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Abstract

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The FlexOffer (FO) concept was initially created within the EU FP7 project MIRABEL [1]. It permits exposing demand and supply loads with associated flexibilities in time and quantity for energy commerce, load levelling, and different use-cases. To put it in a simple way, a FO specifies an amount of energy, a duration, an earliest begin time, a latest finish time, and a price, e.g., "I want 50 KWh over 3 hours between 5 PM and 12 PM, for a value of 0.25 €/kWh".

The Aggregators receives FOs from FlexOffer Agents(FOA), which are entities capable of creating FOs, combines them with FOs from other sources, into larger macro FlexOffers and then puts them to the Virtual Market of Energy. In order to reach competitive prices and have importance and relevance, the FO has to be combined into a bigger FO using the different FO sent to the Aggregator (AG) from all other sources. Afterwards, the AG receives a response from the Virtual market of Energy, disaggregates the response and sends the FOA its corresponding consumption schedule. By using external technologies, in this case provided by Virtual Power Solutions (VPS), a Portuguese energy solutions company, the demonstrator is able to apply the FO concept to a real-life situation. VPS provides smart-plugs. These devices have embedded actuators and sensors, and it is possible to perform remote control on the electricity fed to the appliances plugged into the smart-plugs. The smart-plugs are also able to gather data regarding the consumption of the appliances. These actuators and sensors are used to apply the energy schedule provided by the AG and to verify that the consumption was within the values of the FO, and that the stipulated amount of KW was spent. The structure of the demonstrator is shown in Figure 1[2].

The central part of the demonstrator is the FlexHousing system, developed within the Arrowhead environment and using the Arrowhead framework. FlexHousing acts as a middleware system, providing a link between the systems and services related to the scenario, by using the FlexOffer Interface to send FOs and the Flexoffer Scheduler for the reception of schedules, and the VPS cloud. The latter provides the interfaces required to operate and interact with the smart plugs. The VPS cloud allows the user to register new devices, actuate and gather consumption data from specific plugs. The devices are accessed using the home area control gateway, seen as the device with the infinity symbol in Figure 1 The FlexHousing devices are intended to be deployed inside the user's house or building, hosted on an embedded device, and only requiring internet access and a power supply to be deployed.

The FlexHousing system will provide its own services through an API, accessible directly, or using a web service under development. The services will allow the user to configure and customize the system to meet needs and demands. FlexHousing will enable the retrieval of data from the devices regardless of a FO being applied to it.

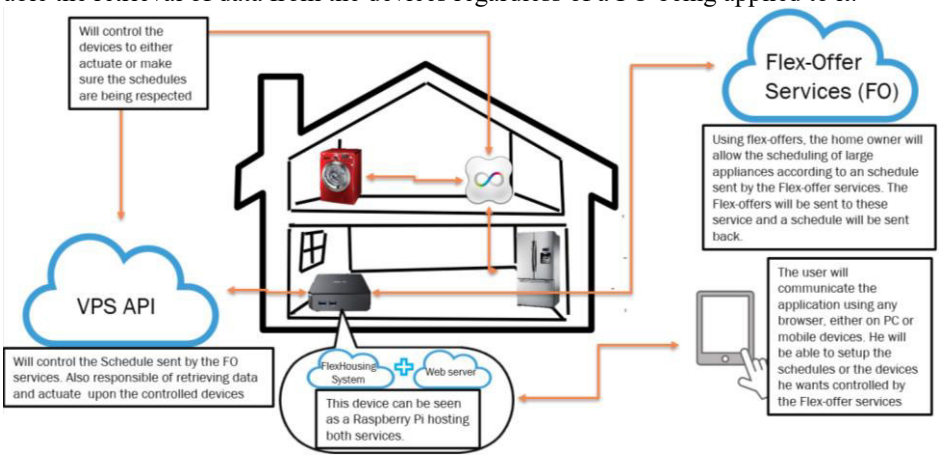

Figure 1- The systems modules and architecture

This allows the user to be aware of any energy consumption inside his house. The more information the user has, the more precise his decisions will be regarding applying a FO or not to a device. The system will accept FO at any time. Any FO applied to a device will be resubmitted every day with the same parameters until the user modifies any of them or completely removes the device from the FO interface. Everyday at 11 PM, all the FO collect so far, the new ones and the resubmitted, will be sent to the Aggregator. From that time to 12 PM, the schedules will be received and loaded into the system. After that, until the midnight of the next day, the electrical feed of the applainces with a FO will be controlled by the FlexHousing system. The web server will be hosted on a different system, central to all FlexHousing systems. This will provide the user with a user-friendly interface, allowing him to visualize his appliances, the energy consumption of his devices and input the information necessary to the creation of the FO upon the appliances he wishes. The user will be able to create rooms and bind specific devices to them, allowing an easier management.

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