

# AN EXAMPLE OF RESILIENCE AND ASSURANCE IN SECURE SMART GRIDS

Nino De Falcis, Sr Director, Sync Business Development Americas,  
Oscilloquartz | Austin, Texas

**WSTS 2022 Webinar – Resilient Timing for Critical Infrastructure**

April 6, 2022 | 12-1p ET (8 min power talk)



Can your smart grid/substation timing survive the next cyberattack?

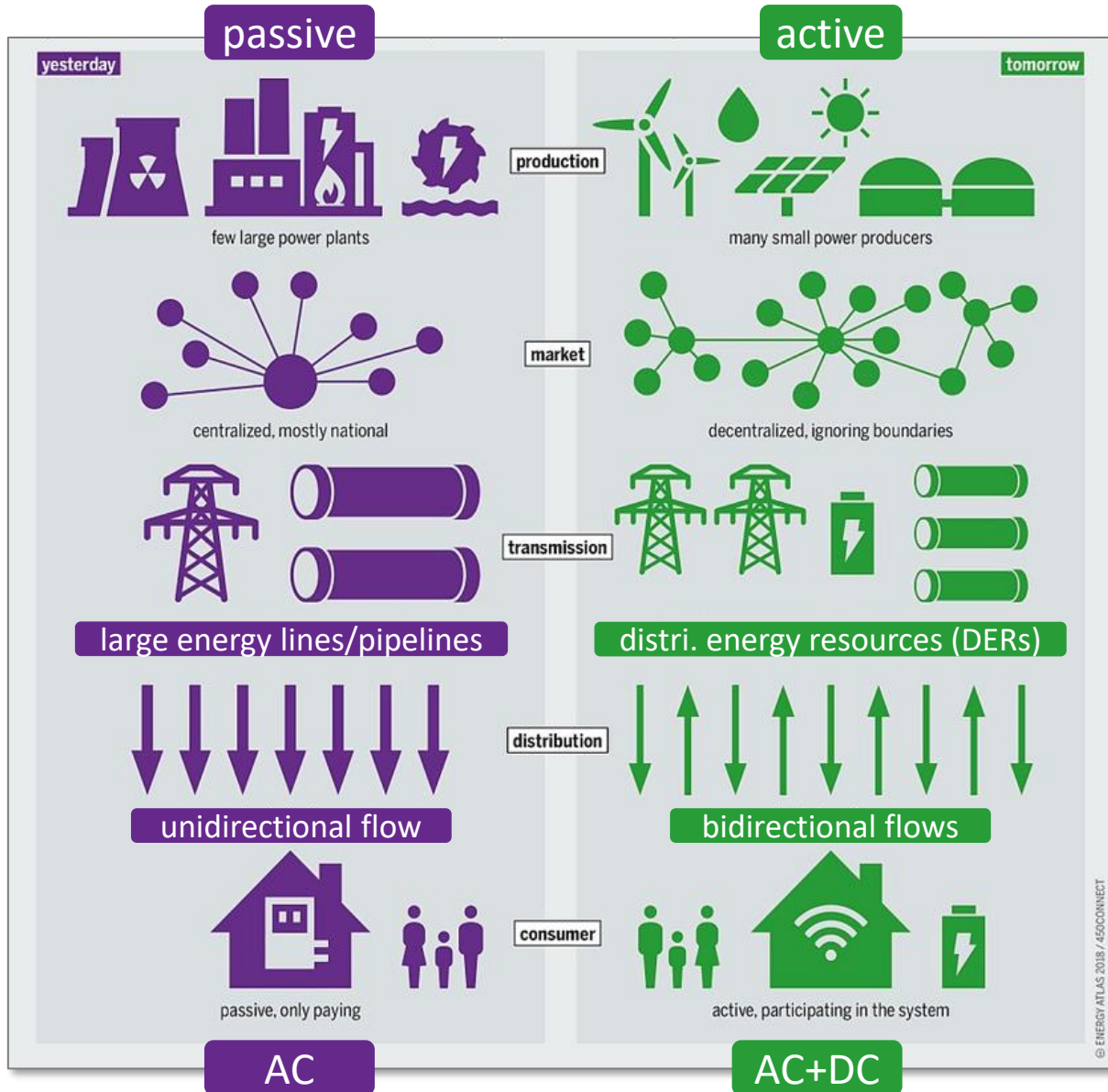


**PNT\* cyber threats are at an all-time high everywhere and growing in sophistication and tactics**

\*Positioning, Navigation & Timing. Timing enables P & N



# Tighter NTP-to-PTP data timestamping accuracy requirements



Grid application	Timing requirements (min reporting resolution & accuracy relative to UTC)
Advanced time-of-use meters	15, 30, and 60 minute intervals are commonly specified (ANSI C12.1)
Non-TOU meters	Ongoing, with monthly reads or estimates
SCADA	Every 4-6 seconds reporting rate
Sequence of events recorder	50 $\mu$ s to 2 ms
Digital fault recorder	50 $\mu$ s to 1 ms
Protective relays	1 ms or better
Synchrophasor/phasor measurement unit (30 - 120 samples/second)	Better than 1 $\mu$ s 30 to 120 Hz
Traveling wave fault location	100 ns
Micro-PMUs (sample at 512 samples/cycle)	Better than 1 $\mu$ s
<b>Substation communications protocols</b>	
Substation local area network communication protocols (IEC 61850 GOOSE)	100 $\mu$ s to 1 ms synchronization
Substation LANs (IEC 61850 Sample Values)	1 $\mu$ s

source: [NASPI Time Sync Task Force Report, 2017](#)

