Managing distributed energy resources

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With the increasing availability of low-cost solar and other renewables — as well as distributed storage and small-scale generation microgrids — distributed energy resources (DERs) are already a reality and the fastest growing source of energy. Distribution grid operators need new systems to manage these more flexible generation assets that can automatically ramp, balance, diagnose and heal the grid. This is driving the development of distributed energy resources management systems (DERMS).

Crucial to the operation of a DERMS is a real-time communications system to monitor, control, coordinate, and manage distributed energy assets. Typically, the utility needs to deploy a converged field area network (FAN), which provides:

- Ability to economically reach tens of thousands of sensors and assets
- Very low latency for automation
- Support for mobile assets and workers
- Mission-critical reliability
- Immunity to cyber-security threats.

Given the need for highly distributed coverage and support for mobility and private radio, IP/MPLS married with cellular technologies such as industrial private wireless (LTE/5G) are the ideal solution for a distributed energy FAN.

50 percent of global utilities choose LTE/5G

With its seamless migration path to 5G, LTE has been chosen by more than half of the largest global utilities as the foundation for their future FAN. A combined LTE and IP/MPLS WAN solution enables a utility to simplify operations by leveraging their WAN service, security and management environment to create a single, consistent communications environment that, with LTE/5G, extends to the edge for critical grid operations such as DERMS.

Industry 4.0 wireless

With the high variability in wind and solar power generation, the grid needs to seamlessly manage two-way power flows by automatically adjusting assets, even potentially reaching behind metered resources to turn on or off micro generators and distributed energy storage systems (DESS) as a new service.

DERMS are software management systems that leverage Industry 4.0 technologies such as IoT, AI, machine learning (ML) and data analytics. Connected assets, smart meters and grid sensors provide streaming data, which when analyzed using ML-based models derived from historical data, enable the most efficient use of each grid asset.

Overall, this highly connected, Industry 4.0 automated grid is the key to utilities realizing reduced operations and maintenance costs, including improved system efficiency, reliability, and resilience. Asset lifetimes can be optimized, fuel waste reduced, carbon emission targets met, and cyber-security threats neutralized. Unsurprisingly, when utility companies were asked what capabilities they plan to explore in the next 1–2 years, DERMS ranked first, followed by analytics, AI and ML.[1] All of these point to the need for pervasive industrial-grade wireless communications.

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1 Digital innovation: creating the utility of the future," Deloitte Insights. 9 Apr 2019.
   Online: https://www2.deloitte.com/us/en/insights/industry/power-and-utilities/digital-transformation-utility-of-the-future.html.

Challenge

- Manage distributed energy resources and the grid so as to automatically balance rapidly shifting power flows
- Converge multiple legacy FANs onto a single mission-critical converged FAN that has the ability to economically connect thousands of sensors, assets and legacy systems
- Assured delivery of critical DERMS and associated applications traffic.

Solution highlight

- Private LTE network today with seamless migration to 5G, for ubiquitous reach of a vast and growing variety of sensors and assets
- Layer 3 and layer 2 IP/MPLS VPN services for multiple grid applications, including GOOSE-based and legacy applications
- High mobility to support both assets and workers on the move, including support for Push-to-talk and Push-to-video private radio communications
- Exceptional resiliency and low latency with robust security to address a growing range of cyber-security threats.
- Deterministic quality of service through network traffic classification, priority-based queuing, and over-the-air preemption for critical traffic.

Associated use cases

- SCADA – substation backup or primary for currently un-monitored and/or unmanned substations
- AMI – concentrator backhaul including PLC concentrators
- Distribution automation (FLISR, VVO, recloser, etc.) – more reliable and better-quality power
- Synchrophasors – operating conditions oversight
- FACTS – improve stability and increase transmission capacity
- Drones/UAV – transmission line and vegetation inspection, as well as physical security
- Demand response – a more reliable and sustainable grid
- Workforce – higher productivity
- Microgrid and home area network – microgrid interconnect
- CCTV – monitoring and physical safety
- Leased line replacement/fiber access backup – more resilient substation reachability
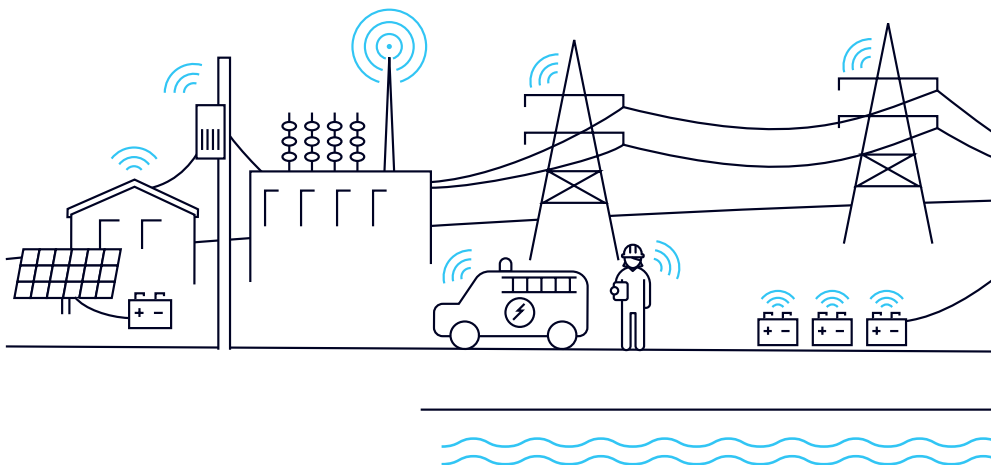
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