Data & Network Management Task Team

September 7, 2007

Montreal

D&NMTT Charter

- **Data & Network Management Task Team** – The scope of the Data and Network Management Task Team includes the development of the hardware and software requirements to collect and store the PMU data at a master storage site(s). The group is also responsible for the defining the communications requirements from the PMU(s) or local storage site(s) to the master storage site(s), and development of future network **architecture** options.

Recent Progress

- Co-chairs met with PNNL staff in mid-July to flesh out architecture options based on application use cases
- Outcomes shared with:
  - ESG in early August
  - Leadership team
  - TT via conference call & distributed PowerPoint in August and yesterday in person

Montreal Team Composition

Paul Myrda	EPRI	pmyrda@epri.com
Kris Koellner	SRP	kmkoelln@srpnet.com
Mark Thomas	Entergy	mthomas@entergy.com
David Bakken	Wash St U	bakken@eecs.wsu.edu
Fred Henderson	PG&E	fwh4@pge.com
J. Ritchie Carroll	TVA	jrcarrol@tva.gov
Serge Benoit	BB&A	serge.benoit@bba.ca
Van Thich Nguyen	BB&A	vanthich.nguyen@bba.ca
Matt Heere	OSIsoft	mheere@osisoft.com
Yi Hu	Infrasource	yi.hu@infrasourceinc.com
Vikram Budhraja	EPG/CERTS	budhraja@electricpowergroup.com
Satish Mahajan	TN Tech U	smahajan@tntech.edu

Architecture Features

- [Massively] De-centralized
  - More onus on asset owner, less on a centralized host
  - Current system is not scalable
- Based on publish-subscribe model
- Differentiated classes for different application types
  - Not all PMU installations are considered equal
- Phasor Gateway concept introduced
  - “Internet routers on steroids for PMUs” – D. Bakken
- Access-control lists for each data set
- Latitude-longitude as a PMU descriptor

Small Signal Stability (Feedback Control)

- Low latency, as fast as possible
- Data integrity
  - no gaps
  - If gaps, application needs to handle
- Operating on ~<12 PMUs that may not be geographically close (hence longer latency)

Class A Example

State Estimator Enhancement – State Measurement

- Time alignment of data based on time stamps
- Ability to select a range of PMUs for state estimation
- Latency up to 5 seconds or so
  - Data loss OK
- Error estimates generated by PMUs
- Configuration utility widely disseminated (e.g. topology)

Class B Example

Post Event Analysis

- Based on archived records
- Requires completeness and accuracy
  - buffering at all level of architecture
- Tolerates data being delivered to archives up to one hour late
- Recovery protocols that move data to archive after connectivity failures
- Keep data on demand for a specified period (e.g. 1 week).
- Ability to ‘mark’ some data
- Ability to handle chain of custody
- PMU configuration data availability (will be in asset management system for a utility)
- Data rate

Class C Example

PMU Visualization (Like RTDMS)

- PMU selection can be a few or many
- Lower latencies, seconds is fine
- Can be minutes late, but must be aligned to specific period
- Some data loss and late delivery is acceptable
- Wider tolerance for accuracy (loosely compression)
- Required data rate

Class D Example

Phasor Application Classification

	Class A	Class B	Class C	Class D
Low Latency				
Reliability Availability				
Accuracy				
Time Align				
Message Rate				

Legend:

