Utility Networks: The inherent risks of doing nothing

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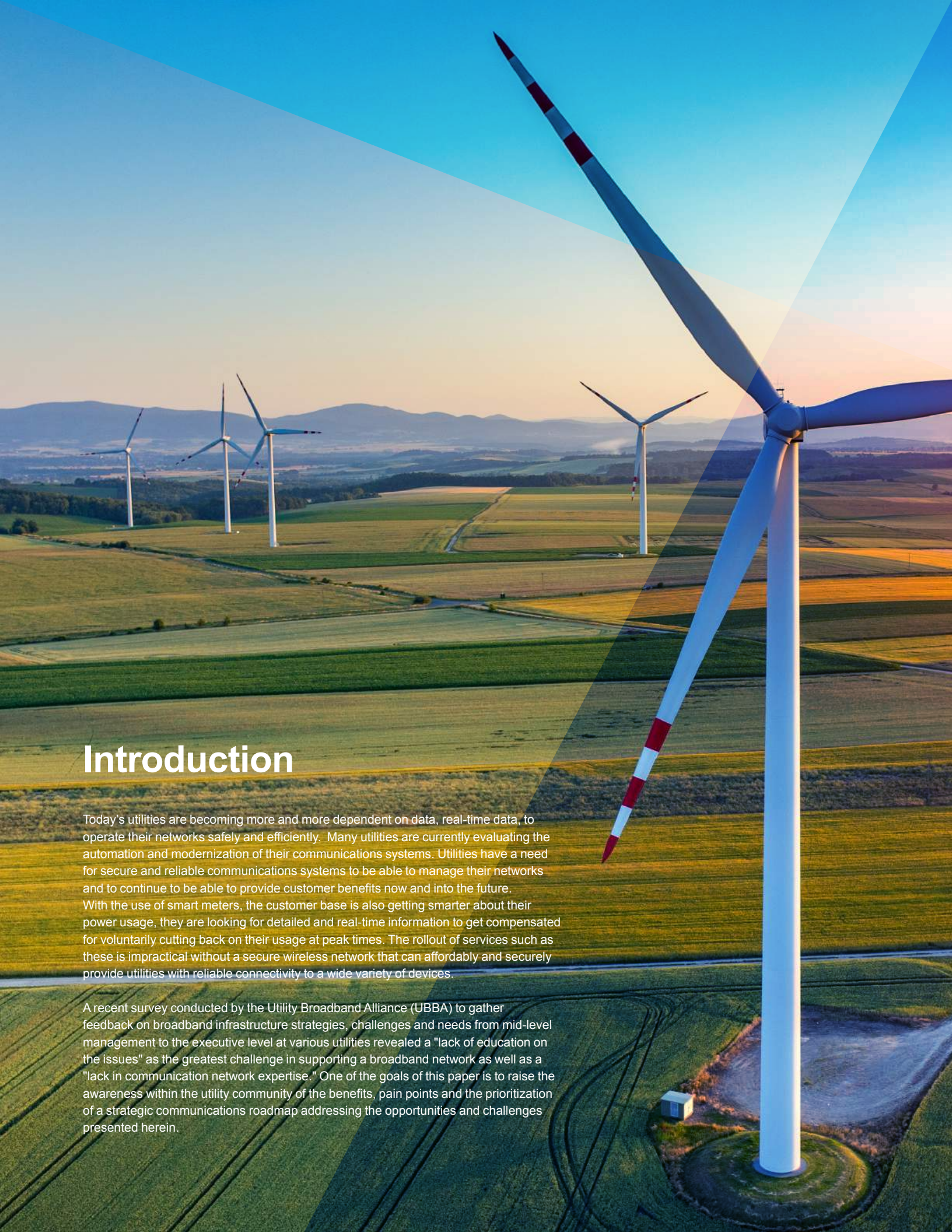

Introduction

Today's utilities are becoming more and more dependent on data, real-time data, to operate their networks safely and efficiently. Many utilities are currently evaluating the automation and modernization of their communications systems. Utilities have a need for secure and reliable communications systems to be able to manage their networks and to continue to be able to provide customer benefits now and into the future. With the use of smart meters, the customer base is also getting smarter about their power usage, they are looking for detailed and real-time information to get compensated for voluntarily cutting back on their usage at peak times. The rollout of services such as these is impractical without a secure wireless network that can affordably and securely provide utilities with reliable connectivity to a wide variety of devices.

A recent survey conducted by the Utility Broadband Alliance (UBBA) to gather feedback on broadband infrastructure strategies, challenges and needs from mid-level management to the executive level at various utilities revealed a "lack of education on the issues" as the greatest challenge in supporting a broadband network as well as a "lack in communication network expertise." One of the goals of this paper is to raise the awareness within the utility community of the benefits, pain points and the prioritization of a strategic communications roadmap addressing the opportunities and challenges presented herein.

Why do organizations delay transformation?

Historically, the challenging process of decision-making among business leaders has been driven by calculating the return on investment (ROI) of a given decision—this is also true within utilities. While delaying an infrastructure upgrade may appear to be a prudent decision to reduce capital expenditures in the near term, it is fraught with significant financial risk in the long run.

