Experiences with Synchrophasor Data Systems & Management

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

Presented by

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Dominion Energy

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

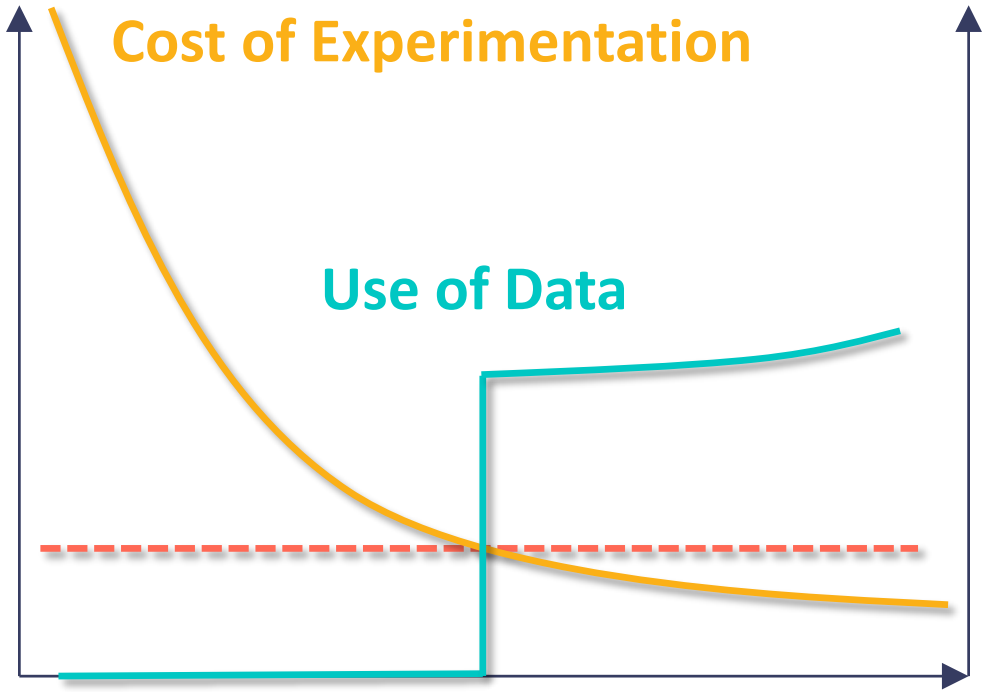
High resolution time series (e.g. synchrophasors) is a special comp. sci problem • Big Data technologies evolved towards specialization • Not all time-series DBs are equal • Historians make data history • Data at rest stays at rest

NO SINGULAR "KILLER APP"; ENSEMBLE INSTEAD

The literature is full (10^3s) 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”

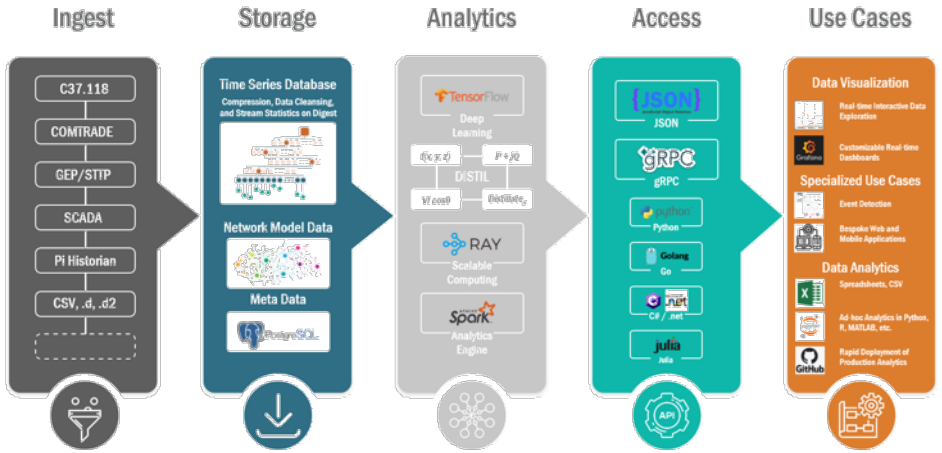
PingThings` PredictiveGrid Platform

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.



