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SPHERITY RESEARCH · NOVEMBER 2026

The EU just built the Digital Product Passport on W3C standards.

What the EU DPP Registry package of 30 October 2026 means for product passports, business wallets, verifiable evidence graphs and AI.

JSON-LD · RDF · SKOS · SHACL · OWL · XSD · SPARQL · DCAT

An educational carousel in 8 chapters · swipe →

THE NEWS

30 October 2026: the European Commission publishes the technical package of the EU DPP Registry.

PUBLISHED BY

DG GROW

Single Market for Products, Digital Product Passport team

WHAT

6 new resources

Guides, OpenAPI specs and semantic artefacts, next to the Registry user guide

> **Its semantic core runs on eight W3C standards. The documents never name W3C once. The architecture speaks for itself.**

This is an endorsement by architecture, not by press release: shared meaning for every product in the Single Market is expressed in W3C standards.

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IN THIS CAROUSEL

Eight chapters, from the registry to AI.

01 The EU DPP Registry: what it is, why it matters

02 The published package: what is in it

03 W3C standards inside the DPP

04 The Registry as a data space foundation

05 Linked data: the base of verifiable evidence graphs

06 DPP5.0: physical objects, AI and physical AI

07 Outlook: identity, trust and policy

08 Why W3C, and what to do now

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01 · THE EU DPP REGISTRY

A Digital Product Passport is a product's data record, readable by people and machines.

- **Legal basis:** Ecodesign for Sustainable Products Regulation (ESPR), Regulation (EU) 2024/1781.
- **Access:** through a data carrier on the product, such as a QR code, pointing to a Unique Product Identifier (UPI).
- **First product group:** batteries, under the Battery Regulation (EU) 2023/1542. More groups follow through delegated acts.
- **Readers:** customs, market surveillance, repairers, recyclers, consumers and business partners, each with the access level they are entitled to.

Implementing rules for the Registry: Commission Implementing Regulation (EU) 2026/1778.

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01 · THE EU DPP REGISTRY

The Registry stores the pointer, not the passport.

ECONOMIC OPERATOR
Hosts the DPP itself at a resolvable URL, the UPI

↓ registers the UPI

EU DPP REGISTRY
Fetches the DPP, validates it, records the UPI and the operator

↓ resolves

CUSTOMS · MARKET SURVEILLANCE · PUBLIC
Find the passport and read what they are entitled to

> “Registry does not persist the fetched DPP payload content.”

DPP Registry API Integration Guide v1.0, 30 Oct 2026

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01 · THE EU DPP REGISTRY

Why it matters: one entry point for every product in the Single Market.

ENFORCEMENT

Customs and market surveillance

One place to check that a product placed on the market has a valid passport.

SHARED MEANING

27 Member States, one vocabulary

Every field means the same everywhere, traceable to the regulation.

SCALE

Batteries first, then textiles, steel, electronics…

Each ESPR product group plugs into the same semantic framework.

SOVEREIGNTY

Data stays with the operator

The Registry points to passports. It does not pool them.

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01 · THE EU DPP REGISTRY

The registration journey, step by step.

1 **Log in**
EU Login account for the person acting.

2 **Verify the organisation**
Identifier (e.g. national trade register, LEI, VAT) plus a document signed with an eIDAS qualified seal or signature.

3 **Register the DPP**
Submit the UPI by web form, file (JSON or XML, up to 100 per batch) or API.

4 **Validation**
The Registry fetches the DPP and checks it against the rules of Implementing Regulation (EU) 2026/1778.

5 **Restricted access**
Self-hosted DPPs check signed tokens from the EU DPP Authentication Service.

02 · THE PUBLISHED PACKAGE

What the Commission published.

RESOURCE	DATE
Semantic Data Guide · how meaning, structure and format fit together	30 Oct 2026
Semantic Data Artifacts · vocabularies, SHACL shapes, contexts, schemas, tests	30 Oct 2026
API Integration Guide · registering DPPs, tracking tasks	30 Oct 2026
OpenAPI Specifications · registry, dashboard, common models	30 Oct 2026
Service Account Integration Guide · machine-to-machine access	30 Oct 2026
Self-Hosted Authentication Guide · protecting restricted DPPs	30 Oct 2026
Registry User Guide · enrolment and registration	Sep 2026 (v3)
Battery passport data points · data points by category	19 Oct 2026

single-market-economy.ec.europa.eu · Digital Product Passport · Resources and documentation

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02 · THE PUBLISHED PACKAGE

The Semantic Data Guide: one master model, many formats.

