Syncing the cloud - from T1 to TAP

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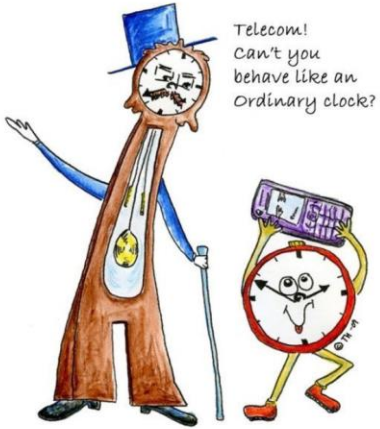
Agenda

- The rise of the data centre and general trends
- Time Appliance Project
- 5G O-RAN architecture and synchronization in white box environments
- Interfaces for bringing synchronization to applications

From T1 to TAP

A time check on Sync…

ATM/PWE3



First T1 "leased line" billed by AT&T

NTP

GPS

PTPv2 2008

TAP

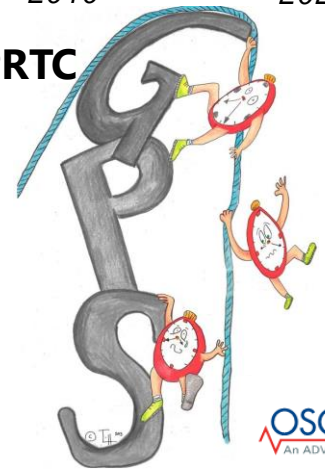
1960 *1970* *1980* *1990* *2000* *2010* *2020*

First T1 lines deployed on intercity trunks

G.81x (SDH)

G.Pactiming

PRTC



From Telecoms (networks) to Data (centeric)

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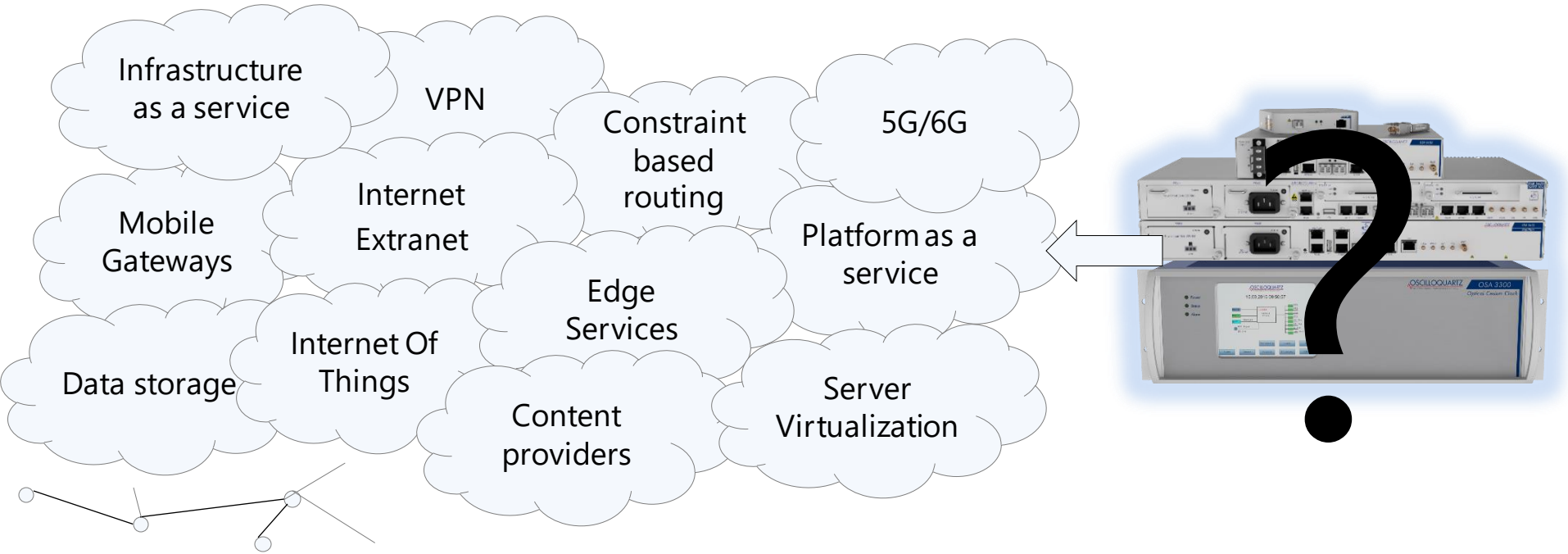
The Cloud needs sync…

