



MADITRACE

Traceability in Raw Material Supply Chains: Maditrace DPP Approach

Material & Digital Traceability for CRM Certification (Maditrace)

ICCS DPP Workshop

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SPHERITY

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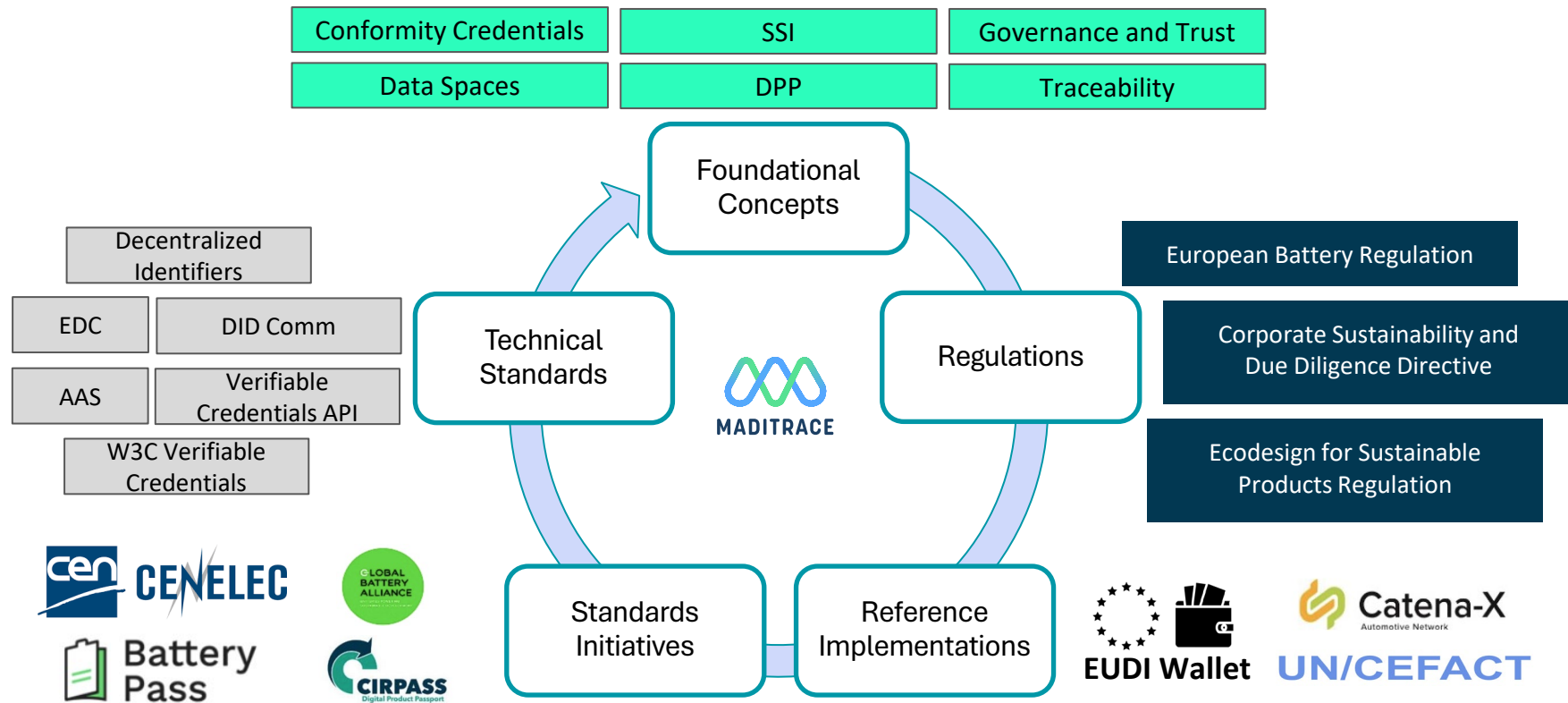
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Maditrace: Material & Digital Traceability for Critical Raw Material (CRM) Certification



