Western Electricity Coordinating Council

# Synchrophasor Applications

# Request for Information

# Western Interconnection Synchrophasor Program (WISP)

**Version: 1.0**
**Issue Date: April 15, 2010**
**Response Deadline: May 7, 2010**

# Table of Contents

# 1 Introduction

## 1.1 PURPOSE

This request for information (RFI) is published by the Western Electricity Coordinating Council (WECC) as part of the Western Interconnection Synchrophasor Program (WISP). The purpose of this RFI is to inform software application vendors of the opportunity to participate in the WISP, and to collect information about vendor offerings for implementing synchrophasor applications in the WISP. This RFI is written for software application and technology solution providers in the energy sector that offer real-time and off-line synchrophasor applications.

The information collected as part of the RFI process will be used to understand the state of the market for synchrophasor applications, to further define the functional scope of the applications, and to determine next steps.

The objectives of this RFI process are to:

1. Understand the functionality of the synchrophasor applications available on the market.
2. Determine the maturity of the synchrophasor application space.
3. Understand the level of engineering and testing necessary to meet WISP business requirements.
4. Collect information regarding the functional boundaries of the synchrophasor applications and determine the optimal suite/mix of applications.
5. Collect information to establish the optimal architecture for the integration (data, messaging, etc.) of the synchrophasor applications.
6. Collect information needed to plan and execute the next steps of the vendor qualification and selection process.

## 1.2 CURRENT SITUATION

The objective of WISP is to deploy a large-scale synchrophasor measurement system and applications using the measurements within the Western Interconnection.

The primary deliverables of WISP are to:

1. Deploy synchrophasor data collection equipment, including phasor measurement units (PMU) and phasor data concentrators (PDC) throughout the Western Interconnection.
2. Implement a wide area network (WAN) for synchrophasor data transmission across the Western Interconnection.
3. Engineer and deploy new software applications that leverage synchrophasor data to improve wide area situational awareness, post event analysis, power system performance analysis, and system wide model validation for the Western Interconnection.

Synchrophasor data and supporting technologies will be used by WECC, participating utilities and system operators to identify and analyze system vulnerabilities and disturbances as they are developing on the bulk electric system in the Western Interconnection. This “early warning” will enable WECC to take timely actions to stabilize the power system and avoid widespread system disturbances. Synchrophasor data will be used to verify the accuracy of models used to simulate the power system in planning and operational studies. This data also can be used to evaluate the performance of the power system after a disturbance has occurred.

## 1.3 WECC BACKGROUND

WECC is the Regional Entity responsible for coordinating and promoting bulk electric system reliability in the Western Interconnection. WECC assures open and non-discriminatory transmission access among its members, and provides a forum for resolving transmission access disputes, and provides an environment for coordinating the operating and planning activities of its members as set forth in the WECC Bylaws.

WECC's service territory extends from Canada to Mexico. It includes the provinces of Alberta and British Columbia, the northern portion of Baja California, Mexico, and all or portions of the 14 Western states between.

WECC is geographically the largest and most diverse of the eight Regional Entities that have Delegation Agreements with the North American Electric Reliability Corporation (NERC). Due to the vastness and diverse characteristics of the region, WECC and its members face unique challenges in coordinating the day-to-day interconnected system operation and the long-range planning needed to provide reliable electric service across nearly 1.8 million square miles.

WECC is the successor to the Western Systems Coordinating Council (WSCC), which was formed in 1967 by 40 electric power systems. WECC was formed on April 18, 2002, by the merger of the WSCC, Southwest Regional Transmission Association, and Western Regional Transmission Association.

# 2 RFI Response Instructions

## 2.1 CORRESPONDENCE

This RFI and other supporting information regarding the WISP can be found on the WECC Web site at www.wecc.biz/awareness/Pages/WISP.aspx. Please direct all questions and correspondence related to this RFI to wisp@wecc.biz with "WECC WISP Application RFI" included in the subject line.

