openECA Project Overview

open ECA

open and Extensible Control & Analytics platform for synchrophasor data

DOE FOA 970

DE-OE0000778

BONNEVILLE POWER ADMINISTRATION

NorthWestern Energy

T&D Consulting Engineers

Dominion

VirginiaTech

OG&E

SPP Southwest Power Pool

GRID PROTECTION ALLIANCE

Project Partners

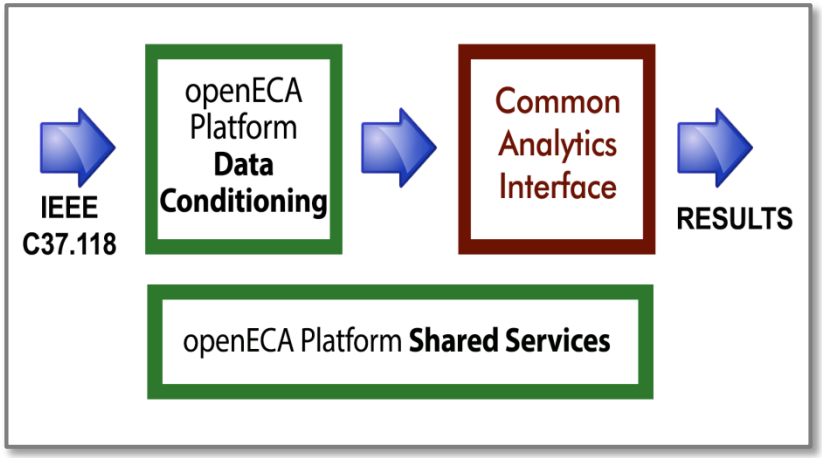
- Dominion Virginia Power
- Oklahoma Gas and Electric
- Southwest Power Pool
- Northwestern Energy
- Bonneville Power Administration
- Virginia Tech
- T&D Consulting Engineers
- Grid Protection Alliance
- DOE – Office of Electricity

openECA Project Summary

A better way to connect phasor data to analytics

Objective

To develop an open-source software platform that enables the production use and facilitates the development of analytics that use high-fidelity synchrophasor data



2-Year Project Schedule

October 2015 – September 2017

- Final design – 6/30/16
- Alpha Version – 3/31/17
- Demonstration Begins - 6/30/17
- Version 1.0 released - 9/15/17

Project Status

Project Awarded Sept. 2015

Value of Award

$ 5.0 M

(< 2% funds expended to date)

Prime

Grid Protection Alliance

Business Value to the Industry

- Lowers cost of addition of new production analytic tools
- Simplified end-to-end configuration and change management
- Improved availability of phasor data with greater visibility of phasor data quality
- Robust scalable solution to support phasor data infrastructure of any size
- Complements current phasor data architecture and supports integration with other data sources such as SCADA

Value to Research Community

- Allows research community to focus on development of new techniques and tools and not on learning how to build information interfaces
- Removes barriers to installation of newly developed research tools in production software environments

Development Approach

- **Build upon existing open source solutions** - Leverage GPA's production-grade open-source code base to create a open source application suite under a permissive license
- **Develop a standard interface** - Provide a "Common Analytics Interface" (CAI) where "data structures" are made available for subscription
- **Detect Bad Data Early** - Create a multi-tier bad data detection and correction system with alarming services
- **Create "3rd Generation" Data Exchange Methods** - Provide secure phasor data exchange using a next-generation version of the Gateway Exchange Protocol
- **Include Visualization Tools** - Develop a visualization tool optimized for testing and verification of analytic results
- **Test and Refine** - Test the CAI with 9 provided analytics at five utility partner locations – and seek more demo locations

