

Smart Grid Investment Grant Update

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Project Participants

- Lead Sponsor / Project Manager
 - Lead Sponsor: David Zwergel, Director of Regional Operations, dzwergel@midwestiso.org, (317) 249-5452
 - Project Manager: David Luedtke, Utilicast, dluedtke@midwestiso.org, (317) 249-2169

- Research and Development Partners
 - University of Tennessee at Knoxville
 - Frequency Network (FNET) Expansion
 - Oscillation and Island Detection Research
 - University of South Florida
 - Dynamic System Parameter Estimation Research
 - Cascading Failure Prevention Research
 - EPRI
 - Research Administration

Project Participants (continued)

- Project TO/ Asset Owner Partners

Organization		PDC	PMU (1st Placement + Quick Hits) Confirmed	PMU (2nd Placement Study) Candidates	PMU (2nd Placement Study) Confirmed
Ameren	AMIL, AMMO	1-3*	10	17	10-27
Duke Energy	CIN	1-3*	10	15	10-25
Great Rivers Energy	GRE	1-3*	3	5	3-8
Hoosier Energy	HE	1-3*	7	0	7
Indianapolis P&L	IPL	1-3*	6	1	6-7
International Transmission Co.	ALTW, CONS, DECO	1-3*	12	22	12-34
Manitoba Hydro	MHEB	1-3*	5	17	5-22
MidAmerican Energy	MEC	1-3*	5	7	5-12
Minnesota Power	MP	1-3*	1	8	1-9
Northern Indiana Public Service	NIPS	1-3*	5	0	5
Ottertail Power	OTP	1-3*	3	7	3-10
Vectren	SIGE	1-3*	1	1	1-2
Pending Organizations**	FE, NSP, MDU, WAUE	4-12*	0	57	0-57
TOTAL		16-48*	68	157	82-132***

* Reviewing feasibility of Highly Available PDC solution.

** Pending organizations have yet to confirm SGIG project participation.

*** A total of 150-200 PMU will be funded under the SGIG project.

Project Infrastructure Overview

- PMUs

- The PMU Placement objective is to identify widespread coverage with Synchrophasors to monitor across the footprint.
- Other Placement Considerations
 - General Selection Criteria
 - Existing Transmission Owner Plans
 - Other Synchrophasor Deployment Efforts (by PJM, ATC and others)
- Process
 1. Worked with Transmission Owners to determine “Quick Hit” PMU Sites that could be deployed in 2010; 24 Sites were confirmed.
 2. Using the existing and newly confirmed sites, the 1st Iteration of the Placement Study identified an additional 100 PMU Sites required for 345kV observability; an additional 44 sites were confirmed.
 3. Using the existing and newly confirmed sites, the 2nd Iteration of the Placement Study identified an additional 157 PMU Sites for 230 kV observability; the Transmission Owner costing and confirmation process starts this month.
 4. The final step will be a Supplemental Analysis that selects additional sites up the available funding levels.

Project Infrastructure Overview (continued)

