E.ON Energy Research Center

Exchange of Energy Price Data with Smart Customers

GEs: Orion, Wirecloud

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Introduction

- Nicolas Berr
- RWTH Aachen University
- Institute for Automation of Complex Power Systems
- Working on development of cloud based smart energy services
  - The SCoOP project
  - Smart City quarters OPerating system
  - Test bed for cloud based Smart Energy Services
  - Example use case scenario: heat storage management

SCoOP Example Use Case Scenario I

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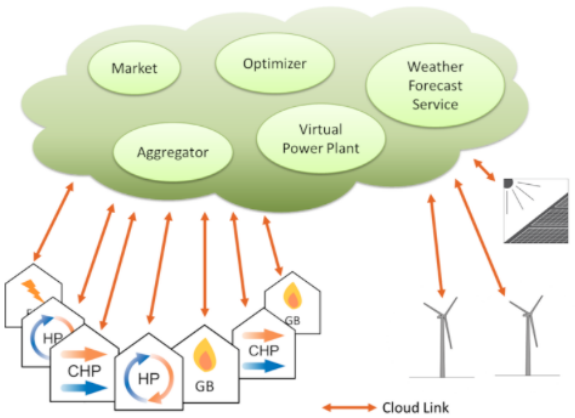
ACADEMICS | RESEARCH | THE INSTITUTE

Research › Research Projects › SCoOP: Test bed for cloud based Smart Energy Services

- Research Areas
- Research Projects
  - FINESCE: Future Internet Technology for Smart Energy
  - FLEXMETER - Flexible smart metering with active prosumers
  - COOPERATE: Control and Optimization for Energy Positive Neighbourhoods
  - IDE4L -Ideal Grid for All
  - Flexible Electric Networks of the Future
  - Sustainable and Intelligent Energy Management: The case of Railway Systems
  - Green Networked Data Centers as Energy Prosumers in Smart City (GEYSER)
  - **SCoOP: Test bed for cloud based Smart Energy Services**
  - eHome

SCoOP: Test bed for cloud based Smart Energy Services

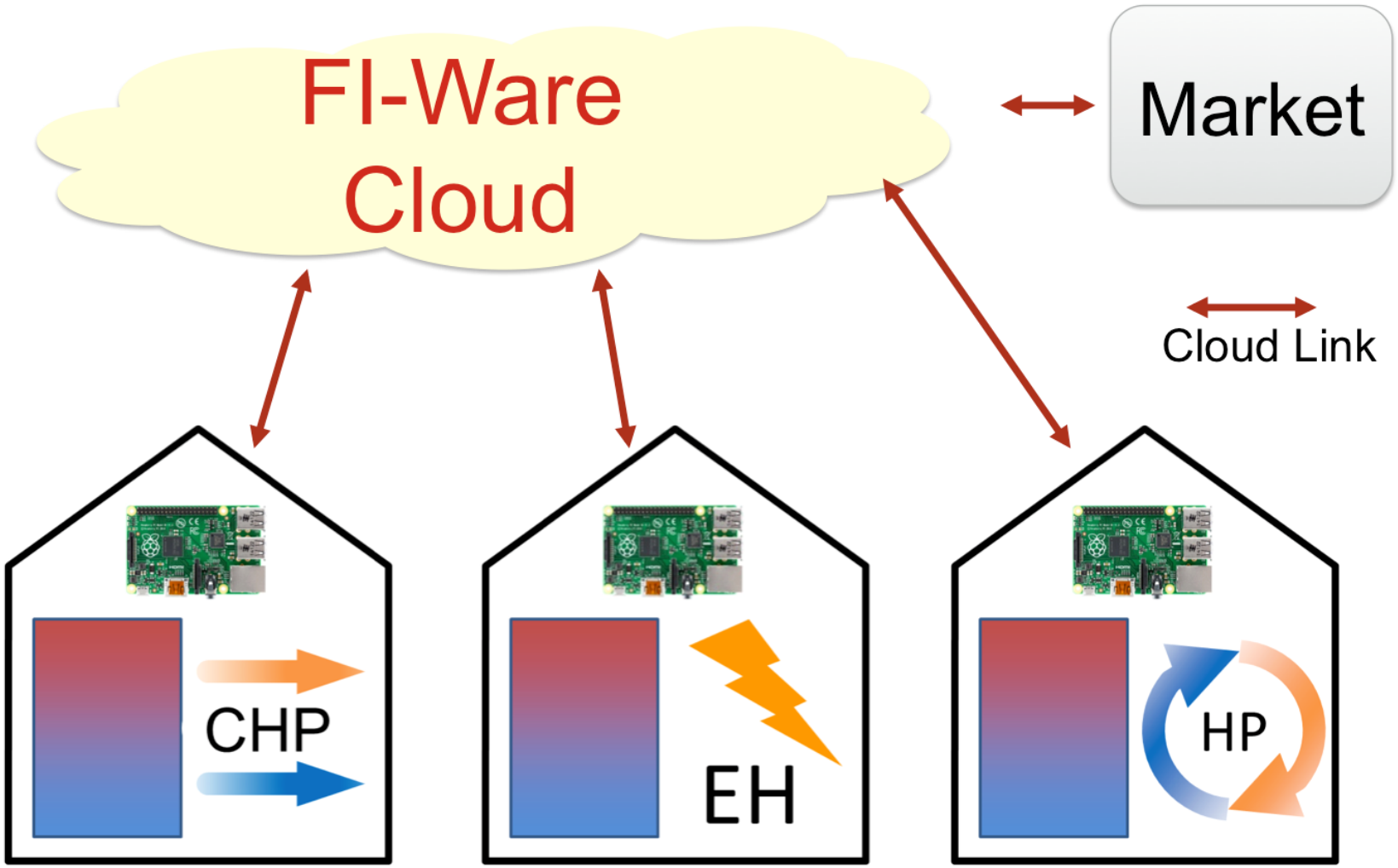


The objective of the SCoOP project is to set up a test bed which allows for testing cloud-based Energy Services for Smart Cities. Furthermore, the project will deliver basic buildings blocks which can be used to create and test easily new cloud based services. The SCoOP platform will be built on the Future Internet cloud services (FI-lab) thus guaranteeing compatibility with other services using FI-lab technology. In order to enable a hassle-free and secure testing and development, the FI-lab components used will be installed at local servers and will be operated similar to the real cloud environment.

