

Real world Sync Experience from the Statnett Networks

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Statnett

COSECTIME



Timescale



Timetransfer



Digital substation

COSECTIME

COordinated

Traceable to UTC by timing link to UTC(JV).
Enables interoperability and exchange of timestamped measurements across the common Nordic (FIN/SWE/NOR) synchronous power transmission grid

SECure

Secure timing sources: Statnett will own and control multiple cesium clocks for (semi-) autonomous timescale generation.

TIME

Secure timing distribution using redundant optical networks owned and operated by Statnett



Safe time reference

Operational control system that relies on exact time reference, must have reliable sources for time.

Ministry of Petroleum and Energy

beredskapsforskriften

§ 7-14 j) Sikker tidsreferanse

*Driftskontrollsystem som er avhengig av eksakt tidsreferanse, skal ha **sikre kilder** for tidsangivelse.*



COSECTIME 1

Prestudy



FINGRID



Statnett



SYRTE

Justervesenet

COSECTIME 2

Pilot:

Establish high precision link to Norwegian NMI

Establish high precision link Statnetts Pilot Substation

Testing Cesium-clock in Statnett locations.

COSECTIME 3

Technology qualification:

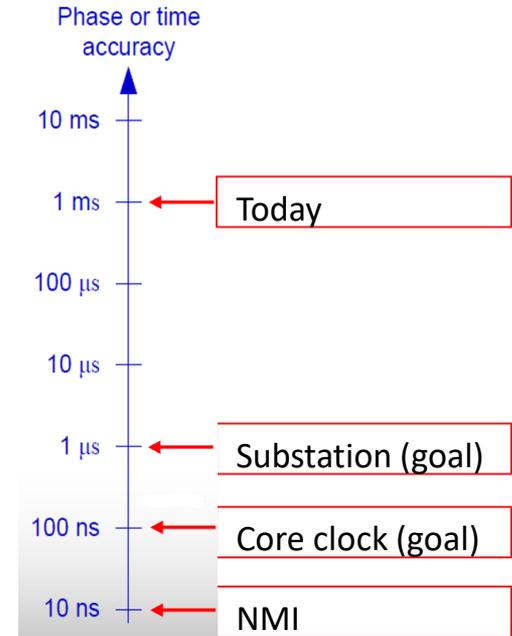
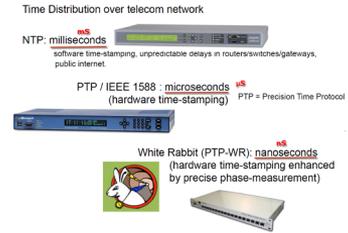
Bidirectional optical links

