

The Case for WiFi Smart Meters

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As a networking engineer and consultant in the Smart Grid, home networking, and home controls industries I am often asked which “no new wires” networking technology is the “best” for a given product or application. The answer is not always obvious. You don’t need an expert to know that for computers, broadband distribution, and digital entertainment, WiFi is the clear leader in terms of the number of connected devices, although solutions such as HomePlug®, MoCA® and HomePNA® do an excellent job as well. For home controls the leaders are ZigBee®, LonWorks, and Z-Wave®, sharing the market with numerous other solutions. The question gets more complicated when a device does not fit neatly into one or the other category. A Smart Meter is one such product.

One view of a Smart Meter is that it connects the utility to the major energy consuming devices in a home such as HVAC and lighting systems, major appliances, and pool heaters and pumps. The purpose is, of course, to provide information on the energy used by the consumer and to influence when and how much energy is used by these devices either directly through a Demand/Response (DR) program or by encouraging and facilitating changes to the customer’s energy consumption habits. Therefore it is logical at first blush to view it as a part of a home control or energy management system. This is the thinking behind the inclusion of a ZigBee wireless RF connection in many Smart Meters to connect them to the consumer’s Home Area Network or HAN. It is a standards based, low cost, low power network optimized for communicating control information and other small packets of data over relatively short distances (typically <10 meters) and it has broad based support for this application. WiFi on the other hand is a high speed, longer distance network used primarily for connecting broadband Internet, entertainment and other data between PCs, tablets, smart phones, game consoles, TVs, etc. Case closed right? Not necessarily. There is a second view of what a Smart Meter does that is perhaps even more important.

The Out-Of-The-Box Experience

The initial customer experience for any new product or service is crucial to its success. Smart Meters are no exception. They will be the consumer’s first and primary exposure to the developing Smart Grid and its benefits. Therefore utilities must ensure the best possible “out-of-the-box” experience of a Smart Meter. The more consumers can do with the meter immediately after it is installed, the greater the likelihood they will want to take advantage of its capabilities and connect it to more devices and applications. It’s all about generating momentum and creating a great initial customer experience. Here’s the rub. Very few homes have even a single ZigBee device.

There are few things worse than telling a customer that this great new widget you are giving them won’t do anything unless they go out and buy something else. For a Smart Meter that means you want to be able to tell them that as soon as it is installed they can begin to view their pricing and usage data, monthly bills, and information related to their services; that they will be able to download applications that will help them lower their energy bills; and of course that there are new energy saving devices they can buy. If the meter comes with a WiFi connection, the customer can immediately begin to interact

with it and with their utility though any WiFi connected computer, smart phone, or tablet. However, if the Smart Meter only comes with a ZigBee connection, there will be nothing in the home that it can connect to until they buy a gateway to connect it to their existing network. There will be no display on which to view their data; no third party applications that can be downloaded to help them track their usage; no ability to immediately see what a change in temperature settings is having; no user interface. That new Smart Meter the utility spent so much to install and tell them about is no different from their old dumb meter until it gets connected to something in their home. And to do that costs the consumer time and money. Not a good marketing plan.

The real question is not which wireless network technology is the best, lowest cost solution for a low bandwidth energy management device. The question should be which home network connection will allow the Smart Meter to achieve the goals of load-shifting and energy conservation at the lowest TOTAL cost? I maintain that WiFi wins this discussion hands down.

Connected Appliances

Most existing appliances will not be able to be upgraded to connect to a Smart Meter. They need to be replaced. HVAC on the other hand can be connected without replacement. Replacing an existing thermostat with a connected thermostat will enable it to control the boiler or AC system over existing wiring, and pool pumps and heaters may be able to be upgraded without replacing the more expensive components. So the obvious question is which network are they most likely to use? That depends on what the manufacturer sees as the most important things their customers will want to connect to. Unless the manufacturer is going to include a display and user interface, the consumer will have to connect them to a display and UI, the majority of which use WiFi. Certainly many thermostats already include a display and a UI but it is tough enough to set up today's programmable thermostats. What happens when you add more complex functions? Additionally, people who are most likely to take advantage of a smart meter's capabilities are online daily for emails, social networking, and the news. How often do you look at your thermostat?