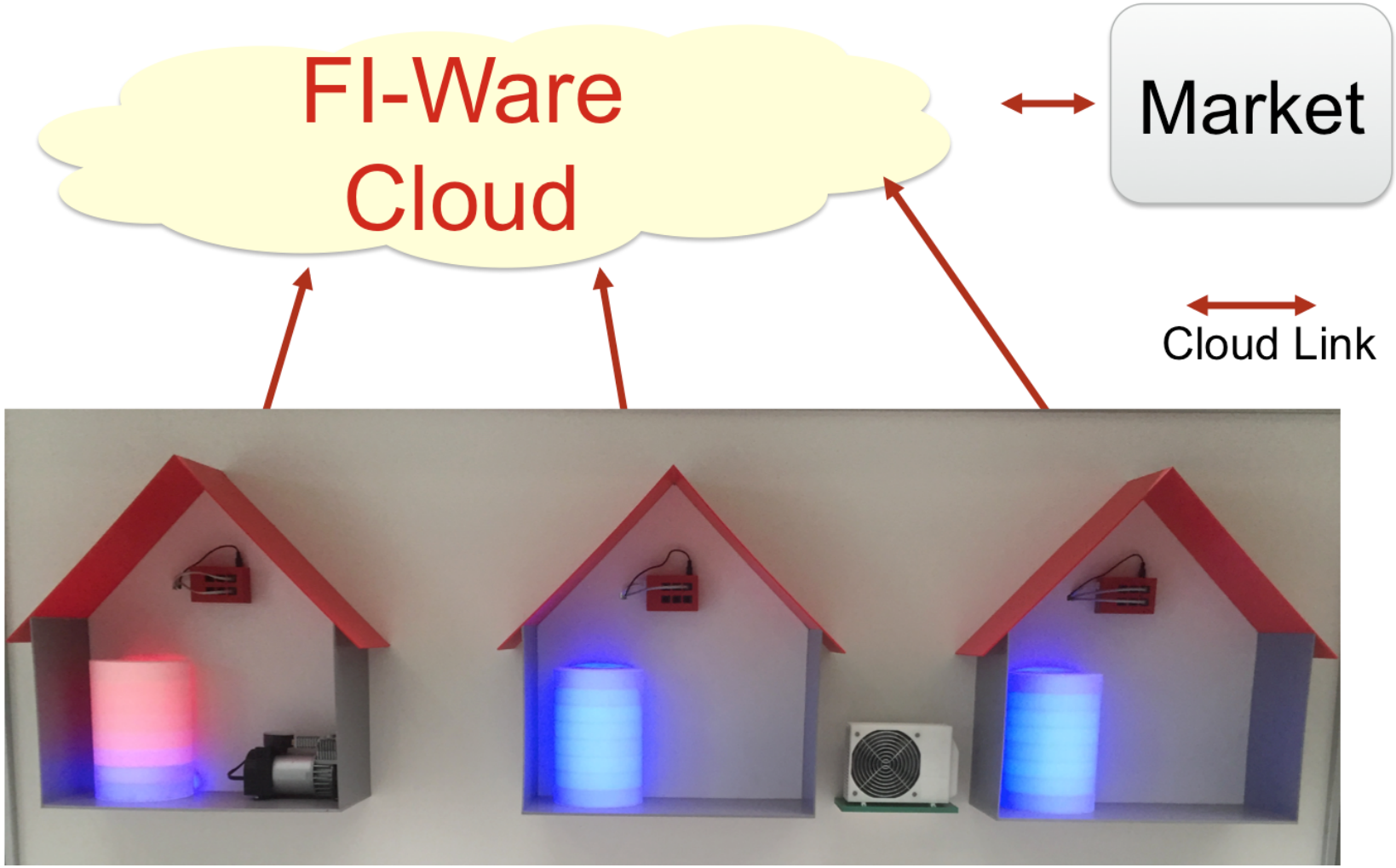
The SCoOP platform will provide the opportunity to test new services and components at different levels: reaching from pure software testing to hardware and Power-Hardware-in the-Loop testing. The pure software testing is suitable for testing cloud-based algorithms, services and interfaces between them. Involving real Smart Home Gateways and Control Units in the tests, known as Hardware-in-the-Loop, enables the user to analyze the integration and interaction of real hardware with the cloud. A further step, the incorporation of the Smart Home test bed, developed here at the E.ON Energy Research Center, allows for testing entire Smart Home systems, reaching from heat pumps to controllers and cloud-based services.

In order to establish the described test bed and facilitate the development of new services with the platform, a whole new lab infrastructure will be created and is already under development. The lab infrastructure will host computing infrastructure, workplaces to develop hardware components as well as novel visualization and demonstration capabilities.

