Green Transport Delta
Electrification

WP3 overview (Battery Passport Sounding Board meeting)

08-11-2023

WP3 partners

OEMs/use cases:

Electrical buses/cars

Electrical trucks

Solar electrical cars

Solar-powered trailers

Battery pack makers:

Semiconductors:

Battery cell maker:

Knowledge institutes:

WP3 goal

- **<u>Develop a new BMS architecture</u>**:

  - Applicable in a <u>range of applications</u> (automotive, industrial, maritime, storage)

    - Generic base, partly programmable/adaptable to fit in specific application

  - Taking demands for <u>full life cycle into account by design</u>, including (functional) safety

  - Involving <u>innovative SoH, SoF, SoS functions</u> to maximize life as well as optimize maintenance planning; unexpected behaviour can be detected by comparing to data from many packs/modules monitored in the cloud.

  - <u>Modular/scalable</u>: modules keep accurate track of status and can be reused in second life

  - <mark><u>Satisfies legislation</u>, e.g. battery passport (secured access to all relevant life cycle data to optimize reuse and recycling).</mark>

  - <u>Future-proof</u> w.r.t. future battery technologies

- Proof architecture useability by demonstrating it in two different applications.

WP3 overview

Agenda

- Digital Product Passports and the Battery Regulation

- Battery passport implementation

- Whitepaper

- Open points

- Questions

- Panel discussion / Discussion starters

Digital Product Passports (DPP)

LMT

Industrial (incl. energy storage / Home)

EV

based on RDF ontologies

Clothing

Upholstery

Semiconductors

Consumer electronics

Appliances

(a) the battery passport shall be fully interoperable with other digital product passports required by Union law concerning eco-design, in relation to the technical, semantic and organisational aspects of end-to-end communication and data transfer;
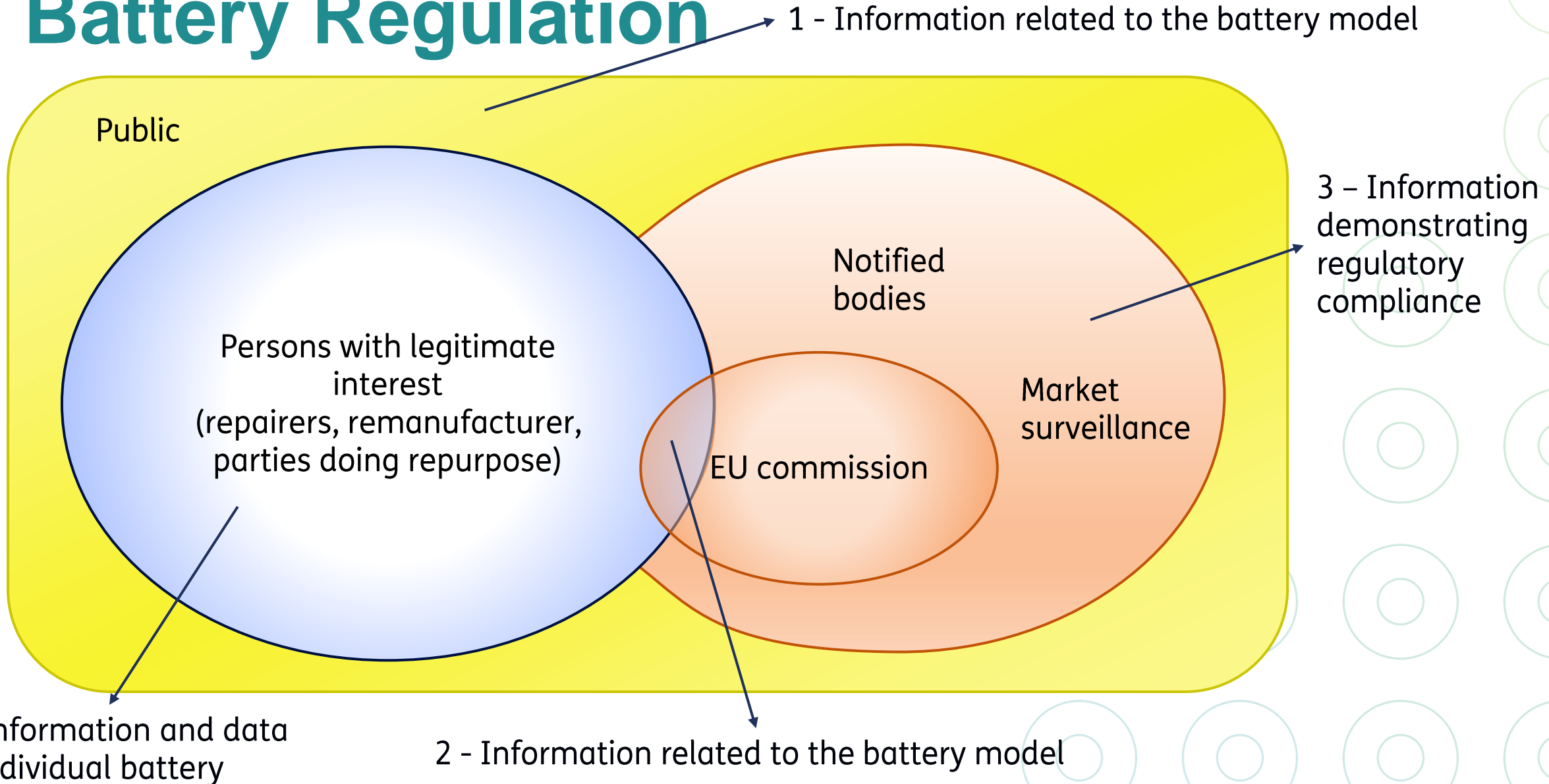
Batteries