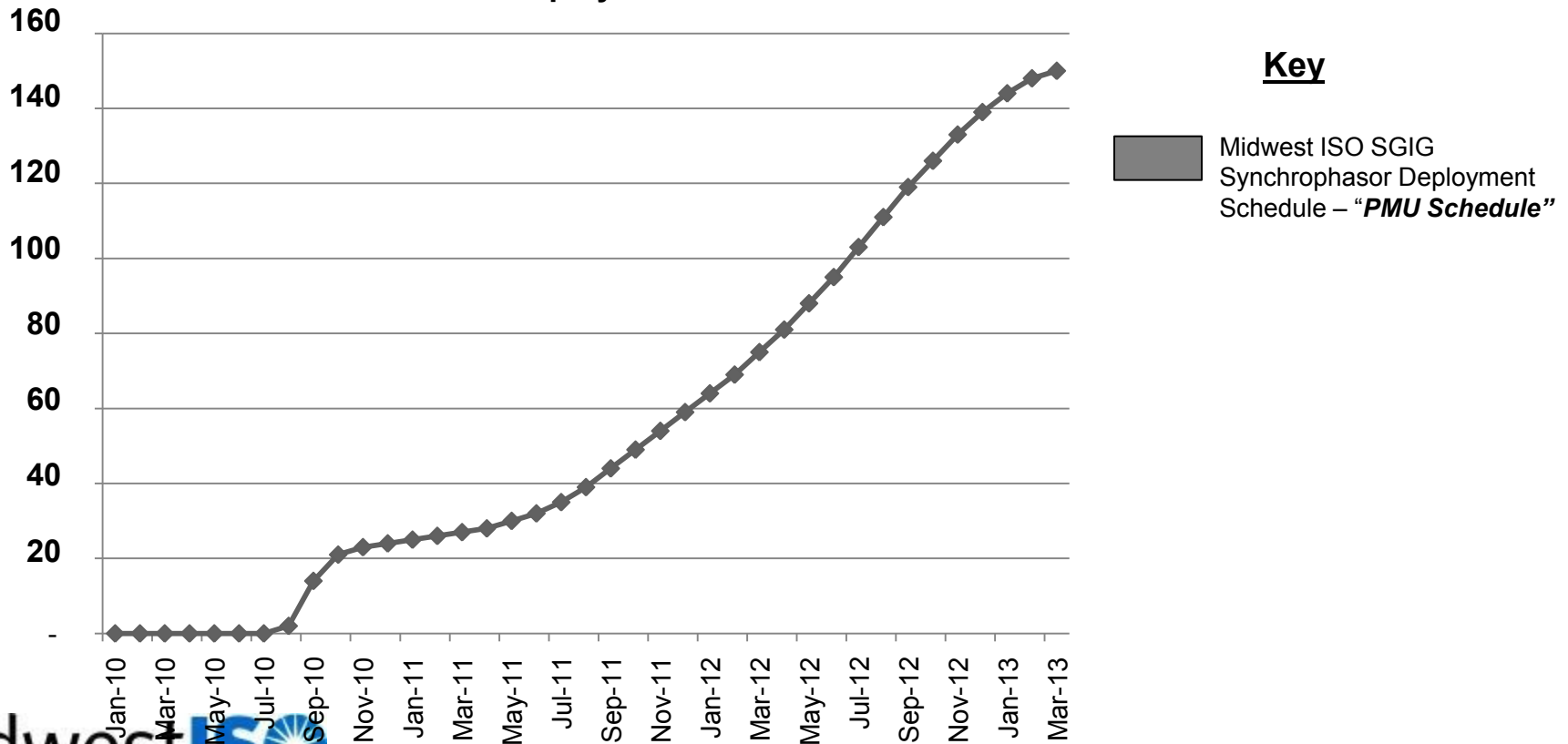
- PDCs
 - Selected Electric Power Group's ePDC as Midwest ISO's Local and Inter-RTO PDC Solution.
 - Starting to work with Electric Power Group on High Availability Requirements (both local failover and back-up site).
 - Working with PJM on Inter-RTO Data Exchange Pilot (2Q 2011).
 - For SGIG Project, current Inter-RTO Data Exchange Plan is for Multiple PDC-to-PDC Connections.
- Phasor Gateways
 - The project is monitoring NASPI Phasor Gateway discussions.
 - Security
 - Role-based Authorization
 - Areas where NASPI can provide guidance are Registry and Network Infrastructure (like NERCnet).

Project Infrastructure Overview (continued)

The graph below illustrates the deployment schedule for PMUs across the Midwest ISO footprint. The first 24 PMUs are scheduled to be deployed by the end of 2010.

Based on early costing information the Midwest ISO is likely to increase the target of networked PMUs to 200.