And the cloud is in the Data Center/Mobile…



How to connect Sync to the cloud?

General Timing Trends and Cloud Trends

General:

Miniaturization

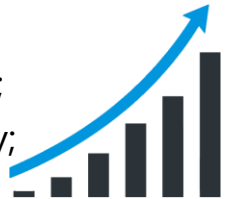
Consolidation

Cloud:

Scalability ⇨ Explosive growth
(synchronization management)

Sustainability ⇨ Open Source (White Box)
(efficiencies of scale)

Accuracy;
Resiliency;
Security



The Cloud impacts the future of Synchronisation

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Major sources of Time error

Ranking may vary…

Error Category	Error type	Solution
Antenna delay compensation	Offset; Hassle	Use PTP from antenna

Synchronization is a discipline

Time Appliance Project

Platform for cross-industry Sync with focus on DataCenters

Open Compute Project https://www.opencompute.org/

Mission

1) Create specifications and references for **Data Center Timing** appliances, applications and networking infrastructure:
   - Open Time Server
   - DC profile coming…

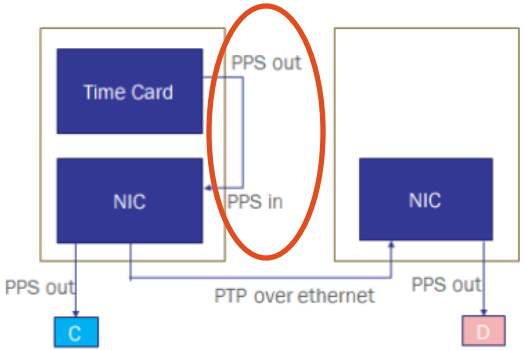
2) Promote openness in **Timing Appliances** and interfaces through open-source implementations

