D&NMTT

Virtual Session 2026-01-22

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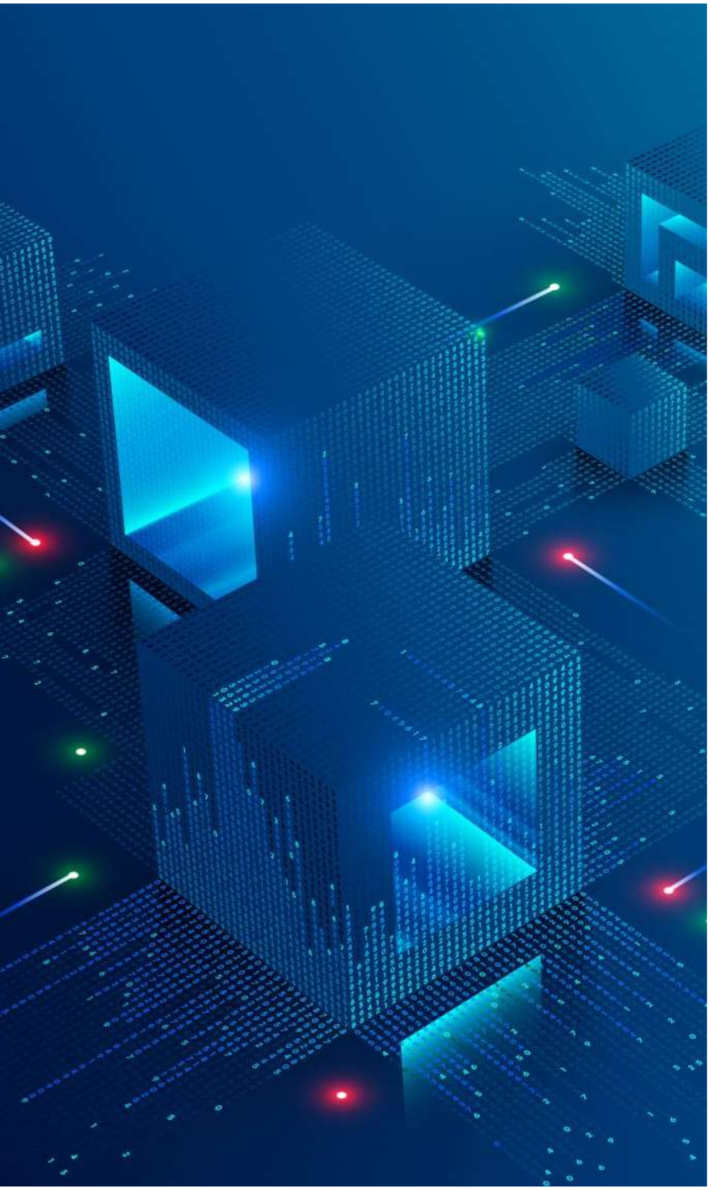


Agenda

- D&NMTT
  - Mission Statement
- Ritchie Carroll Grid Protection Alliance
  - Select best PMU in a redundant architecture
  - STTP update
- D&NMTT Work Topics
  - Data Formats
  - Communication Protocols
  - Archive Systems
  - Network Architecture
  - Redundant Systems
  - Cloud
  - Questionnaire

Mission Statement

The NASPI Data and Network Management Task Team advances the reliable, secure, and interoperable delivery of time-synchronized grid measurements across North America. We develop practical guidance, reference architectures, and metadata conventions for collecting, governing, and exchanging high-quality streaming data from PMUs and related sources. Through collaboration with utilities, vendors, researchers, and regulators, we promote resilient A and B data paths, cloud and hybrid deployments, and standards-based integration to enable real-time monitoring, analytics, and decision-making. We emphasize data quality and clarity, especially the correct use and distinction of sample rate and report rate and align our practices with evolving compliance expectations so operators can confidently turn measurements into actionable reliability outcomes.

Mission Data Quality

High-quality data is essential for reliable decision-making, especially in applications such as power grid monitoring and real-time network management. Three key factors define high-quality data: accuracy, precision, and availability.