MASTER DATA · W3C

SKOS taxonomies + SHACL shapes

SKOS defines the shared vocabulary. SHACL defines structure, cardinality and validation rules.

↓ compiled into

XML	JSON	LINKED DATA
XSD	JSON Schema	JSON-LD context

JSON and XML are checked against their generated schemas. **JSON-LD and RDF are validated directly against the master SHACL shapes**, so the full graph semantics is checked.

DPP Registry Semantic Data Guide v1.0, ch. 2

02 · THE PUBLISHED PACKAGE

The artefacts: layered like the law.

CORE · EVERY DPP

ESPR fields: passport ID, UPI, granularity, status, last update

↓ extends

PRODUCT GROUP · BATTERIES

Battery Regulation fields: manufacturer, chemistry, mass, critical raw materials

↓ extends

SUB-GROUPS

EV batteries · industrial · light means of transport

ACCESS VIEWS

pub public · **res1–res3** restricted levels, each with its own shapes and schemas

PER LAYER

.ttl vocabularies and shapes · **.jsonld** contexts · **.schema.json** · test data

02 · THE PUBLISHED PACKAGE

Meaning is W3C. Access is IETF.

LAYER	STANDARDS IN THE PACKAGE
Meaning & validation	W3C: RDF, JSON-LD, SKOS, SHACL, SPARQL, OWL, XSD, DCAT (via DCAT-AP)
Exchange formats	JSON (baseline), JSON-LD and XML for self-hosted DPPs; JSON or XML files for batch registration
API & access	IETF: OAuth 2.0, JWT, private_key_jwt, JWKS, HTTP · OpenAPI
Organisations	eIDAS qualified seals and signatures · LEI (ISO 17442), trade register, VAT
Data model	CEN-CENELEC JTC 24: EN 18223:2026, EN 18216:2026

Not in the package yet: W3C Verifiable Credentials, Decentralized Identifiers and the ODRL policy language. More on that in chapter 07.

03 · W3C STANDARDS INSIDE THE DPP

Eight W3C standards carry the DPP's meaning.

STANDARD	ITS JOB IN THE DPP
RDF	The data model: every fact is a subject–predicate–object statement
JSON-LD	Turns plain JSON fields into RDF statements through contexts
SKOS	Vocabularies: concepts, codes, labels, definitions, hierarchy
SHACL	The rulebook: required fields, datatypes, allowed values
SPARQL	Rules that SHACL keywords cannot express
OWL	Versioned ontology identifiers (owl:versionIRI)
XSD	Datatypes such as dates, plus the XML schemas
DCAT	The machine-readable catalogue of releases (via the EU profile DCAT-AP 3.0.1)

03 · W3C STANDARDS INSIDE THE DPP

SKOS: every field gets one meaning, traceable to the law.

```
bat:registrantIdentity a skos:Concept ;
  skos:notation    "registrantIdentity" ;
  skos:prefLabel   "Identity of who is registering
                    the battery passport"@en ;
  dct:source       <…/eli/reg/2023/1542/…> ;
  skos:scopeNote   "Article 77 (3) … Public.
                   EV: Mandatory …"@en ;
  dct:accessRights dpptype:publicType .
```

- **Notation** is what machines use; **label** is what people read.
- **dct:source** links each concept to its legal provision (ELI).
- **dct:accessRights** says who may see it.

Excerpt, battery vocabulary 1.0.0 · Semantic Data Guide ch. 3

03 · W3C STANDARDS INSIDE THE DPP

SHACL: the rulebook a machine can check.

```
# at least one manufacturer field is required
sh:or (
  [ sh:property [ sh:path bat:manufacturerName ;
                  sh:minCount 1 ] ]
  [ sh:property [ sh:path bat:manufacturerTradeName ;
                  sh:minCount 1 ] ]
  [ sh:property [ sh:path bat:manufacturerTrademark ;
                  sh:minCount 1 ] ]
) .
```

BUILT-IN CONSTRAINTS

cardinality · datatype · node kind · allowed values from SKOS (sh:in) · patterns

BEYOND KEYWORDS

SPARQL constraints, e.g. checking a language tag format

Semantic Data Guide ch. 4

03 · W3C STANDARDS INSIDE THE DPP

JSON-LD contexts: plain JSON in, semantic facts out.

```
{
  "@context": "https://repository.product-passport
               .ec.europa.eu/core/contexts/core.jsonld",
  "@id":   "https://www.example.org/dpp/1234545",
  "@type": "dpp:DigitalProductPassport",
  "digitalProductPassportId": "https://www.example.org/1234545",
  "manufacturerName": "ExampleCorp"
}
```

- The **context** maps each JSON key to a global IRI in the EU vocabulary.
- **@import** stacks core, product group and sub-group contexts.
- **@protected** stops anyone from silently redefining an EU term.