SCoOP Example Use Case Scenario II



SCoOP Example Use Case Scenario II



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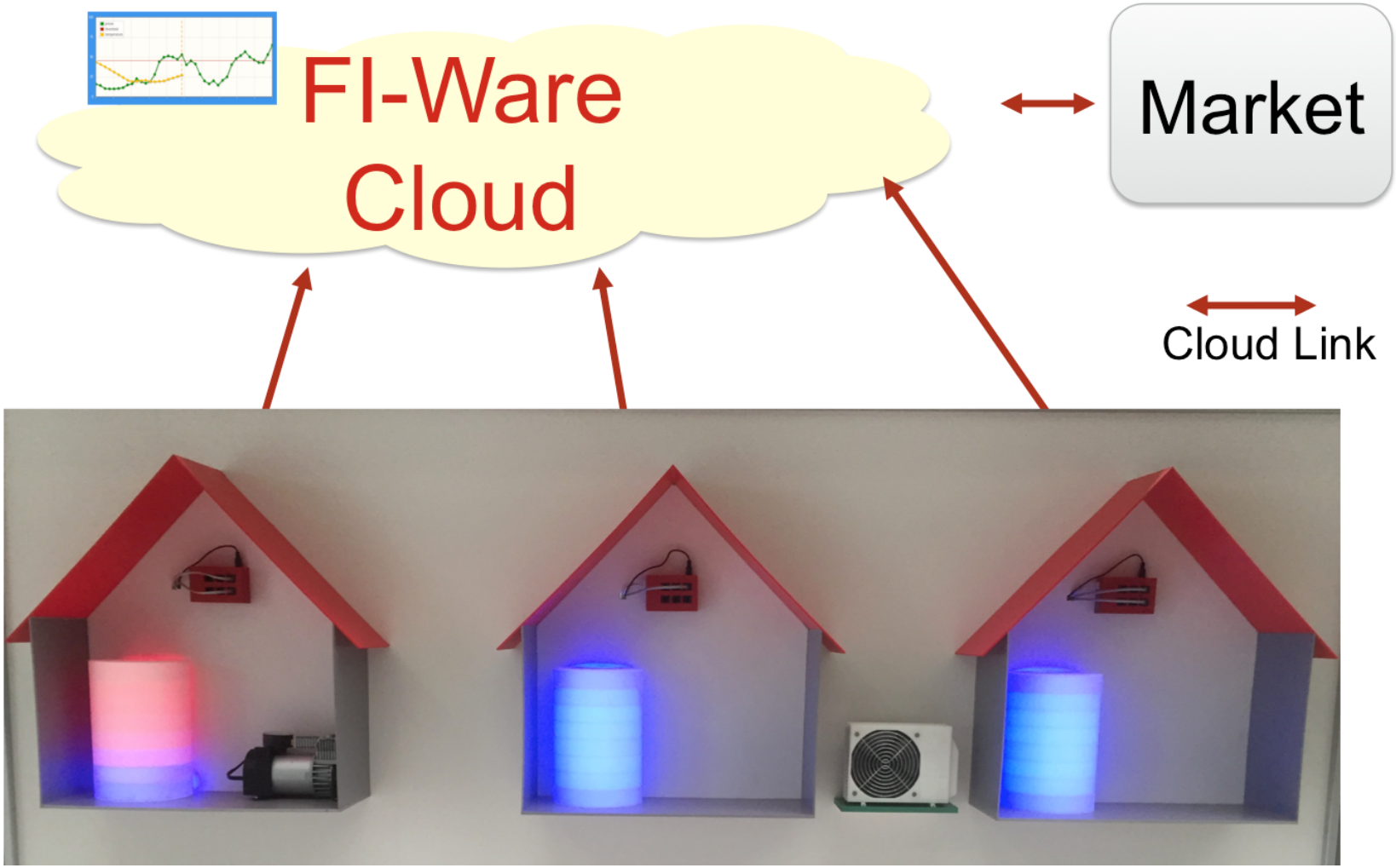
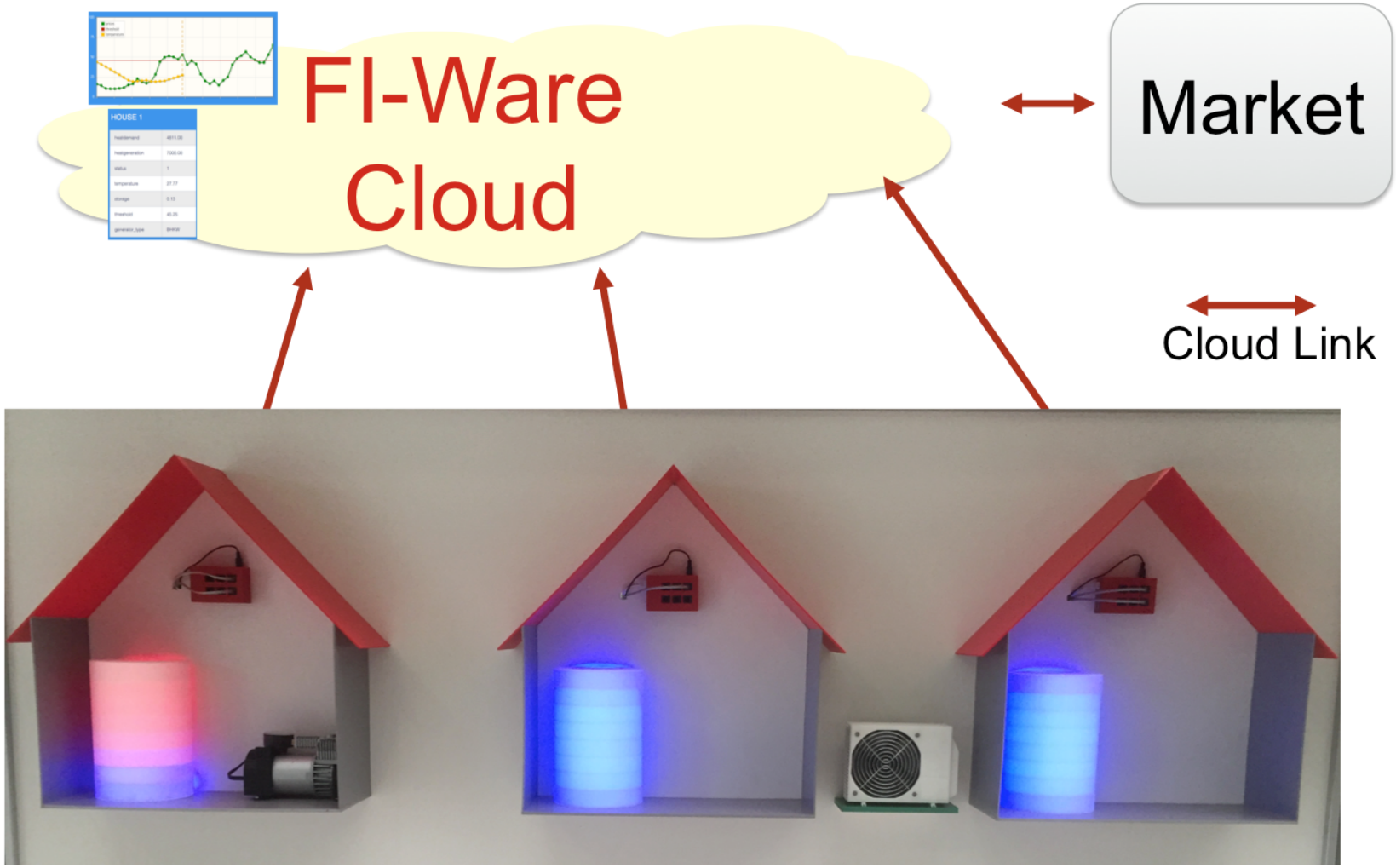


