DER Marketplace Demonstration

EDGE |Milestone 2 base functionality

16/12/2021

Contents

Project introduction

Project EDGE (Energy Demand and Generation Exchange) is a collaboration between the Australian Energy Market Operator (AEMO), AusNet Services (AusNet) and Mondo, with financial support from the Australian Renewable Energy Agency (ARENA).

Project EDGE seeks to understand, test, and demonstrate in practice, a proof-of-concept Distributed Energy Resources (DER) Marketplace that enables efficient and secure coordination of aggregated DER to provide wholesale and local network support services within the constraints of the distribution network in a way that promotes the National Electricity Objective (NEO).

This demonstration will showcase base capability developed under the project's 2nd milestone including a working solution in which data is exchanged in a technology ecosystem between all current project partners. Additional functionality will be deployed during future phases of the project.

For further information and updates on Project EDGE, please refer to AEMO | Project EDGE news and knowledge sharing.

Solution overview – key functions

Dynamic Operating Envelope (DOE)

- A dynamic operating envelope provides upper and lower bounds on the import or export power, in a given time interval, for either individual DER assets or a connection point.

Bi-directional Offer (BOffer)

- Bi-directional Offer means an offer that includes both generation & load across the aggregator's registered portfolio of NMIs. As the trial progresses through various phases the application of BOffers will also go through a progression.

Wholesale Dispatch Instruction

- Dispatch Instructions are issued by AEMO to Aggregators for the purpose of meeting the supply and demand balance in EDGE by either generating (i.e. export to grid) or by consuming (i.e. import from grid) as a DER portfolio

Solution overview - systems

DERMS
Distributed energy resources management system

- Generates customer forecast data
- Calculates DOE using forecast data and network model

Ubi platform
Smart meter, aggregator portal, customer portal

- Generates fleet forecast data
- Creates BOffer
- Orchestrates dispatch of energy
- Collects telemetry data