## 2.2 COMMITMENT

The issuance of this RFI by WECC in no way represents a commitment, or intention to commit, and WECC will not reimburse responders for expenses that occur as a result of responding to this RFI. Documentation submitted in response to this RFI shall become WECC property and will not be returned. WECC requires that confidential or proprietary data not be submitted in response to this RFI unless it is clearly marked as proprietary or confidential. WECC will summarize any such marked data and will not release specific submitted information outside of those evaluating the responses or otherwise having a direct need to know. All evaluators will maintain the confidentiality of such marked materials.

## 2.3 SCHEDULE

Please respond to the WISP RFI for synchrophasor applications by Friday, May 7, 2010. Any changes to this schedule will be communicated to participants through e-mail and posted on the WECC Synchrophasor Web site.

The current schedule for the RFI response:

- Release Application RFI Thursday, April 15, 2010
- RFI Responses Due Friday, May 7, 2010

## 2.4 RFI RESPONSE FORMAT

### 2.4.1 COVER LETTER

The cover letter shall be in the form of a standard business letter and shall be signed by an individual authorized to legally represent the vendor. It shall include the following:

1. A statement specifying whether or not proprietary data has been included in the RFI response.
2. The availability of product and support services.

### 2.4.2 DOCUMENT

Acceptable response formats include MS Word (versions 2007 or '97-2003') and Adobe Acrobat PDF files sent via e-mail to WECC at: WISP@wecc.biz.

Any graphics included in the response should be able to be viewed by MS Word or Adobe Acrobat.

All answers and respondent-provided information should follow the RFI format.

### 2.4.3 ADDITIONAL INFORMATION

The response may include additional information deemed important and not otherwise requested by the RFI's functional, technical, or general business questions. This information may include emerging technology information, recommendations on technical and/or functional direction or information that differentiates your company, solution, products or services.

## 2.5 COMPANY INFORMATION

Please provide the following information with your RFI response:

- Company name, address and contact information for the company.
- Legal structure of the company (corporation, partnership, sole proprietorship, etc.).
- Provide the names of Company Principals
- Information on public trading and stock symbol.
- Company mission statement.
- A company statement regarding its volume of business, credit worthiness and financial stability.
- Company financial information already prepared by the company including recent financial annual report, current balance sheet, and profit and loss statements.
- General information regarding how long the company has been providing energy technology products and/or services.
- Any qualifications your company has as a minority business enterprise, women business enterprise or small business.

### 2.5.1 RELEVANT STAFF EXPERIENCE

Please describe your company's staffing:

- Functional background - number of employees, position, responsibilities, and qualifications.
- Technical background - number of employees, position, responsibilities, and qualifications.
- Identify any subcontracting companies you routinely use in accomplishing similar work. Describe their qualifications and staffing.

### 2.5.2 SOFTWARE AND SUPPORT SERVICES

Please describe your service model for providing software applications, maintenance and support services. Include service offerings, delivery and pricing. This information will be used for application delivery budget estimates in the planning phase of the project.

- Software applications – describe the software modules available and the pricing model (user license, application license, corporate license).
- System installation, configuration and integration services – describe the services your company offers to support the installation, configuration and integration of the synchrophasor applications.
- Ongoing support and maintenance of software applications (annual fees, hourly rates, etc.).

## 2.6 REFERENCES

Please provide three (3) references or client sites that we may contact that have installed the vendor's synchrophasor applications. Please include the following for each reference:

- Client business name and address.
- Client contact name, telephone number and e-mail address.
- Description, scope and use of the applications installed at the client site.

# 3 System Overview and Architecture

The full scope of WISP includes the deployment of phasor measurement units (PMU), phasor data concentrators (PDC), a wide area network (WAN) and synchrophasor applications. The total synchrophasor system is intended to improve situational awareness, system wide modeling, performance analysis and limited automatic controls for the Western Interconnection. The target of this RFI is the synchrophasor applications including real-time, wide area situational awareness applications used to monitor grid reliability, off-line applications used to improve power system performance, post event analysis and system wide model validation.