SCoOP Example Use Case Scenario II



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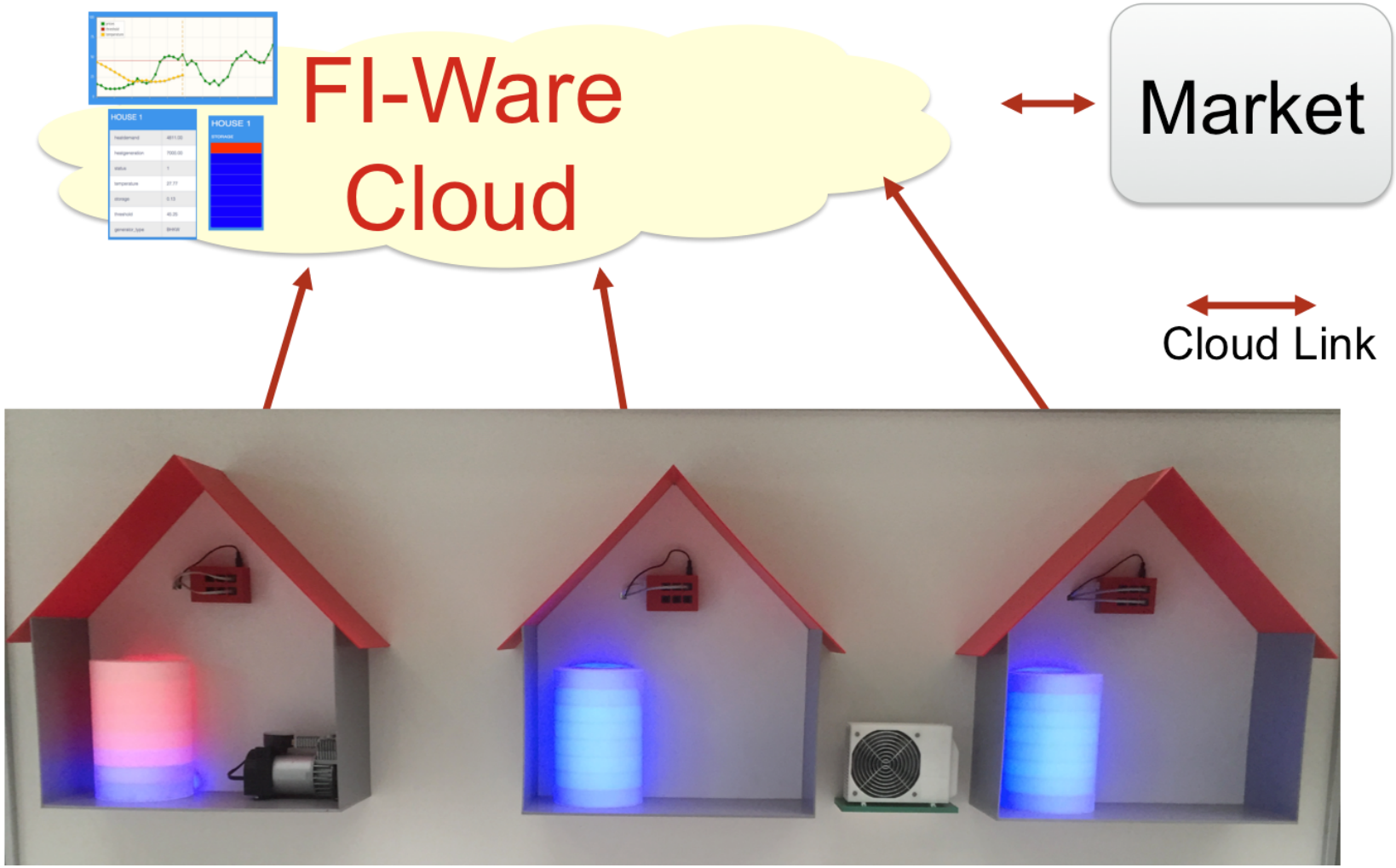
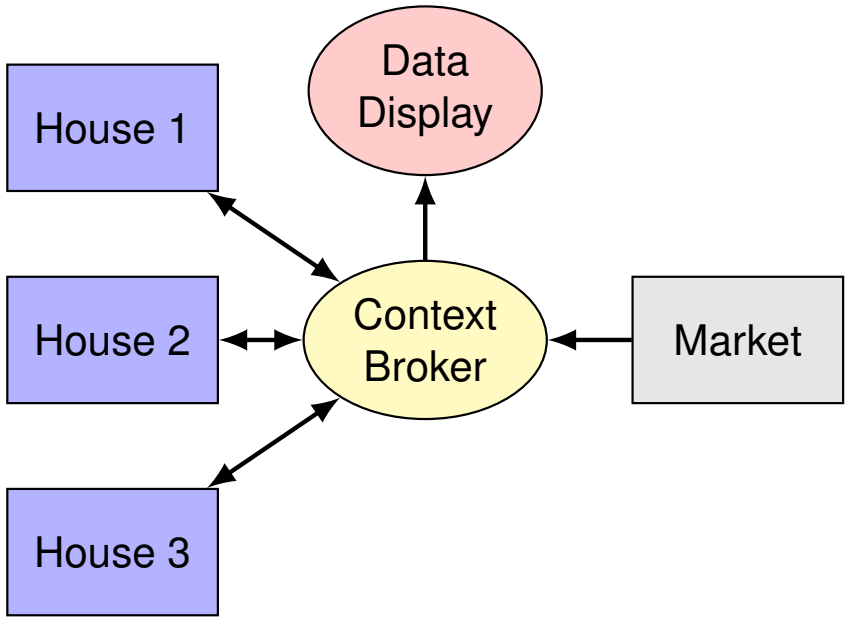
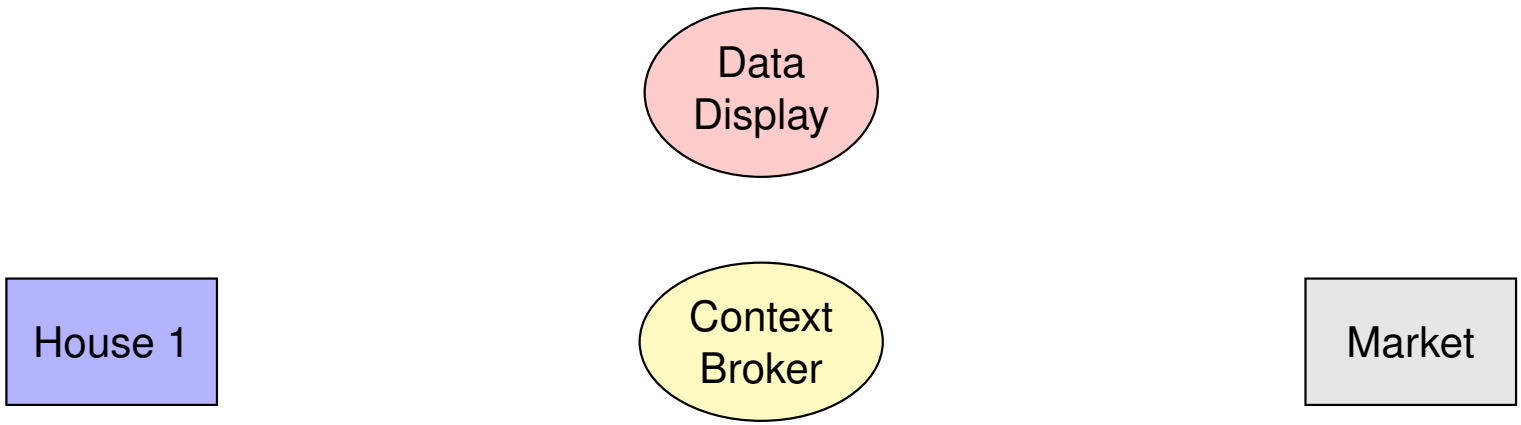