Automotive

Textiles

Electronics

build on data spaces

Generic DPP infrastructure
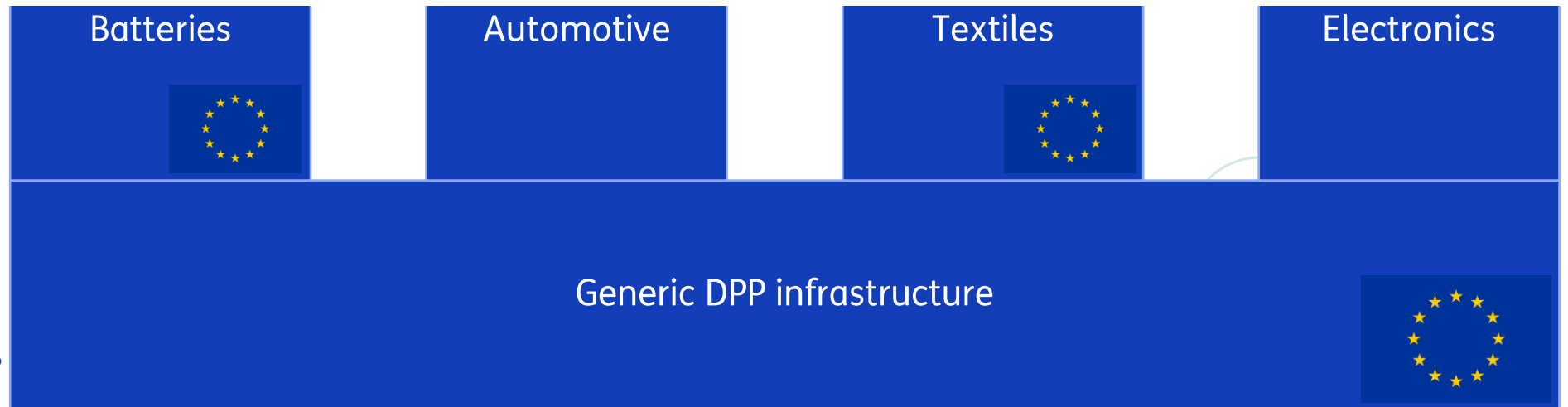
EU Battery Regulation

From 18 February 2027 each <u>LMT battery</u>, each <u>industrial battery with a capacity greater than 2 kWh</u> and each <u>electric vehicle battery</u> placed on the market or put into service shall have an <u>electronic record</u> ('battery passport').

(Battery Regulation, Art. 77(1))

The passport shall contain information relating to the <u>battery model</u> and to the <u>individual battery</u> (including information resulting from its use), divided by groups for which information should be accessible

Battery Regulation

1 – Information related to the battery model

Public

Persons with legitimate interest
(repairers, remanufacturer, parties doing repurpose)

Notified bodies

EU commission

Market surveillance

3 – Information demonstrating regulatory compliance

4 – Information and data on individual battery

2 - Information related to the battery model

Battery Regulation - Data (1/2)

1. Public information on battery model

   a. Manufacturer and manufacturing information

   b. Material composition

   c. Carbon footprint

   d. Recycled content

   e. Minimum, nominal and maximum voltage

   f. Original power capacity

2. Information related to battery model available to persons with legitimate interest and EU commission

   a. Part number for components, and contact detail of source for replacement

   b. Dismantling information including exploded diagrams of battery system/pack, disassembling sequence, tools required

Battery Regulation – Data (2/2)

3. Information accessible only to regulatory and surveillance bodies

    a. Test report demonstrating compliance with requirements from Battery Regulation and delegated or implementing act

4. Information and data on individual battery available only to persons with legitimate interest

    a. Performance and durability

    b. State of health on the battery

    c. Information resulting from the use of battery including the number of charging and discharging cycles and negative events, such as accidents

Only #4 contains dynamic data -> GTD-E focus

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Battery Regulation Other initiatives

GBA BATTERY PASSPORT

Battery Pass

CIRPASS
Digital Product Passport

Catena-X
Automotive Network

gaia-x
Hub the Netherlands

Battery Regulation – Battery Pass

Battery categories: x = mandatory per Battery Regulation; (x) = mandatory per other regulation; (o) = voluntary.										Granularity level: pack vs. module vs. cell x = mandatory; (o) = voluntary.		
#	EV	LMT	Industrial >2 kWh	Stationary >2 kWh	Attribute category	Attribute sub-category	Attribute	Access rights according to Battery Regulation	Data behavioural characteristic: static vs. dynamic	Granularity level: model vs individual battery	Pack	Module	Cell
75	x	x	x	x	Performance and durability	Round trip energy efficiency & self-discharge	Round trip energy efficiency at 50% of cycle life	Public	Static	Battery model	x		
76		x		x	Performance and durability	Round trip energy efficiency & self-discharge	Remaining round trip energy efficiency	Interested persons	Dynamic	Individual battery	x		
77	x	x	x	x	Performance and durability	Round trip energy efficiency & self-discharge	Round trip energy efficiency fade	Interested persons	Dynamic	Individual battery	x		
78	x	x	x	x	Performance and durability	Internal resistance	Initial internal resistance on battery cell level	Public	Static	Battery model			x
79	(o)	(o)	(o)	(o)	Performance and durability	Internal resistance	Current internal resistance on battery cell level	Interested persons	Dynamic	Individual battery			(o)
80	(o)	(o)	(o)	(o)	Performance and durability	Internal resistance	Internal resistance increase on battery cell level	Interested persons	Dynamic	Individual battery			(o)

Battery Pass deliverable - Good for external reference, but includes more than the EU Regulation

