

Chapter 6

Summary

Abstract Multi-tenant data center has become large energy consumers due to the increasingly popular cloud computing services. However, their efficiency is lower than that of owner-operated data centers. This is due to the split incentives of the stakeholders, i.e., the operator and its tenants, are not aligned. This chapter summarizes the formulated problems and their corresponding proposed solutions for sustainable multi-tenant data centers.

Keywords Multi-tenant data center • Sustainability • Pricing • Randomized auction

We have studied sustainable multi-tenant data center in this chapter. We have identified the following ingredients of the problem of sustainability in multi-tenant data centers:

- Stakeholders: the operator and tenants;
- Major challenges: split incentives and on-line decision making;
- Objectives: improve energy efficiency and reduce carbon footprint;

This chapter surveys and compiles the solutions from [124–126] which address the above items.

To solve the sustainability problem, pricing- or auction-based approaches can be used to (financially) reward tenants who voluntarily reduce their electricity consumption. Further, to solve the formulated problems (4.1) or (4.2), the following on-line optimization approaches are applied:

- Kalman filter [173],
- randomized convex decomposition [128, 167, 168],
- Lyapunov technique [161].

The authors then designed the on-line algorithms that let the operator dynamically select the winning bids and reward its tenants who, in turn, reduce their electricity consumption. Their respective simulations and results show that it is indeed possible to improve sustainability (i.e., reduce energy demand, electricity cost, and carbon footprint). In doing so, they have also shown the economic benefits for operational cost savings of both the operator and its tenants.