Miffed at MiFID?

The practical issues to be considered when auditing paper clocks in the real world...

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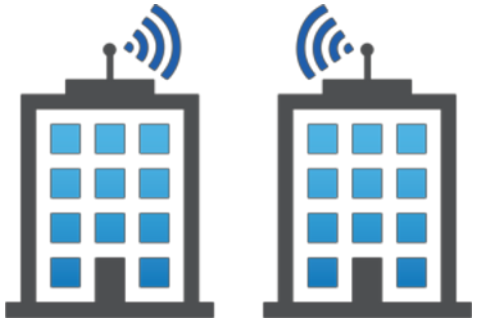
Agenda

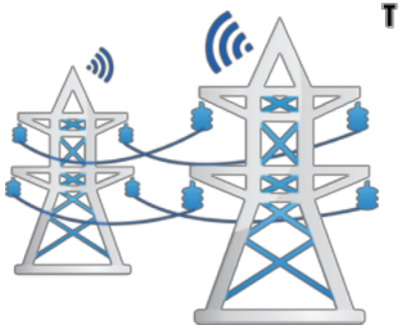
- Introduction
  - Financial Applications Requirements
- Audit process
  - Paper audits
  - Physical audits (where's the clock?)
- Findings
- Summary

Time Enables ALL Infrastructures

Data Centers

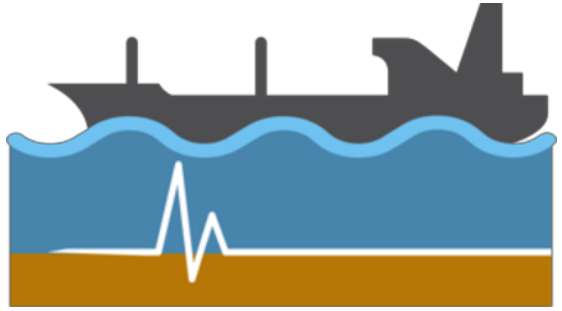


Enterprise Communications



Power Grid Communications

Wireline Communications



Seismic Exploration

Secure Communications

Cellular Communications

Financial Exchanges

Requirements Evolution: Financial Trading Regulations

- From 3rd Jan 2018 EU legislation –
  Markets in Financial Instruments Directive ("MiFID II") - is in effect.
  Its scope includes the synchronisation of trading clocks to UTC
  and timestamping granularity:

Type of Trading	Granularity	Max. Divergence to UTC
Voice trading	1 s	± 1 s
All other trading	1 ms	± 1 ms
High frequency trading	1 µs	± 100 µs

- US regulation (SEC) Rule 613 (effective 2018):
  Synchronisation of business clocks to within 100 µs of NIST clocks

- The aim is to prevent trading irregularities & provide an audit trail for "reportable events"

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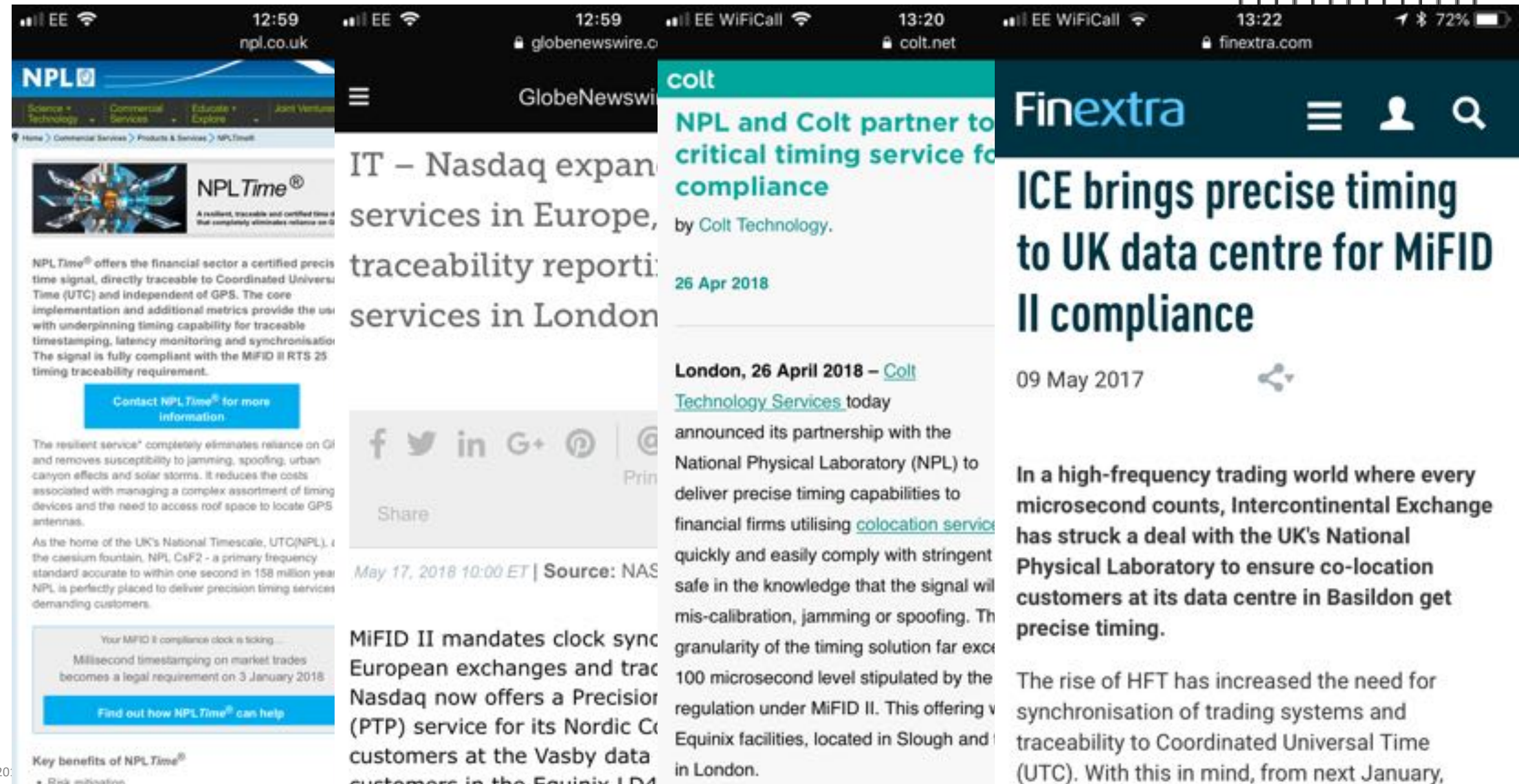
Requirements Evolution: Financial Trading Regulations



Requirements Evolution: Financial Trading Regulations

- **COMMISSION DELEGATED REGULATION (EU) 2017/574:** Accuracy & traceability to **UTC** summary

