Performance and Standards Task Team

Summary of Activities

Vahid Madani – Pacific Gas and Electric Co.
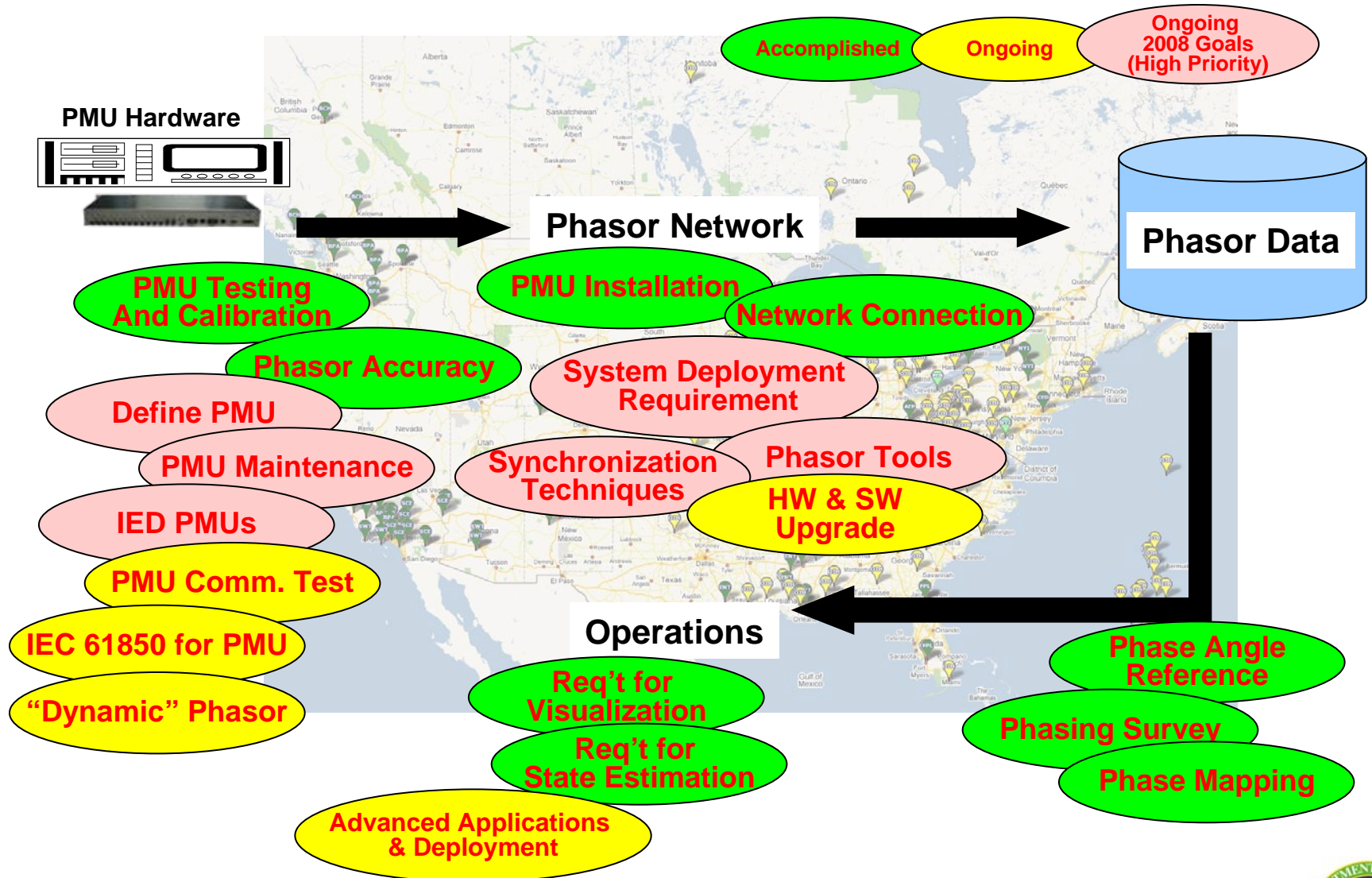*Damir Novosel – Quanta Technology*
Zhenyu Huang – Pacific Northwest National Laboratory