# What are the PNT cyber threats & GNSS vulnerabilities?



## External GPS/GNSS level

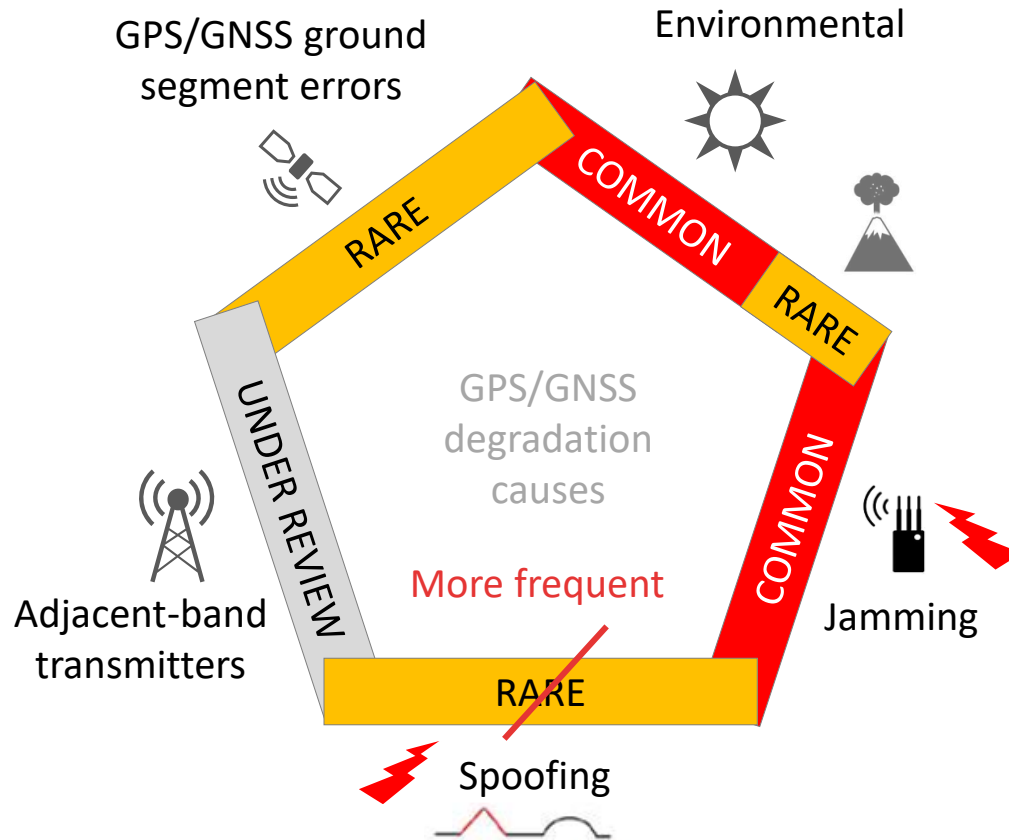
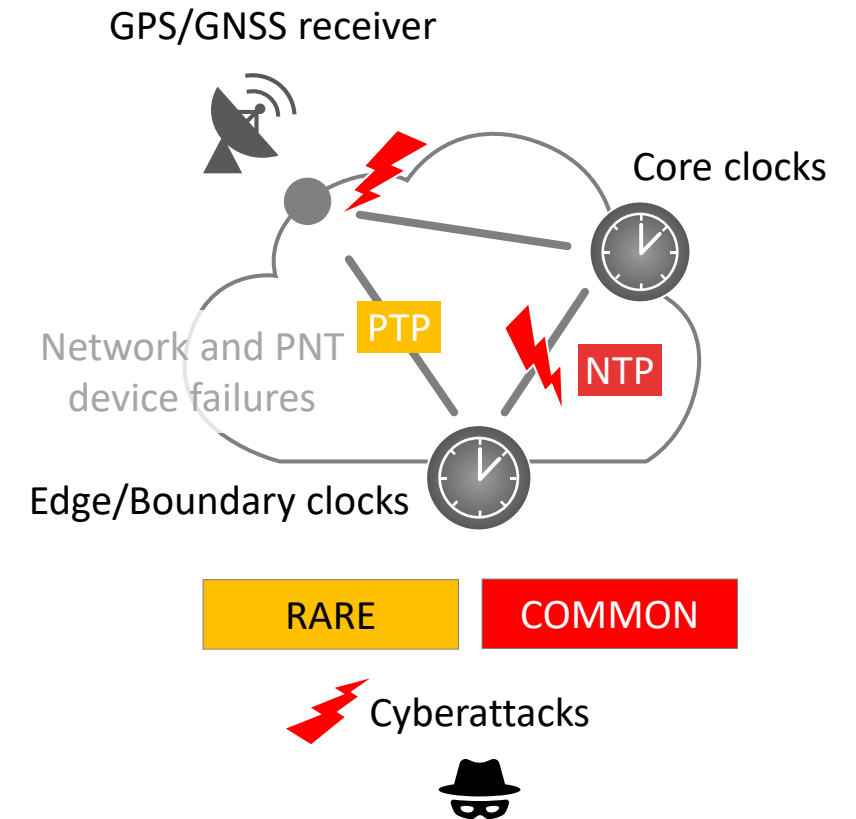
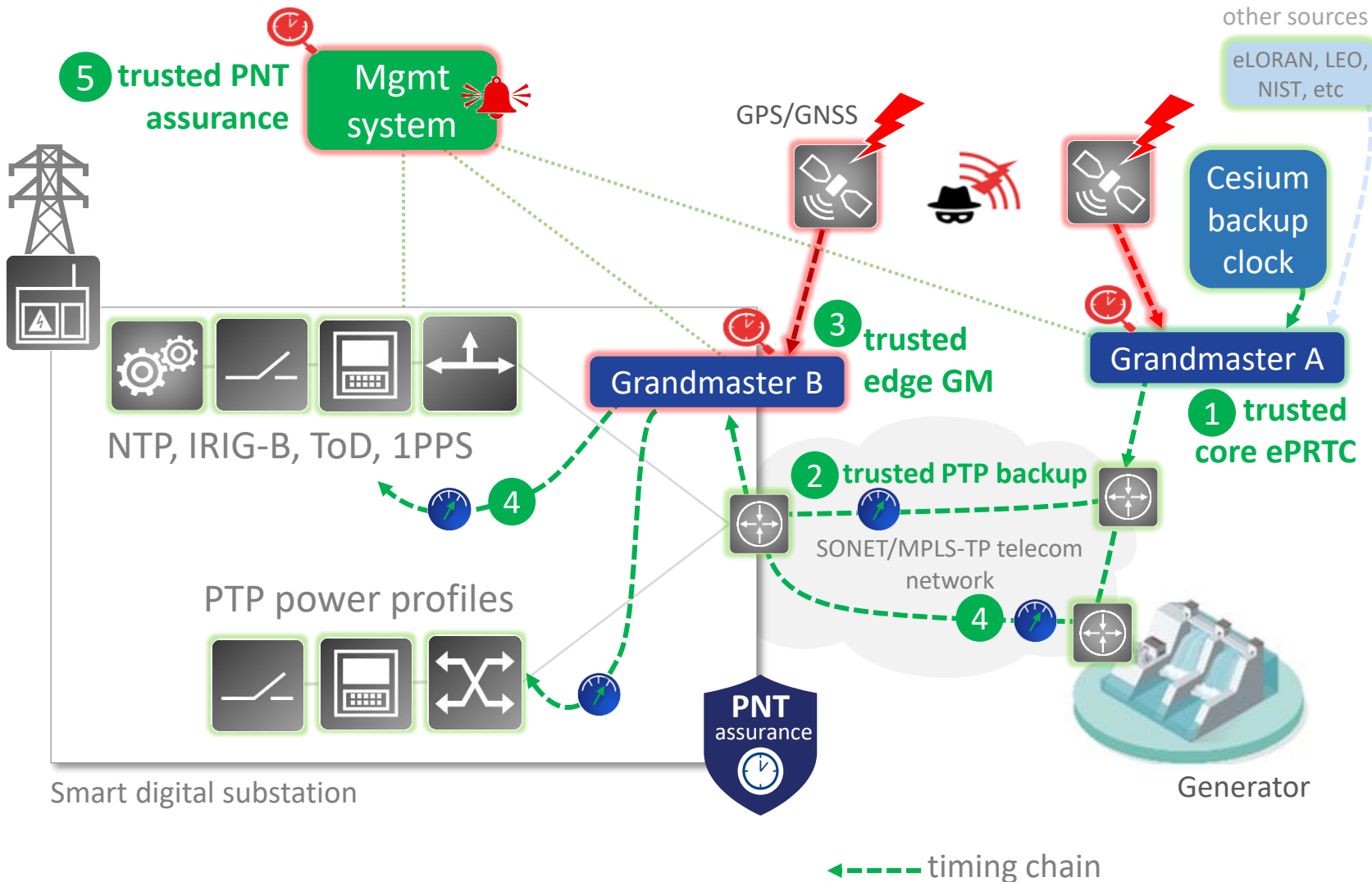


