Final Project Briefing

NASPInet Specification Project

Dr. Yi Hu, Dr. Matt Donnelly

Quanta Technology LLC

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- Project status

- Specified NASPInet

- Final specifications delivered

- Moving forward – Quanta recommendation

Project History and Status

- **The NASPInet specification project**
  - Started as NASPI's mission to fulfill a long recognized need
  - DNMTT did extensive preliminaries including RFP preparation
  - DOE issued competitive solicitation in mid 2008
  - Contract awarded to Quanta Technology 2008-09-27
  - Final specification delivered on 2009-04-27
  - Updated final specification delivered on 2009-05-29
    - Available to general public for comments/feedbacks at NETL's reading room and NASPI website (http://www.netl.doe.gov/business/solicitations/NASPI/index.html and http://www.naspi.org/)

- **The specification project is complete; and it is now ready to take the next steps towards NASPInet implementation.**

Results of a broad industry support

- Meetings held throughout the project
  - DOE-NETL review team scheduled meetings
  - Regular DNMTT teleconference meetings
  - Utility-hosted Meetings
    - New Orleans – Dec. 9-10, 2008
    - Los Angeles – Jan. 20, 2009
    - Valley Forge – Feb. 10, 2009
    - San Diego – Mar. 12, 2009

- Written and verbal comments/suggestions received from
  - DOE-NETL review team members
  - NASPI and DNMTT members

- The final specifications have taken many feedbacks, comments, and suggestions into account wherever appropriate.

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System View of NASPInet
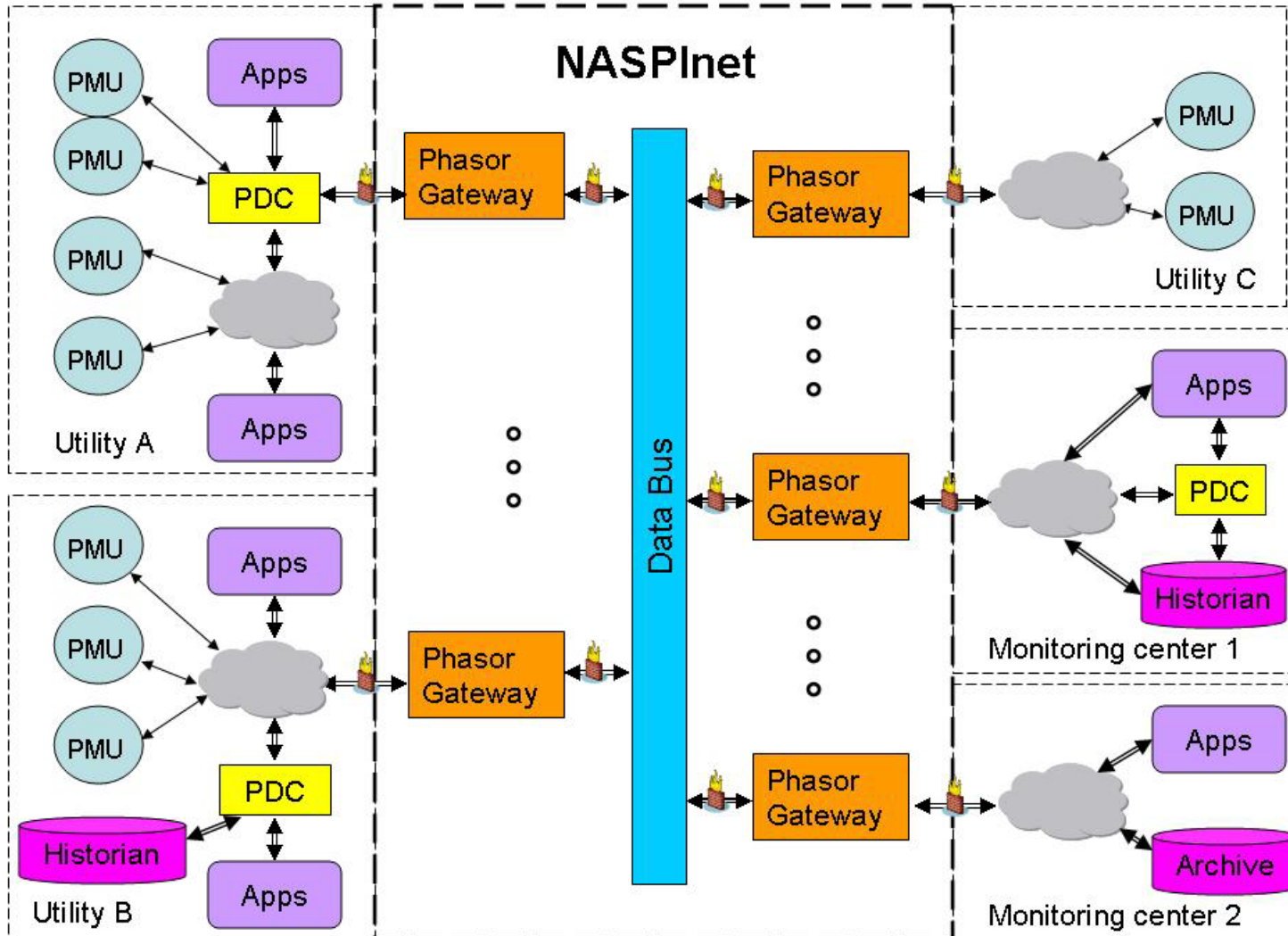
Overview of NASPInet Specifications