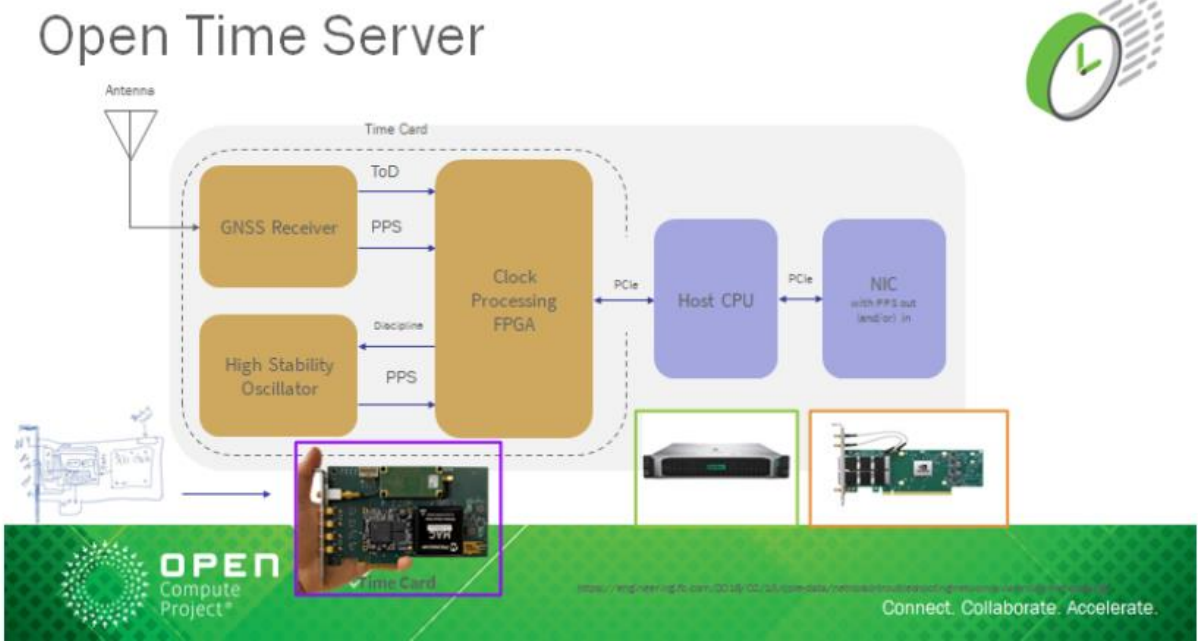
Open Time Server

= TimeCard + Standard Server + Standard NIC

- Interconnect via PCIe (using PTM)
- Optional PPS connections (to ensure high accuracy)

TAP use case:





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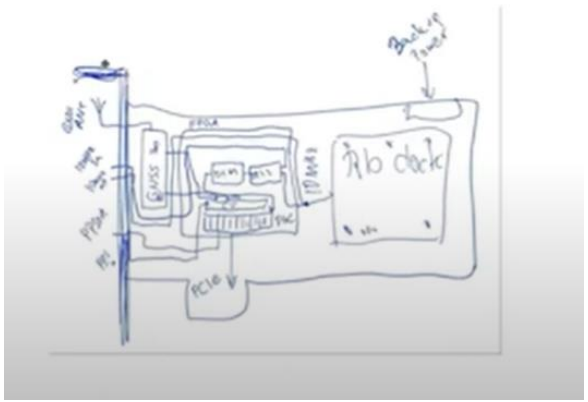
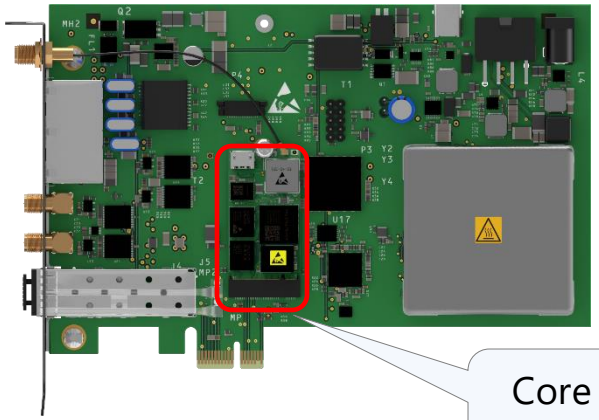
PCIe TimeCard with M.2 module as core