- **But what is UTC? Where do I get it?**

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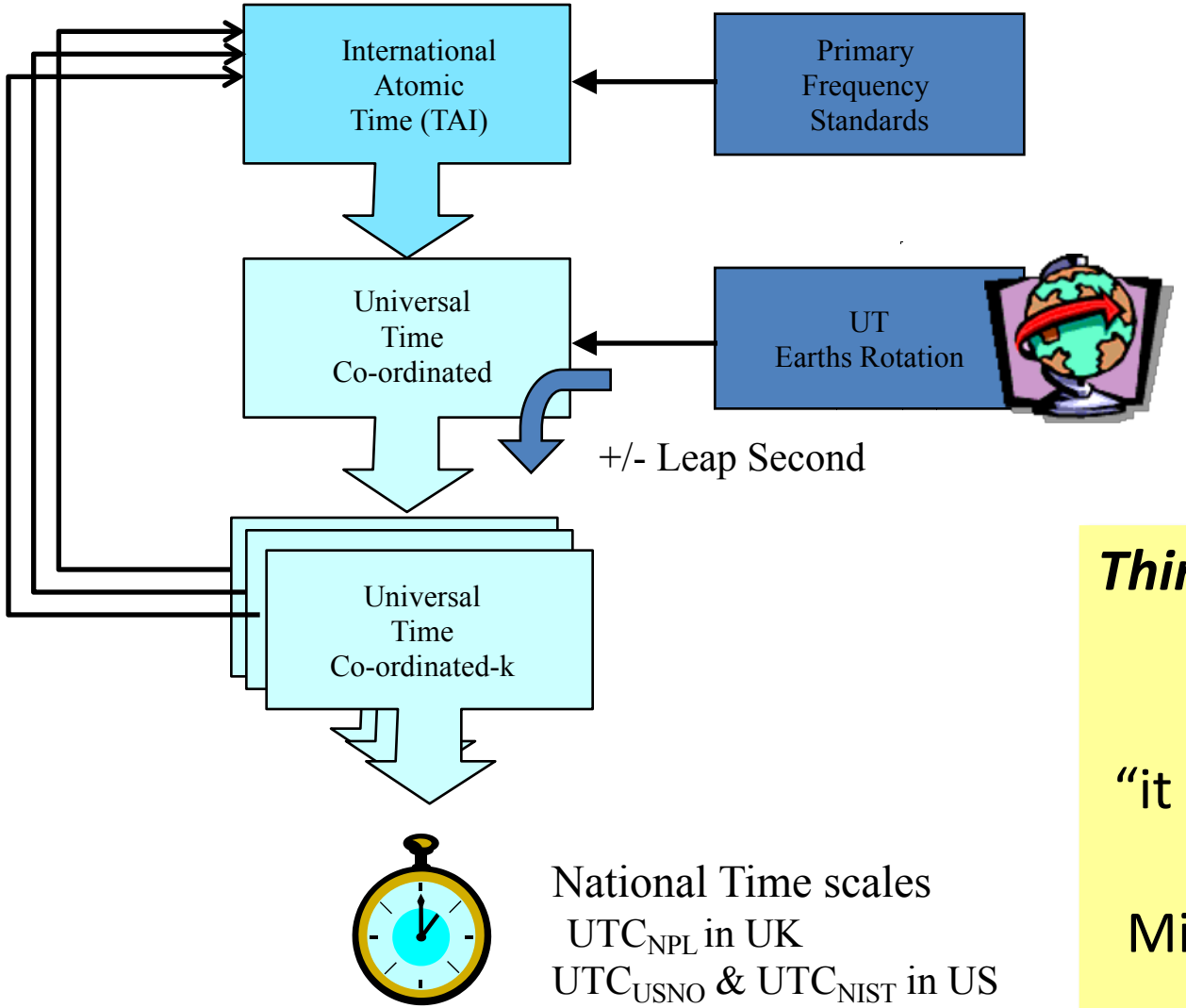
What is UTC? Where do I get it?



Things to note about UTC:

"it's paper clock"
"it only exists in the past"

MiFID allows us to use & test to UTC$_{USNO}$

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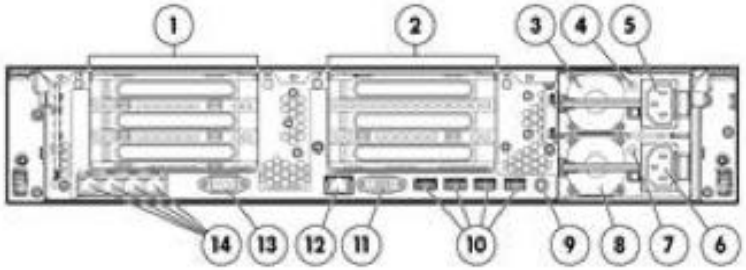
From the ESMA MiFID II requirements:

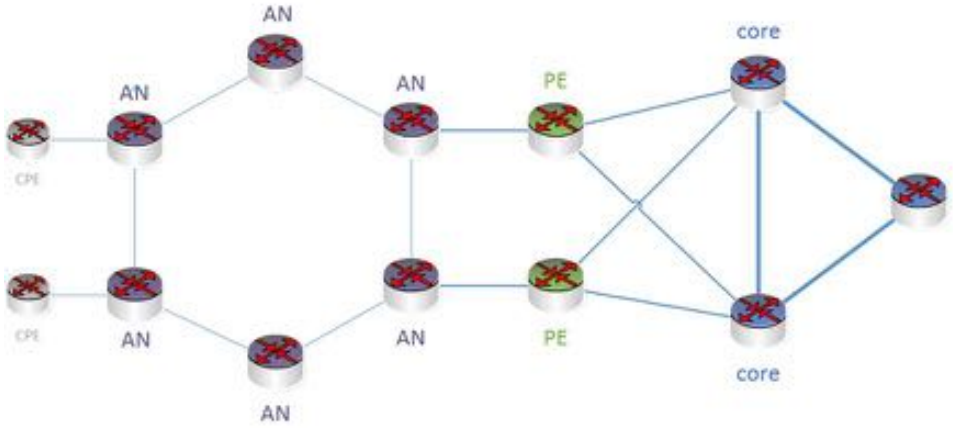
- *Establish a system of traceability to UTC, where such a system shall:*
  Demonstrate traceability to UTC by documenting the system design, functioning and specifications. This is to be accomplished by:
- *Establish a system of traceability of their business clocks to UTC, including ensuring that their systems operate within the granularity and a maximum tolerated divergence from UTC as per RTS 25.*
  Evidence that their systems meet the requirements by documenting the system design, its functioning and specifications.
- *Evidence that the crucial system components used:*
  - *meet the accuracy standard levels on granularity and maximum divergence of UTC as guaranteed and specified by the manufacturer of such system components (component specifications shall meet the required accuracy levels); and*
  - *that these system components are installed in compliance with the manufacturer's installation guidelines.*
  - *Identify the exact point at which a timestamp is applied and demonstrate that the point within the system where the timestamp is applied remains consistent.*
    Firms shall conduct a compliance review of the traceability system at least once a year.
    Ensure procedures are put in place to establish a systems of traceability to UTC by documenting the system design, functioning and specifications and review such a system once a year.