Just as importantly, a smart appliance, thermostat, etc. has added functionality whether or not there is a smart meter in the home. I can set my new thermostat, control my smart pool heater/and pump, etc. from anywhere in the world using a smart phone, PC, etc. even if my utility hasn't deployed Smart Meters in my region or begun to offer tiered rate plans.

This is not to say that ZigBee and Z-Wave devices are not coming to the home and potentially in large numbers. The low operating power, small size, and low cost advantages are important for a system with many nodes since the advantages are multiplied by the number of devices needed and some devices such as a light switch have severe size and power limitations. Control systems using these and other networks have been around for many years but they are still primarily found in high-end homes. It will take many years for consumers to buy into a systems approach to energy management. And when they do, it is likely each will operate on its own network, ZigBee or otherwise, and include a connection to the main network using either WiFi or Ethernet, which is included in every WiFi access point.

Lower Total Cost

One argument for choosing ZigBee is that adding ZigBee to the meter costs less than adding WiFi. However, gateways cost money and there is no need to buy one if the meter uses Wi-Fi. The meter can simply connect to the existing WiFi network. WiFi is very secure as well. Of course many homes do not have a home network. However, there are already hundreds of millions of WiFi devices in tens of

millions of homes today. Additionally, most homes with WiFi have an Internet connection. A Smart Meter connected to the Internet will propel entrepreneurs to create new and innovative applications and products for the Smart Grid. An Internet connection also provides a second path (the first being the over utility's meter connection) for the utility or authorized third parties to easily walk you through the configuration process and verify it is properly configured and the connection is secure. Additionally, most people have access to friends, family members, retailers and local professionals who know how to connect a device to their WiFi network, further reducing the need for customer service.

Another potential issue for ZigBee, at least in the near term, is its relatively short range. Meters are typically installed on an exterior wall. However, the device(s) it needs to communicate with may be too far away, with too many intervening walls, floors and other obstructions for the signal to reach them. To remedy this, the device either needs to be moved closer to the meter (not very realistic for most appliances) or additional ZigBee devices or repeaters must be purchased and installed between them.

Let's assume an estimated cost for each truck roll of \$250 (NARUC estimates it at \$275) and that a WiFi connection costs \$5.00 more than a ZigBee connection (my own best guess). If only 1 in 50 installations require an additional truck roll due to the shorter range of ZigBee, the utility breaks even. And that doesn't include call center costs, the cost of the one or more intervening devices, or the bad PR that accompanies any failure of a product to perform as expected.

One Last Point

In addition to the goal of rapid and widespread deployment of the smart grid, the federal government has a goal of a computer and Internet connection in every American home. By including a WiFi connection in the Smart Meter consumers, ISP providers, and others have a built-in application, energy conservation and lowering energy bills. Any other connection will do little to drive computer ownership and Internet connectivity into homes that do not already have them until and unless the consumer buys a gateway or the government subsidizes its cost.

In summary:

- Millions of homes have WiFi networks, few have ZigBee.
- A WiFi enabled Smart Meter will provide immediate functionality to the tens of millions of consumers that already have a WiFi network without the additional cost and complexity of a gateway.
- A WiFi connected Smart Meter becomes just another device on the network. Consumers already understand they own their WiFi network. Utilities will therefore benefit from clearly ending their service responsibilities at the meter avoiding many customer service issues within the home network.
- Additional ZigBee devices may be needed in many homes to reach devices that are otherwise out of range increasing cost and customer service calls.
- ZigBee and other control networks will grow over time to include HVAC, lighting, health care, and other systems. These systems will provide the gateway function since the majority will include either a WiFi or Ethernet connection in addition to whatever control network they operate on.
- From an overall cost, functionality, complexity, and convenience perspective, WiFi enabled Smart Meters will help utilities and the government to reach their goals for rapid deployment and broad consumer adoption.