Example from the Semantic Data Guide ch. 5.3

03 · W3C STANDARDS INSIDE THE DPP

Versioned IRIs: the meaning has a provenance too.

```
https://repository.product-passport.ec.europa.eu
  /product/batteries/subgroup/evb
  /shapes/evb-shapes/1.0.0
```

- Every vocabulary, shape, schema and context has its own **semantic version inside its identifier**.
- Each DPP declares the exact releases it was built against: **contentSpecificationIds**, at least core plus product group.
- All releases are listed in a **DCAT-AP catalogue**, so tools discover them automatically.

> **A verifier knows not only the value, but which version of the law's meaning it was written against.**

03 · W3C STANDARDS INSIDE THE DPP

Takeaway: W3C is the foundation. One open point remains.

FOUNDATION

Without the W3C stack, there is no single source of truth across XML, JSON and JSON-LD.

OPEN POINT

JSON is the only mandatory format (EN 18216:2026). JSON-LD is optional.

Plain JSON passes the schema, but loses the graph: no global meaning per field, no links across companies, no signature over meaning.

OUR RECOMMENDATION

Make JSON-LD the default in practice. It costs one line, the @context, and keeps JSON developers in JSON.

04 · A DATA SPACE FOUNDATION

Abstracted, the Registry lays key foundations of a data space.

DATA SPACE BUILDING BLOCK	EU DPP REGISTRY TODAY
Catalogue & discovery	Registry of UPIs and operators; DCAT-AP catalogue of semantic releases
Vocabulary hub	Semantic repository: SKOS vocabularies, SHACL shapes, JSON-LD contexts
Participant data plane	DPPs hosted by each economic operator
Identity & onboarding	EU Login and eIDAS-sealed organisation verification
Access control	Central authentication service; access views pub/res1–res3
Usage policies	**Not yet: no policy language**
Verifiable claims	**Not yet: data is not signed per claim**

Building blocks as described by the Data Spaces Support Centre (DSSC); mapping by Spherity

04 · A DATA SPACE FOUNDATION

Control plane and data plane.

CONTROL PLANE · SHARED EU INFRASTRUCTURE

Registry	Semantic hub	Auth service
who, what, where	what it means	who may read

↕ pointers, rules, tokens: no payloads

DATA PLANE · EACH COMPANY

Manufacturer	Supplier	Recycler
hosts its DPPs	hosts its evidence	adds lifecycle facts

This split is what data spaces are built on: shared services for trust and meaning, data under the control of the party that owns it.

04 · A DATA SPACE FOUNDATION

Sovereignty by design, in line with the European strategy for data.

- **Data stays with the producer.** The Registry holds pointers and validation results, not passports.
- **Meaning is a public good.** EU vocabularies under an open licence (EUPL), published in open standards.
- **Any provider can host.** A DPP is a resolvable URL that passes the same open rules, whoever runs the server.
- **Interoperable by default.** One semantic framework for every ESPR product group and Member State.

> **The DPP is the first EU-wide data space that every manufacturer selling in the Single Market will touch.**

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05 · LINKED DATA

From fields to facts: RDF in one slide.

RDF expresses every piece of data as a **statement**: subject, predicate, object. Each part is a global identifier (IRI) or a value.

SUBJECT	→	PREDICATE	→	OBJECT
Battery EV-0042		has chemistry		LFP
Battery EV-0042		made by		Cell Co. (LEI …)

Statements that share identifiers join into a **graph**. No schema migration is needed to add new facts later: that is the open world.

05 · LINKED DATA

JSON-LD: developers keep JSON. Every field gains a global identity.

PLAIN JSON

```
"manufacturerName":
  "ExampleCorp"
```

Meaning lives in a PDF and in people's heads.

JSON-LD

```
bat:manufacturerName
  → "ExampleCorp"
```

Meaning travels with the data, as an IRI defined by the EU.

