EPRI DATA ANALYTICS CASE

Optimal Placement of Automated Distribution Switches

The Data Challenge

The placement of a new automated distribution switch has long-term impacts on the reliability of the circuit in which it is installed. Common placement strategies rely on manual processes and the tribal knowledge of the planning engineer about the configuration, past reliability performance, future load growth, planned distributed energy resources (DER), and other protection-related schemes of the circuit being analyzed in order to select a new switch location. Without optimization algorithms to account for the many operating parameters and outage scenarios, a non-optimal location may be selected by the planning engineer. A non-optimal placement may lead to a less-than-optimal reliability performance and adversely affect customer satisfaction.

Solution Overview

Enhanced planning algorithm(s) and/or application(s) must be developed to assist with the optimal placement of a new automated distribution switch. With the complexities of the modern grid, an automated analysis that performs numerous simulations to account for all possible interactions of the newly placed automated switch with other smart grid devices and resources is required to ensure optimal performance.

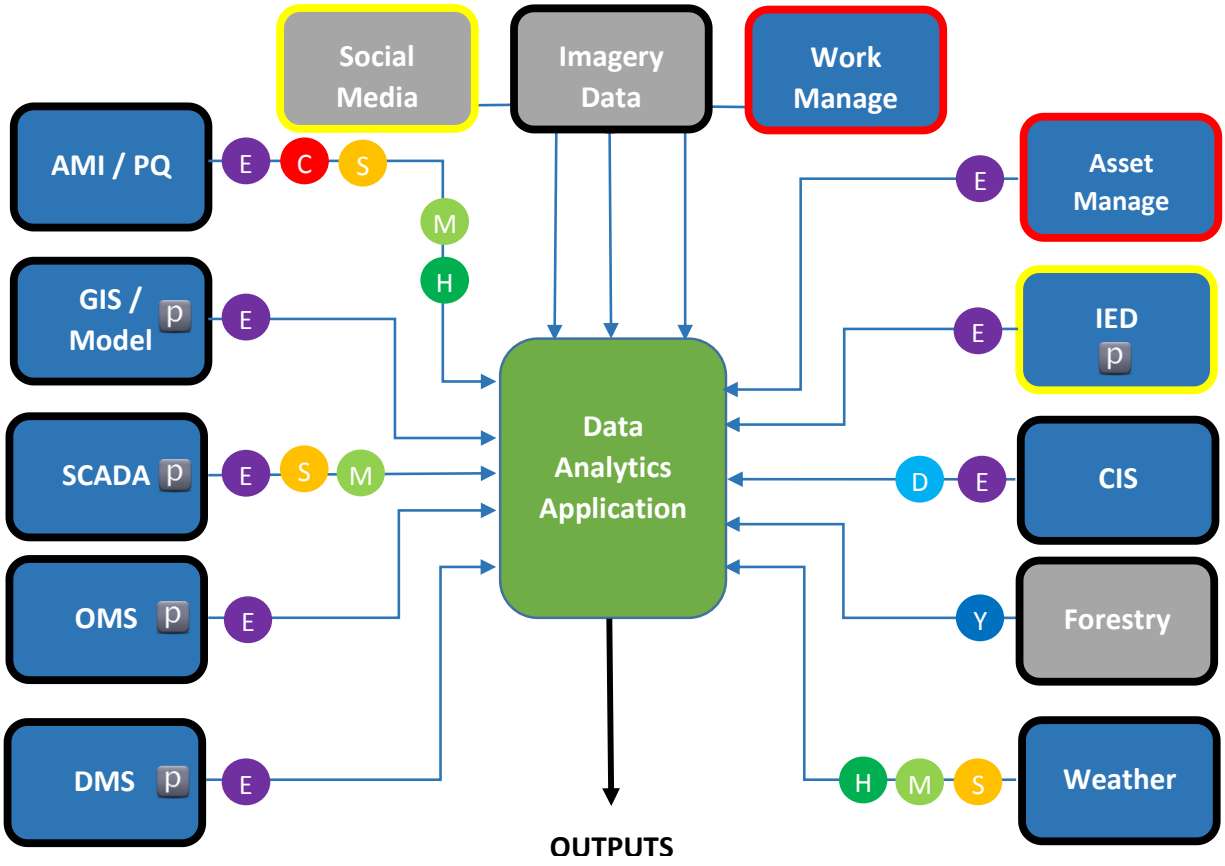
Potential Methods for Solving the Problem

The standalone placement algorithm or algorithm embedded in a power-flow analysis tool or application for managing the distribution system would need to solve for the improvement in the reliability indices based on the placement of an automated switch on the existing circuit. The application would need access to the circuit topology, customers per circuit segment, other protective devices and relay settings data , such as fuse location and sizes, historical momentary and sustained outage information to determine average number of faults and location and other outage related information, average cost of interruption, and cost per type of automated switch. After solving for the first recloser location, the application or planning tool would need to solve for each viable automated switch location. Once all viable locations have been evaluated, the reliability improvement of each should be ranked to determine which location provides the greatest reliability impacts.

The proposed method should be expanded to include multiple installations of automated switches to determine an optimal device configuration and an acceptable cost/benefit ratio. One approach would be to place the devices sequentially, meaning to place the first automated switch and the subsequent ones, one after the other, so that the location of the previous device is set before evaluating the next one. An alternate approach would be to place the automated devices, two or more, simultaneously. The second approach is more complex and would require more computation time but would likely produce the optimal solution and provide the greatest reliability impact.

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

Frequency of Measurement

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

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