

Time Sync for Power

Tutorial

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The logo for Meinberg, featuring the word "MEINBERG" in a stylized, italicized, blue font with a white outline, set within a white rounded rectangular box with a blue border.

The Synchronization Experts.

WORKSHOP
— ON —
SYNCHRONIZATION
— AND —
TIMING SYSTEMS

Challenges of today's power grids

Fluctuation (production AND demand)

- ❑ Renewables
- ❑ Energy production varies over time
- ❑ Generation amount does not follow the energy demand



Disruption in Mobility

- ❑ Electric cars will change the demand side drastically
- ❑ New demand will kick in eventually instead of continuously



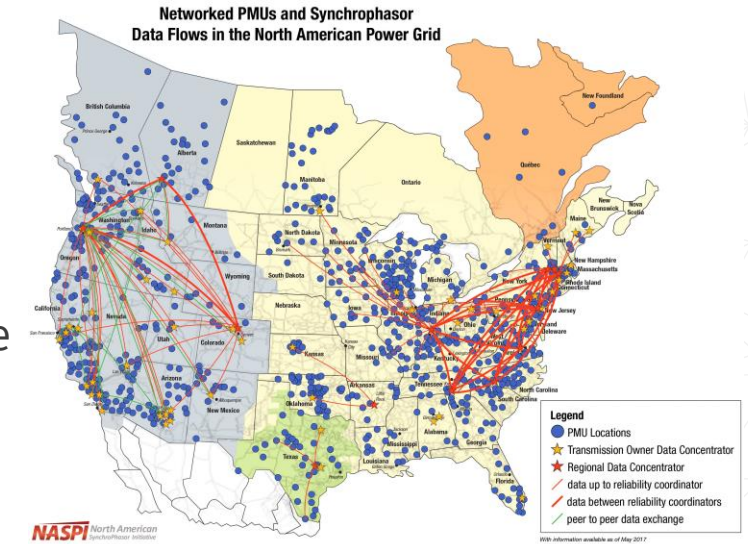
Measures to master the challenges

PMU – the NASPI

- ❑ Measure the frequency in the electrical grid
 - ❑ Basis for counteract generation/demand imbalance
 - ❑ The faster the fluctuations occur, the more precise the measurements need to be
 - ❑ Time synchronization enables measurement correlation
- ➔ Synchronization accuracy: < 1 usec

Modern flexible digital Substations

- ❑ The higher demand on flexibility and communication asks for digitalization
 - ❑ Losing synchronicity going from analogue to digital
- ➔ Synchronization accuracy: 1 msec on station level
1 usec on process level

