Agent-based local energy market control using 4DIAC

Smart Campus Salzburg Feasibility Study

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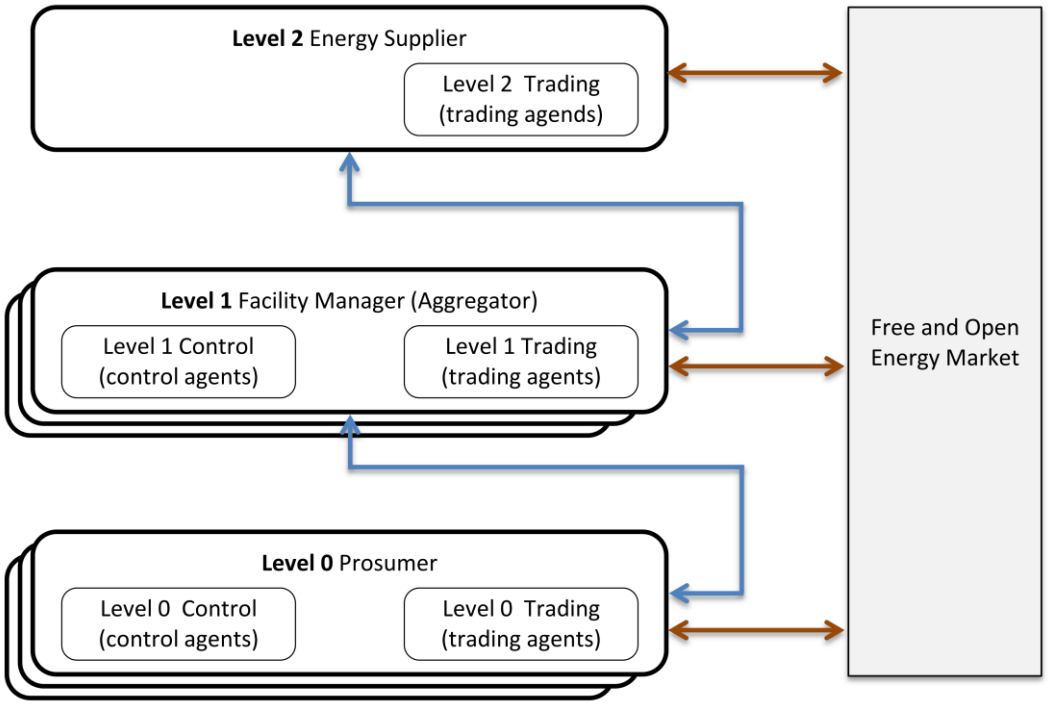
Motivation

- Austrian Smart Campus Salzburg (SCS) project
  - Feasibility Study
- R&D innovation in decentralisation of energy production and energy consumption
  - Business models (user behaviour)
  - Requirements
  - Decentralised Control Architecture
  - Communication Architecture (unified interoperable IPv6 communication)
- Aim
  - To be the first project to implement distributed control of smart campus applications

