

# Merging Legacy Systems and the Smart Grid

by Dave Mayne, *Digi International*

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The Smart Grid is a term that is now recognized by a broad range of people that have never worked at a utility or related business. There are stock indices following businesses developing products and services that enhance the grid, continual legislation focused on investment and research in energy generation and distribution, and an increasing recognition that the way people view and manage their energy usage in the future will be dramatically different from today. These factors are driving many analysts to predict more than \$200 billion will be invested in new grid technologies between 2008 and 2013, with over \$53 billion in the U.S. alone (source: Pike Research).

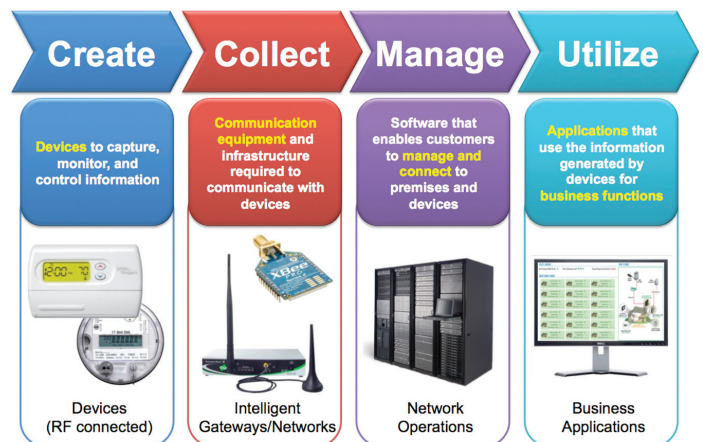
These new investments cover a broad range of products and services, but virtually all are focused on enabling enhanced monitoring and control across the electrical distribution network. This includes capturing more granular information related to power quality, consumption, and grid performance by facilitating two-way communication and generation capabilities throughout the distribution system.

It is becoming increasingly clear that the Smart Grid is not defined by NEW devices, but by the services enabled by adding secure and reliable two-way communications to as many points on the distribution grid as possible. Clearly this will require some new equipment, but it will also require innovation that minimizes stranded assets for the utility industry.

Digi International has identified four capabilities (Figure 1) that are required to drive the benefit goals of the Smart Grid:

- **Create:** devices and sensors to capture information and provide control services
- **Collect:** communication devices and networks that allow data and control services to happen
- **Manage:** a network operating environment for managing all the connected devices
- **Utilize:** business applications that turn the data into actionable information and driving benefits

## A Complete Solution



**Figure 1:** Capabilities required for a successful Smart Grid.

In reviewing these capabilities, several interesting observations can be made. The first is that these do not define a specific network technology, device, or sensor. They are a capability that must be enabled for all devices (new and old) that are part of the energy distribution framework. These capabilities will need to exist for devices in the substation, down the feeders, at the metering points, and even into the extended grid inside a home or business.

A second observation is that the value is not defined by the device, but rather by the business application utilizing this communication and control capability. In other words – these capabilities drive benefits whether this is a new asset or an investment that was made five years ago. The benefits are almost universally defined by business functions rather than the device itself. Once this is recognized, it is much easier to evaluate technology gaps that need to be filled. These gaps tend not to be specific devices or protocol, but rather a machine-to-machine management platform that can easily connect these devices to the appropriate business applications. Making the right decisions at this level will drive accelerated deployments of Smart Grid technologies that can leverage distribution equipment both new and old.

As stated earlier, it is estimated that over \$200 billion will be invested globally in the Smart Grid by 2013, but the existing grid assets far exceed this number. Is it possible to enhance these solutions to make them more viable in supporting bi-directional communications, control and generation services? Can the utility (and rate payers) achieve an

