On behalf of:

Umwelt Bundesamt

circular.fashion

CONTIQ

Technische Universität Berlin

Product Information 4.0

Technical pillars of a product information system such as the DPP

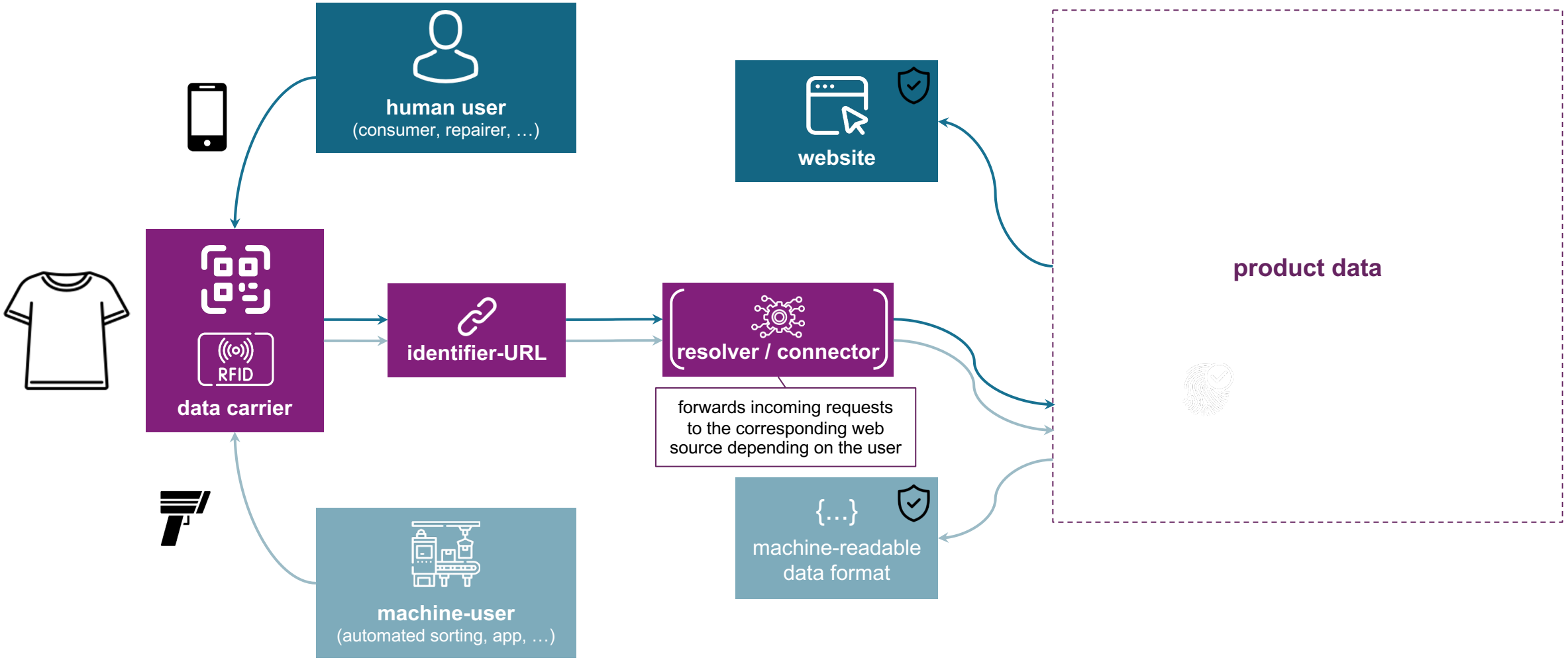
including access management, verification, product identification and data carriers