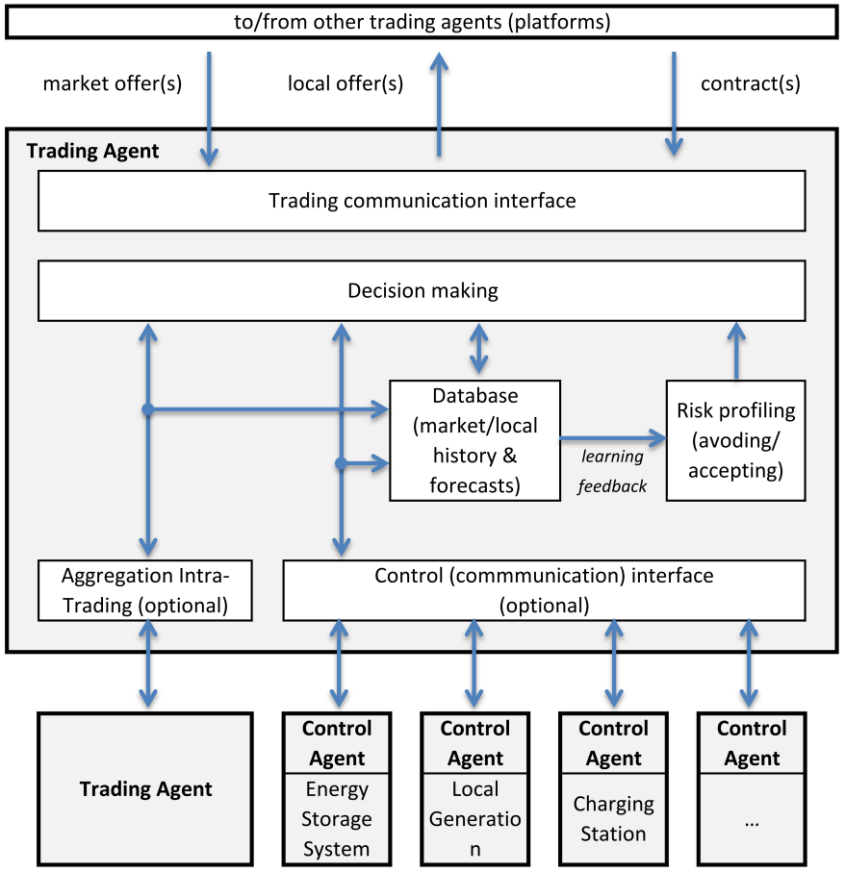
Distributed Control Concept

- Overview
  - Setup based on transactive energy and holonic control principles
  - 3 control layers
    - Energy Supplier
    - Aggregator
    - Prosumer
  - Trading Agent (Prosumer)
    - Implemented using 4DIAC



