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SELF-SUFFICIENT SMART HOUSE

INTRODUCTION

As a part of the university course D7042E IoT-based industrial automation and digitalization the student is given the project to design their own use case scenario which should represent and simulate how a real credible application system would be integrated into the arrowhead framework.

The project must have a realistic approach on how the dataflow work. Meaning it must have some realism and coherence in the scenario.

The project must follow certain criteria's, it must be integrated into at least one arrowhead local cloud.

This arrowhead local cloud must include the mandatory core systems built in arrowhead, which is the service registry, orchestration and authorization system.

It also must consist of four different application systems. Which means that at least four systems must provide or/and consume functionality inside the arrowhead local cloud.

A working demo is important. Which will be showcased at the end of the course.

SCENARIO

The scenario in my case that I have created will be energy consumption/production for an energy self-sufficient smart house.

The simulation and scenario will be in real time. Meaning 10 seconds of execution time will represent one day of scenario time.

The scenario would consist of four different application systems:

- Solar panels that will be generating electricity.

  The simulation for this will be real-time which means that the kw/h generated will change depending on an efficiency factor of how efficient the solar panel was during the day (night/day and cloudiness).

  In this case the static variable for how much one solar panel generates per day on average is 2 kW/h.

  For the terms of simplicity, the efficiency factor will be randomized between a value of 0.7 to 1.2. Meaning on average the solar panels will have an efficiency rate of 0.95 each day.

  The total amount of solar panels can be determined during execution of simulation. The total amount of solar panels will be chosen so it sometimes will undercut and overcut the house daily consumption. Not so that every day will result in an overproduction of electricity.

$$Daily\ kw/h\ = 2\ kw/h * Total\ amount\ of\ solar\ panels * Efficiency\ factor$$

The solar panel system will update the efficiency factor after the house has sent a GET request to the solar panel, meaning a day has passed.

- A smart house that will be receiving electricity from the solar panels which provides electricity.

The smart house will have an energy storage, which is the total kw/h accumulated from the solar panel.

$$Current\ electricity\ stored = Current\ electricity\ stored + Daily\ kw/h$$

The smart house will have a wallet with money balance, a number which represent the dollars gained from selling excess energy to the electricity grid.

The smart house will also have a variable which decides how much of excessive energy it will sell. Ranging between 0-100%. In this case a value of 40% will suffice.

$$Shipped\ kW/h = (Current\ electricity\ stored - Total\ electrical\ consumption) * Sell\%$$

If the house is consuming more than it's producing it will lose balance since the value of shipped kW/h will be negative. Hence the household will lose money and possibly be in debt if money balance is negative.

- An electricity grid, which is an application system that makes it possible to sell electricity to the public electricity grid from the smart house.

Which rewards the household with some kind of money balance depending on price per kW/h and the current demand. The average price per kW/h in my simulation will be 0.11$, a value chosen from a site where electricity prices ranges in different U.S States.

$$Money\ gained = 0.11 * (Shipped\ kW/h) * demand$$

- Outlets/consumption, outlets for the smart house which makes it possible to charge and use electrical devices in the house.

This is the current electricity consumption. On average household consumes around 26-33 kW/h per day.

The sources which values are taken from can be taken by a grain of salt but since this is a simulation, the requirement for the simulation values is that they are consistent and somewhat realistic.

LOCAL CLOUD DRAFT

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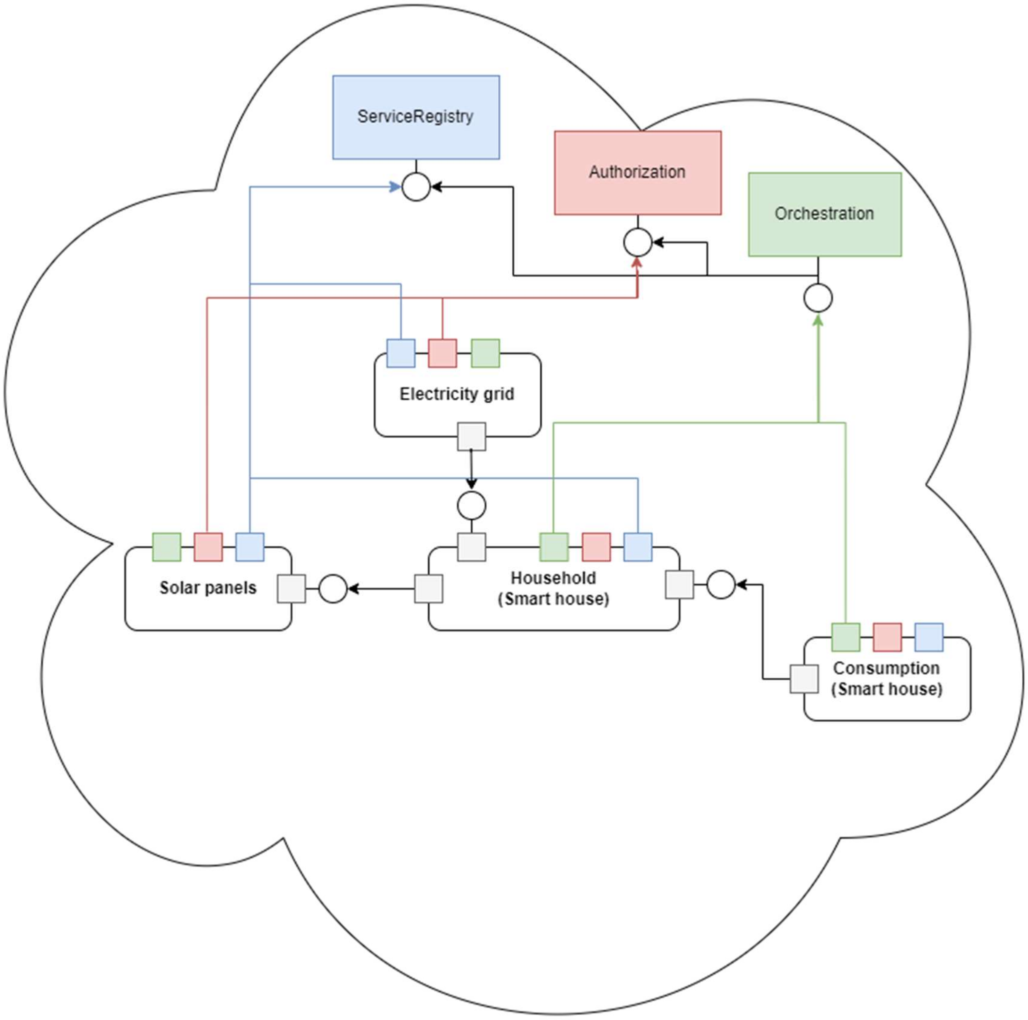

FIGURE 1: DRAFT OF LOCAL CLOUD