- Same payload, same tooling, one extra key: **@context**.
- Any JSON-LD document is also RDF, so it can be validated with SHACL, queried with SPARQL and merged with other graphs.
- It is the format of W3C Verifiable Credentials (next slides).

05 · LINKED DATA

Linked data across companies: one product, many sources.

SUPPLIER
Cell origin and materials declaration

LABORATORY
Test report for the cells

↓ linked by IRIs ↓

MANUFACTURER · DPP
Battery EV-0042, its configuration and its release decision

↓ linked by IRIs ↓

OPERATOR
State of health, repairs

RECYCLER
Recovered materials

Each company keeps its own data. The **shared vocabulary and identifiers** let an authorised reader compose a view across all of them, without a central database.

05 · LINKED DATA

Why JSON-LD matters for verifiable evidence graphs.

1 · ONE FORMAT FOR MEANING AND PROOF

The W3C Verifiable Credentials Data Model 2.0 is expressed in JSON-LD. The same @context that gives a DPP field its EU meaning can sit inside a signed credential.

2 · SIGNATURES OVER MEANING, NOT JUST BYTES

W3C Data Integrity with RDF Dataset Canonicalization signs the graph itself, so a claim stays verifiable when it is reformatted or merged.

3 · CLAIMS BECOME EVIDENCE

Each statement carries who issued it, when, under which version of the rules and whether it is still valid. That turns a graph of facts into a graph of evidence.

A verifiable evidence graph links claims, their sources and their meaning, and makes every link checkable by machines.

05 · LINKED DATA

Why AI and physical AI need this.

GROUNDING

AI answers from linked, sourced facts instead of guessing from PDFs.

PROVENANCE

Every answer traces to an issuer, a version and a legal source.

GUARDRAILS

SHACL rules are machine-checkable conditions an agent must meet before it acts.

CHANGE PROPAGATION

When evidence changes, every dependent decision can be found.

EXAMPLE · A HUMANOID ROBOT (FICTIONAL)

A laboratory withdraws one test report. The evidence graph finds the robot configuration that relied on it and puts its release on **HOLD** for review. A flat record cannot do that.

06 · DPP5.0

The DPP maturity ladder.

1.0 Document
PDF behind a QR code. Readable by people only.

2.0 Data
Structured fields in JSON. Machine-readable, meaning in documentation.

3.0 Semantic · the EU Registry, Oct 2026
Shared vocabularies and rules: JSON-LD, RDF, SKOS, SHACL.

4.0 Verifiable
Signed, issuer-bound claims: W3C Verifiable Credentials, trusted issuers.

5.0 Evidence graph
Access-controlled, verifiable evidence graphs for physical products, AI and physical AI.

DPP1.0–DPP5.0 is a Spherity framing, not an EU term.

06 · DPP5.0 · A DEFINITION

Access-controlled[3], verifiable[2] evidence graphs[1] for physical products, virtual products and physical AI. Every fact links to its source, meaning and version; every operation to an actor's authority[6] and current permission[3]. Built on open international standards[4] and open-world semantics[5], as shared infrastructure[7] across companies and jurisdictions.

1 **Evidence graph** · linked claims, not flat fields

2 **Verifiable** · signed, issuer-bound, sourced, versioned

3 **Access-controlled** · a policy check on every request

4 **Open standards** · works beyond one platform

5 **Open-world** · others add facts later

6 **Accountable** · every operation traces to a person or company

7 **Shared** · one infrastructure across companies and jurisdictions

Stöcker, C. (2026). Verifiable, Access-Controlled Digital Product Passports. Spherity Research.

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06 · DPP5.0

Where the EU Registry stands against DPP5.0.

PROPERTY	TODAY	WHY
Evidence graph	**Partial**	JSON-LD/RDF supported; plain JSON is the baseline
Verifiable	**Missing**	Operators are sealed at enrolment; claims are not signed
Access-controlled	**Partial**	Access views and tokens; no policy language
Open standards	**Yes**	W3C semantic stack, CEN, IETF
Open-world	**Partial**	RDF and SKOS are open; extension through versioned layers
Accountable	**Partial**	Verified operators; no mandates for agents
Shared	**Yes**	One EU registry and semantic hub

Assessment by Spherity, based on the 30 Oct 2026 package

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07 · OUTLOOK · IDENTITY & TRUST

Next: the European Business Wallet needs W3C Verifiable Credentials.