Battery Regulation – Mapping

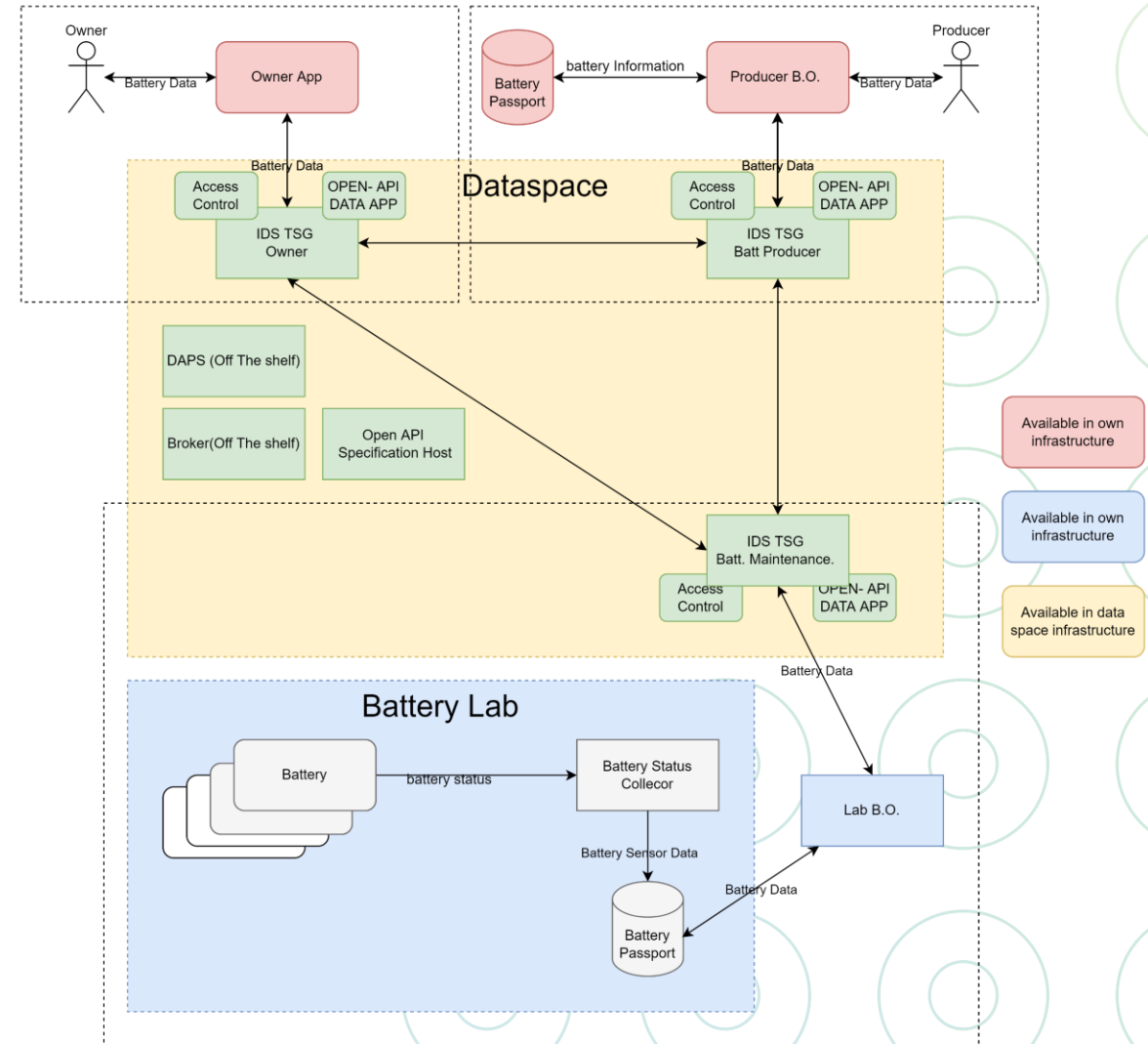|				Mapping Battery Pass	Mapping Regulation
BatPass_Public_F4	Information on responsible sourcing must be available	Functional	Must have	32	Annex XIII (1)(d) information on responsible sourcing as indicated in the report on battery due diligence policy referred to **in Article 52(3);**
BatPass_Public_F5	Information on the recycled content must be available	Functional	Must have	44-51	Annex XIII (1)(e)
BatPass_Public_F6	The rated battery capacity (in Ah) must be available	Functional	Must have	62	Annex XIII (1)(g)
BatPass_Public_F7	The minimum, nominal and maximum battery voltage (in V) must be available	Functional	Must have	66-68	Annex XIII (1)(h)
BatPass_Public_F8	The original power capabilitiy (in W) must be available	Functional	Must have	69	Annex XIII (1)(i)
BatPass_Public_F9	The original battery power limitations (in W) must be available	Functional	Must have	69 for temperature, but no mention to other limitations	Annex XIII (1)(i)
BatPass_Public_F10	The expected battery lifetime (in cycles) must be available	Functional	Must have	86	Annex XIII (1)(j) expected battery lifetime expressed in cycles, **and reference test used;**
BatPass_Public_F11	The capacity threshold (in Ah) for exhaustion must be available	Functional	Must have	92	Annex XIII (1)(k)

