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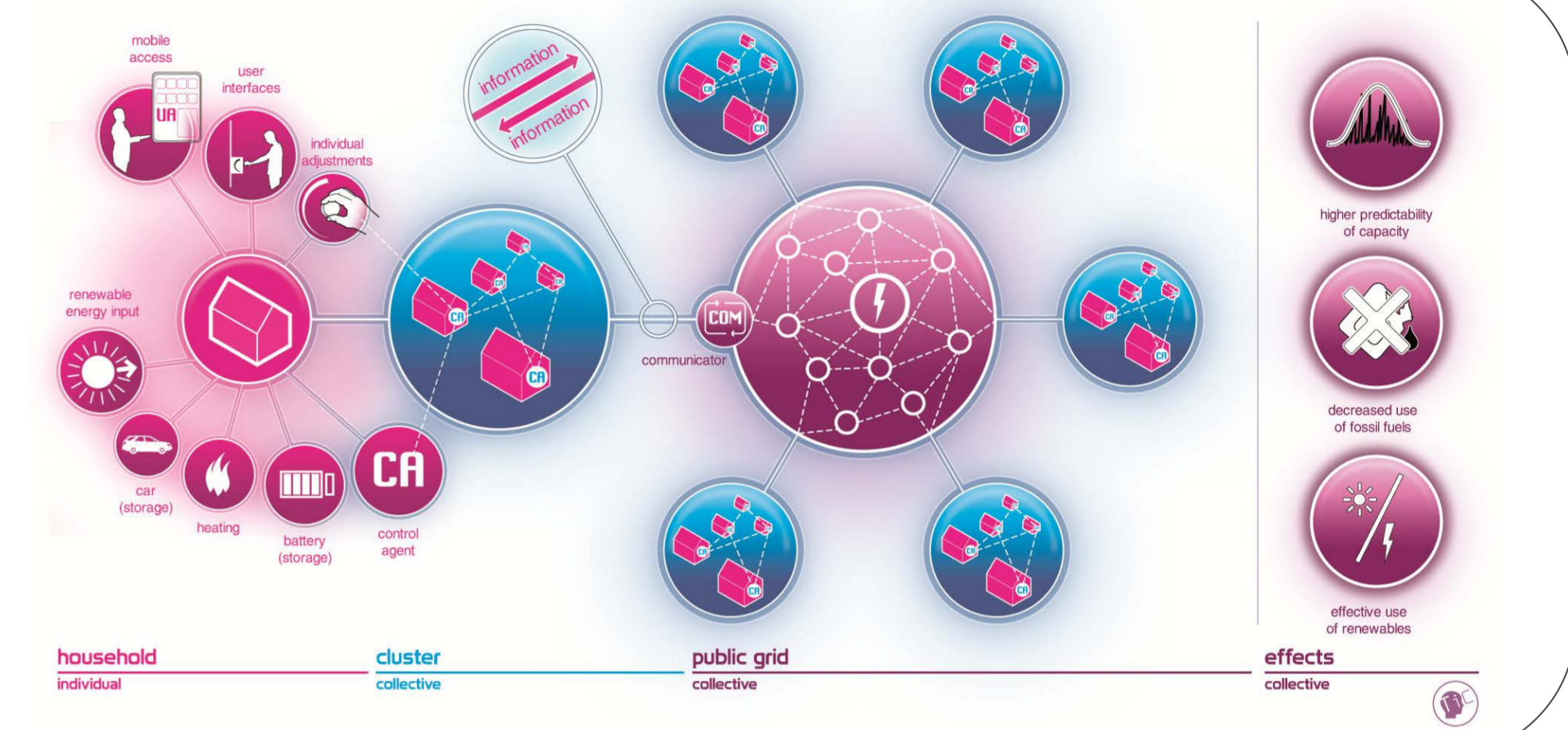


The increasing demand for energy and the availability of several solutions of **renewable energy** sources has stimulated the formulation of plans aiming at expanding and upgrading existing power grids in several countries. By linking information technologies with the electric power grid to provide electricity with a brain, the smart grid promises many benefits, including increased energy efficiency, reduced carbon emissions, and improved power reliability.