Paper Audit – network design

- Network plans & drawings
- Specs/datasheets for all equipment that affects timing
- SLAs & Agreements for any Services provided by 3rd parties
- Logs/configs of all equipment
- Add some “Best Practice”

```
#ptp interface config
interface Ethernet1/x
  speed 1000
  ptp
  ptp vlan 350
  switchport mode trunk
  switchport trunk allowed vlan 350,2100
```

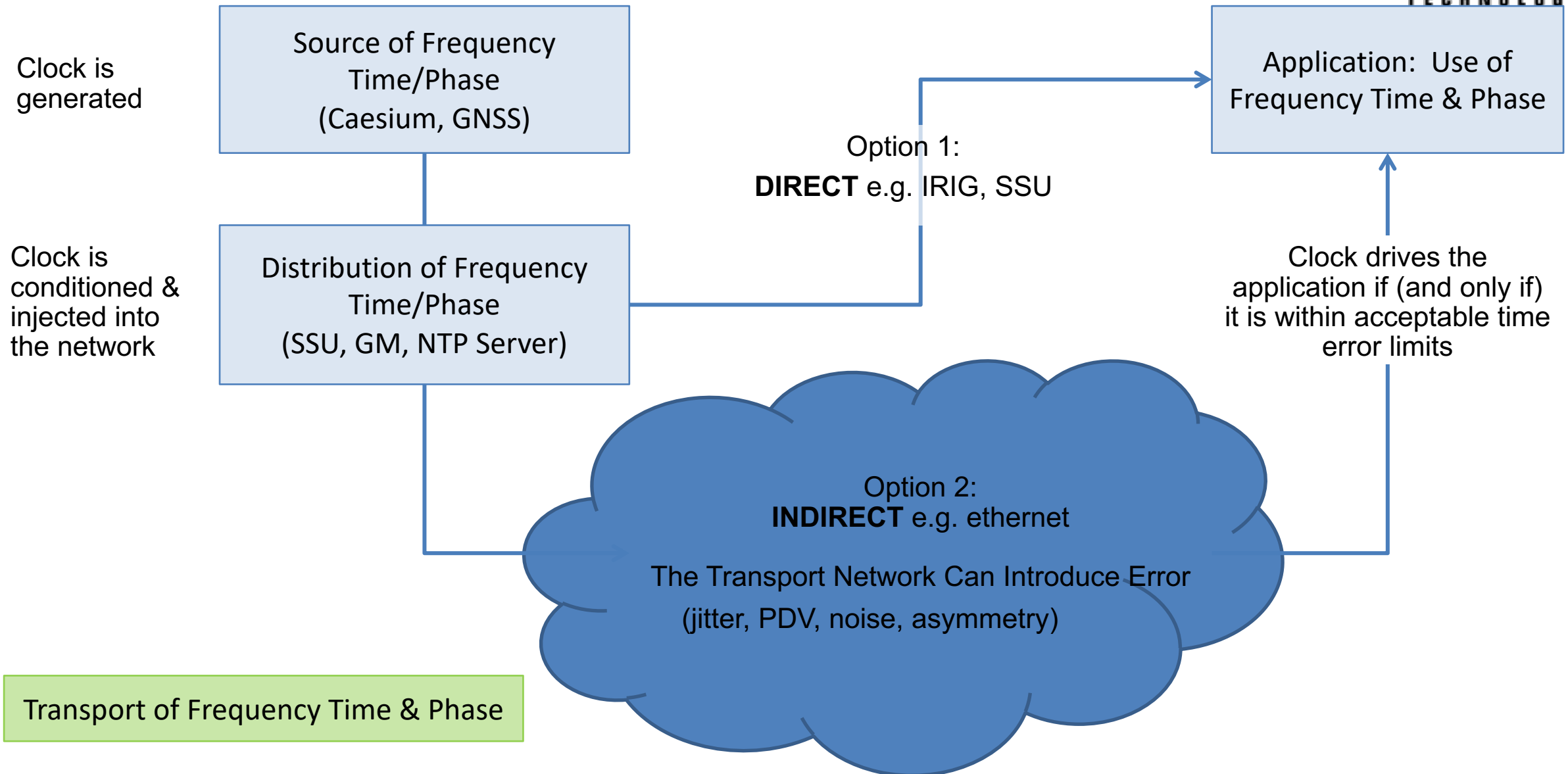




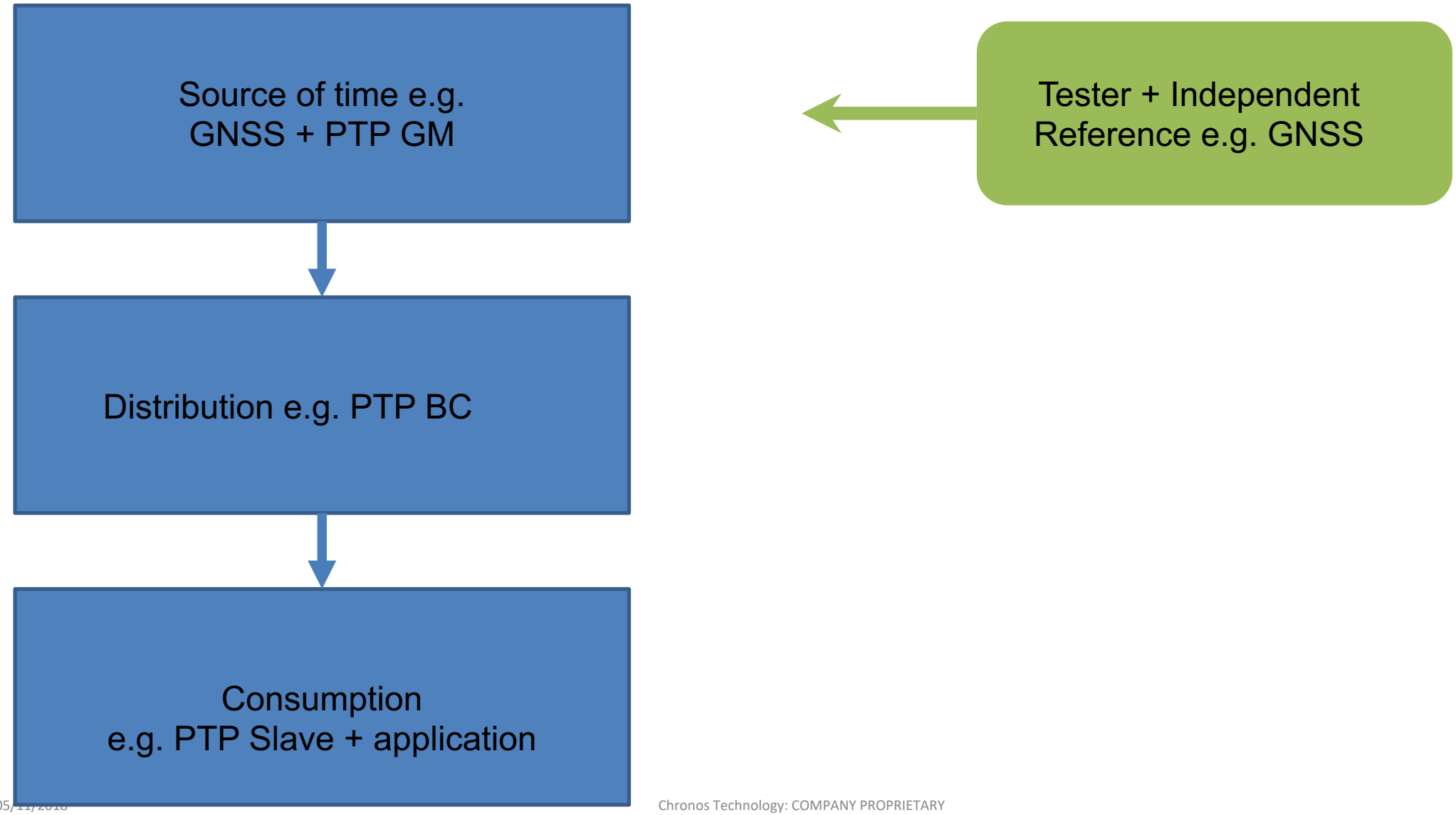
Auditing the clock + distribution…

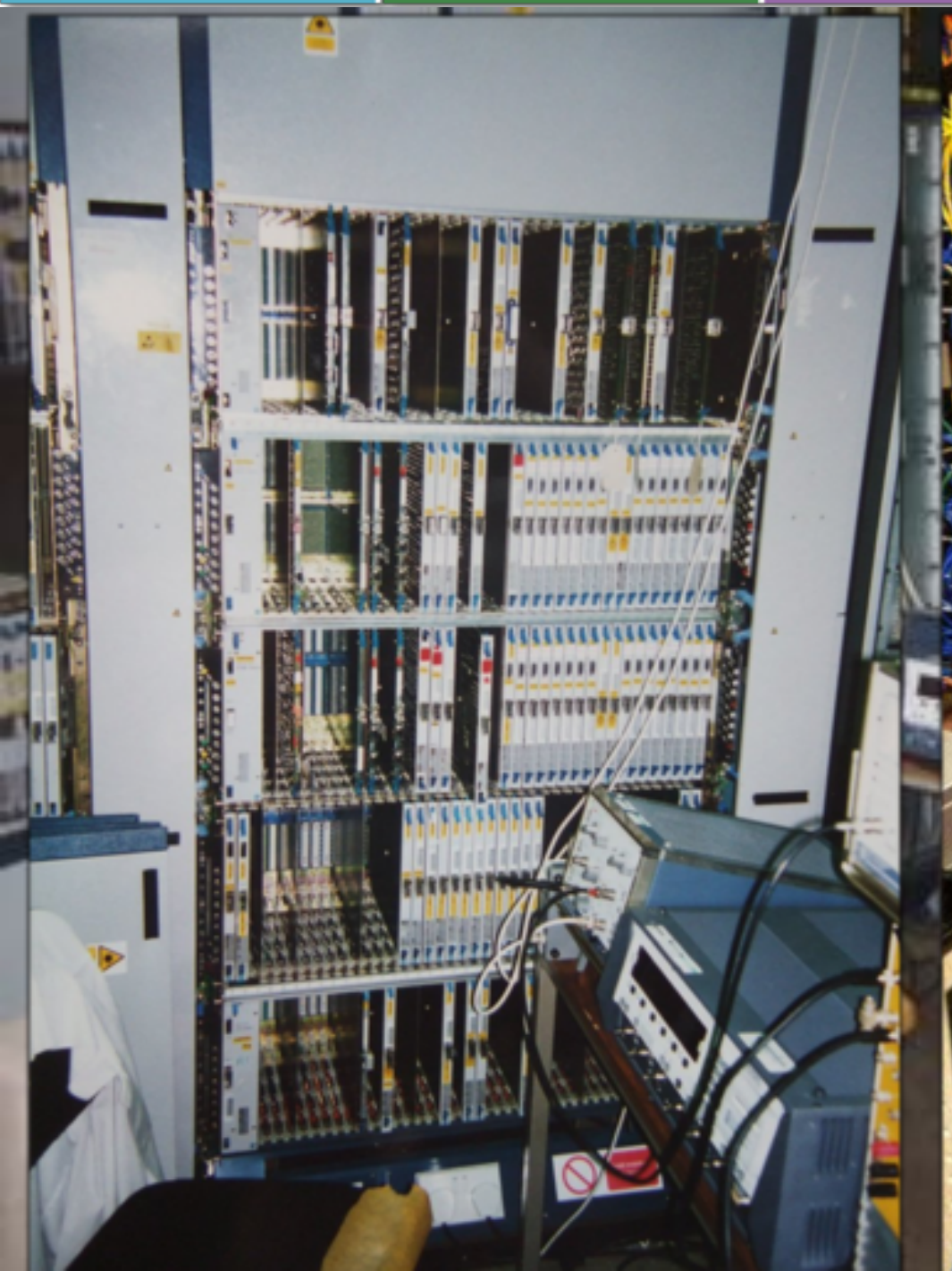
- Physical things:
  - UTC delivery: GNSS receiver, PTP GM
  - UTC distribution: PTP BC, PTP Slave
  - Network design – how all the above things are connected together
- Non-Physical things:
  - UTC: consumption: Trading application!