## 3.1 DATA ARCHITECTURE

The architecture for the synchrophasor system is in a preliminary design phase. The program is interested in receiving input from respondents concerning the preliminary data and integration architecture designs. The architecture diagram below shows the WECC components, the WAN and a typical configuration of the PDC and PMU installations within the firewalls of a partner entity. This information is provided to give respondents insight into the planned architecture for synchrophasor data collection, concentration, storage and redundancy.

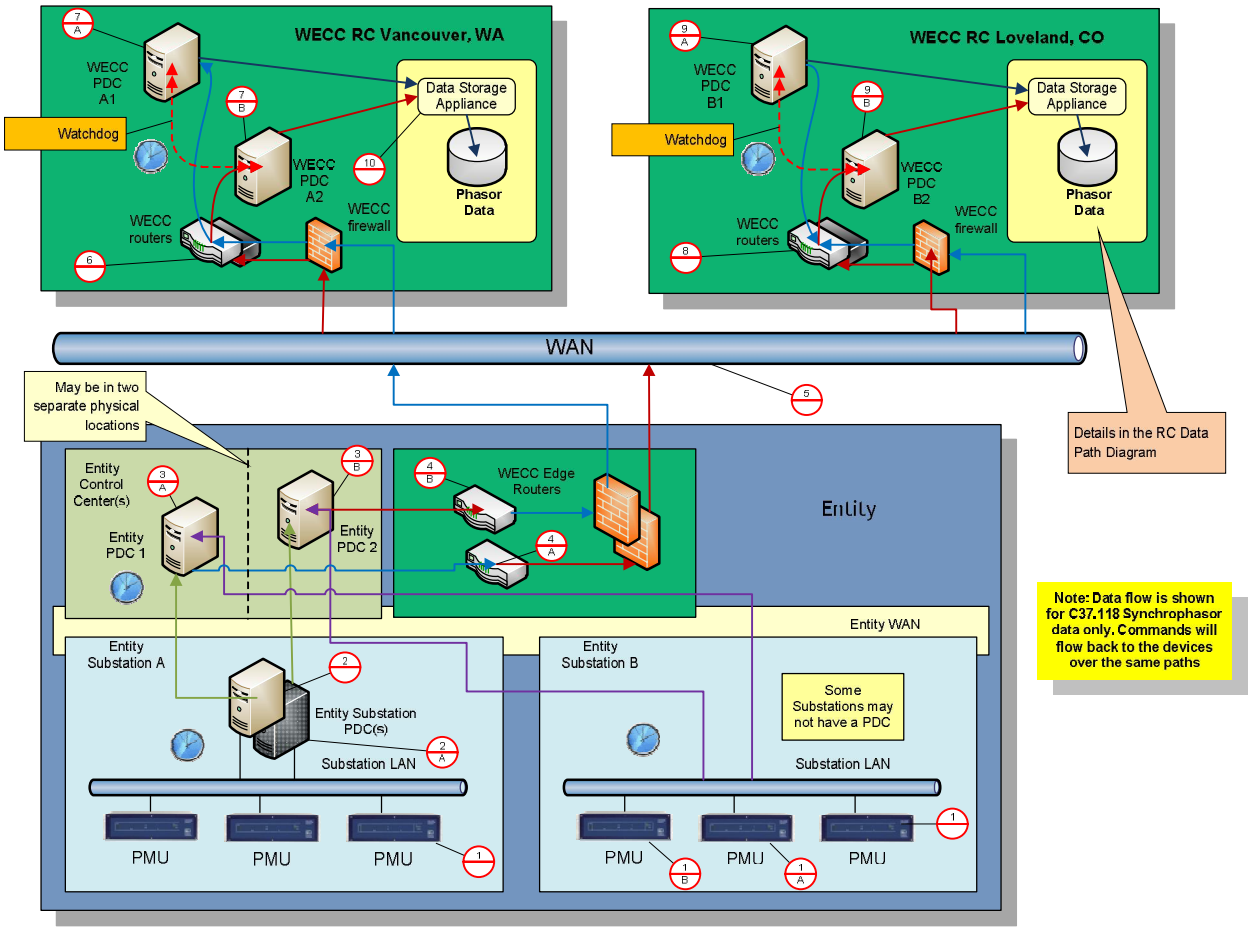


**Figure 1: Data Architecture**

## 3.2 INTEGRATION ARCHITECTURE

The software applications will use the synchrophasor data and other wide area information input, to provide real-time situational awareness applications for decision making. This includes Energy Management System/Supervisory Control and Data Acquisition (EMS/SCADA) data, the power network model, and nonelectrical information (weather, traffic, fire, earthquake, etc.).

The preliminary design for the integration architecture shows the portfolio of software applications, messaging protocols and potential integration points in a Service Oriented Architecture (SOA). The program is interested in input on integration architecture design alternatives.