- Accuracy – Data must correctly represent the true state of the system. If measurements deviate significantly from reality due to errors, noise, or calibration issues, they can lead to incorrect conclusions and unreliable operations.
- Precision – Data should be consistent and reproducible across multiple measurements. Even if data is accurate, inconsistent readings can introduce uncertainty, reducing confidence in analytical models and control decisions.
- Availability – High accuracy and precision are meaningless if data is missing, delayed, or incomplete. Data availability ensures that critical information is continuously accessible when needed, without gaps that could hinder real-time monitoring and post event analytics.
- Usability – The analytical value of synchrophasor data is diminished without precise and complete metadata, as the effort required to identify and interpret measured quantities becomes prohibitively high.

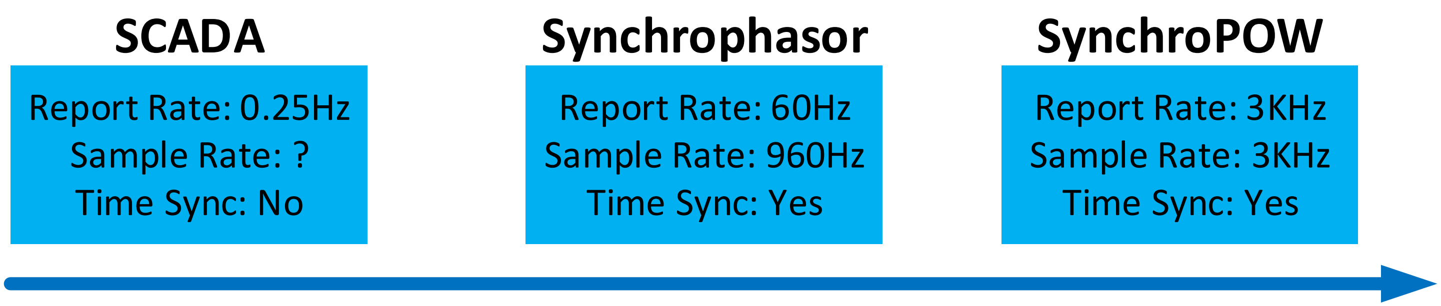
Mission Networks are Complicated

- Random – Something is random if it has no predictable pattern or order. Each outcome is independent, and there is no underlying rule governing the results. Example: rolling a fair die.
- Chaotic – A system is chaotic if it follows deterministic rules but is highly sensitive to initial conditions, making long-term prediction nearly impossible. Small differences in starting points can lead to vastly different outcomes. Example: weather systems.
- Stochastic – A process is stochastic if it has a random component but may follow probabilistic rules or patterns. Unlike purely random events, stochastic processes can exhibit some structure. Example: network traffic.

Communication Protocols

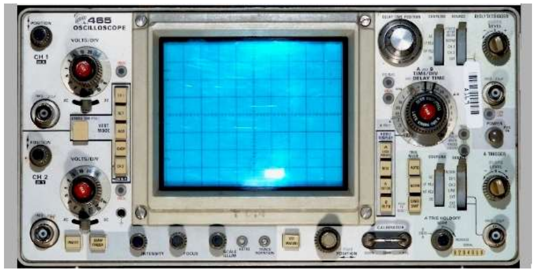
- Network Layer Protocols
- *Makes sure the data gets to the right destination*.
- TCP/IP and UDP operate at the transport and network layers and provide generic mechanisms for sending data between devices.
- Synchrophasor Communication Protocols (Application Layer Protocols)
- *Makes sure the data is understandable and useful*.
- IEEE PC37.118.2-2024
  - *The ballot has closed.*
- IEC 61850
  - *Applicability, Vendor Support, etc.*
- STTP
  - *IEEE P2664-2024 Streaming Telemetry Transport Protocol (STTP)*

