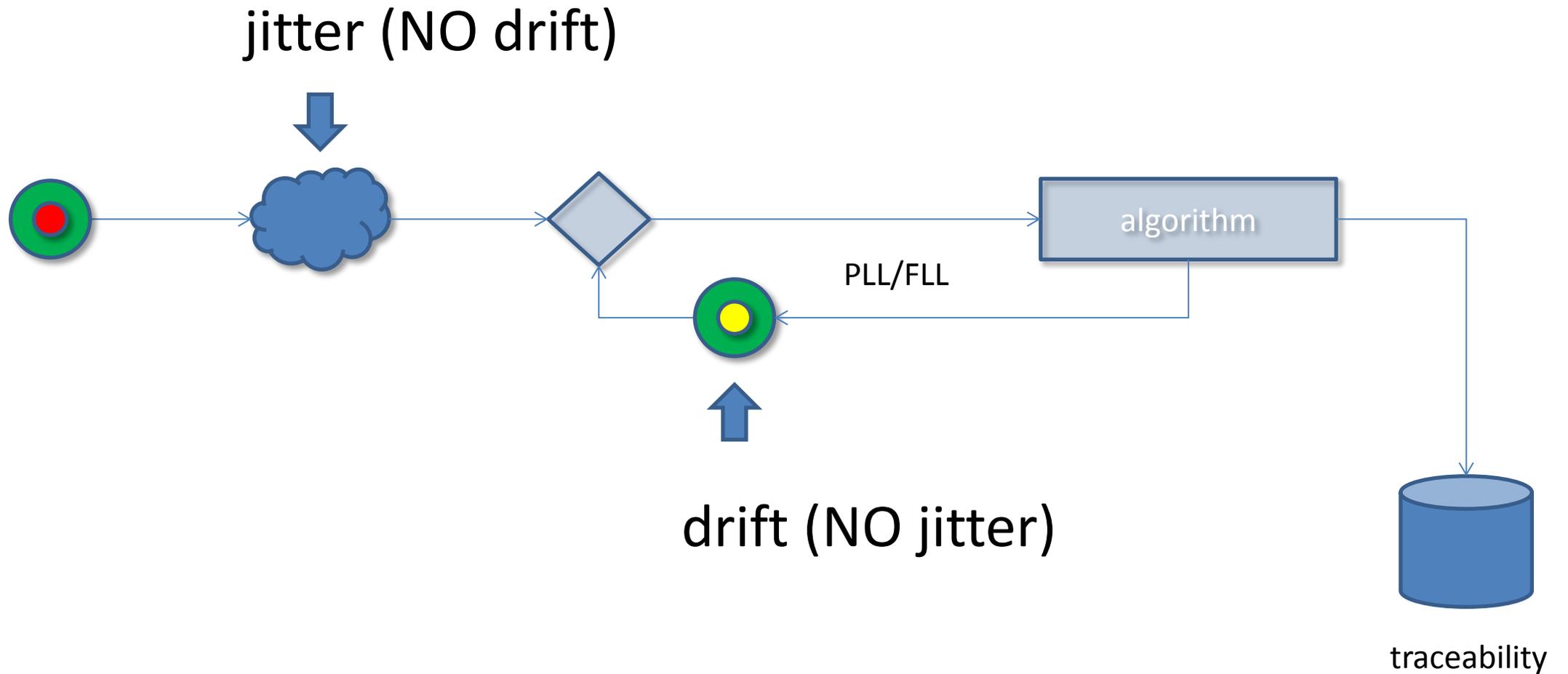
# Clock sync in a nutshell.