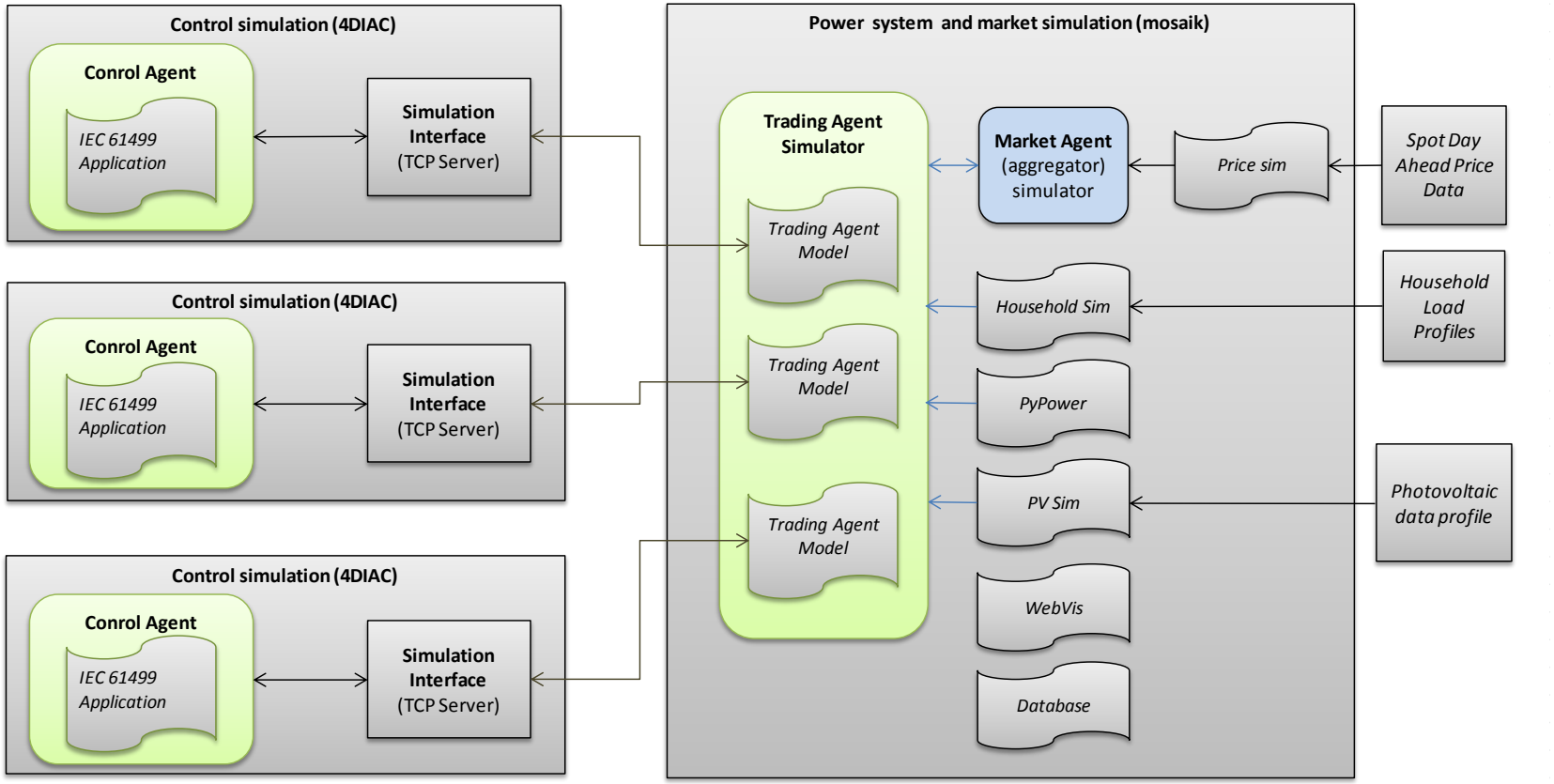
Distributed Control Concept

- Proposed Architecture
  - Focus on local energy trading between prosumers
  - Market Agent/Aggregator
    - Utilises consumption forecast
    - Carries out local trades and higher level trades with energy supplier