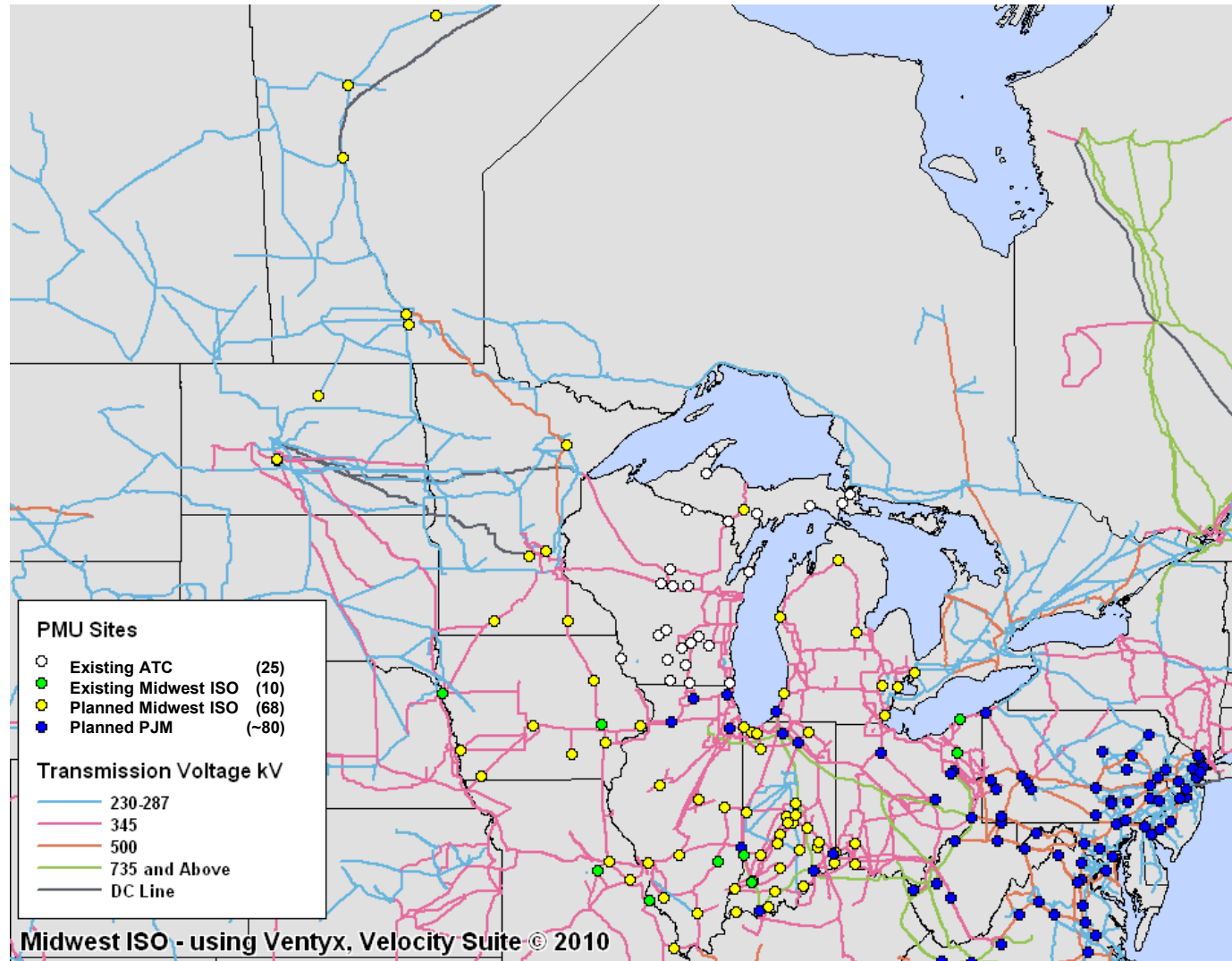
Midwest ISO PMU Deployment Schedule



Project Infrastructure Overview (continued)