Geographically distributed core atomic clocks

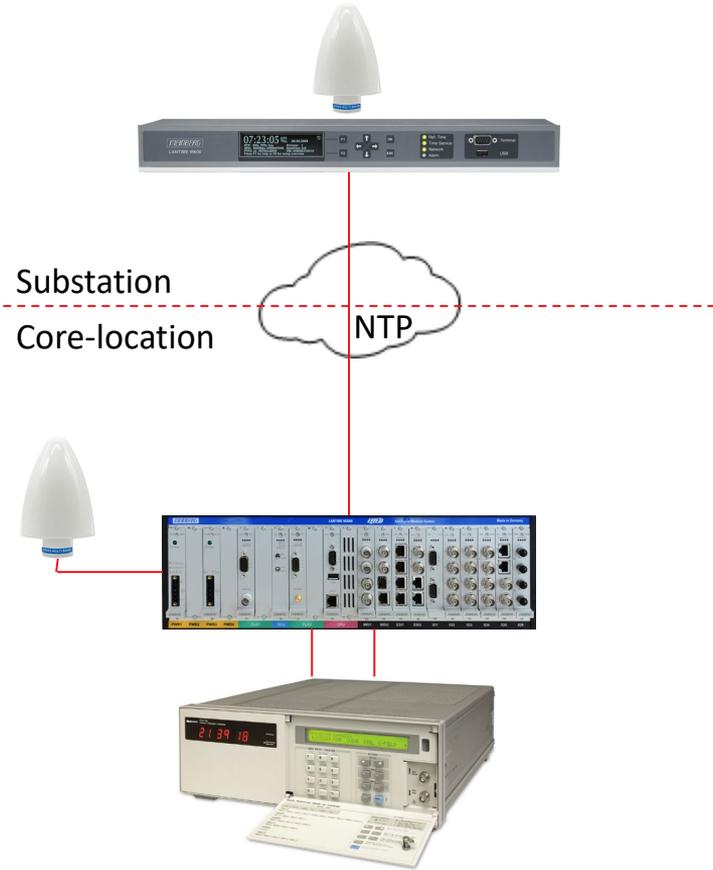
Management of the time reference system

Goal

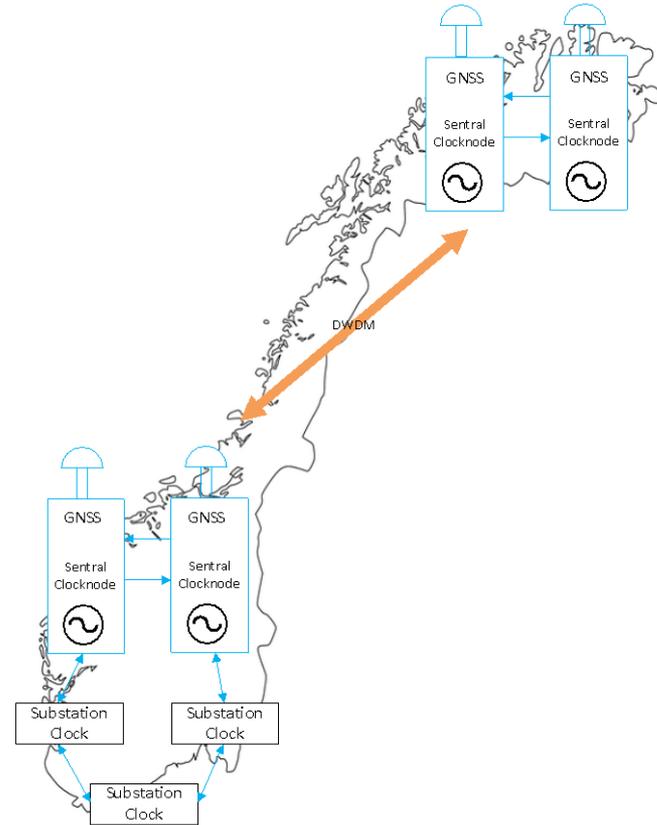
- Statnett generates its own autonomous atomic timescales referenced to UTC
- Independent of the global navigation satellite system
- Deliver accurate timing ($1\mu\text{s}$) to transmission network substations via optical fibers for:
 - Protection relays (over IP)
 - Phase Measuring Unit