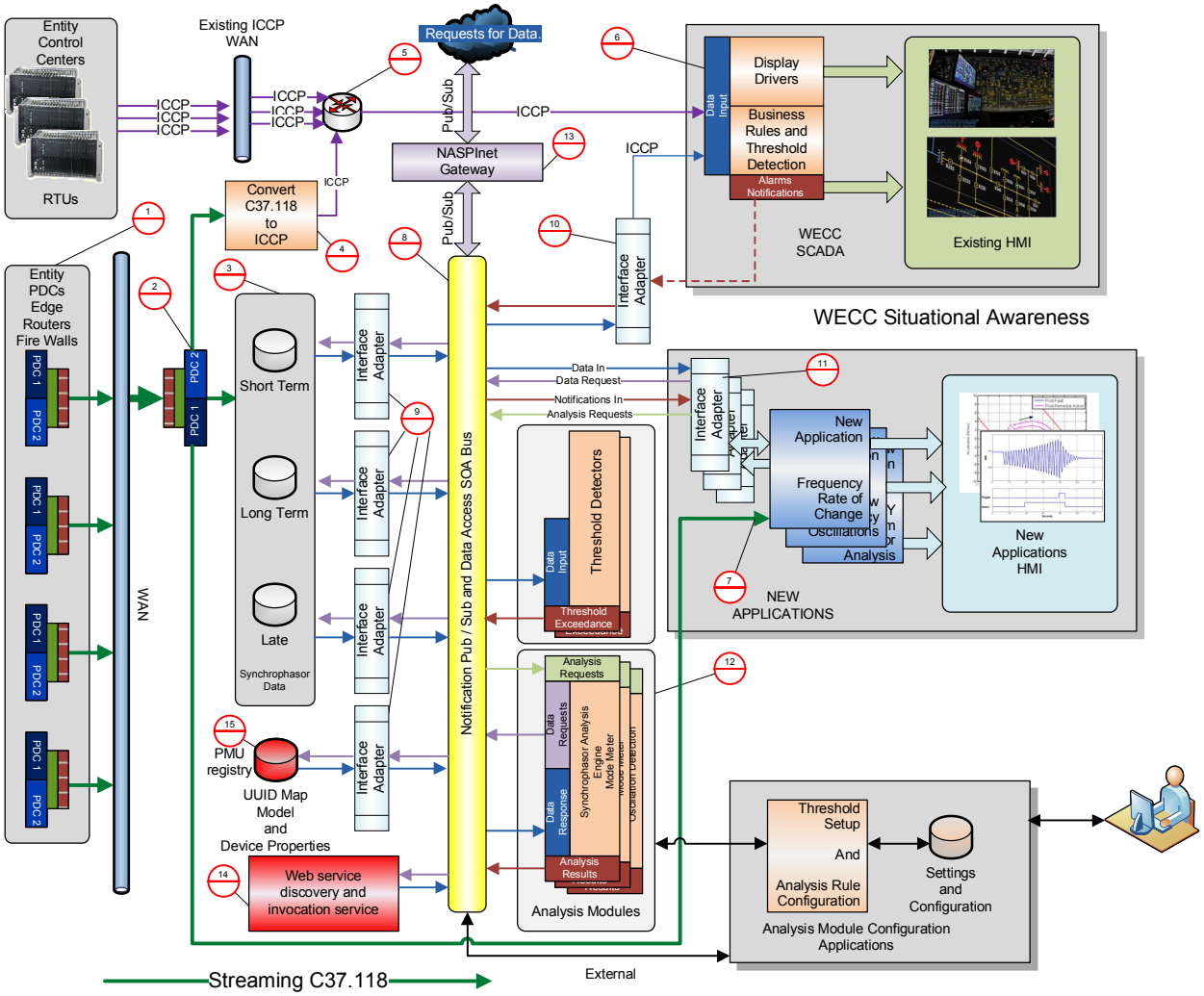


**Figure 2: Integration Architecture**

# 4 Synchrophasor Application Functionality

The synchrophasor application functionality within the scope of WISP is listed below. Please respond to the questions in Section 5 with information regarding your company's products or solutions that address the synchrophasor application functionality.

- Further detail about the target functionality can be found on the WECC Web site (http://www.wecc.biz/awareness/Pages/WISP.aspx). Review the Final WECC Synchrophasor Whitepaper 07-17-09, and in the WISP Project Plan_SGIG Application 08-06-09.

1. **Real-time data display for wide area visualization**
   - 1.1. Frequency and frequency rate of change
   - 1.2. RMS voltage
   - 1.3. RMS current (line)
   - 1.4. Phase angle
   - 1.5. Positive sequence voltage
   - 1.6. Positive sequence current
2. **Calculation and real-time display for wide area visualization**
   - 2.1. Path flow
   - 2.2. Reactive capacity/reserves
   - 2.3. Voltage stability
   - 2.4. Oscillation energy
   - 2.5. Mode meter
   - 2.6. Percent damping
3. **Monitoring of real-time PMU data and calculated data for alarms**
   - 3.1. Frequency
   - 3.2. RMS voltage
