NASPI White Paper: Integrating Synchrophasor Technology into Power System Protection Applications

Task Force on Synchrophasor Protection Applications
NASPI Engineering Analysis Task Team

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Task Force Purpose

- Formulate a NASPI position on the future of Synchrophasors in Power System Protection
  - Comprehensive look at protection applications and utilization of synchrophasors for each
  - Perspective and timeline on utilization of synchrophasors for protection
- Develop a roadmap of future efforts and goals
- Develop a venue to showcase utility uses and expectations for Synchrophasors in power systems.

Task Force Efforts

- Task Force on Synchrophasor Protection Applications formed at the March 2015 WG meeting with over 20 members.
- Position Paper
  - Research applications of synchrophasors for protection systems
  - Identify obstacles for the proliferation of synchrophasor technology
- Industry Survey
  - Utility – Current applications and future expectations
  - Vendor – What services are offered now and in the future
  - R&D – Current research into new applications

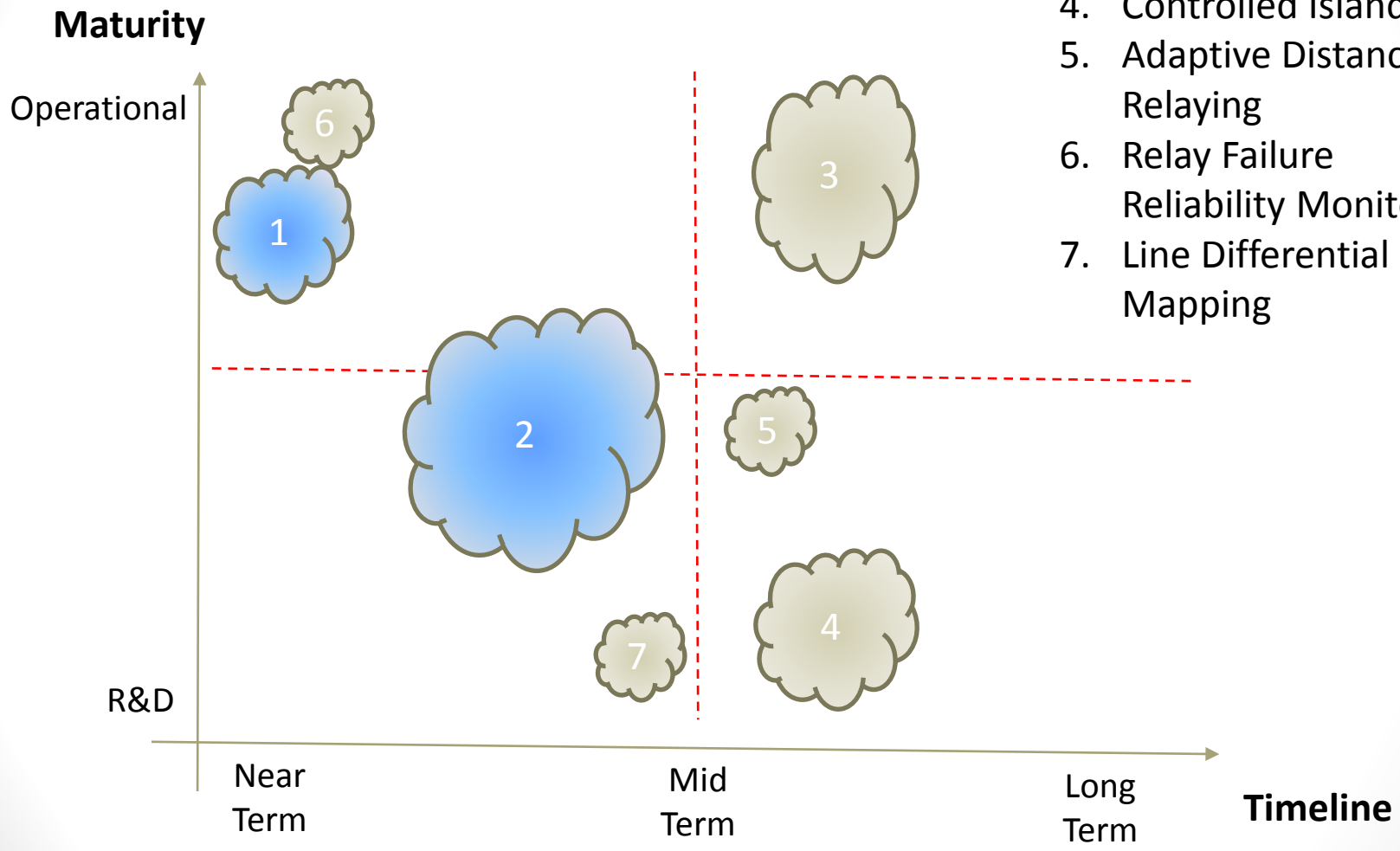
Position Paper Status

- Reviewing Protection applications
- Consolidating research contributions
- Developing Maturity/Value vs. Time

