Poster: Unionized Data Governance in Virtual Power Plants

Niels Ørbæk Chemnitz
Philippe Bonnet
Sebastian Büttrich
{niec,phbo,sbut}@itu.dk
IT University of Copenhagen
Copenhagen, Denmark

Irina Shklovski
ias@di.ku.dk
University of Copenhagen
Copenhagen, Denmark

Laura Watts
l.watts@ed.ac.uk
The University of Edinburgh
Edinburgh, United Kingdom

ABSTRACT

Flexible electricity networks continuously coordinate and optimize operations through ICT systems. An overlay data grid conveys information about the state of the electricity grid, including the real-time status of demand and production. Data is thus the basis for decisions that affect electricity costs and availability of assets. It is crucial that these decisions are formed and monitored according to a well-defined governance model. No such data governance model exists today. In this paper, we focus on data governance in virtual power plants. We define the problem, insisting on the issues linked to the inherent asymmetry of this system. We propose unionization as a framing device to reason about these issues. The central contribution of this paper is a set of principles for a unionized data governance model for virtual power plants.

CCS CONCEPTS

• **Social and professional topics** → **Socio-technical systems**; • **Applied computing** → *IT governance*.

KEYWORDS

Data Governance, Virtual Power Plant, Aggregators, Personal Data, Power Asymmetries

ACM Reference Format:
Niels Ørbæk Chemnitz, Philippe Bonnet, Sebastian Büttrich, Irina Shklovski, and Laura Watts. 2021. Poster: Unionized Data Governance in Virtual Power Plants. In *The Twelfth ACM International Conference on Future Energy Systems (e-Energy '21), June 28-July 2, 2021, Virtual Event, Italy.* ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3447555.3466570

1 INTRODUCTION

In this paper, we explore some of the issues around governance of the data that flows from individuals to aggregator within a Virtual Power Plant (VPP). This data is both extremely personal and valuable [5, 8]. Due to the power asymmetry between individual user and service provider, users have limited ways to influence how their data is used.

e-Energy '21, June 28-July 2, 2021, Virtual Event, Italy

ACM ISBN 978-1-4503-8333-2/21/06…$15.00
https://doi.org/10.1145/3447555.3466570

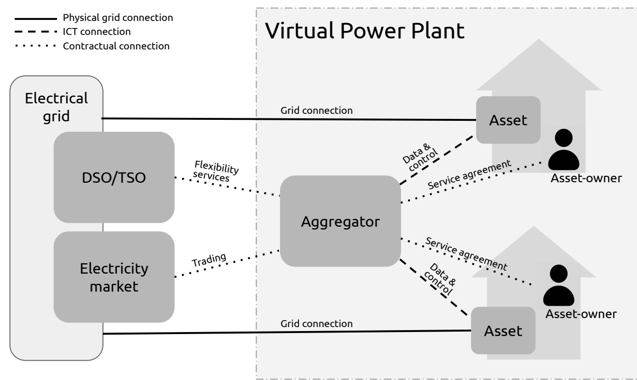


Figure 1: VPP structure. The aggregator controls a portfolio of assets and participates in the energy market or provides flexibility services.

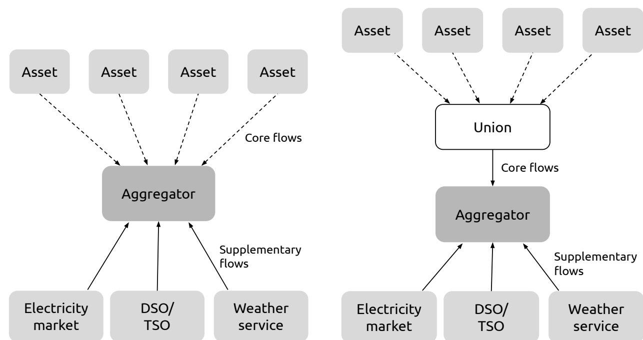
The category "*virtual power plant*" is not completely defined [1], and can assume many different organizational shapes. The subset of VPPs of interest here are those in which the Distributed Energy Resources (DERs), or *assets*, are owned by individuals outside the organization that owns the aggregator.

While a VPP conceptually includes all the stakeholders, we are particularly interested in the relationship between the *asset-owners* and the *aggregator*. An asset-owner is a stakeholder that owns an individual asset in the portfolio of the aggregator. An example is a homeowner with a heat pump, electric car or domestic battery that can be remotely controlled. The aggregator is the stakeholder controlling the ICT system that collects data and controls the assets [2]. The relationship between asset, aggregator and VPP is shown in Figure 1.

2 ASYMMETRICAL DATA FLOWS

We can distinguish between two discrete types of data flows: The *core flows*, data which flows from the assets to the aggregator, and the *supplementary flows*, which are data from external sources (see Figure 2a). The **core flows** represent the relationship between an organization (the aggregator) and an individual (the asset-owner), a one-to-many relationship. Each of the core flows are in practice interchangeable. The **supplementary flows** are the basis of the direction of the VPP, carrying the outside parameters that are used when optimizing for system goals. They are one-to-one relationships between two organizations, and typically not interchangeable or expendable.

The nature of these data flows creates an asymmetrical power relation between the aggregator and the asset-owner. The aggregator



(a) Individual data flows **(b) Unionized data flows**

Figure 2: Data flow models. The upper part represents the assets in the aggregators portfolio, while the lower part represents the data sources on which the aggregator bases its decisions.

has control over the electricity cost and availability for the asset-owners and access to valuable and personal data about them. This perceived loss of control can lead to *digital resignation* [4], which is an issue when the aggregator and asset-owners have conflicting goals. An example of conflicting goals is the discrepancy between maximizing profits and preserving the integrity of the personal sphere of the asset-owners. Allowing an organization to monitor and control the daily lives of users demands a high degree of trust [7]. Either through earned trust in the organization [9], or though a trust-worthy regulation structure. It is the latter we explore here.