- CRMs like Cobalt, Lithium, Natural graphite and rare earth elements are vital for industries such as electronics, renewable energy, and automotive manufacturing
- Traceability is the process of tracking the history and location of products and materials throughout the supply chain.
- Ensure traceability of CRMs to enable compliance with European regulations
- **How?** By providing an architectural framework for traceable supply chains that brings together:
 - Data models
 - Traceability tools
 - Digital Product Passports (DPP)
 - Management systems
- DPP links information on tracking, transport, and processing of CRMs through decentralized information-sharing methods between verifiable and trusted organizations
- Stores information as verifiable credentials (VCs)
- Serves as the interface with the CERA 4in1 certification scheme for supply chain stakeholders

Background



Maditrace Architecture Principles



Maditrace Architecture

Accessibility

To create an architecture that is free from proprietary standards, Maditrace utilizes Open API documentation for secure API endpoints.

Interoperability

Open standards like W3C Verifiable Credentials are used to ensure different systems work together in a semantically interoperable manner.

Modularity

Modularity principle is implemented by clearly identifying independent building blocks with defined interfaces

Verifiability

Maditrace ensures that all data is accurate and traceable back to a verifiable identity, issued by a legitimate source, to meet regulatory compliance with verification workflows.

High-Level Architecture

Components



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serves as a digital representation and repository for raw material data

a state-issued digital credential that uniquely identifies an organization as a legal entity

allows permissions to be managed through verifiable credentials

standardizes the meaning and structure of shared information

Secure communication and data transfer between stakeholders

Data embedded with cryptographic proofs that confirm its authenticity, integrity, and origin

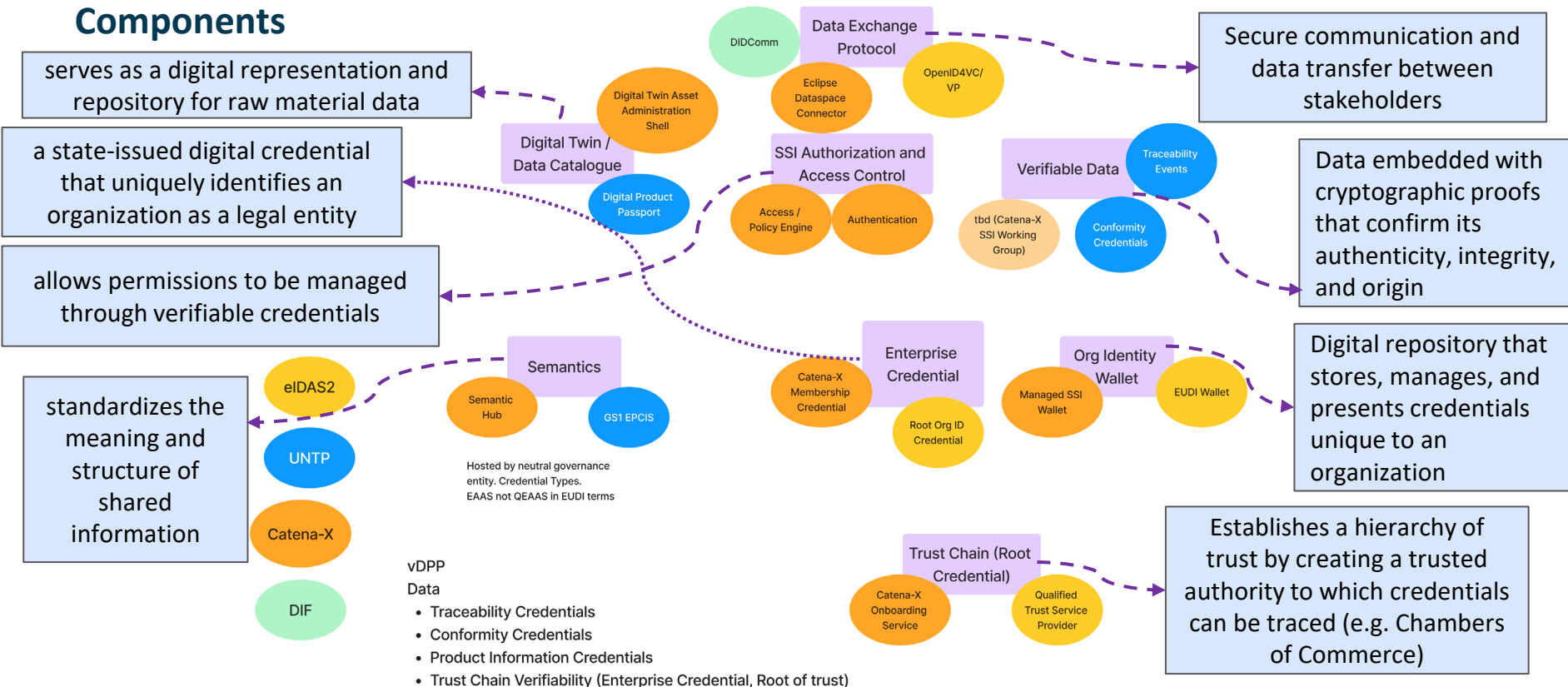
Digital repository that stores, manages, and presents credentials unique to an organization

