Orange
Innovation

Evolution of Synchronization needs for Telecom Operators

Olivier Le Moult
ORANGE/INNOV/NET/WNI/AOT/SOAN
October 2, 2024

orange™

Summary

1. Synchronisation – current situation
2. Other precise timing need
3. Future needs
4. New constraints
5. Conclusion

1 – Synchronisation – current situation

Since the 5G arrival, phase and time synchronisation are needed for Telecoms Operators. The main requirement is **+/- 1,5 µs** end-to-end relative to **UTC** timescale. Below are key points for 5G synchronisation:

1

TDD

Main 5G need: Time synchronisation is mandatory for each operator

2

FDD

Still necessary for all operators

3

Specificities

Carrier Aggregation
CoMP
Massive MIMO

4

Services

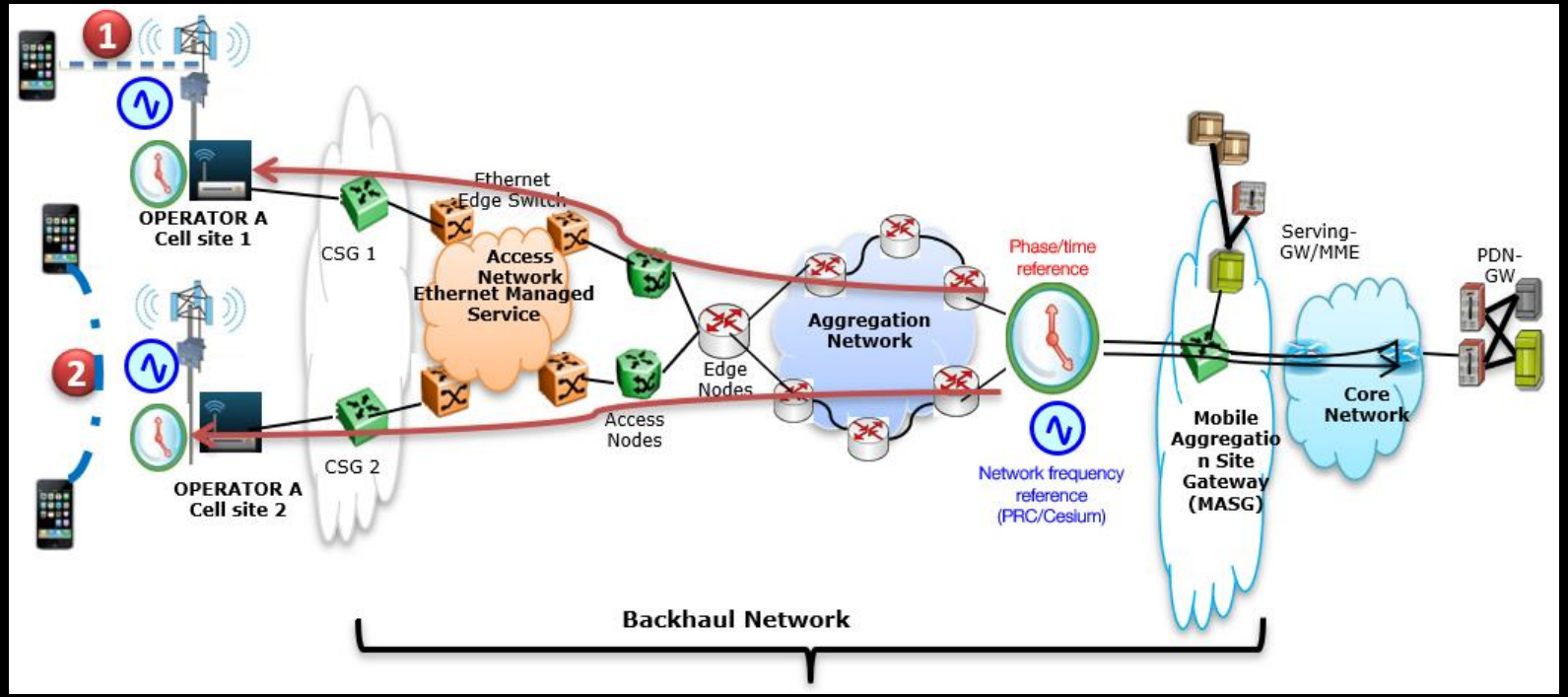
Network Slicing

Specific use cases

e.g. Industry 4.0

1 – Synchronisation – current situation - figure

Requirement **+/- 1,5 µs end-to-end relative to UTC**. Example for two of the key points for 5G synchronisation:



1: Radio Framing Accuracy 2: Hand-over

Source: ORANGE

Summary

1. Synchronisation – current situation
2. Other precise timing need
3. Future needs
4. New constraints
5. Conclusion

2 – Other precise timing need

DATACENTERS

Time synchronisation for servers, for applications and between datacenters (in case of mirroring).

Use of a specific PTP (Precison Time Protocol) IEEE-1588 profile, different from Telecoms one.

