Concept White Paper

Concepts for Proposed Content of Eventual Standard(s) for Project 2009-02: Real-Time Monitoring and Analysis Capabilities

Real-time Monitoring and Analysis Capabilities
Standard Drafting Team
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1.0 INTRODUCTION

FERC Order 693 indicates the need for a minimum set of capabilities to be available for System Operators to assist in making Real-time decisions. The work done by the Real-time Tools Best Practices Task Force (RTBPTF), which was formed by NERC in response to the *Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations,* is the basis for the Real-time Monitoring and Analysis Capabilities SAR that was approved by the Standards Committee in April 2010 and the subsequent appointment by NERC of a Standard Drafting Team (RMACSDT) to develop a standard to satisfy the proposed issues described in the SAR utilizing the results-based standards methodology.

This White Paper is a description of the present thinking of the RMACSDT regarding standard requirements for Real-time monitoring and analysis capabilities. The paper consists of four sections that describe the major areas proposed to be addressed by the eventual standard(s). These areas are:

- Section 2 - Monitoring
- Section 3 - Data exchange
- Section 4 - Alarming
- Section 5 – Analysis

The SDT will also be crafting an Implementation Plan for any eventual standard(s) that will be vetted by the industry through comments and that will allow for sufficient time for applicable entities to bring their systems into compliance with any new requirements.

2.0 MONITORING

Monitoring is the first component in the process of establishing situational awareness for the System Operators so that they can rapidly assess the state of the Bulk Electric System (BES). In the context of this standard, "monitoring" implies System Operators viewing data in a manner that allows them to determine the state of the BES in Real-time and to take corrective and preventive actions when necessary. The types of data to be considered by the standard are:

- Real-time analog and status
    - Scanned
    - Calculated

For purposes of monitoring as described in this paper, this is data scanned by a central system from Data Collection Units (DCU) such as Remote Terminal Units (RTUs).

Calculated values are treated the same as scanned values in this paper.

It is proposed that requirements for monitoring will be applicable to Reliability Coordinators, Transmission Operators, and Balancing Authorities.

The following requirements are proposed for monitoring of Real-time data. These requirements assume that the Responsible Entity is utilizing an Energy Management System (EMS) and/or Supervisory Control and Data Acquisition (SCADA) system to collect the Real-time data.

2.1 PERFORMANCE

A performance parameter is proposed for each category of data collected and the data displayed to the operator.

2.1.1 Status Data

Status data shall be collected at a scan rate not to exceed 4 seconds.

2.1.2 Analog Data

In many systems analog data is collected at multiple scan rates depending on the applications in which the data is being used. It is proposed that all analog data, except the data identified in the BAL standards, is scanned at a rate not to exceed 10 seconds - the rate suggested in the RTBPTF report.

2.1.3 Data Display

All active displays utilized for visualization of the data discussed above shall update by the end of the next status or analog scan cycle, as stated above, following the scan in which the data was received by the central system. For example, status data should be updated within 4 seconds following the receipt of the scan by the central system.

2.2 AVAILABILITY

The SDT proposes two requirements for availability:

- A demonstrable procedure shall be developed describing the alternate plans and/or mitigating measures entities have in place when the data used to monitor BES or perform analyses on BES (see Section 5) becomes unavailable

- For each DCU, availability shall be calculated by dividing the number of “good” scans received at the central system by the number of scans scheduled to be received in a calendar month. (A ‘good’ scan is a complete packet of requested data returned to the central system.) The ratio of scans received to scans scheduled shall exceed 99% for a

calendar month. This calculation can include alternate or backup data sources that provide data when the primary DCU is unavailable.

2.3 FAILURE NOTIFICATION

'Failure' is assumed to occur when a scan is not completed for any reason and it shall be notified after the 9th consecutive 'failure' occurs. The System Operator shall be notified of such failure within 60 seconds of the 9th consecutive 'failure'.

2.4 MAINTENANCE

Each Responsible Entity shall provide the System Operator with approval authority for planned maintenance that impact monitoring capabilities.