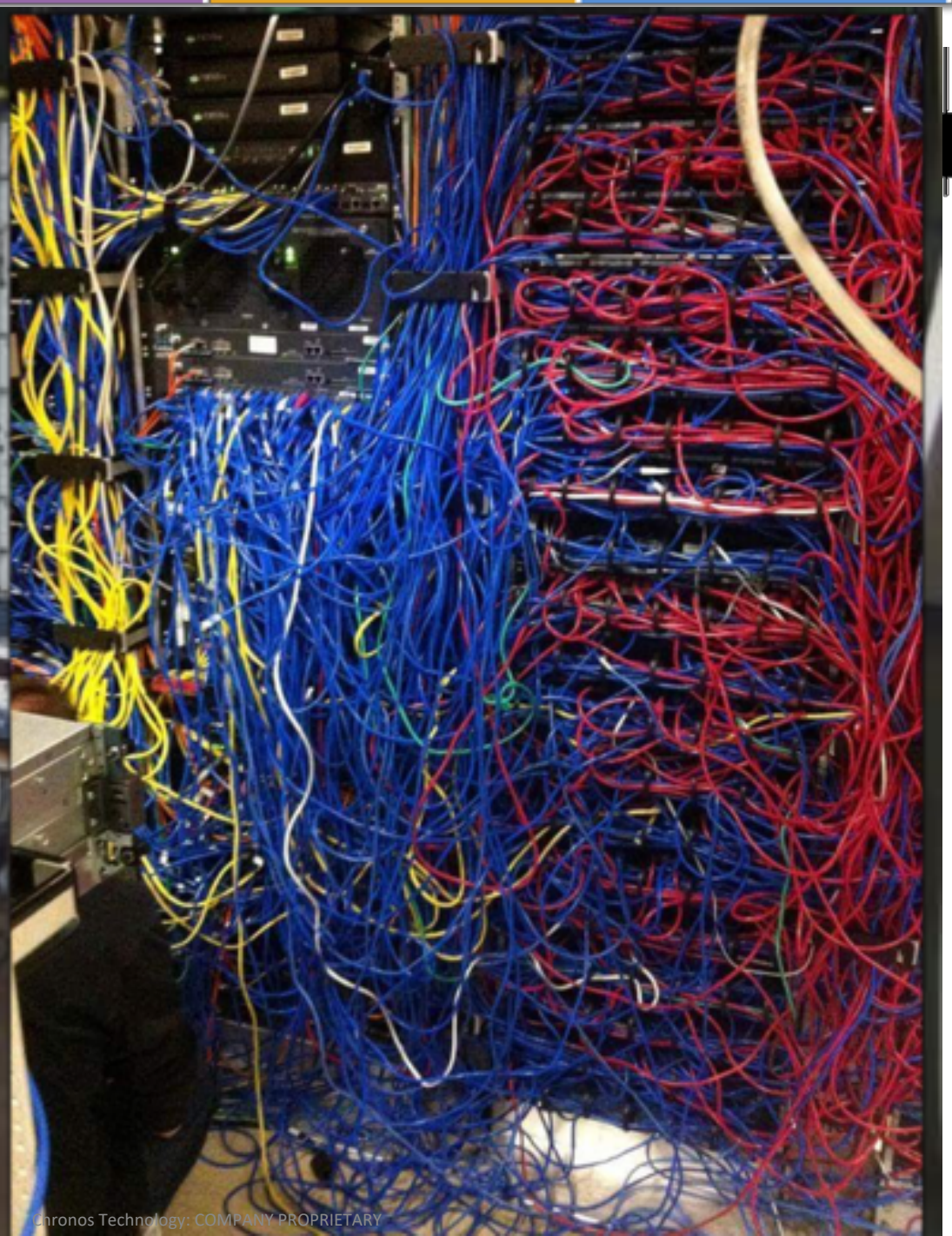
Timing: a simplified model



Auditing the clock…







TECHNO
FORTINET
FortiGate
Primary

15
14
PTP CLK
EVERNEW
Patch Cable UTP

Optional extra…?

NIC + PTP slave:

"sorry, we didn't think we needed the 1PPS option"

Auditing the clock…

- Physical things:
  - UTC delivery: GNSS receiver, PTP GM
  - UTC distribution: ~~PTP BC, PTP Slave~~ ***no 1PPS (or other) clock O/P!***
  - Network design – how all the above things are connected together
- Non-Physical things:
  - UTC: consumption: Trading application!

cgk[redacted] Beginner

12-15-2015 03:36 PM

No signal at pulse-per-second (PPS) output (PTP CLK connector)

The [redacted] data sheet at

http://www[redacted]/data_sheet_c78-707001.html

describes a "IEEE 1588 PTP with pulse-per-second (PPS) output" feature, stating "Network administrators deploying IEEE 1588 PTP often find it challenging to measure the accuracy to which each device is synchronized. To assist in this effort, the [redacted] platform includes a 1-PPS output port that can be used to measure timing drift from the grandmaster clock."

On the front panel of the [redacted] is a coaxial mini DIN connector labeled PTP CLK. My understanding is that this is the 1-PPS output port referenced in the data sheet.

I have configured the network switch to enable PTP, have connected a PTP grandmaster, etc. and am attempting to observe the signal output by the PTP CLK connector using an oscilloscope. I am not observing any pulses being output by this connector.

How do I enable this PTP CLK connector?

Other Network Infrastruct...

Everyone's tags (1)

1588 PTP [redacted]

I have this problem too

cgk2[redacted] Beginner

02-04-2016 04:04 PM

After discussing this issue

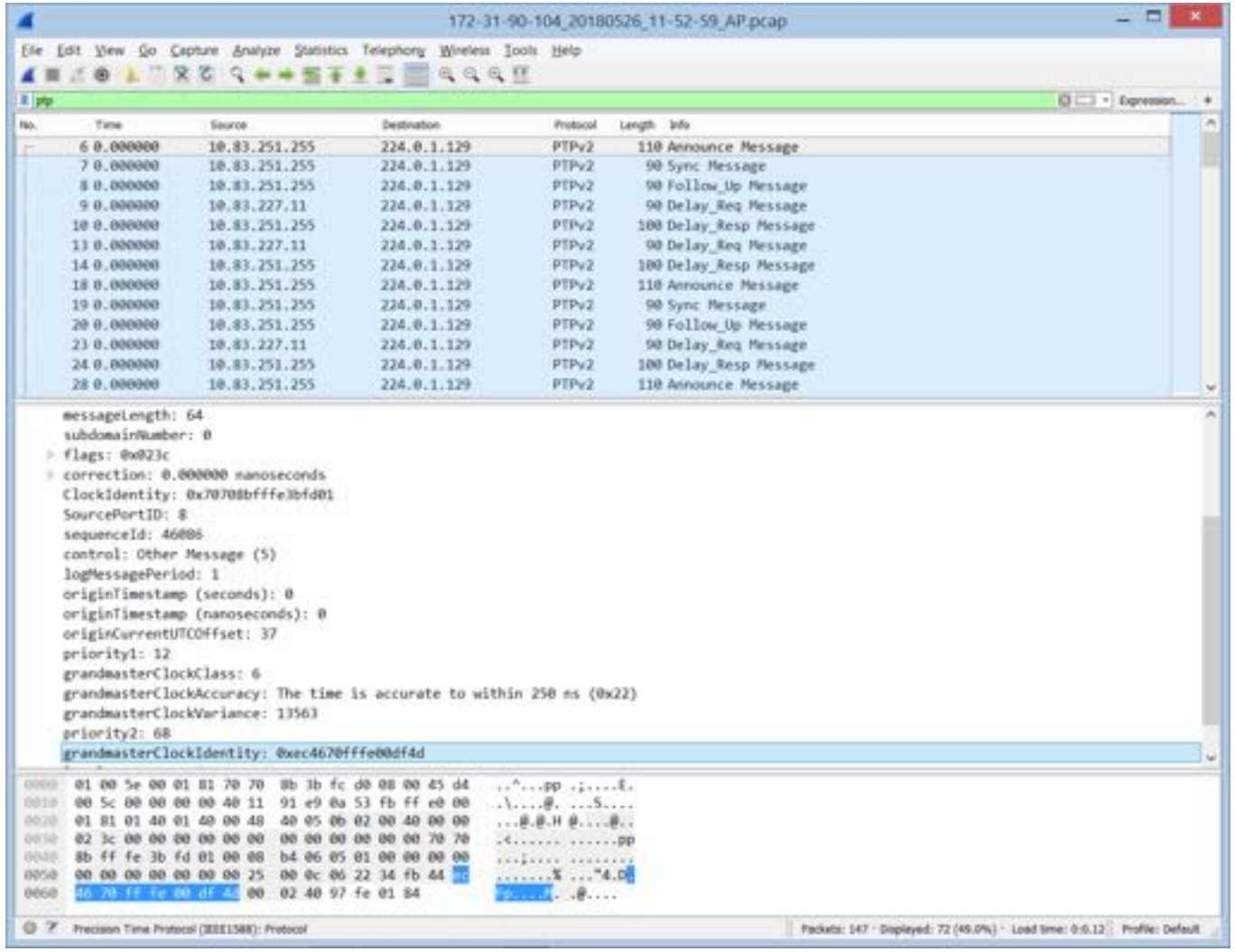
After discussing this issue with a [redacted] TAC engineer, I learned that while this PTP CLK connector is present on [redacted], and [redacted] (front panel names), there is no software support for this connector at this time. There is also no time frame for [redacted] to support this PTP CLK connector.

