Simplifying Access to Energy Data: Matter-Based Integration of Distributed Energy Resources into an Energy Data Agent

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Access to near-real-time data from distributed energy resources (DERs) is a key prerequisite for emerging energy services, yet remains difficult due to vendor-specific integration approaches and technical complexity faced by users. This paper investigates the use of the Matter protocol as a vendor-neutral standard for simplifying DER integration into energy data platforms. We present the integration of Matter into the DataWallet energy data agent through a modular Matter-Bridge. It connects the protocol stack to an existing MQTT-based data pipeline without modifying the system core. To enable evaluation in the absence of commercially available Matter-enabled DER devices, an ESP32-based photovoltaic inverter simulator was developed, implementing relevant Matter device types and energy management functionalities. The results establish technical feasibility and demonstrate that an already network-commissioned DER device can be onboarded with four UI selections and one code entry. This lowers the complexity of device connectivity and reduces barriers to accessing energy data.

CCS Concepts: • **Hardware** → **Interconnect power issues**; **Smart grid**; • **Software and its engineering** → *Middleware*; • **Networks** → *Cyber-physical networks.*

Additional Key Words and Phrases: Matter Protocol, Distributed Energy Resources (DER), Energy Data Integration, Interoperability, Data Accessibility, Internet of Things (IoT)

1 Introduction

The energy transition is driving the emergence of data-intensive service models across the electricity sector. Flexibility providers require device-level telemetry from distributed assets to aggregate household-level capacity and offer it on balancing markets [15]. Dynamic tariff schemes presuppose fine-grained consumption data to verify that time-varying price signals yield measurable load shifts [24]. Despite their differing governance structures and market mechanisms, these services converge on a common prerequisite: access to near-real-time energy data from behind-the-meter assets; limited near-real-time access and a lack of standardisation remain recurring barriers in distributed energy settings [26].

This data originates from various distributed energy resources (DERs) such as photovoltaic inverters, battery storage systems, heat pumps, and electric vehicle supply equipment [1]. Because these assets reside on the customer side of the metering point, they fall outside the direct observability of the distribution system operator [35]. An in-home energy data agent is therefore required to acquire device-level telemetry, normalise it, and relay it to the services that consume it. For broad uptake, the barrier to adoption must remain low: device onboarding should demand no or minimal technical expertise from end users [45].

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Realising this low-barrier integration is difficult in practice. Inferring from [25, 36], the prevailing approach to behind-the-meter device connectivity is fragmented across proprietary vendor APIs, cloud-dependent data paths, and protocol-specific gateways. Each pairing of device manufacturer and service platform constitutes a bespoke integration effort. The resulting complexity scales with the product of device types and platforms, yielding an $n \times m$ integration problem that imposes a disproportionate burden on both platform operators and device manufacturers. An end user whose inverter or heat pump lacks a supported integration path is simply excluded from participation.

The Matter protocol offers a principled resolution to this fragmentation. Governed by the Connectivity Standards Alliance (CSA) and backed by over 850 member organisations, Matter is an open, royalty-free smart home connectivity standard operating at the application layer over IPv6 [7, 14]. Its recent specification releases (versions 1.3 through 1.5) introduced energy-specific device types and measurement clusters that provide a vendor-neutral interface to DER data and control [8–10]. A single Matter integration in an energy platform can, in principle, serve any Matter-certified device, reducing the $n \times m$ integration problem to $1 \times m$.

In this paper, we present the integration of the Matter protocol into the DataWallet, an energy data agent operating within the home. We make three contributions. First, we describe the integration architecture itself: a Matter-Bridge component that connects the Matter protocol stack to the DataWallet's existing MQTT-based data pipeline without requiring modifications to the agent's core. Second, we present a PV inverter simulator built on an ESP32 microcontroller that implements Matter's Solar Power device type, providing a functional testbed in the continued absence of commercial Matter-enabled DER hardware. Third, we demonstrate the end-to-end commissioning workflow and show that user-facing device onboarding of an already commissioned device reduces to four UI selections and a single setup code entry.