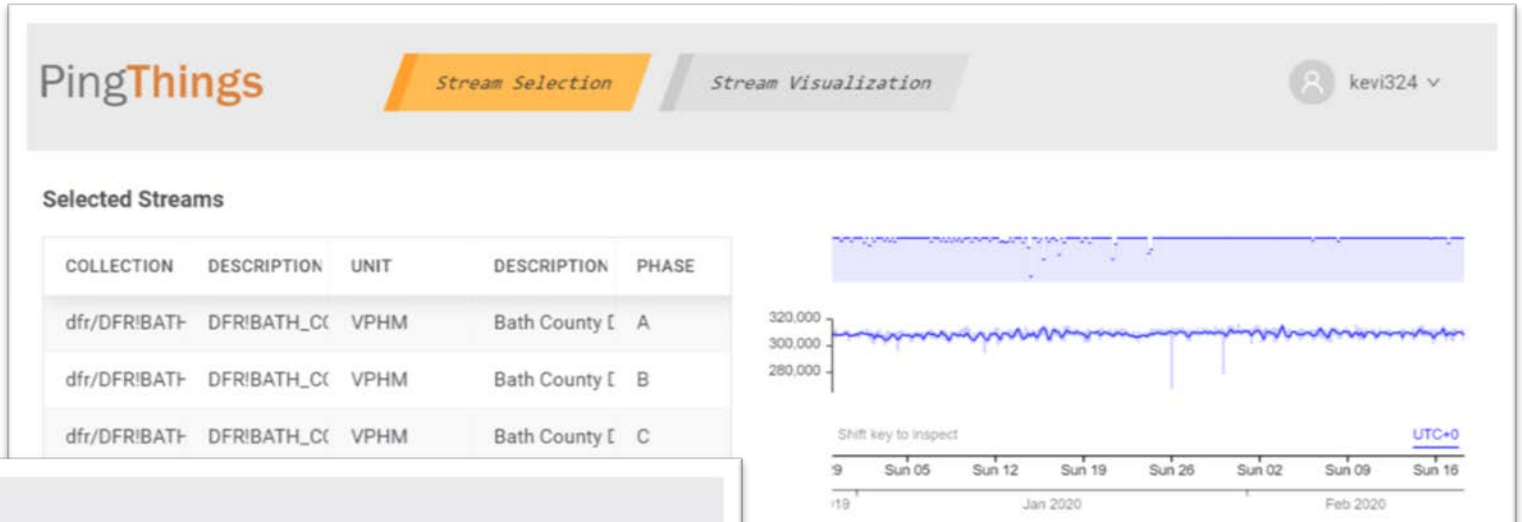
Zero to streaming data in under 4 months. ← *Success Story*

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.