There is no clock to audit

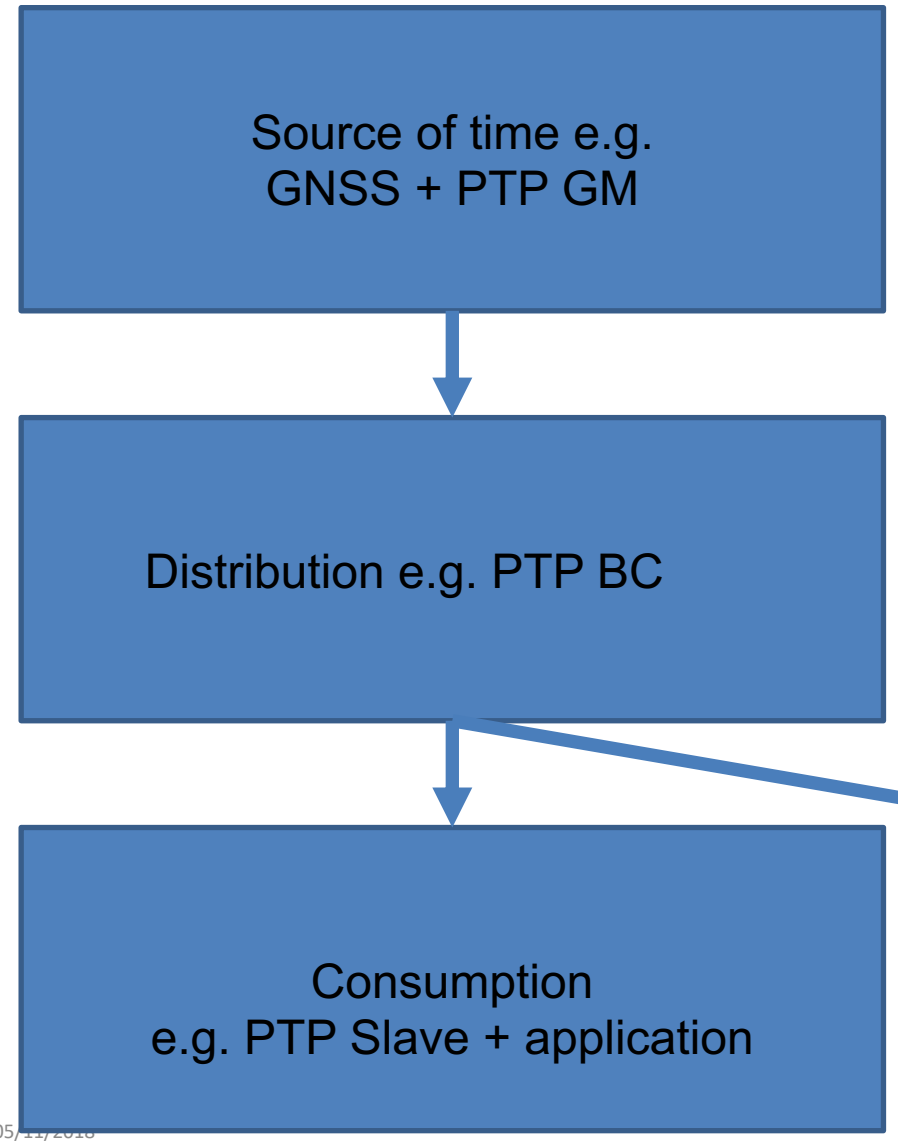
- ***Turn up on site and nothing to measure!***
- Add test slave – compare output
- Mirror port - capture PTP packets
- SECURITY hampers the audit process
- GNSS receivers calibrated
- Packet captures all OK
- Test slave 1PPS ~10µs
  - Agrees with other work

PTP packet capture

- Security policy/paranoia hampers capture!
  - Request “mirror port”
  - Announce Message: GM ID, UTC-TAI offset
  - Message rates etc. as expected
    - Two-step, Layer3 (UDP/IP)
      Sync: 2Hz Del_Req/Resp: 0.5Hz
      Announce: 0.5Hz

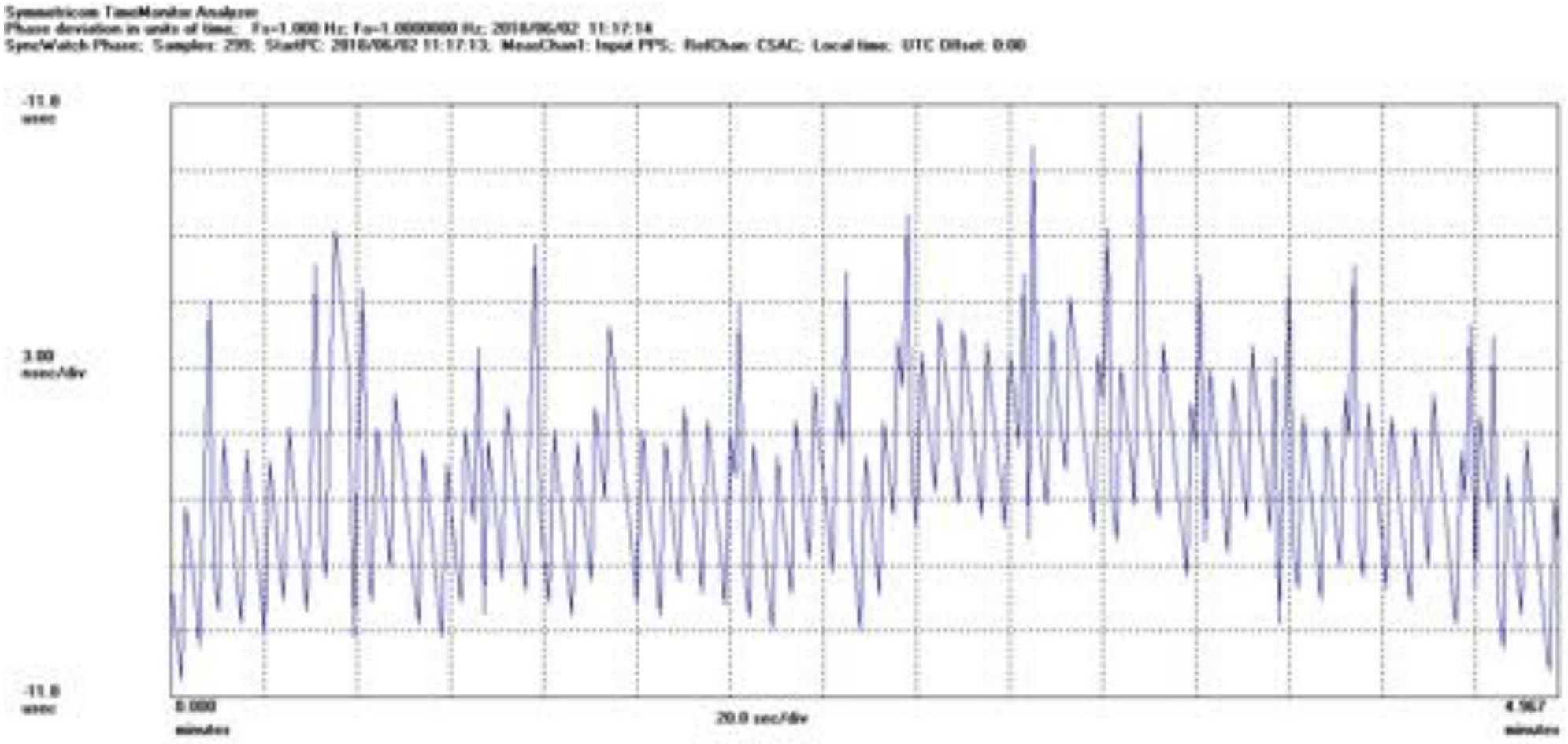


Surrogate PTP slave



- Comparative position in the network hierarchy
- Security/paranoia again – mirror port/MAC whitelisting etc.
- Does the test slave behave exactly as the real one?