- Seeking volunteers for protection scheme descriptions and applications of synchrophasors

- Final paper expected by March 2016 WG meeting

1. Line Parameter Estimation
2. Wide-Area Protection
3. Backup Protection
4. Controlled Islanding
5. Adaptive Distance Relaying
6. Relay Failure Reliability Monitor
7. Line Differential Mapping

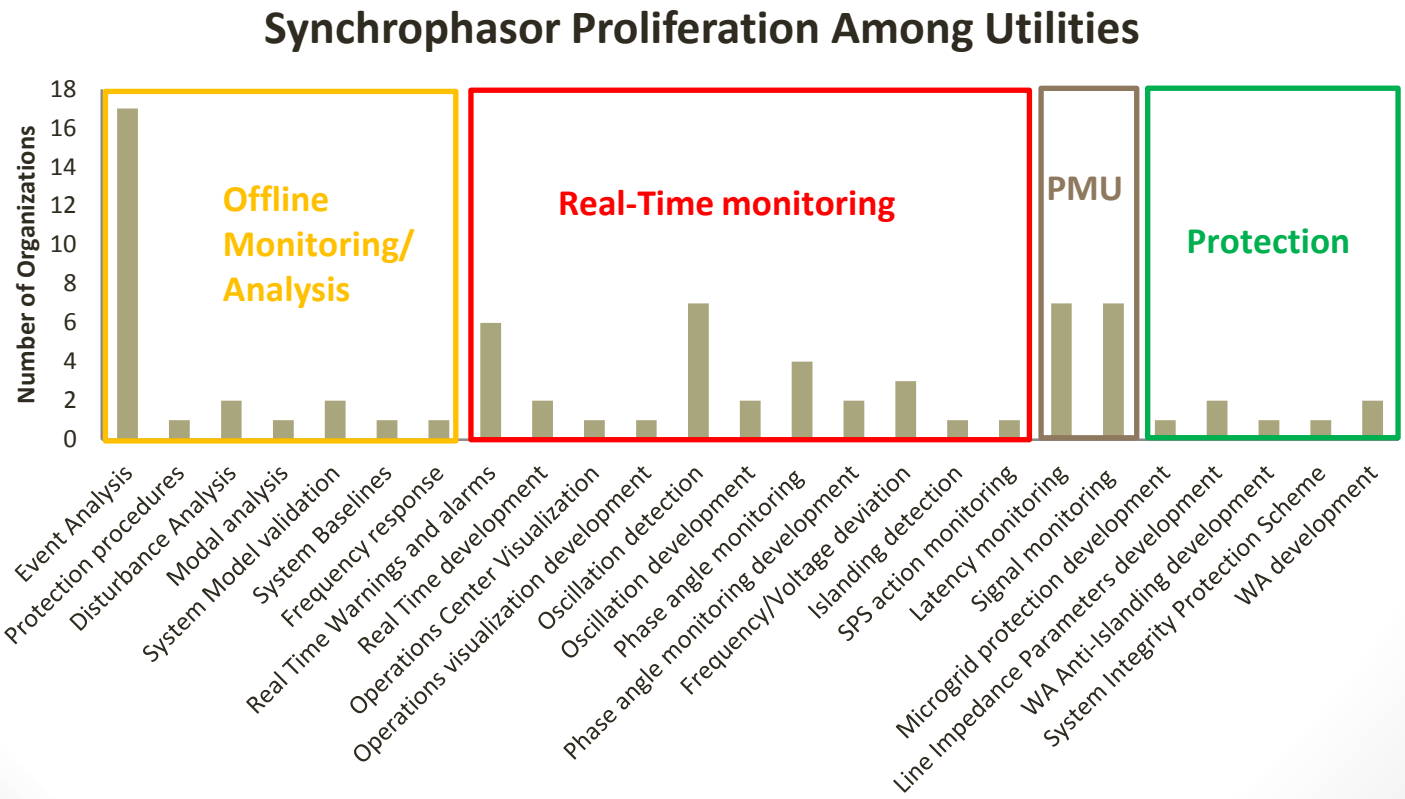


Survey

- Purpose: Pulse the industry on current utilization, obstacles, and expectations for synchrophasors applied to protection systems
- Utility survey scope