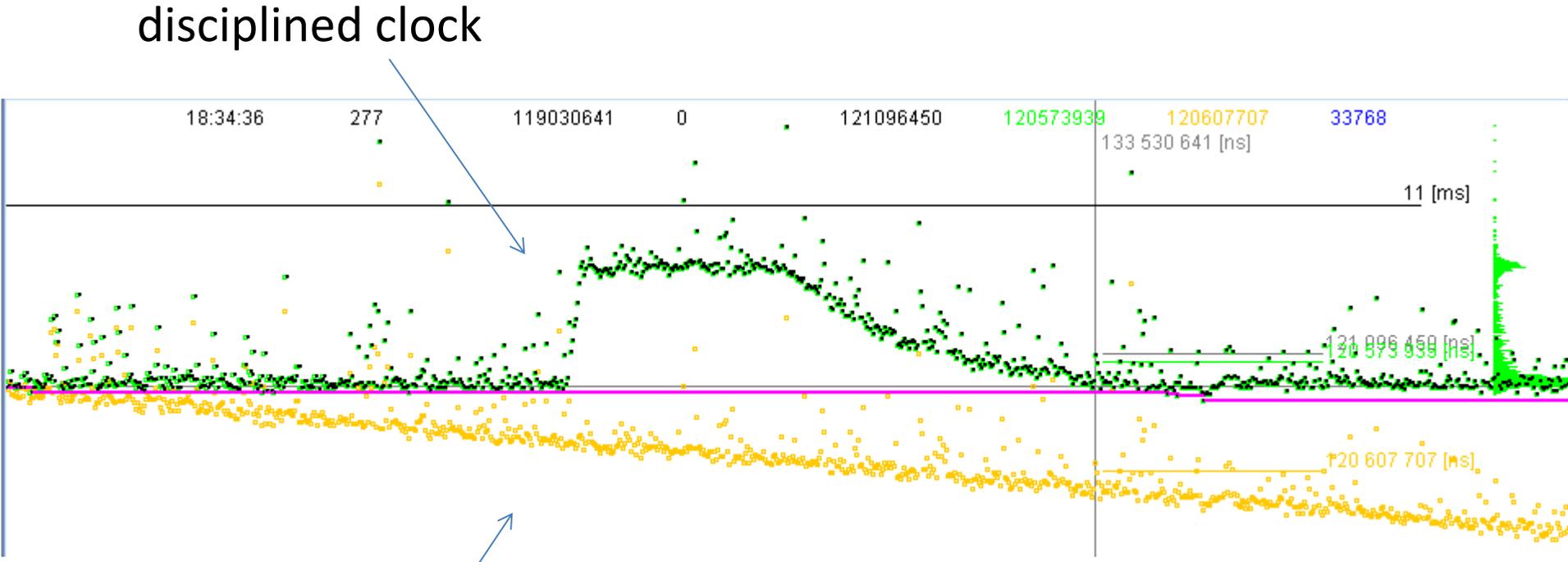
Anything wrong?

**YES**

# Large jitter and stable drift



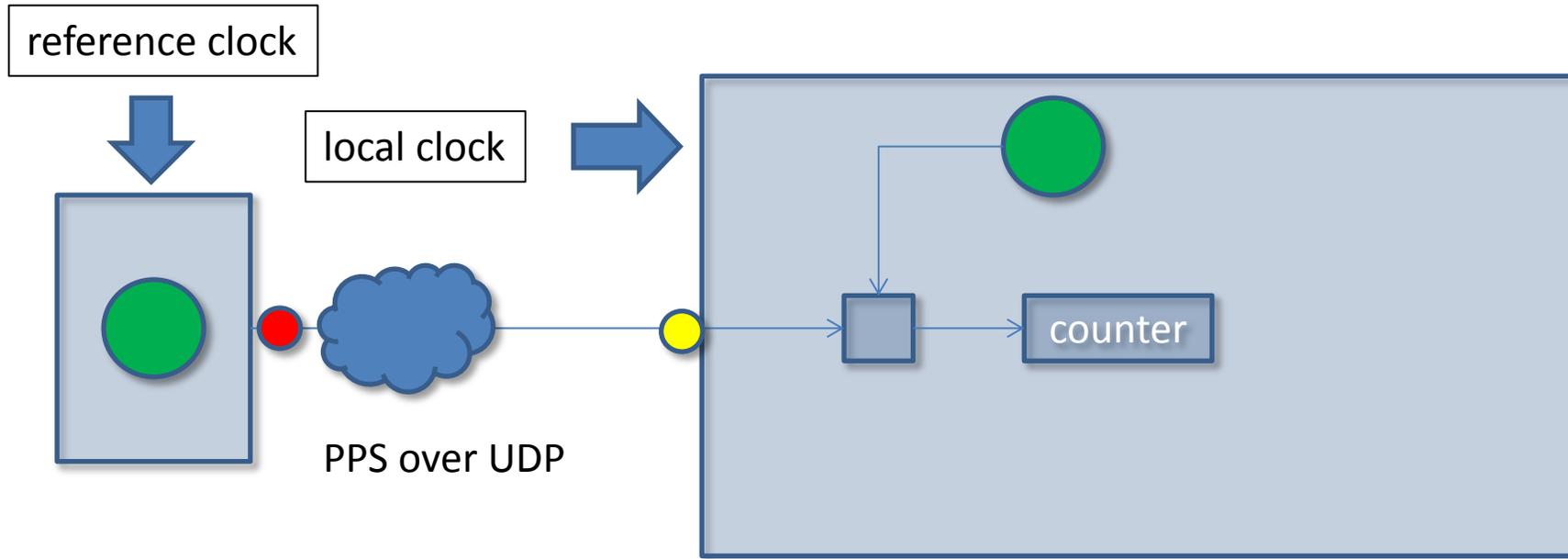
# Any evidence?