Analytics Development is Simplified

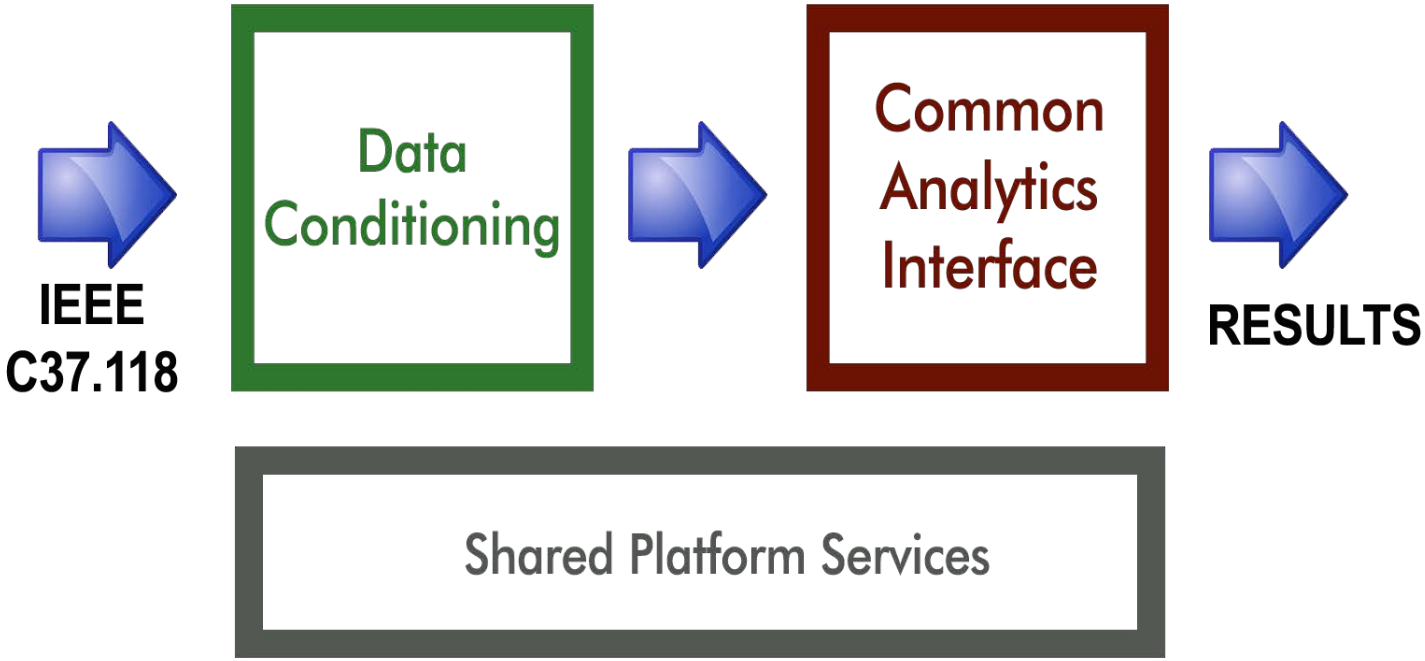
Today's Approach

- "Signal" paradigm
- Use C37.118
  - Socket management
  - Protocol parsing
  - Exception handling
- Local data buffering to support analytic cycle times
- Local configuration management