3 THE UNIONIZATION FRAME

Inspired by trade unions and the field of *industrial relations* [10], we employ unionization as a method to restore symmetry in this power relation. The core data flows of a VPP can be seen as analogous to the relations of industrial employment, where the production is contingent on the pooling of a significant amount of labor. For the employer each worker is interchangeable, resulting in an asymmetrical power relationship between worker and employer. **Trade unions** mediate the flow of labor from workers to employer, and through this mediation gain leverage when negotiating wages and conditions. This is what is known as *collective bargaining*. Should the employer refuse to meet the demands of the trade union representing the workers, they can invoke a *strike*, removing the employers access to labor and thereby halting production.

In a more general sense, unions can be seen as *aggregators of power*. Whether in relation to labour, consumer rights, student conditions, or a host of other domains, the fundamental concept remains: By organizing, the interchangeability and replaceability of the individual relation is countered by collective action. We propose the creation of a new institutional actor - the **data union**, which individual asset owners can join. The data union has clearly articulated and defined goals and mediates on behalf of the asset owners, controlling all (or a significant amount of) the core data flows. This allows for collective bargaining, by using the possibility of halting or limiting the core flow (a "strike") as leverage. The structure of unionized data flows is shown in Figure 2b.

4 GOVERNANCE PRINCIPLES

Based on the unionization frame and the data governance framework proposed in [6] we derive the following principles for unionized data governance.

Unionization of Data Subjects The basis for these data governance principles is the constitution of a data union that mediates the goals of the asset-owners. The asset-owners should be able to bargain collectively about the conditions and purposes of the data flows. This includes which supplementary data flows to include and how to utilize them.

Data Principles and Representation The decision domain of *data principles* is concerned with "clarifying the role of data as an asset" [6]. The asset-owners should be represented in a central organizational governing body, which is in charge of defining and overseeing the data principles.

Disruptive Measures for Asserting Power The asset-owners should be able to limit or halt core data flow, disrupting the operation of the VPP. These measures are intended as a last resort, but their existence is crucial to assert power and symmetry in the relation with the aggregator.

Accountability Needs Transparency As the aggregator is responsible for the majority of the data collection, storage, processing, and usage, transparency measures should be put in place to ensure the asset-owners ability to audit the data usage performed by the aggregator, in order to detect misuse and assign accountability

5 FURTHER WORK

Designing usage interfaces, digital organizational platforms, automatic disruption methods, and experimentally comparing performance of (non-)unionized systems are all interesting avenues for further work. A longer version of this paper is available on arXiv.org [3].

REFERENCES

[1] Kankam O. Adu-Kankam and Luis M. Camarinha-Matos. 2018. Towards Collaborative Virtual Power Plants: Trends and Convergence. *Sustainable Energy, Grids and Networks* 16 (Dec. 2018), 217–230. https://doi.org/10.1016/j.segan.2018.08.003

[2] Daniel Esteban Morales Bondy, Kai Heussen, Oliver Gehrke, and Anders Thavlov. 2015. A Functional Reference Architecture for Aggregators. In *2015 IEEE 20th Conference on Emerging Technologies Factory Automation (ETFA)*. 1–4. https://doi.org/10.1109/ETFA.2015.7301638

[3] Niels Ørbæk Chemnitz, Philippe Bonnet, Irina Shklovski, Sebastian Büttrich, and Laura Watts. 2020. Unionized Data Governance in Virtual Power Plants. *arXiv:2006.02709 [cs]* (June 2020). arXiv:cs/2006.02709

[4] Nora A Draper and Joseph Turow. 2019. The Corporate Cultivation of Digital Resignation. *New Media & Society* 21, 8 (Aug. 2019), 1824–1839. https://doi.org/10.1177/1461444819833331

[5] Ulrich Greveler, Peter Glösekötter, Benjamin Justus, and Dennis Loehr. 2012. Multimedia Content Identification through Smart Meter Power Usage Profiles. *Proc. Int. Conf. Inf. Knowl. Eng. (IKE)* (Jan. 2012).

[6] Vijay Khatri and Carol V. Brown. 2010. Designing Data Governance. *Commun. ACM* 53, 1 (Jan. 2010), 148–152. https://doi.org/10.1145/1629175.1629210

[7] G. Le Ray and P. Pinson. 2020. The Ethical Smart Grid: Enabling a Fruitful and Long-Lasting Relationship between Utilities and Customers. *Energy Policy* 140 (May 2020), 111258. https://doi.org/10.1016/j.enpol.2020.111258

[8] J. Liisberg, J. K. Møller, H. Bloem, J. Cipriano, G. Mor, and H. Madsen. 2016. Hidden Markov Models for Indirect Classification of Occupant Behaviour. *Sustainable Cities and Society* 27 (Nov. 2016), 83–98. https://doi.org/10.1016/j.scs.2016.07.001

[9] Trine Pallesen and Peter H. Jacobsen. 2018. Articulation Work from the Middle—a Study of How Technicians Mediate Users and Technology. *New Technology, Work and Employment* 33, 2 (2018), 171–186. https://doi.org/10.1111/ntwe.12113

[10] Michael Salamon. 2000. *Industrial Relations : Theory and Practice.* Financial Times Prentice Hall, Harlow.