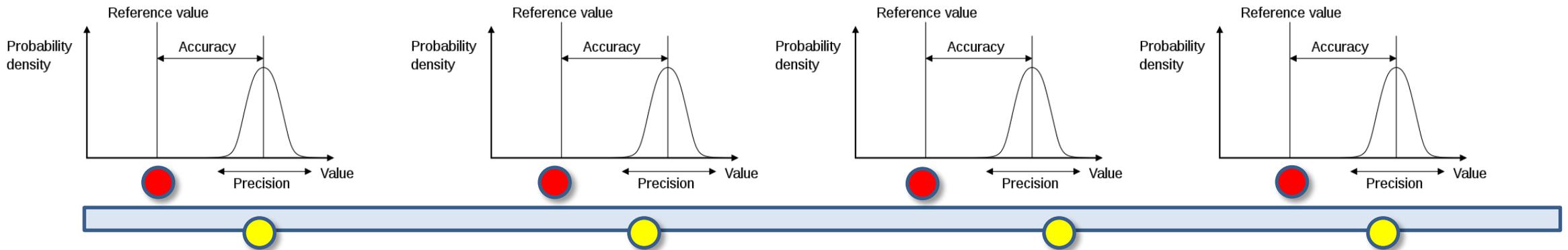
undisciplined clock

YES

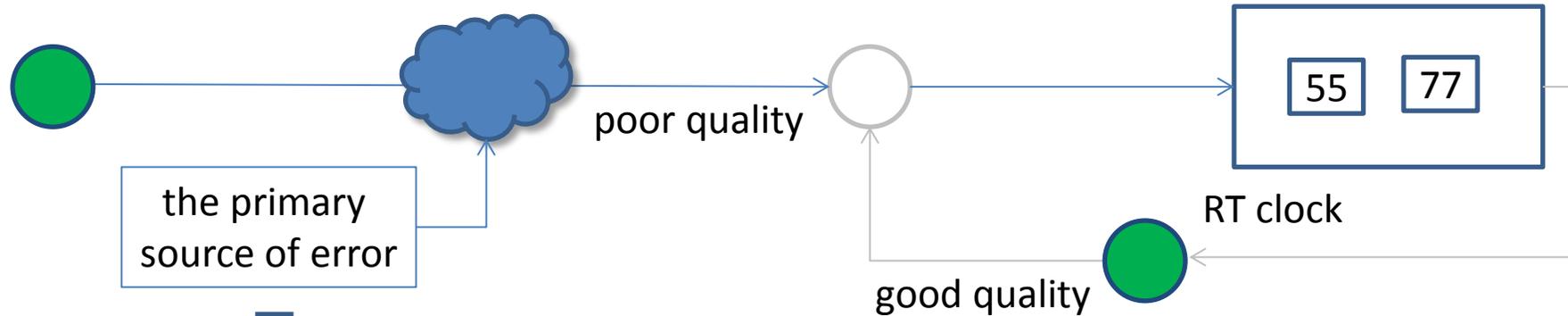
# Frequency counter



## PPS



# Summary



The local clock is a quartz oscillator.  
It has a very low jitter  
and a significant but stable drift

Historically the objective of NTP and PTP was generally just to eliminate the local clock drift. MiFID II is about something different. It is about making sure that at no point in time we are more than 100 [us] off from true UTC (punishable with a heavy fine).