DER marketplace
Intelligence platform

- Receives DOE
- Receives BOffer
- Applies business rules to DOE & BOffer
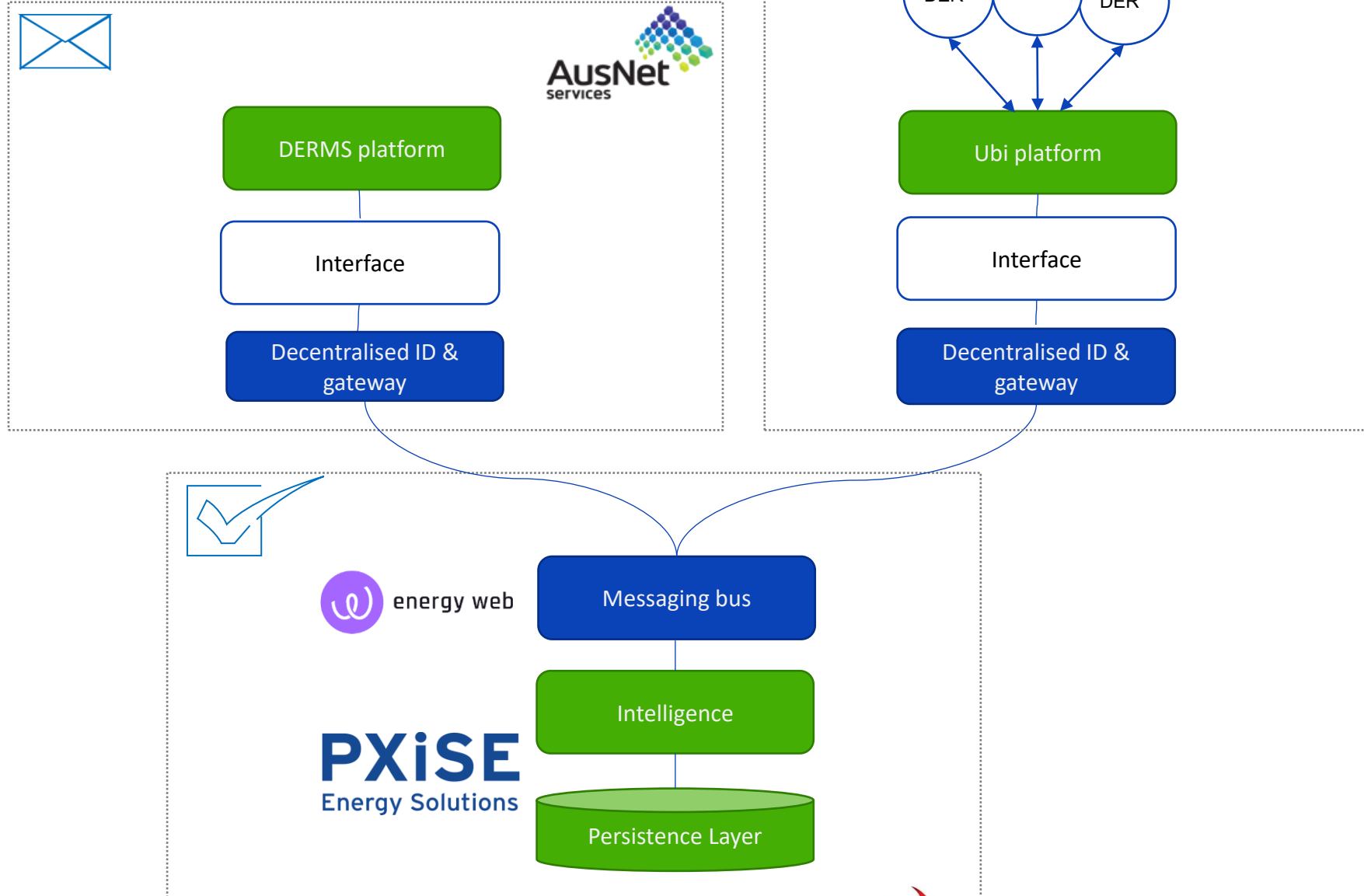- Sends dispatch instructions
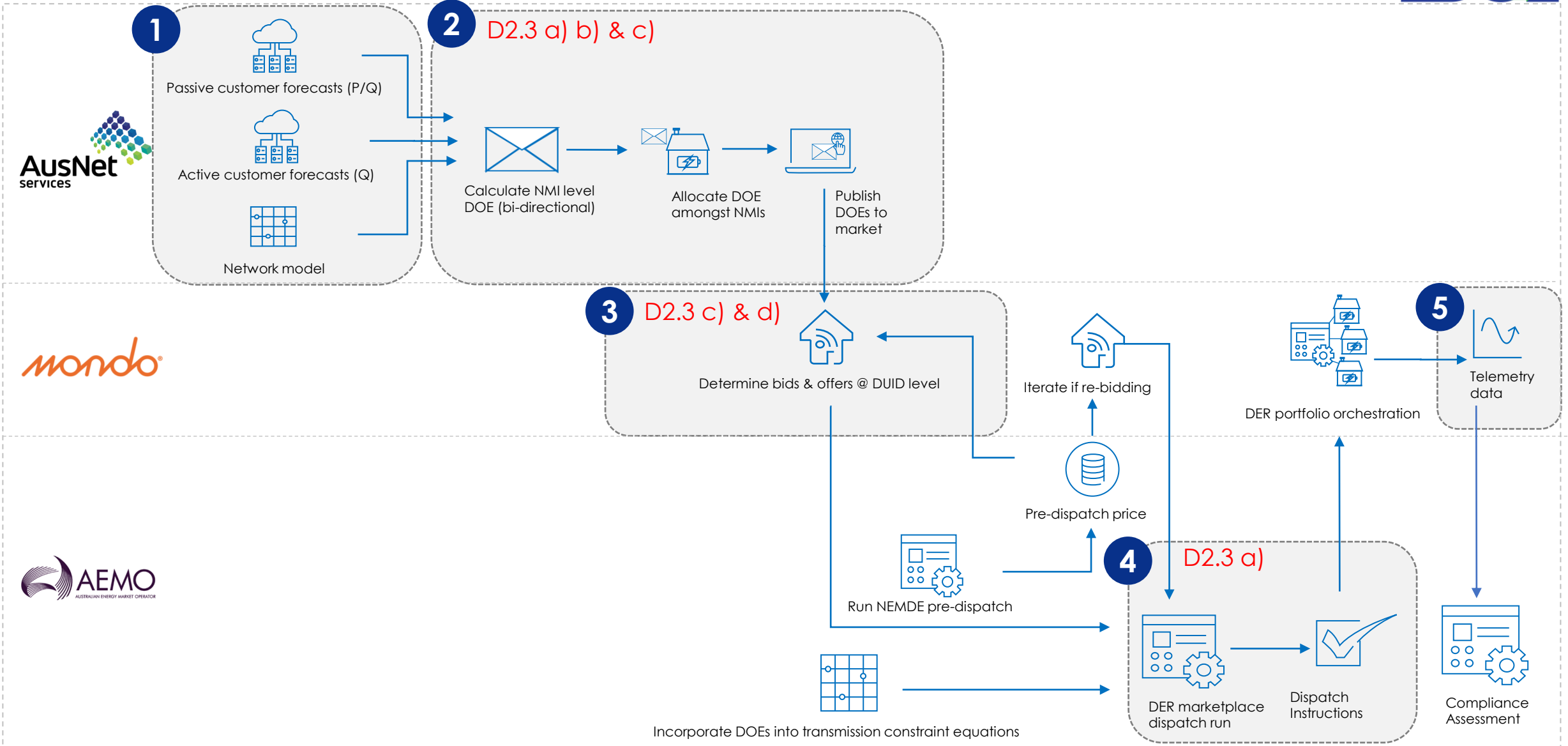
Data exchange
Messaging Bus & client portal