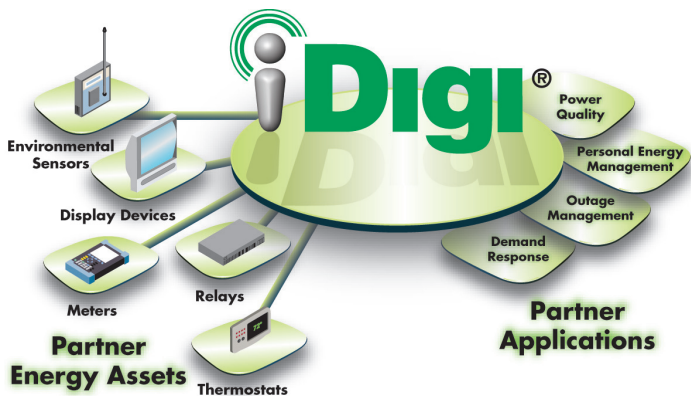


Figure 2: Value derives from business functions, not devices.

adequate percentage of projected Smart Grid investment benefits without replacing the current asset? There are a growing number of communication companies trying to address these questions in an effort to accelerate deployment of Smart Grid services, and service the widely varying business case drivers being presented by utilities large and small.

### Smarter AMR with consumer engagement

The industry is closely watching the early adopters of Smart Metering technology, with several utilities now announcing deployments exceeding one million units. While this progress is impressive, there are nearly 150 million meters that are already automated with AMR communication technology. Clearly these devices do not provide all of the interval data collection, remote disconnect capabilities, or other enhanced communication services that are envisioned for the final Smart Grid deployment. But it is possible today to add communications over public networks (cellular, broadband, etc.) that deliver consumer engagement/Energy management services with full HAN support. These capabilities allow utilities to deliver a broad range of demand-side services to their customers leveraging the existing metering investment.

Digi International, for example, recently launched a series of ERT gateways enabling the owners of over 40 million ERT meters to communicate over IP networking solutions. This allows utilities to

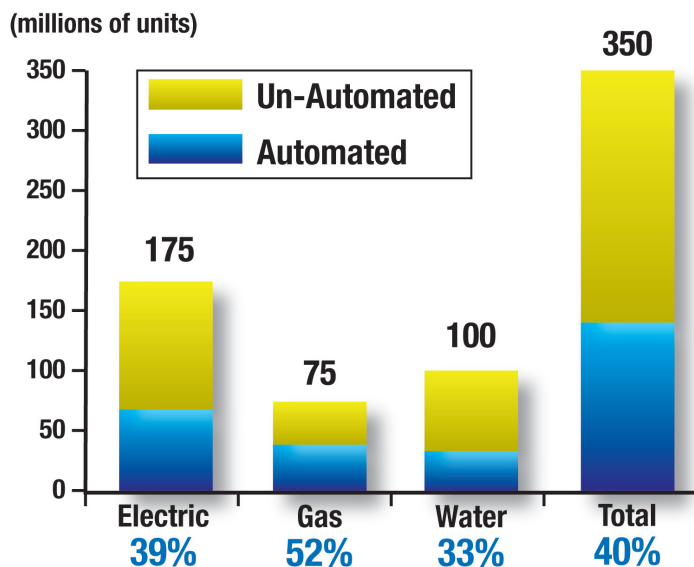


Figure 3: North American AMR Penetration (Source: IMS Meter Report 2007 Edition).

leverage their existing metering assets to provide customer energy management services, verified demand response measurements, or view coincidental load across a set of meters for load forecasting purposes. While this clearly is not a Smart Metering platform, it does facilitate a suite of services consistent with many Smart Grid business cases.

In addition, products are available that convert these AMR devices to industry standard protocols such as the ZigBee Smart Energy Profile. This minimizes stranded asset risk by connecting these ERT modules to a wide range of certified Smart Energy devices, presenting a smooth migration from the world of AMR to the Smart Grid.

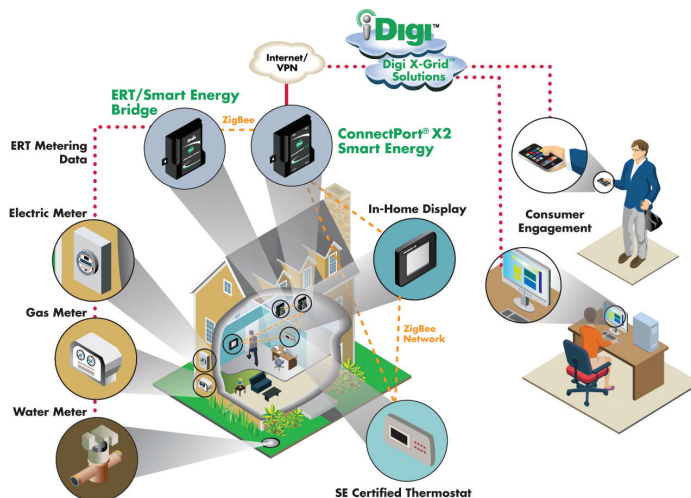


Figure 4: Consumer engagement with Smart Energy devices.