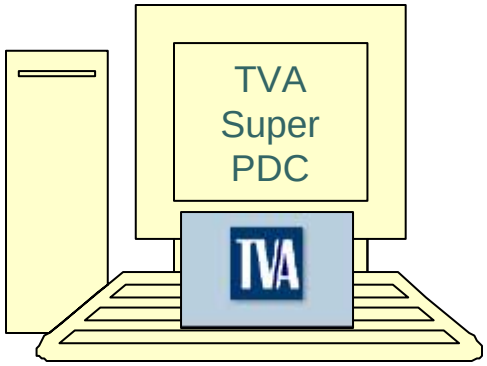

Not very important

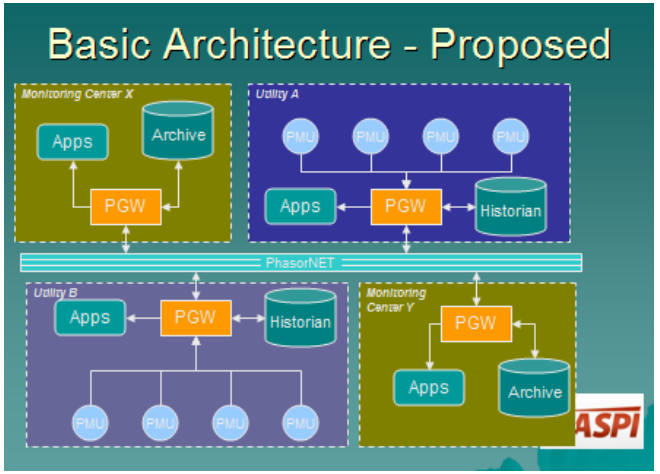

Somewhat important


Fairly important


Critically important

Internet analogy

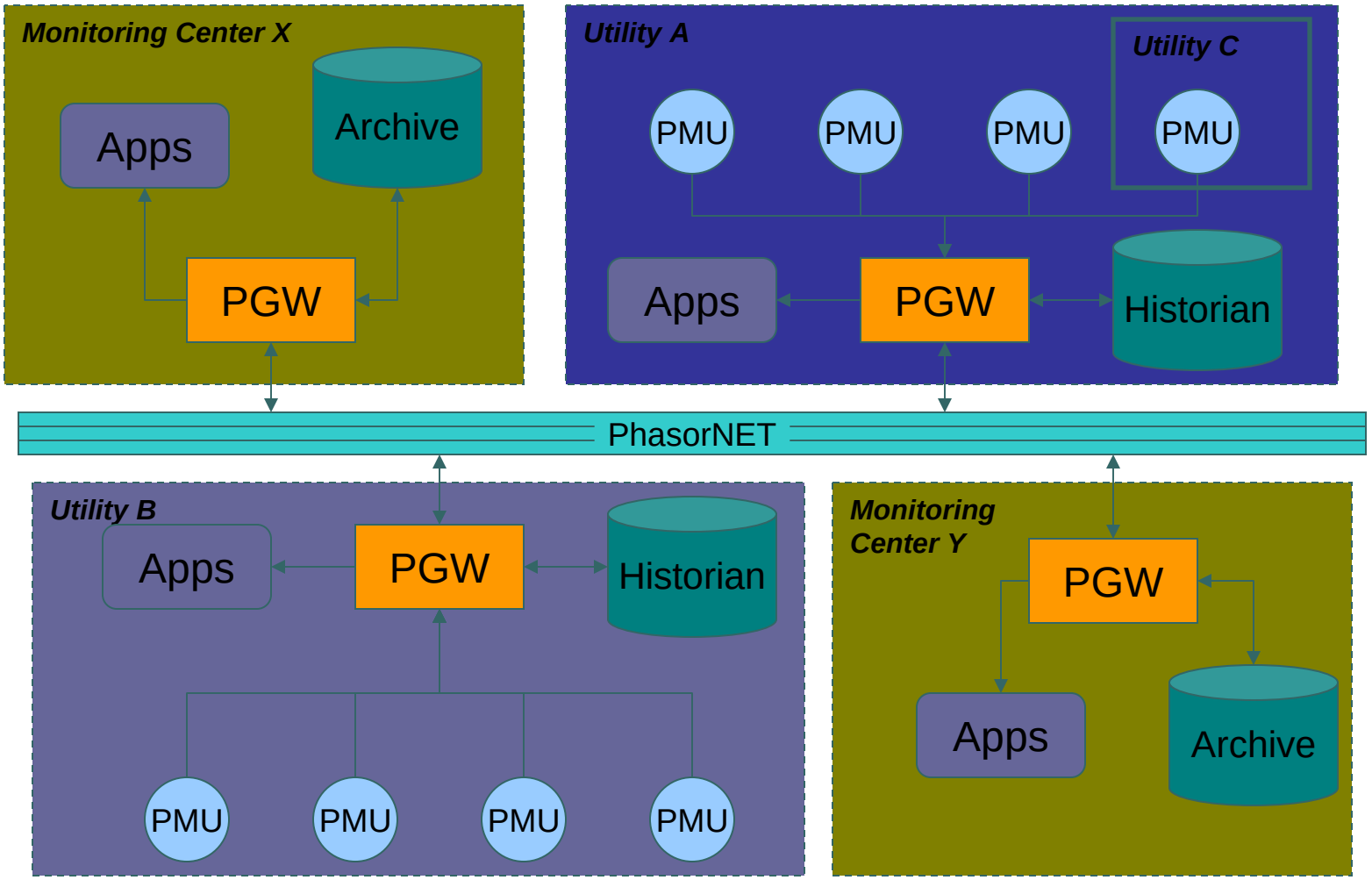




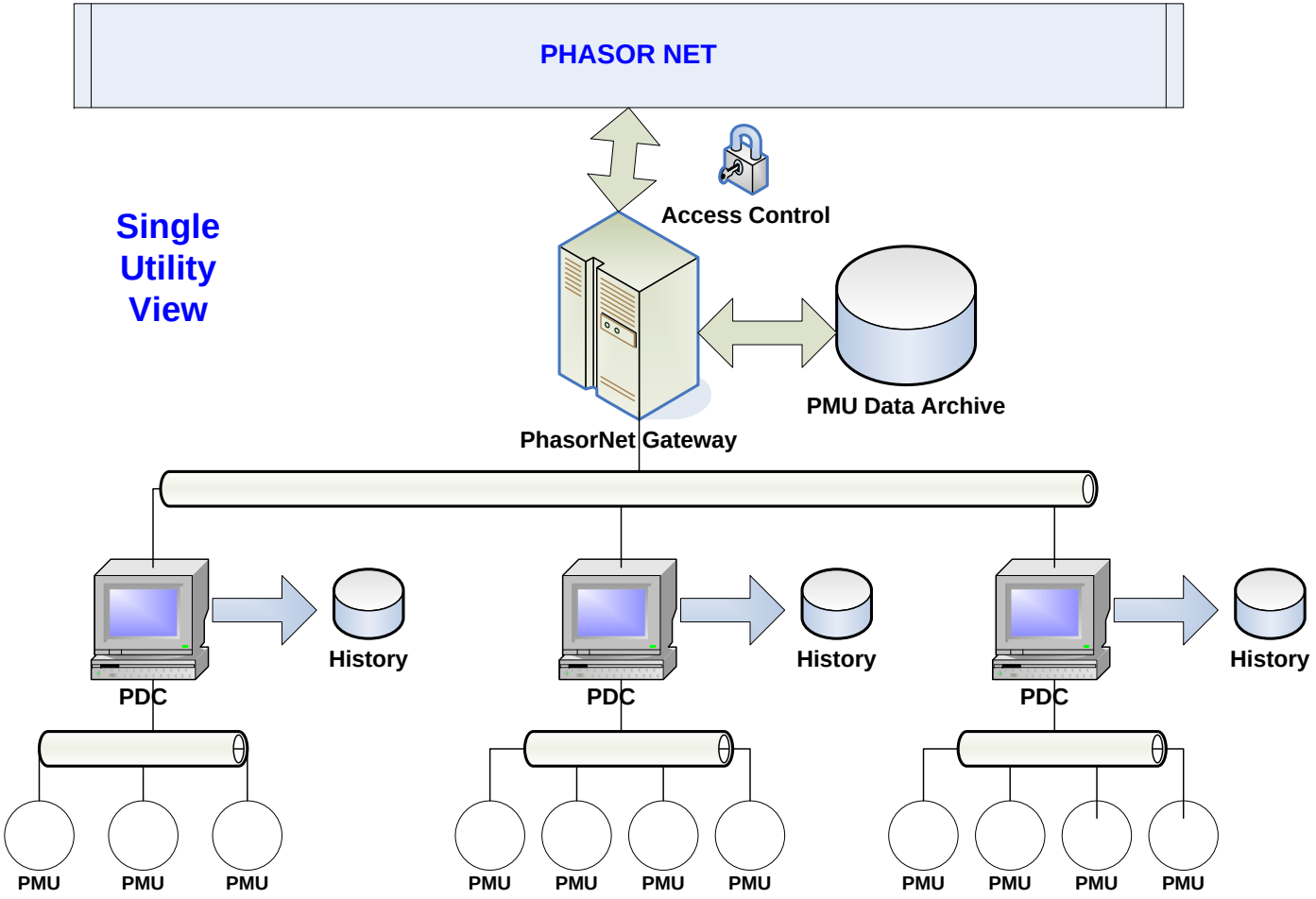
First web server at CERN;
Centralized,
Specialized,
Home grown

Today web servers are ubiquitous;
De-centralized
Standardized interfaces/protocols,
Vendor supported, outsourced

Basic Architecture - Proposed



Single Utility View Architecture



Purpose of PhasorNET Gateways

- Principal access point for inter-organizational phasor traffic
- Access/admin rights enforcement
- Disseminates access rights
- Maintains data integrity
- Handles format compatibility issues
- Manages traffic class priority

Benefit of publish-subscribe

- Avoid many-to-many traffic congestion
- Publishers announce what data is available
- Subscribers announce what data they want
- Gateways relay only what is needed and only once, no matter how many clients each channel has

What we heard

- Classes are good, keep it simple
- Work back from the applications, make classes support all apps
- Need to define phasor gateway roles vs. PDC, PMU
- Phasor gateway approach may help data sharing problem

Another breakthrough

- TVA has developed a Generation 2 architecture
- There is a need to meld the two architectures and develop common terminology and a phased transition from Gen 1 (today) through Gen 2 on to Gen 3 (end state)

Critical path action items

- Meld Gen 2 and Gen 3 architecture visions together
- Firm up class descriptions
- Firm up phasor gateway roles and functionality
- Think about how C37.118 will support final architecture and what protocol enhancements may be necessary

- DNMTT will be meeting bi-weekly via conference call to fast track these items through the end of 2007

- Join us!

- http://www.naspi.org/resources/dnmtt/dnmttresources.stm