- Authenticates and authorizes participant access
- Provides distributed transport layer
- Validates schemas for business objects

System overview - architecture

Demonstration overview – use cases

1 Passive customer forecasts (P/Q)

Active customer forecasts (Q)

Network model

2 D2.3 a) b) & c)

Calculate NMI level DOE (bi-directional)

Allocate DOE amongst NMIs

Publish DOEs to market

3 D2.3 c) & d)

Determine bids & offers @ DUID level

Iterate if re-bidding

Pre-dispatch price

Run NEMDE pre-dispatch

Incorporate DOEs into transmission constraint equations

4 D2.3 a)

DER marketplace dispatch run

Dispatch Instructions

DER portfolio orchestration

5 Telemetry data

Compliance Assessment

AusNet services

mondo

AEMO
Australian Energy Market Operator
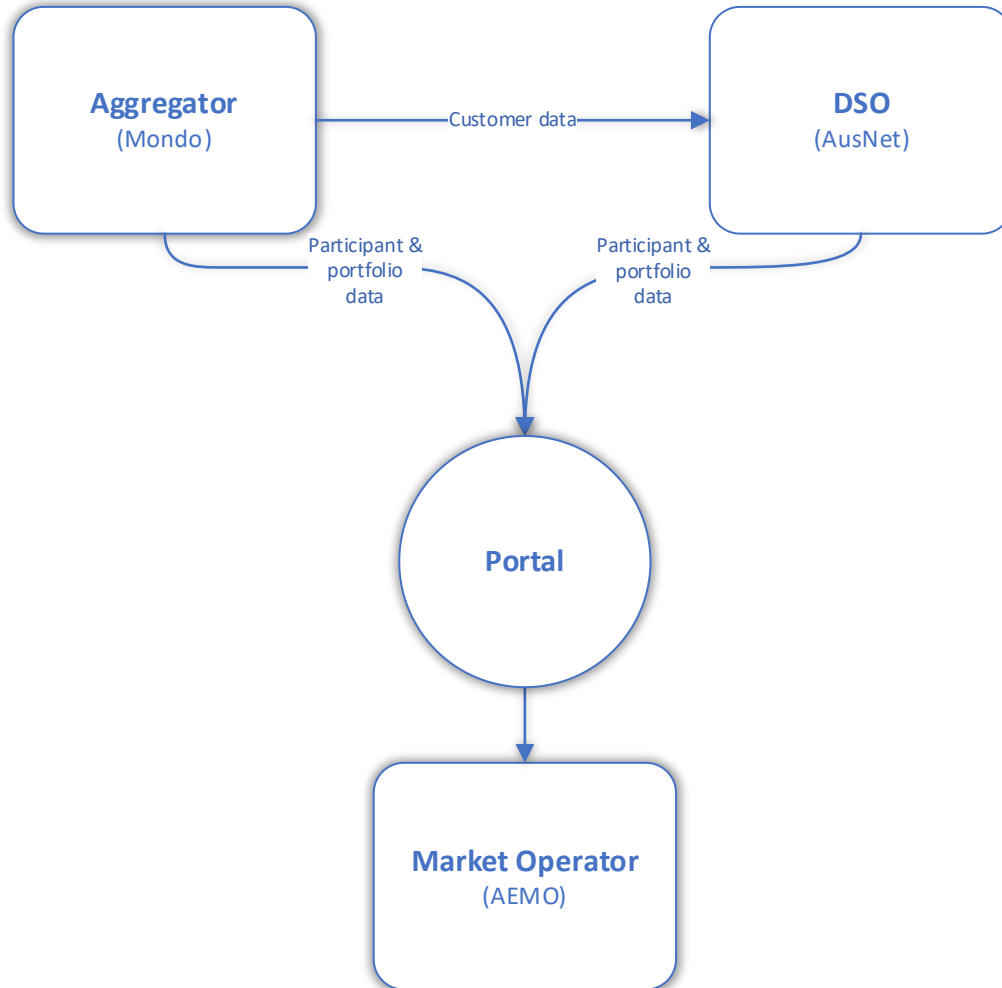
EDGE

