Unplugg: A Cloud-based Home Energy Management Platform

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Abstract. The residential market represents an important part of the global energy consumption. However it is one of the hardest places to improve our energy efficiency. Several solutions exist with different approaches, however their adoption and results are suboptimal. We believe that this occurs due to the fragmentation of the solutions, up-front costs and a some lack of focus on the user experience. In this paper, we present a consumer centric, cloud-based Home Energy Management platform. Its aims are: to build the foundations of a hardware agnostic solution, supporting the main open data sources available and enlarging the potential interested consumer base; provide actionable metrics and consumption simulations that give insight to the user and help understand the impact of habits and choices; explore the potential of Internet of Things and cloud based energy management; and finally, to achieve in a market-ready solution that can be sustainable and effectively drive change.

Keywords: Home Energy Management, Cloud, Internet, Internet of Things, Open Data

1 Introduction

The residential market is responsible for an important part of the global energy consumption, representing 26,65% [1] in Europe, where 20% [2] of all energy is wasted. Being a fragmented market [3], and highly dependent on individuals convictions and circumstances, it presents a great challenge for energy efficiency increase. There is a crucial effort of promotion and innovation to be made, in order to effectively execute current energy policies [4, 5] and achieve concrete results.

Many concepts and market solutions have been developed in the Home Energy Management (HEM) field. Yet the market reality has failed to comply with expectations [3]. An important issue is the reasonably high cost of energy 'management systems, which creates a natural entry barrier for the consumer adoption. Most of these systems deliver a home-based solution where the intelligence of the systems is located in-site. This has its advantages from a technological stand point, providing a quicker and more effective response. However it has its drawbacks from a efficiency and business point of view. The up front cost is high,

and quickly loses its novelty for smarter solutions due to its limited upgradability. The updates are irregular and the technology loses its novelty quickly due to the difficulty of upgrading hardware.

An interesting alternative is to move the intelligence to the cloud where it can be iterated and updated quickly, while leaving just the sensors and actuators in home. This enables lighter business models with lower costs for the customers up front. In this way the user can take advantage from the state of the art of HEM technology and pay by what is effectively used. This results in a more efficient solution from a data processing point of view; but also from a business point of view, since the since the cloud based management enables relevant economies of scale [6].

2 The Unplugg Platform

The cloud potential as base for innovation through open data and communication has been until now reasonably overlooked where the possible exceptions are the deprecated Google Power Meter[3] and the HITS concept [7]. Herein we explore a consumer oriented vision of this while making a market-ready solution. The developed platform is designated as "unplugg".

The ultimate goal of this platform is to enable an Internet of Things focused on energy management, building upon the many interesting concepts on this field [9]. In order to achieve that, beyond data sources which are already present, it is necessary to enable innovation in simple and global control solutions and explore its integration potential through an open platform [3].

2.1 Architecture

The effectiveness of such platform depends on its capability of integrating most of the main sensoring and actuation solutions. This presents a challenge to support a broad set of communication protocols. Looking into the power monitoring systems today, which is more a mature market than the control and actuation, one can understand that most data can be acquired simply through HTTP which simplifies its implementation. The exception are the smart meters that use standards like DLMS [8] which are a lot more powerfull, but also much more complex to interact with.

In this case, HTTP was selected as a priority in order to support immediately the market represented by power meters such as Current Cost[4] and The Energy Detective[5]. Another key element that make this selection obvious is that the integration with these systems through HTTP is based on open APIs, unlike the use of DLMS by utilities which is naturally closed to their infrastructure. The communication with these systems can also be made through brokers such

[3] http://www.google.com/powermeter/about/
[4] http://www.currentcost.com/
[5] http://www.theenergydetective.com/

as Cosm[6], or in the future the middleware solutions from utilities for which Tendril[7] can be seen as a possible example. A simplified vision of the integration architecture can be seen in Figure 2.1. This platform is currently deployed in heroku[8], a Platform as a Service (PaaS) hosting solution built upon Amazon EC2[9] that simplifies the administration while keeping the advantages of the cloud.

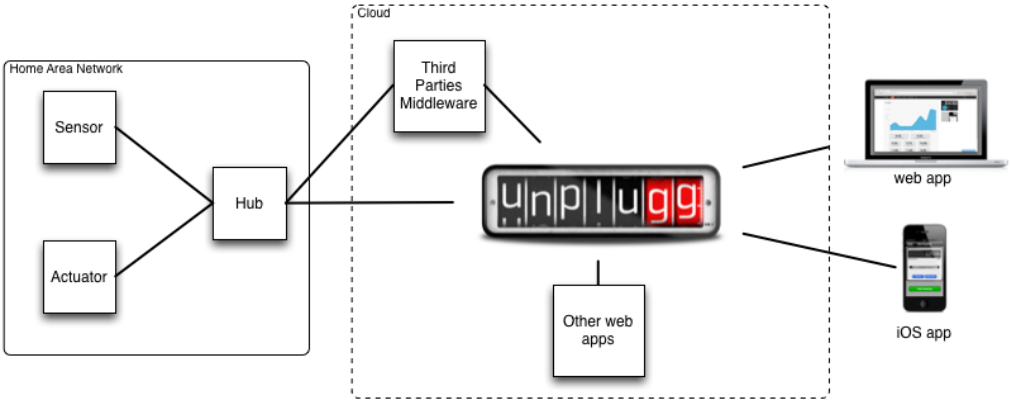

Fig. 1. Unplugg Platform architecture

Present systems integrated to the platform are: Cloogy[10], Current Cost Envi, The Energy Detective and the Tendril API[11]. These systems act generally as energy consumption data sources.

2.2 Internet of Things

Control solutions at low price points start to appear in the market. Examples of this are Cloogy which offers smart plugs that can be remotely controlled through an API, and through the just launched Wemo[12] from Belkin, which provides control and movement sensing. This type of integrations are already present in more early adopter segments where the IFTTT[13] association with Wemo stands out. In this field exciting times are coming with the arrival of the

[6] http://cosm.com
[7] http://tendrilinc.com/
[8] http://heroku.com
[9] http://aws.amazon.com/pt/ec2/
[10] http://cloogy.com
[11] http://dev.tendrilinc.com/
[12] http://www.belkin.com/wemo/
[13] http://ifttt.com/recipes/search?utf8=%E2%9C%93&q=wemo

Internet of Things and the growing awereness for energy issues, and cloud based solutions are a natural enabler due to its ubiquity and quick evolution potential.

However this trend will only evolve organically when the more tech enabled consumers start experimenting and creating mashups between the Internet of Things, HEM solutions and even other web applications. This makes the offer of an open, powerful and well documented API a crucial step for the effectiveness of a platform in this context.

2.3 Data Analysis and Presentation

Web and mobile apps are also a driver for smart energy solutions adoption, by enabling rich, frequently real-time energy management through already omnipresent devices. But these apps require access to actionable, meaningful data that can be easily crunched in the cloud. For unplugg, an iOS app was developed that provide actionable metrics which allow users to track progress, and complements the view offered by the main platform interface.

3 Conclusion

Cloud based energy management presents several advantages comparing with home based control systems, such as efficiency, low entry barrier, increased ease of adoption, global and ubiquitous potential of integration. It can hence be a technological solution to tackle the slow adoption of HEM systems. In this paper a global platform named unplugg was presented. It stands out by enabling the support of multiple data sources and empower the innovation through the Internet of Things while keeping a user-centric vision. It is currently in beta at http://unplu.gg.

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