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Semantics for Implementing Data Reuse and Altruism under EU's Data Governance Act

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- Motivation & Challenges
- Information Flows in the Data Governance Act
- Related Work
 - Expressing Policies
 - Data Protection Vocabularies
- Extending W3C vocabularies to cover DGA requirements
 - Reusing Public Data
 - Registers of Data Intermediaries
 - Data Altruism
- Conclusions and Future Work

Semantics for Implementing Data Reuse and Altruism under EU's Data Governance Act

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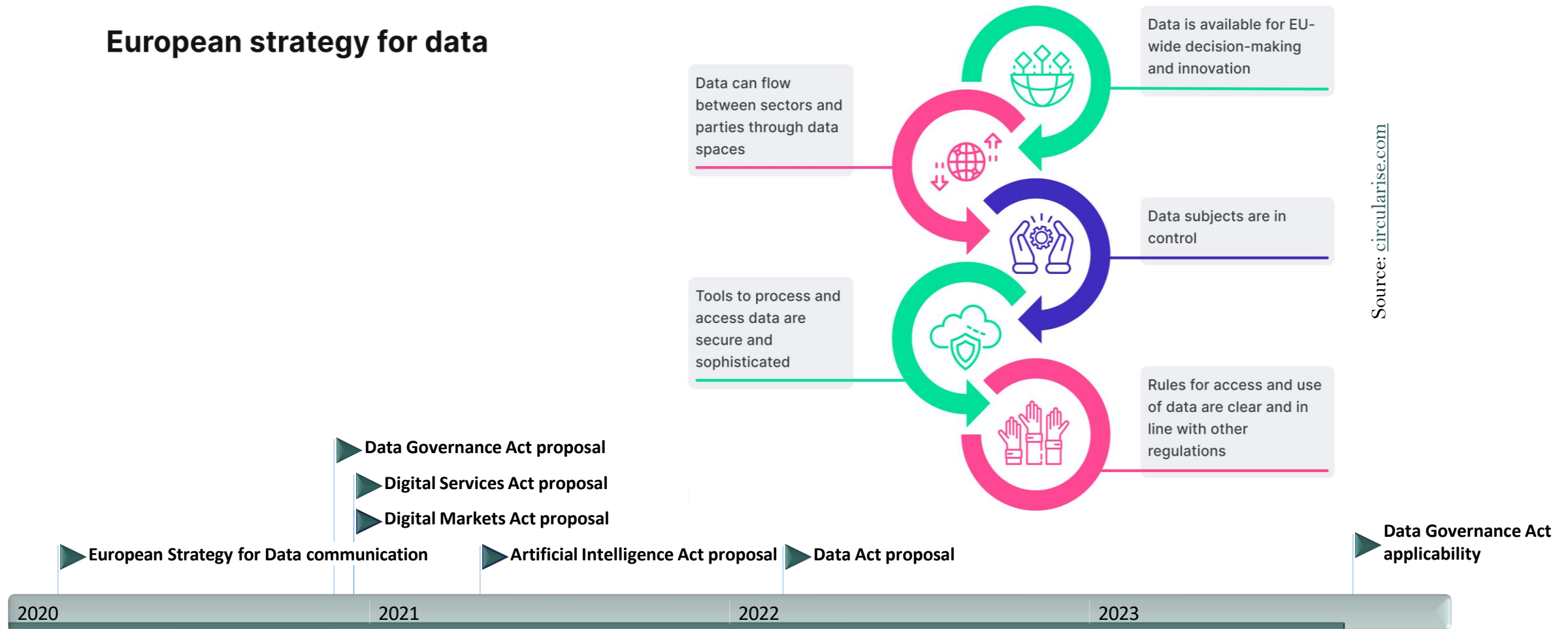
^c *ADAPT Centre, Trinity College Dublin, Ireland*

Abstract. *Purpose:* Following the impact of the GDPR on the regulation of the use of personal data of European citizens, the European Commission is now focused on implementing a common data strategy to promote the (re)use and sharing of data between citizens, companies and governments while maintaining it under the control of the entities that generated it. In this context, the Data Governance Act (DGA) emphasizes the altruistic reuse of data and the emergence of data intermediaries as trusted entities that do not have an interest in analysing the data itself and act only as enablers of the sharing of data between data holders and data users. *Methodology:* In order to address DGA's new requirements, this work investigates how to apply existing Semantic Web vocabularies to (1) generate machine-readable policies for the reuse of public data, (2) specify data altruism consent terms and (3) create uniform registers of data altruism organisations and intermediation services' providers. *Findings:* In addition to promoting machine-readability and interoperability, the use of the identified semantic vocabularies eases the modelling of data-sharing policies and consent forms across different use cases and provides a common semantic model to keep a public register of data intermediaries and altruism organisations, as well as records of their activities. Since these vocabularies are openly accessible and easily extendable, the modelling of new terms that cater to DGA-specific requirements is also facilitated. *Value:* The main results are an ad-hoc vocabulary with the new terms and examples of usage, which are available at <https://w3id.org/dgaterms>. In future research, this work can be used to automate the generation of documentation for the new DGA data-sharing entities and be extended to deal with requirements from other data-related regulations.

