Utility Applications of TSN

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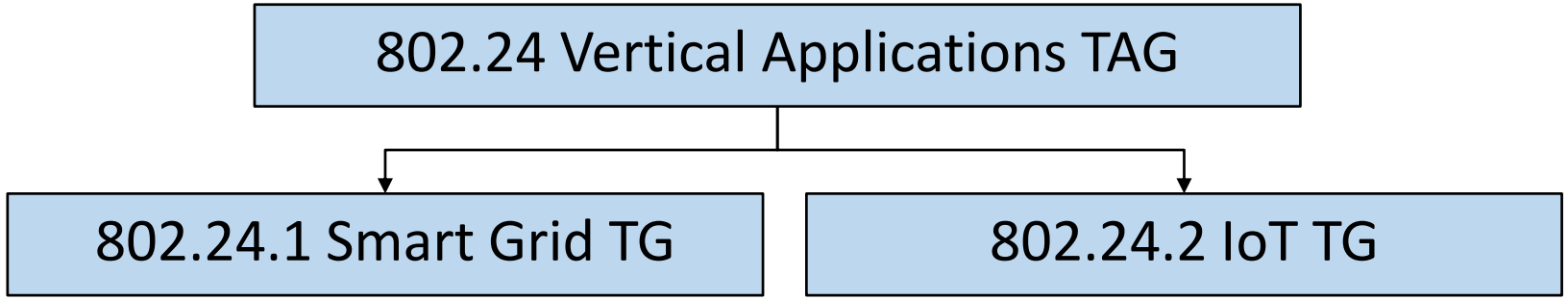
802.24 Overview



- 802.24.1 Smart Grid Task Group
  - Internal / external coordination in matters related application of IEEE 802 standards for Smart Grid
  - 802.24.1 TG meets at Plenaries and Wireless Interims
- 802.24.2 IoT Task Group
  - Internal / external coordination in matters related application of IEEE 802 standards for Internet of Things (IoT)
  - 802.24.2 TG meets at Plenaries and 802 Interims

Presentation Objectives

- To introduce 802.24 structure and activities
- To identify utility applications that could potentially benefit from TSN
- To discuss whether an 802.24 white paper on the topic would be
  - A) Useful
  - B) Supported by participation from 802.1 TSN members

Transmission: Protection

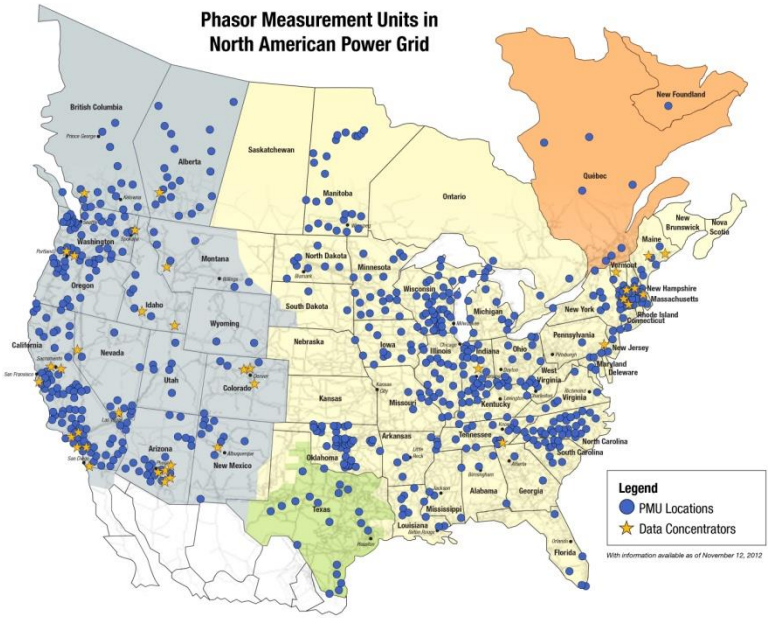
Telecom Requirements

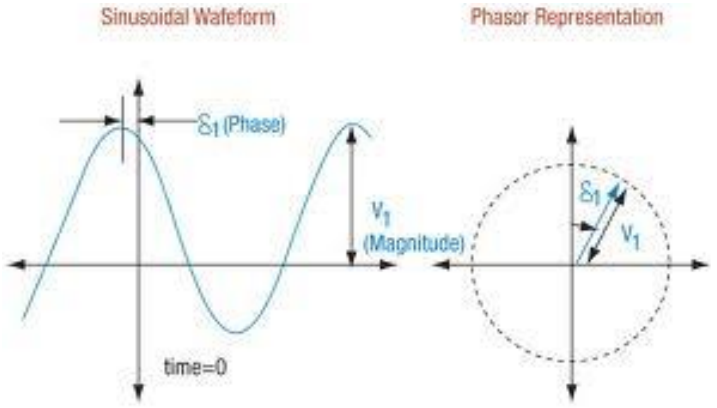
- Reliability: Highest
  - Essential for line current differential protection
  - Redundancy may be used
- Latency: Very low – a few mS typically
  - Some systems can compensate for delay if delay is constant.

Transmission: Synchrophasors

Telecom Requirements

- Reliability: Medium-High
  - Each PMU is part of a network and provides data for a specific location.
- Bandwidth: High
  - Depends on repetition rate of measurements – can be Mbps
- Latency: Sub-cycle time precision required. Limited delay compensation by time stamping packets





One researcher finds a need for TSN

- Effects of Bursty Event Traffic on Synchrophasor Delays in IEEE C37.118, IEC61850, and IEC60870
  - Wu, Nordstrom, Bakken
  - IEEE SmartGridComm 2015

- OpNet simulation of substation network environment combining protection event messages (IEC 61850 GOOSE), control center SCADA (IEC60870-5-104), and Synchrophasor data (IEEE C37.118)
- Summary conclusion – Although the average data load can easily be accommodated with 100 Mbps Ethernet, under certain event conditions, application requirements are not met

Discussion

- Current status is lack of awareness of TSN in utility market
- In cases where any deterministic solutions are employed, they are proprietary.

- Would 802.1 TSN be interested in contributing to the development of an 802.24 white paper on how TSN can address utility application requirements for
  - Substations LANs
  - Protection
  - Synchrophasors
  - Others?