Experiences with Synchrophasor Data Systems & Management

NASPI DNMTT Panel on *Success Stories & Lessons Learned of Utility Synchrophasor Archive and Network Standups*

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What We Have at Dominion

• Many Hundreds of PMUs: 40,000+ individual measured quantities
• Critical and Non-Critical PMUs
• Substation PDCs
• Central PDC w/ Software PDC
• Gateway (Software PDC) to PJM and PredictiveGrid (PingThings) in AWS
• PredictiveGrid State-of-the-Art Data Mgmt & Analytics Platform in AWS
• Undergoing evaluation of new control room applications
An Important Underlying Principle for Synchrophasor Networks & Archives

We must drive down the cost of working with data! ← Lesson Learned

THE RIGHT TOOL FOR THE JOB
High resolution time series (e.g. synchrophasors) is a special comp. sci problem • Big Data technologies evolved towards specialization • Not all time-series DBs are equal • Historians make data history • Data at rest stays at rest

NO SINGULAR “KILLER APP”; ENSEMBLE INSTEAD
The literature is full (10³s) of proposed applications • Each utility may have niche use cases • Value prop. of individual use cases is myopic

ANALYTIC EXPERIMENTATION >> A PRIORI “GUESSES”
We need to use lean methodologies, not guesses that play out over years, to arrive at our highest valued use cases
Data Transport

• Firewalls
  • Firewalls are the only real blockers we have experienced
  • Substation PDC minimizes firewall rules ← Lesson learned
  • Hire dedicated person to handle firewalls ← Lesson learned

• Central PDC
  • Use openPDC
  • Use physical hardware, not virtual ← Lesson learned
  • Data quality monitoring

• Communication
  • GEP (STTP) for aggregate streaming ← Lesson learned
  • VPN from Dom network to AWS
  • Dedicated circuit to PJM
  • Eventually dedicated circuit to AWS
Our “Archive”
PingThings` PredictiveGrid Platform

PREDICTIVEGRID IS A PLATFORM-AS-A-SERVICE

This means we pay an annual subscription as an all-in-cost for:

- All Platform Features
- Infrastructure
- Maintenance
- Scheduled Upgrades
- Security
- Services

The combination of best-in-class tech, hosted in the cloud, and supported by a world-class team allows us to achieve at a scale and pace that would be otherwise impossible.

Zero to streaming data in under 4 months. Success Story

We can do more with less [people, time, and resources] with PingThings & PredictiveGrid.
Human-Scale Data Exploration

YOU MUST LOOK AT YOUR DATA!
Any data, at your fingertips, instantly, fluidly.
Rich, Programmatic Access

PREDICTIVEGRID DRIVES DOWN THE COST OF ANALYTIC DEVELOPMENT

• Ad-hoc Analytics & Experimentation
  • Exploration

• Rapid & Targeted Use Case Development
  • Exploitation

• Great for Exploration and Exploitation.

• Great for beginner, intermediate, and advanced users.

9/30/20
Beyond Synchrophasors

- Upload from UI
- Automated uploads from Sixth Man

**COMTRADE Event Files**

**DFR PMU Data**

- Bulk historical uploads
- Synchronous updates
- From PI

**Relay PMU Data**

**Historical SCADA**

**Network Model / Snapshots**

- 10 Minute Network Snapshots from ANODE

**PingThings’ Predictive Grid**

Future??
Getting Help with the Cloud

• Cloud technologies and technology partners make all the difference for synchrophasors at scale \(\Rightarrow\) Success stories, Lesson learned

• Cloud infrastructure makes the most sense as a:
  • Terminal node in a data system (i.e. archive/historian/data analytics platform)
  • A portal into a data system
  • NOT a router/PDC/streaming gateway

• PaaS/SaaS cloud solutions help limit IT bottlenecks and improve pace of innovation, flexibility of solutions, cost management, access to premier talent.

• Challenges:
  • Perception of security
  • Services/IT org feels their role is being taken from them
  • Cloud infrastructure is treated as O&M, not capital.
Conclusion
Key Takeaways

• Design data systems with a focus on cost of experimentation
• Consider post-synchrophasor use cases for data storage and retrieval
• Leverage the cloud whenever possible
• Don’t limit solutions to internal Services/IT
• Find skilled collaborators
Other NASPI Talks to Check Out

To get more of our story:

- **Sep 30, 2020**: Synchrophasors at Dominion Energy: Yesterday, Today, and Tomorrow
- **October 30, 2019**: Considerations for Working with Time Synchronized Measurements from Disparate Sources
- **October 29, 2019**: Zero to One: A Digital Transformation at Dominion Energy
- **October 29, 2019**: Architectural Influences on the Success of PredictiveGrid at Dominion Energy
- **April 16, 2020**: Turning 10: A Decade of Synchrophasor Technology at Dominion Energy
- **April 15, 2019**: Archiving Strategies for Synchrophasor Data
- **October 24, 2018**: Getting Beyond Base Camp: Scaling Your Synchrophasor Data Mountain
- **April 24, 2018**: The Role of a High-Performance Sandbox in Your Synchrophasor Analytics Pipeline
Thank you!

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