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## **Utilities: Empowering the Smart Grid**

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“Smart Grid” is about transforming the way electricity is generated, distributed and consumed and replacing antiquated electricity delivery systems with secure, intelligent, end-to-end digital, two-way communications infrastructure to increase system reliability. The result is reduced consumption, higher efficiencies, better diagnostics controls and forecasting.

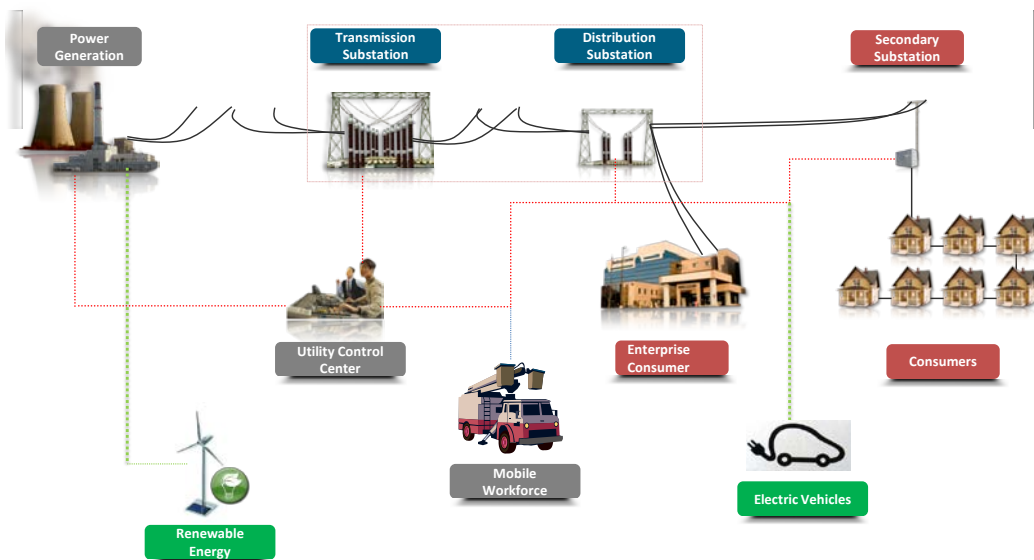
The integration of IT and automation to upgrade the electricity communications infrastructure empowers an “energy Internet”. Mission-critical applications managed at operations and control centers driving intelligence on the grid require secure, IP-open standards-based, high-speed real-time two-way communications.

Great volumes of data from more intelligent devices, combined with better management applications, allow for better end-to-end monitoring, planning and control of the grid — from power generation through transmission and distribution to residential, commercial and industrial customers. Beyond injecting more intelligence into existing assets on the grid, Smart Grid enables smoother integration of renewable energy sources and plug-in electric vehicles.

Critical to enabling a Smart Grid or energy Internet is secure two-way networked communications at key points throughout the grid — from fossil fuel and renewable power generation and transmission to distribution and consumption — as well as a mobile workforce that services the infrastructure. The 3G wireless networks in place today, in which major operators continue to make significant investment, act as an ideal on-ramp for the electric super highway.

## The Smart Grid Landscape

*Sierra empowers utilities end to end*



## **Transmission & Distribution Communications**

Remote sites in harsh environments supporting legacy equipment, as well as new intelligent electronic devices (IED), enable better substation monitoring and more efficient power rerouting in outages. Required to monitor mission-critical data securely via native DNP3 Modbus and other legacy protocol support:

- Voltage regulators
- Capacitor bank controllers
- Reclosers
- Fault monitors
- Surveillance cameras
- Access controls
- Weather and seismic monitors
- Wi-Fi hot spot for mobile workers

## **Smart Metering**

Energy meters are able to reliably and securely communicate information with a central location. The availability of metering information in real time allows accurate meter reading, improved billing, and energy management through customer profiling.

There are several types of network technologies that can be used for a Smart Metering deployment. It can be done using point-to-point WAN technology or through a concentrator that is connected to several meters using RF Mesh radio or PLC (Power Line Carrier) technology.

Secure broadband wireless technology is required to accelerate the monitoring of millions of homes and enterprises with the ultimate objective of empowering users to control and curb their usage. This network must be highly secure and reliable to ensure consumer privacy and increase confidence. Improved insight into customer usage allows utilities to better pinpoint outages and reroute power more efficiently, which translates into better customer service.

## **Home Area Networks**

The Home Area Network (HAN) gateways facilitate demand-side management (DSM), including energy efficiency and demand-response in homes and small businesses. HANs use low power RF mesh protocols (such as Zigbee) to communicate with devices in the home, acting as a communications gateway to smart meters and metering infrastructure. Gateways can either be integrated into the smart meter itself or connected to the meter via a controller incorporated in a home control system, in a set-top box or PC server.

Sierra Wireless maintains a diverse wireless solutions portfolio which includes multiple RF mesh applications supporting either approach.

## **Commercial/Industrial Demand Response**

Energy efficiency programs help commercial and industrial customers identify opportunities to drive energy efficiency of control systems within the workplace and across multiple locations. Always-on

intelligent gateways allow businesses to monitor energy use 24/7, quickly identify inefficiencies and make rapid adjustments.

### **Renewable Energy**

Sustainable energy sources such as wind, solar and biomass, and their storage far from population centers in remote, harsh environments with limited local power and communications infrastructure:

- Accelerate integration of renewable resources with the web
- Allow for more effective and efficient management with other energy sources
- Allow for real-time broadband remote monitoring, diagnostics and of data collection

### **Plug-In Electric Vehicles**

Two-way vehicle-smart grid communications is converging with telematics and location-aware technologies that will help people plan their most efficient EV route, as well as the most economical way to recharge away from home without stressing the grid.