Surrogate PTP slave



Findings

- GNSS 1PPS output confirms:
  - Cable delay not set at all
    - ~500ns error – “standard” 100m cable drum used
    - Questionable install?
    - GNSS GM manufacturer states
      “probably no need to set cable delay compensation”
- PTP Packet capture confirms:
  - GM Identity + network performance
- Test Slave confirms:
  - Approximate/Achievable performance

Summary

- 1PPS outputs!
  - Telecom learned this lesson already
- BREXIT the new focus – MiFID is “done”
  – money/resource was allocated 2016/17
  – difficult to get commitment now it seems the “MiFID compliance” box has already been ticked
- If/when the regulator imposes penalties on traders this may change…
- Meaningless requirements need to be updated

Thank you for listening, any questions?

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Reference Slides

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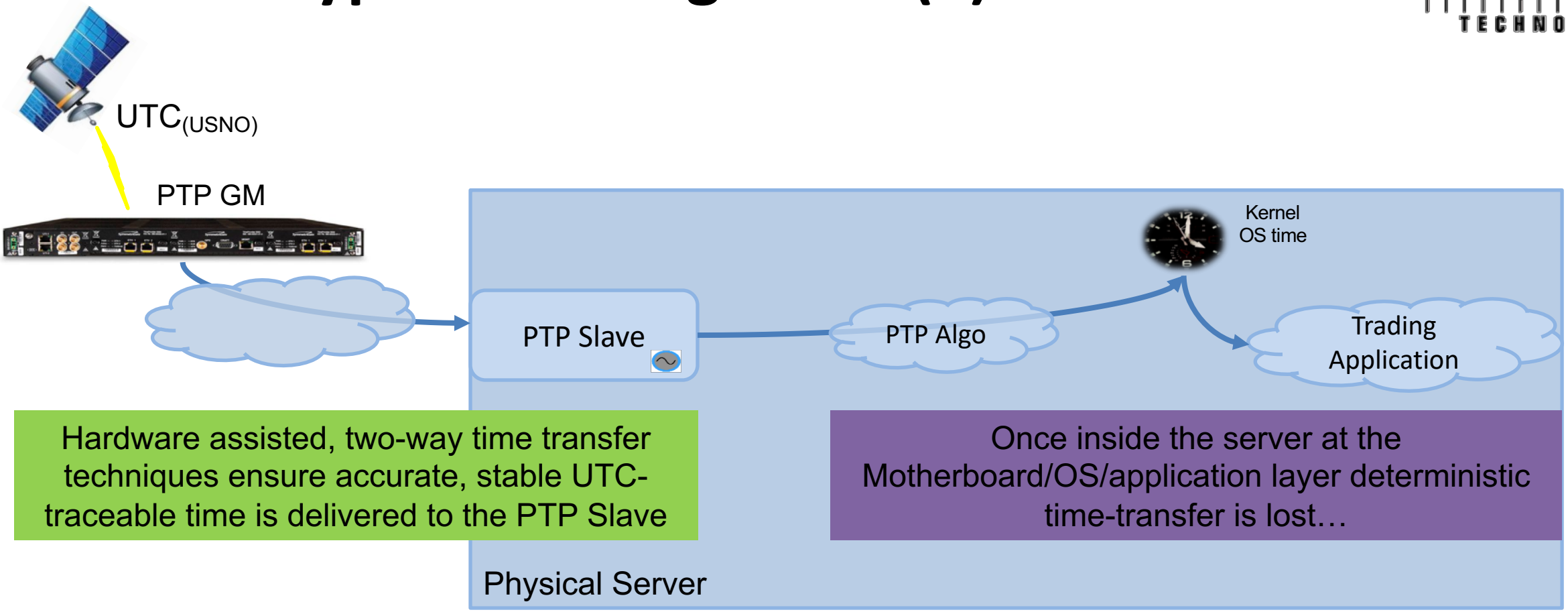
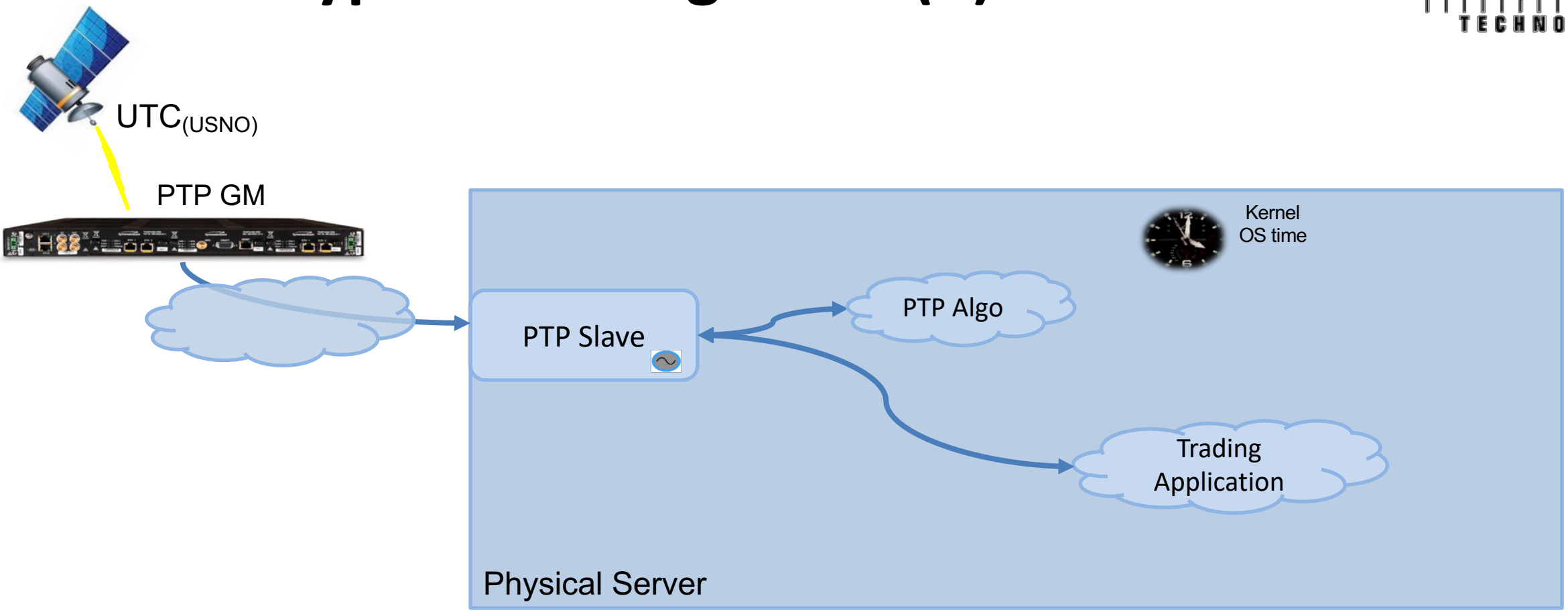
Typical Trading Clock (a)



Hardware assisted, two-way time transfer techniques ensure accurate, stable UTC-traceable time is delivered to the PTP Slave