**And we are trying to achieve this by adjusting a good quality local time (RT clock) with the reference time of much poorer quality (at the point of delivery).**

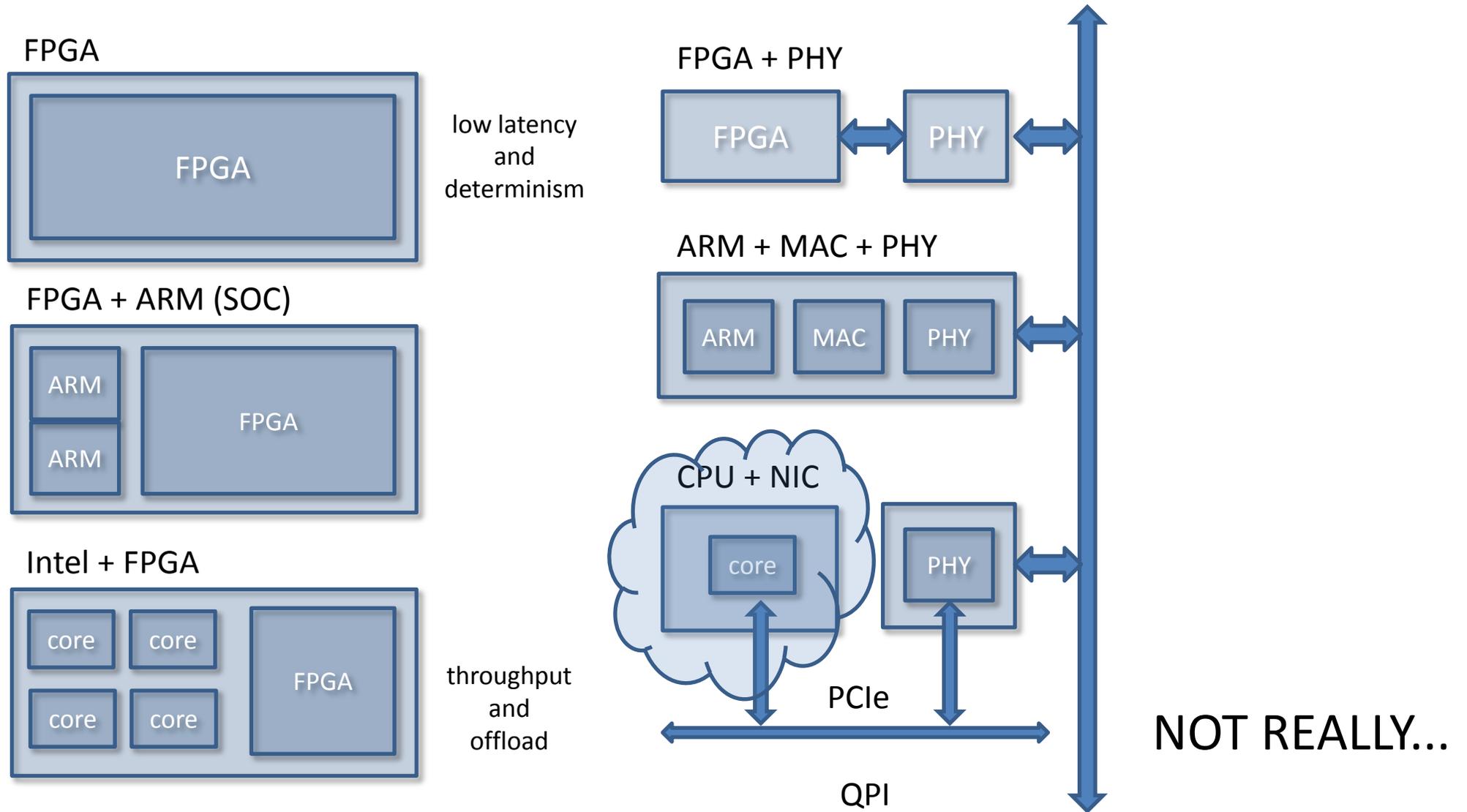
**The PPS based approach allows to measure the quality of the time distribution channel and drift of the local clock independently of the clock sync software and in the 'open loop' fashion.**



