Building a smarter grid with a FirstNet-powered converged FAN

Solution brief

Introduction

The adoption of smart grid technologies enables power utilities to operate their electric grids more efficiently, deliver greener and higher-quality power, and deepen customer relationships. Substation automation, distribution automation, distributed energy resources, storage integration and new applications such as drone-based visual inspections will revolutionize the way utilities produce, manage and deliver electricity across their grids. To unleash the full potential of smart grids, utilities need a smarter communications infrastructure that can route increasing amounts of monitoring, control and status information effectively, efficiently and on time.

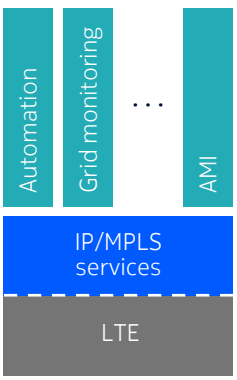
Field area networks (FANs) play a critical role in the digitalization of the distribution grid, and they will need to evolve to meet these new requirements. Many of today's grid utility applications, including distribution automation, SCADA, sensors and FAN technology, have evolved over time and reflect the state of the art of ICT at the time they were developed. As a consequence, utilities today run many different FANs to support these applications. Most of these FANs are incompatible with each other and approaching end-of-life.

This creates challenges for utilities. Operations, maintenance and administration tasks are multiplied, and securing disparate FANs is far more difficult than securing a single FAN. The networks are usually specific to an application and have limited capacity and incomplete coverage. There can also be interference problems between different networks when unlicensed spectrum is used. Furthermore, because their underlying technology has usually been superseded, many FANs do not provide a basis for future evolution.

The converged FAN

The concept of a converged FAN ushers in a new FAN paradigm (see Fig. 1) that will help utilities respond to these challenges. Grounded in standards-based LTE and IP/MPLS, it offers a common network that facilitates communications among field devices, grid applications, control systems, smaller substations, control centers and data centers.

Figure 1. Converged FAN architecture



Many utilities have already deployed IP/MPLS in their wide area networks (WANs) to support teleprotection, SCADA and synchrophasor applications. A converged FAN uses LTE to extend these proven service capabilities to the edge of the distribution grid to address smart grid communication requirements:

- Ubiquitous reach to connect a vast and growing variety of intelligent electronic devices (IEDs) and IoT sensors
- Deterministic quality of service for applications that require extremely low latency or high bandwidth
- Advanced layer 3 (IP) and layer 2 (Ethernet) VPNs to support multiple grid applications, including GOOSE-based applications
- High mobility to support assets and workers on the move
- Exceptional reliability to avoid disruptions
- Robust security to address a growing range of cyber threats

Smart grid applications supported by a converged FAN

Riding over LTE, a converged FAN can connect machines (IoT sensors, IEDs) and utility crews to the operations center and data center to support a wide range of traditional and emerging FAN applications, including:

- Reclosers/fuse savers
- Wide area situational awareness
- SCADA (traditional and IEC 61850)
- Distribution system teleprotection
- Distribution line switching
- Synchrophasor control
- Dynamic line rating
- Voltage VAR control
- Synchrophasors
- Advanced metering infrastructure (AMI)
- Smart lighting

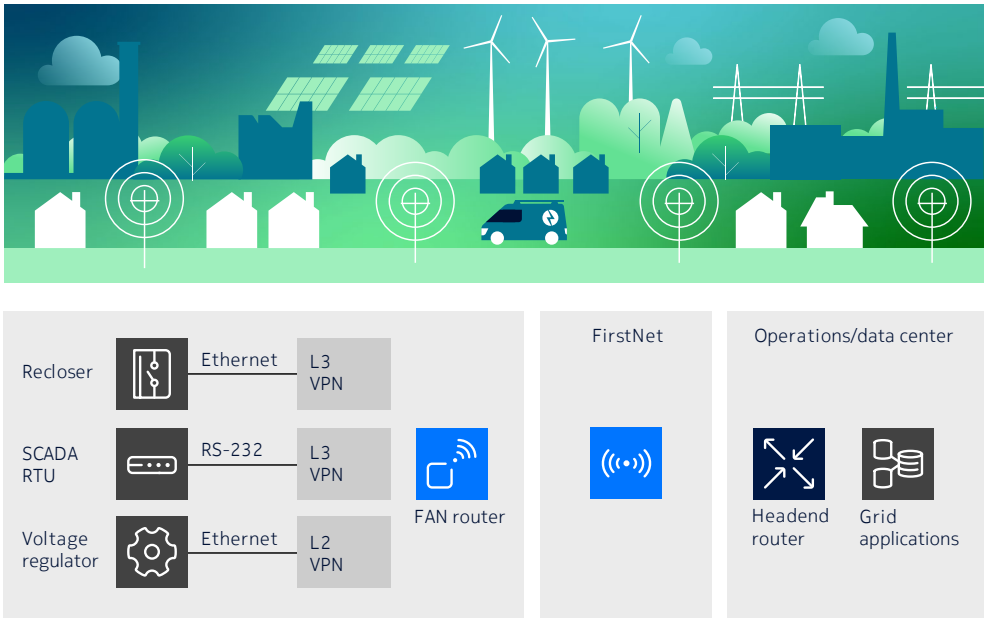
Additionally, LTE provides specific support for low-power IoT sensors with narrowband IoT (NB-IoT) and LTE-M, and can support push-to-talk (PTT) and push-to-video (PTV) applications for utility crews. It also provides a 3GPP-defined evolution path to 5G to support future innovations.

FirstNet brings converged FAN to the grid edge

The FirstNet™-powered FAN innovatively combines the strengths of the Nokia 7705 SAR-Hmc)[1] wireless IP/MPLS router and the FirstNet wireless broadband network. Harnessing the power of IP/MPLS services, the 7705 SAR-Hmc connects IEDs such as reclosers, fuse savers and circuit breakers on utility poles and inside smaller substations to grid applications running in operations and data centers. FirstNet, a fully-redundant LTE network, provides resilient and high-performance wireless connectivity. Its robustness, quality of service and preemption capabilities ensure that IEDs are connected 24 x 7.

1 The 7705 SAR-Hmc has achieved the FirstNet Ready™ certification. Download the 7705 SAR-Hmc data sheet here.

Figure 2. The FirstNet-powered converged FAN



Why Nokia?

The Nokia converged FAN solution enables power utilities to provide reliable, secure, ubiquitous and cost-effective communications for smart grid applications such as distribution automation, substation automation, distributed generation and AMI. It also leverages Nokia's market-leading IP/MPLS service, LTE/5G, network management and automation, and security capabilities to meet the communications demands of mission-critical applications such as teleprotection and SCADA. For the many utilities that already use Nokia IP/MPLS WAN, the converged FAN is a seamless extension of their WANs that brings intelligence to the grid edge with optimal operational efficiency.

Nokia complements its utility solutions with professional services that have helped modernize more than 200 utility WAN and FAN networks over 30-plus years. Nokia Bell Labs Consulting can also assist utilities in planning for the future and analyzing business case benefits of new technologies using a structured methodology for establishing quantifiable outcomes for their power grid operations.

Visit the Nokia power utilities web page to learn more: https://www.nokia.com/networks/industries/power-utilities/

About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

Nokia OYJ
Karakaari 7
02610 Espoo
Finland
Tel. +358 (0) 10 44 88 000

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