DER Market Integration Consultative Forum

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

30 June 2022

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.

We pay respect to their Elders past, present and emerging.

AEMO Competition Law Meeting Protocol

AEMO is committed to complying with all applicable laws, including the Competition and Consumer Act 2010 (CCA). In any dealings with AEMO regarding proposed reforms or other initiatives, all participants agree to adhere to the CCA at all times and to comply with this Protocol. Participants must arrange for their representatives to be briefed on competition law risks and obligations.

Participants in AEMO discussions **must**:

- Ensure that discussions are limited to the matters contemplated by the agenda for the discussion
- Make independent and unilateral decisions about their commercial positions and approach in relation to the matters under discussion with AEMO
- Immediately and clearly raise an objection with AEMO or the Chair of the meeting if a matter is discussed that the participant is concerned may give rise to competition law risks or a breach of this Protocol

Participants in AEMO meetings **must not** discuss or agree on the following topics:

- Which customers they will supply or market to
- The price or other terms at which Participants will supply
- Bids or tenders, including the nature of a bid that a Participant intends to make or whether the Participant will participate in the bid
- Which suppliers Participants will acquire from (or the price or other terms on which they acquire goods or services)
- Refusing to supply a person or company access to any products, services or inputs they require

Under no circumstances must Participants share Competitively Sensitive Information. Competitively Sensitive Information means confidential information relating to a Participant which if disclosed to a competitor could affect its current or future commercial strategies, such as pricing information, customer terms and conditions, supply terms and conditions, sales, marketing or procurement strategies, product development, margins, costs, capacity or production planning.

Today's meeting

Time	Item	Speaker
11:00 – 11:05	Welcome and introductions	Rachel Rodrigues McGown [AEMO]
11:05 - 11:15	Project EDGE Trial Update	Nick Regan [AEMO]
11:15 – 12:00	Project EDGE – Scalable Data Exchange	Nick Regan [AEMO] Nilesh Kevat [AEMO]
12:00 – 12:25	Q&A	All
12:25 – 12:30	Future Meetings & Close	Rachel Rodrigues McGown [AEMO]

Project EDGE - Trial Update

Nick Regan [AEMO]

Project EDGE update

Current position

- Three additional aggregators have joined!
  - Discover Energy, Rheem & Combined Energy Technologies (CET) and AGL (research participant)
- Technical onboarding of Discover and Rheem progressing very well
- Market Suspension Tests last week
- Public webinars for Interim and Customer Insights reports now online

Key upcoming activities

- Sharing of results from Market Suspension tests
- Further develop platform capability and sophistication.
- Ongoing customer acquisition (including additional) C&I customers

EDGE Market Suspension field tests

To operate the system AEMO needs:
1. **Visibility**: Telemetry in real time
2. **Predictability**: Generator forecasts
3. **Controllability**: Dispatch instructions
4. **Measurement**: Telemetry (settlement)

The AEMO, AusNet and Mondo team reacted quickly to establish a test plan to learn from this rare event

Why specific Market Suspension tests?

In Market Suspension AEMO was directing large scale generators.
What should this look like in a high DER future (via VPPs)?

Hypothesis 1:
AEMO Dispatch Instructions that give a 'target' are more reliable than DOEs which give 'permissible limits'.

Hypothesis 2:
These two signals together will conflict at times and this needs to be understood to be managed in future operations.

What did we do?

Test	Summary
Test 1 **Self-Dispatch (no AEMO direction)**	• In lieu of capability to dispatch VPPs at scale ('Controllability') i.e. current state, AEMO needs visibility (telemetry) and predictability (forecasts via boffers) to consider when directing large scale resources • **Q: What do VPPs do without AEMO direction?**
Test 2 **AEMO -> DUID direction via Dispatch Instructions**	• Under market suspension AEMO instructs generators/loads test is for future where controllability exists for VPPs (i.e. test will provide setpoints for aggregators to follow). • **How reliably can VPPs follow AEMO directions that differ from market incentivised behaviour?**
Test 3 **AEMO –> DNSP –> DUID direction via DOEs**	• Currently AEMO instructs NSPs to maintain a profile within their network, NSPs currently do this by shedding load or generation. • **Are DOEs a better mechanism than directing VPPs under a non-market use case (e.g. market suspension) ?**
Test 4 **Synchronous AEMO directions to DNSP and Aggregator (Test 2+3)**	• Testing synchronous instructions from AEMO to DNSP and Aggregator to see if this helps reduce potential conflicts. Test 2 & Test 3 together. • **Is it worth building capability to do both mechanisms for redundancy?**

