End to end ICT architecture for Smart Grid Demand Side Management services

Mots clés :
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● Domaine scientifique principal: Divers

Résumé du projet de recherche (Langue 1)

Reduction of CO2 emissions and energetic independence are among the main goals of the European Commission in terms of energy. The deployment of Renewable Energy Sources along the electricity distribution chain, from centralized generation assets to local micro-generation at customer premises, together with electric vehicles are critical means to fulfill those objectives. However, the stochastic characteristics of these generation sources and their increasing weight in the energy mix will force the energy operators to face a paradigm change in the way they manage the grid. As generation becomes less predictable and controllable, demand side energy management (DSM) becomes more important in order to keep the grid stable. This new paradigm will require a change in consumers' role from a simple subscriber to a main grid actor involved in energy production, storage, consumption shifting and trading (through Aggregators). Service models must be designed to encourage consumer's active participation and involvement of new stakeholders like Aggregators in Demand Response (DR) solutions. Also, to ease consumer participation, the targeted system will enable the definition of end user policies for energy management and self-organization principles will be applied to enforce such policies. This change in Business models is driving the development of advanced control algorithms, management strategies and communication architecture needed to put in place this advanced energy management services. Machine to Machine (M2M) automation systems and “Internet of Things” architectures facilitate the design of advanced applications for the control of energy production, storage and consumption, both in residential and enterprise contexts. The benefits of these applications are even larger when used at the neighborhood scale. Such systems represent a major driver for the deployment of Demand Response and other advanced services but their design pose many challenges due to stringent requirements in terms of energy consumption, interoperability, scalability, reliability, security, CAPEX and OPEX. Energy companies are analyzing the potential impact of these applications on their business as well as on the performances of their infrastructure control and management systems. This work will be focused on the design of the end to end ICT architecture needed to implement advanced DR mechanisms and related service models. By leveraging the Internet of Things paradigm, first studying the control of an individual client and then extending the scope to a neighborhood scale based in a distributed control plane of the various clients' environments and taking into account the role of aggregators. Cloud computing principles will also be considered to simplify the management of the large amount of data that will be processed and one of the key questions will be how to distribute the system intelligence among the various components, from cloud to things through, optionally, an energy box. The proposed activities will contribute to an initiative launched with Electricité de France (EDF), one of the major energy companies worldwide.