Example - Heat Storage Management

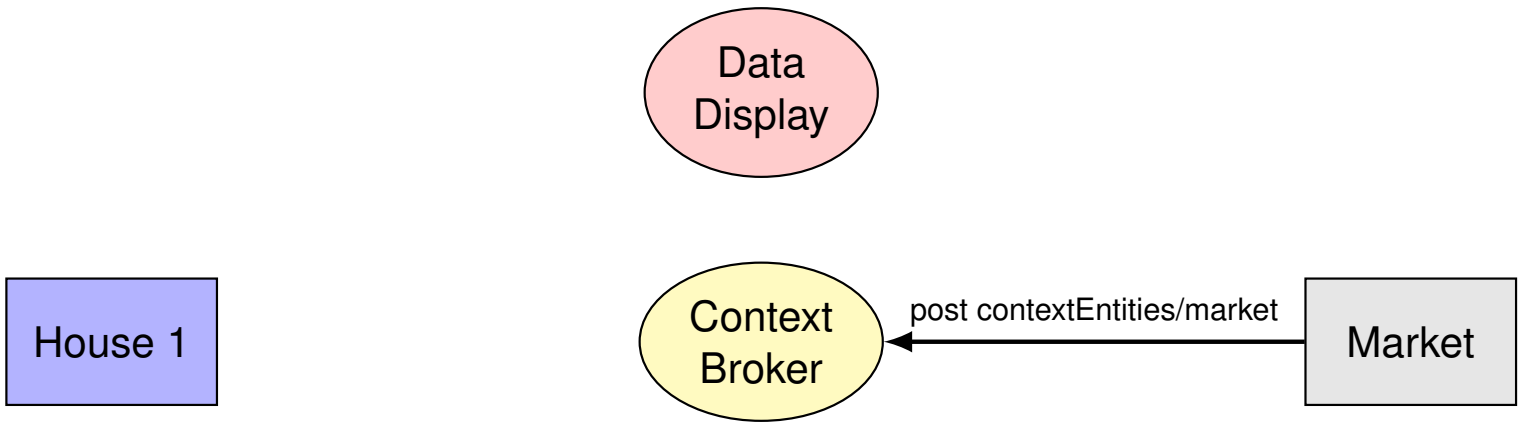


- Modeled components (C programs using libuc/libcurl)
  - House: heatdemand, charging (on/off), temperature
  - Market: actual energy price
- Utilized GEs
  - Context Broker: Orion
  - Data Display: Wirecloud based Application Mashup