- Developed to meet
  - Immediate procurement and implementation needs
    - Most administrative and operational activities could be interactive
    - Maximize the use of available technology and commercial off the shelf products
  - Future system needs
    - New standards and technologies
    - Most of the administrative and operational activities automated

Overview of NASPInet Specifications

- **A secure and quality of service guaranteed data exchange network**
  - Publish/subscribe based data exchange
    - Data publishers have the control over published data
    - Signal level granularity
  - Browsing, publishing, and subscription of data from registered data sources are limited to authorized and authenticated Phasor Gateways (PG)
    - Data sources and applications must be connected to a PG that has been connected and registered to the NASPInet Data Bus (DB) to use NASPInet services
    - All data and messaging for NASPInet functions will be exchanged using secure methods
  - Quality of Service is ensured with continued monitoring and resource management by the DB and PGs under both normal and abnormal conditions

Overview of NASPInet Specifications (cont'd)

- NASPInet communication network shall be a secure, high-speed IPv6-based network with high availability and scalability

- Devices, applications, signals, subscriptions, etc. will be identified with 128-bit global ID

- Historical data to be transmitted in 1 subscriber to 1 publisher manner

- Streaming real-time data to support both 1-to-1 and 1-to-N publish-subscribe scenarios

- Each subscriptions shall have a cryptographic key that is unique systemwide

Overview of NASPInet Specifications (cont'd)

■ Open Application Programming Interfaces (APIs)

➢ The DB supplier shall provide open APIs for connecting PGs from various suppliers

➢ PG suppliers shall provide open APIs for connecting PMU/PDC devices and applications

➢ The DB/PG suppliers shall support and maintain the APIs respectively, and update them to comply with standards as they become final and available.

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Final delivered specifications

- **Data Bus Specification**
  - NASPInet data communication network
  - Data Bus services
    - system administration and management
    - Quality of Service management
    - Security management, etc.
  - Must support incremental deployment

- **Phasor Gateway Specification**
  - Functional & technical requirements for full-feature and full-capability PG
  - PG Requester is expected to tailor the specifications to the applications and classes of data services that the PG is expected to support
  - List of applicability of each requirement to class of data service is included in Appendix A.

Final delivered specifications

- Both specifications contain common sections to ensure common understandings between DB and PG suppliers
  - NASPInet Architecture Framework (Sec. 2)
  - Overall NASPInet Functional Requirements (Sec. 3)
- DB and PG Requesters are expected to provide specific information regarding their policies, guidelines, IT platform preferences, existing IT and telecom infrastructures, etc.
  - Attachment I is a placeholder for such information
- DB and PG Requesters are expected to tailor general hardware, software, and project services requirements to their specific environments and needs
  - Sample specifications for these requirements are included in Attachment II

Final Data Bus and Phasor Gateway Specs

- **NASPInet *Data Bus* Specification (172 pages)**
  1. Introduction
  2. System Architecture
  3. NASPInet overall functional requirements
  4. Data Bus specific functional requirements
  5. System integration requirements
  6. Network and communication requirements
  7. Security requirements
  8. Sizing, performance and availability requirements
  - Appendix A: Abbreviations and Acronyms
  - Attachment I
  - Attachment II
    9. Hardware requirements
    10. Software requirements
    11. Implementation and sustainment

- **NASPInet *Phasor Gateway* Specification (204 pages)**
  1. Introduction
  2. System Architecture
  3. NASPInet overall functional requirements
  4. Phasor Gateway specific functional requirements
  5. System integration requirements
  6. Network and communication requirements
  7. Security requirements
  8. Sizing, performance and availability requirements
  - Appendix A: PG requirements applicability check list
  - Appendix B: Abbreviations and Acronyms
  - Attachment I
  - Attachment II
    9. Hardware requirements
    10. Software requirements
    11. Implementation and sustainment

Using the specifications

- **Data Bus Specification**
  - Add DB_REQUESTER info in Sec. 1
  - Must provide additional information
    - PGs locations and projected data volume for each class of data service (publishing/subscribing, initial and final)
    - IT policies and guidelines – e.g. IT governance, security policy, preferred IT platforms, etc.
    - Operating procedures – e.g. safety procedures, equipment connection guidelines, etc.
    - Existing and planned infrastructures – e.g. major facility locations, telecom network, etc.
    - Existing IT systems – Enterprise IT services (e.g. Enterprise Service Bus or middleware), Database Mgmt System, Enterprise Performance Mgmt tools, etc.
  - Tailor or replace these sections:
    - Hardware, Software, and Implementation & Sustainment Services