The remainder of this paper is structured as follows. Section 2 surveys existing connectivity solutions and situates our work within the current state of Matter in the literature. Section 3 introduces the reference architecture within which the integration operates. Section 4 provides the requisite background on the Matter protocol and its energy-relevant capabilities. Section 5 details the implementation before Section 6 presents a short evaluation. Sections 7 and 8 discuss limitations and conclude.

2 Background and Related Work

2.1 Behind-the-meter device connectivity

Connecting distributed energy resources to external service platforms requires bridging the gap between heterogeneous in-home

devices and the data infrastructure that aggregators, community operators, and grid services depend on. Several approaches exist, each with distinct trade-offs.

The most common integration path today runs through proprietary vendor clouds. Manufacturers such as Fronius and Tesla expose device data through cloud portals, as indicated in [36]. While functional, this approach ties every integration to a single manufacturer's ecosystem. Platform operators must implement and maintain a separate connector for each vendor, and any change to a vendor's API can break the data pipeline without notice [4]. The resulting architecture is cloud-dependent by design: if the vendor's servers are unreachable, local device data becomes inaccessible to the service platform. For end users, this means that participation in energy services is contingent on whether the aggregator has implemented support for their specific hardware.

Protocol-level gateways offer a partial alternative. Modbus, originally developed for industrial automation, has become a widely adopted communication protocol for DER integration [34]. Haupt et al. [25] report that Modbus is used for communication between home energy management systems and electric vehicles, battery storage, and heat pumps. Moreover, it remains the de facto standard for PV inverter connectivity [22]. Its strengths are vendor independence and simplicity at the protocol level. These advantages come at the cost of consumer friendliness: integrating a Modbus device requires knowledge of register maps, connection parameters, and manufacturer-specific documentation. Modbus also lacks a standardised device model; two inverters from different manufacturers may expose identical physical quantities through entirely different register layouts. The SunSpec Alliance addresses this gap by defining standardised data models for DERs on top of Modbus [34], but its scope is restricted primarily to inverters and storage systems, limiting broader applicability. Other building-level protocols such as KNX target commercial building automation at a price point and complexity level ill-suited to residential deployments [28], while EEBUS, though designed for residential energy management, has seen limited market adoption to date [25].

General-purpose home automation platforms represent a third category. Open-source systems such as Home Assistant and OpenHAB support a broad range of device integrations, including Matter [43, 44]. Home Assistant allows for different services and integrations to be added and run locally that access data from connected devices and optimize their operation. One example is EMHASS (Energy Management for Home Assistant), an integration that optimizes operation of devices connected to Home Assistant [16]. While Home Assistant allows data access to local services, it does not allow the consent-driven sharing of collected energy data with dedicated third-party service platforms and typical dataspaces and data marketplaces. This would require every service provider to develop an own Home Assistant integration. Using such a platform as the device connectivity layer for an energy data agent would require substantial adaptation that falls outside the platform's design intent of local control and privacy first [38].

At the grid-to-aggregator boundary, demand response standards such as OpenADR define how utilities and grid operators communicate load-adjustment signals to customers or aggregators [18]. OpenADR standardises the signalling interface between the grid side and the customer side but does not specify how signals are translated into device-level actions within the household. The gap between receiving a demand response event and actuating a heat pump or curtailing an inverter remains outside its scope. The same limitation applies to IEEE 2030.5, which addresses utility-to-device communication for grid services but assumes direct addressability of endpoints. In practice, however, devices might sit behind proprietary gateways or communication standards, requiring translation to the used communication protocol of the DER [29].

Taken together, the existing connectivity landscape leaves a gap. Vendor clouds lock integration to individual manufacturers. Protocol gateways require technical expertise and lack unified device models. Home automation platforms serve a different purpose. Demand response standards operate above the device layer. What is missing is a vendor-neutral, application-layer standard that defines both the data model and the communication interface for energy-relevant household devices, and that can be integrated into a purpose-built energy data agent with minimal user-facing complexity.