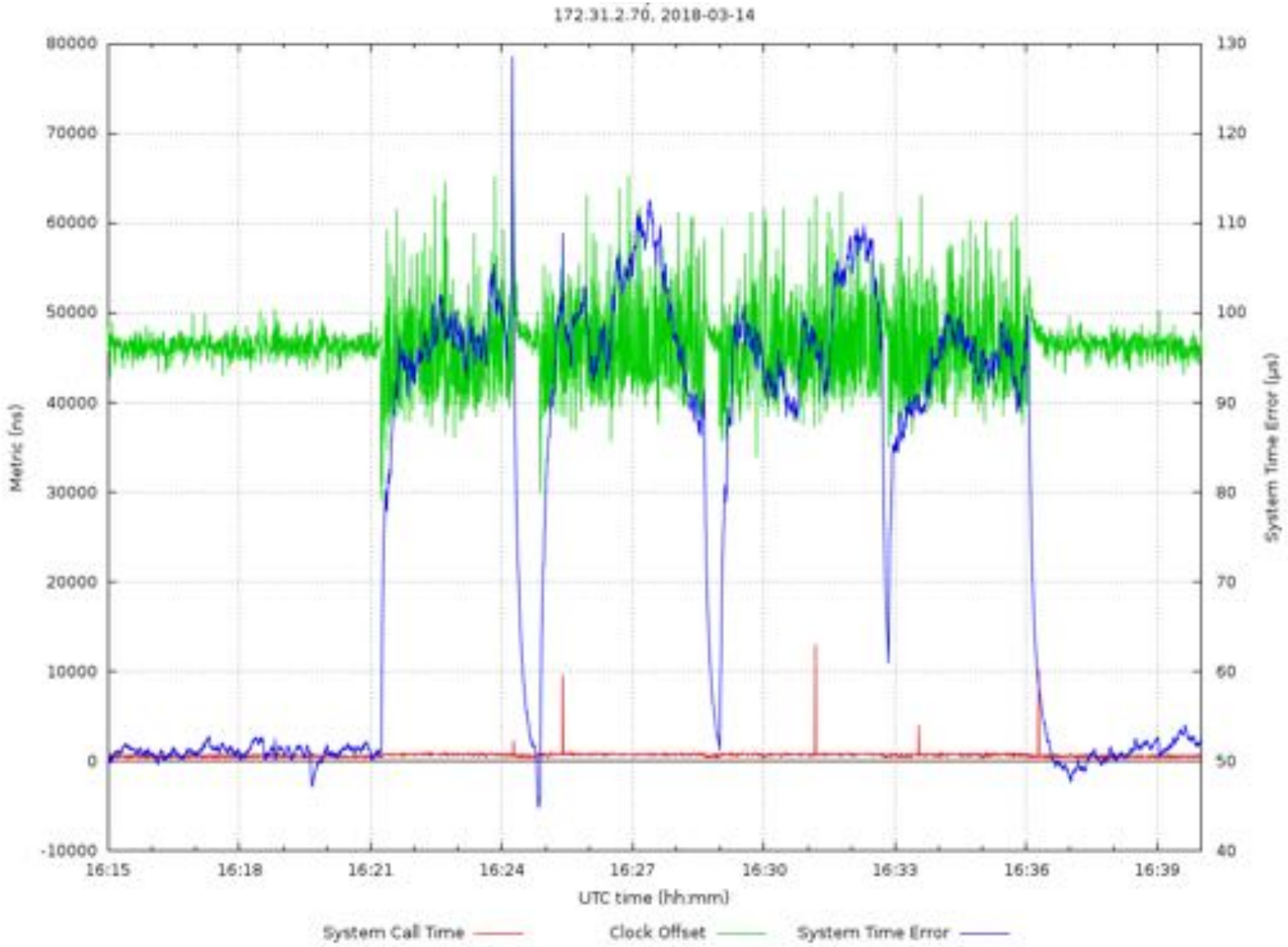
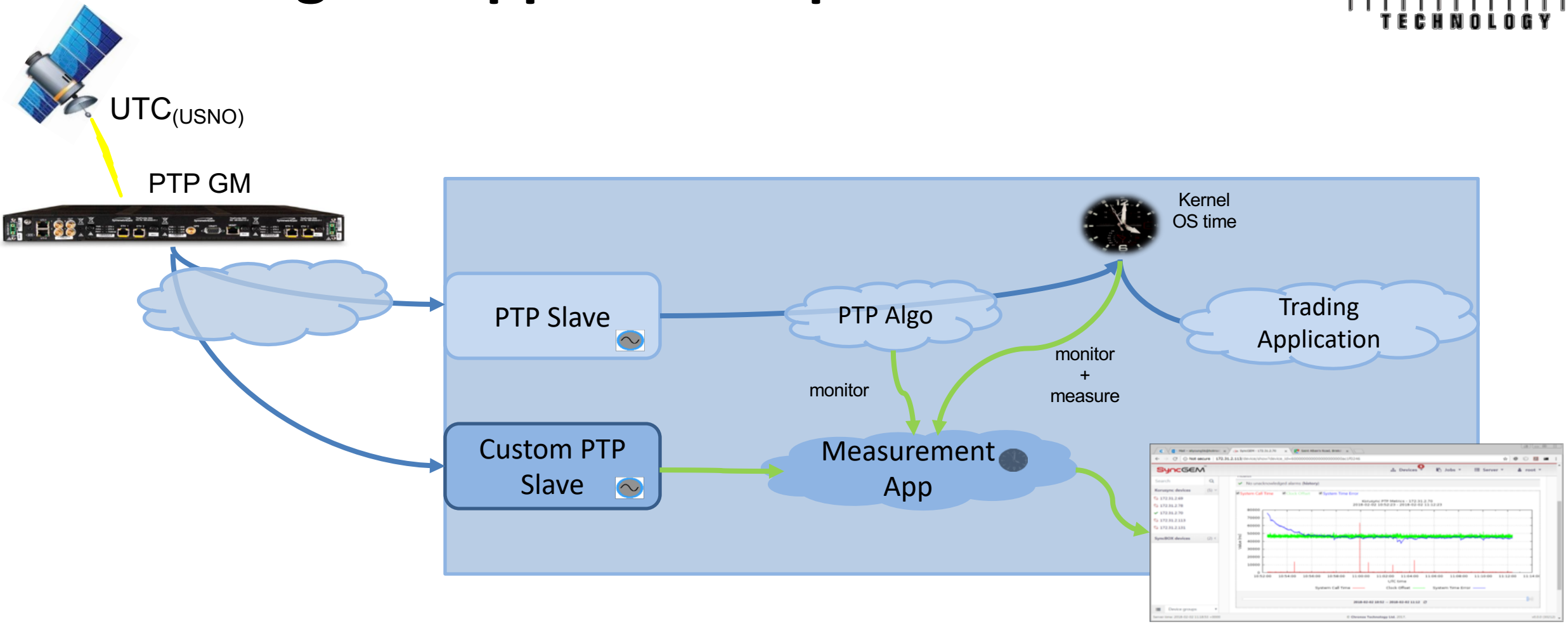
Once inside the server at the Motherboard/OS/application layer deterministic time-transfer is lost…

Typical Trading Clock (b)



Profiling the application space

- Lab test plots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