Establishes a hierarchy of trust by creating a trusted authority to which credentials can be traced (e.g. Chambers of Commerce)

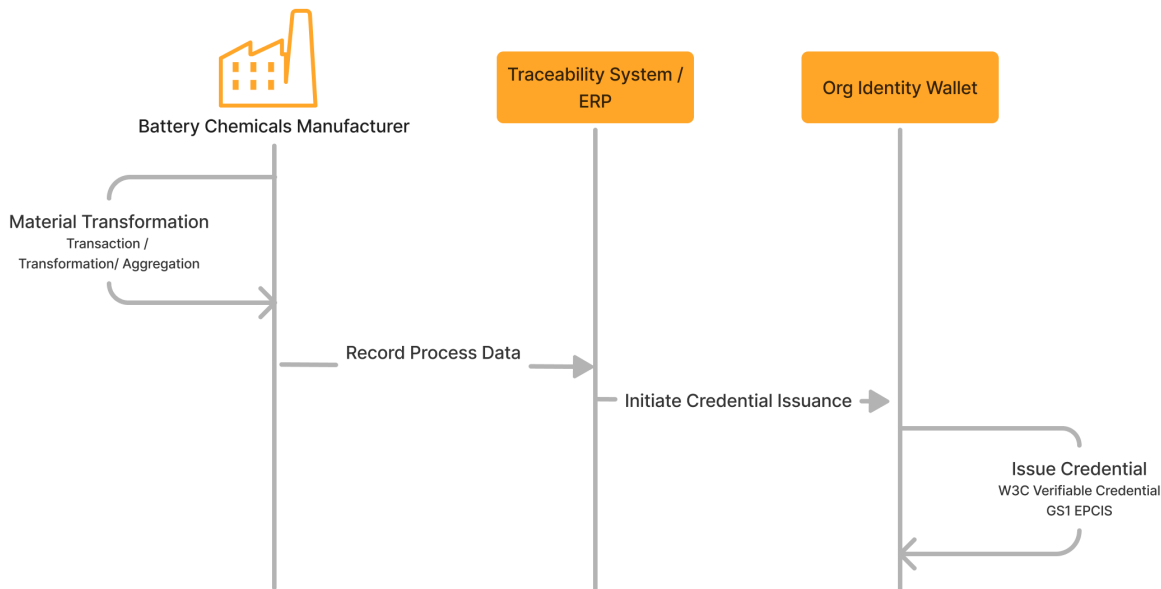
vDPP Data

- Traceability Credentials
- Conformity Credentials
- Product Information Credentials
- Trust Chain Verifiability (Enterprise Credential, Root of trust)