NASPI Working Group Meeting
June 12, 2008

Summary of PSTT Activities and 2008 Goals

Legend:
- **Accomplished** (green)
- **Ongoing** (yellow)
- **Ongoing 2008 Goals (High Priority)** (pink)

PMU Hardware

Phasor Network

Phasor Data

Operations

- PMU Testing And Calibration
- PMU Installation
- Network Connection
- Phasor Accuracy
- System Deployment Requirement
- Define PMU
- PMU Maintenance
- Synchronization Techniques
- Phasor Tools
- IED PMUs
- HW & SW Upgrade
- PMU Comm. Test
- IEC 61850 for PMU
- "Dynamic" Phasor
- Req't for Visualization
- Req't for State Estimation
- Advanced Applications & Deployment
- Phase Angle Reference
- Phasing Survey
- Phase Mapping

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PSTT 2008 Goals and Priorities

	Priority	Amount of Work
Focus Area 1: Phasor and PMU		
• Define std PMU:	High	Low
• Maintenance guide:	High	Medium
• Expand guidelines for IED PMUs:	High	Medium
• Test PMU at commissioning level:	Medium	Medium
• Standardizing PMU Configuration for IEC 61850:	Medium to High	Medium
• Dynamic phasors:	Low	High
Focus Area 2: Phasor Network/Architecture		
• Phasor Network/Architecture Requirements	High	High
Focus Area 3: Application Requirements		
• Protection and Control:	Low	High

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PSTT Expectations of Tasks

Tasks	Deliverables	Schedule

Tasks

- Define Standard PMU – Ken Martin
- Expand guidelines for using devices with Integrated PMU Functionality – Damir Novosel
- Requirements to guide PMU deployment and system architecture needs, locally and regionally
  - System and device requirements for combined applications – Yi Hu
  - Phasor Tools Listing - Requirements and specifications for phasor tools – Henry Huang
  - Guidelines for synchronization techniques – Accuracy and Availability – Alfredo Vaccaro
  - Requirements for hardware and firmware upgrades – Shane Haveron
- Standardizing PMU Configuration for IEC 61850 Applications – Sushil Cherian
- COMTRADE Format for Phasors – V. Madani / K. Martin / J. Hackett

Deliverables / Schedule

Deliverables	Schedule
Definition document	2008
Expanded guideline	2008
Requirements document	2008
List of tools	2008
Requirements document	2009
Guideline of synch tech	2008
Requirements document	2008
PMU configuration document	2008
Coordination w/ IEC Stds (ongoing)	2008
Expanded 61850	2009
Improved COMTRADE Format	2008

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Definition of PMU

- **Background:** More and more "PMUs" emerge in the market, with various functionalities. This situation can be confusing to PMU users as to what to look for from a PMU.

- **Objective:** To define a "PMU" with clear specifications and requirements of basic PMU functions. This definition is intended to serve as educational material.
  - Time-synch'ed measurements: phasor & frequency, 1-phase/ "+" sequence
  - Real-time data streaming
  - Compliance with IEEE C37.118-2005
  - Test data provided

- **Targeted Audience:** PMU users.
  - To help PMU users to understand a PMU
  - To help PMU users in making procurement decisions

- **Status:** Draft completed and approved by PSTT team.

Phasor Tools Listing

- **Background:** Phasor applications are being developed, and vendors are putting phasor tools out to the market.
  - The quality of the tools greatly affects the acceptance of phasor technologies.
  - There is a need for categorizing, specifying phasor tools, and ensuring interoperability of phasor tools.
- **Objective:** To develop a phasor tool repository and define requirements for selected phasor tools.
- **Targeted Audience:** Both phasor tool developers/vendors and users.
  - To help developers/vendors to gain visibility of their tools
  - To help users in understanding and selecting tools
- **Status:** Ongoing. A draft website and repository for phasor tool listing is developed.
- **Ongoing activities:**
  - Complete the phasor tool listing website and repository
  - Categorize phasor tools
  - Develop phasor tool requirements

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Phasor Tools Listing – website

