Quanta Technology is an industry leader in synchrophasor technology and its applications, and the deployment of large scale Wide-Area Monitoring, Protection, Automation and Control (WAMPAC) systems based on the technology. We have been providing comprehensive deployment support services for several large-scale WAMPAC systems through working with a number of electric utilities and Independent System Operators (ISOs) (e.g. PJM, NYISO, Brazilian ISO ONS, Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, Bonneville Power Administration, Entergy, and many others).

Our team of experts has been heavily involved in the North American SynchroPhasor Initiative (NASPI) activities and efforts, leading, contributing and assisting in the creation of timely industry guides for adopting the synchrophasor technology and its applications. We led the NASPInet architecture design and requirement specifications development for NASPI under a U.S. Department of Energy (DOE) contract.

NASPInet was conceived by NASPI to be a North America information exchange network that enables a secure and assured quality of service exchange of synchrophasor data among all connected entities. Quanta Technology has also worked with our partners on a number of DOE-funded R&D project awards in developing advanced synchrophasor applications and technologies. Our experts actively continue to contribute in the development of many synchrophasor technology-related standards.

WAMPAC Deployment Challenges
The deployment of WAMPAC systems based on synchronized measurement technologies for operational use presents some unique challenges:

- **Accommodate diverse requirements of different WAMPAC applications:** There is a wide-range of advanced WAMPAC applications for system monitoring, operation, planning, protection, and control with diverse system requirements. How to implement a WAMPAC system that is capable of supporting all different applications is critical to the system operation, performance, management, longevity and ROI. Enhanced application functions based on use of synchrophasor-based data are evolving, such as a linear state estimator, voltage instability predictor, etc.

- **Minimize the impact of the constant changes:** The synchronized measurement, communication network, and information technologies will continue to improve/advance. WAMPAC systems are also expected to grow and expand in size and data volume on a continuous basis, while adding more and more applications / functionalities over the time. How to deploy a WAMPAC system that will be able to leverage prior investment, accommodate these changes and quickly take the advantage of the improvement/advancement with minimal impact to the system (cost and the efforts involved in making changes, system performance, etc.) is a unique challenge.

- **Address other critical issues:** WAMPAC systems will need to comply with various NERC CIP requirements, achieve a high cyber security level, interface with other systems such as EMS/SCADA systems and/or with WAMPAC systems of other entities, and so on.

To properly address these unique challenges, the technical team of a deployment project needs broad cross-disciplinary knowledge, experience and expertise in many areas including synchronized measurement technology, communication networking, information technology, power systems, market operations, cyber security, relevant interoperability standards, system integration, as well as in-depth understanding of the current status and developing trends in WAMPAC systems and applications.

*Source: NASPI map showing PMUs with synchrophasor data flows in North America (https://www.naspi.org/documents)*
The success of any WAMPAC system deployment depends on:

- Careful and thorough system planning and needs identification
- Future-proof system design and specifications
- Excellent implementation execution and testing
- Continued operation and maintenance efforts

**WAMPAC Deployment-Related Services**

Quanta Technology has a team of industry recognized experts with unmatched knowledge and expertise in the area of WAMPAC systems and applications. Our experts have worked with utility customers in this area since the invention of the technology. Our team of experts includes the working group chairs and members of IEEE and IEC synchrophasor standards, NASPI task team leader and members, and the project managers and technical leaders of the large-scale WAMPAC systems deployment projects.

These team members have assisted and are assisting clients in various stages of their WAMPAC system deployment, including business case development, deployment planning and roadmap development, system design and specification, system procurement support, project management support, PMU placement studies, PMU qualification testing, system test, and training. This unmatched in-depth knowledge and expertise allows us to provide a wide-range of services and solutions to assist our utility and industrial customers to realize tangible benefits and maximize their return on WAMPAC system investment through leverage on prior investment and the improved operation efficiency & reliability, etc.

Quanta Technology provides our expertise and services in the following WAMPAC system deployment areas:

**WAMPAC System Planning**

- WAMPAC system business case development
- WAMPAC system rate case support
- System requirements and application needs identification
- Implementation strategy and roadmap development
- Optimal PMU placement strategy development
- WAMPAC and EMS/SCADA systems integration strategy development
- Data sharing planning
- Cyber security strategy development

**WAMPAC System Design & Specifications**

- Overall system design and architect
- Phasor data concentrator specification
- Communication system and network specification
- Application specifications
- Interface specifications (e.g., EMS/SCADA systems, external WAMPAC systems)
- Pilot implementation specifications

**WAMPAC System Deployment & Implementation Support**

- Procurement RFP documents preparation
- Vendor / product selection and vendor proposal evaluation
- WAMPAC project management support
- PMU calibration and certification testing
- Application testing
- System design proof-of-concept testing
- Factory acceptance testing
- Pilot system and application implementation
- System integration, site acceptance testing and commission
- System user training

**Synchronized Measurement Technology Applications**

- Synchrophasor based online real-time monitoring and situational awareness applications
- Synchrophasor based and assisted State Estimators and data validation applications
- Intelligent big-data post-mortem analysis and information mining applications
- Synchrophasor based wide-area protections, such as system integrity protection systems (SIPS), remedial action schemes (RAS), and system protection systems (SPS)
- Synchrophasor based Smart Grid applications
- Protective relaying and adaptive protection using synchrophasors
- Substation automation with synchrophasors
- Synchrophasor applications for distribution systems
- Advanced synchrophasor applications (e.g. fault location voltage instability predictor)

**Best Practices & Standards**

- Benchmarking against worldwide best practices in the industry
- Standards interpretation, application and compliance
- NERC requirements compliance

For additional information regarding Quanta Technology’s Synchrophasor Technology & WAMPAC System capabilities, please contact Dr. Yi Hu, Director, WAMPAC, at (919) 334-3042 or yhu@quanta-technology.com.