2.2 Matter in the literature

Academic research on the Matter protocol is still at an early stage. The existing body of work clusters around two themes: security analysis and testbed development. On the security side, Shashwat et al. [40] examine the trust model underlying Matter's controller architecture. Their analysis reveals that controllers are never independently vetted during the commissioning process, which introduces attack vectors through compromised or malicious controller implementations. Schlett et al. [37] demonstrate that even under Matter's encrypted communication, it is possible to infer device types and interaction patterns from traffic metadata. Matter uses fixed packet lengths for certain message types, and devices exhibit characteristic message sequences that function as identifiable fingerprints.

Several groups have built experimental testbeds to evaluate Matter in practice. Nobile et al. [32] compare Matter over Thread with Zigbee in a controlled environment and find that Zigbee holds advantages in small, homogeneous installations, while Matter over Thread performs better as deployment size and device heterogeneity increase. Mota et al. [31] implement a Matter accessory on an ESP32 platform, demonstrating the feasibility of developing custom Matter devices with commodity hardware. Zegeye et al. [46] construct a Matter-enabled door lock on Silicon Labs' EFR32 platform and validate end-to-end device control through a standard Matter controller.

Work specifically addressing Matter's relevance to the energy domain remains scarce. Fiastri [17] argued as early as 2022 that Matter could play a significant role in enabling residential demand response, identifying device incompatibility as a key barrier that Matter's unified application layer could resolve. At the time of writing, Matter had not yet introduced energy management functionality, but major energy technology companies were already members of the CSA. Belli et al. [3] provide the most comprehensive survey of Matter to date, mapping the protocol's applicability across domains including healthcare, building automation, smart grid, industrial IoT, and automotive. The authors identify the smart grid domain as particularly promising, citing Matter's interoperability guarantees and

its security architecture as enabling factors, but note that concrete implementations remain absent.

At the 2025 Consumer Electronics Show, NXP and Green Energy Options (geo) presented SeeZero, a Matter-enabled home energy management system that coordinates a solar inverter, battery storage, and EV charger through the Matter protocol [33]. Geo has additionally published a specification for bridging OpenADR signals to Matter-enabled devices [23], allowing utility demand response events to be translated into Matter commands. These efforts confirm industry momentum but remain at the demonstration stage; neither has been subjected to independent evaluation, nor do they address integration into a broader energy data platform architecture.

The gap that emerges from this survey is clear. Academic work on Matter has focused on protocol-level security and general-purpose IoT testbeds. Industry prototypes have begun to explore energy use cases but remain isolated demonstrations. No prior work integrates Matter's energy-specific device types and clusters into a dedicated energy data agent designed for consent-governed data collection and forwarding to energy service platforms. This publication addresses the discussed gap.

3 System Context: Reference Architecture

The integration presented in this paper operates within a broader energy data and service platform whose architecture we summarise here to establish context. The platform is developed as part of a European research project. Its objective is to provide a consent-driven infrastructure through which energy data from households can be collected, governed, and made available to service providers (also referred to as eligible parties) such as distribution system operators, energy communities, and other third-party data-based service providers.

As depicted in Figure 1, the central component is the DataWallet, a continued development of the AIIDA (Administrative Interface for In-house Data Access) platform [2]. It is deployed on the user's premises and connects to heterogeneous household assets through protocol-specific connectors and serves two major roles. First, it collects and normalises device-level telemetry from sources such as smart meters and home automation systems, publishing the data to authorised service providers. Second, it executes energy services locally on behalf of the user. Services such as load shifting recommendations, energy saving analytics, digital twins, and energy community optimisation run inside the DataWallet rather than inside external applications. This design ensures that raw device data need not leave the premises unless the user has explicitly consented to its sharing.

Data governance is enforced through a declarative policy-driven Marketplace Backend that mediates all interactions between the DataWallet and external service providers. Each service provider (eligible party) must formally declare aspects such as the data attributes, temporal granularity, polling frequency, and intended purpose of the data it requests. These declarations constitute enforceable data contracts: the DataWallet transmits only those data streams for which the data owners have granted explicit consent against a registered policy. The Marketplace Backend further serves as the registry for service publication, enabling providers to submit new services against standardised data contracts, and administers the remuneration framework governing data exchange between participants.