① Enrol participant & portfolio data

This diagram represents the process to enrol participant & portfolio data.

```
┌─────────────────┐   Customer data   ┌─────────────────┐
│   Aggregator    │ ───────────────>  │      DSO        │
│    (Mondo)      │                   │    (AusNet)     │
└─────────────────┘                   └─────────────────┘
      Participant &                      Participant &
       portfolio                          portfolio
         data                               data
              \                           /
               \                         /
                      ┌──────────┐
                      │  Portal  │
                      └──────────┘
                           │
                           ▼
                  ┌─────────────────┐
                  │ Market Operator │
                  │     (AEMO)      │
                  └─────────────────┘
```

- Aggregator shares customer data with DSO to 'activate' their site with a dynamic connection agreement (this process is not automated)

- In the trial, aggregators and DSO will submit participant and portfolio data to the Market Operator on an ad hoc basis

- Aggregator enrolls with the Market Operator by submitting participant and portfolio data, including the DUID, NMI and device ID and parameters

- DSO enrolls with the Market Operator by submitting participant and portfolio data, including transformers, NMIs, and static NMI dynamic operating envelopes (DOE)

This diagram represents the process to send, receive & process operating envelopes between DSO, Market Operator & Aggregator. This demonstration will also explain the process to derive, communicate and dynamically update operating envelopes.

DSO
(AusNet)

DOE
(1 day before trading day)

Messaging Bus

Market Operator
(AEMO)

DOE

Messaging Bus

Aggregator
(TBC)

Aggregator
(Mondo)

Aggregator
(TBC)
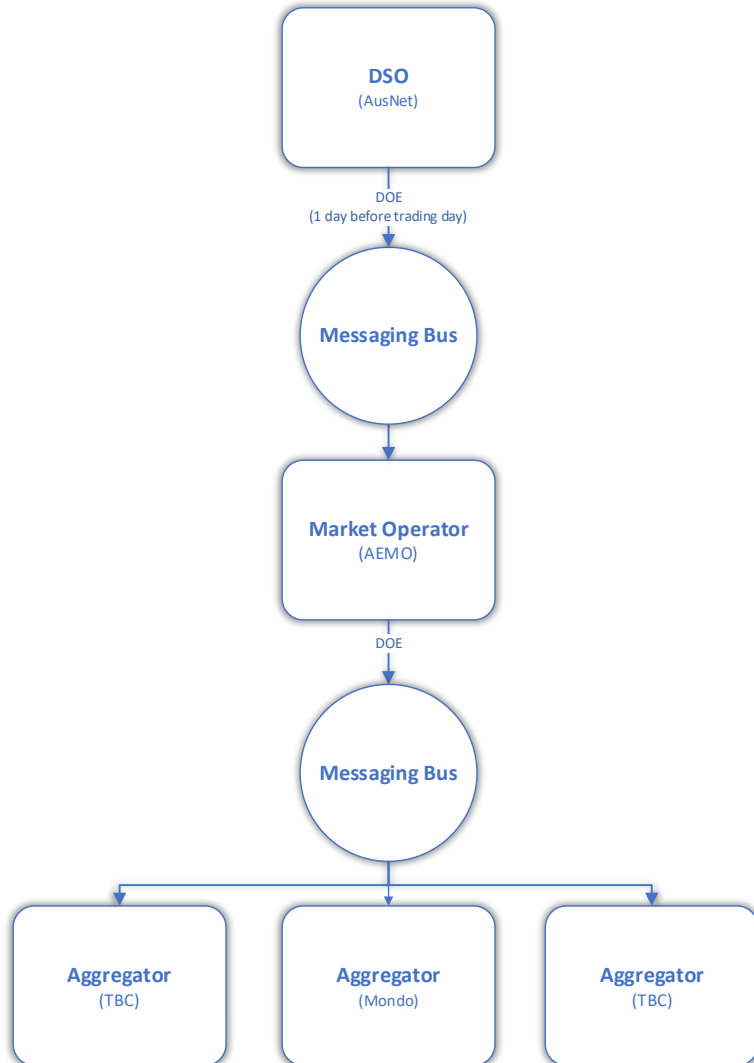
- DSO calculates a dynamic operating envelope by running an algorithm that uses network model and customer forecast data as inputs