GTD-E requirements

Mapping Battery Pass
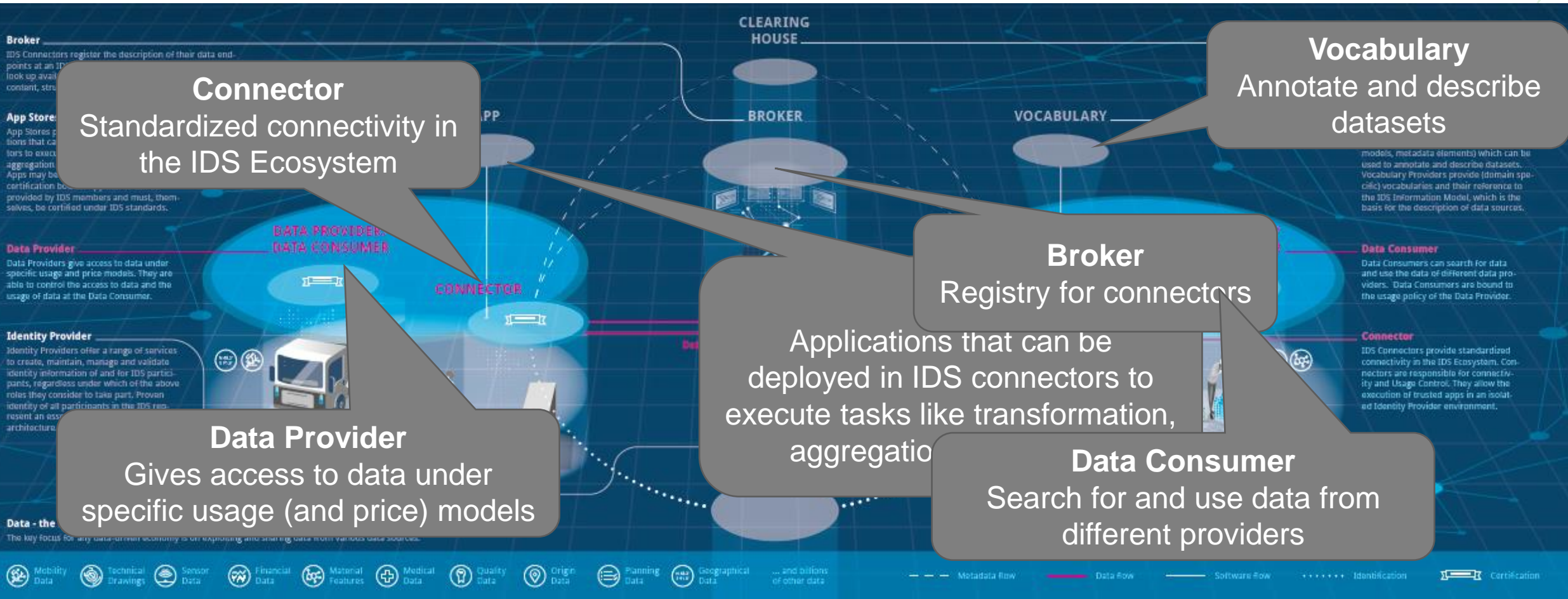
Mapping Regulation

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Battery passport implementation

- **Framework based on International Data Spaces (IDS)**

- Open implementation

- Computational ability for calculations

- Security and access control

- Data ownership with the provider

International Data Spaces

Connector
Standardized connectivity in the IDS Ecosystem

Vocabulary
Annotate and describe datasets

Broker
Registry for connectors

Applications that can be deployed in IDS connectors to execute tasks like transformation, aggregatio...

Data Provider
Gives access to data under specific usage (and price) models

Data Consumer
Search for and use data from different providers

International Data Spaces

Broker
IDS Connectors register the description of their data endpoints at an IDS Broker. Thus, potential Data Consumers can look up available data sources and data in terms of their content, structure quality, actuality and other attributes.

App Stores
App Stores provide Data Apps, i.e. applications that can be deployed in IDS Connectors to execute tasks like transformation, aggregation or analytics on the data. Data Apps may be certified by IDS-approved certification bodies. App Stores can be provided by IDS members and must, themselves, be certified under IDS standards.

Data Provider
Data Providers give access to data under specific usage and price models. They are able to control the access to data and the usage of data at the Data Consumer.

Identity Provider
Identity Providers offer a range of services to create, maintain, manage and validate identity information of and for IDS participants, regardless under which of the above roles they consider to take part. Proven identity of all participants in the IDS represent an essential imperative to the IDS architecture.

CLEARING HOUSE

Clearing House
Intermediary providing clearing and settlement services for all financial and data exchange transactions within the IDS.

Vocabulary
Vocabulary Providers manage and offer vocabularies (ontologies, reference data models, metadata elements) which can be used to annotate and describe datasets. Vocabulary Providers provide (domain specific) vocabularies and their reference to the IDS Information Model, which is the basis for the description of data sources.

Data Consumer
Data Consumers can search for data and use the data of different data providers. Data Consumers are bound to the usage policy of the Data Provider.
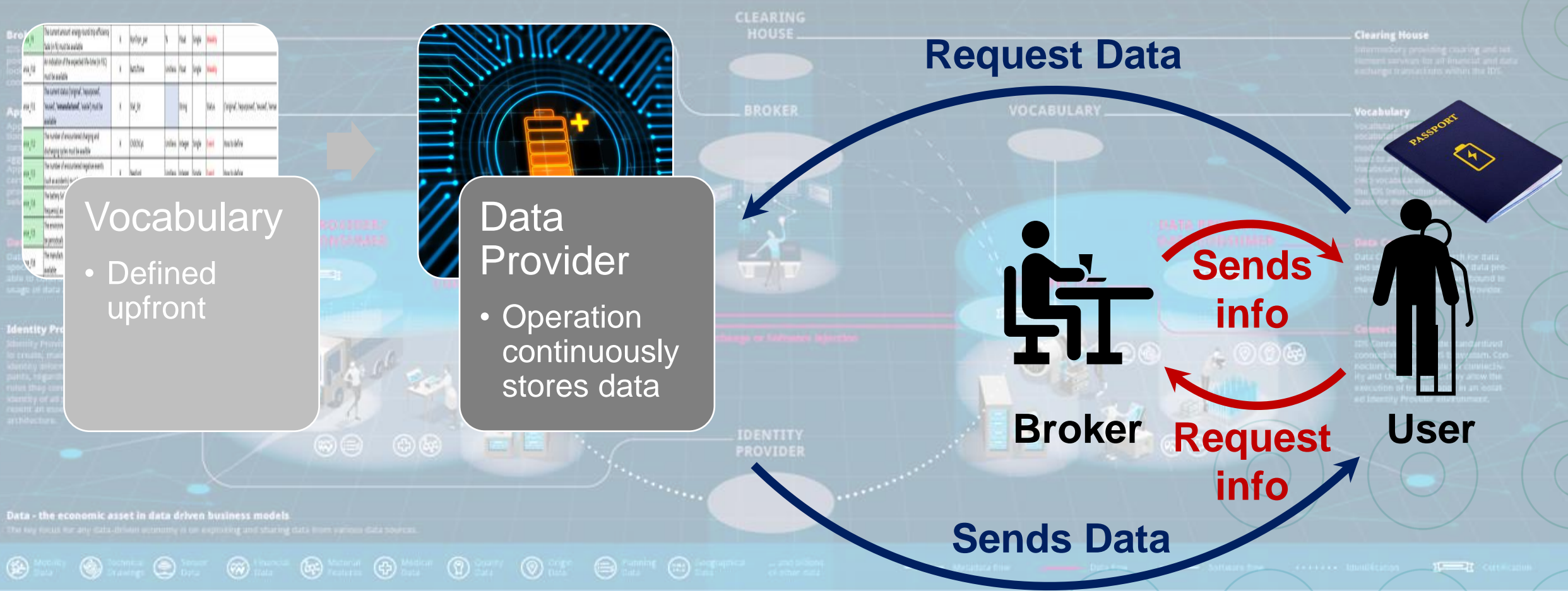
Connector
IDS Connectors provide standardized connectivity in the IDS Ecosystem. Connectors are responsible for connectivity and Usage Control. They allow the execution of trusted apps in an isolated Identity Provider environment.
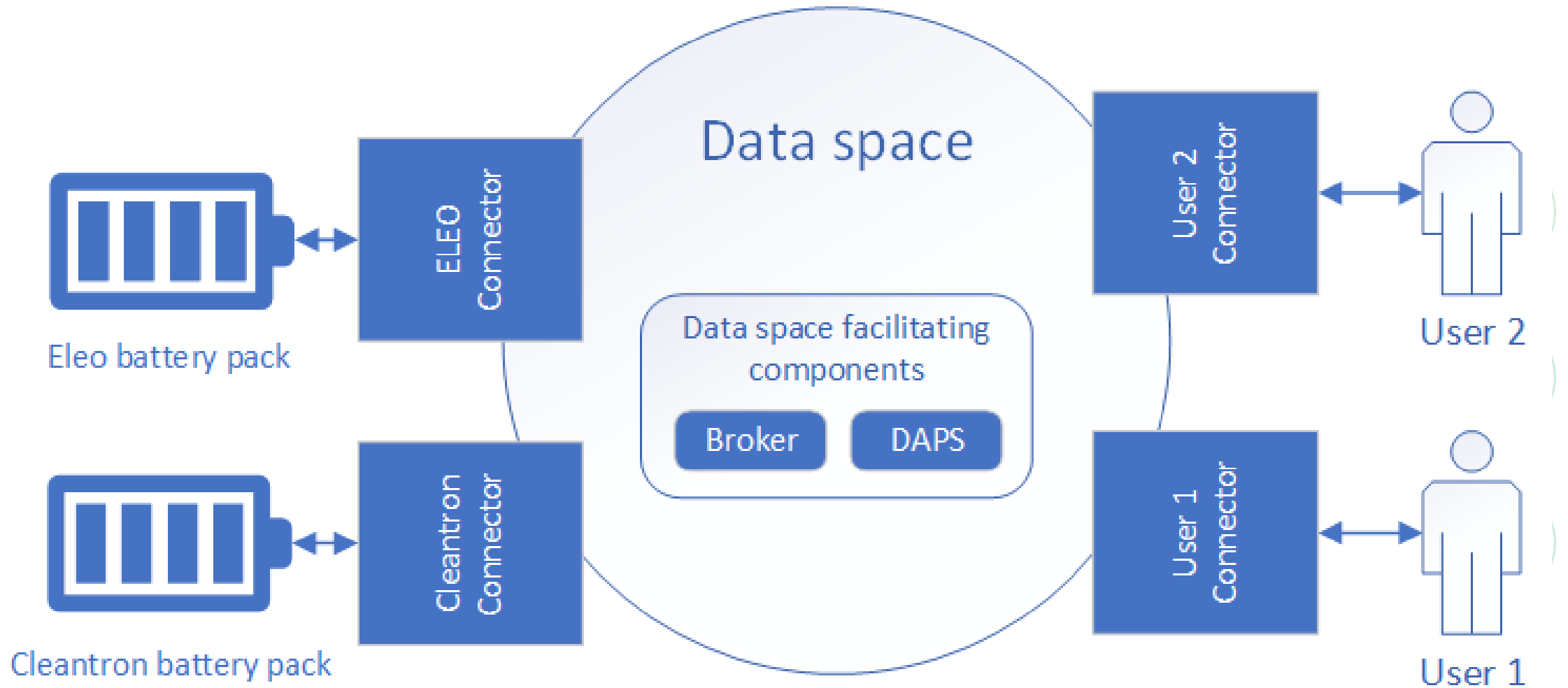
Data - the economic asset in data driven busine...
The key focus for any data-driven economy is on exploiting and...