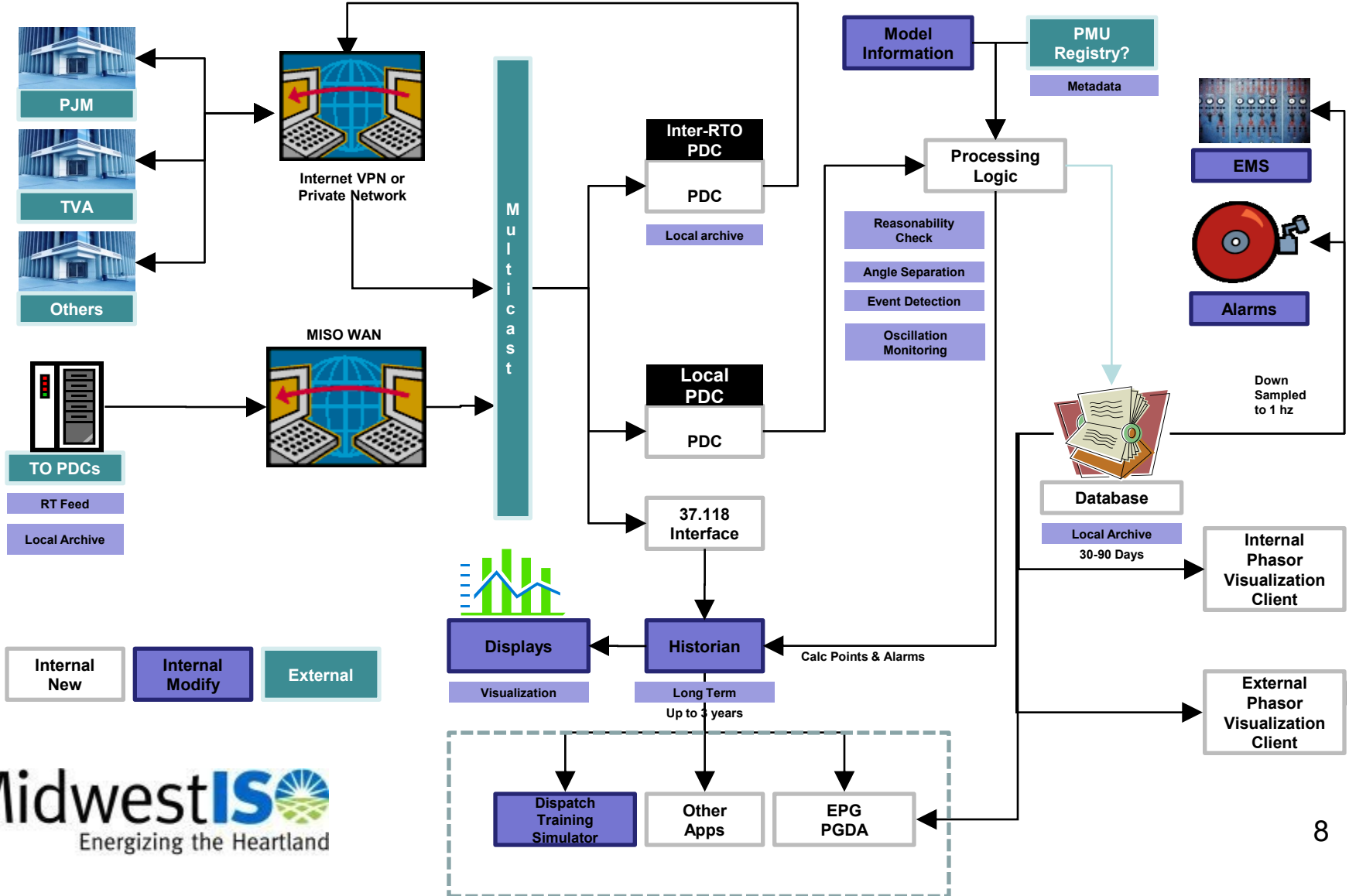
The map to the right shows confirmed PMU sites in the Midwest and Mid Atlantic region.

The Midwest ISO's SGIG project plans to add 82 to 132 PMUs (yellow dots) to the 68 sites that have been confirmed to date.



Project Infrastructure Overview (continued)

The diagram below illustrates the project's *latest* technical architecture concept.