- DSO sends the dynamic operating envelope to the Market Operator a day before the next trading day

- Market Operator validates the dynamic operating envelope by checking that the NMIs in the dynamic operating envelop are in the DSO's portfolio

- Market Operator partitions the dynamic operating envelope and collates the data for each aggregator

- Market Operator sends the dynamic operating envelope to the relevant aggregator

This diagram represents the process to send, receive & process a bi- directional offer between Market Operator & Aggregator. This demonstration will also explain the process to derive and communicate operational bids for a DER fleet.

Aggregator
(Mondo)

BOffer
(1 day before trading day)

Messaging Bus

Market Operator
(AEMO)
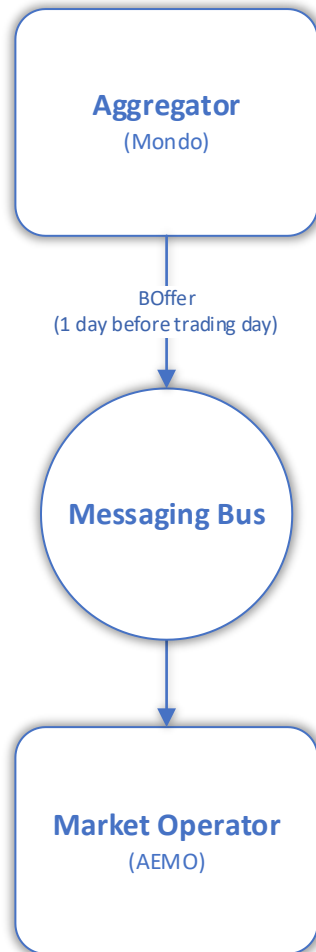
- Aggregator has received an operating envelope for the next trading day

- Aggregator generates a day-ahead, aggregated net meter forecast for all portfolio customers

- Aggregator creates a 'lite' price-taking bi-directional offer using the day-ahead, aggregated net meter forecast

- Aggregator sends the bi-directional offer to the Market Operator, a day before the next trading day

This diagram represents the process to send, receive & process dispatch instructions between Market Operator & Aggregator.

Market Operator
(AEMO)

Dispatch instructions
(On trading day, every 5 min)

Messaging Bus

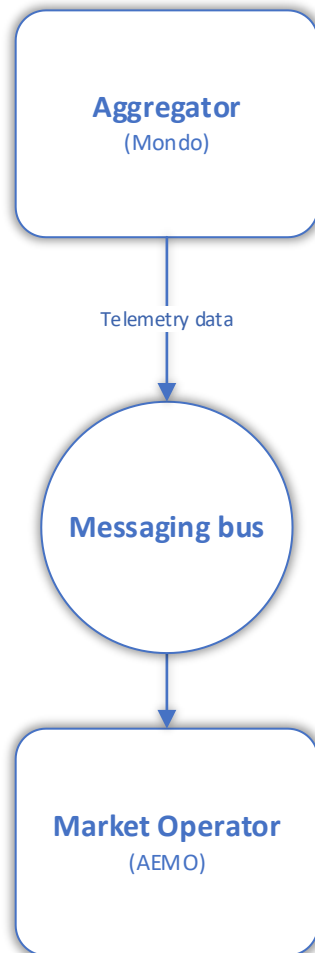**Aggregator**
(Mondo)