Mobility Data · Technical Drawings · Sensor Data · Financial Data · Material Features · Medical Data · Quality Data · Origin Data · Planning Data · Geographical Data · ... and billions of other data · Metadata flow · Data flow · Software flow · Identification · Certification

Main take-aways:
- **Data stays with the owner (Data Provider)**
- **Data Consumers can request information about data availability and its source to the Broker**
- **Data Consumers can then request data that is available to them directly at the Data Provider**
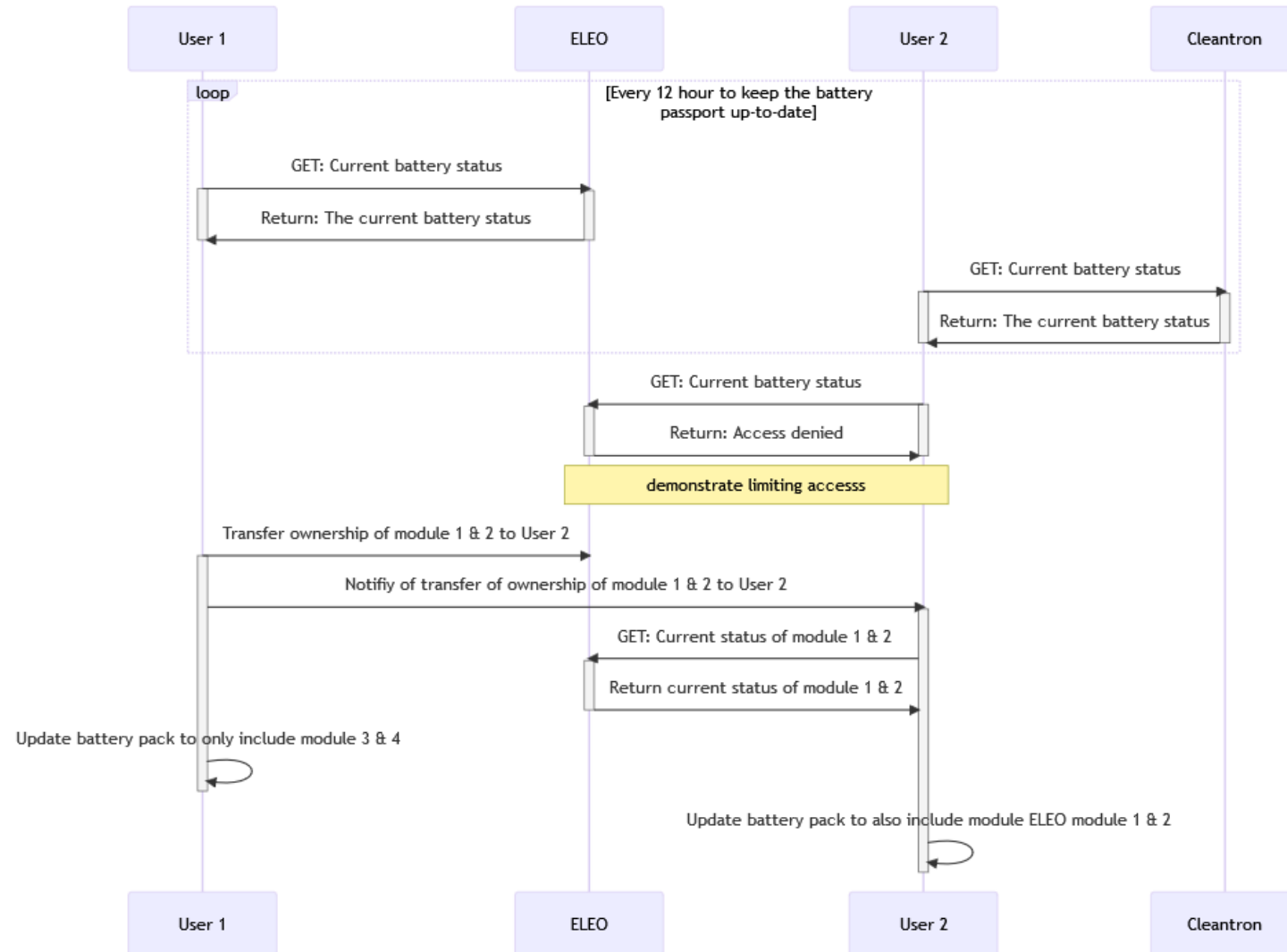
Battery Passport in IDS