Input Form

Browsing

Listing

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Listing in Alphabetical Order

NORTH AMERICAN SYNCHROPHASOR INITIATIVE

Resources
Business Management Task Team
Data & Network Management Task Team
Equipment Placement Task Team
Operations Implementation Task Team
Performance and Standards Task Team
Planning Implementation Task Team
Research Initiatives Task Team
Executive Steering Group

Related Sites
Research Repository
Tools
Training

Resource Archive

NASPI Phasor Tools

Add New Phasor Tool

Sort By: Alphabetical

Search: [ ] Search

A H M P S T Show All

A
A Dynamic Information Manager for Networked Monitoring of Large Power Systems
Assessment of Applications and Benefits of Phasor Measurement Technology in Power Systems
Assessment of Applications and Benefits of Phasor Measurement Technology in Power Systems

H
Handy Dandy Opener

M
Monitoring Dynamic of Power Systems Using Characteristic Ellipsoid Approach
Monitoring Dynamic of Power Systems Using Characteristic Ellipsoid Approach
Monitoring Dynamic of Power Systems Using Characteristic Ellipsoid Approach

P
Phasors Monitor Grid Conditions
Power System Security Pattern Recognition Based on Phase Space Visualization
Project Name

S
Synchronized Phasor Measurements for the Western Systems Coordinating Council (WSCC)
system test

T
test
Test Project
Test Project Name
Test Project Name
Test Project Name 3
Testing Character Overload

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Guidelines for Synch Techniques

- **Background:** Various time synchronization techniques exist, with different accuracy, reliability and availability. This affects how PMUs would be built (e.g. internal clocks, GPS receiver) and how phasor network would be deployed (e.g. local time synchronization via time signal distribution).

- **Objective:** To characterize various synch techniques and develop guidance for testing synch techniques.

- **Targeted Audience:** Both PMU manufacturers and phasor users.
  - To help PMU manufacturers to achieve specified accuracy and reliability
  - To help users in deploying phasor networks

- **Status:** Ongoing. A draft document on synch technique characterization is developed and under PSTT review.

- **Ongoing activities:**
  - Complete the characterization document
  - Develop testing guidance and testing techniques

IEC 61850 for Phasors

- **Background:** IEC 61850 is becoming a standard protocol for substation data exchange. Phasors do not want to be left out.

- **Objective:** To expand IEC 61850 for phasor data exchange.

- **Targeted Audience:** Primary phasor users and phasor tool developers. Affect PMU manufacturers.
  - To help phasor users to improve interoperability between phasors and other grid functions
  - To help phasor tool developers to standardize data interface and interpretation
  - To help PMU manufacturers to understand the protocol

- **Status:** Ongoing. A work plan is developed.

- **Ongoing activities:**
  - Several tasks are specified in the work plan, including data models, data representation, communication, and performance requirements.
  - Resources and support are needed to complete the tasks.

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"Dynamic Phasors"

- **Background:** "Steady-state-based" phasor definition in IEEE standard is not adequate for some applications. "Steady-state" PMUs may not capture grid dynamics. Dynamic calibrations of PMUs are needed.

- **Objective:** To investigate the characterization of dynamic phasors and identify the needed for definition and requirements.

- **Targeted Audience:** Both phasor users and PMU manufacturers.
  - To help phasor users to improve understanding of dynamic phasors and the implications.
  - To help PMU manufacturers to improve phasor algorithm and implementation

- **Status:** Ongoing.
  - Jerry Stenbakken developed and tested dynamic calibration methods.

- **Ongoing activities:**
  - Define dynamic phasors and identify the implications regarding applications.
  - Expect to add to next IEEE phasor standard.