Many time and frequency developments for Datacenters synchronisations needs, see for example **OCP TAP :**

OCP: Open Compute Project

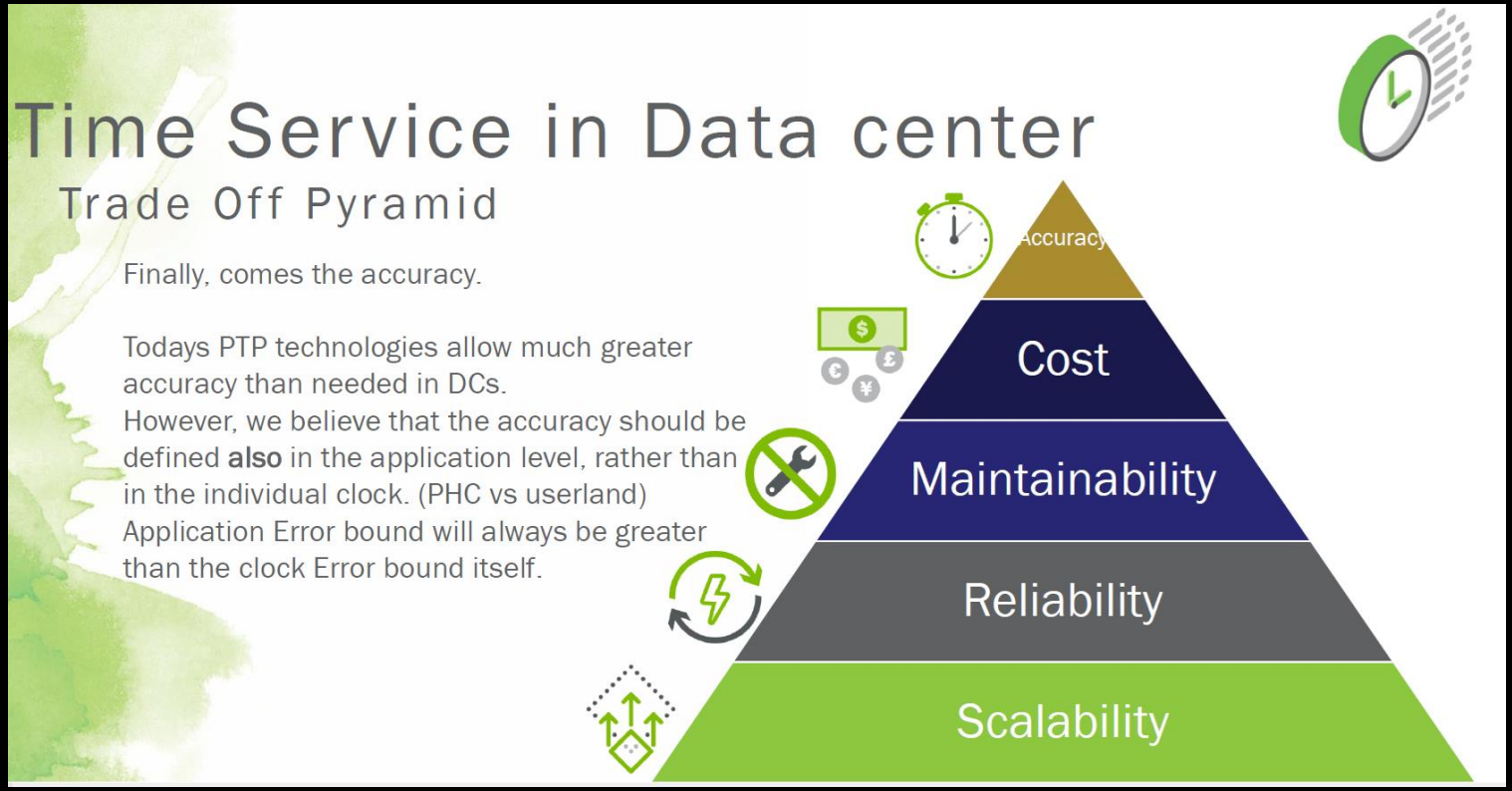
TAP : Timing Appliances Project

It is definitely an important synchronisation domain for Telecommunications as more and more telecommunications features are virtualized as applications on generic IT servers in Datacenters.

OCP TAP: https://www.opencompute.org/projects/time-appliances-project-tap

See next slide for the view of TAP from OCP Foundation.

2 – Other precise timing need - figure



TAP vision 2020: https://drive.google.com/file/d/1WAUl4JVaakqCY8e7yZlQiz5j6NhMkHPb/view?usp=sharing

Summary

1. Synchronisation – current situation
2. Other precise timing need
3. **Future needs**
4. New constraints
5. Conclusion

3 – Future needs – part 1

6G will not be a revolution but a continuous enhancement of 5G, see main goals for 6G Stage 1 from 3GPP:

- Identify new services and enhance the existing services for the next generation global mobile markets and the relevant market segments.
- Develop use cases and service level requirements to build system capabilities above and beyond 5G system.
- Define the potential requirements to enable 3GPP system to support the new/enhanced services and scenarios including the ITU-R IMT-2030 usage scenarios.
- **Support societal advancements** and **bring value to society** in the 2030s and beyond in secure, resilient, environmentally and economically sustainable ways.

