July 29, 2020
Webinar Questions and Answers

"Synchrophasor Data Networks and Management: A Journey of Successes and Failures" with Matthew Rhodes and Dan Brancaccio

Question: Why UDP is not preferable?

Answer: UDP and TCP have their advantages and disadvantages. UDP is typically not preferable for field device connection as there is no handshake guarantee of PMU packet connectivity whereas TCP ensures a confirmed end to end connection before packet streaming.

Question: What are the measures to prevent PMUs data loss?

Answer: PMU data loss lies almost entirely on the communication network infrastructure. Ensuring the networking personnel understand the communication needs and bandwidth of PMU data is the best measure to reduce PMU data loss. The best solution is having a dedicated and well-defined high-speed communication network designed for PMU data but this is difficult to come by.

Question: Can the PMU be equipped at generator side? Is it common to equip the PMU at distribution network in America?

Answer: PMUs can be installed as far down as at the generator terminals but there are far less common installations inside the generator itself (turbine, exciter, etc.). It is not common at this time to equip PMUs at the distribution level in America, but the price and size of micro-PMUs are coming down significantly making them marketable for such uses. The one main drawback being seen is the efficient distribution of GPS time to these devices as typical direct connections of multiple GPS clocks for each PMU is cost and real estate prohibitive.

Question: When you say external cloud-based systems, do you mean public cloud services like Azure or AWS?

Answer: Yes, that is precisely what I mean by external cloud systems. A utility can have distributed dedicated mini-cloud services available for use internally to the utility.

Question: If we go for PDC less System how can we validate or concentrate data from different PMUs1?
Answer: There are new methods of time-alignment at the point of data archiving that can efficiently collect multiple PMUs directly from the network. Concentration of PMU data accomplishes two things:

1.) Reduced payload size from the PDC output and 2.) Ensuring all PMU packets arrive before output packets are sent. From the payload size, which leads to network bandwidth considerations, PDCs help reduce multiple streams of traffic. As long as the network can be bandwidth conscience of PMU streams and built to be expanded, these large numbers of individual PMU streams do not become as much of an issue when going PDC-less. The drawback is that PMU streams might not arrive at the same time and there may be time-momentary data gaps but, unless used for real-time visualization, this is not an issue.

Question: Can you share a bit more what is that SRP virtual platform?

Answer: SRPs virtual platform is essentially just a set of physical servers at dedicated locations across SRP that can be cross dedicated for different functions of an operating system for software installations or for data storage. Different types of low speed and high-speed virtual machine services are available based on the usage of the application mounted.

Question: Why did you use Synchrowave solution vs software PDC?

Answer: SynchroWAVe is used for a synchrophasor visualization platform only. SRP still utilizes software PDCs for data collection.

Question: What is CIP Compliance?
Answer: CIP is Critical Infrastructure Protection -- cybersecurity requirements associated with the bulk power system governed in North America by NERC.

Question: How CIP related aspects are handled?

Answer: Assuming your question is SRP related. At this time PMU data is not CIP secured as it is not used for real-time decision making. Synchrophasors are used for post-event and live system monitoring.

Question: Won't PDC less system be more vulnerable to cyber-attacks? PDC synchronizes and aggregates data from PMUs situated at different parts of the grid and at any timestamp, a PDC data stream represents situation of the grid. Without PDC in WAMS architecture, it may give opportunity to attackers to manipulate data.

Answer: From my knowledge, PDCs do not perform any cyber intrusion protection against PMU data. PDCs can exist either at a substation or at a control center location. Therefore, whether you send PMU data to a PDC or directly to an archive there is the same vulnerability to cyber-attacks. The PDC is, essentially only a concentration point.

Question: What is the advantage of having a PDC at the substation level if the PMU data is streamed to the control center?

Answer: Substation PDCs allow for field level concentration of multiple PMU data streams which reduces network traffic.

Question: Multiple Questions on Archived data. 1) How quickly archived event is retrieved (seconds, minutes, etc.) from local storage vs. cloud stored data? Assume 5 minutes of window data at 60 frames M class. 2) What information the user needs to provide in order to receive correct archived event? 3) Could the user request "P" class have archived data?

Answer: 1.) From my experience on local storage archive data retrieval, a 5 minute 60 frames/second M class would typically take on the order of a few minutes. I have no experience retrieving from cloud

storage. 2.) Typically, the only data the user provides is the time window and PMU data stream selection. 3.) Typically, I have not seen a selection to choose P versus M class data for event retrieval.

Question: Thank you for the presentation! Do you use any data compression methods in your network? How many PMUs' data are archived in the 160TB storage?

Answer: No data compression is used in SRPs network. The 160TB is inclusive of over 700PMUs.

Question: Storage of data without alignment (no PDC) for use by app developers/researchers. Benefits?

Answer: The benefits of PDC-less networks really has no added benefits for developers/researchers as it is solely a data management and collection factor.

Question: Impact on "point on wave" on these architectures?

Answer: Point on Wave on PMU system architectures impacts the bandwidth of the network due to the large amount of data if constantly streamed. From an archive architecture perspective, newer cloud based and advanced data collection methods are more conducive to adequately and consistently as the storage medium is highly flexible to multiple types of data being stored.

Question: What are the current/potential use cases where you can see delays caused by all sorts of networking or architectural issues become problematic?

Answer: Real-time visualizations always have been impacted from delays, but I can see the possibility of new interpolation methods to allow 90% accurate visuals until the data is received to ensure less detriment to applications.