Diana Baumgärtel, circular.fashion

Umwelt Bundesamt

Product Information 4.0 System

Aspects of a Product Information System



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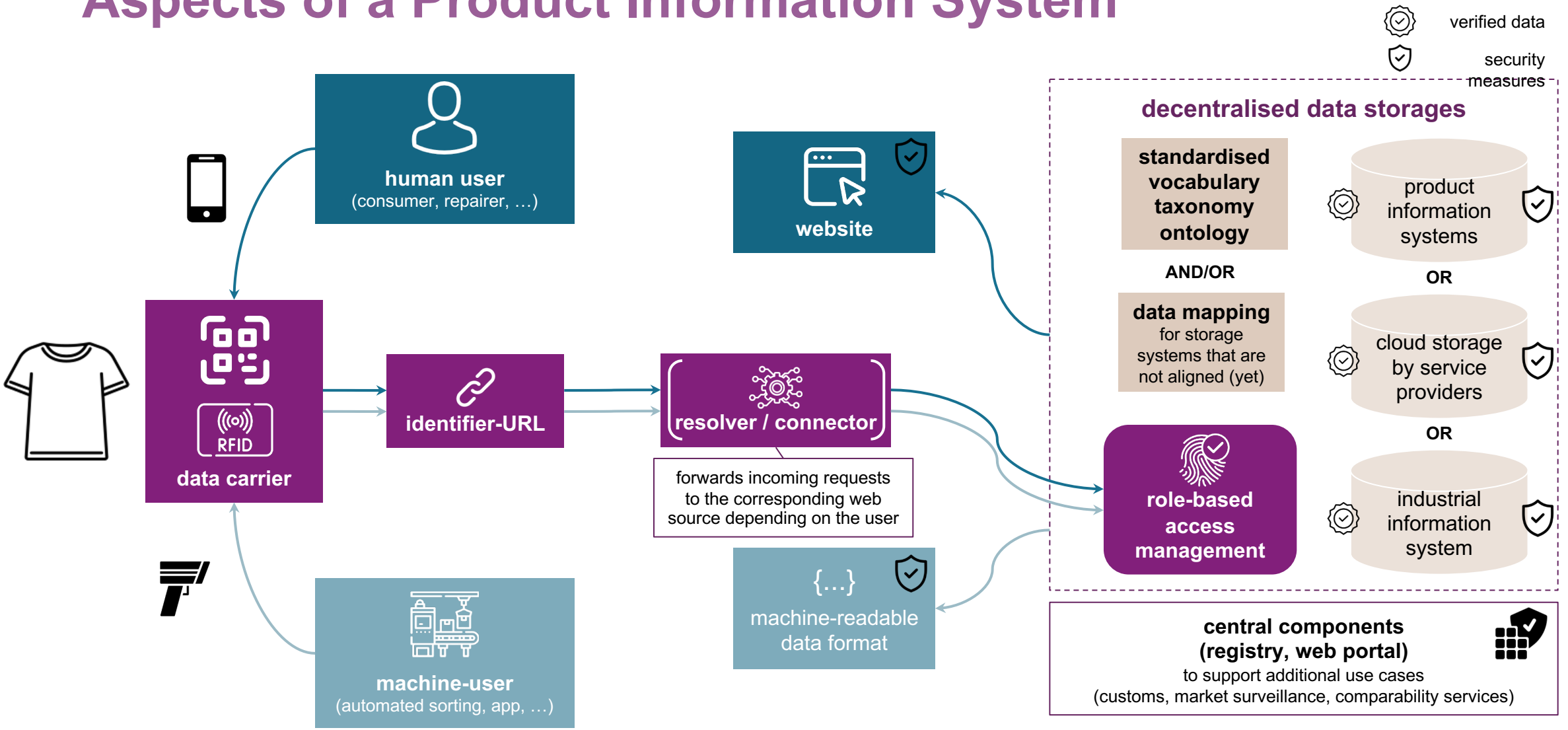
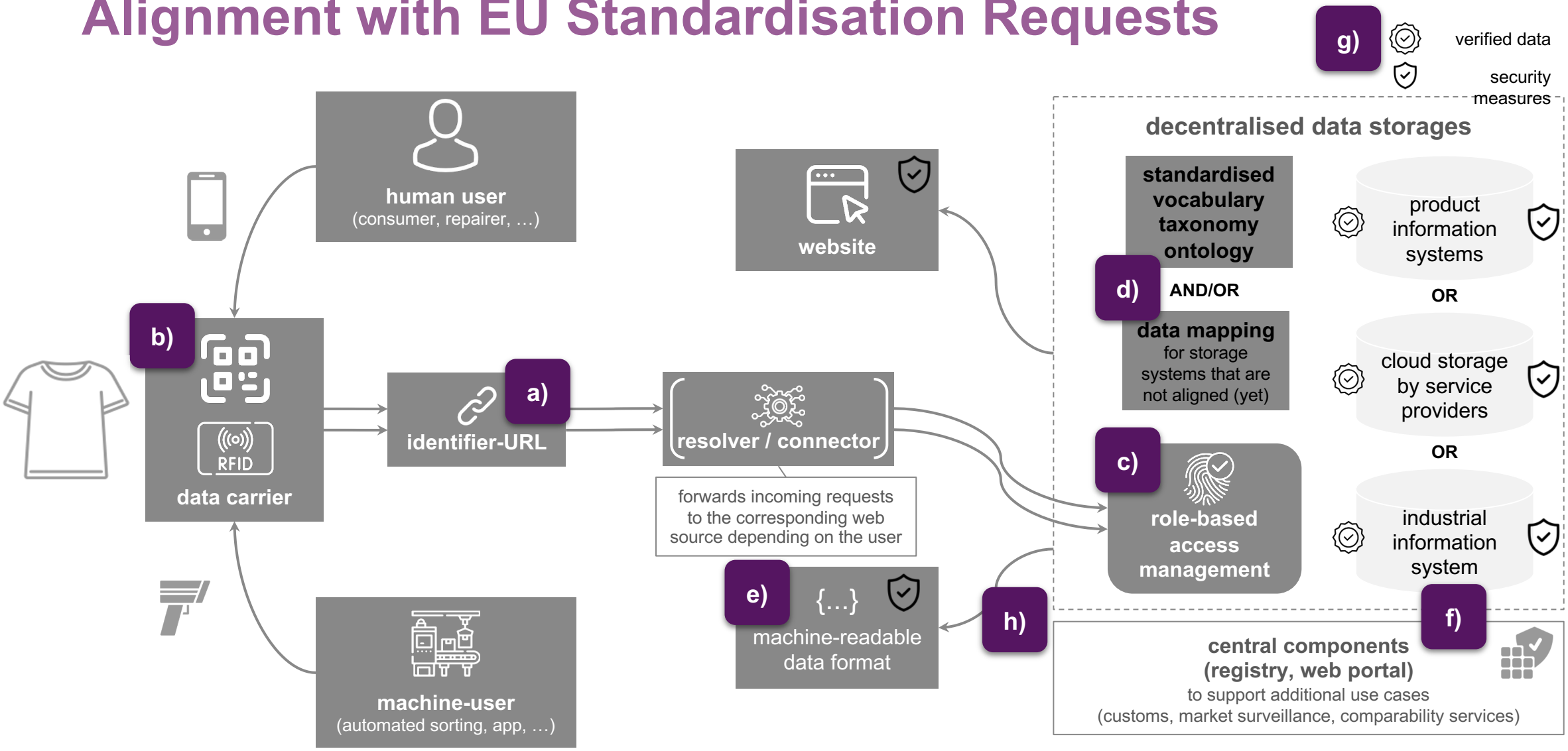


