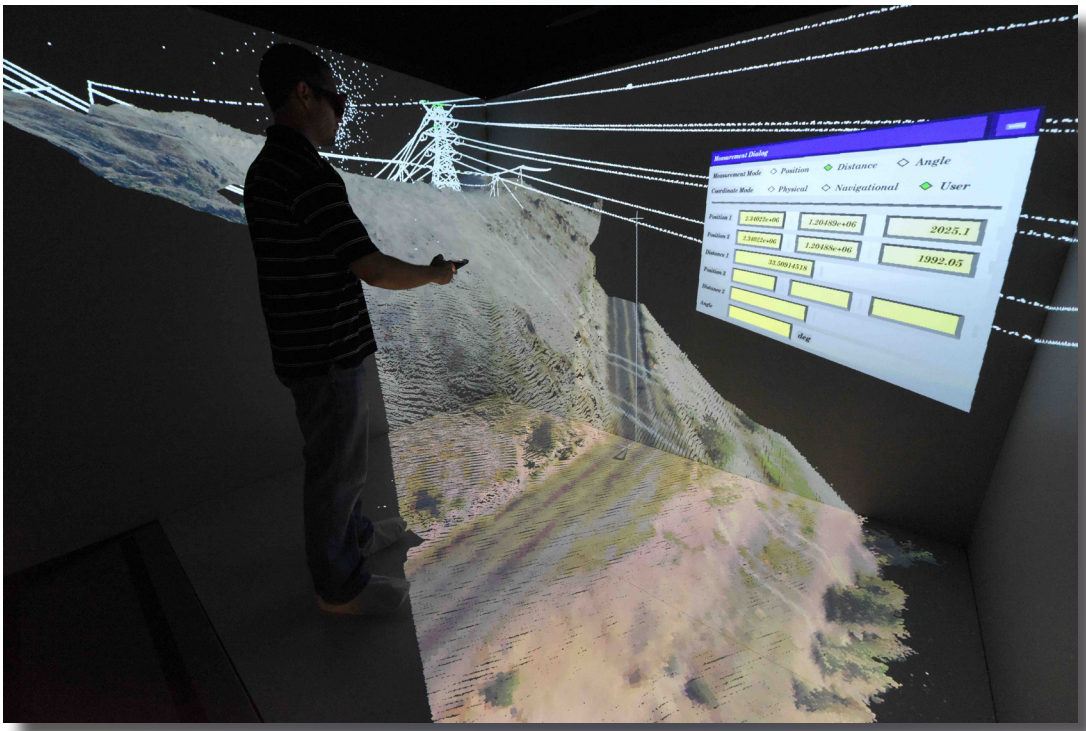

Real-time limits for transmission lines can be computed by INL software and visualized in the Computer-Assisted Virtual Environment (CAVE).

General Line Ampacity State Solver (GLASS)

Wind power researchers at Idaho National Laboratory believe moving more electricity through existing transmission lines is both possible and practical. In areas where wind farms are being developed, there is potential to take advantage of wind cooling on transmission and distribution lines concurrent with wind power generation.

The key is to pay close attention to the weather. The more electric current a line carries, the hotter it gets. After a certain point, a line operator cannot add additional current without overheating and damaging the line. However, an increase in wind speed blowing at a right angle to a high-voltage line can cool the line enough to safely increase the amount of current it can carry by 10 to 40 percent.

Ampere capacity, or "ampacity," defines the maximum amount of electric current a conductor or device can carry before sustaining immediate or progressive deterioration. INL researchers are developing a Java-based software package called General Line Ampacity State Solver (GLASS), which calculates real-time ampacity and thermal conductor limits.

GLASS can help the end-user determine, in real-time, the limiting ampacities and thermal ratings for any given transmission line segment. This capability in turn provides utility companies with the ability to use dynamic line rating to adjust power production throughout their grid network according to these computed restraints.

What GLASS does

The software can compute real-time ampacity and conductor thermal limits based on current weather conditions at sparsely-located weather stations. It does this by using actual Geographic Information System (GIS) data along with previously measured weather conditions and pre-computed Computational Fluid Dynamics (CFD) models.

For CFD modeling and verification, INL collaborates with WindSim, a simulation software company. For transmission line data verification and research, INL has part-

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The Energy of Innovation

Idaho National Laboratory

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nered with regional utilities including Idaho Power, which provides electricity to roughly 1 million people spanning 24,000 square miles. This partnership enables GLASS to adhere to an industry standard of quality and verifiability and helps industry format data for ready input into the GLASS software.

