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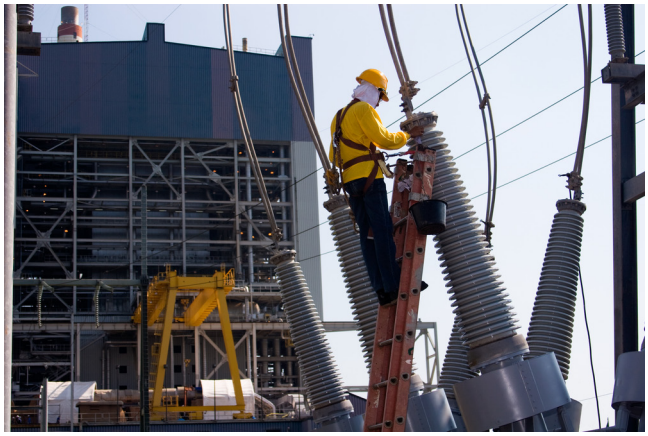
Utility Solutions

Smart Networking for the Smart Grid



An intelligent grid requires a smart backbone made up of a strong network and communications infrastructure. Indeed, the requirements of the communications network are inextricably tied to those of the smart grid itself, encompassing issues such as scalable bandwidth, robust security, high network reliability and availability, and cost–effectiveness. The industry generally agrees that the most pragmatic approach to meet these requirements is to leverage the wide range of transport technologies available while relying on common open standards, such as IP, to integrate into a single, overall network architecture. This white paper discusses the value that advanced, satellite-based networks can deliver as part of the smart grid communications infrastructure, across applications ranging from Substation Automation (SA) and Distribution Automation (DA), to mobile work flow and Advanced Metering Infrastructure (AMI) collectors.

Next-Generation Satellite Data Networking

Satellite networks have evolved at a similar—or even faster—pace as other communications networking technologies, making huge strides in improving performance and reliability, and reducing cost. In fact, some of the most demanding networks in the enterprise market, such as those provided to the lottery industry, financial institutions, and energy exploration companies, are based on satellite infrastructure. And when combined with high-performance IP and other standards-based capabilities, satellite networks deliver private, broadband connectivity that is second to none.

Indeed, very high network availability, in excess of 99.99 percent, can be achieved through innovative dual frequency, dual access solutions. Smart grid distribution assets, such as remote substations and distribution line elements, can be connected without compromising the expected benefits driving the smart grid. Furthermore, new satellite technology can cost-effectively deliver benefits such as broadband connectivity on-the-move, enabling those in the field to always stay connected with headquarters and other offices for rapid exchange of information.

Moreover, because of ubiquitous continent-wide coverage, satellite holds the potential to facilitate distribution automation, enabling proactive monitoring of far-flung distribution elements for outages and service demands, no matter the location. The many compelling benefits of satellite technology make it essential to be part of any decision-making when designing smart networking for the smart grid.

Substation Connectivity and Distribution Automation

Satellite connectivity has been used for years to provide Supervisory Control and Data Acquisition (SCADA) applications for remote locations in the oil and gas industry and other energy exploration areas. The data requirements are generally low in volume but regular in frequency. Private satellite networks have served this need by delivering highly secure, custom network bandwidth profiles and ubiquitous coverage. This still holds true today.

These applications are typically engineered with Ku or Ka-band satellites to deliver 99.7 percent to 99.9 percent link availability, which means that on average, 0.1 percent to 0.3 percent of the time, a satellite connection is lost.

That percentage coincides with a certain intensity of precipitation when it rains or snows, during which the satellite connection drops. Because substation connectivity is most critical during storms when electrical outages increase, conventional satellite systems have not provided the optimal solution to achieve near-100 percent availability—until now.

With any type of connectivity solution, it is very difficult to achieve 99.99 percent or 99.999 percent availability with a single-thread connection. To address this issue, many organizations employ a backup solution that can increase the availability of a connection to nearly 100 percent. A solution that integrates dual satellite paths based on frequency diversity can achieve this, in particular using L-band, which is in the 1 GHz to 2 GHz range and is not susceptible to degradation during precipitation. Consequently, when the primary Ku- or Ka-band satellite service fades during rain, the backup L-band path, is available to pass traffic. An alternative terrestrial solution at hard-to-reach areas might cost three or more times that of this satellite solution for the same level of availability.