Concept



Implementation

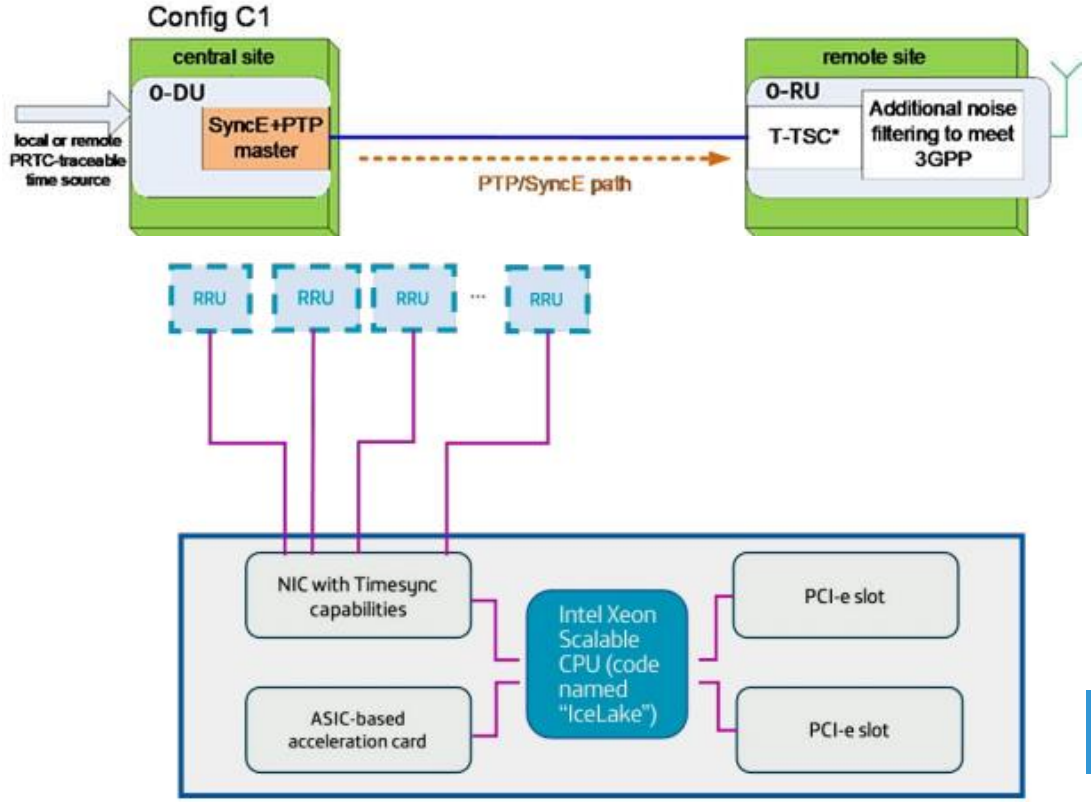


Core built as M.2 Sync Module

M.2 slot is commonly available and allows smooth sync add on

