Distributed Autonomous Microgrid Control

The coordination and control of energy power systems has traditionally been delivered through centralized management systems. However, with the advent of more intelligent field devices generating massive amounts of data, along with a dynamic landscape of distributed power generation such as renewables (solar, wind), microgrids and storage, combined with new customer driven technologies (electric vehicles and home automation systems), a new architecture employing both centralized and distributed information management is necessary to enable effective management of the energy power system.

Distributed autonomous control of microgrids can help the Energy industry to achieve real operational benefits

"We already dispelled the myth that interoperability can't be done in the short term without spending millions.

Now, we have three primary goals: create a cost-competitive microgrid, help manufacturers bring interoperable products to market and develop common industry-adopted language to navigate this new territory."

Jason Handley

Director of Smart Grid Emerging Technology & Operations - Duke Energy

Key Challenge

The next generation of energy grids will need to adopt new approaches for the integration of distributed grid-edge devices and equipment from many different manufacturers to realize operational benefits. Existing systems that were designed to support a small number of large generation facilities will be faced with the need to integrate an increasing number of Distributed Energy Resources (DERs) such as wind, solar and electricity storage into existing power generation and distribution networks.

A new architecture for microgrid control is needed to deliver benefits that are not sufficiently met by existing utility infrastructure, including scalable data and information management, near real-time response times, enhanced situational awareness, interchangeability, distributed control, greater energy efficiency and reduced total cost of ownership.

The Solution

In 2013 US utility giant Duke Energy formed the "Coalition of the Willing"(COW), a consortium of grid technology vendors focused on the promotion and adoption of an Open Architecture approach to standardizing the way grid-edge technologies are integrated together.

The consortium is made up of communications and grid control systems, electronics and software vendors. The initial COW member companies were limited to Duke Energy, Accenture Alstrom Grid, Ambient Corporation, Echelon, S&C Electric and Verizon. The consortium has quickly grown to over 25 companies. The full list of current consortium members, with founding members highlighted is shown below:

ABB
Alcatel-Lucent
AT&T
CalAmp
Cisco
Duke Energy
Elster Solutions
General Electric (acquiring **Alstom**)
Green Energy Corporation
ITOCHU
Itron
Leidos Engineering
Moxa
Cisco
National Instruments
Networked Energy Services
OMNETRIC Group (Siemens + **Accenture**)
Parker Hannifin
PrismTech
RTI
S&C Electric Company
Schneider Electric
Scweitzer Engineering Laboratories
Siemens
Sierra Wireless
Tollgrade
Verizon

All COW members must implement interoperable communication protocols that conform to open standards. These protocols must also conform to the Common Information Model (CIM) utility standard. The protocols are used as the basis of a common communication backbone called the "Field Message Bus" which is used to connect edge-devices via standardized nodes deployed by Duke Energy. The core communication protocol that must be supported is the Object Management Group's Data Distribution Service for Real-time Systems (DDS) standard. DDS implementations including ADLINK's Vortex are being used by the consortium to provide a high performance, fault tolerant, secure, real-time interoperable data connectivity layer between microgrids and centralized management systems. DDS can be used to unify operational control for the edge-grid devices and enable substation automation, while at the same time making important real-time data available to the centralized systems.

Results

After successfully demonstrating in real-time how different grid devices could talk to each other without the need to contact a remote centralized management system and reducing the feedback control process from minutes to less than 10 seconds, the energy industry has really started to take notice. The responsiveness that Duke Energy and its partners have demonstrated can enable a system to react dynamically to changes such as a sudden drop in the wind powering a farm of turbines. The distributed management system can automatically and in real-time (within seconds) switch in battery backup storage to ensure that a smooth voltage supply is maintained. This is something that is much harder to achieve if the process of communicating with a centralized system takes minutes. This work is helping address the key issue of intermittent availability of supply when deploying renewables as part of an integrated generation system.

For More Information

To learn more about ADLINK and how its Vortex Intelligent Data Sharing Platform is being used to build smarter solutions for urban environments, contact your ADLINK Sales representative or visit: **ist.adlinktech.com**

ADLINK

Leading **EDGE COMPUTING**