Additionally, satellite still provides its inherent advantage—100 percent nationwide coverage. Simply put, there are no "dark" spots. Furthermore, satellite supports broadband applications such as Voice over IP (VoIP) and video surveillance, and network bandwidth can be tailored to specific requirements. Perhaps most importantly, the solution is completely private, meaning no traffic crosses the public Internet, eliminating the risk of infiltration by hackers and viruses. L-band and Ku-band satellite technologies are field-proven and with many advanced terminal options available, from fixed to mobile and portable units. Until now they have not been combined in this manner to provide a single, very high-availability solution. A "perfect storm" of requirements exists such that the traffic profile, the remote locations, and the need for very high availability make satellite an ideal solution for the utility industry.

The attributes of private satellite connectivity that enable distribution automation are similar to those for substation connectivity. In certain cases, a dual, high-availability solution may not be cost- justified, and a single, high-availability connection at an access point that is fed by distribution devices may be a more effective answer for monitoring and control. Ku-, Ka-, and L-band, satellite solutions are available to address this application. New advanced antenna designs offer a very small form factor, are easily installed and pointed, and provide the advantage of fixed operating costs. In most cases, availability can be designed to approximately 99.9 percent or higher. The emergence of these antenna solutions aligns well with the emergence of pilot deployments of distribution automation, and should therefore be considered as part of the overall strategy.

AMI Smart Meter Backhaul

AMI requires communication between a smart meter, residential or commercial, and the data center. To achieve this end-to-end connectivity, various technologies are required. Typically, both licensed and unlicensed wireless solutions are deployed between the home and a collection point further upstream. The collection point then needs a communications link to the data center. A common practice in today's deployments is to use carrier cellular solutions from the collection point onward . One challenge to that solution is that carrier cellular networks are susceptible to the congestion patterns of consumer voice users. Another issue is that during disasters, either cellular coverage is knocked out or cellular use dramatically increases, thereby eliminating or diminishing bandwidth for data applications over the network. And lastly, cellular data coverage is limited typically to more populated areas and therefore is not available in remote locations.

Satellite technology can also serve a key role in implementing the WAN. Enterprise satellite systems deliver custom network solutions that are private, and therefore are not susceptible to public usage, don't traverse the Internet or other public

network, and provide ubiquitous coverage. Further, advanced antenna designs enable easier installations, including pole mounts. Privacy, scalability, bandwidth, ease-of-deployment, and reach are all significant benefits satellite can provide, either in the dark spots of a cellular network or in place of the cellular network itself to provide a complete end-to-end AMI solution.