Findings to be shared in coming weeks and relate to some gaps as highlighted in the Engineering Frameworks Paper[1]

1 At https://aemo.com.au/-/media/files/initiatives/engineering-framework/2021/nem-engineering-framework-march-2021-report.pdf?la=en&hash=3B1283D31B542115CC56E0ECCDFB3D69

Scalable Data Exchange

Project EDGE focus area

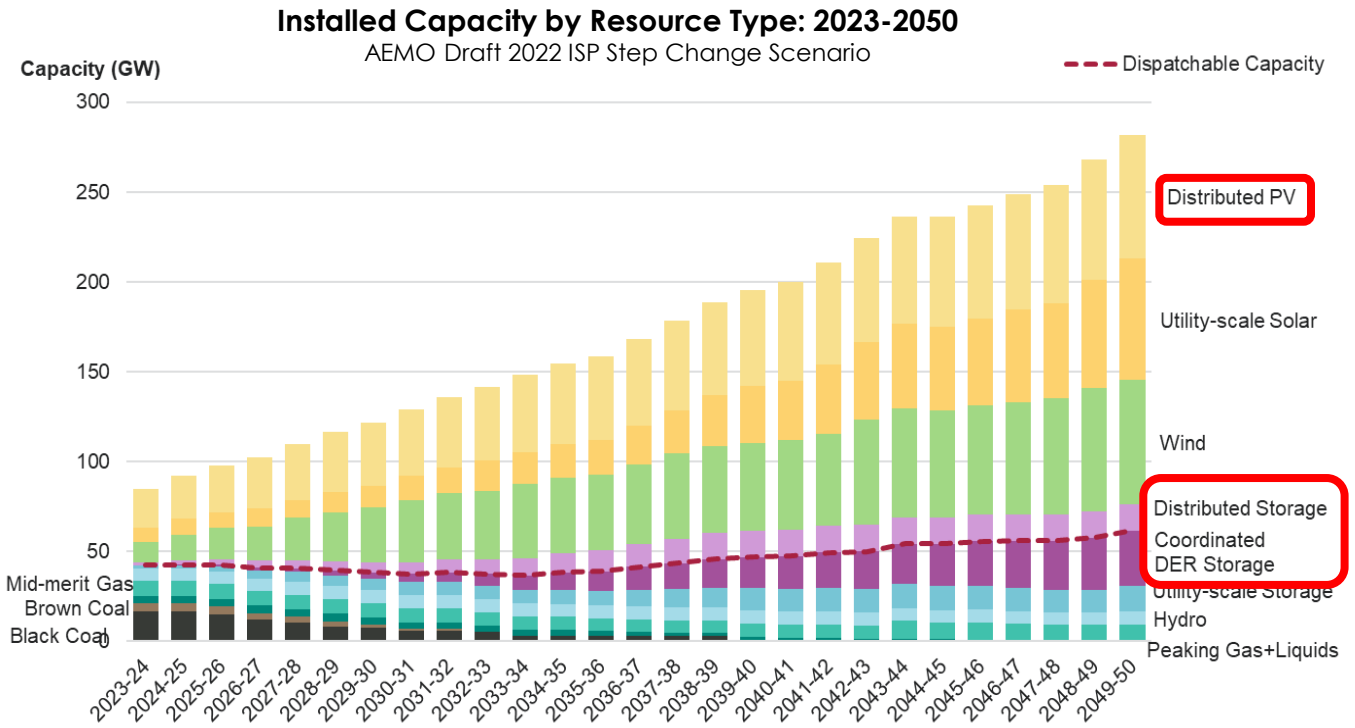
Nick Regan [AEMO]

EDGE AEMO mondo AusNet services Australian Government Australian Renewable Energy Agency ARENA

What's coming: a DER-rich landscape

AEMO's **draft 2022 Integrated System Plan's** most likely scenario (Step Change scenario) projects capacity in the National Electricity Market (NEM) in 2050 to be over 280 GW, of which **114 GW (40%) is connected to the distribution network**[1]