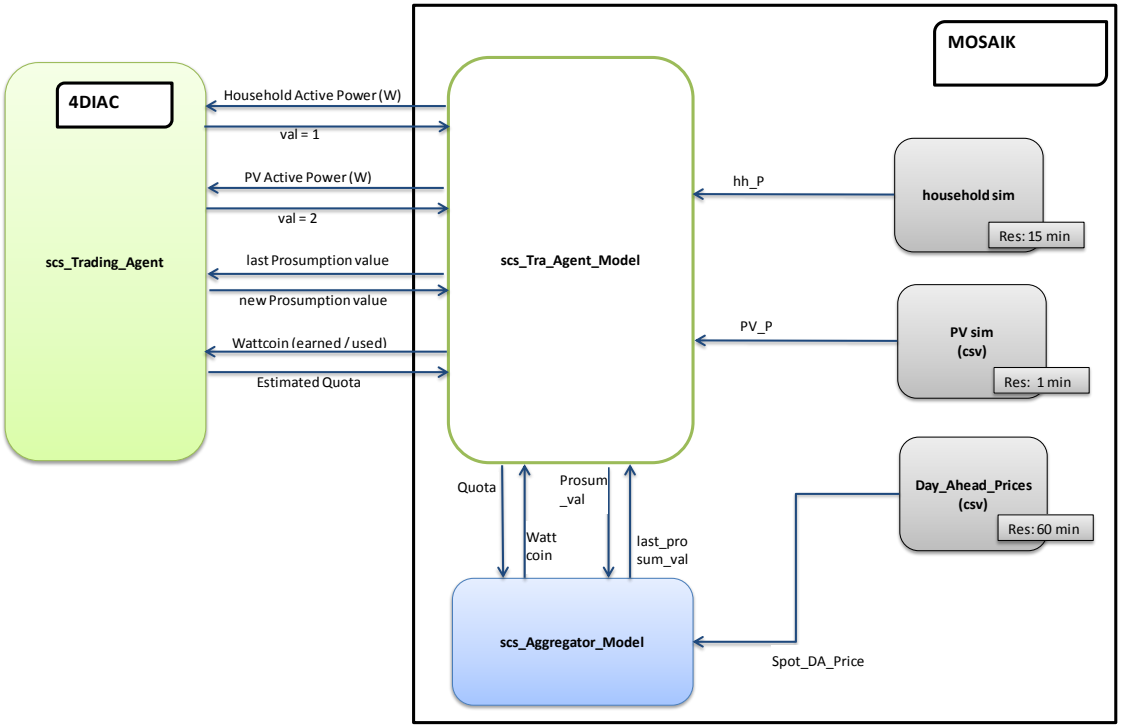
Co-Simulation Setup

- Overall setup



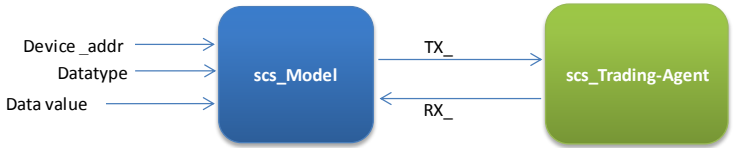
Co-Simulation Setup

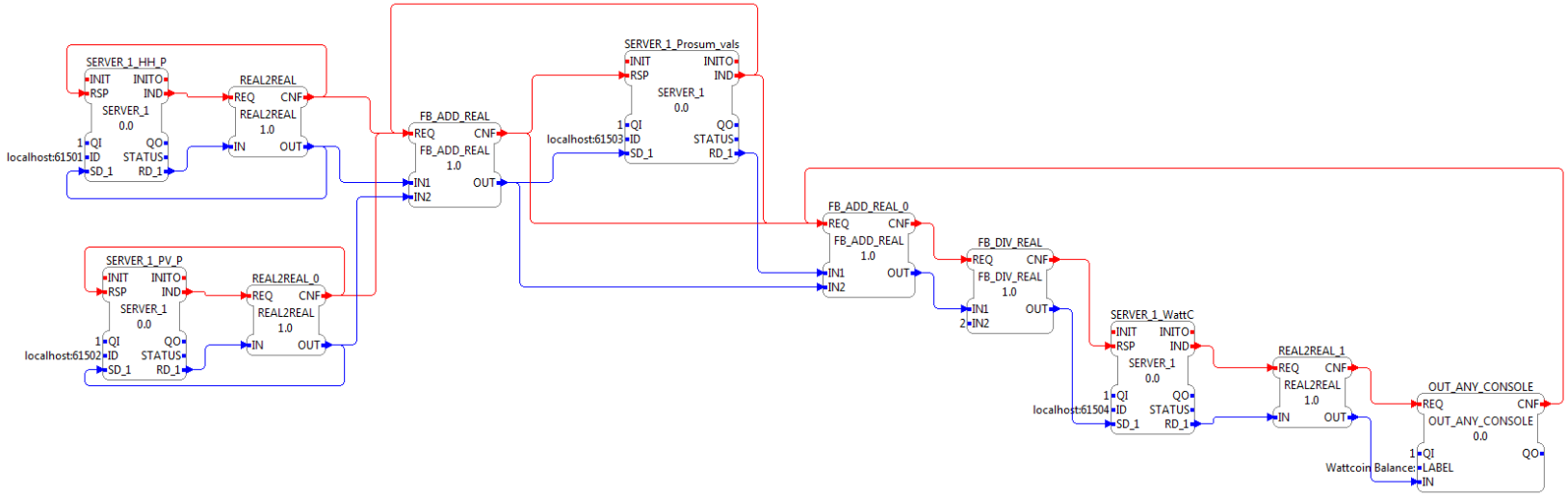
- Device communication
  - Devices receive information from other agents
    - Household Active Power
    - Photovoltaic Active Power
    - Wattcoins (earned / used)