Open-RAN Architecture Config C1

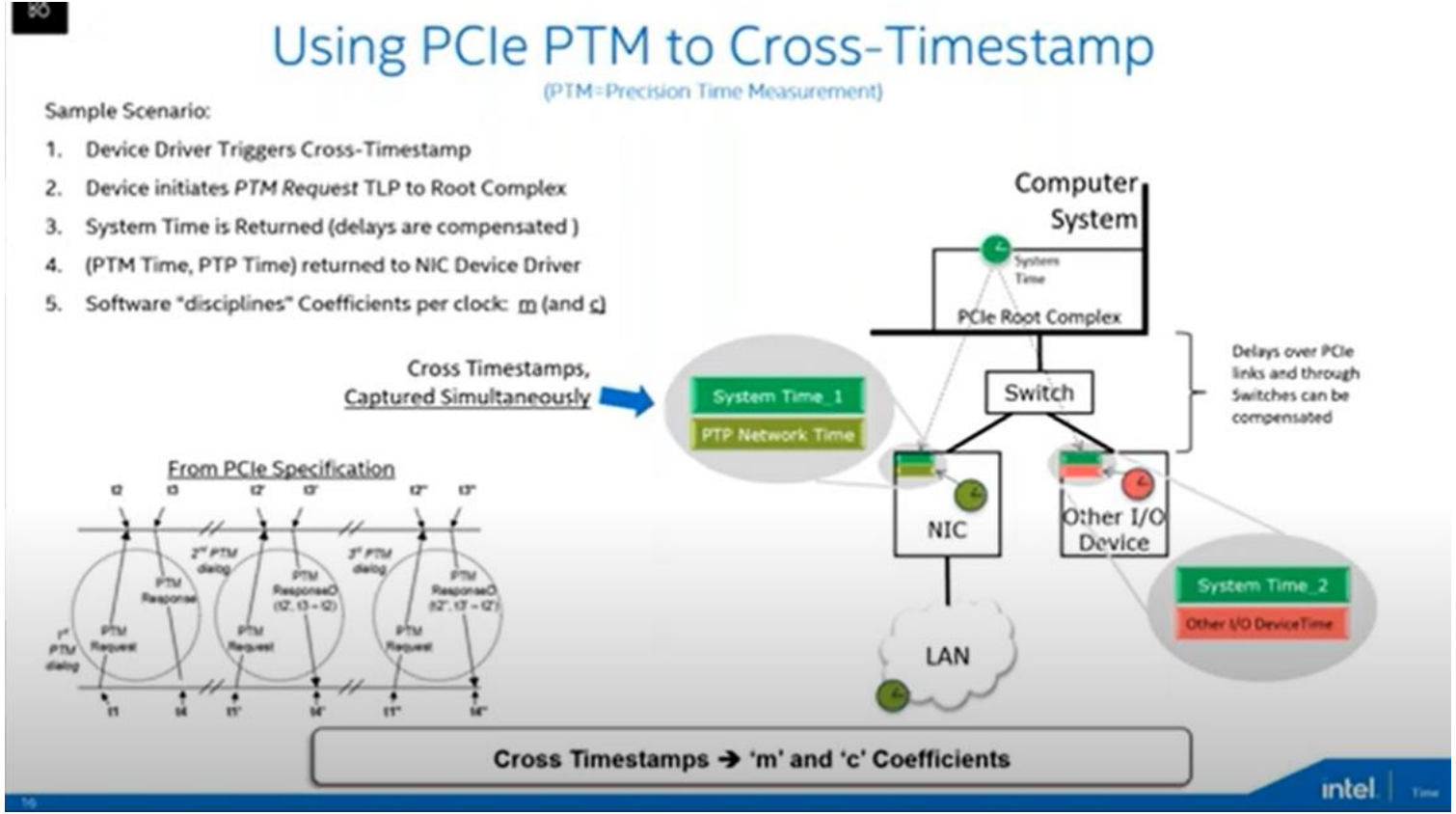
O-DU based on whitebox server + NIC



PCI-e is becoming a sync interface

Synchronization over PCI-e (PTM)