Dispatch energy

End
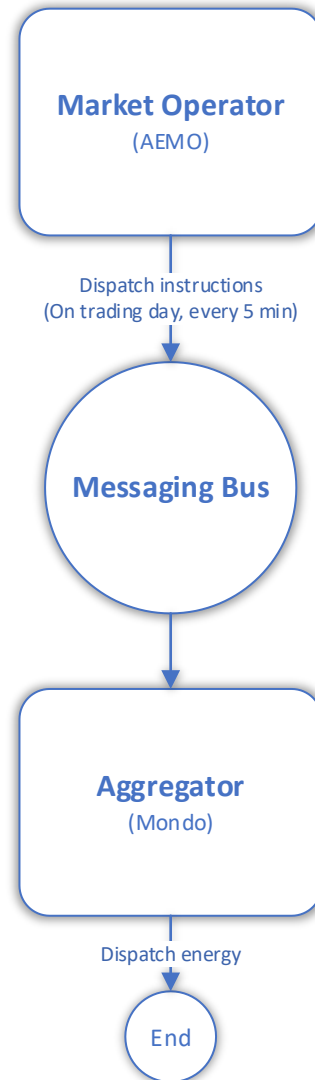
- Market Operator receives a bi-directional offer

- Market operator compares the bi-directional offer with distribution network limits (checks the quantity for a given dispatch interval, in a bi-directional offer, against the sum of the Aggregators dynamic operating envelope)

- Market Operator constrains the bi-directional offer quantity, if required for a given dispatch interval (when the quantity in the bi-directional, is greater than the sum of all dynamic operating envelopes for that Aggregator)

- Market Operator creates & sends dispatch instructions to Aggregator every five (5) minutes, on the trading day (this solution is modelled on and consistent with existing NEMDE processes)

- Aggregator orchestrates fleet of DER to meet wholesale dispatch instructions based on customer preferences, DER conditions, DOEs, comms availability (not yet tested)

This diagram represents the process for the Aggregator to submit telemetry data to the Market Operator. The demonstration will also explain the process for collecting telemetry data.

Aggregator
(Mondo)

Telemetry data

Messaging bus

Market Operator
(AEMO)

- Aggregator captures detailed telemetry data that is uploaded and stored in the Ubi platform in near real-time

- Data is captured at the device, site and fleet level and will be aggregated to align with bi-directional offer and network services

- The mechanism for the Aggregator submitting telemetry data to the Market Operator will evolve throughout the project (incl. manual daily upload, automated daily upload and near real-time)

- Aggregator submits telemetry data to Market Operator so that the Market Operator can check fleet activity during a dispatch interval, against the relevant fleet dispatch target

- Aggregator will capture and store extensive telemetry data. The project will evaluate exactly what data is required to successfully operate the marketplace and provide visibility of DER performance and operation

Summary – base DER Marketplace capability demonstrated

Key marketplace functions	Milestone 2 base capability demonstrated
Enrolment	Aggregator and DSO first-time enrolment into the DER Marketplace
Bi-directional offers	Generate and send simple, price-taking bi-directional offers (one value per interval)
Operating envelopes	Create and send day-ahead operating envelopes based on network data only
Dispatch	AEMO ability to send and aggregator receive wholesale dispatch instructions
Telemetry	Compile 5s measurement granularity

Next steps - project development pipeline

Key marketplace functions	Upcoming marketplace development
Enrolment	Portfolio management capability
Bi-directional offers	Generate and send price-setting bi-directional offers (scheduled bidding in 20 price/quantity pairs)
Operating envelopes	Create and send intra-day operating envelopes with economic optimisation
Dispatch	Aggregator fleet orchestration to meet wholesale dispatch instructions
Telemetry	Compile and transmit at 1 min frequency, 1 min/5s measurement granularity, flexible capacity/net NMI flow
Local Services Exchange	Establish marketplace interface and services for DSO/aggregator bilateral trade (demand & voltage services)