Request Data

Vocabulary
- Defined upfront

Data Provider
- Operation continuously stores data

Broker

Sends info

Request info

User

Sends Data

Green Transport Delta - Elektrification

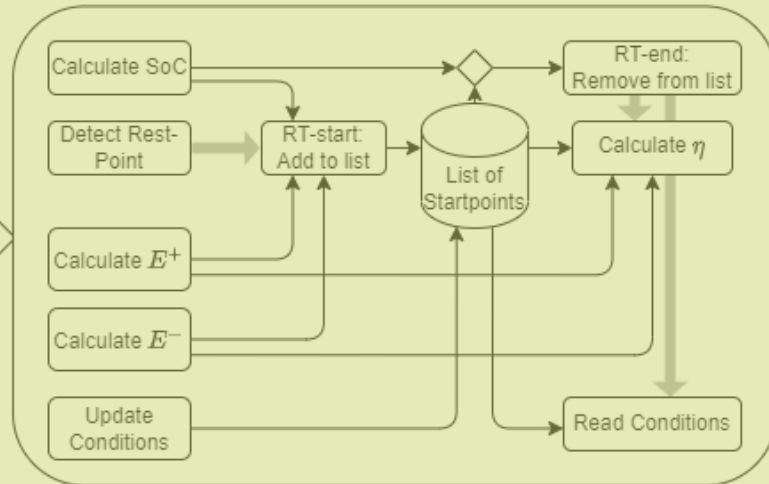# Battery Passport in GTD-E WP3

Battery Passport in GTD-E WP3

Algorithm example

- Algorithm developed with data from public transport
- Being implemented into the BMS of Cleantron and ELEO
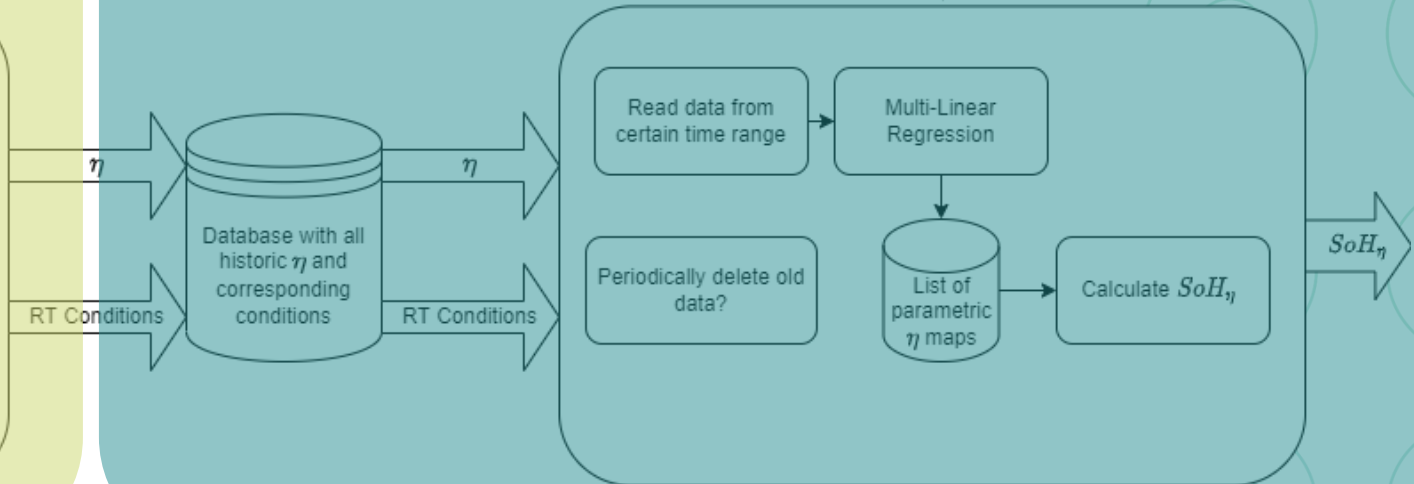 - Partly in the BMS and partly in the Battery Passport Cloud

Whitepaper

- TNO will publish a whitepaper on its view on a battery passport implementation

  - Target end 2023

  - Release event

  - Would you like to receive a copy?

    - erik.hoedemaekers@tno.nl

    - ruud.roelen@tno.nl

TNO innovation for life

Getting to understand product passports

First-time engineering of a battery passport

TNO Public | ONGERUBRICEERD Releasable to the public) TNO
2023 R00000
28 July 2023

Open points

- Clear definition of some of the required data

- Required data frequency

- Required data accuracy

Partly/Potentially covered in future standards like 'EURO 7'

- Examples:

  - State-of-Health -> Maximum capacity, attainable capacity, at which temperature, etc.?