Figure 4.1 – Known GPS vulnerabilities to telecom

## Internal network level



# Trusted timing architecture in core stations & substations



- 1 **trusted core ePRTC\***: GNSS PTP grandmaster + independent optical Cesium backup clock with trusted PTP-verified feeds
- 2 **trusted PTP backup**: PTP L2 telecom profile with full on-path support - all switches with PTP-aware BC (if not, PTP L3 profile with partial/no path support)
- 3 **trusted edge GM**: GNSS PTP grandmaster with trusted PTP backup
- 4 **trusted timing monitor** 🕒: integrated multisource monitor, with analytics to compare, verify & select a trusted source 🌐
- 5 **trusted PNT assurance**: neural mgmt system for self-survivability, end-to-end control, visibility & trusted PNT

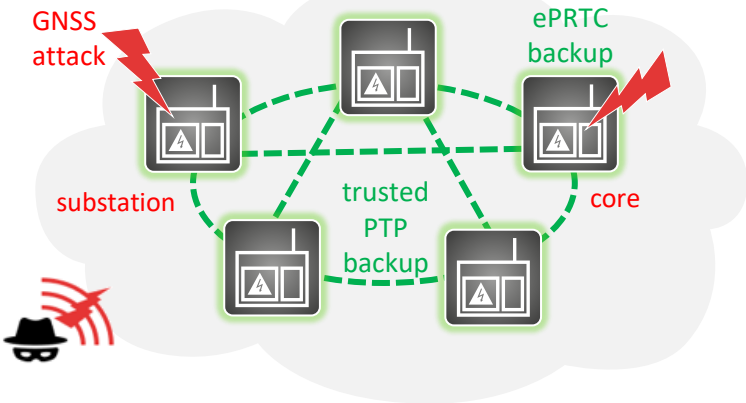
\*enhanced primary reference time clock

# Trusted timing management functions in secure smart grids

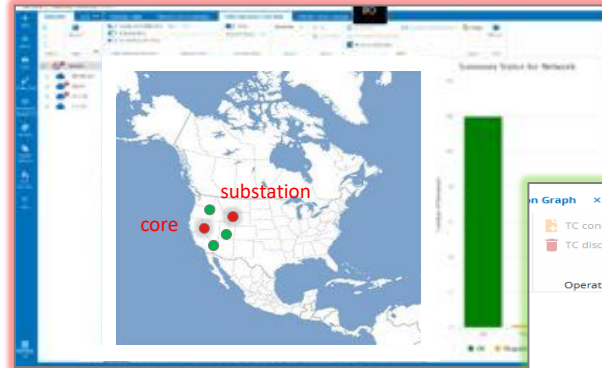
Neural AI/ML intelligence for self-survivability, end-to-end control, visibility & trusted PNT

Trusted mgmt system

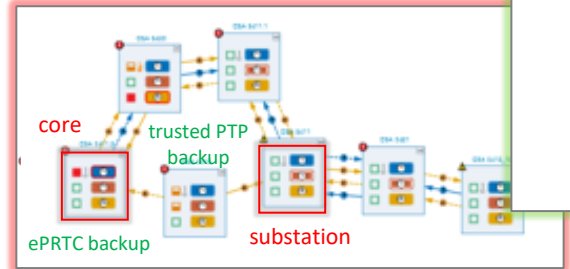
8 self-survivable timing chain with trusted PNT assurance



PNT assurance



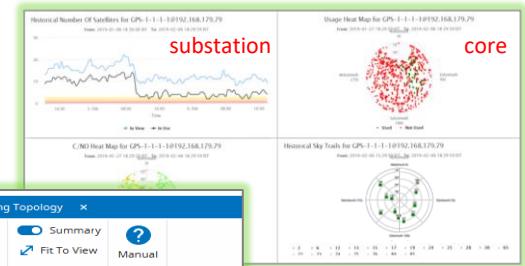
1 geolocation site alert



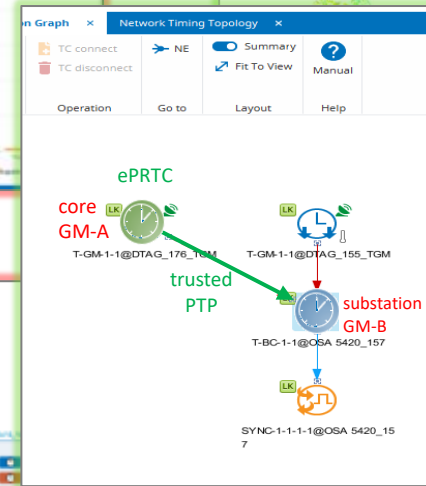
2 timing chain alert with ePRTC & PTP backup rearrangements



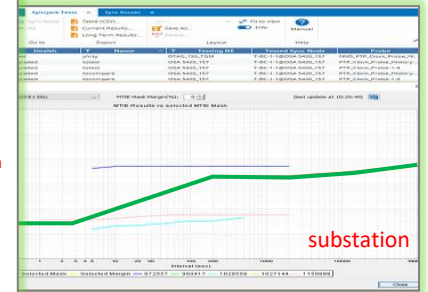
3 core GM-A alert with ePRTC & PTP backup



7 GNSS assurance analytics



5 timing topology with ePRTC backup



6 PTP backup assurance



4 edge substation GM-B alert with PTP backup

GNSS attack

**THANK YOU!**

Need help?  Contact me at [ndefalcis@adva.com](mailto:ndefalcis@adva.com)