Regardless of the standards agreed upon, it is clear is that there will be a need for PCI compliant charging stations, together with downloadable route planning and EV charging station locations. Sierra Wireless is leveraging its broad experience in wireless infrastructure and telematics applications to support the establishment of 'best practice' guidelines for the automakers as the power utility, transportation systems and automotive segments converge in the roll out of the PIEV and its supporting infrastructure.

### **Mobile Workforce**

Communications for mobile and remote operations personnel need to be integrated with remote fixed assets, while reducing risks associated with vehicle investment and operational expenses. Ultimately, field personnel are given the ability to operate with greater knowledge through the availability and exchange of real-time mission-critical data. Ensuring that mission-critical information is securely delivered over the right network, on time and to the appropriate personnel requires a combination of communication hardware, software and services — often from a variety of different suppliers. Maintaining this multitude of field solutions often requires an additional investment in vendor proprietary testing and support equipment.

Utilities with large mobile workforces have limited options for reducing costs associated with managing and maintaining their wireless solutions:

- Rely upon each vendor to maintain and support for their specific solution
- Acquire the necessary training and equipment to be self maintained
- Contract out to a third party capable of maintaining network and device operations
- Rely upon vendors with open source tools capable of supporting third party equipment

With today's tight economic conditions and fast-paced technology cycles, many utilities are finding an optimal balance between self-maintenance and outsourcing by working with established vendors who

participate in a common solution ecosystem. In well-defined ecosystems, vendors certify that their applications are interoperable within the solution chain.

Sierra Wireless recognizes the utility industry's need for alternative solutions in a variety of mobile workforce applications and is assisting our partners in developing an ecosystem of certified utility solutions. This approach will result in lowering the utility's overall maintenance and support costs by infusing more open development platforms and non-proprietary maintenance and support tools such as:

Communications Control Environment:

- End-to-end management for all remote and mobile assets
- Secure communications intelligence including SSL IPsec VPN, GRE Tunneling WPA2 Wi-Fi encryption, stateful packet inspection firewall and MAC address filtering
- Persistent network connectivity including events reporting, location information, I/O status, and network settings
- Remote configuration, simplified installation and over-the-air firmware updates
- Web-based, enterprise grade hosted remote management
- Connection signal and strength monitoring

Sierra Wireless maintains a comprehensive portfolio of wireless devices (intelligent embedded modules, gateways, routers and adapters), connectivity options, software applications, and integration and device management services for the three core wireless utility applications using wireless IP connectivity based on cellular technology (W-WAN) such as GSM/GPRS, HSPA and CDMA and next generation 4G technologies.

### **Keeping Smart Grid Applications 'Smart'**

Maintaining a fully optimized wireless smart grid application begins with the development of the organic wireless module and the integration and testing of that module in the end-point (such as a meter or concentrator).

To be able to match the requirements of the grid, the wireless module shall:

- Be rugged and compliant with Industrial Grade standards (support extreme temperature -40C - +85C)
- Include an Embedded SIM card (and not a consumer grade plastic SIM card) as it is the only technical choice to guarantee reliability and simplified logistics and deployment
- Be programmable to be able to embed specific metering and communication protocols
- Include the IP and security protocol layers
- Be monitored and upgraded over the air

The phases of a wireless WAN product development in Smart Grid applications should include:

Device Integration:

- Program Management & Guidance
- Product Design Consultation: Hardware, Communication Firmware, Software Application, SIM card integration and management (Embedded SIM) or Antenna design

#### Platform Verification/Validation:

- RF testing
  - Passive; (Q)TIS; TRP; OTA desense
- Satimo Stargate 64 Chambers, OTA RF Performance
- SIM integration and testing
- Environmental qualification
- Field & Lab testing

#### Certification Preparation:

- Agency, Regulatory
- Device preparation
- Document preparation
- Submission logistics, management

#### Customer Development:

- Software (Drivers, Protocols, Apps, Tools)
- OS porting
- Testing, Commercialization support

### **Remote Management & Diagnostic Tools**

With millions of customers dependent on the grid for reliable service, utilities must use an explicit set of remote management and diagnostic tools to keep Smart Grid applications fully optimized. The wireless network must monitor and control a variety of open and proprietary end-point devices, enable firmware over the air (FOTA) configuration for the device and software application, ensure multiple layers of security encryption, heal itself from outside attacks, and do all of this in an open and standardized environment. No single utility can afford to fully staff its IT department with the resources necessary to support this evolving environment. The support and expertise needs to come from the vendors and network operators.

Gone are the days when a standard protocol analyzer was all a utility needed to deploy and maintain its wireless network. In today's environment, new services and applications are available to the utility that were once deemed exclusive for mobile network operators (AT&T, Verizon, Sprint and T-Mobile). Machine to Machine (M2M) Internet-based portals that manage and diagnose the network operations, including each mobile device are now available to utilities either directly or through a managed service provider. These M2M portals provide real time access to network conditions (outages) and can manage third party devices on the network(s), reducing the costs associated with the multiple tools / services required to maintain mobile clients.

Utilities that do maintain their own networks and mobile devices should ask their vendors to supply the necessary tools for self-maintenance. That tool-box should include:

- GSM/CDMA network throughput testing, troubleshooting and validation programs
- Digital Storage Scopes — SIM electrical pre-screen testing
- JTAG Memory Capture Tool — Used to capture module memory dumps
- RF Reference Device — Ring testing and RF noise troubleshooting

- OEM provided platforms for numerous hardware design validation tests

Providing the necessary wireless management tools to simplify the provisioning, managing and troubleshooting of remote equipment enables utilities to monitor and control their network of wireless gateways and end-points from one or more central locations. This ultimately lowers the total cost of ownership (TCO) by virtually eliminating the need for field service technicians to travel to remote distribution points.

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