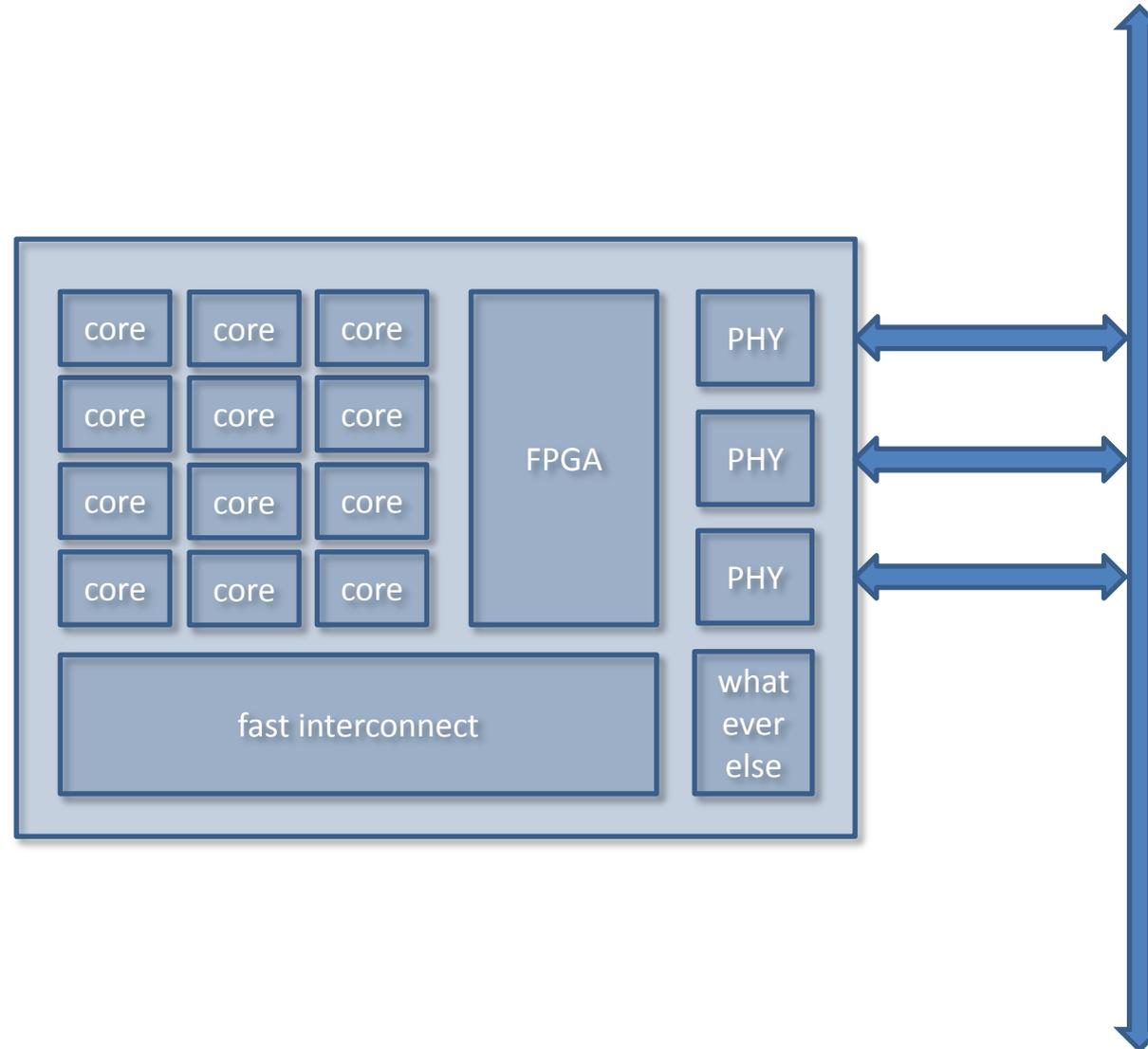
The network  
is the computer.

Is it really?