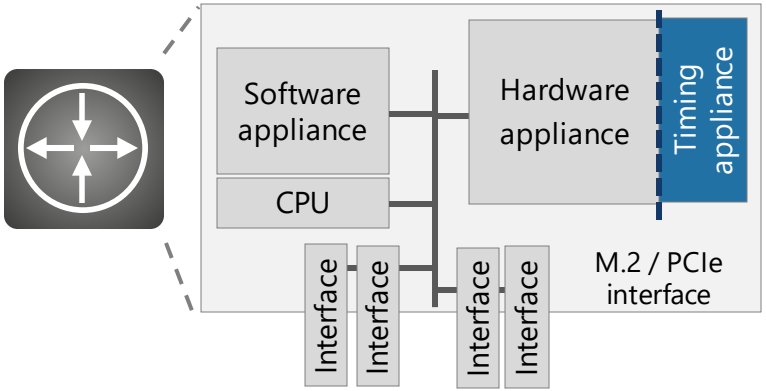
Precision Time Measurement

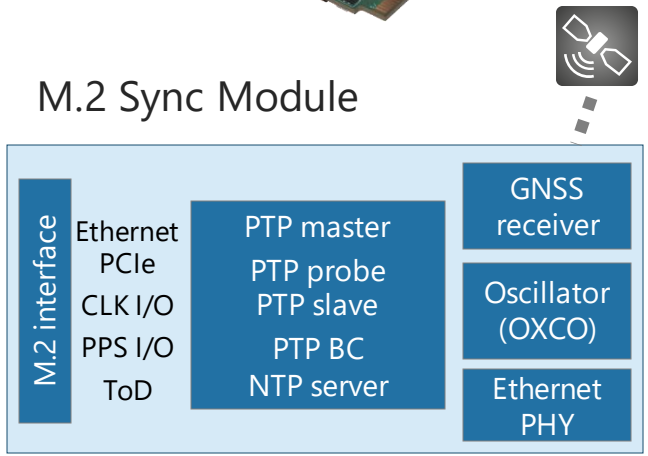


While M.2 Sync Module natively supports PCIe…

It can be extended to other applications

Generic architecture of a network device





M.2 provides sync to host devices

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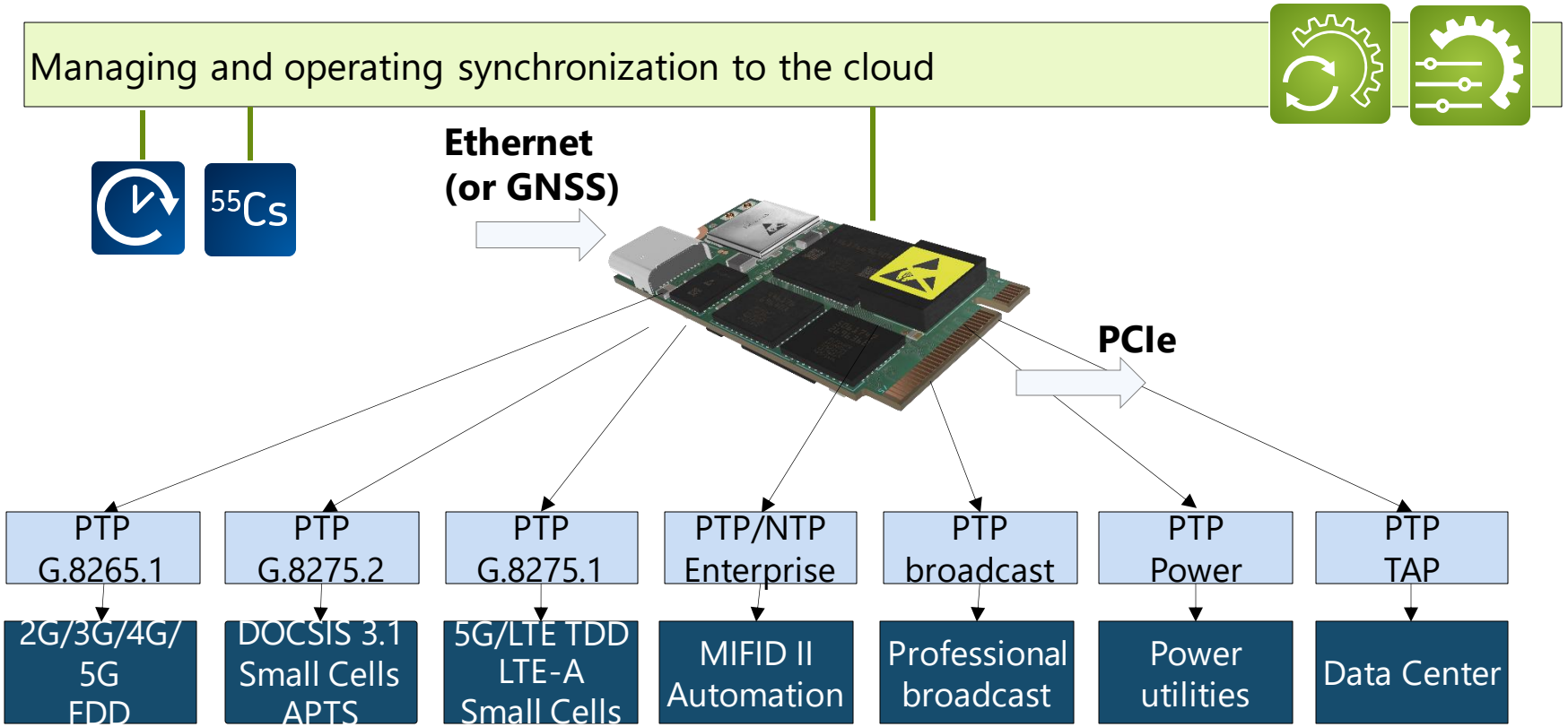
M.2 Sync Module synchronize many applications



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Conclusions

1) General move from Transmission centric to Data centric
   - Explosive growth of "the Cloud"
   - Cloud Services need high accuracy Sync (TAP; O-RAN)