  - State-of-Safety -> Should it be a single value, indications for all potential failures, other?
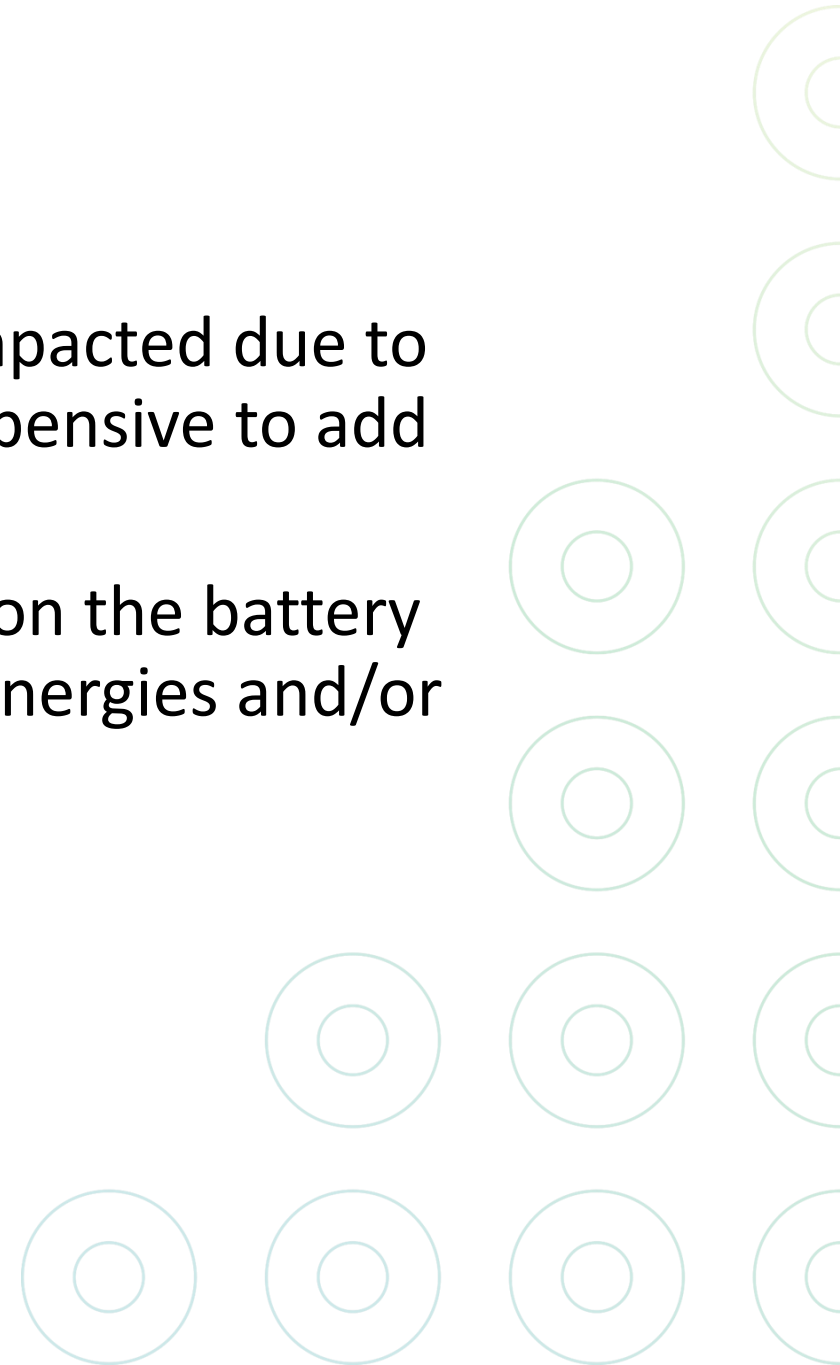
Questions?
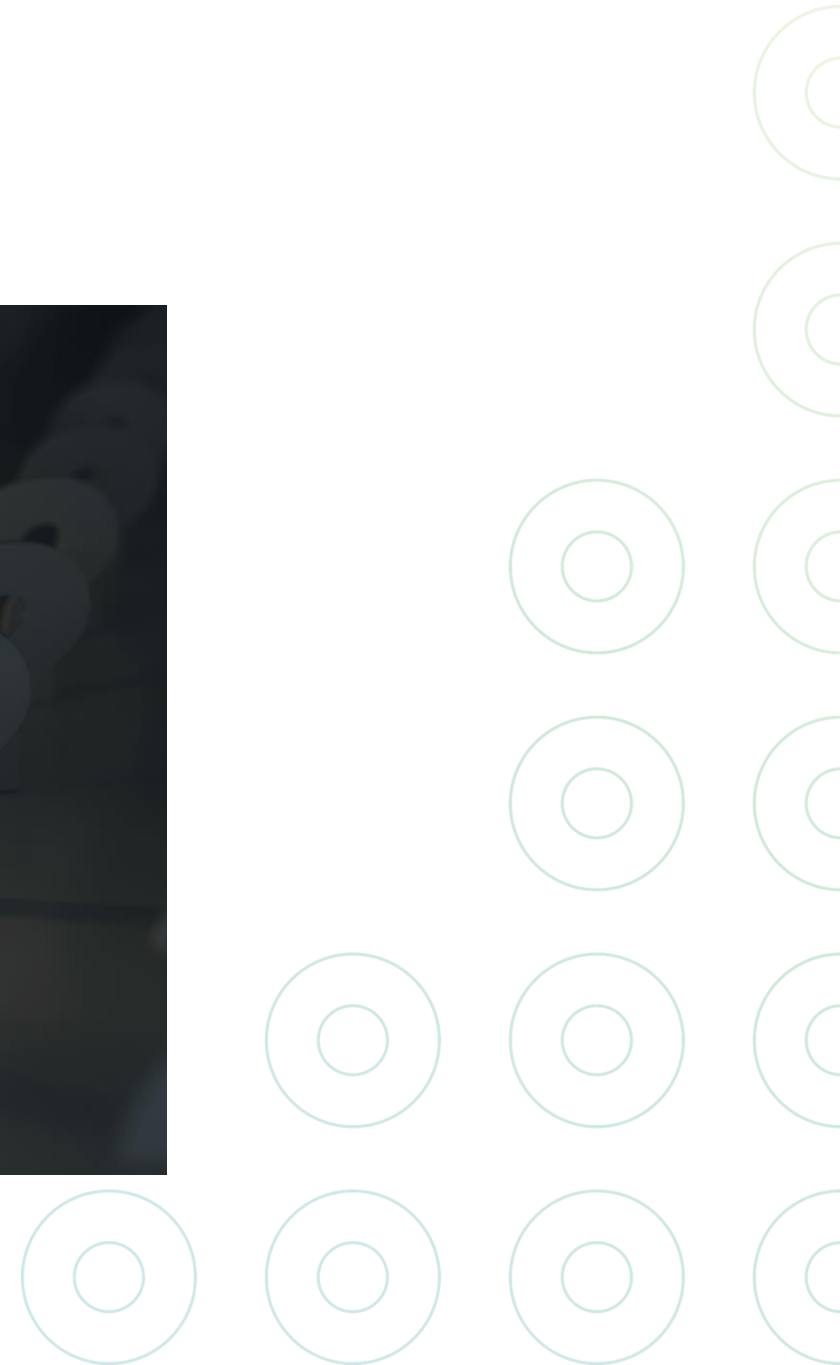
Discussion starters