Historical validated energy data is supplied by EDDIE (European Distributed Data Infrastructure for Energy), a cross-border energy dataspace, which interfaces with country-specific metering data access providers (DAPs), such as EDA in Austria, reflecting the variation in energy-data access roles and infrastructures across European countries [27], as shown in Figure 1.

Two user-facing applications complete the platform. The Marketplace Application functions as the consent management interface: users inspect available services, review the precise data requirements each service declares, and grant or revoke consent at any time with immediate effect. The End Customer Application provides operational monitoring, service visualisation, and direct interaction with installed services.

For the purposes of this paper, the salient architectural property is the DataWallet's connector design. The agent abstracts device communication behind a protocol-agnostic connector interface. Introducing support for an additional communication protocol requires implementing a new connector module without modification to the DataWallet's core data pipeline or service execution layer. The Matter integration described in Section 5 instantiates this pattern. As established in Section 2, existing connectivity options for behind-the-meter devices impose several difficulties (per-vendor integration, technical barriers, etc.). The Matter protocol, introduced by the Connectivity Standards Alliance, is an open standard that provides a vendor-neutral application-layer interface to DER. Integrating Matter as a connector within the DataWallet would, in principle, collapse the per-manufacturer integration effort into a single protocol-level implementation. The following section provides the technical background on Matter necessary to understand this integration.

4 Matter Protocol

4.1 Origin and governance

Matter is an open application-layer connectivity standard for smart home devices, developed and maintained by the Connectivity Standards Alliance (CSA) [7]. Since its initial announcement in 2019, the CSA has grown to over 850 member organisations spanning device manufacturers, platform operators, and semiconductor vendors [5, 14]. The specification is freely available, and the SDK, including reference implementations, is published as open-source software [12]. Interoperability is enforced through a mandatory certification programme [41]. Devices must pass compliance testing administered by accredited test providers before the CSA issues certificates and registers the device in the Distributed Compliance Ledger (DCL). This ledger is queried during device commissioning to verify attestation, providing a cryptographic chain of trust from manufacturer to deployment.

4.2 Technical architecture

Matter operates at the application layer over IPv6-based transport networks using Wi-Fi, Thread, or Ethernet; initial device commissioning relies on Bluetooth Low Energy (BLE) for out-of-band channel establishment. Because Matter is transport-agnostic, a single