There will be times when the **entire NEM demand for electricity could be met with distribution connected resources,** aka Distributed Energy Resources (DER). This **distribution-based capacity is also 2-way: it can export and import** (or reduce demand). So DERs can also provide support to distribution grids ("network services")



114 GW

40% of total installed capacity is connected to the distribution network

1 At https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp
2 At https://www.cleanenergycouncil.org.au/resources/technologies/grid

EDGE Scalable Data Exchange Hypotheses

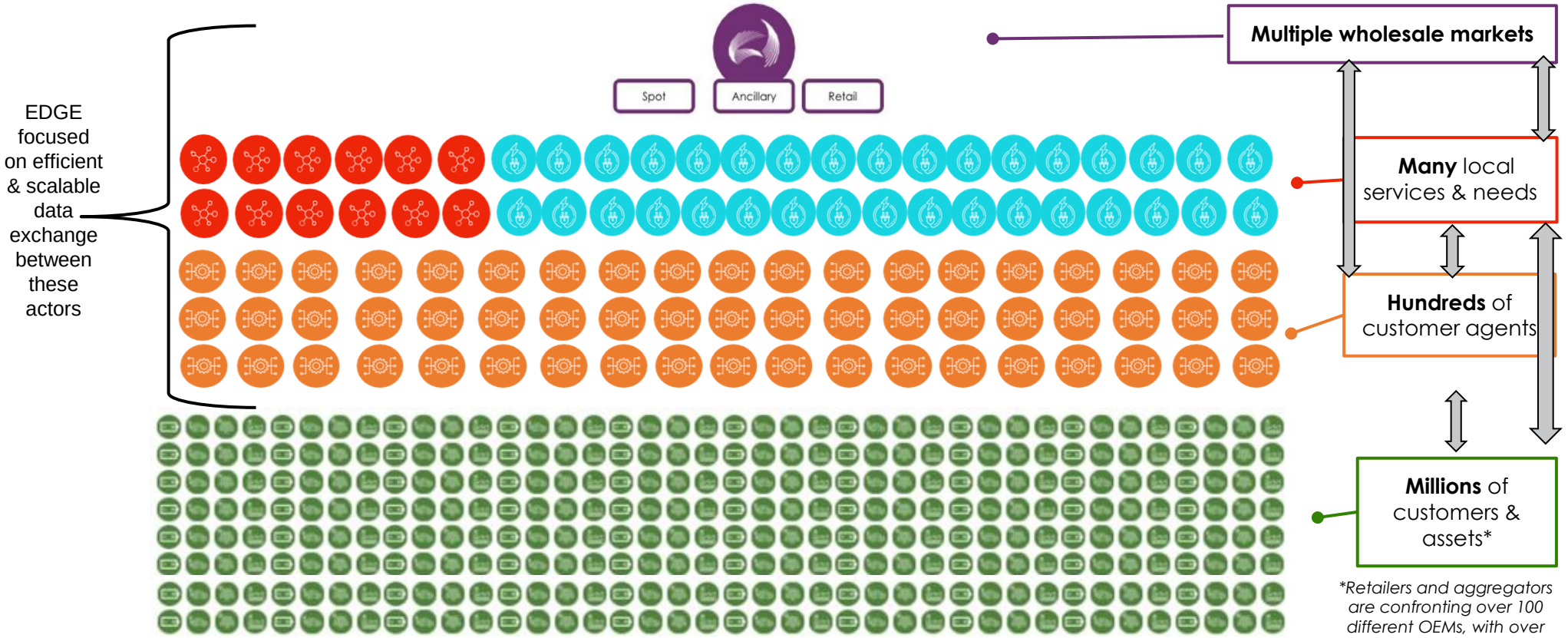
The project will test two core hypotheses:

1. **A data hub model provides a scalable and long-term approach for DER Marketplace data exchange compared with a web of many point to point interactions between industry actors**
   - The ESB DER Implementation Plan requires DNSPs to begin implementing DOEs in late 2023
   - The ESB also require DER to be rewarded in the market and DNSPs to procure DER-based network services
   - The Reform Delivery Committee NEM2025 Implementation Roadmap has a "DER Data Hub & Registry Services" initiative that needs to be scoped in detail and in context of parallel ESB reforms
   - The data hub concept aims to lower aggregator barriers to entry by providing one integration to access wholesale markets, local network support services and DOEs

2. **A decentralised data hub model is the most efficient solution that could deliver the most net benefit to NEM customers**
   - AEMO currently operates a centralised hub approach, the e-hub for the retail market
   - As an off-market proof of concept project, EDGE has a unique opportunity to test innovative approaches to DER market integration
   - Project analysis on scaled data exchange challenges suggests a decentralised data hub approach could have value and testing this approach was encouraged by executive sponsors

AEMO and Industry stakeholder feedback is paramount to understanding the merit and costs of a future DER Data Hub, centralized or decentralized.