The proposed European Business Wallet (EBW) lets companies prove identity, exchange verified business evidence and show who may act for them, including AI agents with a mandate.

WHY W3C CREDENTIALS IN THE EBW STANDARDS

- Same **JSON-LD** and vocabularies as the DPP: a wallet credential and a passport claim speak one language.
- EBWs and DPPs then **work together without translation layers**.
- One **open, royalty-free** standards ecosystem, not proprietary profiles.

Spherity is working to bring W3C credentials into the EBW standards.

07 · OUTLOOK · IDENTITY & TRUST

EBW + DPP: the identity of the company signs the claims about the product.

EUROPEAN BUSINESS WALLET
Company identity · mandates · attestations

↓ issues and signs

VERIFIABLE CREDENTIALS (JSON-LD)
Test report · materials declaration · conformity claim

↓ linked into

DIGITAL PRODUCT PASSPORT
A verifiable evidence graph, checked against EU shapes

One verifier stack checks **who** said it (EBW), **what** it means (EU vocabulary) and **whether it is still valid** (status).

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07 · OUTLOOK · POLICY

Next: a policy engine for access control, speaking ODRL.

ODRL, the W3C Open Digital Rights Language, expresses who may do what with data, under which conditions.

TODAY IN THE DPP	WITH ODRL
Access views **pub**, **res1–res3** and a central token service.	Machine-readable policies per view, purpose and party, evaluated on every request.

- Already used in data spaces: the Dataspace Protocol and Eclipse Dataspace Components evaluate ODRL policies.
- Combines with credentials: “a recycler with a valid permit may read res2”.

Spherity pushes for ODRL in the DPP policy engine.

07 · OUTLOOK

The target: one W3C stack from identity to policy.

Policy	ODRL
Identity & trust	VERIFIABLE CREDENTIALS · DIDS · EBW
Data & evidence	JSON-LD · RDF
Meaning & rules	SKOS · SHACL · OWL
Catalogue	DCAT

Cyan: in the EU DPP package today. **White**: the next layers to standardise.

08 · WHY W3C

Why W3C standards are the right foundation.

OPEN

Developed in public, with public review.

ROYALTY-FREE

The W3C Patent Policy makes Recommendations free to implement.

GLOBAL

Europe, the US and Asia-Pacific build on the same specifications.

MULTI-STAKEHOLDER

Industry, governments, research and civil society at one table.

> **No vendor owns the meaning of a product. That is exactly what a sovereign, global product data infrastructure needs.**

08 · WHAT TO DO NOW

Three moves for the next 12 months.

1 **Industry: publish DPPs as JSON-LD**
Use the EU contexts. It is one key, and it turns your passport into linked data.

2 **Standards bodies: align the EBW with W3C credentials**
So business wallets and product passports share one standards family.

3 **Policy makers: put ODRL into the DPP policy layer**
Machine-readable access and usage rules, as data spaces already use.

LET’S BUILD IT

From product passports to verifiable evidence graphs.

Spherity connects digital identity, verifiable credentials, business wallets and evidence graphs, so that companies, machines and AI agents can cooperate with explicit, provable authority.

Build Europe’s industrial digital core with us. Partner with Spherity →

SOURCES

Sources.

- European Commission, DG GROW: Digital Product Passport, Resources and documentation, single-market-economy.ec.europa.eu
- DPP Registry Semantic Data Guide v1.0, Semantic Data Artifacts, API Integration Guide v1.0, OpenAPI Specifications, Service Account Technical Integration Guide, Self-Hosted Authentication Guide (all 30 Oct 2026); User Guide for Economic Operators v3 (Sep 2026)
- Regulation (EU) 2024/1781 (ESPR) · Regulation (EU) 2023/1542 (batteries) · Implementing Regulation (EU) 2026/1778
- W3C: RDF, JSON-LD 1.1, SKOS, SHACL, SPARQL, OWL 2, XML Schema, DCAT, Verifiable Credentials Data Model 2.0, Data Integrity, RDF Dataset Canonicalization, DIDs, ODRL 2.2
- Data Spaces Support Centre (DSSC) building blocks · Eclipse Dataspace Protocol and Dataspace Components
- Stöcker, C. (2026). Verifiable, Access-Controlled Digital Product Passports. Spherity Research

Analysis and DPP1.0–DPP5.0 framing by Spherity. Not an official EU document.