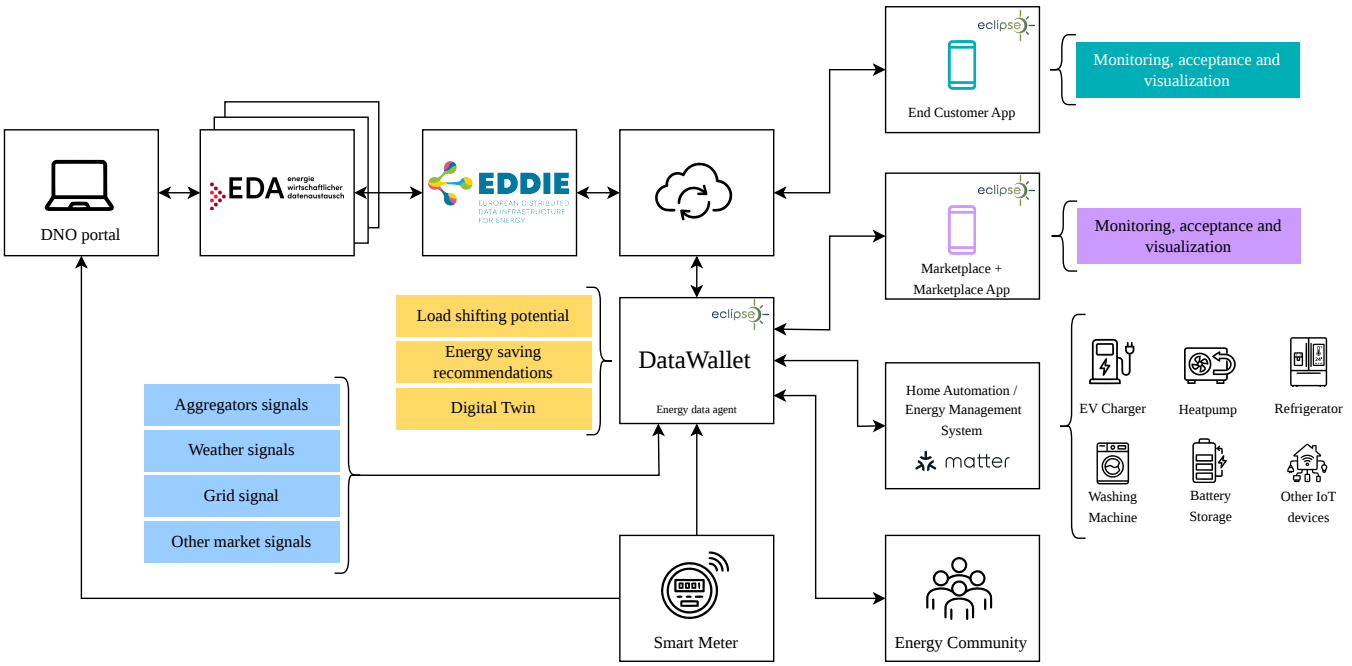

Fig. 1. Reference architecture of the energy data and service platform. The DataWallet collects device-level telemetry from household assets via protocol-specific connectors and executes services locally. The Marketplace Backend governs data policies and service publication. EDDIE provides historical validated energy data from national metering infrastructure.

logical network can span heterogeneous physical media. This logical network is termed a *fabric*: a closed security domain in which all participating nodes hold mutually authenticated operational certificates [19]. A Matter controller creates and administers a fabric, commissioning new devices by establishing a Passcode Authenticated Session Establishment (PASE) session using a device-specific setup code, performing device attestation against the DCL, and issuing an operational certificate that binds the device to the fabric [21]. Subsequent runtime communication is secured via Certificate Authenticated Session Establishment (CASE) with AES-CCM-128 encryption [42]. Devices may participate in multiple fabrics simultaneously, a capability referred to as Multi-Admin mode, which allows several controllers to access the same physical device independently [19].

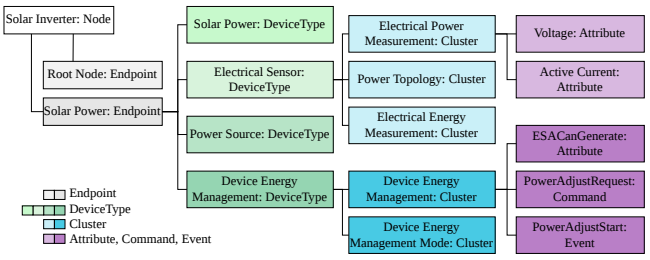

Fig. 2. Matter data model hierarchy illustrated for a solar inverter. The node exposes multiple endpoints, each carrying clusters that define attributes, commands, and events for a specific functional domain.

4.2.1 Data Model. Matter defines a hierarchical data model that structures device functionality into composable layers [20]. Figure 2 illustrates this hierarchy for a solar inverter. A physical device hosts one or more *nodes*, each uniquely addressable on the network. In practice, most devices expose a single node. Each node comprises two or more *endpoints*, where an endpoint represents a logically distinct unit of functionality or service provided by the device. Every node must define Endpoint 0 for protocol-level operations (such as commissioning, network management, and diagnostics) and at least one additional endpoint carrying device-level functionality. Each endpoint contains one or more *clusters*. A cluster groups a coherent set of *attributes*, *commands*, and *events*. Attributes represent the actual data elements of a specific property or state of the device (e.g. current brightness level of a dimmable light), commands allow to interact with a device and perform actions on the device (e.g. turning a light on or off) and events are signals generated and published by the device to indicate a change of state (e.g. the start of power adjustment period). Inside a cluster, attributes, commands, and events can be assigned to a *feature*, which are used to easier impose conformance.