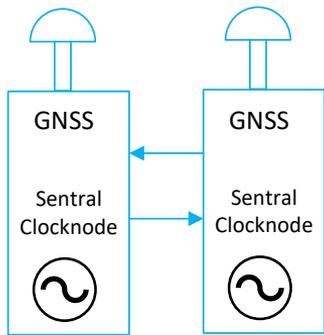


Today

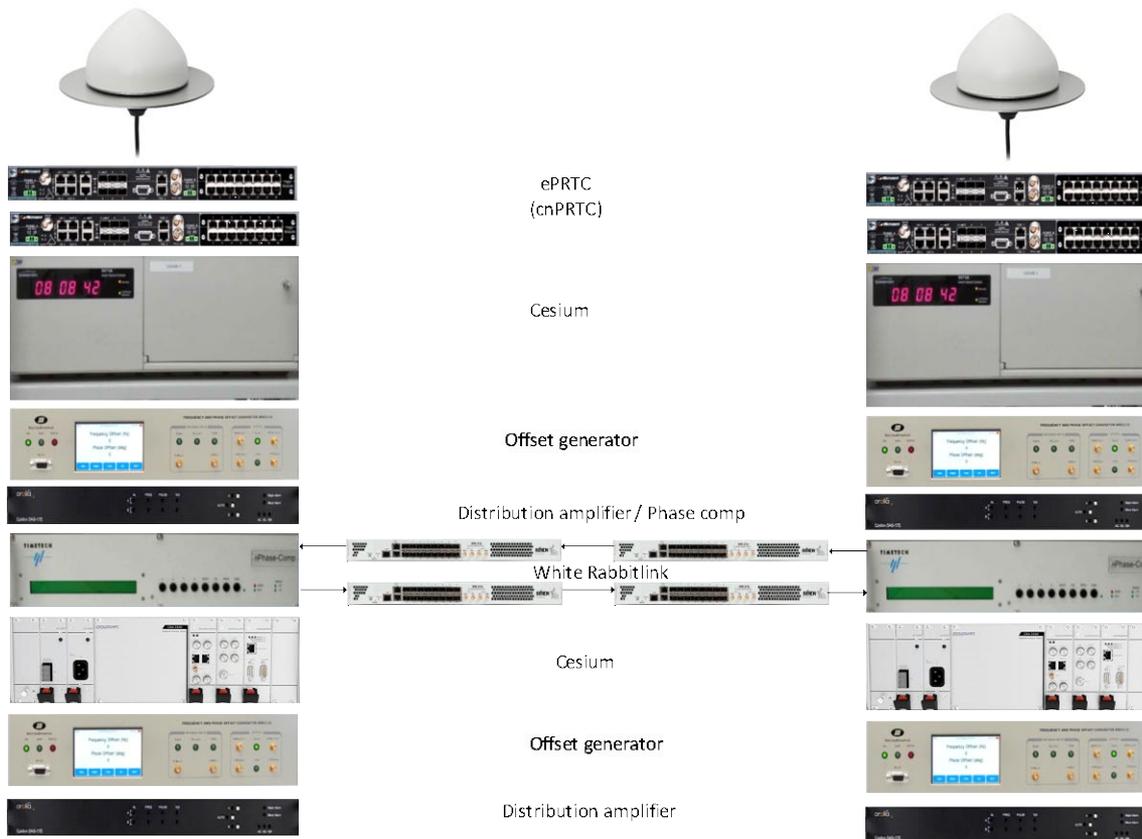


COSECTIME (goal)

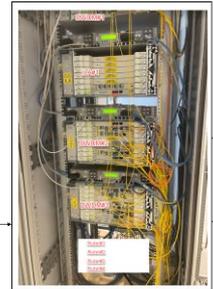
