Decentralised optimisation solution for Smart Grids using Smart Market aspects and P2P internetworked Energy-Community

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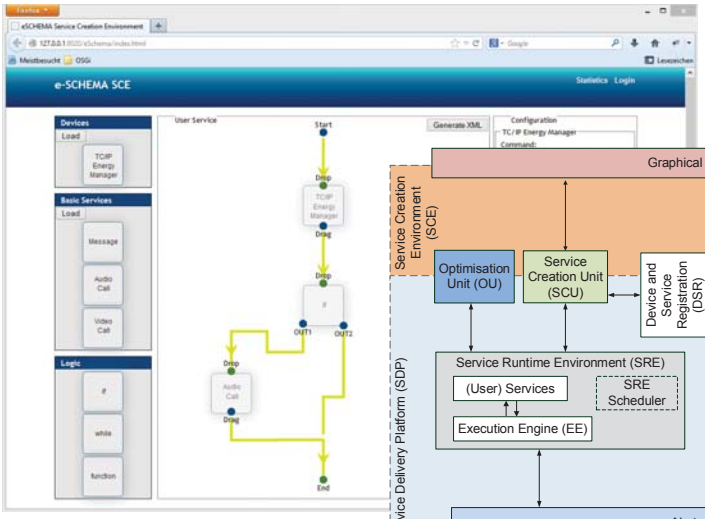
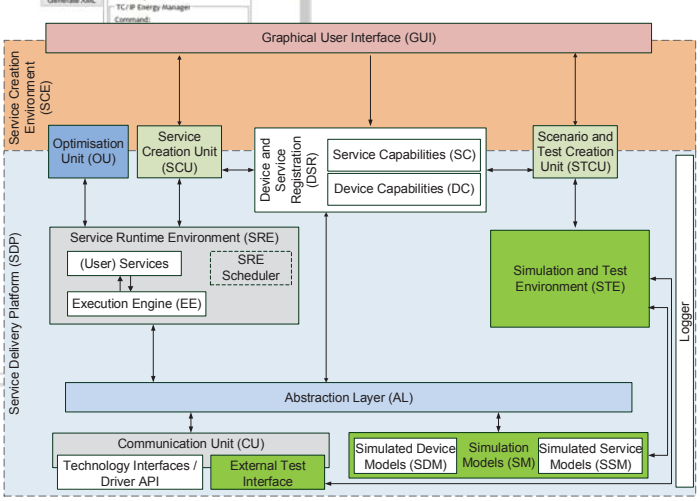
This publication introduces a new overall solution for individual home and energy management and its application for optimisation of Smart Homes and Smart Grids. The user gets the possibility to develop personalised services for home and energy management on its own, according to its personal needs, using a Service Management Framework (SMF) which is developed based on OSGi and may be integrated in the DSL-Router. This SMF also includes the functionality for P2P interconnection of households which is used for simultaneous energy optimisation of peers inside a P2P network of households.



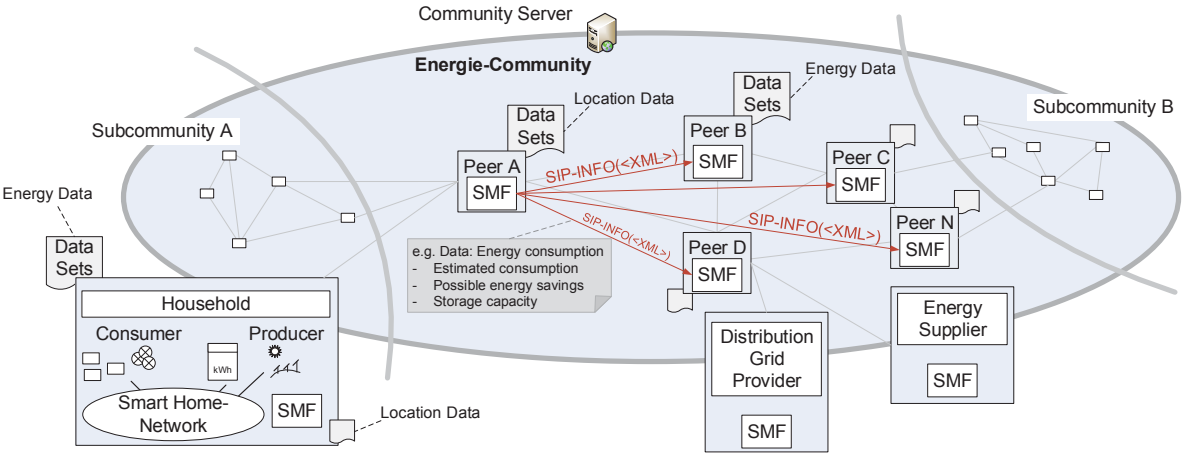
Through a SCE (Service Creation Environment), the user is able to design value added services for controlling of his Smart Home by graphically combining of device blocks delivered by the manufacturer of home appliances. These services are transformed into a formal notation and interpreted/ executed by the Service Delivery Platform (SDP).



An Abstraction Layer integrated into the SMF allows the connection of different Smart Home systems to the platform.

A communication unit enables information exchange between peers and offers the possibility to connect various Smart Home appliances. For information exchange the SIP protocol is used. The data storage, which is needed for addressing all peers as well as persisted energy data, is realised completely decentralised using Distributed Hash Tables (DHT) and the Chord algorithm.

Based on constant exchange of information between peers in terms of energy consumption, production (e.g. photovoltaic power plant), storage capacity and potential energy savings, all involved peers autonomously optimise the energy consumption in their households.

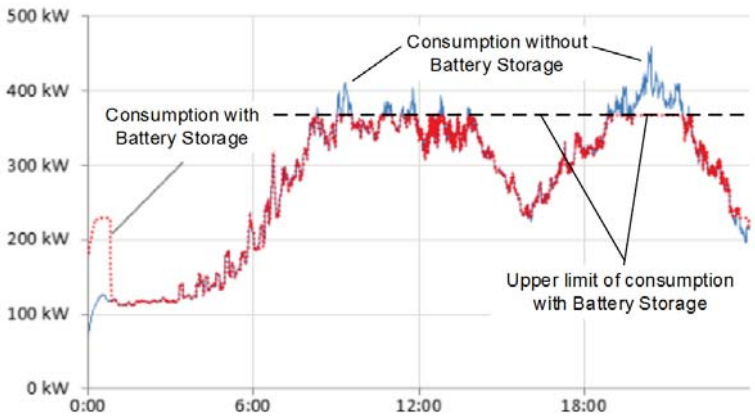


The concept provides a mechanism for convenient networking of households, energy suppliers, distribution network operators and others with the objectives cost savings, avoidance of grid expansion, energy savings, CO_2 reduction etc.

This network offers statistical aggregation and optimisation through cooperation within a cluster of consumers.

An Energy-Community forms a new comfortable way to join the network, whereby the connection of households is done by joining the users to a social network for energy-peers.

Depending on the optimisation goal it is possible to achieve a financial benefit for each participant as well as a relief of the energy grid through e.g. the reduction of the residual load.



An exemplary simulated scenario covers "avoidance of peak load" by using battery storages for a community of 1000 households. The results shown on the left side indicate that, for a 20% peak load reduction (from 45.9kW to 36.7kW), already 23 standard battery storages are sufficient, that means only 2.3% of households would have to be equipped with one battery storage.

References

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