The specification prescribes *Device Types* that define the mandatory and optional cluster composition for a class of devices [20]. A thermostat Device Type, for instance, mandates the Thermostat cluster and optionally includes additional clusters such as Relative Humidity Measurement and Temperature Measurement, amongst others [11]. Any certified device implementing a Device Type must expose at minimum its mandatory clusters, guaranteeing a baseline

level of interoperability across manufacturers. The distinction between mandatory and optional clusters is consequential for energy applications: manufacturers may implement only the mandatory subset, leaving advanced telemetry or control capabilities inaccessible through the Matter interface.

4.3 Energy-relevant aspects

Matter's specification [13] has evolved through successive releases, continuously extending the set of formally defined clusters and Device Types. The initial version 1.0 (October 2022) did not include energy-relevant definitions yet, covering only conventional smart home device categories such as lighting, HVAC thermostats, window coverings, sensors, and door locks [6].

Starting with version 1.3 (May 2024) and continuing in subsequent releases, the specification has progressively been extended towards the energy domain through the introduction of additional clusters and Device Types. Version 1.3 introduced standardised electrical measurement capabilities, including the Electrical Power Measurement and Electrical Energy Measurement clusters [8], providing access to instantaneous electrical parameters (voltage, current, active power) and cumulative and periodic energy consumption or production data. In the same release, the Electric Vehicle Supply Equipment (EVSE) Device Type was formally defined, specifying a standardised cluster composition for integrating EV charging infrastructure within the Matter ecosystem.

Version 1.4 (November 2024) significantly expanded the scope of energy-related functionality [9]. It introduced the Device Energy Management cluster, which defines mechanisms for representing and interacting with device-level energy flexibility, including power adjustment capabilities and forecast-related attributes. The specification also formally defines Device Types for key distributed energy resources, including photovoltaic systems (Solar Power), Battery Storage, and Heat Pumps. These Device Types compose the measurement clusters with management and device-specific control clusters, providing a standardised interface for monitoring and controlling these assets through the Matter protocol.

Version 1.5 (November 2025) introduced clusters for tariff and pricing information, as well as electrical grid condition signalling [10]. These extensions provide the specification-level foundation for demand response and flexibility-oriented applications by enabling devices to receive and act upon external economic and grid-state signals. For now, the grid communication is limited to providing carbon intensity information to devices. Additional Device Types defined in this release include the Electrical Meter and Electrical Utility Meter.

For the presented integration, these clusters and Device Types are directly relevant. The data model implemented by the PV inverter simulator is described in Section 5.2.

5 Integration of Matter into the DataWallet

5.1 Integration Architecture

To communicate with these devices, the DataWallet system is extended by the components shown in Figure 3. To connect and interact with Matter devices, a Matter controller is required. A Matter controller is the central node of a fabric, handling commissioning and control of devices. The open-source Python Matter Server [30] proved to solve exactly this problem. It is developed and maintained by The Open Home Foundation and is also used for the Matter integration in Home Assistant. The Matter Server serves two main functions: First, it is a Matter controller, handling the Matter specific interaction. Second, it provides a WebSocket API that enables easy interaction with the Matter part. The Matter-Bridge was introduced to bridge the gap between the DataWallet and the Matter Server. It is responsible for sending commands to the Matter Server, interpreting the data, and finally forwarding it to the corresponding MQTT topic. Each device is mapped to a corresponding data source in the DataWallet's data model. The data source configuration specifies data access using the Matter attribute path (`endpoint/cluster/attribute`), the polling interval, and optional value transformations. An example is the *ActivePower* attribute (path: `1/144/8`) of the Electrical Power Measurement cluster. It is polled every five seconds, published to the corresponding MQTT topic, mapped to the DataWallet's `instantaneous-active-power` data model property, and converted from mW to W.

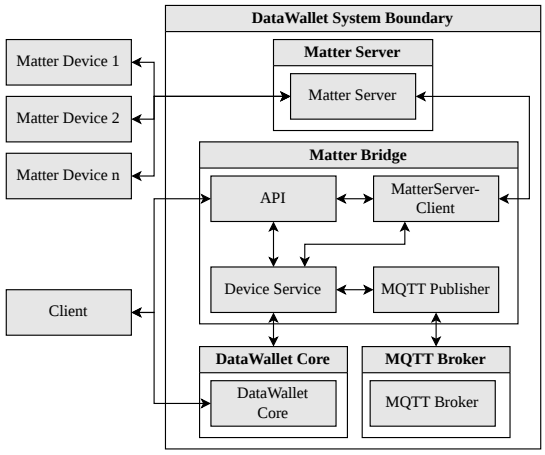

Fig. 3. Components of integrating Matter devices into DataWallet.