Product Information 4.0 System

Alignment with EU Standardisation Requests



Methodology

How to Compile & Provide Information for a Circular Economy

Initial Research for **Existing Technologies**	Analysis of **Information Systems**	**Stakeholder** Opinions	**Expert** Opinions
	5 systems	6 Workshops	Workshop; Expert Interviews

1. Vocabulary / Terminology
2. **Data Storage**
3. Data Exchange
4. Ownership and **Data Verification**
5. **Access management** and IP Protection
6. **Data Carriers**
7. **Product Identifiers**

Evaluation of circularity.ID, IMDS, KEEP, PCDS and RAMI 4.0

What We Can Learn From Existing Systems

	circularity.ID	RAMI 4.0	IMDS	KEEP Electronics	PCDS PRODUCT CIRCULARITY DATA SHEET LUXEMBOURG
sector	Fashion	Industrial Products	Automotive	Electronics	Cross-sectoral
market					
readiness	In use	Data model in use	In use	Demonstrator	Data model in use
vocabulary	c.ID Open Data Standard	Framework to embed several standards	Material Data Sheet	*Joint information standard*	PCDS Data Sheet
data storage	Single server *become decentralised service provider*	-	 Central	 *Decentralised*	 Decentralised
access management	Role-based sharing for consumers & sorters	-	Project-based or sharing on request (bi-directional communication)	*Role-based sharing + sharing on request*	Full insight for supply chain partners & brands
identifiers	GS1 identification schemes, tagID, Internal identification	Internal identification	Internal identification	Internal identification	GTIN, internal identification
data carriers	RFID, NFC, QR	Different options	-	Barcode, QR code	-

current state
future plans

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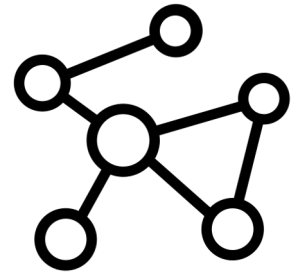
Data Storage

Why Experts Advocate for a Decentralised Solution

It may be challenging to implement a central system and force industry players to adopt it.
Many stakeholders prefer to retain control over their data.

Storing data in decentralized storages mitigates the risk of a single point of failure, thereby **reducing the likelihood of security breaches**.



A decentralized system enables data owners to **keep current systems in use**. This also supports SME data storage service providers.

The advantages of a central system, such as facilitating customs and market surveillance, can likely be achieved through a **complementary central server**.