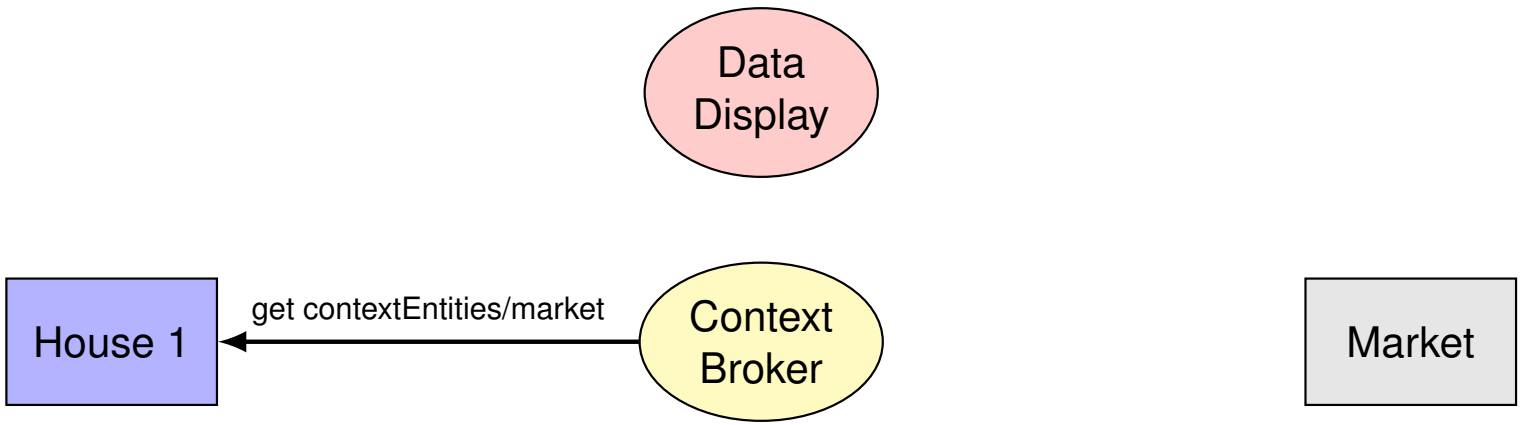
Example - Communication Scheme



Example - Communication Scheme



Example - Communication Scheme



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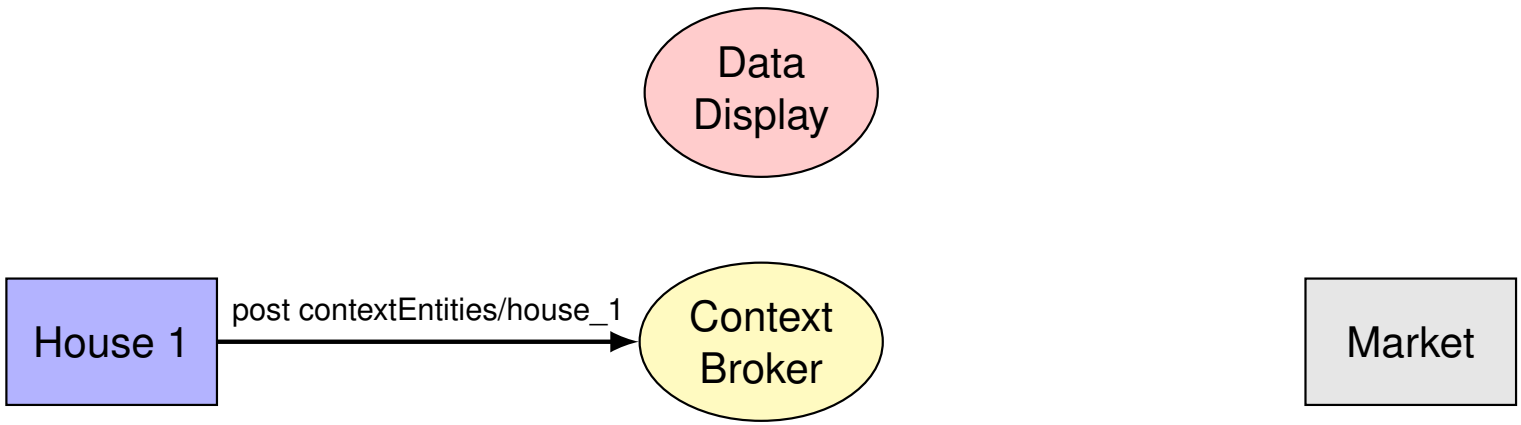
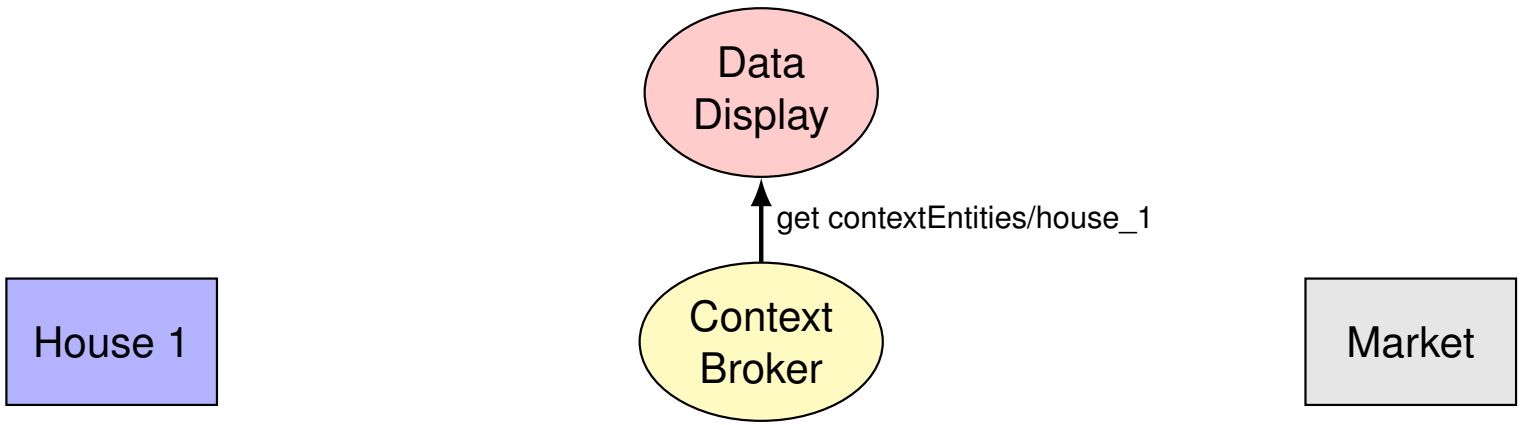