Hosted by neutral governance entity. Credential Types.
EAAS not QEAS in EUDI terms



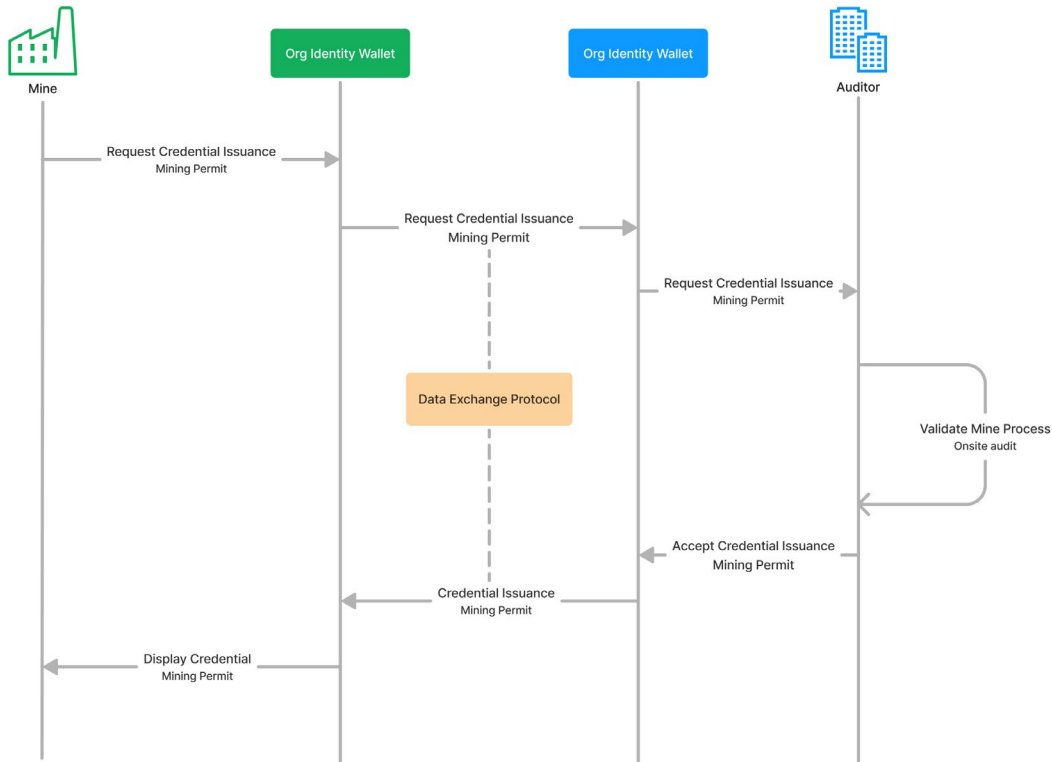
Create Traceability Event Use Case



A Material Transformation Event example is used to show the creation of a traceability event in Maditrace architecture.

1. The Battery Chemicals Manufacturer initiates the process by creating a material transformation event.
2. The event is used to record relevant data about materials and manufacturing activities, such as transaction, transformation, or aggregation.
3. Manufacturer records process data in a Traceability System/ERP and initiates credential issuance.
4. A W3C Verifiable Credential is issued, stored in the OID Wallet, and managed by the manufacturer for secure presentation.