1. Are you aware of and able to supply all required data, in terms of defining the state of the battery (dynamic data) as defined in the EU regulation?

2. Depending on where data is generated (in module, in pack, in cloud), do you foresee any problems with availability at the required moment of this data?
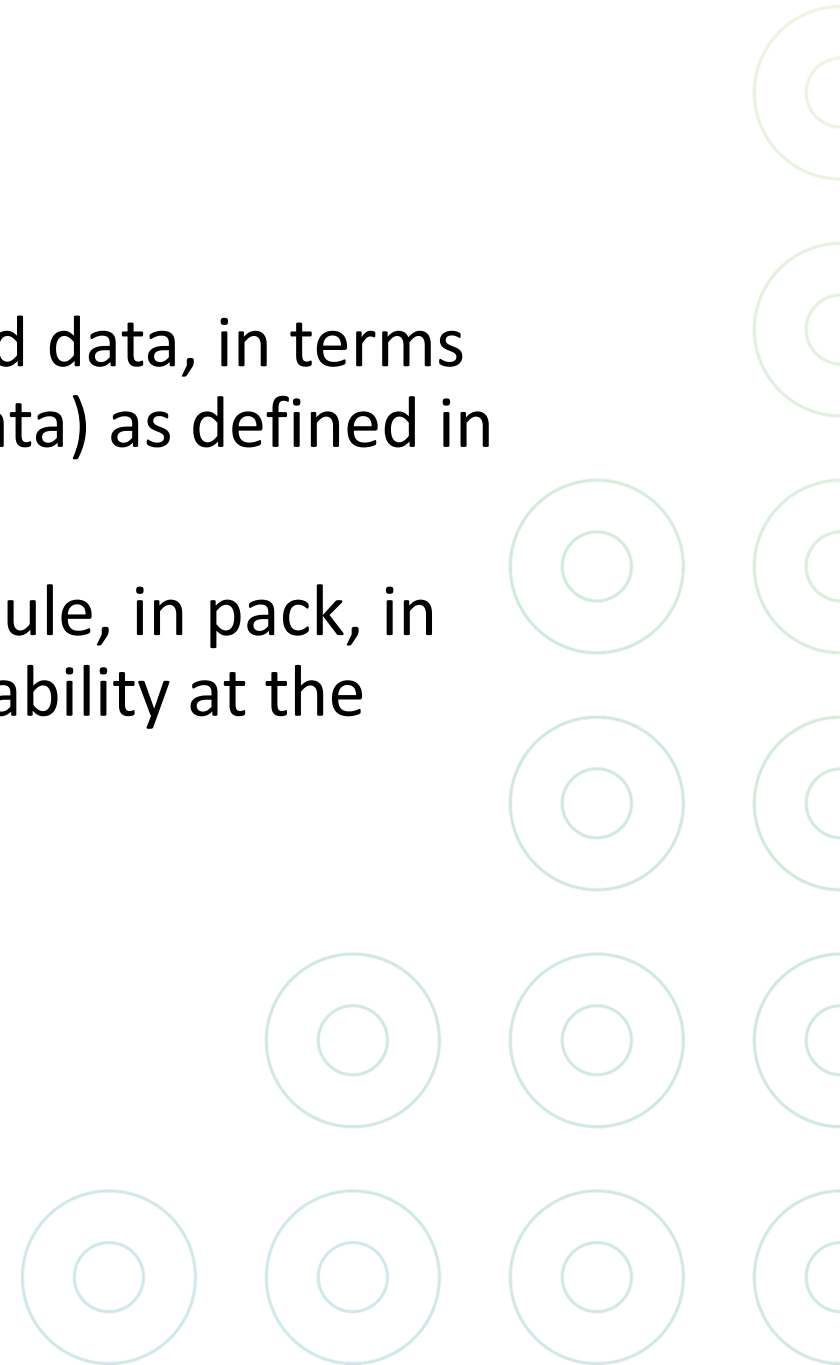
Discussion starters

3. Do you see business cases being negatively impacted due to the battery passport requirement (e.g. too expensive to add connectivity to a small battery pack)?

4. Are you already involved in another initiative on the battery passport implementation? If so, do you see synergies and/or fundamental differences?

Project Partners

VDL · NXP · heliox · TNO innovation for life

DAF · Lightyear · ELEO · cleantron cleantech batteries · Airborne · TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY · Maastricht University

EST-Floattech Intelligent Energy Storage Solutions · NPS Diesel Engine Applications · LionVolt · CarePack Dangerous Goods Packaging · CIRCULAR INDUSTRIES SCALING THE CIRCULAR ECONOMY · LITHIUM SAFETY SOLUTIONS De specialist in lithium-ion veiligheid · IM EFFICIENCY

SCHOLT energy · Elaadnl · van Kessel · ah · DEAC Dutch Electric Aviation Centre Teuge · Steinbuch Motion lab · E-FLIGHT ELECTRIFLYING ACADEMY