We present an **agent based architecture for supporting collection and processing of information about local energy production and storage resources of neighborhoods of individual houses and to schedule the energy flows using negotiation protocols.**

COSSMic is a Collaborative Project (STREP) Funded by European commission FP7-Smart Cities – 2013:

- Micro-grids, embedded with renewable energy production, storage capacity and consumption, are combined with an intelligent ICT platform.
- Such a framework will allow for both peer-to-peer collaboration between micro-grids in a neighborhood, forming a cluster.
- All the cluster collaborates for the reduction of variation of decentralised renewable energy transfer to the grid and a higher rate for self-consumption.
- At the same time the central power grid enables the provision of energy for contingent requirements or to complement the neighborhood resources.
- Agents are used to manage the Home Area Network (HAN) with the aim to optimize self-consumption rates using renewable energy sources.
- Households with renewable energy facilities can sell excess energy to the neighborhood while households that needs more energy can buy it.
- Ideally, the pool is at the zero level when the energy production within the household matches the consumption, and there is not external exchange of energy.
- This agents pool also participates to two different market places: for the energy exchange within the neighborhood, and for the exchange with the outside world.

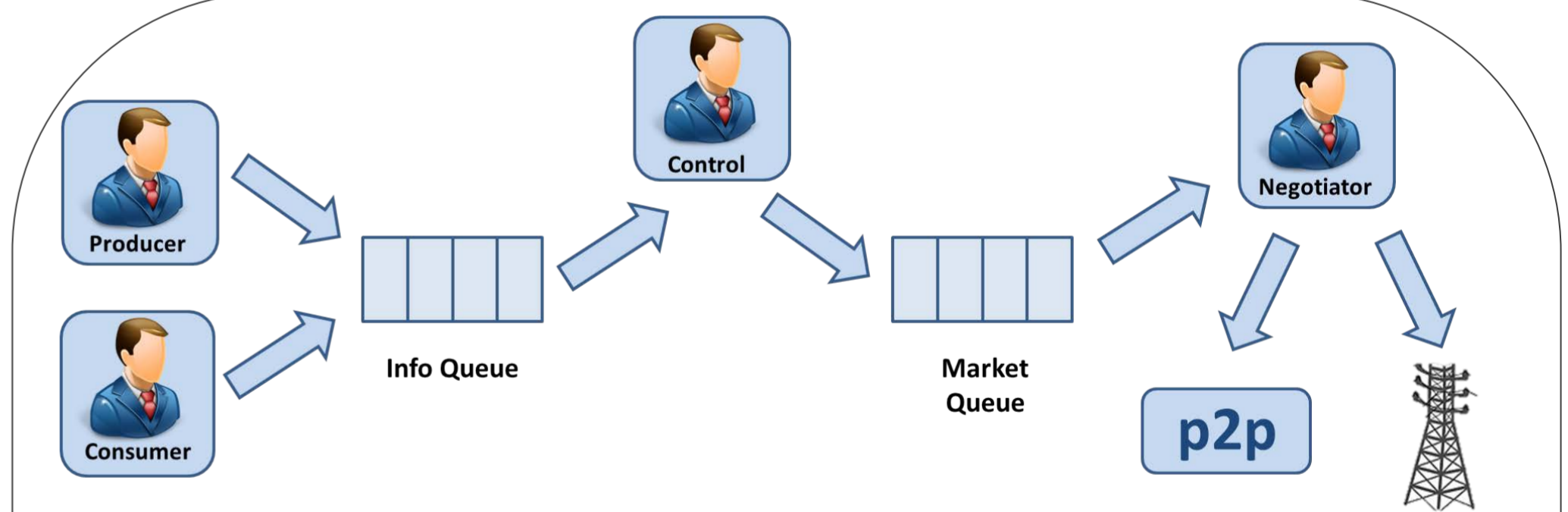
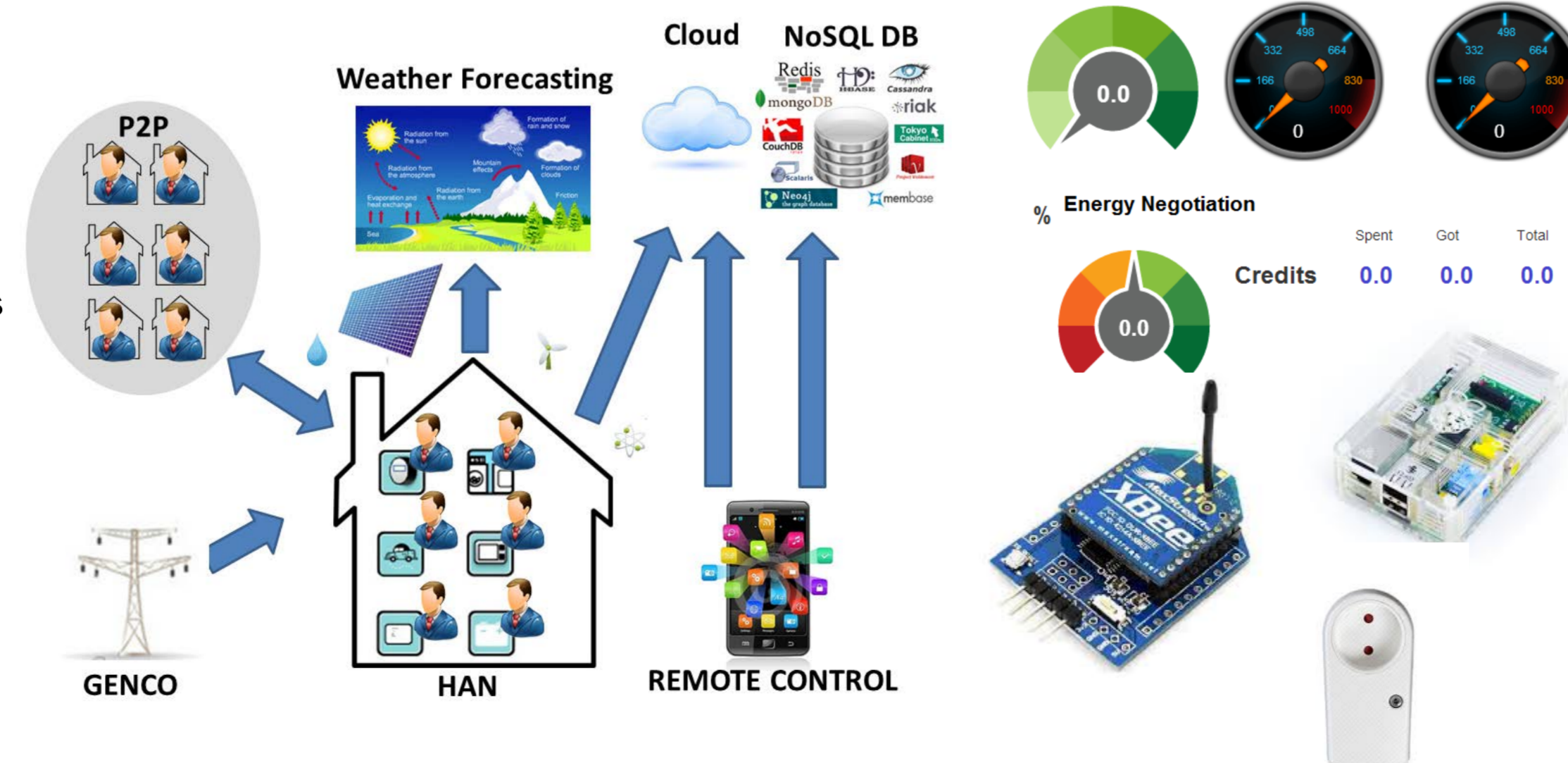