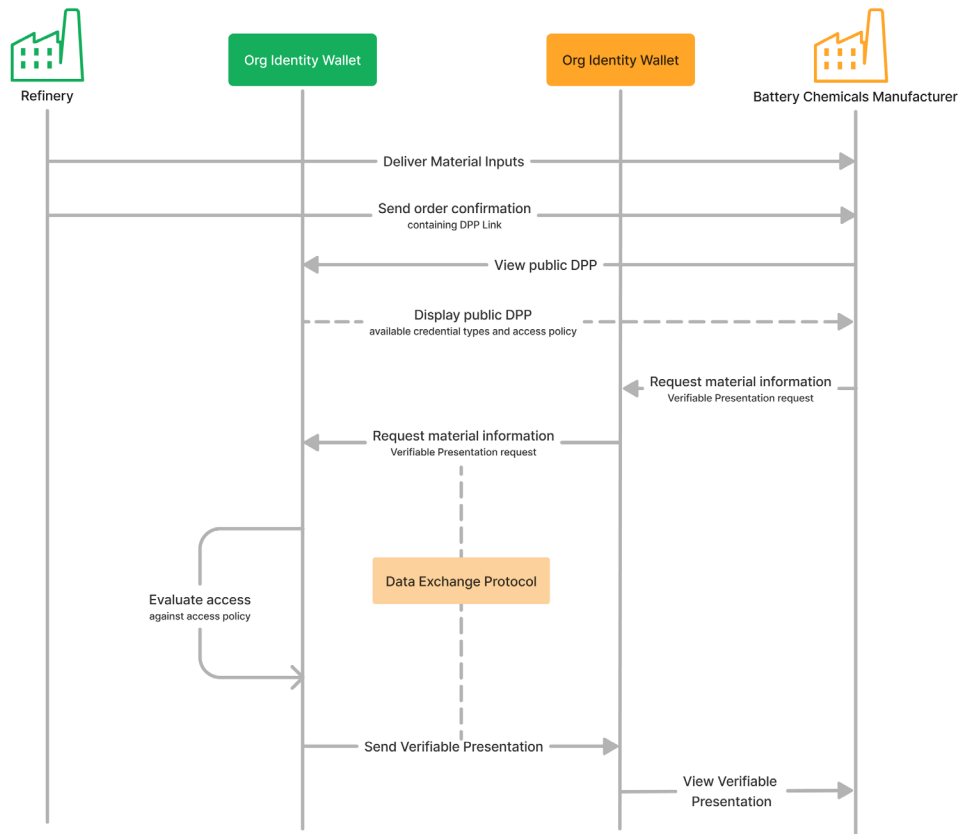
Request Mine Audit Use Case



**Audit Process occurs between Mine and Auditor
(potentially using the Eclipse Data Connector and Asset
Administration Shell)**

1. Mine requests a mining permit credential via its OID wallet.
2. Data exchange protocol facilitates communication and transfer between the Mine and Auditor.
3. Auditor performs the audit and creates the mining permit credential if the audit is successful.
4. Mining permit credential is stored in the Mine's OID wallet and can be displayed to third parties.