Most Important Synchrophasor Applications

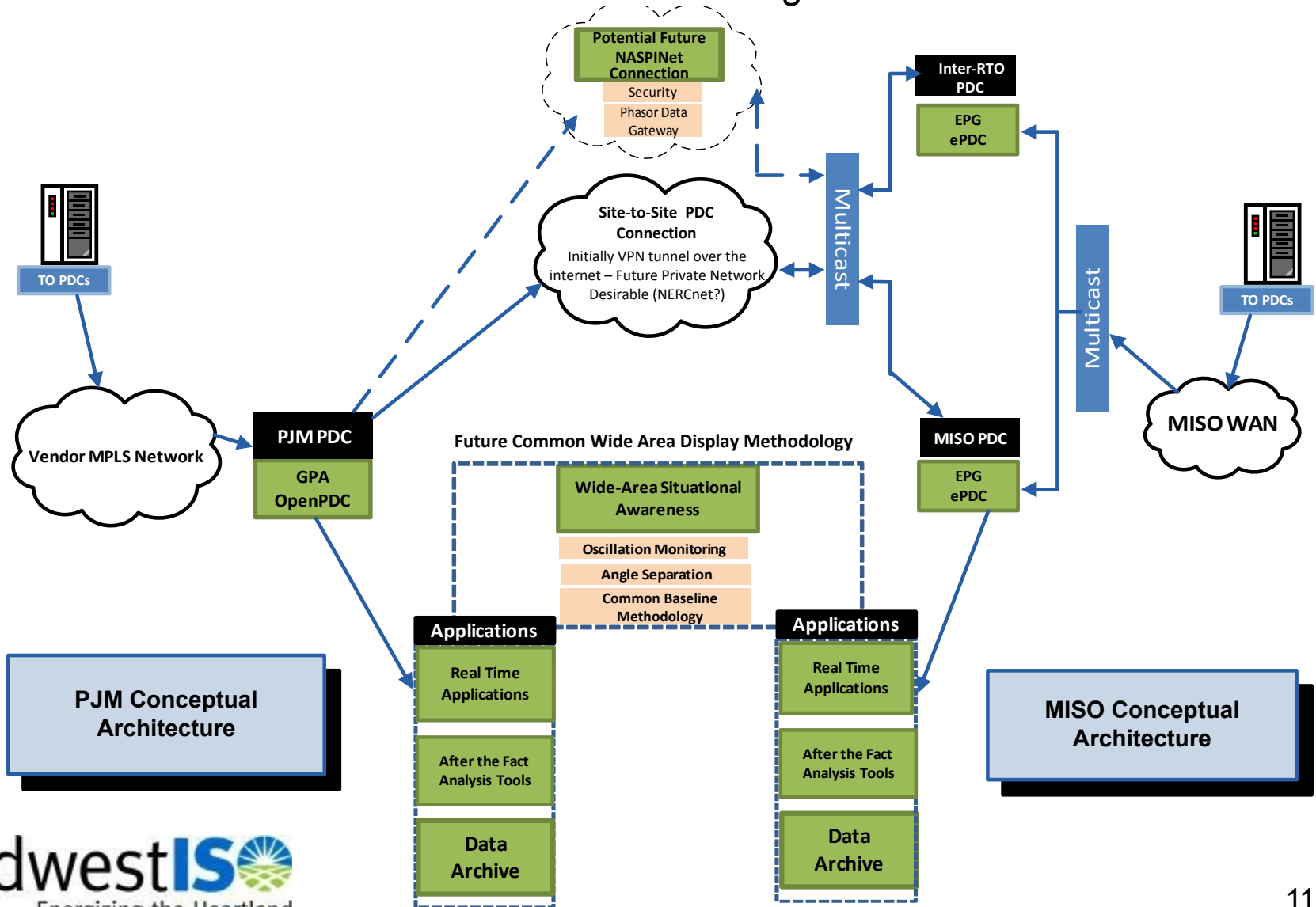
- Data Architecture
 - Transmission Owner Phasor Data Concentrator (PDC)
 - Inter-RTO and Local PDCs
 - Regional PDC and Phasor Data Gateway
 - Phasor Data Historian
- Modeling and Forensic Tools
 - Integration of Phasor Data
 - Modeling Tools
 - Forensic Tools
 - System Baseline Tools
- Real-time Operations
 - Wide Area Situational Awareness
 - Oscillation Monitoring
 - Voltage Stability Analysis
 - Contingency Analysis
 - Improved State Estimation
 - State Assessment

Data Architecture Applications

Data Architecture	Midwest ISO SGIG Scope	Observations	Next Steps
Transmission Owner Phasor Data Concentrator (PDC)	Yes	Several options exist that support C37.118.	Transmission Owners are procuring PDCs that meet published guidelines.
Inter-RTO and Local PDCs	Yes	A few options exist, but there are concerns with stability, high availability and scalability.	Midwest ISO selected Electric Power Group's ePDC and is working on high availability configuration.
Regional PDC and Phasor Data Gateway	No	Not available at this time	Current SGIG project plan is to focus on Inter-RTO solution with secure PDC-to-PDC exchanges.
Phasor Data Historian	Yes	A few options exist but early testing has determined problems with C37.118 implementation.	Midwest ISO is evaluating Data Historian solutions.