   - 3.3. RMS current
   - 3.4. Phase angle
   - 3.5. Path flow
   - 3.6. Reactive capacity/reserves
   - 3.7. Voltage stability
   - 3.8. Oscillation energy
   - 3.9. Mode meter
   - 3.10. Percent damping
4. **Display options of all PMU and calculated values**
   - 4.1. X/Y 2-dimensional
   - 4.2. Polar chart of phase angle
   - 4.3. X/Y/Z 3-dimensional
   - 4.4. State values of alarms
   - 4.5. Grid text in rows and columns
5. **Alarm management**
   - 5.1. Set warning and alarm thresholds or limits
   - 5.2. Playback and archive of alarm
   - 5.3. Set alarm prioritization / levels
   - 5.4. Capture of events based on alarms
   - 5.5. Visualization of alarm status in real-time
6. **Power system performance and post event analysis**
   - 6.1. Post event analysis
   - 6.2. Power system performance baseline
   - 6.3. Power system performance analysis
7. **System wide model validation**
   - 7.1. Generation model validation
   - 7.2. High voltage DC intertie
   - 7.3. Load model validation
   - 7.4. System model verification
8. **Export of all data in common formats**

# 5 RFI Response Questions

Please answer the following questions regarding your company's products or solutions for the functionality listed in Section 4.