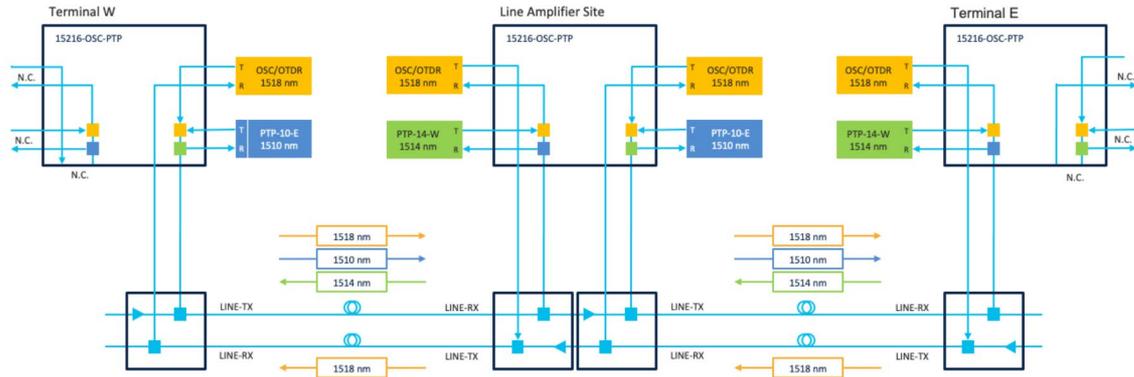
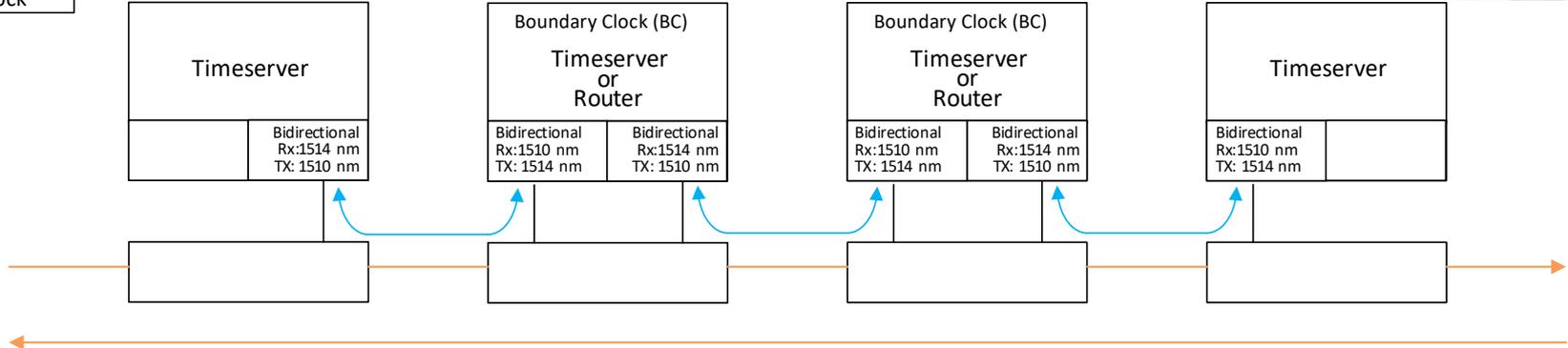
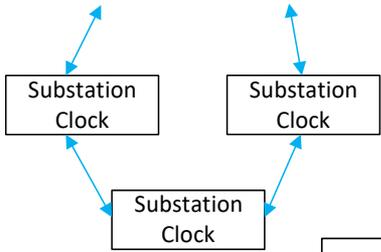




