

What Makes Appliances Smart?



marathon[™]
laundry machines

Abstract

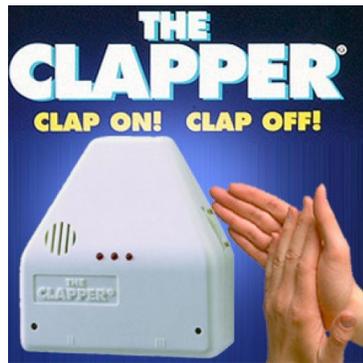
This whitepaper explores the Smart Home space and the technologies by which your home devices operate and interact with you. The advent of the internet has changed the landscape – but not as much as the futurists of the past have imagined. Remote control of dumb devices is being replaced by truly smart appliances.

Home Automation Over the Years

Home Automation has been around for 40 years, starting with X10 in 1975. Electromechanical timers for outlets existed even before that, in the 1940's and 1950's. The category has evolved very little since then, with most offerings being "smart controllers" for turning your lights and appliances on and off. The advent of the internet has allowed the "remote control" to be a mobile device, but the concept is similar to what it has been all along: control your switches and outlets.

Smart On/Off Switches

Dumb Appliances with Smart Controllers



The progression towards realizing the smart, interconnected home began with existing appliances, still 'dumb,' with a new added layer of smart controls. This trend was introduced to the public in a widespread way in 1986 with the infamous Clapper, a device that you could use to turn your lamp on and off by clapping your hands. The Clapper asserted on/off control of another device by simply plugging that device (e.g., a lamp) into the Clapper. Now it is easy to think of the sound activating a circuit within the Clapper that opens or closes the electricity flow to the lamp. It seems a bit more high tech than a

regular lamp, but the lamp has remained dumb. The lamp doesn't gain any functionality. It is as if the Clapper serves the surrogate role of the human hand to power the lamp on and off.

The product offerings currently available so far in the smart home market can be conceptualized in two different categories according to how much interactivity they provide between the user and the home.

Smart Controllers Monitoring, Alerting, Communicating

The simplest of smart home devices puts extra eyes and ears throughout the residence. For instance, the Canary home security system is described by its manufacturer as covering all aspects of home safety, from movement-activated video surveillance to monitoring air quality and temperature in case of chemical leaks or fire. Canary sends alerts to the user's device, giving peace of mind while the user is away from home. There is no two-way communication from the remote user back to the in-home Canary system. No aspect of the home is actually controlled by a Canary interface.

Some systems, like Nucleus, bring two-way communications into the home network. An upgrade of the old home intercom system, Nucleus simplifies all areas of communication, providing a high-tech replacement for phones, apps, video calls, different contact lists, etc., as well as providing a dashboard to integrate other home monitoring solutions.

Centralized Control

The next category involves some control over home systems, including lighting, heating, and outlet control over vampire electric loads like TV's and computers, which are always drawing a small amount of power, even when supposedly switched off.



These ON / OFF control systems can sound elaborate and enticing (like Nest thermostats) but in fact all the smarts are in the controller. Furnaces are just as dumb as lights. Several of these centralized control apps and systems provide sophisticated software controls, learning algorithms, and other ways to optimize the switching of things on and off, and many of them act as a hub to which other devices can connect, enabling the user to control more aspects of the home from a single interface.

Summary

With few exceptions, most of the commercially available smart home devices are not conceptually or functionally more advanced than the Clapper. A light switch, thermostat, or furnace functions the same whether controlled by human hand or an app or a console controller.

Truly Smart Devices and Appliances

The next step beyond smart on/off switches is for the devices themselves to become "smart." There are very few examples of this as yet, but it is the next step. Solar power controllers, Tesla chargers, Samsung refrigerators, and the August smart lock are among the few.



The hallmark of a smart device (as opposed to a smart controller) is that the device itself connects to the internet.

This is the fastest-growing and most important category in the smart home. If all your lamps, appliances, and other electrical systems had their own internet connectivity (the "internet of things"), there would be no need for smart hubs and switches.

As this category evolves, the open question is: what does it do? If all the "smart" functionality does is a slightly more sophisticated on/off, or a twist on monitoring (sending alerts when state changes, for example), then the value is not much greater than a dumb device with a smart controller.