  - Those surveyed were asked to categorize their uses of Synchrophasor and their expectations for Synchrophasor protection applications
- R&D survey scope
  - Those surveyed were asked to categorize their synchrophasor application projects with the associated TRL level and their plans for the future
- Vendor survey scope
  - Those surveyed were asked to describe their synchrophasor product integration, addressing of latency and cyber security, and present and future synchrophasor applications.

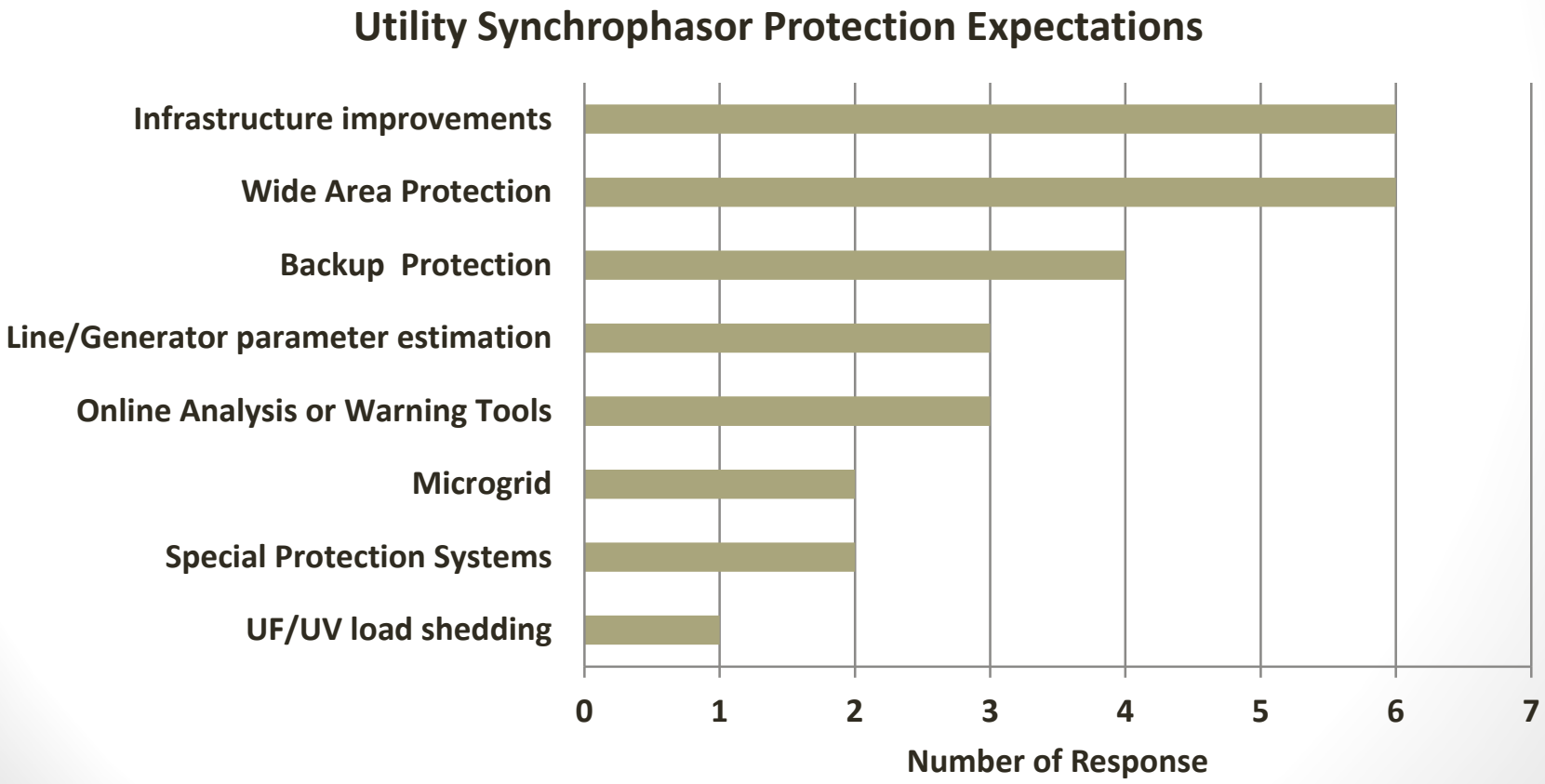
Utility Survey Results

- 27 organizations responded with a equal split of RCs and TOs
- Response to “current practices”:



Utility Survey Results

- "Utility expectations for Synchrophasors"
- 19 survey responses



R&D Survey

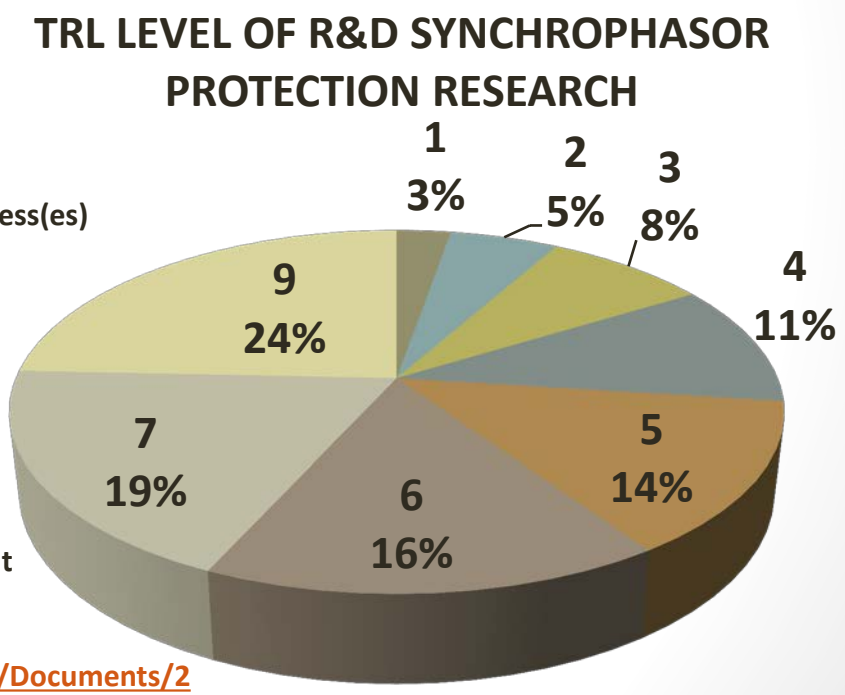
- 15 R&D organizations responded with 19 projects qualified as synchrophasor protection based
- Projects rated based on Technology Readiness Level table

Innovation Phase
TRL 1: Basic Research
TRL 2: Applied Research
TRL 3: Critical Function or Proof of Concept Established

Emerging Technologies
TRL 4: Laboratory Testing / Validation of Component(s) and Process(es)
TRL 5: Laboratory Testing of Integrated / Semi-Integrated System
TRL 6: Prototype System Verified

Systems Integration
TRL 7: Integrated Pilot System Demonstrated
TRL 8: System Incorporated in Commercial Design

Market Penetration
TRL 9: System Proven and Ready for Full Commercial Deployment



Source:
http://www.bpa.gov/Doing%20Business/TechnologyInnovation/Documents/2014/Collaborative-Transmission-Technology-Roadmap-March-2014.pdf

Vendor Survey

- 7 vendors responded

Vendor current product capability:
"PMUs (most relays and meters output C37.118), PDC (software and hardware), Visualization and archiving software …. Automated Control …"

Vendor view of Synchrophasor protection application today:
"Wide area protection due to better understanding of the system. Also, islanding detection and various over/under value detectors are already very helpful right now."

Vendor view of Synchrophasor protection application in the future:
"We believe the synchrophasor technology and its base technology, synchronized measurement, coupled with guaranteed communication latency, will be applied to an expanded list of protection areas in the future…"

Next Steps

- Finalizing survey results
- Formulating observations from survey
- Consolidating task force paper contributions
- Seeking additional participation from industry
- Developing a road map

Questions

- If you have any questions or would like to participate in this effort please contact:
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