"Dynamic Phasors" – *example*

- Total Vector Error for a PMU relative to fundamental and dynamic phasors
  - Concurrent 10% phase modulation and 10% amplitude modulation from 1 to 71 Hz
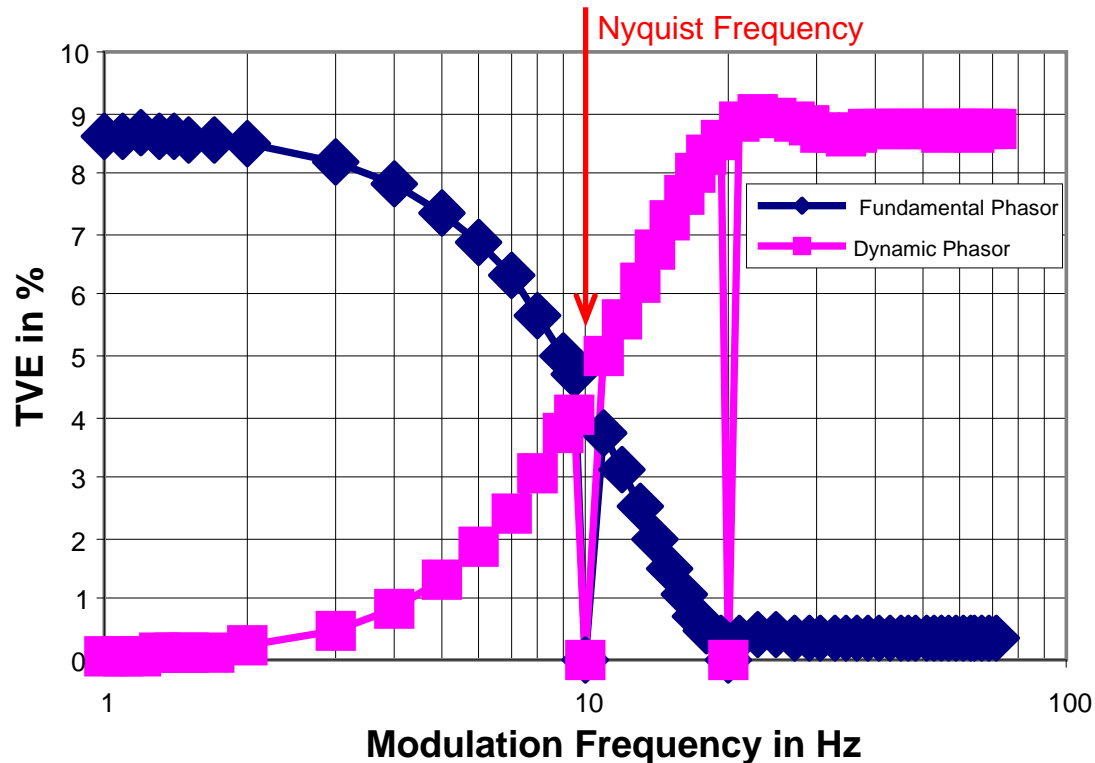
COMTRADE for Phasor Files

- **Background:** No standard format available for phasor data files. BPA PhasorFile is commonly used in WECC, Excel CSV is used with TVA SuperPDC, proprietary formats exist ➔ inconsistency and non-interoperability ➔ difficulties in phasor data sharing, phasor tool interfacing, …

- **Objective:** To develop a standard phasor data file format by leveraging existing COMTRADE Format.

- **Targeted Audience:** Phasor users and phasor tool developers.
  - To help phasor users to streamline data sharing and data management
  - To help phasor tool developers to standardize data interface and interpretation

- **Status:** Ongoing. Actively interacting with PSRC WG H10 and a work plan is in place.

- **Ongoing activities:**
 - Develop COMTRADE add-on configuration for phasor data.

Functional PDC Requirements - Scope

- There is a complete standard for synchro-phasor measurement (C37.118)
- There is no complete standard for the phasor data concentrator (PDC)

- The goal is to provide a generalized reference for the PDC which could be used by industry and manufacturers to aid in:
  - The education of the function of the PDC
  - To aid in the creation of PDC specifications that could be used for wide area measurement systems.
- This reference might later be used to create a standard but that will not be addressed by this group.

- PDC Requirements – Core functionality
- Distributing data to various users
- Providing system management functions such as performance history and trouble alarms
- Architecture, Hardware and Functional Considerations
- Local and Regional PDC's

Requirements of PDC

- **Background:** BPA PDC, widely used today, is based on hardware techniques of several years old. Upgrade with new hardware techniques is needed and capability needs to be expanded to accept large number of PMUs.