The industry will continue to develop and expand the use cases enabled by these new technologies, but providing tools that can provide flexible deployments that can future-proof the distribution grid are essential in driving early technology adoption. These AMR gateways are made possible by leveraging machine-to-machine management services that connect the utilities applications (consumer energy management portal, Demand Response platform, etc.) with their customers metering device – a key development in making this technology commercially viable.

### Responding to network and other technology changes

On February 18, 2008 the Advanced Mobile Phone System (AMPS), better known as the analog cellular network, was no longer required to be supported by the carriers. This change forced the industry to figure out new methods of communicating with thousands of metering and distribution devices – most deployed at commercial utility customers across North America. The industry did not respond with a singular approach to this issue, but rather architected innovative solutions that met the needs of their respective business. For some utilities, this helped accelerate Smart Grid deployments – while others worked hard to avoid any meter change-outs by identifying technologies that could IP enable dial-up modems.

These decisions were not made based on the best technology, but rather based on the business drivers. This is true for Smart Grid deployments as well. There is not (nor will there be) a single software or communication solution that works for all utility business functions. The reality is that many communication

solutions – public, private, wired and wireless – all can and will contribute to the overall Smart Grid ecosystem. Each technology provides a unique set of performance, cost, reliability, and security goals that differentiate, but do not diminish their contribution to the overall system.

The challenge for the industry is not in identifying the communication solutions required, but in developing efficient, secure, and scalable connectivity over a broad range of networks. This “middleware” management platform will be a critical piece of the Smart Grid, and must not only provide support for the new technologies, but also manage devices and technologies that are already deployed. Most importantly, many M2M management platforms isolate the utilities’ applications from the specific communication network allowing new technologies to be deployed without disrupting existing systems.

**Conclusion – device management is key to being future proof**

The combined forces of all networking technology utilized in the Smart Grid are aimed at time-sensitive collection of energy consumption data. Whether utilizing power-line carrier, fiber, cellular, or proprietary wireless communications, the goal is to determine what energy is being used, and more importantly, when! If I commute to the office during rush hour, I use far more

gas than in the middle of the day; hence my costs (environmental and economical) are much higher than if I try to shift my driving patterns. The same is true for energy consumption. If I use electricity during the “electrical rush hour,” the cost to the utility is significantly higher – yet in most cases they are unable to pass that extra cost on to the consumer.

The Smart Grid is the first broad reaching initiative enabling utilities to better map costs to price, which in turn will strengthen support and adoption of time-based rate structures. This will greatly increase the need for “energy dashboard” tools communicating rate and consumption data to consumers, and will rapidly expand the number of people actively participating in load shifting programs.

Once again, these challenges do not define a specific networking technology – but rather an information and control ecosystem that will utilize many networks – both wired and wireless – to promote an interactive, reliable, and efficient energy delivery grid. Selecting a software service that allows your applications to operate independent from the communication network will maximize the utility’s ability to leverage existing assets while helping to future-proof the investments. ☺

# WiFi Authentication

## Rabbit Semiconductor

Rabbit Semiconductor’s guide to WiFi authentication is a self-paced tool to introduce design engineers to update program firmware via a secure wireless connection.



The product training module allows design engineers to learn about new features of Dynamic C v10.54 release, recognize security terminology, protocols, and standards for WiFi authentication, and to understand remote program update firmware, and tools and sample programs used to implement features.

The module is 14 pages in length and can be viewed with or without audio in ten minutes.



## Did You Know?

Actress Hedy Lamarr and composer George Antheil together patented frequency hopping technology in 1942 that was the basis for modern spread-spectrum communication technology used in WiFi and in some cordless and wireless telephones.