| ID# | RFI response questions | Y/N |
|---|---|---|
| **A** | **PRODUCT QUESTIONS** | |
| A1 | Does your company have a software product that addresses the real-time data display for wide area visualization functionality listed? | |
| A2 | Does your company have a software product that addresses the calculation and real-time display for wide area visualization functionality listed? | |
| A3 | Does your company have a software product that addresses the monitoring of real-time PMU data and calculated data for alarms functionality listed? | |
| A4 | Does your company have a software product that addresses the display options of all PMU and calculated values functionality listed? | |
| A5 | Does your company have a software product that addresses the alarm management functionality listed? | |
| A6 | Does your company have a software product that addresses the power system performance and post event analysis functionality listed? | |
| A7 | Does your company have a software product that addresses the system wide model validation functionality listed? | |
| A8 | Does your company have a software product with functionality to that allows the user to export data to several file format options for off-line study by industry standard power flow and model validation applications? If yes, which applications are supported by the export function? | |
| A9 | If you do not have a software product available for the functionality above, is it in your future development plans? | |
| A10 | If data export functionality is available, what filtering options does it have? | |
| A11 | What is the name and version of the software that provides this functionality? | |
| A12 | Is the product currently installed and operational at client site(s)? If so, how many client site have it installed? | |
| A13 | Do you have a functional roadmap for the product? If yes, please provide it in the additional information section of the response. | |
| A14 | Was the product design based on a published set of technical design standards? | |
| A15 | Was the product's graphical user interface (GUI) built based on a published set of human machine interface (HMI) standards? | |
| B | **FUNCTIONALITY QUESTIONS** | |
| B1 | Does the application have frequency and frequency rate of change monitoring functionality? | |
| B2 | Does the application have voltage monitoring functionality? | |
| B3 | Does the application have current monitoring functionality? | |
| B4 | Does the application have phase angle monitoring functionality? | |
| B5 | Does the application have functionality for the contour plotting of PMU data including voltage and phase angle? | |
| B6 | Does the application have active and reactive power flow monitoring functionality? | |
| B7 | Does the application have power plant reactive reserve monitoring functionality? | |

| ID# | RFI response questions | Y/N |
|---|---|---|
| B8 | Does the application have oscillation energy monitoring functionality? | |
| B9 | Does the application support user setup and preferences? | |
| B10 | Does the application support options of data source: real-time, playback and archive? | |
| B11 | Does the application provide world-view geographical display? | |
| B12 | Does the application provide graphical interconnection wide visibility? | |
| B13 | Does the user interface allow users to drill, pan, zoom, tilt and rotate? | |
| B14 | Does the application support additional “layers” of visualization? | |
| B15 | Does the application support a weather layer? | |
| B16 | Does the application support a wind layer? | |
| B17 | Does the application support a rain layer? | |
| B18 | Does the application support a lightning layer? | |
| B19 | Does the application support an earthquake layer? | |
| B20 | Does the application support a fire layer? | |
| B21 | Does the application support a phase angle topography layer? | |
| B22 | Does the application support a voltage topography percent layer? | |
| B23 | Does the application support alarm reporting/logging? | |
| B24 | Does the application support alarm threshold setting/modification? | |
| B25 | Does the application support a variety of alarm methods (audible, visual, etc.)? | |
| B26 | Does the application support grid operator decision aid for system conditions beyond nominal (in the alarm range)? | |
| B27 | Does the application support real-time alarms on threshold violations? | |
| B28 | Does the application support real-time oscillation detection alarms? | |
| B29 | Does the application support real-time external alarms? | |
| B30 | Does the application support real-time e-mail notifications? | |
| B31 | Does the application support reporting functions such as long-term trends and statistics? | |
| B32 | Does the application support PMU performance reports? | |
| B33 | Does the application support alarm log summary reports? | |
| B34 | Does the application use “good” and “bad” colors to represent triggered and cleared alarms throughout visualization displays? | |
| B35 | Are the alarm sounds globally configurable to maintain common sounds? | |
| B36 | Are the alarm thresholds that trigger (or clear) alarms dynamically and globally maintained? | |
| B37 | Are the alarm intelligence options configurable (duration, count, frequency, group, etc.)? | |
| B38 | Can the application detect and log any changes to the warning setting? | |
| B39 | Can the application detect and log any changes to the alarm setting? | |
| B40 | Can the application detect when value enters into and out of warning level? | |
| B41 | Can the application detect when value enters into and out of alarm level? | |
| B42 | Can the application detect the frequency of each PMU? | |
| B43 | Can the application detect the voltage of each PMU? | |
| B44 | Can the application detect the current of each line PMU? | |
| B45 | Can the application combine lines of designated PMUs to make a path, and then detect path loading? | |
| B46 | Can the application detect reactive flow of PMU? | |