COSSMic Framework will support sharing of information, scheduling of exchanges between power producers, consumers and energy storages in accordance with policies defined by owners, collection of data from weather stations, weather forecasts, and habits and plans of participants.

- The CoSSMic platform will run on embedded computer systems which will be provided to final users as a black box, to be plugged into the power network and connected to Internet.
- The Platform will be installed in every household and will join a community of other instances within the neighborhood.
- Instances of the platform communicate by a P2P overlay and with the Cloud to eventually exploit advanced services.
- User's information will be bounded to the private network of each household and will be forwarded outside only with the user's agreement and for debugging purpose.
- Each platform instance will communicate with other households only for the energy negotiation.

COSSMic Platform is composed of :

- a Graphical User Interface (GUI) that allows users to interact with electronic devices through graphical icons and visual indicators;
- a Knowledge Base (KB) that is an information repository that provides a means for information to be collected, organized, shared, searched and utilized;
- a Multi Agent System (MAS) to allow for the deployment of agents of consumers and producers that will participate in the energy distribution;
- a Market for the energy negotiation within the neighborhood, and eventually with GenCO.



- **Consumer and Producer agents** represent smart meters which notify their measures by an Info Queue.
- **Control agents** of each category of device subscribe to the Info Queue to be notified about changes in the household, on whose occurrence they react and plan the **optimal schedule** inside the household.
- The residual energy to be sold or to be bought are notified to the **Market Queue**.
- **The Agent Negotiator** is updated about the quota to be negotiated with the neighborhood or with the **GenCO**, according to the contingency level and availability on the **P2P** overlay.
- **Storages of Android Mobile Phones** have been used as test devices.