Synchronized Point on Wave

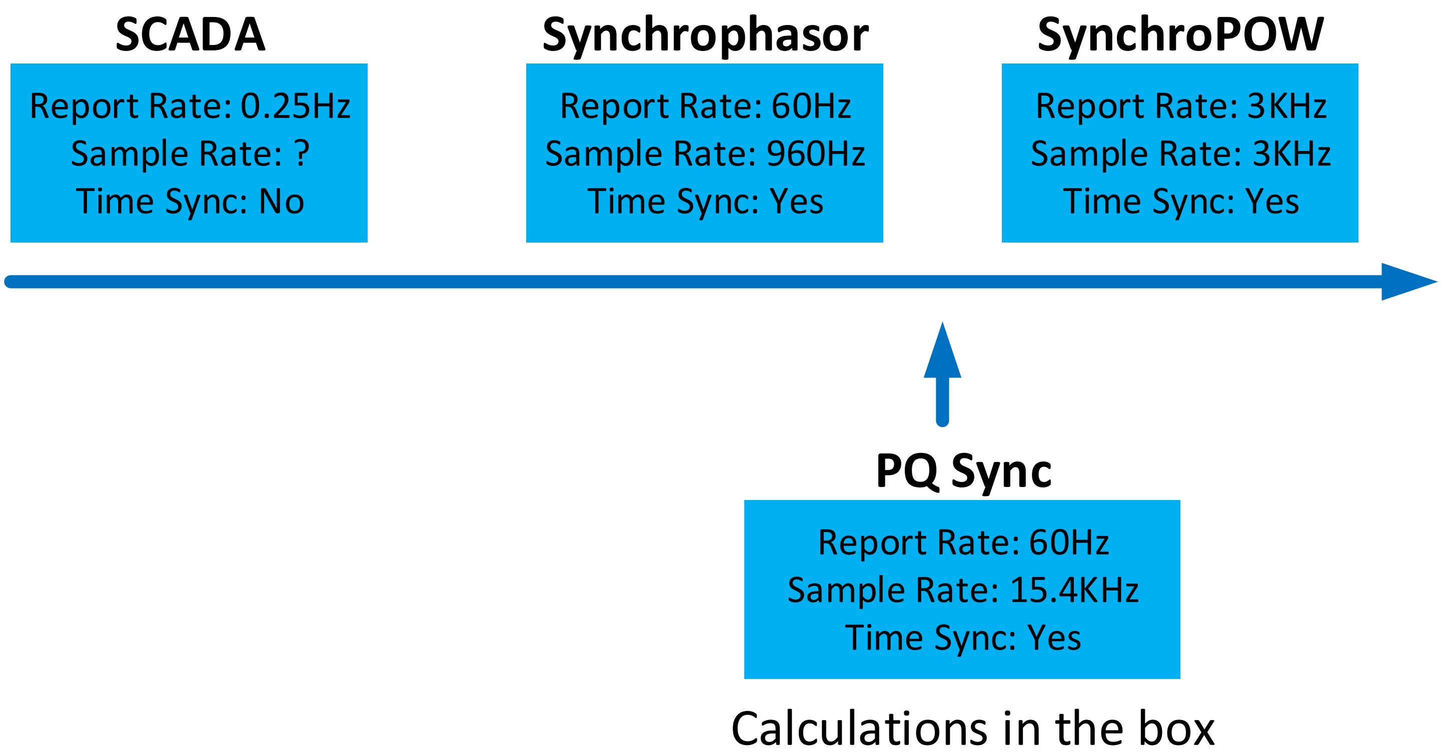


Why Synchronized Point on Wave

- Instantaneous voltage and current waveforms
- High-order harmonics and interharmonics
- Total harmonic distortion (THD)
- Sub-cycle transient detection (e.g., capacitor switching, lightning, breaker operations)
- Traveling wave time-of-arrival for fault location
- Inrush current analysis (transformers, motors)
- Arcing and corona discharge detection
- Breaker contact bounce detection
- High-frequency oscillation detection (e.g., 300–3000 Hz or higher)
- DC offset in waveforms
- Electromagnetic wavefront tracking
- Partial discharge and insulation degradation indicators
- Accurate fault inception angle and waveform characterization
- Supersynchronous and subsynchronous components
- Switching resonance and ferroresonance detection
- PQ event classification (e.g., sags, swells, notching, impulses) at high fidelity
- Equipment condition diagnostics (e.g., transformer saturation events)
- Lightning strike waveform signature characterization
- Wideband power quality analysis



Synchronized Point on Wave Half Step



Protocols
Point on Wave not new

C37.118.2-2024

COMTRADE

PSRC H8 Application of COMTRADE for Synchrophasor Data Approved by IEEE PSRC Subcommittee H on May 13, 2010 as a PSRC Report