3.0 DATA EXCHANGE

Data exchange, as discussed in this paper, refers to electronic exchange of data between two computer based control systems (EMS and/or SCADA) whether they are internal or external to each other. It is assumed that the data links discussed will utilize ICCP or an equivalent protocol. Data exchange, in this context, does not include RTUs or other similar types of DCUs. Required data sets to be exchanged are covered in proposed IRO-010-2 and TOP-003-2.

ICCP is the Inter-Control Center Communications Protocol (ICCP or IEC 60870-6/TASE.2 or latest release). It is an international standard used by utility organizations to provide data exchange over wide area networks (WANs) between utility control centers, utilities, power pools, regional control centers, and Non-Utility Generators.

Collecting and exchanging real-time data on power system status is one of the elementary steps in the complex process of developing the information that System Operators need to maintain situational awareness. Real-time reliability tools such as the state estimator and contingency analysis can only provide results that accurately represent current and potential reliability problems if these tools have Real-time analog and status data. The accuracy of the information that Real-time reliability tools provide depends on the accuracy of the data supplied to the tools. The quality of the results that Real-time reliability tools produce is also influenced by the breadth and depth of the portion of the BES for which Real-time data are collected, relative to the breadth and depth of the relevant Reliability Entity's area of responsibility.

It is proposed that requirements for data exchange will be applicable to the Reliability Coordinator, Transmission Operator, Balancing Authority, and Generation Operator.

The following requirements are proposed for data exchange of Real-time data. These requirements assume that the Responsible Entity is utilizing an EMS and/or SCADA system utilizing ICCP or an equivalent protocol to exchange data.

3.1 PERFORMANCE

The SDT proposes the following requirements for data exchange performance:

- ICCP (or equivalent) data exchange must be redundant and the redundancy must be supplied through diverse routing.

- Entities shall develop data exchange agreements and comply with data specifications.

- Data exchange agreements must include the following:
    - Interoperability of ICCP and equivalent systems
    - Data access restrictions
    - Data naming conventions
    - Data management and coordination including data quality
    - Joint testing and data checkout
    - Monitoring of availability
    - Responsibility for failures
    - Restoration process

3.2 AVAILABILITY

The SDT proposes the following requirements for data exchange availability:

- Establish procedure for actions to be taken if some or all of the data exchanged is not available for a 30 minute timeframe.

3.3 FAILURE NOTIFICATION

Notification of link failure must be made to the System Operator within 60 seconds of when link failure occurred. Failure is identified as the inability to receive a complete data set regardless of reason.

3.4 MAINTENANCE

Each functional entity shall provide System Operators with approval authority for planned maintenance of its data exchange capabilities. Coordination with affected entities is required.

4.0 ALARMING

Alarms must be generated to alert System Operators in Real-time to events and conditions affecting the state of the BES. Alarms can be audible and/or visual. Alarms must be generated for the following reasons:

- Limit violations (for any defined limits including multiple limits on a single point)
- Uncommanded status changes
- DCU unavailability
- Data exchange link unavailability

Alarms are important to the safe and secure operation of the BES. System Operators depend on alarms to identify problems occurring or about to occur. All values measured or calculated by the EMS and/or SCADA must be subject to processing to determine either change of state or limit violations. If either of these conditions occurs, an alarm must be generated.

It is proposed that requirements for alarming will be applicable to Reliability Coordinators, Transmission Operators, and Balancing Authorities.

The following requirements are proposed for alarming of measured and calculated data.

4.1 PERFORMANCE

Performance issues such as volume and throughput of alarms are recognized as potential concerns but are generally handled in initial EMS/SCADA vendor specifications. It would be difficult if not impossible to measure in a production system. Therefore, no performance requirement is anticipated as part of this project.

4.2 AVAILABILITY

The SDT proposes the following requirements for alarming availability:

- No specific numeric value will be proposed for alarming availability.