The GLASS software utilizes an algorithm found in the Appendix of IEEE Standard 738, the national standard defined by the Institute of Electrical and Electronics Engineers. This algorithm enables the software's iterative solver to generate real-time ampacity and thermal conductor limit calculations.

What's next

GLASS is currently in the alpha phase, focused on full testing and verification for the IEEE Standard 738 engine. Developers are validating the models by comparing CFD values with actual weather station data. This work can also lead to better input data by identifying geographic locations that need more or fewer weather stations.

Ultimately, the GLASS software will help industry more readily adopt the Dynamic Line Ratings and optimize the capacity of grid networks. Providing advanced data directly to control rooms will allow operators to make decisions based on reliable data with less uncertainty about real-time ampacity limits.

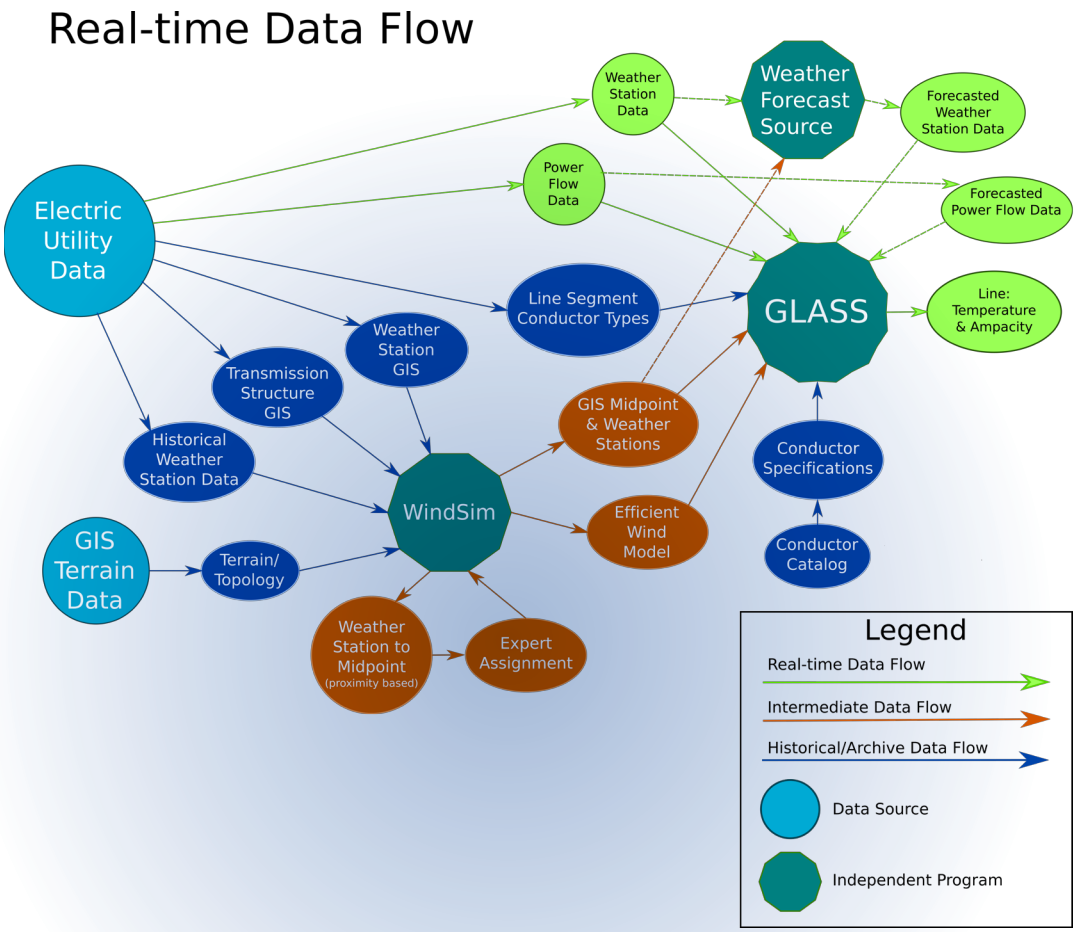

Diagram shows the required data flow and computational components for the real-time and forecast calculation of transmission line rating.

For more information

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