Mobile Workforce

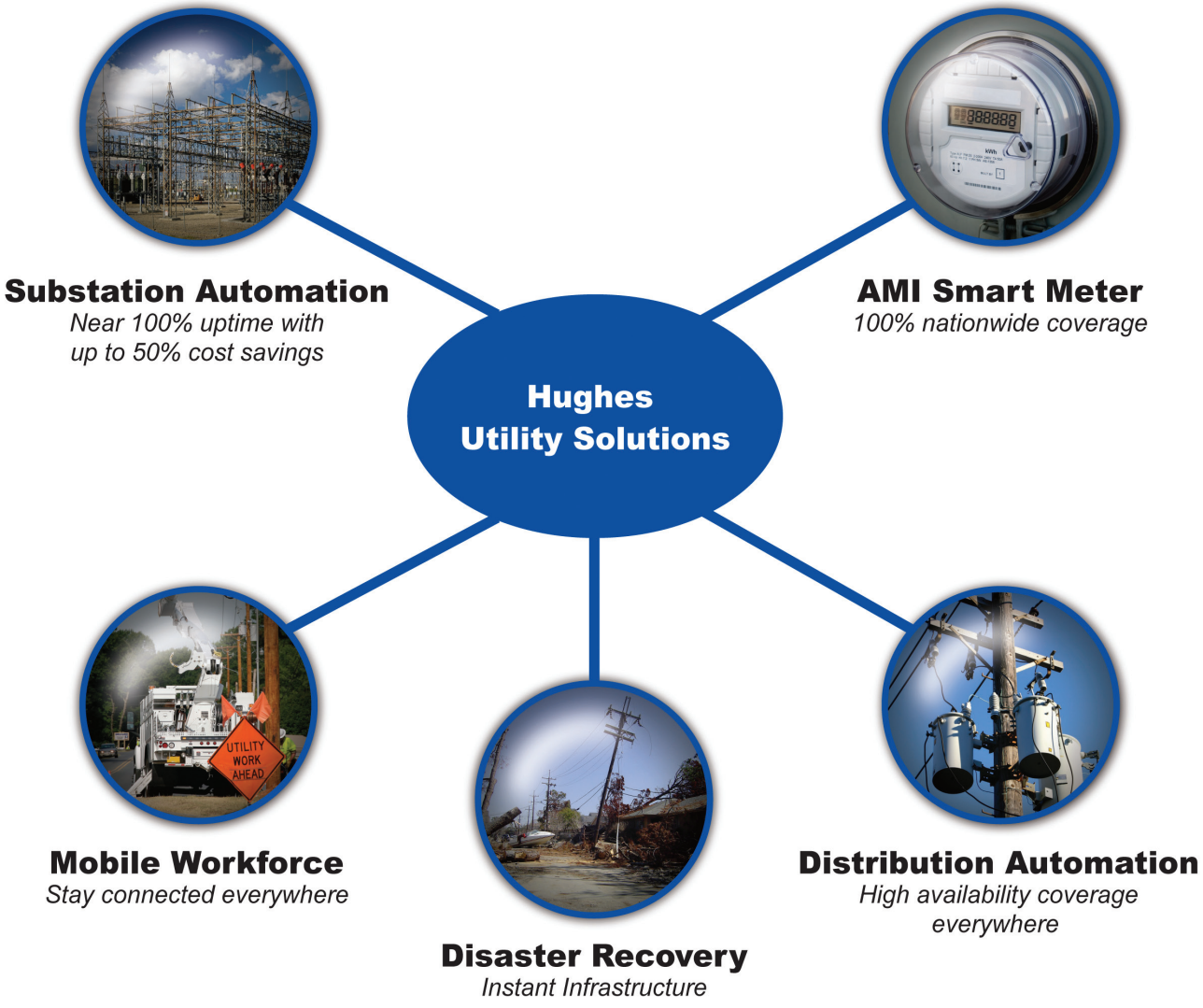
Gone are the days where a company's workforce does not need to be connected at all times. With so many options for field personnel to stay in touch, there is no reason not to equip them with the right technology. So what is the right technology? Cellular coverage is extensive, and the service is affordable but may require multiple providers to cover larger geographic areas. And although cellular data delivers a few hundred kilobits-per-second performance it fluctuates and coverage may not be complete. Other radio networks also are typically limited in range and bandwidth. And although cellular technology is affordable and radio networks are already in place, what happens if personnel are out of range when supporting restoral efforts outside of a service area? It becomes problematic if staffers are required to interrupt their work and drive long distances to find connectivity.

These dark spots are exactly where satellite technology can provide the solution. Vehicles as small as compact cars can be equipped with fixed mobile or on-the-move satellite technology. One way to leverage the best of the technology available is to equip the line truck with a router that can connect to cellular service, private radio, and satellite,. The router automatically finds the service that is available, so field personnel are constantly connected. This solution supports all data needs, including work orders, dispatch, and repair support. Satellite also supports higher bandwidth requirements than other technologies can, such as multi-Mbps downloads—an attribute unique to satellite technology in mobile applications. Finally, the same satellite infrastructure can be used for other aspects of an organization's communications infrastructure, whether mobile or fixed.

Satellite: A Critical Part of a Multi-Technology Approach

Satellite networking technology has evolved significantly over the past several years and now delivers high performance, availability, and security that can greatly aid smart grid efforts for the utility industry. Substation connectivity, distribution automation, AMI Smart Meter backhaul, and smart trucks are four key areas in which a satellite solution can provide the most cost-effective communications solution. Indeed, satellite solutions are an essential part of the multi-technology approach required by utilities to achieve an end-to-end, smart grid communications infrastructure—one that is reliable, fast, secure, and cost-efficient.

Next Generation Satellite Technology for Your Smart Grid Applications



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