- **Objective:** To develop a requirement document for next-generation PDCs.

- **Targeted Audience:** Phasor users and phasor hardware developers.
  - To help phasor users to deploy phasor networks
  - To help phasor hardware developers to develop next-generation PDCs

- **Status:** Ongoing. Scope document is completed.

- **Ongoing activities:**
  - Survey user communities to gain insights about PDC functional needs.
  - Develop PDC requirements.
  - Coordination with DNMTT is ongoing, as it is related to the phasor architecture and has commonality with PhasorGateway.

PDC Family
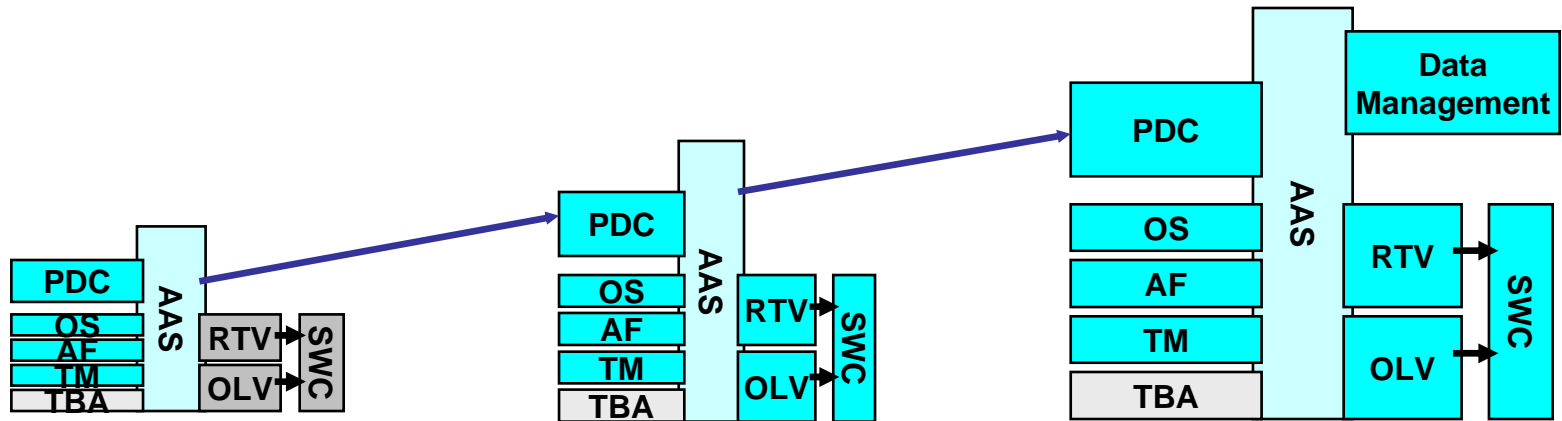
PDC 10[1]

- Ruggedised PCs
- Substation Use
- Local buffer
  - Comms failure
  - On Demand
- Hub (Multiple WAMS)
- Limited Applications
- <10 PMUs

PDC 10[2]

- Single Datacentre Server
- Regional/National Use
- Variety of Applications
- Offline and Control Room
- <100 PMUs

PDC 10[3]

- Multiple Servers
- Large connected areas
- Parallel/redundant use
- Security
- Management tools
- <1000 PMUs

Coordination and Cooperation with Other Technical Communities

- **IEEE PES General Meeting:**
  - Invited panel presentation "Performance Evaluation of Phasor Measurement Systems", by Henry Huang (PNNL), Bogdan Kasztenny (GE), Vahid Madani (PG&E), Ken Martin (BPA), Sakis Meliopoulos (Georgia Tech), Damir Novosel (Quanta Technology), and Jerry Stenbakken (NIST).
    - Summarize two accomplished PSTT Tasks: PMU Testing Guide and SynchroPhasor Accuracy Characterization.

- **IEC 61850 Group:**
  - Expanding IEC 61850 protocol for phasor measurement.

- **PSRC WG:**
  - COMTRADE format for phasor data files.
  - Revision of SynchroPhasor standard IEEE C37.118.

Questions?