NASPI North American SynchroPhasor Initiative

NIST Interoperability Standards Update

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NIST Three Phase Plan

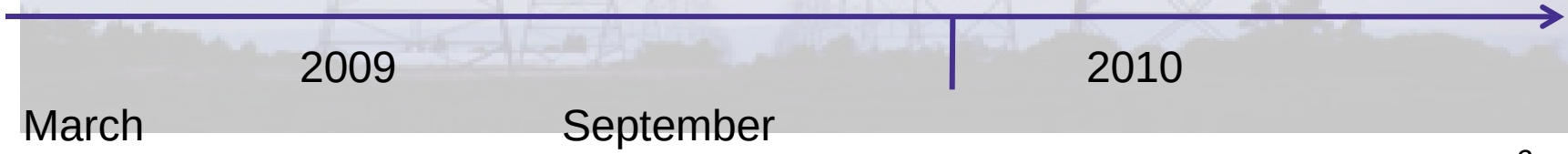
PHASE 1
Identify an initial set of existing consensus standards and develop a roadmap to fill gaps

PHASE 2
Establish public/private Interoperability Panel to provide ongoing recommendations for new/revised standards

NIST Domain Expert Working Groups

T&D, Home-to-Grid, Building-to-Grid, Industry-to-Grid, PEV-to-Grid, Business and Policy, Cyber Security

PHASE 3
Testing and Certification Framework



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NIST Phasor related tasks identified in this phase

- Priority Action Plan (PAP) number 13 – Time Synch
- PAP 15 – Cyber Security (somewhat)
- Harmonization of IEC 61850 and IEEE C37.118
- Participate in the SGIP

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First 16 NIST Framework Standards

	Domain Expert Working Groups							
1	AMI-SEC System Security Requirements	✓	✓	✓			✓	✓
2	ANSI C12.19 End Device (Meter) Tables		✓	✓				✓
3	BACnet Building Automation & Control Net			✓	✓			✓
4	DNP3 – Distributed Network Protocol		✓		✓	✓	✓	
5	IEC 60870-6 – Inter-Control Center		✓					
6	IEC 61850 – Comms Nets in Substations		✓		✓	✓	✓	
7	IEC 61968/61970 – Common Info Model		✓	✓				
8	IEC 62351 – Data Comms Security		✓		✓	✓	✓	
9	IEEE C37.118 - Synchrophasors		✓			✓		
10	IEEE 1547 – Distributed Resources		✓		✓	✓	✓	
11	IEEE 1686 – IED Cyber Security				✓	✓	✓	
12	NERC Critical Infrastructure Protection	✓	✓	✓	✓	✓	✓	✓
13	NIST SP 800-53/82 Fed Info Sys Security	✓	✓	✓	✓	✓	✓	✓
14	Open Automated Demand Response	✓	✓	✓				✓
15	Open Home Area Network Requirements							✓
16	ZigBee/HomePlug Smart Energy Profile							✓

Smart Grid & Phasor Issue Definition

- Data from phasor measurement units
  - IEEE C37.118 for PMU
  - IEC 61850 seen as key standard for field equipment in the future
  - Scope of IEC 61850 expanded for wide area communication; e.g. between substations
  - Stream based communication or report based communication?
  - Rate of publishing
- Several applications requiring accurate ti… synchronization
  - PMUs
  - Sampled values fo…
  - IEEE 1588, provide… …nization over comm. networks
  - Other methods for s… …IRIG-B?
- Objectives
  - Integrate IEEE C37.118 and IEC 61850; define PMU models in IEC 61850 based on IEEE C37.118
  - Develop requirements from Smart Grid application, on time synchronization, and time management
  - Discuss migration paths

IEC 61850 / IEEE C37.118 / Time synchronization

Key issues to consider

- Multiple applications support
- System reliability
  - Continued operation under single component failure
- Quality of Service guarantee
- Security control – standard compliance
  - Confidentiality
  - Integrity
  - Authentication
  - Logging and audit
- Accommodate future needs
- Balance near term and long term needs

C37.118 in a Substation

Not readily integrated with substation engineering, automation, and protection

- Automation - C37.118 doesn't reuse IEC 61850 data semantics or wire protocol.
- Existing substation automation equipment cannot receive C37.118.
  - C37.118 only supports data streaming and not report by exception.
  - Substantial increases in the cost of using PMU data in substations
- Protection – C37.118 only specifies the use of TCP or UDP.
  - Without access to lower layers of the communication protocol stack, difficult to reserve WAN/VLAN/LAN bandwidth
    - Cannot set the data delivery priority
  - Phasor data transmitted using C37.118 cannot be used for reliable system protection.
- Engineering – No standard way to describe a PMU in IEC 61850 Substation Configuration Language (SCL).
  - No way to configure a system off line.

Issues with C37.118

- Types of data – NASPINet needs to support exchange of other data including but limited to:
  - Historical phasor data
  - COMTRADE files
  - Alarm/events data
  - Network model configuration data
- Miscellaneous protocol issues
  - There are numerous error handling issues that need to be resolved. Consequently, C37.118 is not a highly reliable protocol
  - Quality and Timestamp loose meaning when C37.118 streams are aggregated and then split up

Issues with Current C37-118

- No means of guaranteed delivery
- Security – C37.118 does not have security built in
  - RBAC required down to the Item level is needed
- Filtering – one cannot receive only selected items of interest using C37.118
  - Topic based subscriptions are needed
  - Should be able to filter on location of the PMU data
- No context to data – Phasor data without the context of network/device data has limited value
  - NASPINet should be integrated using a common network/device model such as IEC 61850 and/or IEC 61970 Common Information Model (CIM)

IEC/IEEE Joint Standard for Synchrophasors

- Joint development of the entire standard, not just harmonization with IEC 61850.
- Any parts of the synchrophasor standard that need to go into IEC 61850 will be part of that standard, not a separate standard.
- IEEE C37.118 could be split into measurement and communication standards which could simplify the joint IEC work.
- The IEEE C37.118 communication method is widely used for Phasors at this time.
- Transition time would be needed once / if transition from C37.118 to 61850 is to occur

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Coordination with IEEE, IEC, and NIST on standard PMU developments

Further formalize the process by expanding existing PSTT documents to become IEEE standards:

- PMU System Testing and Calibration Guide
- Guidelines for synchronization techniques - Accuracy and Availability
- PMU Installation/Commissioning/Maintenance Guide
- SynchroPhasor Accuracy Characterization
- Standard PMU Definition / Basic Specification

Clarify role of PSTT in relationship to focused NIST activities on interoperability standards.

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Questions?