

In Development

Navigating the ‘Moving Parts’ of Grid Telecommunications

EPRI Helps Utilities Manage and Operate Complex, Tiered Networks

By Brent Barker

Telecommunications (telecom) for the modern grid is developing into a complex, multi-tiered network-of-networks that can manage and integrate diverse technologies and facilitate the rapid, seamless flow of information.

At the top of the grid telecommunications hierarchy are wide area networks (WAN). These are the most comprehensive networks and can extend beyond the utility’s service territory. As the telecom backbone, they support smaller field area networks (FAN), which in turn support neighborhood area networks (NAN) and even home area networks (HAN). Each network can employ multiple technologies.

“There are many moving parts,” said EPRI Technical Executive Tim Godfrey, who leads EPRI’s [telecommunications research](#). “Telecom options and preferences can change rapidly. Ten years ago, for example, utilities were thinking that home area networks would be connected through a smart meter, but now the customer is more likely connecting through their broadband provider.”

Telecommunications can potentially enable greater levels of distributed generation, distribution automation, substation automation, and alternative telecom business models, but technical and operational challenges remain.

“The utility industry’s telecommunications networks may be extremely heterogeneous, with all kinds of different technologies tied together to facilitate the transfer of information and data in the most efficient manner,” said Godfrey. “Our job is to research the common threads and collaborative issues that affect the whole industry. These include not only technical options, but operational issues, such as speed, spectrum access, integration, reliability, standards, and performance.”

EPRI’s telecommunications research focuses on three areas:

- **Wide area networks.** Operational excellence and strategic vision for the WAN. Critical areas include the transition from legacy systems to packet-based networks, the convergence of IT and OT Networks, and new approaches for strategic fiber deployment.
- **Field area networks.** Evaluating and selecting optimal FAN solutions. Critical areas include evaluating various wireless technologies in both private and public spectrums and analyzing usage trends in the unlicensed wireless spectrum.
- **Network management and planning.** Critical areas include automation, metrics, and cyber security.

Strategic Fiber in Wide Area Networks

According to Godfrey, the most common technology used for WANs today is fiber-optic cable.

Fiber material is cheap. While the cable is expensive to install (either overhead or underground), it typically lasts more than 30 years. It is often deployed atop transmission lines in optical protective ground wire.

“Fiber is the gold standard for telecom,” said Godfrey.

“Every strand is as fine as your hair, strong as steel, and supports multiple gigabits per second. It’s fast-lane, reliable, and durable. In areas of devastation I’ve seen the fiber cable holding up the pole.” In 2017, EPRI published two reports (see Strategic Fiber Handbook [Phase 1](#) and [Phase 2](#)) that evaluate ways to improve deployment and operation of fiber.

Some utilities have explored offering aggregated fiber services to homes. “Most utilities ultimately backed away because the business model puts them into the highly competitive Internet service provider market,” said Godfrey. “We probably won’t see many utilities providing a full-service model of electricity, Internet, telephone, and TV because of the potential for stranded assets. Regulations can also prohibit investor-owned utilities from entering other markets such as Internet services.”

One of EPRI’s goals for 2018 is to research the potential benefits and challenges involved in expanded use of fiber in a 5G world.

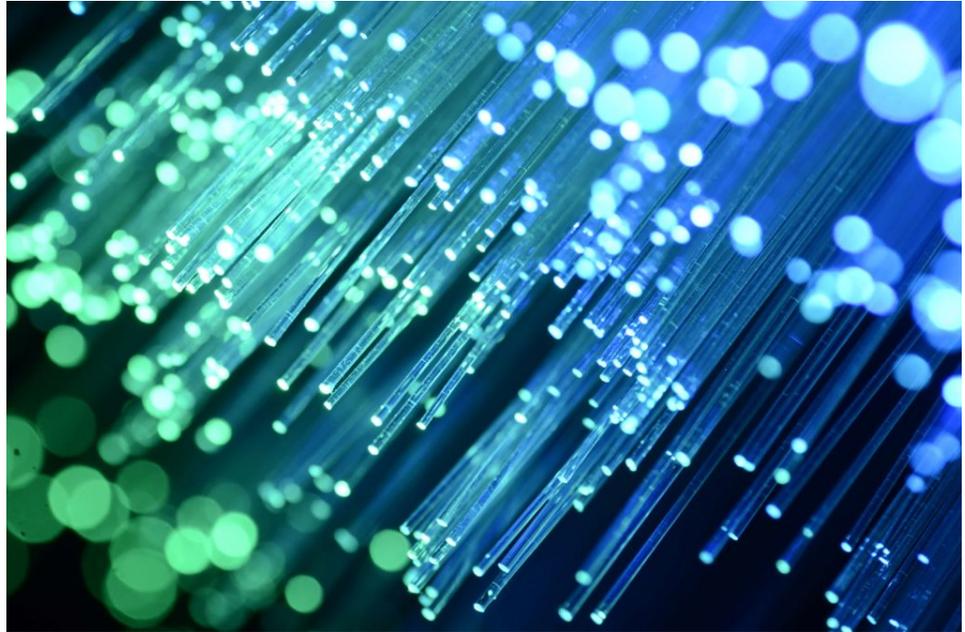
Wireless in Field Area Networks

EPRI is building on its Field Area Network Demonstration, which focused on wireless connectivity from substation to the distribution grid. “We developed a platform that utilities could use to test long-term reliability and performance of various wireless systems,” said Godfrey.

Conclusions from the demonstration include:

- A mix of wireless technologies is necessary for various applications.
- The private licensed spectrum is the optimal choice for many applications, but cost is high and availability limited.
- New opportunities are emerging with commercial cellular technology, including Mobile Virtual Network Operators (MVNO), Private Virtual Network Operators (PVNO), and private LTE networks.

For 2018, EPRI plans to examine trade-offs between private wireless and commercial cellular networks and evaluate usage trends in unlicensed spectrum. “Deploying a private network is a challenge for utilities, since global operators own most of the suitable wireless spectrum and are unlikely to sell their spectrum,” said Godfrey. “In some cases, they may lease some of their underutilized or underperforming spectrum to utilities or others.”



Improving Network Security

Telecommunications network security is a concern for grid operators. “We’re looking at how the telecom network can take advantage of software-defined networking,” said Godfrey. “In the old days you would have a rack of routers and switches, with patch cables going everywhere. To change your network, you had to physically go in and change things. With software-defined networking, you issue some software commands, and you’re on a different network. During a grid cyber attack, it may give us the ability to reconfigure a telecom network quickly and automatically.”

Key EPRI Technical Experts

Tim Godfrey