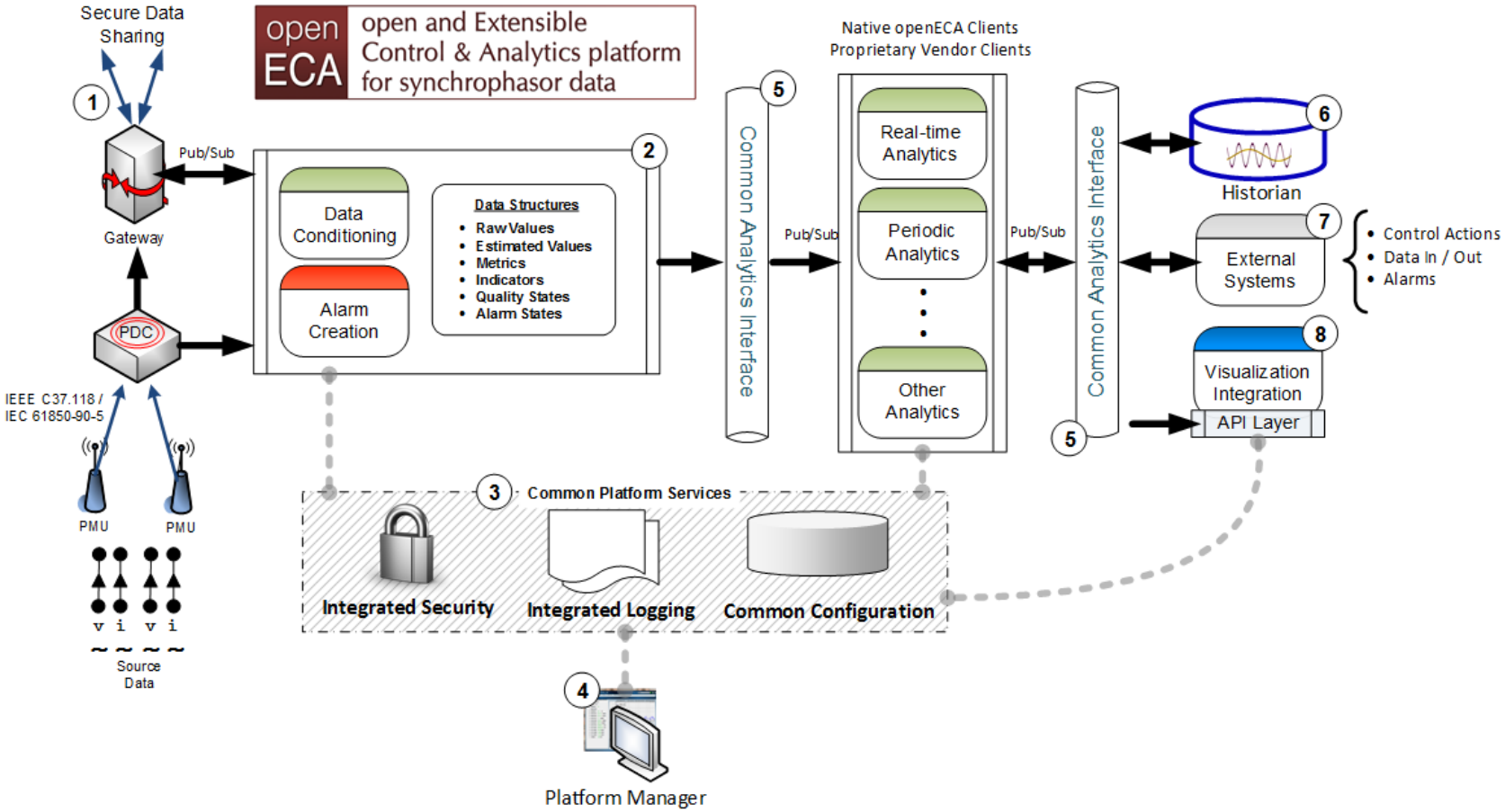
Using openECA

- Both standard and custom data objects
- An API that provides
  - Hi-performance pub/sub data access using standard messaging (e.g., Zero MQ)
  - Access to meta data services
  - Local data buffering options
- Starter templates provided
  - Matlab
  - F#
  - C#

openECA Architecture



openECA Architecture



Project Provided Analytics

- Real-Time Analytics
  - Oscillation Detection Monitor (ODM)
  - Oscillation Mode Meter (OMM)
  - Topology Estimation
  - PMU Synchroscope
- Control Analytics
  - Regional Volt-Ampere-Reactive (VAR) Control
- Off-Line Analytics
  - Dynamic PMU Transducer Calibration (Automated, Periodic Use Case)
  - Line Parameter Estimation (Ad-Hoc Use Case)
  - Synchronous Machine Parameter Estimation (Research Use Case)
  - Acceleration Trend Relay (ATR) Improvement (Research Use Case)

Plus – within the platform
Linear State Estimation

DOE Acknowledgement & Disclaimer

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