Archive Systems

What’s new

Time series

Relational

Object Oriented

NoSQL

Hierarchical

Network Architecture

Wide Area

Field Networks

Control Center

Corporate

Redundant Systems

Field Devices

Network

Archive

Active-Active

Fail over

Best Practices

Cloud

Lessons learned

Security concerns

Costs

Use cases

Root cause analysis

Time stamp issues from GPS

Questionnaire

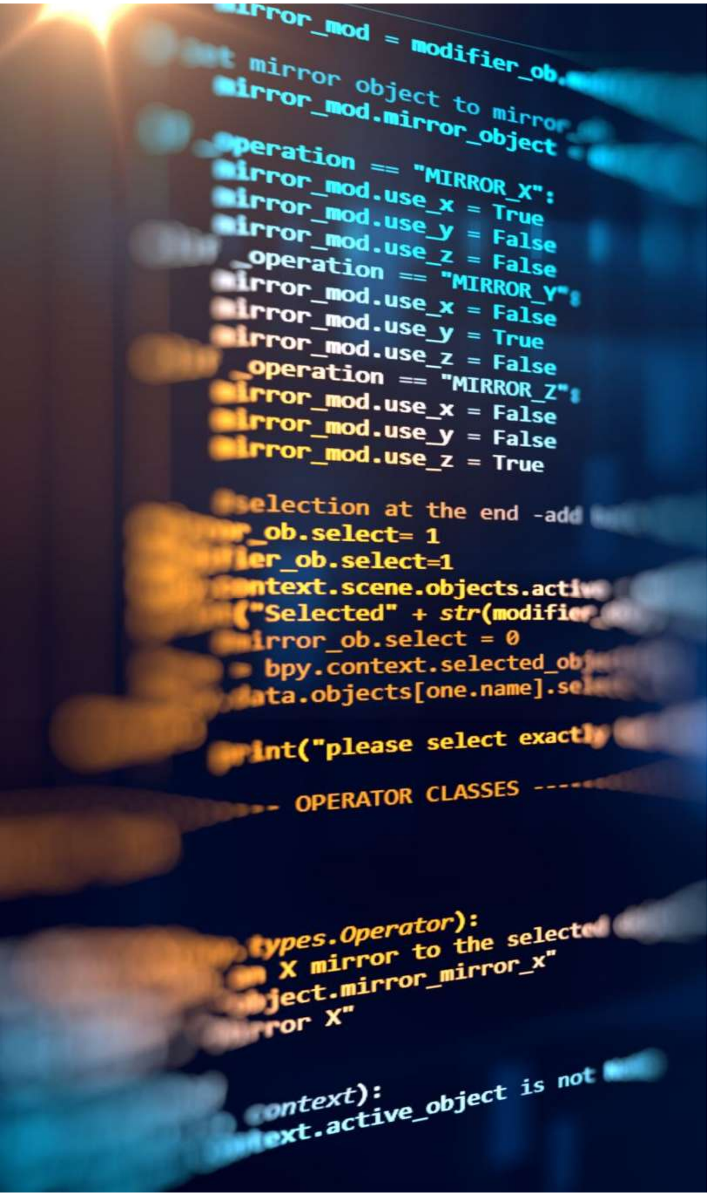
Archive Strategies

NERC CIP 15-minute decisions

Redundancy

Cloud

Data Sharing



Discussion Topics / Work topics

Sample rate vs Report Rate

Frequency measurements

Definition of terms

Nyquist Limit

Database performance

Network recommendations including CIP compliance

PTP at data and control centers

Metadata

- **External asset linkage & topology context**
Persistent IDs for Bus/Line/Terminal/Breaker, EMS/SCADA tag(s), substation code, geo (lat/long) with accuracy, and network model version they map to.
- **Installation & transducer details**
CT/VT ratios & classes, burden, wiring/polarity verification status (method/date/result), MU/IED port/channel, anti-alias filter cutoff/order, sensor location notes (bay/structure).
- **Calibration & uncertainty model**
Calibration date/method, gain/phase offsets by channel, temperature drift spec, **ENOB** of ADC and noise floor, TVE vs. frequency/voltage ranges (as a model, not just a flag).

Example JSON

{"P":[{"I":"HELMS:IA","V":["HELMS:VA","GREGG:Vpos"],"S":"OUT"},{"I":"HELMS:IB","V":["HELMS:VB"],"S":"OUT"}],"D":[{"T":"HELMS:Vpos","R":"GREGG:Vpos"},{"T":"HELMS:V_A","R":"HELMS:V_B"}]}