D&NMTT

Breakout Session 2025-04-15

Dan Brancaccio
Executive Advisor Quanta Technology
dbrancaccio@quanta-technology.com

Agenda

- D&NMTT
  - Mission Statement
- Computer Scientist’s Critique of MPLS, IEC 61850, and SCTP – Dave Bakken, Washington State University
- STTP integration for synchrophasor stream processing applications in Apache Flink – Daniel Villegas, University of Manitoba
- 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** (DNMTT) is dedicated to enhancing the reliability, security, and efficiency of synchrophasor data networks across North America. Our mission is to develop best practices, frameworks, and guidance for the collection, management, and secure exchange of ***high-quality*** time-synchronized measurement data. We collaborate with industry stakeholders to optimize data availability, support grid resilience, and advance the use of synchrophasor technology for real-time monitoring, analysis, and decision-making. Through research, innovation, and stakeholder engagement, we strive to ensure the integrity and interoperability of synchrophasor networks, enabling a smarter, more resilient power grid. **Promote the correct use of Sample Rate vs. Report Rate**

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.

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
    - *Is now published.*
  - IEC 61850
    - *Applicability, Vendor Support, etc.*
  - STTP
    - *IEEE P2664-2024 Streaming Telemetry Transport Protocol (STTP)*

Synchronized Point on Wave

SCADA

Report Rate: 0.25Hz
Sample Rate: ?
Time Sync: No

Synchrophasor

Report Rate: 60Hz
Sample Rate: 960Hz
Time Sync: Yes

SynchroPOW

Report Rate: 3KHz
Sample Rate: 3KHz
Time Sync: Yes

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

SCADA

Report Rate: 0.25Hz
Sample Rate: ?
Time Sync: No

Synchrophasor

Report Rate: 60Hz
Sample Rate: 960Hz
Time Sync: Yes

SynchroPOW

Report Rate: 3KHz
Sample Rate: 3KHz
Time Sync: Yes

PQ Sync

Report Rate: 60Hz
Sample Rate: 15.4KHz
Time Sync: Yes

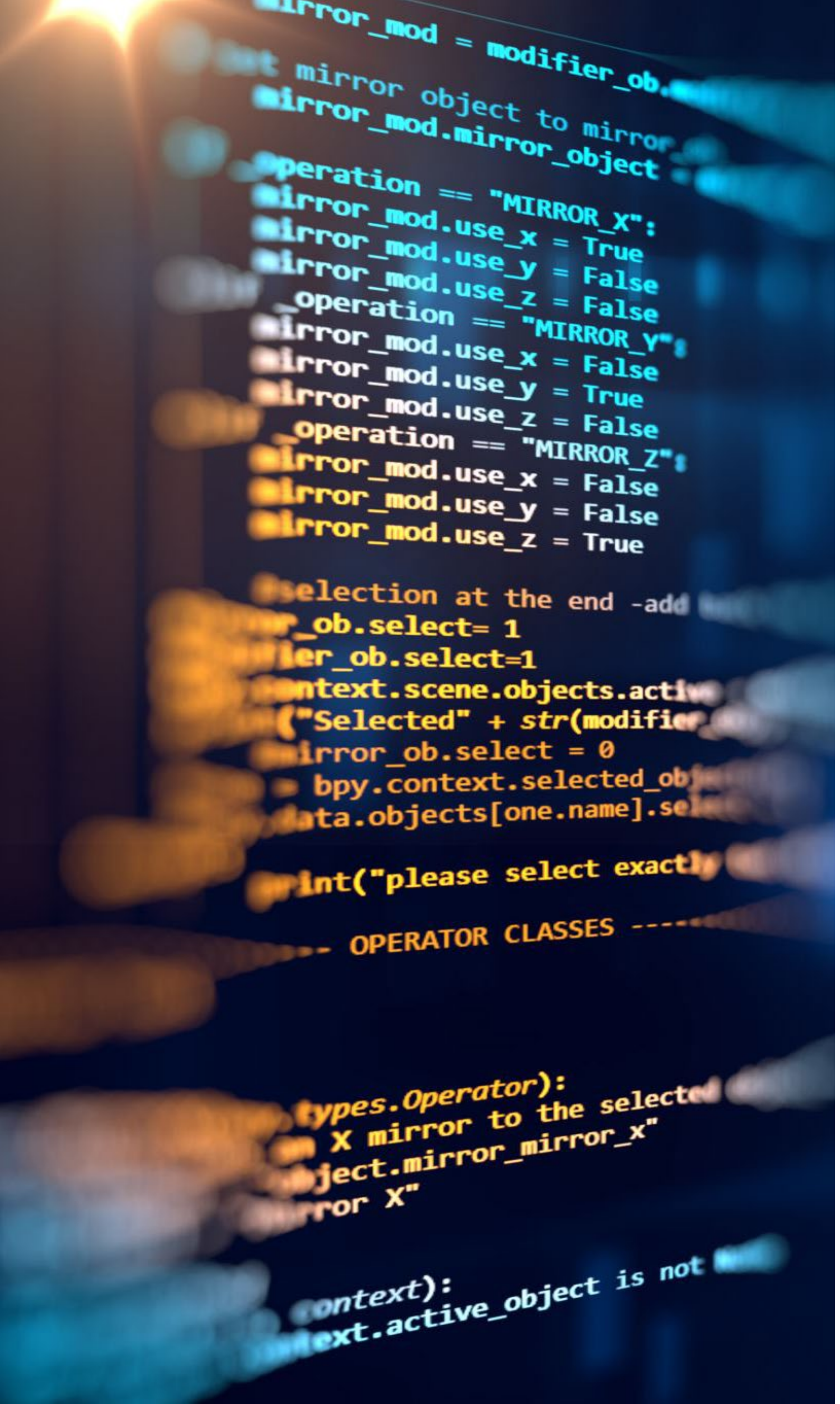
Calculations in the box

Protocols

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



Discussion Topics / Work topics

Meta Data

Sample rate vs Report Rate

Nyquist Limit

Database performance

Network recommendations

PTP at data and control centers