A DER-rich market needs data exchange capabilities scaled by orders of magnitude



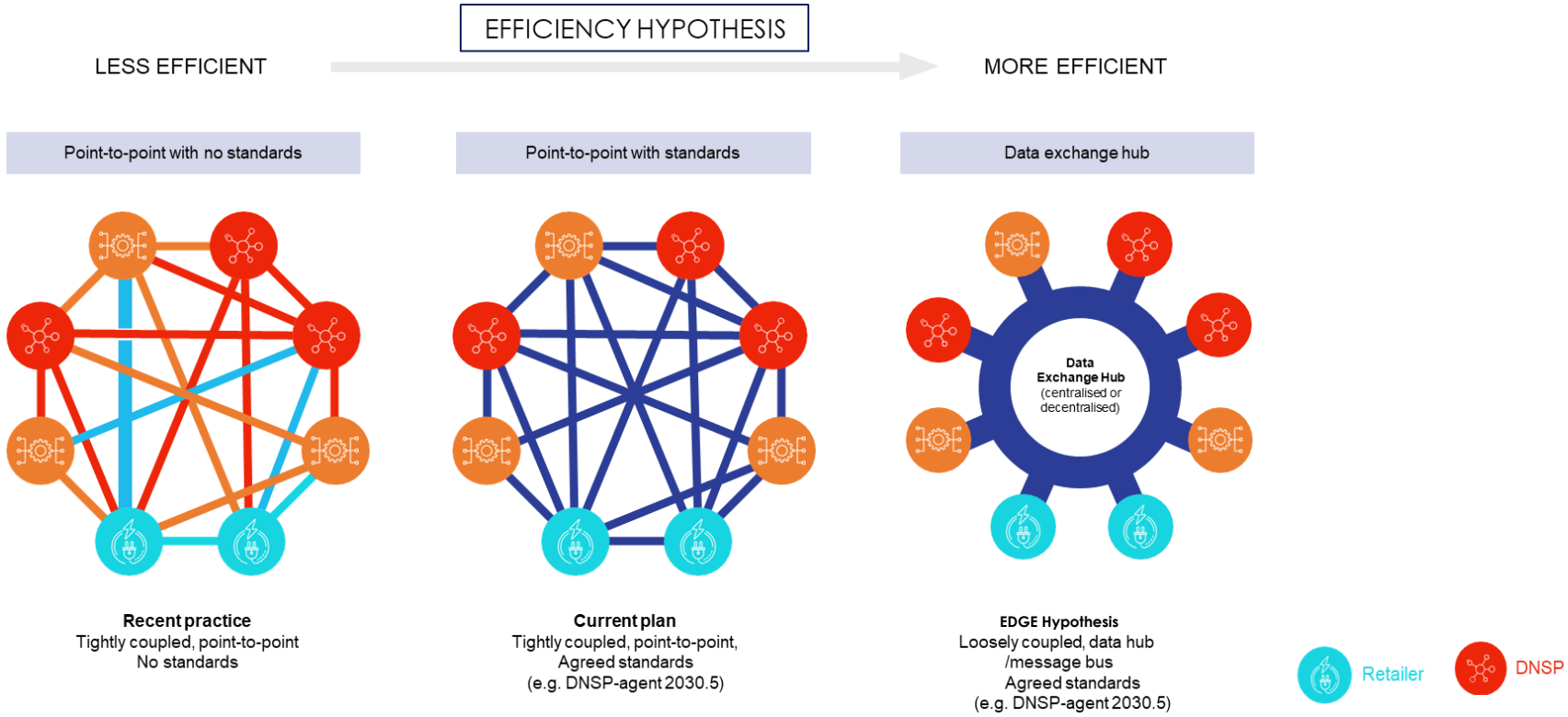
With the exponentially greater number of participants, markets, services, and especially devices, a DER rich landscape means industry must consider the **basic challenges** like:

- **Establishing & maintaining relationships** between customers, devices, and participants for processes like service enrolment, registration, and facilitating customer / device churn
- **Scaling to handle the volume of data** (transmission and storage) being exchanged across all markets and participants (and ensuring for performance, maintenance, security, and resilience)
- **Managing communication, credentials and integrations** between all market participants (and relevant 3rd parties like "agents" who can control the output of solar PV)

How can we approach data exchange?