Validation, Verification, Integrity Control

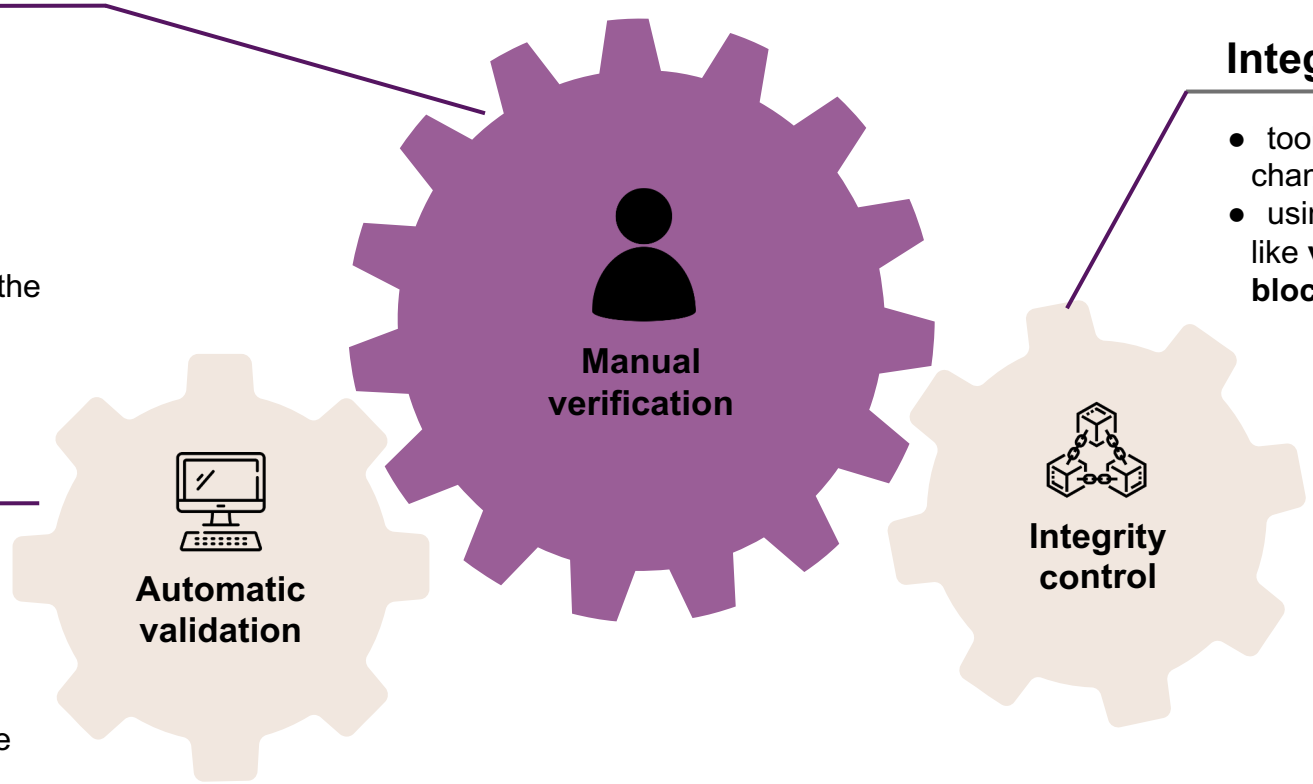
Ensure Accuracy of Data Stored

Verification | manual

- tool to ensure data quality (accuracy)
- can be performed
  - **internally** by the data owner
  - externally through a **third-party auditing process**
  - through **certification**
- either data can be audited directly, or the processes used to gather the data

Validation | automated

- tool to avoid small errors and have a good basis for verification
- can check for
  - data **availability**,
  - **reasonability**,
  - **data format usability** with software
- cannot check for accuracy



Integrity control | automated

- tool to make sure data is not changed after adding it to the system
- using unchangeable data methods like **versioned databases** or **blockchain** technology

Access Management

Need-to-Know-Principle to Define Legitimate Data Users

1 Define user profiles and information requirements

- Publicly accessible subset of the data
- Need-to-know principle
- Further methods to protect IP such as sharing aggregated data or levels of information depth

	Publicly accessible	**Shared with specific stakeholders**
Mandatory	• shared openly	• role-based access management (*need-to-know principle)*
Optional	• shared openly if desired • shared on request if desired	• role-based access management (*optional sharing)* • need for bilateral communication channels

2 Use available technologies to secure the system and exchange channels, e.g.

- encryption, hashing or digital signatures for basic system security
- multi-factor authentication and single-sign-on methods for authentication

Access Management

Mandatory and Optional Data

 # mandatory data:

product identifier type: GTIN
product identifier: 012345678901
product type: scarf
colours: white
brand: brand x
material composition: [80% wool, 20% cotton]
…

 # optional data:

certifications: GOTS, Fairtrade
production country: Spain
pattern: unicolour
market segment: premium
…

data field: value
This example uses fictional data.

Data Carriers

Data Carrier Requirements | Definition per Product Group

General

- **durability**
- **process time**
- **storage capacity**
- **readability**
- **implementation guidelines**
- **privacy protection**
- **environmental impact**

+ digital data carriers for e-commerce

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Textile

- support **reuse and recycling**
- **water, heat and pressure resistance**
- **design and comfort** requirements
- **metals** can disrupt textile recycling
- support **efficient** sorting processes

Electronics

- support **reuse and recycling**
- main sustainability levers: **purchasing decisions, reuse, repair**
- **design and functionality** demands
- including **electronic tags and metals** doesn't add challenges

+ digital data carriers for e-commerce

Data Carriers

Technologies in Textile and Electronics

	Textiles	Energy related products / Electronics
Purchasing Decisions		
Use Phase (e.g. repair)		
Reverse Supply Chain (e.g. sorting, recycling)	 *if in standardised visible location*	

