EPRI DATA ANALYTICS CASE

Load Balancing Using SCADA and Smart Meter Data

The Data Challenge

The load balance of a multi-phase distribution system varies over time as single-phase loads turn on and off or as their energy consumption increases or decreases. If not evaluated frequently by the utility, the imbalance leads to increased losses, voltage imbalance, and even malfunctioning of protective relays. Large load imbalance and corresponding voltage imbalance can damage grid and customer devices and equipment.

Solution Overview

With historical loading data from SCADA devices and smart meters, robust algorithms are to be developed to monitor and alert utility employees of imbalance, to determine a plan to correct the load balance, and to advise system planners and engineers about which phase to connect new single-phase taps (laterals) and service transformers to.

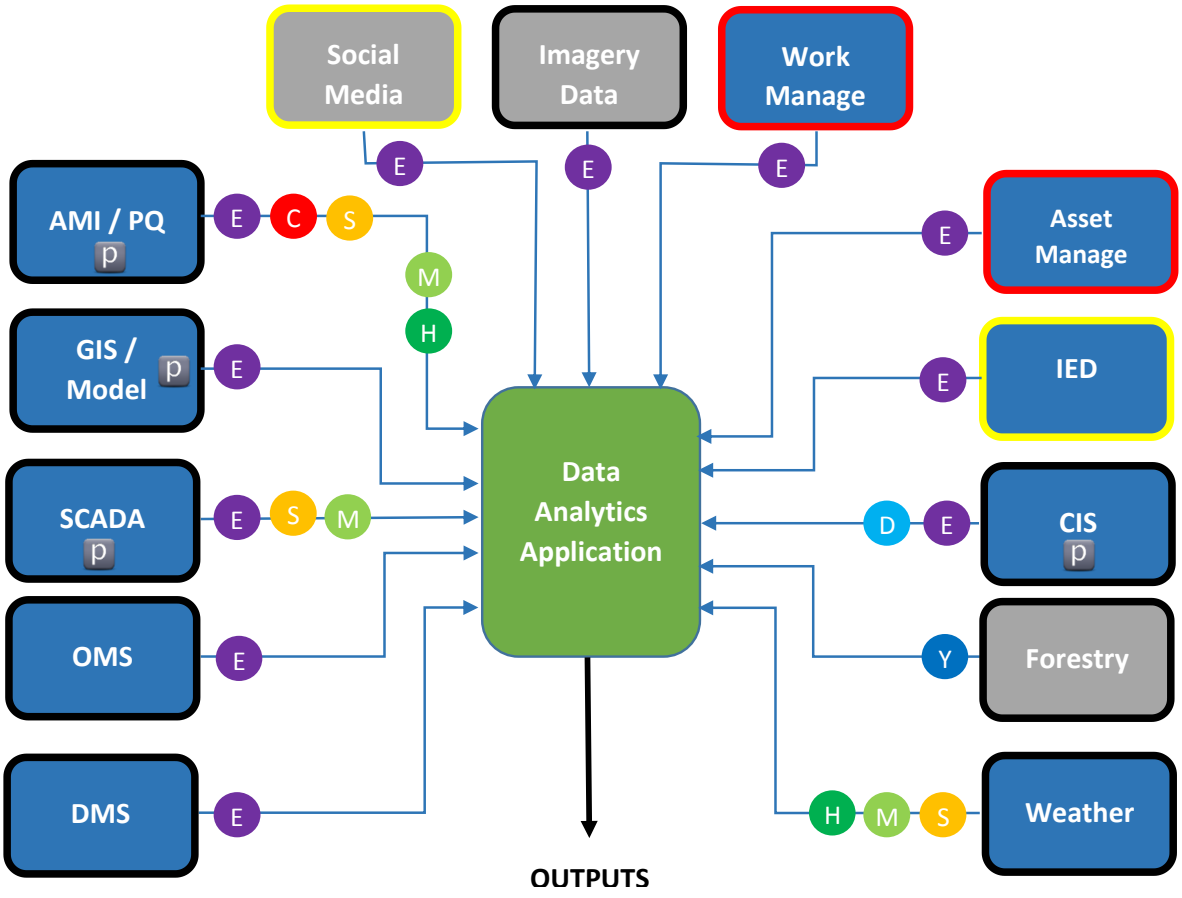
Potential Methods for Solving the Problem

Because distribution circuits are often highly branched with numerous single- and two-phase taps (laterals), the analytical approach to balancing the grid must account for local imbalances at the node or tap level as well at the circuit breaker and power transformer levels. The traditional approach to balancing the three-phase system was to make manual measurements at taps that have numerous single-phase transformers. These measurements would then be compared to the manual measurements taken or observed at supervisory control and data acquisition (SCADA) devices placed at critical nodes on the circuit in order to determine which taps to swap around between the three phases. Additionally, it is also common to swap the connected phase of a single-phase transformer located on the main circuit line in order to achieve better balance of the loading at points along the circuit and at the circuit breaker (feeder-head). These approaches are labor-intensive and call for an analytics solution.

This problem can be solved easily by utilizing advanced metering infrastructure (AMI) meter data, SCADA data, and accurate geospatial information system (GIS) model information. Individual AMI meter loads can be aggregated together to determine loading at any node, service transformer, tap, SCADA device, or even the breaker on the circuit. The AMI meter data can be supplemented with SCADA measurements to obtain all of the time-synchronized measurements required to solve the load-balancing problem. With knowledge of the system model, the algorithm and/or application would be able to determine which combination of tap and single-transformer phase changes would result in an optimal configuration in terms of a balance solution and the cost to achieve it.

Available Data Sets

The data sets highlighted in the following figure are available in the EPRI Data Repository to solve this data analytics case.



Classifications of Data:

- Traditional Data Set
- New Data Set
- Structured Data
- Un-structured Data
- Format of Data Varies

p **Denotes a primary data set used to solve this data analytics case.**

Frequency of Measurement

- C Cycles
- S Seconds
- M Minutes
- H Hours
- D Days
- Y Months to Years
- E Event Driven