Co-Simulation Setup

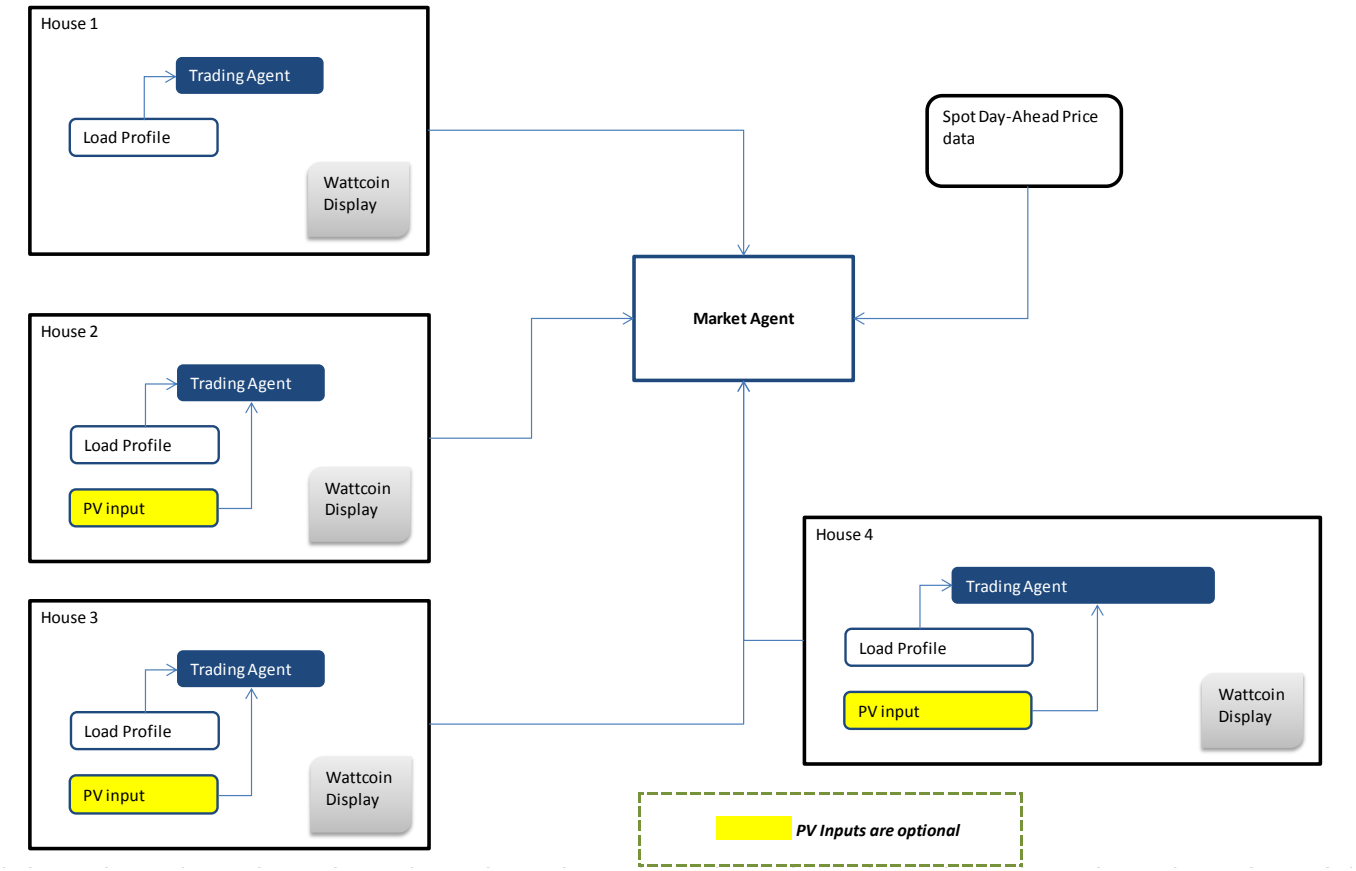
- Prosumer Device Application
  - Basic & composite
  - TCP server blocks for communication
  - Python script for communication





Simulation Scenario

- Multiple Trading Agents, reflecting each households with/without PV generation



Conclusions and Outlook

- Distributed, local market-based control concept for energy systems proposed
- Flexible architecture allows easy integration of additional prosumers
- mosaik/4DIAC-based co-simulation setup implemented
- Integration of other components (stationary energy storage systems, electric vehicle supply equipment – charging stations)
- Play around with market dynamics/different pricing schemes

For further details have a look at

C. Moyo, F. Pröstl Andrén, T. Strasser, T. Heistracher, J. Du, U. Hofmann, "Towards a Holonic-Control Inspired Local Market Approach used in Intelligent Energy Systems," 2016 IEEE International Conference on Systems, Man, and Cybernetics (SMC'16), Budapest, Hungary, Oct. 2016.

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