Here are some of the reasons organizations delay transformation:

- Reactive mindset: The fear of not wanting to "rock the boat" by changing something before it's time, this often ends up doing more harm than good. The lack of proactively seeking outside perspectives to identify where the organization is falling behind and taking action and making investments into the business, people, technology and workflow processes in order to bring about positive change. Most utilities react after major events occur and lessons learned are implemented. The reactive mindset thinks 'if it isn't broke—then don't fix it', the reality is that you ensure reliability by investing in it before these major events occur.

- Organizational changes: Identifying an engaged sponsor to spearhead new initiatives is critical for a successful transformation. However, reorganizations often end up postponing any progress due to changes in the leadership team where successors may not have, for example, the same vision valuing investments for smart grid initiatives.

- Risk aversion: Investor-owned companies generally create value for stakeholders by making informed, yet somewhat risky investments. Utilities often avoid risk at all cost and implement ideas of marginal improvements and in conservative investments—focusing on tried and true solutions 'firstgate' to try instead of trying something new.

On the flipside, there are many more reasons to consider a communications infrastructure upgrade, as will be discussed further and include: regulatory compliance, cyber security, aging infrastructure and workforce, natural weather disasters, and decarbonization. Utilities need to prioritize generating a strategic communications roadmap that will enable them to meet these challenges.

Regulatory compliance

The regulatory environment is constantly changing, whether it is in support of real-time metering or other customer benefits. Yesterday's infrastructure capabilities are lagging behind upcoming technologies and policy development while state governing bodies are seeking to sync policy with a rapidly changing energy market.

Several states are finding that these technologies and practices are outpacing regulatory policy and that changes are needed to appropriately value their contributions, or costs, to the grid. While the changes are significant and rapid, in the case of energy for example, most electricity is still provided by large central power plants and the ultimate balance of centralized and distributed energy resources is yet to be determined.

The challenges facing state policymakers are how to craft policies that promote cost-effective investment in the electricity system while allowing innovative technologies and new energy management approaches to flourish and compete in a rapidly shifting environment. This effort will require states and regions to adapt their policy regimes and infrastructure, which were designed for a centralized energy grid with one-way energy flows to its end customers. Today, they must craft policy that will function with a less centralized electrical system that incorporates multi-directional energy flows between energy providers and customers (or even directly between customers or other entities) and includes a far greater number of market participants.

Security

Continuity of supply and safe operation is of paramount importance for utilities. With ransomware hacking of utilities' IT and OT networks in the news, this is a critical and growing issue. Security is of equal importance to wireless networks. LTE networks have multiple layers of very advanced security built into the RF links to remove risks of unwanted attacks. It is a tried and trusted technology with broad device compatibility. Additionally, a private network allows implementing deeper security protocols at the level needed to protect the data.

A disastrous incident in May of 2021 is a prime example of what can happen when security is breached. Colonial Pipeline (one of the largest pipeline providers in the U.S. that provides roughly 45% of the East Coast's fuel) stated a cyber-attack forced the company to proactively close down operations and freeze IT systems after becoming the victim of a cyberattack. This measure temporarily halted all pipeline operations. Ultimately, Colonial pipeline paid close to USD 5 million in a cyber ransom.

Aging infrastructure and workforce

The traditional network deployment for utilities is disparate for various reasons: mergers and acquisitions, legacy systems managing different aspects of the utilities infrastructure and mission-critical applications including voice, supervisory control and data acquisition (SCADA), advanced metering infrastructure (AMI) and backhaul. These mission-critical networks have proven to be resilient, reliable and require minimal maintenance or upgrades over time. However, many are nearing end-of-life and in need of a tried and tested replacement that can accommodate the breadth and depth of digital transformation. In addition, many subject matter experts who support these systems are also aging out of the workforce. As these resources retire, they take their institutional knowledge with them—presenting challenges for the operation of networks as well the cost to hire or re-train employees.

With these disparate networks, the wireless technologies vary from land mobile radios (LMR), licensed and unlicensed spectrum , and mesh radios to high-capacity point to point radios. Historically, these radios have been proprietary to vendor-specific implementations. In turn, this has created fear within the industry that key connectivity technologies needed for a utilities application will become prematurely obsolete.

As such, there is an emerging trend towards converging these networks into a singular high-speed, low-latency, highly secure, standards-based private LTE network. LTE is based on a 3GPP standard and unlike proprietary networks, it has been reviewed and tested by hundreds of network providers around the world, ensuring that the built in network security is robust.

Private LTE networks provide utilities with an economical solution that enables them to consolidate most or all of their applications onto a single network standard. With only one standard to build and operate, the total cost of ownership is lower than maintaining multiple single use networks. Due to its ability to provide high-bandwidth, low latency and improved performance capabilities for digital transformation initiatives, private LTE networks have the power to greatly reduce operating expenses related to aging infrastructure upgrades.

Natural weather disasters

A report released August 2021 by the Intergovernmental Panel on Climate Change (IPCC) stated that global warming is dangerously close to spiraling out of control, warning the world is already certain to face further climate disruptions for decades, if not centuries, to come. The deadly heat waves, major hurricanes and other extreme weather events that are already happening will only become more frequent and severe.