2) Cloud HW based on COTs Server (TAP; O-RAN)
- PCIe becoming a high performance Timing interface

3) M.2 Sync Module proposed as a flexible solution for PCI-e and other applications

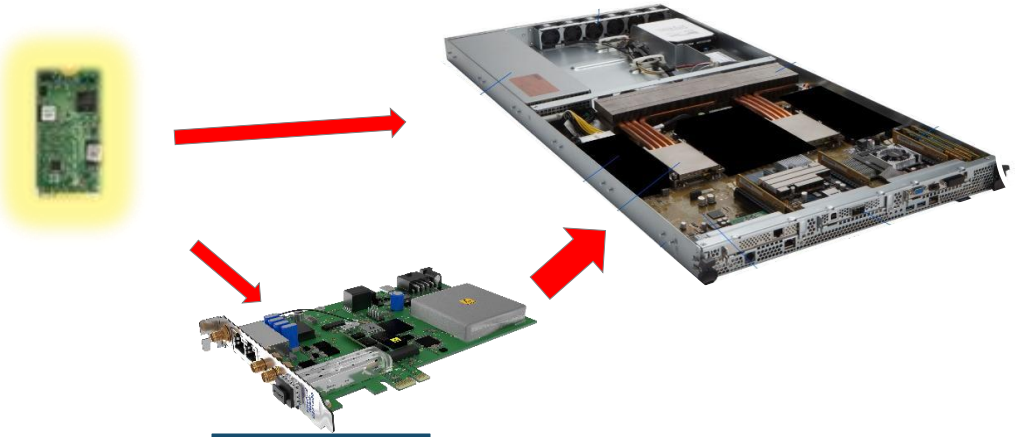
Thank you

Khann@Oscilloquartz.com

Back-up slides

How to interface to a WhiteBox Card or Server

Module
M.2 interface to Host



Embedding timing expertise in 3PP network devices

Introduction- M.2 SyncModule

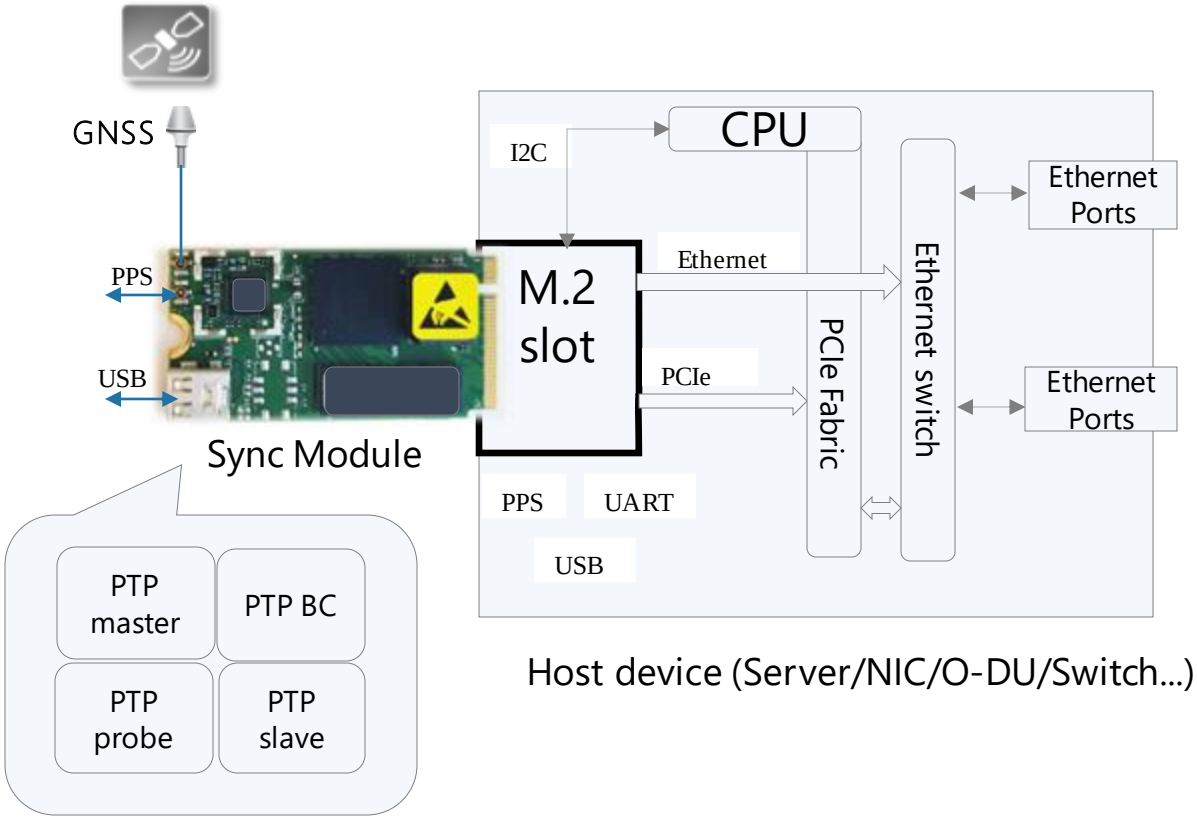
- Low-power, solution
- Easily integrated into systems due to M.2 interface
- Extended temperature range -40°C to +85°C components

