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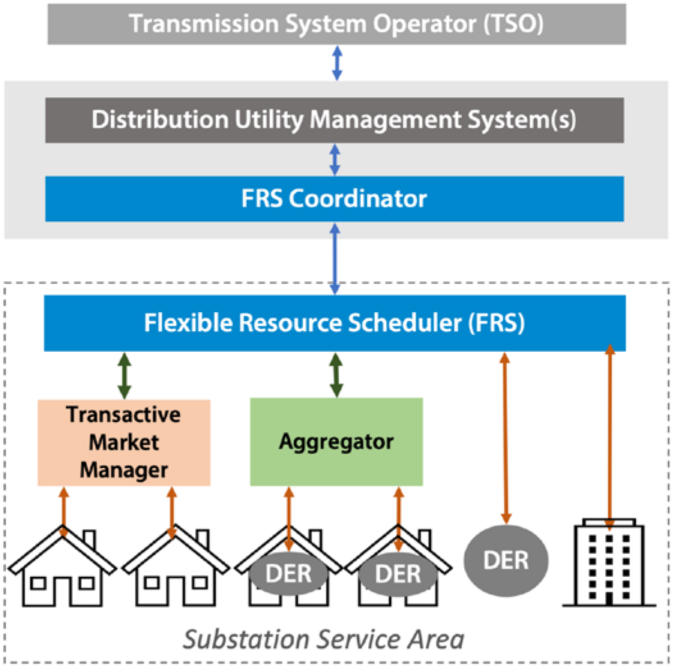
FAST-DERMS: An Architecture to Control the Grid of the Future

In a changing electrical system with higher levels of customer-owned energy sources, aggregators, and transactive energy markets that let customers participate in power delivery, utilities need an updated operational architecture. The Federated Architecture for Secure and Transactive Distributed Energy Resource Management Solutions (FAST-DERMS) provides a clear approach to achieve this. The FAST-DERMS team has developed a lab-tested, tech-agnostic solution to demonstrate the proposed approach on utility systems.

Key Features of FAST-DERMS

Grid management with FAST-DERMS will coordinate distributed energy resources (DERs) at the substation and provide the following features:

- **Aggregation and Dispatch of DERs:** Provides a framework for utility-scale and small-scale DERs to support the grid, either directly, or through aggregators or a transactive market.
- **Integration with Utility Management Systems:** Connects DER management with distribution utility management systems for smooth integration at all grid levels.
- **Flexibility and Control:** Supports a variety of DERs, including photovoltaics (PV), battery storage systems, and electric vehicles, individually or within groups.
- **Predictability:** Transforms the net load of a distribution substation into a predictable, controllable resource akin to a conventional generator from the perspective of the transmission system operator (TSO).



How FAST-DERMS Works: A Scalable Architecture

FAST-DERMS is a federated approach to grid management, meaning that it does not rely on direct utility control over all DERs; rather, they can be managed either directly by the distribution utility, or indirectly through aggregators or a transactive market.

The FAST-DERMS control structure is hierarchical and distributed, with Flexible Resource Schedulers (FRSs) controlling power flow at substations and managing DERs downstream of the substation. The FRS performs reliability-constrained economic dispatch of DERs connected to a substation to provide firm net load forecasts and grid service capacity to the TSO, and/or commitments to a wholesale market. The FRS can either be a standalone system for managing DERs or a component of an existing utility control system.

In either case, multiple FRSs can coordinate with existing utility systems through an FRS Coordinator to provide a way for distribution utilities to manage DERs in the entire network and achieve the maximum operational flexibility. The FRS Coordinator aggregates distribution substations operated by an individual FRS to the appropriate pricing node in transmission markets.

Supporting Grid Flexibility and Resilience

To enhance grid reliability, FAST-DERMS includes:

- Diverse DER Control: Support for the wide-ranging scale and schedules of resources like PV farms, battery energy systems, and public vehicle charging stations.
- Integration with Legacy Systems: Coordination with existing utility management tools, such as SCADA and distribution management systems, to bridge modern DER controls with traditional grid infrastructure.
- Anomaly Detection: Advanced algorithms to detect anomalies and secure grid operations, ensuring resilience against cyber-physical attacks.

Adopt FAST-DERMS In Your System

FAST-DERMS positions distribution utilities to manage the growing complexity of DERs securely, flexibly, and economically. If you are interested in partnering with NREL to apply FAST-DERMS to your grid management challenges, email Annabelle Pratt at annabelle.pratt@nrel.gov.

FAST-DERMS is developed under the U.S. Department of Energy's Grid Modernization Laboratory Consortium (GMLC) and led by the National Renewable Energy Laboratory (NREL).

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