Timescale

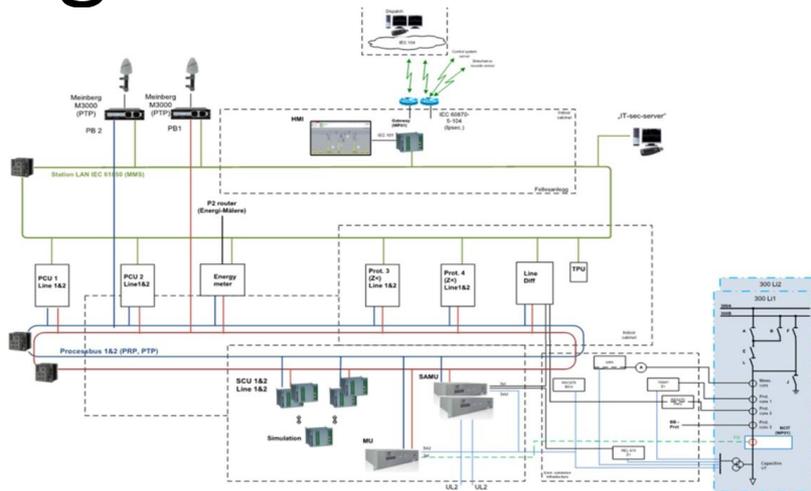


PTP over DWDM





Digital Substation Pilot



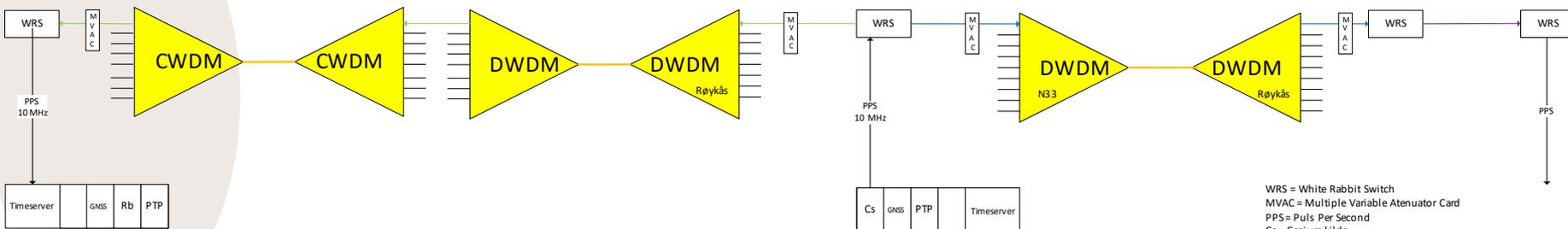
Digital Station Pilot

Site A

Core Site

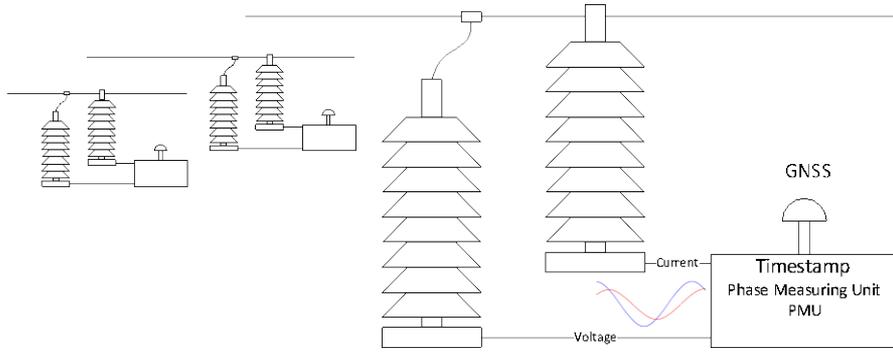
Site B

Justervesenet (NMI)

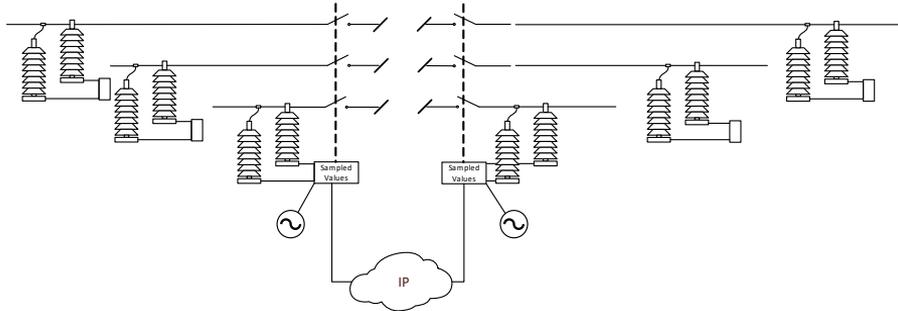


WRS = White Rabbit Switch
 MVAC = Multiple Variable Attenuator Card
 PPS = Puls Per Second
 Cs = Cesium-kilde
 Rb= Rubidium
 GNSS = Global Navigation Satellite Systems
 PTP = Precision Time Protocol

IED (Intelligent Electronic Device)



- Protection
- Control
- Monitoring
- Metering
- Communications



- Protective relays
- Phase Measuring Units
- Digital fault recorders
- SCADA
- Traveling Wave fault location
- Sample Values



European project under EMRP and EMPIR programs

Metrology for digital substation instrumentation (EMPIR call, **21NRM02**, 2022-2025)

- Real-time control and monitoring of future electrical power grids.
- Missing solutions for the calibration and timing of new types of digital substation instrumentation according to Digital substation (IEC 61850 and IEC 61869)

Good practice guide for the calibration of digital substation instrumentation using PTP timing, including a traceable link between PTP timing and 1PPS reference pulse with a target uncertainty of 100 ns

Report on standardised methods for maintaining and periodically evaluating the synchronicity of substation.

VTT
CMI
GUM
JV
Metrosert
RISE
SIQ
VSL
CIRCE
LeftRight
Lukasiewicz-ITR
OMICRON
Statnett

Operation-critical network



- Upgrade of Statnetts DWDM- nodes and Routers
- Alle quipment will be ready for synchronization
 - PTP aware routers
 - DWDM with bidirectional connection on singel fiber.

Jammertest 2022

World's Largest Jammer Test

The Norwegian Communications Authority (Nkom)



THANK YOU