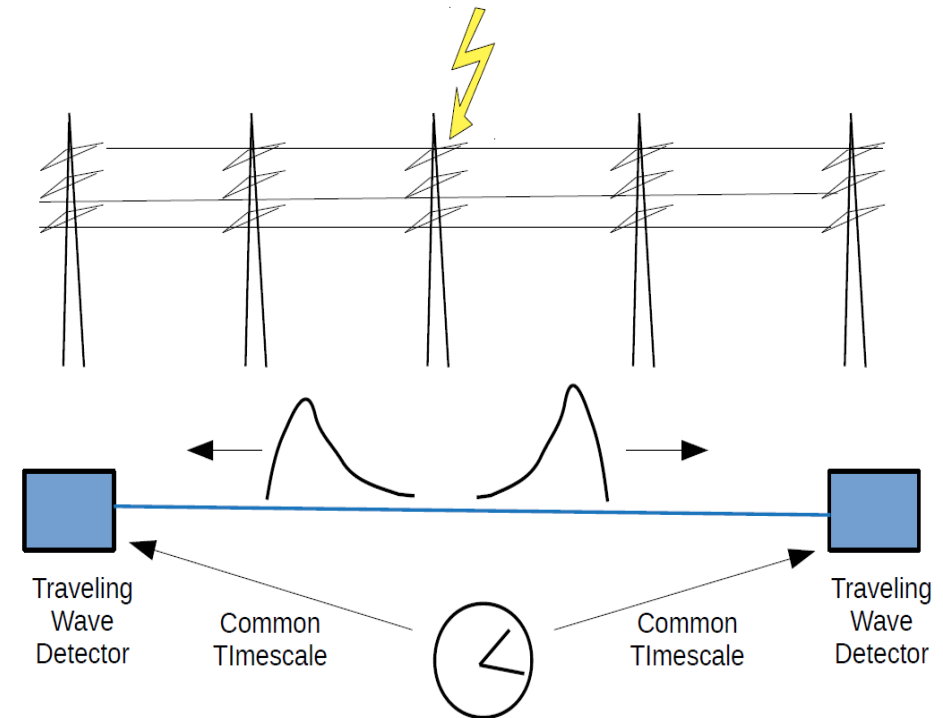


Fault and Event recording

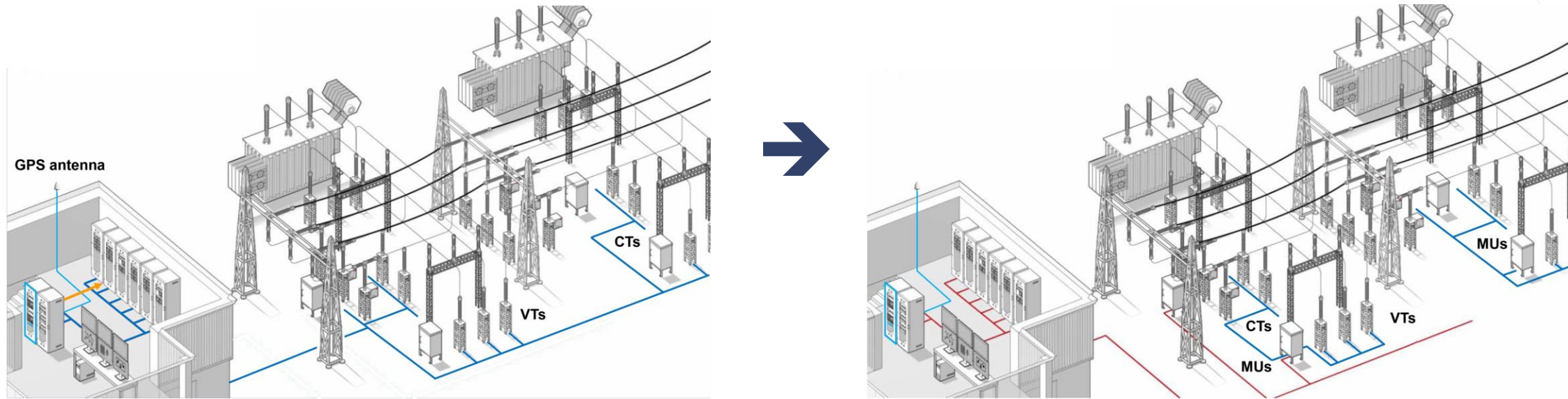
- ❑ Sequence of event recording
 - ❑ Timestamp and track events
 - ❑ Provide system or area-wide Snapshot of Event / Faults and what happened before
 - ❑ Used for post-mortem data analysis
- ➔ Goal: System improvement

Special use case: Traveling fault detection

- ❑ locating faults on transmission lines
 - ❑ a traveling wave is generated at the point of the fault
 - ❑ Fault takes different time to travel
 - ❑ Coordination of 2 Fault recorders
- ➔ Repair crews can spend less time finding the damaged equipment



The digital substation



- The logic moves from the bay level to the process level to the IEDs
- Events must now be timestamped by IEDs for event recording
- To get rid of discrete wiring, data AND sync must be on the same bus system
- ➔ IEC61850-9-3 (specifies usage of PTP IEEE1588-2008 & defines the utility profile)

Synchronization accuracy requirements

Function	Purpose of timing	Accuracy required
Control Room	Log file coordination	1 second
SCADA system	Grid wide monitoring and control	1 ms
Synchrophasors	Measurements more precise than SCADA system. Monitor grid stability. Predict faults	1 μ s
Travelling wave fault detection	Location of faults to within 100s of meters Improves maintenance efficiency	300 -1000 ns

Thank you!

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