There is a spectrum of approaches to exchange data among many parties, including:

- **Heterogenous Point-to-point (no standards)** – individual connections to share data with no preferred methods/protocols
- **Point-to-point with standards** – individual connections to share data with agreed preferred methods/protocols
- **Hub** – connect once to a data exchange hub to share data with all parties. Project EDGE will consider both a centralised and a decentralised hub approach



The centralised hub: single broker model

What does it look like in EDGE?

- AEMO hosted servers send messages and store data, conceptually similar to the existing e-Hub for B2B transactions in the retail market.
- Focused on DER use cases including DOEs, Bids, Portfolio Telemetry, Dispatch Instructions
- Identity of parties connected to the hub has been verified

DOE use case:

- DSOs sends all DOEs to data hub
- AEMO receives DOE payload, stores and partitions into smaller aggregator-specific payloads based on Aggregator registered portfolio NMI list, publishing via data hub channels
- New aggregators access via one integration, no change for DSOs
- Customer churn managed by AEMO

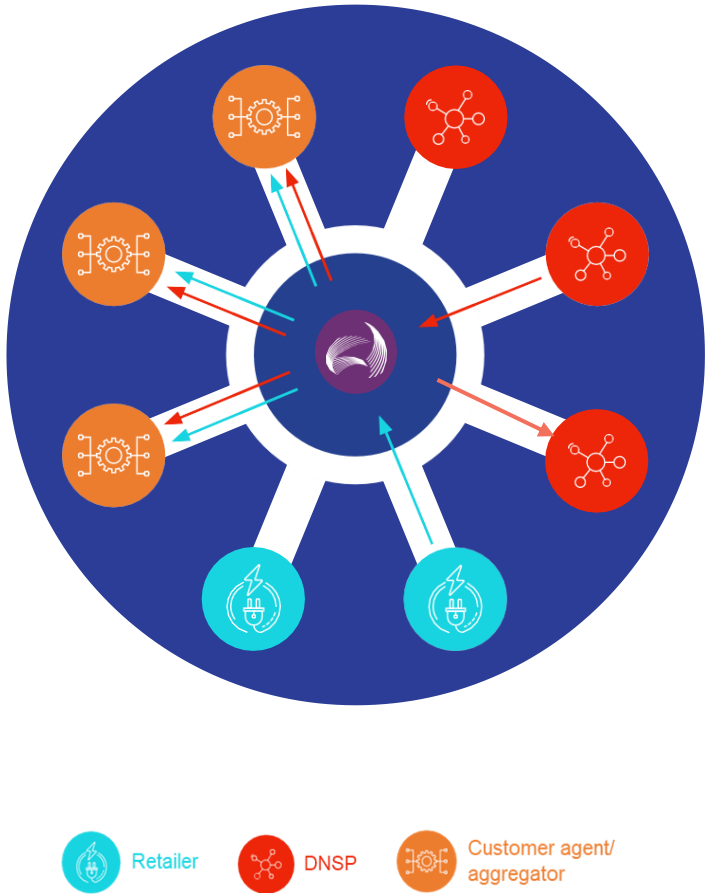
Analogous to all Australian air traffic routing via Sydney International Airport

Pros

- Reduces complexity and cost for establishing and maintaining aggregator market access vs point-to-point model

Cons

- Relies on a single broker (e.g. AEMO)that could be a bottleneck when transmitting data at very high volumes



The decentralised hub

The decentralised hub concept combines multiple technologies, including distributed ledgers (DLT) and self-sovereign identities, to establish a shared digital infrastructure.