The catastrophic grid failure in Texas in early 2021 (Winterstorm Uri) is another dangerous example of what can happen if utilities don't plan ahead and take actions to invest in infrastructure to keep up with the times. The root cause of the problems in Texas are well documented to be a combination of energy sources (gas facilities and coal piles) that became frozen combined with increased demand due to extremely cold temperatures and limited inter-grid connectivity to import power from other ISO regions.

It was exceptionally costly, from loss of life, restricted or limited power and heat, and inflicting at least USD 38 billion in excess electricity costs and an estimated USD 200 billion in economic damages. According to analysis firm Grid Strategies, given those dynamics, the costs to build out more transmission lines would have more than paid for itself by bringing in additional power when Texas desperately needed it. It would have helped them better manage how the limited electricity was distributed to customers.[2] A modernized grid based on a 900MHz private LTE could have provided the feedback needed to better distribute the limited electricity to customers.

Hurricane Sandy is another example that frames how much room there is for improvement in the utilities arena. While it's not possible to prevent natural disasters such as storms, it is possible to improve readiness via disaster recovery planning in order to restore systems to an operational state while minimizing outages.[3]

In the case of natural disasters, the need for dedicated networks becomes more apparent and is not isolated to the United States. There are many overseas scenarios, including the Darwin and Ophelia storms in 2014 and 2017 respectively, where much of Ireland was without power and electricity services that could not be restored without telecommunication services. During the country's 400Mhz auction process, Ireland's TSO (EirGrid) urged the Irish telecoms regulator (ComReg) for a dedicated smart grid network stating, "In such a situation EirGrid cannot depend on public communication networks as these may be compromised by a widespread and prolonged power outage."[4,5]

2 Julian Spector, "Newsletter: Texas outages made transmission upgrades look cheap," Canary Media, 27 July 2021.
3 Nicholas C. Abi-Samra, "One Year Later: Superstorm Sandy Underscores Need for a Resilient Grid," IEEE Spectrum, 4 Nov. 2013.
4 Christina Finn, "Storm Ophelia: Households should prepare to be without power for a number of days," TheJournal.ie, 16 Oct. 2017.
5 "The Power of Communications: ESB's Response to Storm Darwin," Electricity Supply Board, 2014.

Decarbonization

Many large utilities have faced pressure from their investors to take measures in order to secure their position of survivability through climate-related transitional and physical risks. While many utilities are setting aggressive targets, the majority of them are also counting on major advances in related technologies—such as carbon capture and sequestration, advanced nuclear reactors, green hydrogen, longer-lasting battery storage, and carbon offset credits—to achieve their ambitious goals. The takeaway here is that increased pollution will come as a result of inaction or failure to pursue decarbonization initiatives including advanced communications systems.

RF technology advances

In 2020, many utilities were actively participating in the Citizens Broadband Radio Service (CBRS) auctions and now with the availability of the 900MHz broadband spectrum, they have two complimentary spectrum bands available. This is a game changer enabling utilities to advance into the private LTE wireless space.

The trend among utilities is to use a combination of 900MHz broadband spectrum for private LTE networks and 3.5GHz (CBRS) spectrum for applications that require higher bandwidths. Public LTE options are also available but are not within the control of the utility. Use of a globally adopted and managed 3GPP standards, like LTE and 5G NR, allows the utilities to minimize infrastructure costs over the long-term, partially due to economies of scale.

Utilities are looking to use the combination of CBRS and 900MHz broadband spectrum to build out private wireless networks to enable their Advanced Metering Infrastructure (AMI) systems, active monitoring of network infrastructure (substations, remote facilities, generators, and the like), and provide wireless coverage for their field service personnel and the proliferation of Distributed Energy Resources (DER).

Recommendations

Utilities need to prioritize a strategic communications roadmap addressing the opportunities and challenges presented herein. If they can take the challenges mentioned here seriously and advance the use of private LTE networks, they will have significantly more flexibility, scaleability and control managing their networks. Private LTE has the potential to unify the utilities' communications networks across their entire geographic footprints, while increasing the coverage and bandwidth for LTE and IoT applications.

Here are just some of the use cases where a private LTE network can prove beneficial:

- enabling new and future smart grid technologies for both critical and non-critical system operations
- supporting customer affordability by investing capital in lieu of O&M-based cellular services
- leveraging their network by providing access to other critical infrastructure industries such as water and gas utilitities
- complimenting Land Mobile Radios (LMR) for mission-critical communications and worker safety
- providing last mile access to broadband services for underserved and rural communities and the potential to unlock new revenue streams

Utility-grade private LTE networks leverage the same technology as public LTE networks but offer several advantages in owner economics and rate recovery on capital. Private networks are designed to cover the needs of the utility. The combination of data privacy, security, flexibility, high capacity, quality of service (QoS), deterministic latency and coverage make private networks well suited for utilities'mission-critical applications.

As Benjamin Franklin once said "If you fail to plan, you are planning to fail." Utilities must act to strategically address the challenges presented in this paper, for utilities critical communications networks—doing nothing is no longer an option.

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