- **Phasor Gateway Specification**
  - Add PG-REQUESTER info in Sec. 1
  - Must specify PG capability
    - Classes of data service supported
    - Data volume for each class of data
  - Must provide additional information
    - Number of PMU/PDC, signals, and interfacing applications/users
    - IT policies and guidelines – e.g. IT governance, security policy, preferred IT platforms, etc.
    - Operating procedures – e.g. safety procedures, equipment connection guidelines, etc.
    - Existing and planned infrastructures – e.g. major facility locations, telecom network, etc.
    - Existing IT systems – Enterprise IT services (e.g. Enterprise Service Bus or middleware), Database Mgmt System, Enterprise Performance Mgmt tools, etc.
  - Adapt or replace these sections:
    - Hardware, Software, and Implementation & Sustainment Services

Phasor Gateway capability specification

Table 4-1: PG Data Exchange Capability Requirement Matrix

Function	Data Group	Class	Required (Initial)	Required (Final)
Publishing	Streaming data	A		
		B		
		C		
	Historical data	D		
		E		
Subscribing	Streaming data	A		
		B		
		C		
	Historical data	D		
		E		

Classes of Data Services

NASPInet Traffic Attribute	Real-time streaming data			Historical data	
	CLASS A Feedback Control	CLASS B Feed-forward Control	CLASS C Visualization	CLASS D Post Event	CLASS E Research
Low Latency	4	3	2	1	1
Availability	4	2	1	3	1
Accuracy	4	2	1	4	1
Time Alignment	4	4	2	1	1
High message rate	4	2	2	4	1
Path Redundancy	4	4	2	1	1
Table key: 4 – Critically important, 3 – Important, 2 – Somewhat important, 1 – Not very important					

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Supporting Broad Range of Phasor Apps

- **Apps that require STREAMING DATA**
  - Example 1 – Visuals for Transmission Operators
    - Operator display of voltage angle between 2 critical points: alarm if angle reaches threshold value defined by planning studies
  - Example 2 – Inputs to EMS Tools
    - Voltage magnitude and angle help improve boundary conditions for state estimator
  - Example 3 – Inputs to Wide Area Controllers
    - Receiving voltage measurements from others' substations improves SVC control at the substation
- **Apps that require ARCHIVAL DATA (data files)**
  - Example 1 – Data for Post-disturbance Analysis
    - Timelier and more accurate understanding of what caused an event can help save $ by shortening the duration of sub-optimal generating patterns and can help prevent future events of similar nature
  - Example 2 – Data for R&D Purposes
    - Providing abundant data to research organizations can potentially lead to breakthrough technology advancements

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PG requirement applicability checklist

Requirement Number	Pilot NASPInet implementation										NASPInet full deployment									
	Publish					Subscribe					Publish					Subscribe				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
PG-1	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-2	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-3	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-4	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-5																				
PG-6	M	M	M	M	M	M	M				M	M	M	M	M	M	M			
PG-7	M	M	M	M	M	M	M				M	M	M	M	M	M	M			
PG-8	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-9	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-10	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-11	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-12	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-13	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-14	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-15	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
PG-16	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M

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Info for Phasor Gateway sizing (1)

Table 8-1: PG real-time data exchange needs for determine sizing requirements

Sizing items	Initial Quantity						Ultimate Quantity					
	Publish			Subscribe			Publish			Subscribe		
	A	B	C	A	B	C	A	B	C	A	B	C
No. of real-time data streams												
Min. frame size (kB/frame)												
Max. frame size (kB/frame)												
Avg. frame size (kB/frame)												
Min. analog data points/frame												
Max. analog data points/frame												
Total analog data points												
Min. digital data points/frame												
Max. digital data points/frame												
Total digital data points												
Min. reporting rate (frames/s)												
Max. reporting rate (frames/s)												

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Info for Phasor Gateway sizing (2)

Table 8-2: PG historical data exchange needs for determine sizing requirements

Sizing items	Initial Quantity				Ultimate Quantity			
	Publish		Subscribe		Publish		Subscribe	
	D	E	D	E	D	E	D	E
No. of HDS								
Total analog data points								
Total digital data points								
Min. No. of daily file transfer								
Max. No. of daily file transfer								
Min. file size (MB)								
Max. file size (MB)								
Avg. file size (MB)								

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Conclusions and recommendations

- The specifications have been completed and ready for moving into next step implementation

- Necessary steps need to be taken for a successful full scale deployment of the NASPInet

- Pilot implementation and demonstration of NASPInet
  - Validate architecture and design before full scale deployment
  - Foster standards development prior to a full scale deployment

- Fast track standard development
  - Combined with pilot/demonstration implementation
    - Make sure the standards developed are feasible and supported by vendors
  - NASPI to take the lead in the development of necessary standards to ensure rapid development and industry acceptance

yhu@quanta-technology.com