Internet of Things

In essence, the internet is simply a lot of pipes connecting one computer to another. You find other computers by domain names and IP addresses, and you open a connection, and have a two-way conversation. That's pretty much it. That's the internet.

The so-called Web is a lot of servers (web sites) and a lot of clients (browsers) having a conversation in HTTP protocol, sending images and text back and forth.

The Internet of Things is built on the same plumbing. The "thing" has to talk to another computer and have a two-way conversation that means something. It's all about that conversation. What does the Thing have to say? What do you want to say to it? For many Things, this is a vexing question.

Smart Laundry: A Competitive Analysis

Samsung, LG, and Whirlpool have all introduced “smart washers” as early as 2012. Two of these models are now discontinued (LG and Samsung). The Whirlpool model is available, but it is special-order only and is difficult to find. The price points for these machines have been at the upper end (\$1600) and the consumer reviews for accompany apps reflected user dissatisfaction and frustration.

Whirlpool Sixth Sense Live Washer



Whirlpool emphasizes energy savings in marketing this model of smart washer. However, in truth, the machine simply uses its internet connectivity to look up energy rates in a database and has no means of adjusting time of operation for optimal energy usage

This is the model to beat in the smart laundry space. Consumer feedback in app reviews and industry media suggests that consumers perceive the main feature to be on/off control via a smartphone and that the price point is prohibitively high, especially without commensurate features.

Bottom line: exaggerated claims about consumer’s interactive ability to titrate energy usage at optimal times by receiving real-time data

LG ThinQ Top Load Washer



This discontinued model by LG features an attractive touch screen display, but ultimately, the user interface was found to be cumbersome.

Smart functionality added mostly involves remote monitoring of the washing machine on the user’s device.

Bottom line: exaggerated claims about consumer’s interactive ability to titrate energy usage at optimal times by receiving real-time data

Smart Grid

The Grid is a real-time marketplace between Supply and Demand—the Supply is the power company, and the Demand is you. The power company has to match power consumption with equal power generation, within a four-second window. When you turn on your electric dryer, some grid operator somewhere has to make sure that a corresponding amount of power generation is made available.



Smart Grid visualized in a community.

The **Smart Grid** is a conversation back and forth between Supply and Demand that lets the power company smooth out demand by interacting with smart appliances—in *real time*—to help decide when the dryer turns on, and when your thousands of neighbors' dryers turn on. The Smart Grid hasn't happened yet. But it's coming.¹

The first step in Smart Grid is to put Smart Meters on homes—these meters measure power consumption as always, but they also know what time it is, and they report not just how much power is used, but also when it is used. These Smart Meters communicate with the power company to upload the data—about every four hours. It is not a continuous stream, nor is it real-time. It is mostly for billing information and for planning future supply curves. Smart Meters exist in some markets today.²

Smart Meters allow power companies to charge different rates for peak hours than off-peak hours (since they now know when you're actually using the power). They provide rate incentives to shift electrical loads to off-peak hours, but is neither a conversation nor real-time. It is incentivization on the carrot side.

The next step in the Smart Grid is to make controllers (and devices) communicate directly with the power grid to find out when is a good time to consume power. This is happening a little bit, but is mostly done through statistical and historical data mining, rather than real-time analysis. If your Whirlpool washer knows your zip code (which you told it by registering), it can look up in a database to determine the best rate structure for your area, and align the washing functions with better rates.

The real Smart Grid will happen when this conversation is in real-time: a dryer connects to the internet, provides a forecast of its energy use, and asks the power company for a start time, and then when that start time arrives, it connects again to get a confirmation and to let the grid know that a new electrical load is coming online. This Smart Grid is about to happen.

¹ <http://energy.gov/oe/services/technology-development/smart-grid>

² <http://www.eia.gov/tools/faqs/faq.cfm?id=108&t=3>

Summary

The Internet of Things is a conversation that is starting between devices, appliances, and servers—even the power grid. The Smart Home is transforming from a dizzying array of remote control on/off switches to a hub of connected devices, each carrying on its own conversation—with you, with cloud-based servers, with power companies, and each other.