TIP 395: Advanced Synchrophasor Protocol (ASP)

Context

Use of synchrophasors by US utilities continues to grow following the jump start provided by the Smart Grid Investment Grants. Even so, the dominant method to exchange synchrophasor data remains the IEEE C37.118-2005 protocol that was designed for and continues to be the preferred solution for substation-to-control room communications. It achieves its advantages through use of an ordered set (a frame) of information that is associated with a specific measurement time. When IEEE C37.118 is used for Phasor Data Concentrator (PDC)-to-PDC communication or for PDC-to-Application communication, large data frames are typically distributed to multiple systems.

To address the challenges presented by these large frame sizes, many utilities implement purpose-built networks for phasor data only. Even with these purpose-built networks, large frame sizes result in an increased probability of UDP frame loss, or in the case of TCP, increased communication latency.

In addition, IEEE C37.118 has only prescriptive methods for the management of measurement metadata which is well-suited for substation-to-control-center use but which becomes difficult to manage as this metadata spans analytic solutions and is used by multiple configuration owners in a wide-area context.

Description

The project was divided into two major phases – Design-Development and Demonstration-Commercialization. The protocol is defined in detail in a document suitable for review by standards bodies. The ASP protocol implementations, tool suite and related documentation is non-proprietary and fully open-source using the commercially-friendly, unencumbered MIT license. Open source software developed in the project is to be supported following project completion by Grid Protection Alliance (GPA).

The ASP tool suite leverages the successful design elements of the secure Gateway Exchange Protocol (GEP) that was originally developed as part of SIEGate project (DOE-OE-000536). Since the conclusion of the SIEGate project, the GEP protocol has been improved, and it has been tested at PeakRC and shown to be more reliable and more efficient than IEEE C37.118.

Development of the ASP tool suite also builds on the architectural elements of the 'Open and Extensible Control and Analytics Platform for Synchrophasor Data' (openECA) (DOE-OE-0000778) including the Common Analytics Interface that are used to provide phasor data to and obtain analytic results from phasor analytics.

Benefits

The development, test and production demonstration of ASP significantly advances the use of synchrophasor data to support current-day grid operations by improving the delivery reliability of real-time and historical phasor data and by lowering first and operating costs. This lowering of technical risk and cost removes barriers to deployment of new synchrophasor tools designed for large-scale synchrophasor systems.

Accomplishments

The objective of the Washington State University (WSU) demonstration was to evaluate the effectiveness of the ASP protocol to enhance the performance and operational reliability of the WSU suite of four analytic tools which consume and process large frames of synchrophasor data in real time.

Deliverables

The deliverables from this project are:

(1) A publish-subscribe protocol definition document ready for submission to standards bodies;

(2) Open-source, production-grade implementations of the protocol in multiple development platforms;

(3) A collection of tools to test and validate implementations of the protocol; and

(4) A report to document the results of protocol performance measured in project demonstrations.

The new protocol is a well-tested, thoroughly vetted, production-grade solution that is to be supported by project team vendors. It will be ready for broad deployment following the project.

The open-source tool suite for ASP includes a test harness that allows developers outside the project to test and validate ASP in their systems and API's in at least C#, C++ and Java to allow the quick native deployment of ASP in multiple development environments.

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Project Start Date: October 2017

Project End Date: June 2019

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Reports, References, Links

Related Projects

Participating Organizations

Grid Protection Alliance (GPA)
Electric Power Group (EPG),
Washington State University (WSU),
Dominion Virginia Power,
Schweitzer Engineering Laboratories (SEL),
Tennessee Valley Authority (TVA),
Oklahoma Gas & Electric (OG&E),
Southwest Power Pool (SPP),
San Diego Gas & Electric (SDG&E)

Conclusions:

The project team successfully developed the Streaming Telemetry Transport Protocol (STTP), which allows for improved transport of time-synchronized data, including synchrophasors. This protocol was implemented by the vendor participants, proving viability in commercially-ready products. The BPA Synchrophasor Team will determine applicability of STTP within BPA, and will also lead discussions for an implementation of the protocol across the western interconnection.