Network Aggregation and Local Renewable Energy Pricing in Large-Scale Edge-Cloud Networks

EINS ENERGY INFORMATION NETWORKS AND SYSTEMS

TECHNISCHE UNIVERSITÄT DARMSTADT

Bachelor's Thesis

Motivation:

Telecom operators now run computing at small edge sites close to their users. These sites can buy cheap electricity from local solar (PV) owners, who set their own prices: if workloads can be shifted between sites, PV owners compete and prices fall; if not, they can charge up to the grid price.

Our model captures this in detail, but only for a few sites. Real networks are far larger – and simplifying them by merging sites also merges competing PV owners.

Goal:

Find out when such simplified network models can still be trusted. Starting from our existing optimization model (Python, Pyomo), you will scale the network up to many sites and compute the PV owners' prices, the operator's energy costs, renewable share and latency compliance. You will then merge sites into aggregated nodes and quantify the error – and whether it stems from the coarser network or from fewer competing PV owners.

Tasks:

1. Literature research on energy-aware edge computing and network aggregation
2. Familiarization with the existing model
3. Generator for networks of arbitrary size
4. Simulation study for growing networks
5. Network aggregation and error analysis
6. Preparation of written thesis

Requirements:

- Background in electrical or computer engineering
- Python programming skills
- Interest in optimization (linear programming)
- Good English

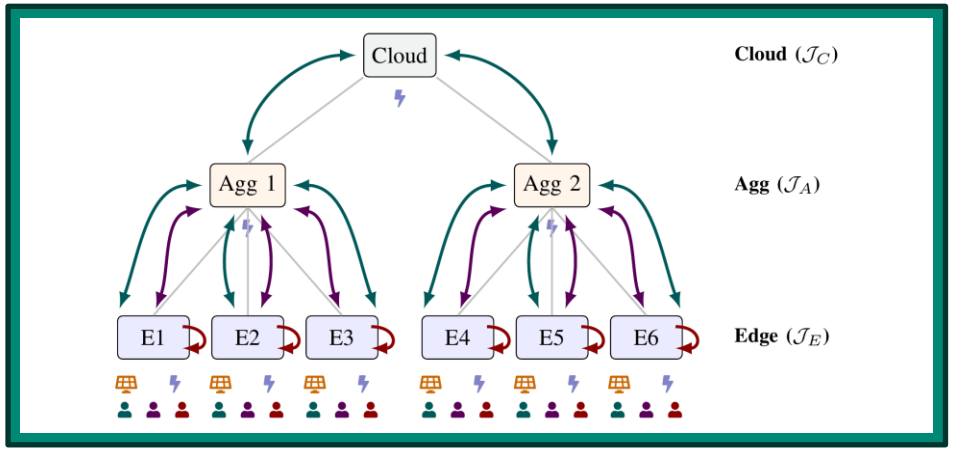

Figure 1: Three-tier edge-cloud network with local PV

Adapted from S. Mollaeivaneghi et al., IEEE CloudNet 2026

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Contact me if you are interested!