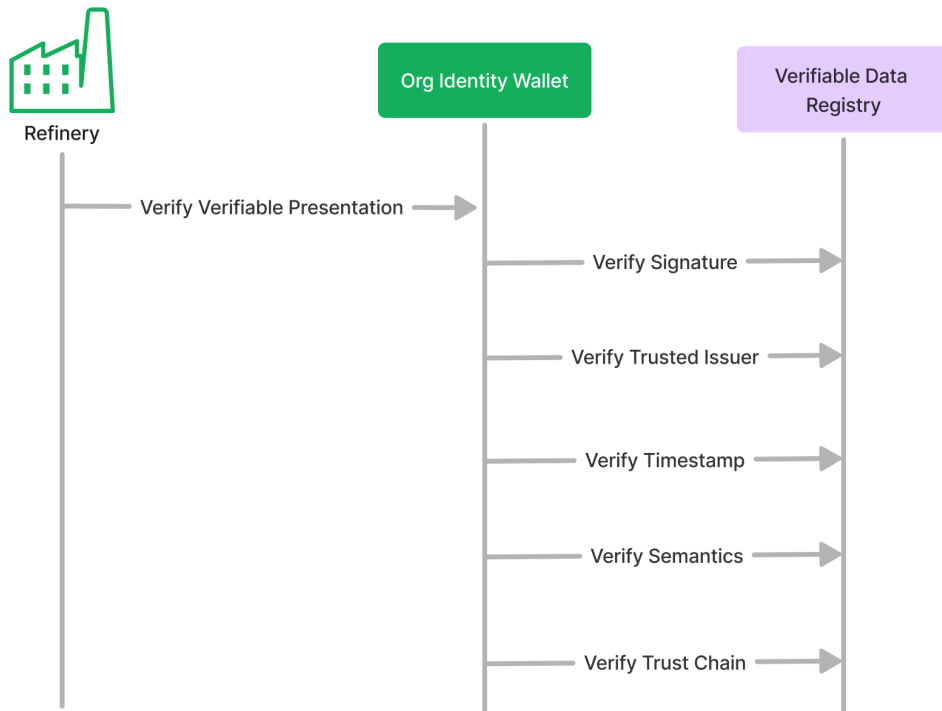
Data Sharing Use Case



Data Sharing occurs between Refinery and Battery Chemicals Manufacturer using the Data Exchange Protocol.

1. Refinery delivers materials and order confirmation with DPP link.
2. Manufacturer views the public DPP with conformity credentials and access policies.
3. Public DPP is stored in the Refinery's OID Wallet.
4. Manufacturer requests material info via Verifiable Presentation evaluated against access policies

Data Verification Use Case



Data Verification involves Refinery and Verifiable Data Registry for traceability of critical raw materials.

1. The Refinery acts as the Verifier in the SSI model
2. Refinery initiates verification via its Org Identity Wallet to validate the verifiable presentation.
3. The wallet interacts with the verifiable data registry to verify signature, issuer, timestamp, semantics, and trust chain integrity.

Summary and Future Work



Summary

- Maditrace architecture:
 - should support the storage and presentation of various credentials, including legal identity credentials
 - should be interoperable with existing ecosystems like Catena-X
 - use SSI principles for direct connectivity among all supply chain stakeholders
 - should handle traceability events; namely transaction, transformation, aggregation, and association.

Future Work

- A prototype of the proof-of-concept architecture will be developed to demonstrate its applicability in use cases.
- The usability of the architecture for different material and supply chain characteristics will be validated.
- CERA 4in 1 Certificate integration will be completed.
- Fingerprinting data in traceability events will be added as a feature.



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EV Car Battery DPP

Batteries for EVs and industrial applications are the **first product group for which the DPP will become mandatory**. The relevant regulation will take effect in February 2027.

The DPP requirements, which are specified in Article 77 of the EU Battery Regulation, include significant **supply chain information** requirements and **distinguish public and confidential data**. For a complete list of attributes, consult the Battery Pass content guidance linked below.



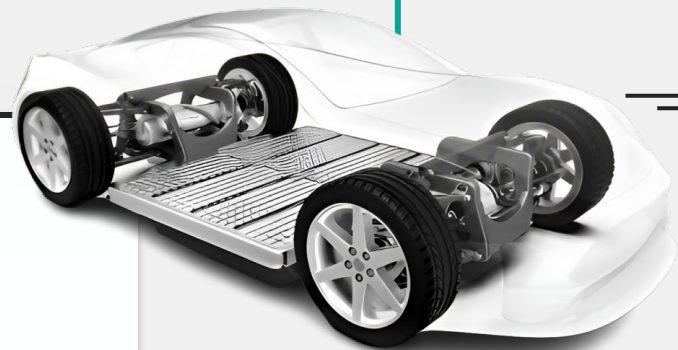
Regulation

EU Battery Regulation Article 77. A **QR code will provide access to a digital passport** with detailed **information on each battery** that will help consumers and especially professionals along the value chain in their efforts to make the circular economy a reality for batteries.



Data Attributes

- General information
- Labels and certifications
- **Product Carbon footprint**
- Supply chain due diligence
- Materials and composition
- Circularity & resource efficiency
- Performance & durability



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