 **variety of data carriers difficult**

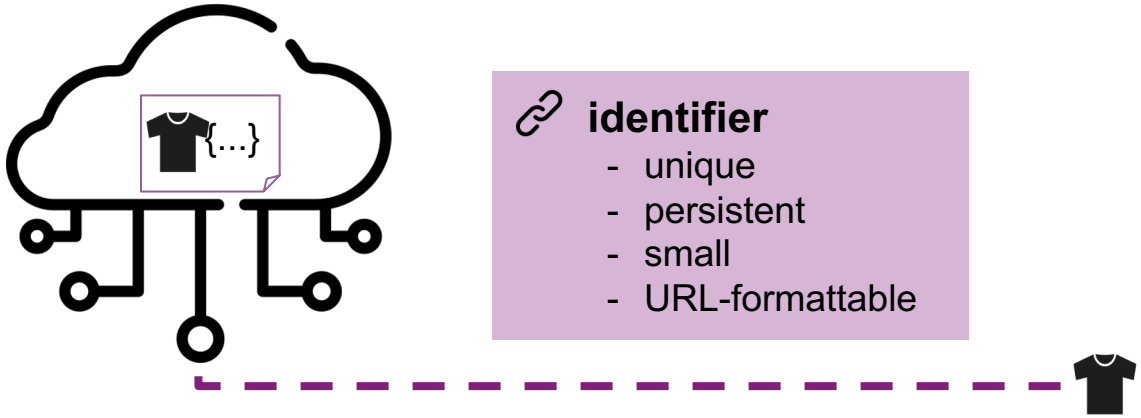
 Optical 2D Codes (QR, DataMatrix etc.)

 NFC (RFID HF)

 RAIN RFID (RFID UHF)

Identifiers

Link the Physical Product to the Information



identifier

- unique
- persistent
- small
- URL-formattable

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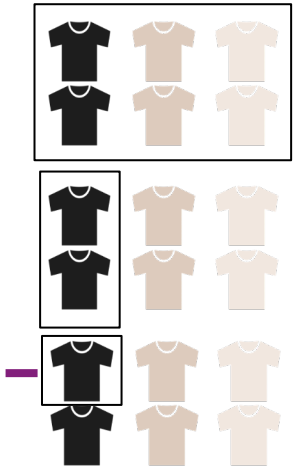

Model

Commercial data
(e.g brand / product description)

Variation

Static upstream data
(e.g. material composition)

Item

Dynamic data
for recommerce, rental etc.

SERIALIZED (ITEM-LEVEL) IDENTIFIERS ENABLE CIRCULAR BUSINESS MODELS

take-back | online resale | repair history tracking | rental

Summary | Technical Aspects

Details Will Be Published in the Final Report

Standards

- Standardisation of product information systems is desirable and recommended.
- Development process should be consensus-driven, including a strong community representing relevant stakeholders.

Vocabulary, Ontology, Taxonomy

→ Should be based on aligned and harmonised existing standards

Data Storage

- Experts advocate for a decentralised solution
- Central registry is an option for additional use cases

Data Exchange

Solution for global interoperability between systems missing

- ~~Central system~~
- ~~Single data standard~~
- Map data between all data standards

Access Management and IP Protection

- Technical solutions available and recommended for data security, authentication and authorisation
- Need-to-know principle to develop an appropriate access management

Identifiers and Data Carriers

- Identifiers can be standardised to a single or multiple solutions
- Different levels of identification granularity possible
- For data carriers, a harmonised solution would be beneficial

Ownership, Liability and Data Verification

- Data verification should be accompanied by digital solutions for data validation and integrity checks
- Financial incentives, penalties and legal sanctions can help motivate companies to improve data quality

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extension of legal information requirements for products and digital implementation by the example of energy-related products and textiles

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