Data Architecture (continued)

Inter-RTO Data Exchange Pilot



Modeling and Forensic Applications

Modeling and Forensic (M&F)	Midwest ISO SGIG Scope	Observations	Next Steps
Integration of Phasor Data	Yes	Limited third party options for translation of Phasor Data into M&F tools.	SGIG Project Plan is to develop the integration layer to translate points (IDs and data) into desired M&F formats.
Modeling Tools	Yes	Numerous third party options exist.	The project plans on using existing Modeling Tools to improve accuracy of models.
Forensic Tools	Yes	A few third party options exist.	The Midwest ISO currently plans on using ePGDA in concert with existing tools to evaluate disturbances.
System Baseline Tools	R&D	Limited options for conducting baseline of system dynamics.	Engineering time will be allocated to establish baselines to: 1) define alarm thresholds, 2) improve static models and 3) to tune transmission applications.

Real-time Operations

Real-time Operations and Engineering	Midwest ISO SGIG Scope	Observations	Next Steps
Wide Area Situational Awareness (frequency and angle monitoring)	Yes	Options are primarily RTDMS or custom developed solution.	Working with PJM to define wide area functional and technical requirements.
Oscillation Monitoring	Yes	Options are primarily RTDMS or custom developed solution.	Working with PJM to define wide area functional and technical requirements.
Voltage Stability Analysis	R&D	Limited third party options available for testing.	Moving this area to third year of project in hopes of giving vendors more time.
Contingency Analysis	No	Limited third party options available for testing. Requires next generation EMS platform.	Eliminated from project scope.
Improved State Estimation	R&D	EMS vendor (AREVA) has plans for integrating phase data into State Estimator.	Midwest ISO has created a separate project to investigate improved State Estimation using phasor data. The SGIG project will provide data interface into SCADA.
State Assessment	No	Limited third party options available for testing. Requires next generation EMS platform.	Eliminated from project scope.

Security Approach

- Local Security (Midwest ISO and its Transmission Owners)
 - Following existing NERC and Midwest ISO Guidelines (consistent with DOE-approved Cyber Security Plan)
 - Consistent with existing ICCP model using private network (Midwest ISO WAN)
- Inter-RTO (PDC-to-PDC)
 - Current Security Approach is VPN over Internet
 - Private Network is desirable but source is unclear (NERCnet?)

Communications Approach

- What are you doing to assure interoperability and smooth data exchange across your project participants?
 - Following Existing Protocols
 - Sharing Vendor Issues with Transmission Owners
 - Conducting Validation Tests on each PMU and PDC
- How are you selecting communications architects and providers?
 - Leveraging Production ICCP Network (Midwest ISO WAN)
 - Utilizing UDP Multicast
 - Initial Inter-RTO Communication over Internet VPN
 - Long-term Inter-RTO Communication or Regional Communication over Private Network (NERCnet or other)
- How will you test the effectiveness and security of your synchrophasor communications system?
 - Following existing CIP requirements and best practices
 - Leveraging similar approach to existing ICCP Network

Other Project Areas

- What is the most challenging thing about your project?
 - Limited Application Options
 - Available Applications are NOT Production Grade
- What are the biggest challenges in resolving architecture for communications and data flow?
 - Implementation Time (Transmission Owner PMU deployment time)
 - Establishment of Private Inter-RTO or Regional PDC Communications Infrastructure
- Other useful info to share?
 - Need Advancement of Real-time Operation Application Offerings
- What can NASPI do to support your project?
 - Focus on Registry Standards
 - Focus on Regional Data Exchange Infrastructure