| ID# | RFI response questions | Y/N |
|---|---|---|
| B47 | Does the application have the ability to display the “health status” of the PMU data? | |
| B48 | Can the application detect rate-of-change of frequency? | |
| B49 | Can the application detect rate-of-change of voltage? | |
| B50 | Can the application detect rate-of-change of path flow? | |
| B51 | Can the application detect rate-of-change of phase angles? | |
| B52 | Can the application detect the phase angle relationship of each PMU to its reference? | |
| B53 | Can the application detect oscillation energy in each mode meter algorithm? | |
| B54 | Can e-mail notification of selected alarms be sent to selected recipients? | |
| B55 | Does an API or process exist to export alarms and supporting meta-data? | |
| B56 | Does the application have functionality to locate events from the alarm log and extract data for analysis? | |
| B57 | Does the application have functionality to place the system into playback mode and select any historic start time? | |
| B58 | Does the application have functionality to instantiate any detail display at any PMU for playback? | |
| B59 | Does the application have functionality to run playback repeatedly and in slow motion? | |
| B60 | Does the application have functionality to modify display details and rerun playback? | |
| B61 | Does the application have functionality to run RMA to locate historical occurrences of patterns? | |
| B62 | Does the application have functionality that allows the user to submit results to the Wide Area Situational Awareness application for viewing? | |
| B63 | Does the application have functionality that allows the user to export results to several common file format options for off-line study? | |
| B64 | Does the application have functionality to handle other sources of data besides PMU data? | |
| B65 | Does the application have an interface to a state estimator? | |
| B66 | Does the application have functionality to process EMS/SCADA data such as breaker status? | |
| C | **TECHNICAL QUESTIONS** | |
| C1 | Do you have documentation regarding the technical architecture? If possible, please provide it in the additional information section of the response. | |
| C2 | Is the application designed to handle integration in an SOA (Service Oriented Architecture)? | |
| C3 | Does the application’s integration/messaging use specific standards or tool sets? | |
| C4 | Does the application have an API designed to meet the NASPI to Phasor Gateway specification? | |
| C5 | What other applications interface with the primary application? Please provide an integration map. | |
| C6 | Does the application have any configurable Application Programming Interfaces (API) that have been built and tested? If yes, are all capabilities of the software accessible via the API, or is there only a limited subset? | |
| C7 | Please in describe in detail the API development environment, i.e. C++, Java, Python, etc. | |
| C8 | On which platforms (os, db, etc.) is the application certified to run? | |
| C9 | Is the application designed for redundancy? Please supply design details and calculations. | |
| C10 | Does the application handle IEEE C37.118-2005 streaming data? | |
| C11 | Is the application designed to handle redundant data streams of IEEE C37.118-2005 streaming data? | |
| C12 | Is the application designed to have an availability of 99.999%? | |

| ID# | RFI response questions | Y/N |
|---|---|---|
| C13 | How does the software application handle security? | |
| C14 | Does the application comply with NERC CIP-002 through CIP-009? | |
| C15 | Can security be applied based upon user or user group authorization? For example, based upon the user profile, a user will not be allowed to see certain data or modify certain settings. | |
| D | **TESTING AND DEPLOYMENT** | |
| D1 | Describe your typical quality assurance (QA) and testing approach. Is there factory acceptance (FAT), site acceptance (SAT) and operational testing? | |
| D2 | Are there existing QA plans, test scripts and/or test cases that can be leveraged to test the application? | |
| D3 | Does your company leverage a QA management tool to manage testing and defect tracking? | |
| D4 | Does your company have a formal software release management process? | |
| D5 | Does your company manage the code with a configuration management tool? | |
| D6 | Does your company have formal training materials for application end user training? | |
| D7 | Does your company have formal training materials for application support and administration training? | |
| D8 | Does your company provide implementation and deployment services to assist in implementation and cutover of the application? | |
| D9 | Does your company provide ongoing support and maintenance for the application? | |