- Establish a procedure for actions to be taken when the alarming functionality is unavailable for 10 consecutive minutes (see RTBPTF report, page 117, paragraph 4). For example, the Reliability Coordinator 'backs up' the Transmission Operator/Balancing Authority and vice versa and entities inform each other of failure of their alarming capability.

4.3 FAILURE NOTIFICATION

Notification of failure of the alarm processing function must be made to the System Operator within 60 seconds of when failure is detected. Notification of failure of alarming capability must be accomplished through independent failure notification where the system creating and presenting the notification is independent of the alarming functionality.

4.4 MAINTENANCE

Each functional entity shall provide System Operators with approval authority for planned maintenance of its alarming capabilities.

5.0 ANALYSIS

The intent of analysis in the context of this white paper is to focus on determining the current condition or state of the BES and evaluate the impact of 'what if' events on the state of the BES. The meanings of "current" and "what-if" are:

- Current - The current system condition or state is a function of the most recent system bus voltages, system topology, frequency, and line flows.

- 'What if' - Analyze the impact on the security of the current power system state of specific Contingencies or simulated outages of the BES such as lines, generators, or other equipment. This analysis should also include other system condition changes that would affect the BES such as Load. The analysis identifies problems such as line overloads or voltage violations that will occur if the system event or Contingency takes place.

The capability to determine the current state of the BES is critical for the System Operator to determine violations of reliability criteria in their area. By accurately determining the current state of the BES, the System Operator is thus capable of evaluating various 'what if' scenarios. Having the results of the 'what if' events before they happen allows System Operators to take the appropriate actions to prevent violations or have plans ready if such Contingencies were to occur.

It is proposed that requirements for analysis will be applicable to the Reliability Coordinator and Transmission Operator.

The following requirements are proposed for analysis of the current and "what-if" states of the BES.

5.1 PERFORMANCE

The requirements for Performance will address periodicity and quality.

5.1.1 Periodicity

The current and "what-if" analyses shall run based on the following conditions:

- Current analysis - Automated program required that runs periodically at no more than a 5 minute interval to determine the system's current condition or state. The analysis may be either a program that runs on the Reliability Coordinator's or Transmission Operator's EMS or through contracted services (3rd party, Reliability Coordinator, or other Transmission Operator).

- "What if" analysis - Automated program required that runs periodically at no more than a 10 minute interval (from pg. 117 of Blackout Report - #4.b) to analyze the impact on the security of the current power system state for specific Contingencies or simulated outages of the BES such as lines, generators, or other equipment. The analysis may be either a program that runs on the Reliability Coordinator's or Transmission Operator's EMS or through contracted services (3rd party, Reliability Coordinator, or other Transmission Operator).

5.1.2 Results Quality

Quality needs to be measured to ensure that the base case used by the automated analysis program(s) accurately represent the state of the system.

- For both current & "what if" analyses:
    - For Reliability Coordinator & Transmission Operator:
        - Compare physical 'tie' line values and generator injections plus selected interconnected transmission line flows from the automated analysis program(s) to actual metered values every time the program runs. These values have been selected because of the accuracy of the metering at those locations and their impact on the BES.
        - Compute the percentage deviation of the program values versus actual metered values
        - Compute the average of the percentages on a periodic basis and compare to the tolerance value. (Actual periodicity will be selected based on industry feedback.)
        - Tolerance must be +/- x%. (Actual value will be selected based on industry feedback.)

5.2 AVAILIBILITY

Responsible entities must establish a procedure for what to do if the program(s) is not available for more than 30 consecutive minutes.

Current - The automated programs must provide a solution every five minutes 99% of the time on a monthly basis.

'What if' - The automated programs must provide a solution every ten minutes 99% of the time on a monthly basis.

5.3 FAILURE NOTIFICATION

Notification of failure of the analysis capability to provide a solution to the System Operator must be made to the System Operator within 60 seconds of when failure is detected.

5.4 MAINTENANCE

Each functional entity shall provide System Operators with approval rights for planned maintenance of its analysis capabilities.