The last goal is a new approach, totally endorsed by ORANGE, see our last 5G-6G White Paper:
Mobile Network Technology Evolutions Beyond 2030

For Synchronisation, it means that most of 5G solutions will be reused.

If real use-cases will need High Performance timing, new synchronisation solution could be deployed (e.g. High Performance Profile for IEEE-1588 2019, PTP v. 2.1 (**White Rabbit**, see CERN presentation in the Workshop).

3 – Future needs – part 2

Quantum Technologies is a real new domain for Telecoms operators.

New synchronisation requirements will depend of each Quantum Solutions.

For example, it is expected that basic QKD* will not require high performance solutions, contrary to enhanced QKD (e.g. **TF-QKD**, or Twin Field Quantum Key Distribution) or **entangled-based QKD** with much higher requirements.

AI Technologies is not a novelty for Telecoms operators.

But Generative AI methods and tools will certainly bring new requirements for Datacenters performances.

It will be logical that new synchronisation requirements for telecom networks will be discovered as the demand for these new tools is skyrocketing.

See for example future activities in **OCP Fundation**, already introduced in previous slides.

QKD*: Quantum Key Distribution, see for example: https://www.etsi.org/committee/qkd

Summary

1. Synchronisation – current situation
2. Other precise timing need
3. Future needs
4. New constraints
5. Conclusion

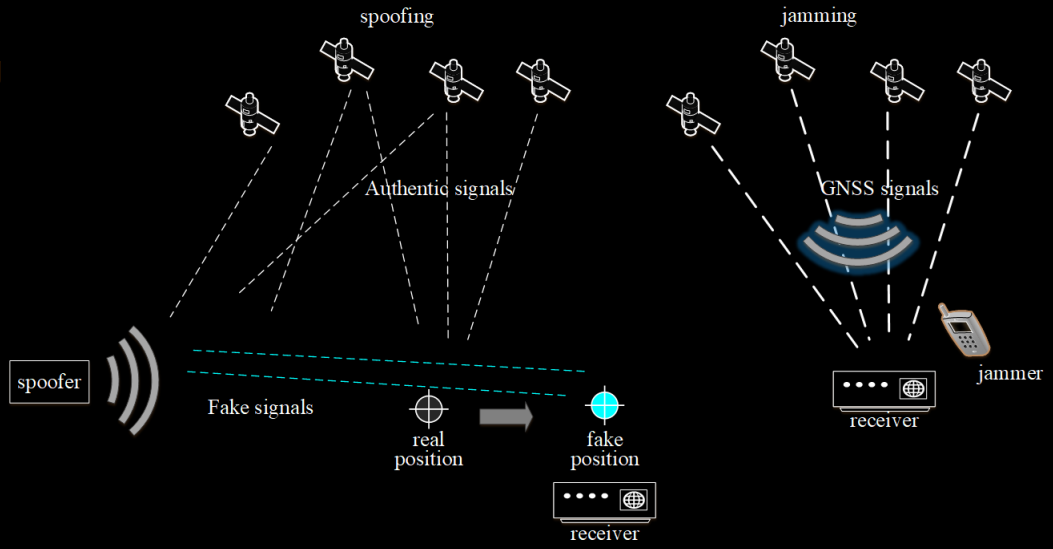
4 – New constraints

Current phase and time synchronisation sources are only GNSS, they can be impacted by GNSS vulnerabilities.

The two main risks are **Spoofing** and **Jamming**

This implies that **RESILIENCY** for Synchronisation networks is mandatory.

First answer is Frequency reference source input for each PTP GrandMaster.



Synchronous Ethernet

for each 5G base station is the second answer.

It permits a Time Holdover feature if GNSS is lost for the correspondant PTP GrandMaster.

Source: Sensors **2024**, *24*(13), 4210; https://doi.org/10.3390/s24134210

For global view of vulnerabilities, see Enjeux et Concepts, MTES presentation in the Workshop.

Summary

1. Synchronisation – current situation
2. Other precise timing need
3. Future needs
4. New constraints
5. Conclusion

6 – Conclusion

Time and Phase features are needed for **mobile 5G**, and other important domains for Telcos (**Datacenters**).

New domains (Quantum, AI) will have specific new requirements.

Whatever the new needs and requirements, very high performance for synchronisation solutions is no longer the main goal.

Redundancy (and more generally, resiliency), energy-saving solutions, environnemental friendly products and societal print of new synchronisation solutions or architectures will be very important.

The important novelty is the new question:

Are synchronization solutions and architectures capable of achieving other objectives than just technological needs?

Orange
Innovation

Thanks

Especially for organisers and FIRST-TF for the funding of the mission.

Olivier Le Moult : olivier.lemoult@orange.com

orange™