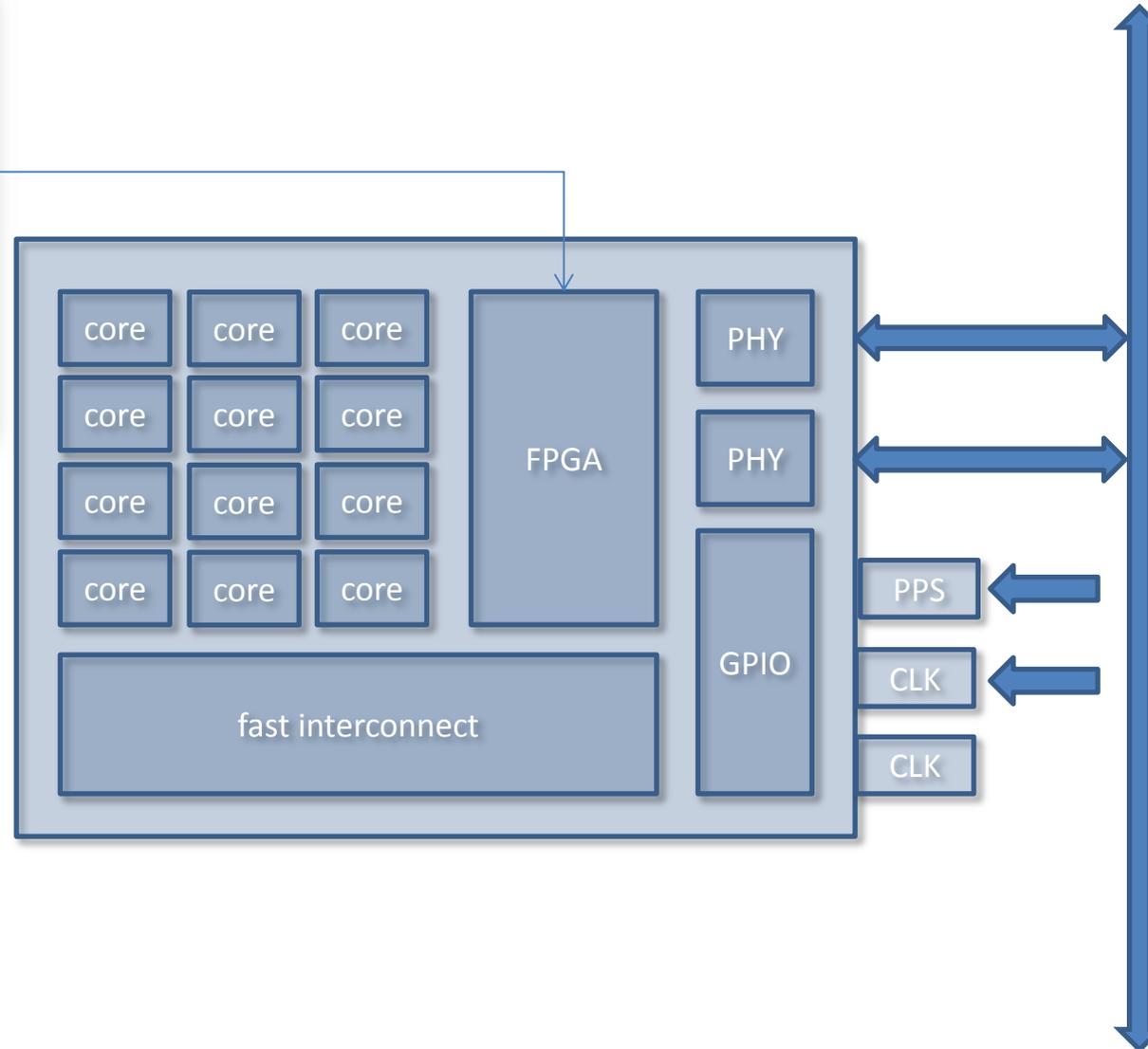
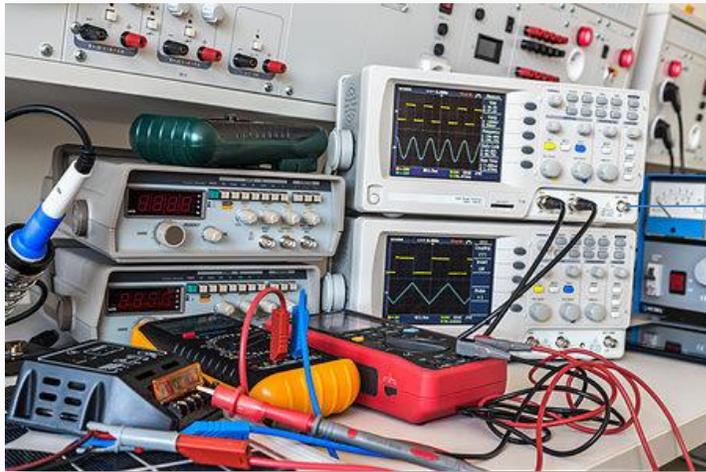
# Architectural choices and trends



# The network is the computer



# The network is the computer (and a lab)





Thank you!

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