Example - Communication Scheme



Example - Context Broker Result

GET contextEntities/house_1 (using curl, requesting JSON)


```
{
  "contextElement" : {
    "id" : "house_1",
    "attributes" : [
      {
        "name" : "heatdemand",
        "value" : "3921.600098"
      }, {
        "name" : "status",
        "value" : "1"
      }, {
        "name" : "temperature",
        "value" : "71.919777"
      }
    ]
  },
}
```


Using a standard web-browser will return XML

Example - Wirecloud Visualization

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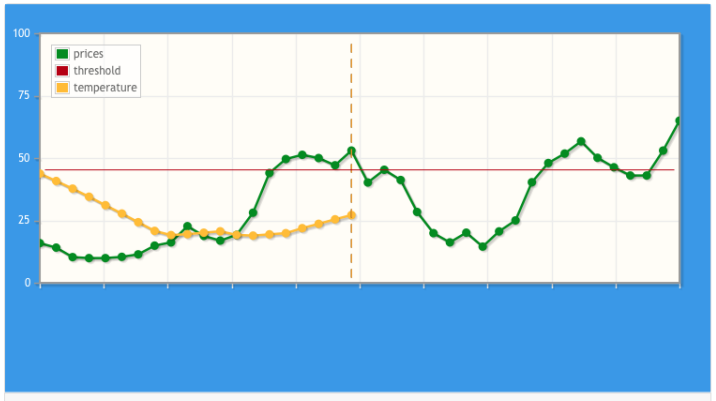
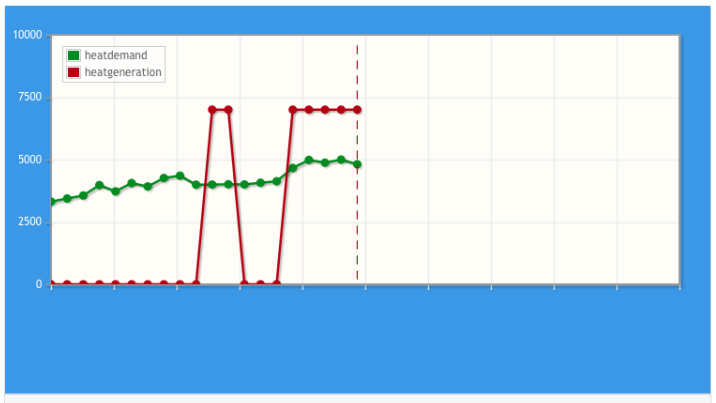
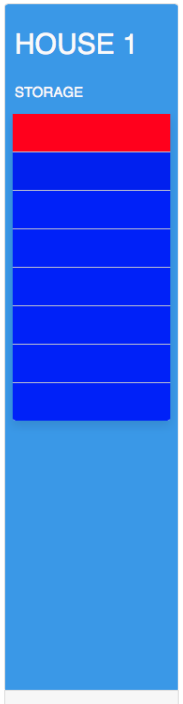
Graph Plot



