Stephen Christopher Wills

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Education

B.S., Computer Science, 2011, University of Colorado at Colorado Springs, with Minor in Mathematics.

Professional Experience

Grid Protection Alliance, Inc.

June 2010 to Present – Senior Analyst. A leading software engineer for Grid Protection Alliance, Inc. (GPA) and tasked with many responsibilities including the management of technology resources for GPA, design and development of GPA client software, installation and customer support for GPA products, architecture and consulting services for GPA clients, and collaboration with vendors to provide integration with tools and hardware used by GPA clients.

Made various contributions to GPA's major product lines, including the following.

- Developed the Open Fault Location Engine (openFLE), an open source fault location tool that detects, locates, and reports on electrical grid faults to improve quality of service by allowing grid operators to monitor, diagnose, and respond to power disturbances more quickly.
- Developed the Open eXtensible Disturbance Analytics (openXDA) platform, an open source and extensible platform for developing analytics to process triggered event data and aggregate trend data from various types of metering devices, expanding on the capabilities provided by openFLE to provide additional intelligence, notifications, and reports based on the data provided by thousands of monitors used throughout the transmission system.
- Developed GSF.PQDIF, an open source Power Quality Data Interchange Format (PQDIF) parser that facilitates the exchange of the voltage, current, power, and energy measurements that are used to determine the health of an electrical grid.
- Developed the Sequence of Events Engine (SOEEngine), an open source engine for processing waveform data from a large-scale deployment of intelligent circuit breaker devices on a distribution system, designed to automatically classify a series of waveshapes from multiple devices on each circuit to assist the engineer in determining the underlying cause for a disturbance and the current state of each device.
- Implemented performance and usability improvements in the Open Power Quality Dashboard (PQ Dashboard), a dashboard tool for visualization of recorded event and aggregate trend data across a wide-area transmission system, to improve user-experience and enable the system to scale to thousands of metering devices, well beyond its original design.
- Implemented new features and resolved defects in the Open Phasor Data Concentrator (openPDC) application suite, a complete, open source Phasor Data Concentrator (PDC) software system that is designed to assist grid operators with maintenance of electrical grid health by processing streaming data in real-time from hundreds of Phasor Measurement Unit (PMU) devices, responding with user-defined actions, and providing custom reporting and data archiving and retrieval.
- Collaborated with University of Illinois at Urbana-Champaign; Alstom Grid; Pennsylvania, New Jersey, and Maryland (PJM) Interconnection; and Pacific Northwest

National Laboratory (PNNL) to develop the Secure Information Exchange Gateway (SIEGate), an electrical grid gateway appliance that is secure, dependable, safe, and survivable.

- Collaborated with Dominion Virginia Power, Oklahoma Gas and Electric, Southwest Power Pool, Virginia Tech, Bonneville Power Administration, T&D Consulting Engineers, and OSIsoft to develop the Open and Extensible Control & Analytics (openECA) platform, enabling engineers and their developers to extend their own synchrophasor data systems with additional real-time data analytics using a variety of tools and platforms such as Python and MATLAB.
- Developed the Phasor Data Quality Tracker (PDQTracker), an open source, real-time synchrophasor data monitoring platform designed to identify data quality issues and provide daily reports to guide users to problem areas in their synchrophasor data systems.

Through work with GPA, achieved a number of major accomplishments to advance the technology used throughout the electrical power industry.

- Implemented curve fitting algorithms to identify the best-fit sine wave using linear regression against sampled voltage and current waveform data to support all downstream analytics in openXDA.
- Implemented logic to determine the location of a faulted transmission line from voltage and current waveform data using six different industry-standard algorithms, including a double-ended fault location algorithm to improve accuracy when monitoring a transmission line from two separate physical locations.
- Implemented logic to determine the likely cause of a fault based on analysis of signatures in a faulted waveform.
- Developed the web API for the Electric Power Research Intitute's (EPRI) Power Quality Investigator (PQI) tool, which provides an interface through which openXDA can automatically determine which specific pieces of equipment at an industrial facility were impacted by voltage fluctuations on the power grid.
- Developed a new measurement routing engine for GPA's synchrophasor products in order to improve scalability by an order of magnitude, allowing the products to grow from supporting around 100 input devices to over 1000.
- Developed extensions to the Gateway Exchange Protocol (GEP), the real-time synchrophasor data exchange protocol designed by GPA for large-scale synchrophasor deployments, to add support for Transport Layer Security (TLS) for secure connectivity to support the SIEGate project.
- Developed the Historian Trending Tool for visualization and analysis of synchrophasor data archived by openHistorian 1.0, the default built-in synchrophasor data archive used by openPDC.
- Developed numerous adapters to extend the synchrophasor product suite for integration with other data systems, such as SQL Server, MySQL, Apache Kafka, InfluxDB, and MongoDB.
- Developed adapters to extend the synchrophasor product suite for real-time analysis for synchrophasor data including custom calculations provided by the user in the form of mathematical expressions.

- Developed adapters to extend the synchrophasor product suite for monitoring data quality by defining alarm conditions, archiving alarm events, querying alarm states, and sending email notifications in real-time.
- Implemented GEP libraries for additional platforms to enable integration of GPA's synchrophasor software solutions with client and vendor tools, such as those used by Florida Power and Light (FP&L) to continually monitor the electrical system frequency in real time.

Tennessee Valley Authority

September 2009 to June 2010 – Intern. Entered TVA just prior to the open source debut of the openPDC. Responsibilities included documentation of the installation and configuration of the openPDC software, automation of configuration database setup for openPDC, development of new real-time processes within the openPDC software, testing, debugging, and resolving customer support issues.