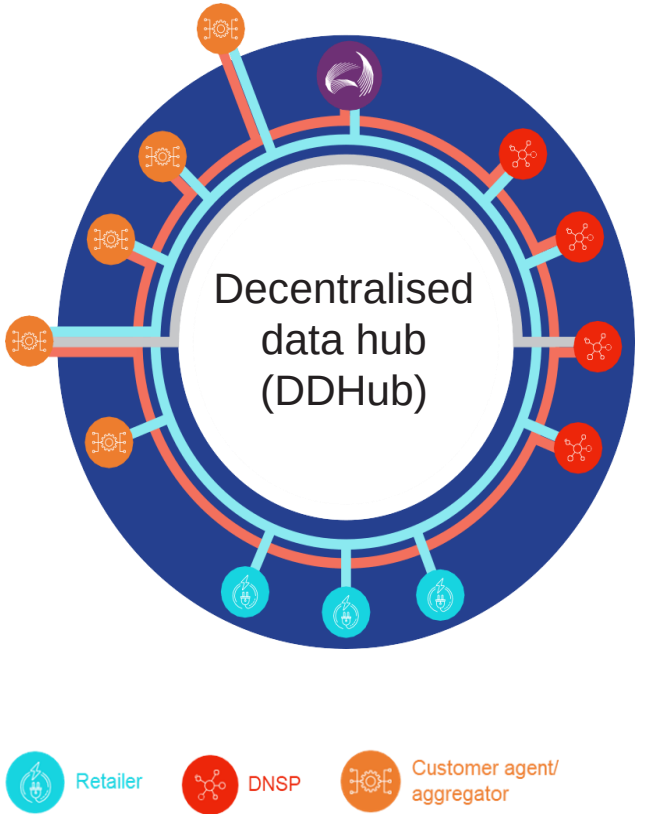
What does it look like in EDGE?

- Multiple service providers host servers to send messages and store data
- Identity of parties connected to the hub has been verified and is stored on the distributed ledger enabling all parties to trust each other and interact directly without needing to setup individual identities with each organisation. E.g. Passport for travel
- DLT used for identity only, not operational data

DOE use case:

- DSOs sends all DOEs to DDHub
- DDHub receives DOE payload, embedded logic automatically directs DOEs to respective Aggregators' channels

Analogous to Australian air traffic routing directly to destination airport



Pros

- Handles greater data exchange volume
- Supports innovation and scaling of new DER use cases e.g. negative spot price protection

Cons

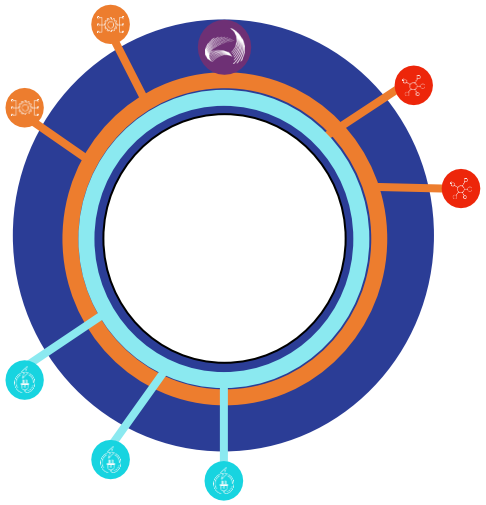
- Requires stakeholder engagement and education due to the novel architecture, governance framework, and commercial model

The EDGE infra is designed to progressively evolve operation and governance

The DDHub can start by being hosted by a single provider (e.g. AEMO), with a few participants "subscribing" to integrate. Over time, participants elect to host infrastructure (or continue to subscribe) and develop additional use cases and independent applications

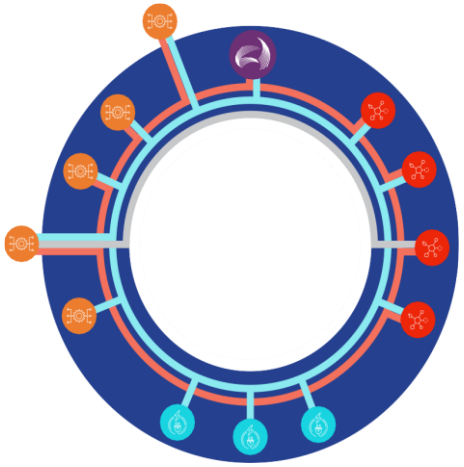
Establishment:

- Single provider (incurs all costs and receives all payments)
- Few subscribers



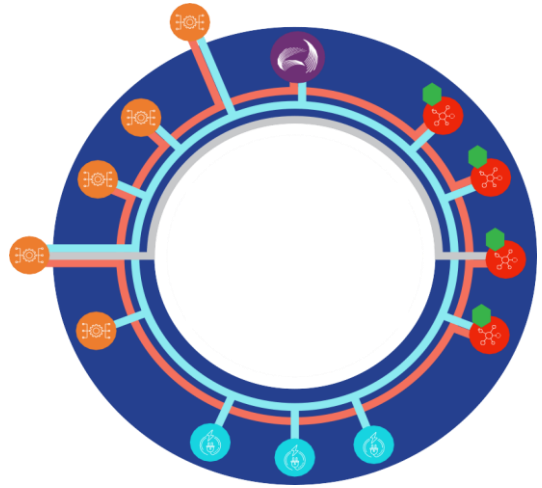
Consolidation:

- Multiple service providers
- Multiple subscribers
- Few use cases



Growth:

- Competitive service provision
- Many subscribers
- Multiple use cases
- Growing "app exchange" of independent solutions



Customer agent / aggregator

DSO

Retailer

AEMO

DER Data exchange use cases

DER data exchange use cases (included in EDGE CBA)	Point to Point	Centralised Hub (single broker)	Decentralised Data Hub	Distributed Ledger (DLT)
(In Field Trial Scope) Efficient transmission of Dynamic Operating Envelopes	Aggregators and DNSPs have an integration with each other to establish and maintain	1x integration with the hub for each aggregator and DNSP, send 1x message via a central message broker for partitioning	Standardised, More directly via decentralised msg bus	Not suitable for DOE is the consensus
(Partially in Field Trial Scope) Participant & Device IDAM	Participants store and maintain each others identities	Can utilise DLT for identities	Can utilise DLT for identities	Stores Participant & Device Identities (their “Passport”)
(In Field Trial Scope) Facilitate efficient uptake of new DER use cases where participants want to interact directly with many other participants: e.g. • Negative spot price protection • Local Services procurement, • Future uses? (e.g. power quality data)	Establish additional integrations, identity verification	Leverage existing identity verifications, Configure another channel to interact with the use case,	Leverage existing identity verifications, Configure another channel to interact with the use case,	Potential to use DLT for Device Register with appropriate roles and permissions.
(Out of Field Trial Scope) Synchronising DER standing data storage across industry: e.g. • DERR • Portfolio Mgmt Systems	Results in inconsistent data between parties	Inform there is a change as applicable, request data from central broker	Inform there is a change as applicable, self serve data	Potential to use DLT for Device Register with appropriate roles and permissions.
(Out of Field Trial Scope) Augmenting DERR and facilitating compliance: E.g. • An OEM/aggregator that can write/update the inverter settings resulting from a firmware upgrade in line with industry standards (future use case where all inverters can be communicated to)	N/A	Sync issue	More real time update	Potential to use DLT for Device Register with appropriate roles and permissions.

Your feedback is crucial

A DER Data Hub, "so what?"

Once you're on the hub you can communicate with other parties on the hub using standard schemas and established trust

Next steps

Project EDGE will be discussing our data exchange hypotheses and approach with industry in the coming weeks to understand the merits and practicalities of implementing a DDhub

Ongoing expert input is crucial to exploring and answering these hypotheses

Tell us your thoughts about:

1. What did you like about this?
2. Considerations for real world implementation?
3. Are there DER Use Cases missing?
4. Which part of these concepts should we focus on next?

Q&A + Activity

Raise a hand to speak
Use the Teams chat function
Scalable Data Exchange Mural

We will use Miro to facilitate the Q&A session and gather relevant feedback

Link: [Scalable Data Exchange]

Process:

1. Post questions, comments, or feedback using post-it notes in the relevant table
2. Any and all feedback is welcome
3. We will use this to guide our thinking and help tailor future knowledge sharing and reporting

Questions:

- **Positives**: *What do you like, what are the benefits?*
- **Considerations**: *What are other use cases, what we have not thought (or talked) about today?*
- **Questions**: *What is not clear or would you like further information about?*

Any other business

Next meeting: 28 July 2022

Future Meetings & Close

Questions & contact

DERProgram@aemo.com.au

For further information for Project EDGE, please visit:

https://aemo.com.au/en/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/project-edge

For more information visit

aemo.com.au