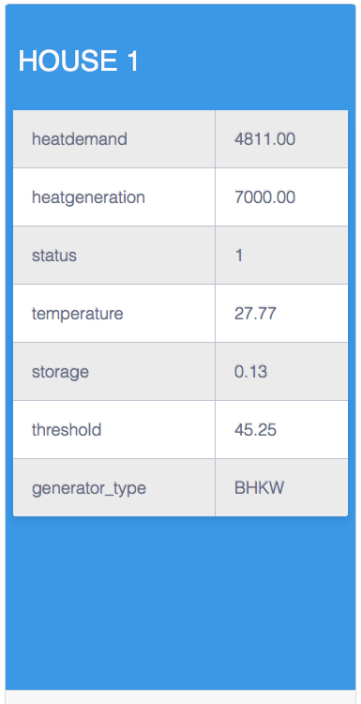
Graph Plot



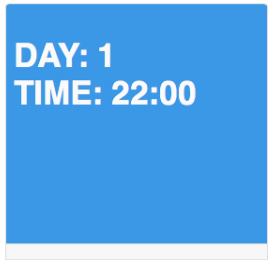
LED panel

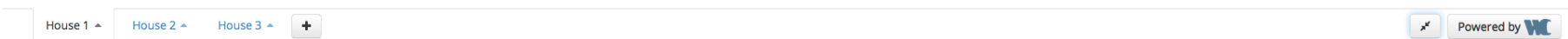


Entity Data



Clock





Example - Wirecloud Wiring

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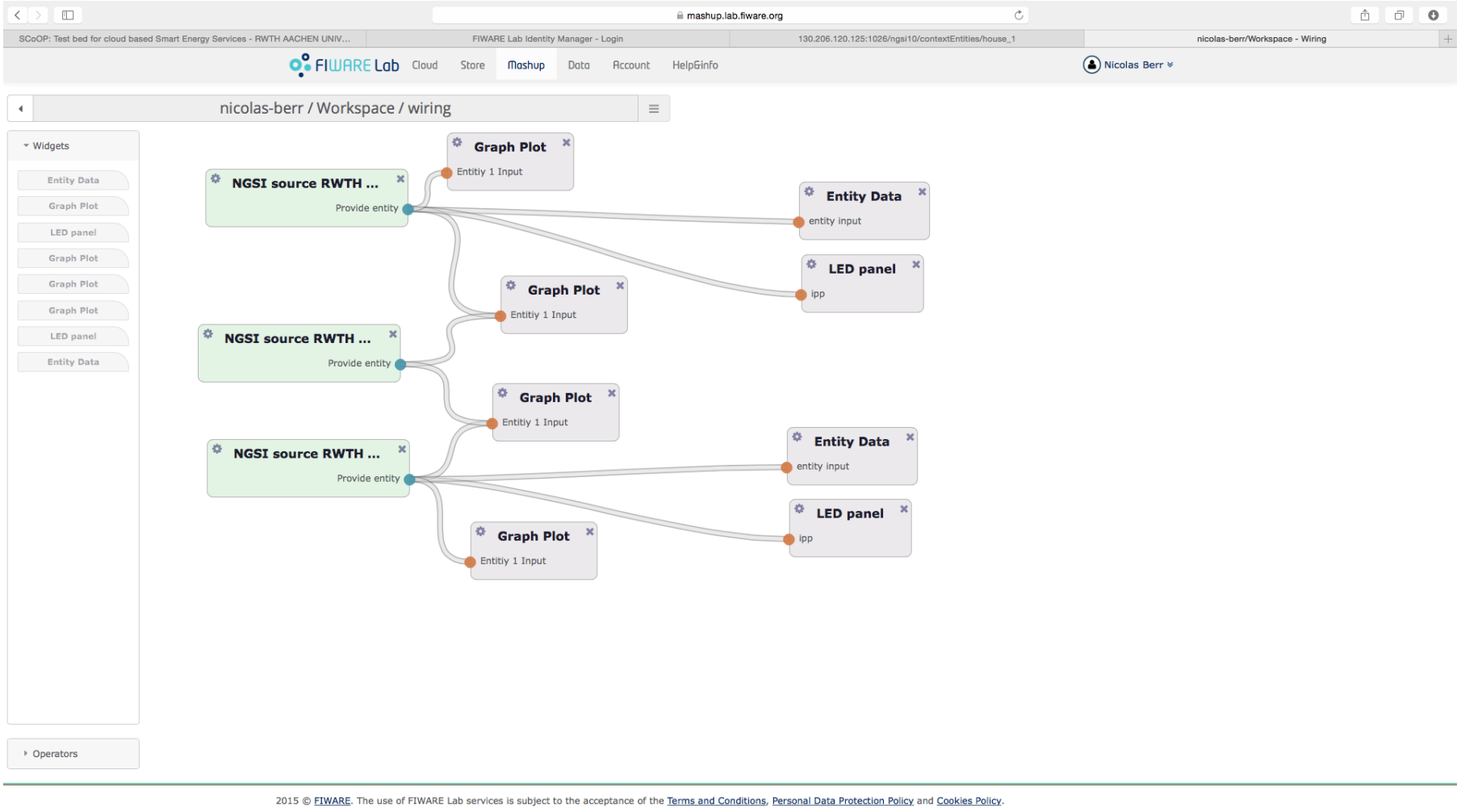
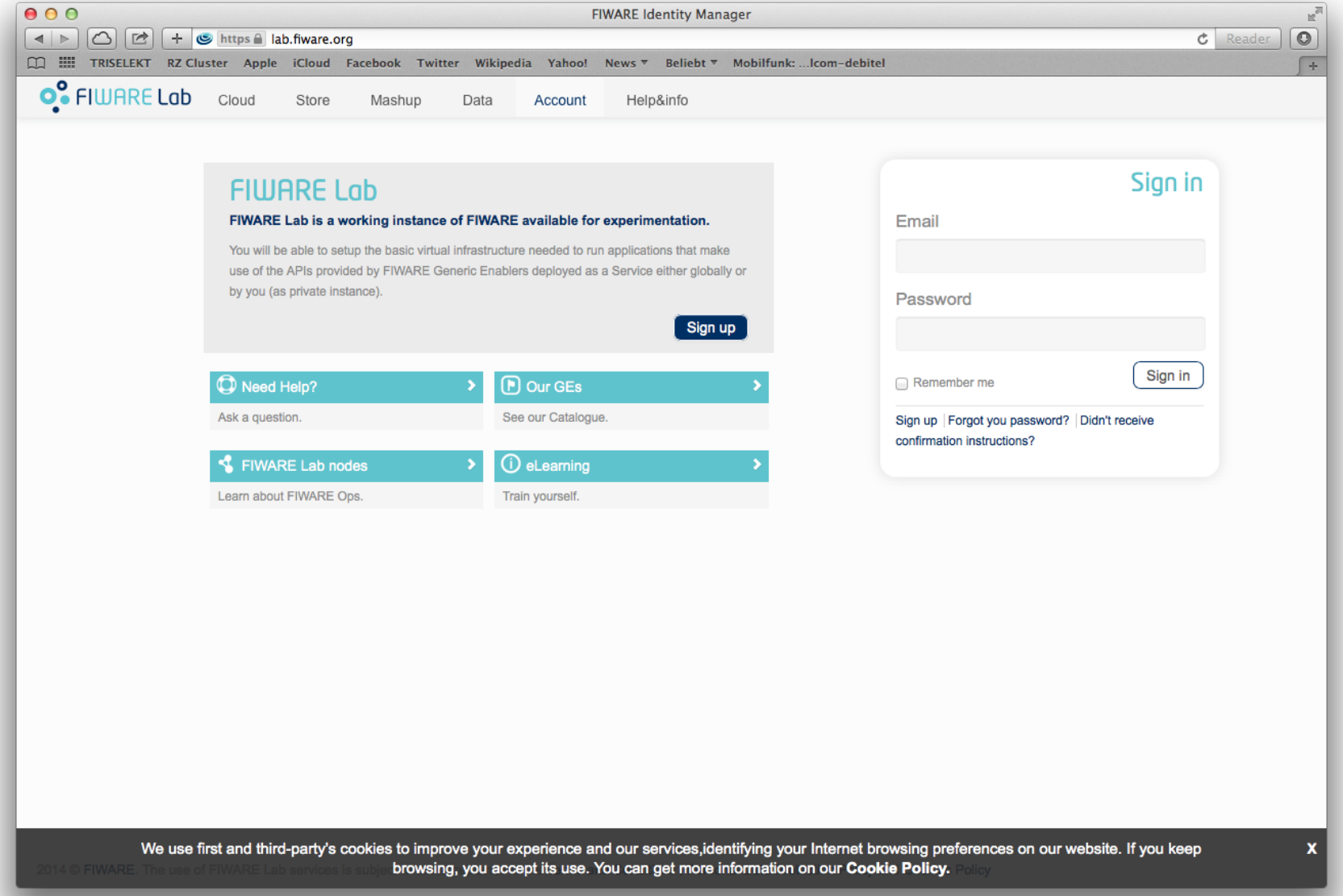


FI-Lab Demonstration



Thank you for your kind attention!

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