The DataWallet has strict requirements on securing access to data. Therefore, the existing MQTT infrastructure was reused instead of opening up an additional data pipeline. Security and governance remain separated into complementary layers. Matter's security mechanisms protect commissioning and communication between the device and Matter Server with the Matter Server managing the operational credentials. Due to reusing the DataWallet's MQTT path, internal data access and disclosure to service providers is governed by the DataWallet's MQTT access controls and the Marketplace's consent policies.

All components are deployed as individual Docker containers, allowing the deployment to be individualized as necessary. If an error occurs during commissioning, the Bridge tries to return to a clean state by decommissioning the device again and deleting its entries. The bridge tracks commissioning requests and allows users to query the current status.

5.2 Matter PV inverter simulator

The Matter specification is far ahead of the actual device adoption; none of the aforementioned device types is available as a Matter compliant device yet. To test and evaluate the proposed integration, such a device had to be implemented by us. A simulator for a solar inverter was developed based on the ESP32 platform. Table 1 summarizes the application-level Matter data model implemented by the simulated solar inverter. The model follows the *Solar Power* device type and exposes the measurement, forecasting, and adjustment functionality.

Table 1. Implemented Matter application data model of the simulated solar inverter.

Device type	Cluster / feature	Purpose
Solar Power	–	Main device type
Electrical Sensor	Electrical Power Measurement; `ALTC` feature; attributes prescribed by the feature; optional attributes `Voltage` (`0x0004`) and `ActiveCurrent` (`0x0005`)	Instantaneous voltage, current, and power values required by `ALTC` feature
Electrical Sensor	Electrical Energy Measurement; `CUME` and `PERE` features; attributes `CumulativeEnergyExported` (`0x0002`) and `PeriodicEnergyExported` (`0x0004`)	Cumulative and periodic exported-energy readings
Power Source	Power Source; `WIRED` feature	Representation as a wired energy source
Device Energy Management	`PFR` and `PA` features; attributes `PowerAdjustmentCapability` (`0x0005`) and `Forecast` (`0x0006`); commands `PowerAdjustRequest` (`0x00`) and `CancelPowerAdjustRequest` (`0x01`)	Two-hour production forecast and temporary power adjustment

Mandatory attributes and commands associated with the listed features were implemented according to the Matter specification. Generic commissioning and management clusters are omitted for brevity.

The simulation is based on pre-recorded data from an actual installation, guaranteeing realistic data. Data is periodically polled as defined by the DataWallet's data model. Additionally, the simulation is synchronized with the current time via the Simple Network Time Protocol (SNTP) before the simulation starts, further increasing its authenticity. The simulator calculates a forecast based on this data for the next two hours. Power adjustments enable the device to diverge from the original forecast for the specified duration or until the power adjustment is canceled. Afterward, the simulation returns to the original forecast.

5.3 End-to-end commissioning flow

Using Matter reduces the device onboarding for users to simply scanning a QR-Code or entering the commission code. Afterwards, the device is commissioned automatically. The DataWallet integration follows this principle as well. The integration requires five device-specific user actions: four simple UI selections/taps and one code-entry action. Specifically, the user selects the connect-device option, chooses Matter as the integration method, selects the option to integrate an already commissioned Matter device, enters the pairing code, and confirms the integration. Putting the device into pairing mode was not counted as it is dependent on the used third-party Matter controller. Similarly, general access steps, such as opening the application, and one-time setup steps, such as creating the DataWallet's data model, are treated as prerequisites and are not included in this count. Afterwards, the device is commissioned and automatically connected to the internal data representation. Note that this currently only applies to devices already commissioned to the network. Factory reset devices must first be commissioned to the network using another Matter controller before sharing the device via Matter Multi-Admin mode. This limitation exists because the Matter Server cannot access Bluetooth interfaces of the host while running in a Docker container.