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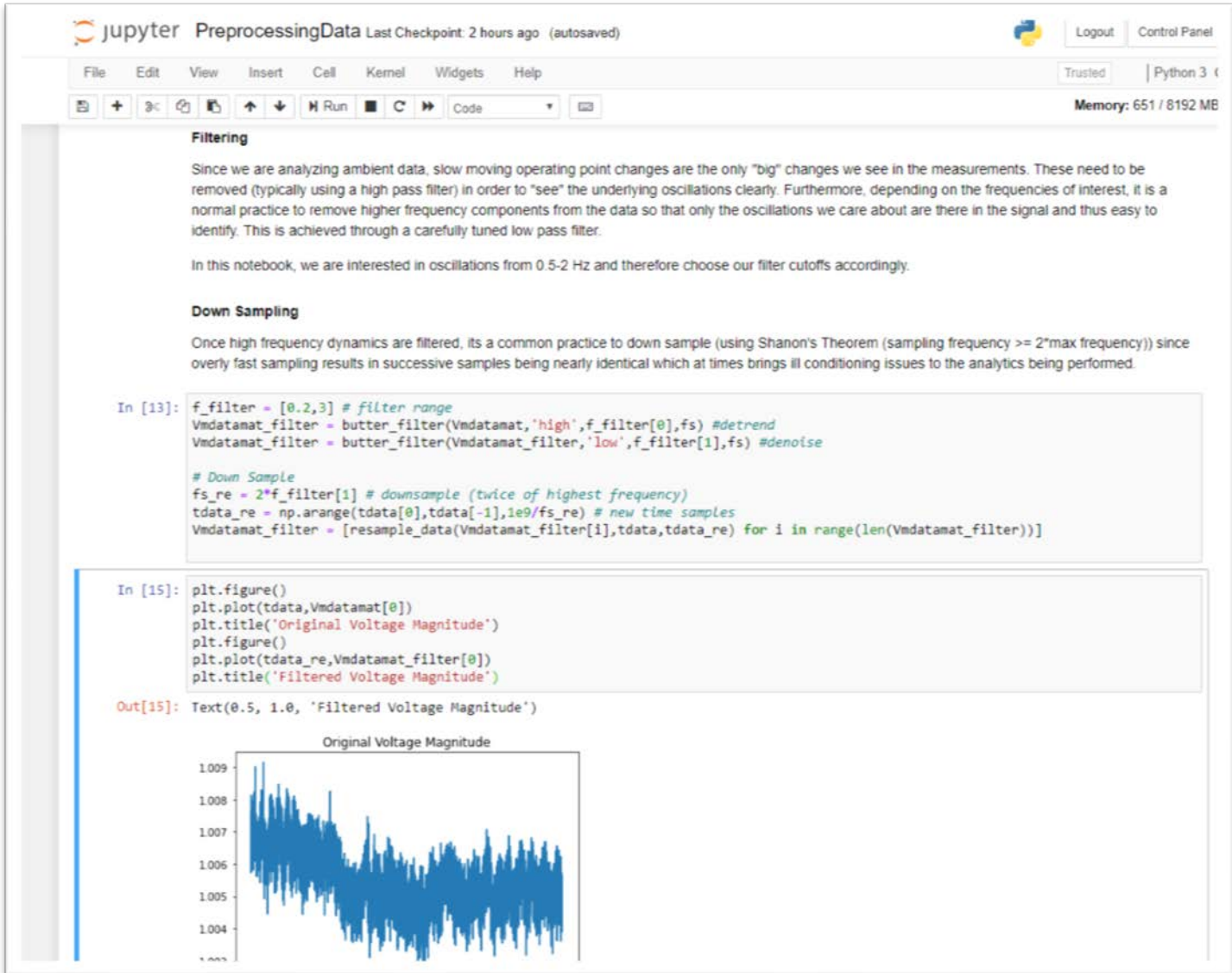
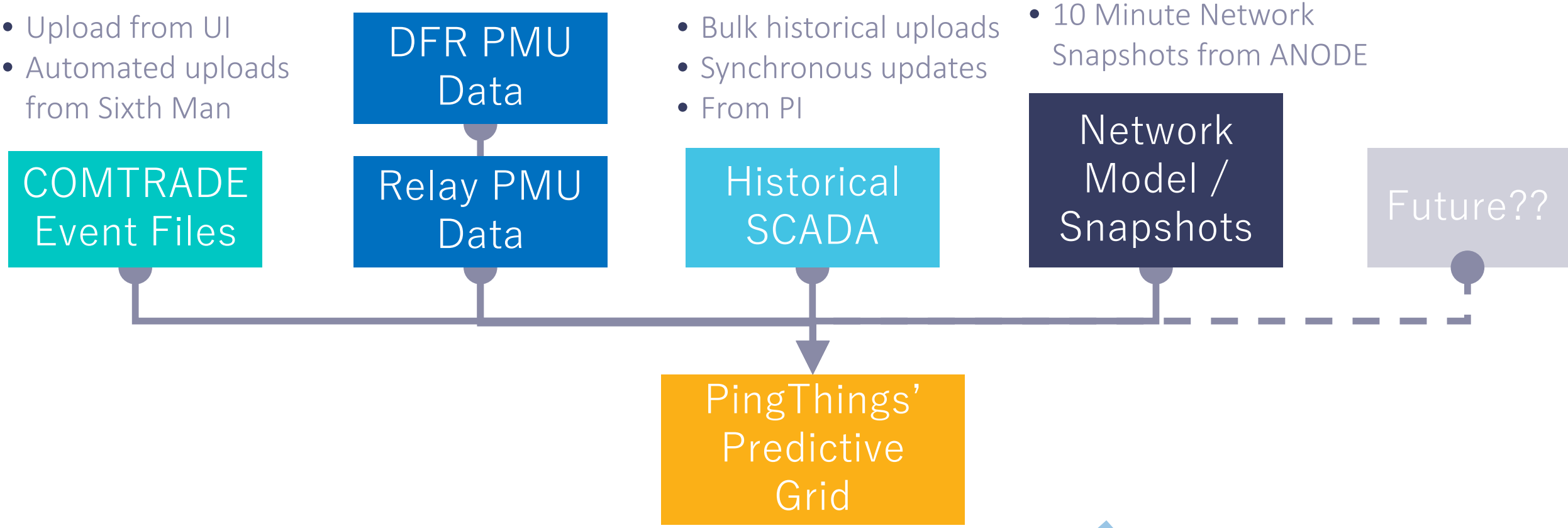
Rich, Programmatic Access

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.



Beyond Synchrophasors ← *Success Story*



Getting Help with the Cloud

- Cloud technologies and technology partners make all the difference for synchrophasors at scale ← *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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