Comprehensive sync capabilities

- IEEE 1588 PTP grandmaster/boundary/slave clock
  - Up to 64 unicast clients at 128pps
  - Multiple PTP profiles
  - PTP profiles conversion
- GNSS receiver
- NTP server
- PTP input as backup to GNSS (APTS)
- Sync probe
- Sync-E In/Out
- OCXO based holdover

While M.2 natively supports PCIe…

It can be extended to other applications



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TimeCard

GNSS antenna input

100M/1G copper +PoE Output

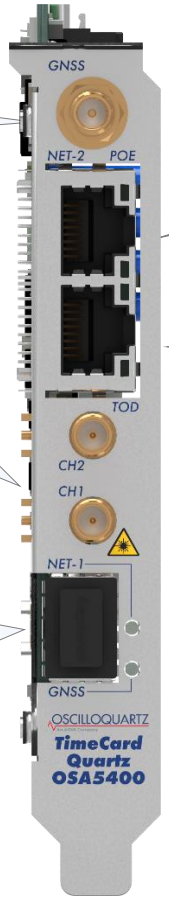
PPS+TOD (HW ready)

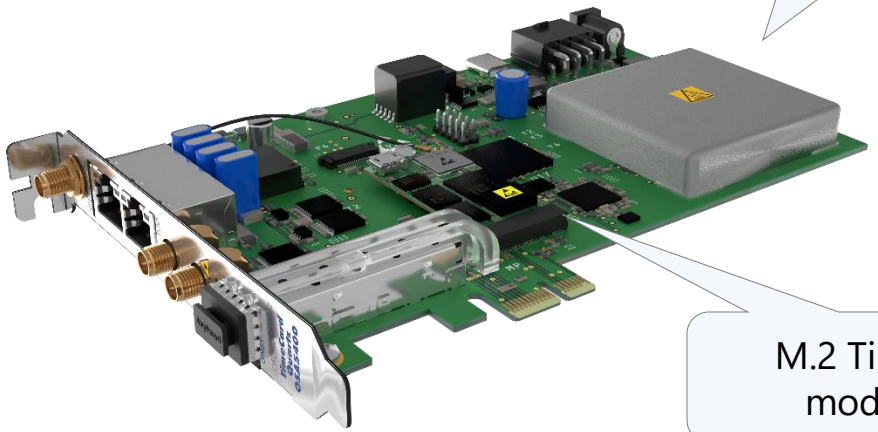
CH1/CH2 I/O (PPS/CLK)

1G Fiber

Qz/HQ+/HQ++/Rb options - extended holdover

M.2 Timing module





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