6 Evaluation

An in-house evaluation was conducted on a single ESP32-S NodeMCU module (160 MHz) running the PV inverter simulator, with the DataWallet system executed on a Dell Latitude 5440 (13th Gen Intel Core i7-1365U, up to 5.2 GHz, 32 GB RAM).

The first evaluated aspect is the time required by the system to onboard and connect a device. The measurement begins once the Matter-Bridge's API receives a commission request after the user successfully completes the required five set-up actions. It ends once the commissioning process concludes, either successfully or with failure. On average, this took 12.79s, with a standard deviation of 1.75s. Before each run, the system was reset to a clean state to eliminate side effects: (1) removing dangling representations from the DataWallet database, the Matter-Bridge, and Apple Home; (2) erasing and reflashing the ESP32's firmware; (3) restarting the DataWallet and Matter-Bridge; (4) recreating the DataWallet's data model; and (5) re-adding the simulator to Apple Home as a third-party Matter controller. The test was conducted by one researcher for 30 trial runs, all of which completed successfully.

The second evaluated aspect is the near-real-time behaviour of data access and is measured as the time between a scheduled poll, the retrieval of new sensor data, and its delivery to subscribers. This required an already-commissioned PV inverter simulator. Within the Matter-Bridge, timing started when periodic polling began and ended once the data was published via MQTT; on average, this took 3.27ms, with a standard deviation of 0.83ms. The DataWallet's processing time was measured separately, starting on MQTT reception and ending once the data was forwarded to its listeners; on average, this took 7.57ms, with a standard deviation of 1.92ms. The total time, spanning both phases and therefore including the intermediary MQTT broker hop, averaged 13.90ms with a standard deviation of 2.54ms. In total, 30 datapoints were evaluated.

7 Discussion

The presented evaluation is a proof-of-concept feasibility assessment rather than a performance or comparative benchmark. The five device-specific actions and the presented evaluation characterise the implemented workflow, but do not establish long-term reliability, scalability, resource efficiency, a comparative baseline, network characteristics, or an intricate user evaluation.

The results show that integrating Matter into an energy data agent such as the DataWallet is feasible and simplifies device connectivity

while retaining the near-real time aspect of the data access. The evaluation was enabled by an ESP32-based solar inverter simulator, which substitutes for currently unavailable Matter-enabled DER devices. The Matter-Bridge implementation demonstrates that DER devices, such as solar inverters, can be integrated swiftly and with minimal user interaction, requiring only four UI selections and one setup-code entry. The reduced effort of integrating DER into the DataWallet directly lowers the barriers to accessing energy data.

However, the results have to be interpreted within the constraints of the implementation. Due to limitations in accessing Bluetooth interfaces from within a containerized environment, the initial commissioning was done using an external controller. While it reflects a realistic deployment scenario, it does not cover out-of-the-box setup from factory reset devices. Additionally, the work highlights structural challenges in the adoption of Matter within the energy domain. Even though the specification already defines functionality for DERs, the implementation from both manufacturers and smart home platforms is still limited.

8 Conclusion

We presented a Matter-based integration for the DataWallet that addresses the fragmented connectivity of behind-the-meter devices in energy service platforms. The Matter-Bridge connects the Python Matter Server to the DataWallet's MQTT pipeline without modifying the agent's core. An ESP32-based solar inverter simulator implements the energy-relevant Device Types of recent Matter releases, providing a testbed in the absence of commercial alternatives. End-user onboarding of an already commissioned device reduces to four UI selections and entering of a single setup code.

The architecture is operational ahead of certified DER hardware. As Matter-compliant inverters, heat pumps, batteries, and EV chargers become available, the proposed connector can provide a common integration path for devices exposing the relevant standardised Matter device types and clusters, reducing the need for per-vendor connectors.

Future work should evaluate its performance in larger deployments, research the usability aspects of the integration, and assess potential limitations related to interoperability across different vendors.

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