Keywords. Data Governance Act, Semantic Web, Machine-readable policies, Data intermediaries, Data altruism, Registers of Activities



European strategy for data



Motivation



Sharing data for altruistic purposes



Data Holder

- Government
- Individuals
- Business



Data User

- Business
- Research



European Data Spaces

- | | | |
|---------------|-----------------------|--------------------|
| Manufacturing | Finance | Agriculture |
| Green Deal | Health | Open Science Cloud |
| Mobility | Public administration | Energy |
| | | Skills |

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REGULATION (EU) 2022/868 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2022

on European data governance and amending Regulation (EU) 2018/1724 (Data Governance Act)

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 114 thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee ⁽¹⁾,

After consulting the Committee of the Regions,

Acting in accordance with the ordinary legislative procedure ⁽²⁾,

Whereas:

- (1) The Treaty on the Functioning of the European Union (TFEU) provides for the establishment of an internal market and the institution of a system ensuring that competition in the internal market is not distorted. The establishment of common rules and practices in the Member States relating to the development of a framework for data governance should contribute to the achievement of those objectives, while fully respecting fundamental rights. It should also guarantee the strengthening of the open strategic autonomy of the Union while fostering international free flow of data.
- (2) Over the last decade, digital technologies have transformed the economy and society, affecting all sectors of activity and daily life. Data is at the centre of that transformation: data-driven innovation will bring enormous benefits to both Union citizens and the economy, for example by improving and personalising medicine, providing new mobility, and contributing to the communication of the Commission of 11 December 2019 on the European Green Deal. In order to make the data-driven economy inclusive for all Union citizens, particular attention must be paid to reducing the digital divide, boosting the participation of women in the data economy and fostering cutting-edge European expertise in the technology sector. The data

Challenges on alignment with legal requirements



“This Regulation lays down: (a) conditions for the re-use [...] of certain categories of data [...]; (b) a [...] framework for the provision of data intermediation services; (c) a framework for voluntary registration of entities which collect and process data made available for altruistic purposes”

REGULATION (EU) 2022/868 (Data Governance Act) [[Source](#)]



EU Recognised
Data Intermediary



EU Recognised
Data Altruism
Organisation

Challenges

Availability / Discovery of datasets

Establishment of conditions for usage and access to data

Production of Documentation



Gaps

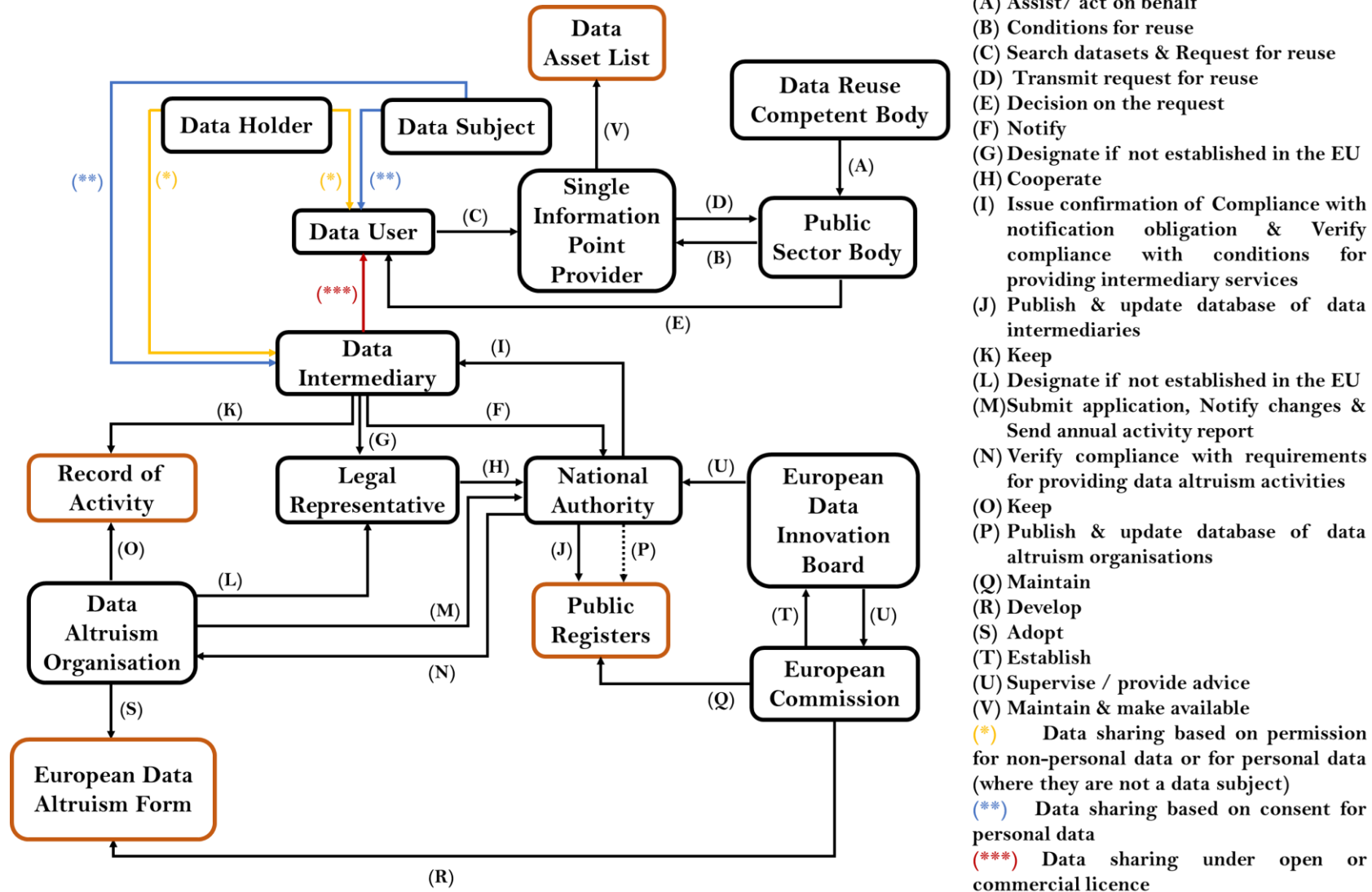
Identify stakeholders & information flows between them

Model data-sharing policies and consent terms

Generate registries of altruistic and data intermediary activities

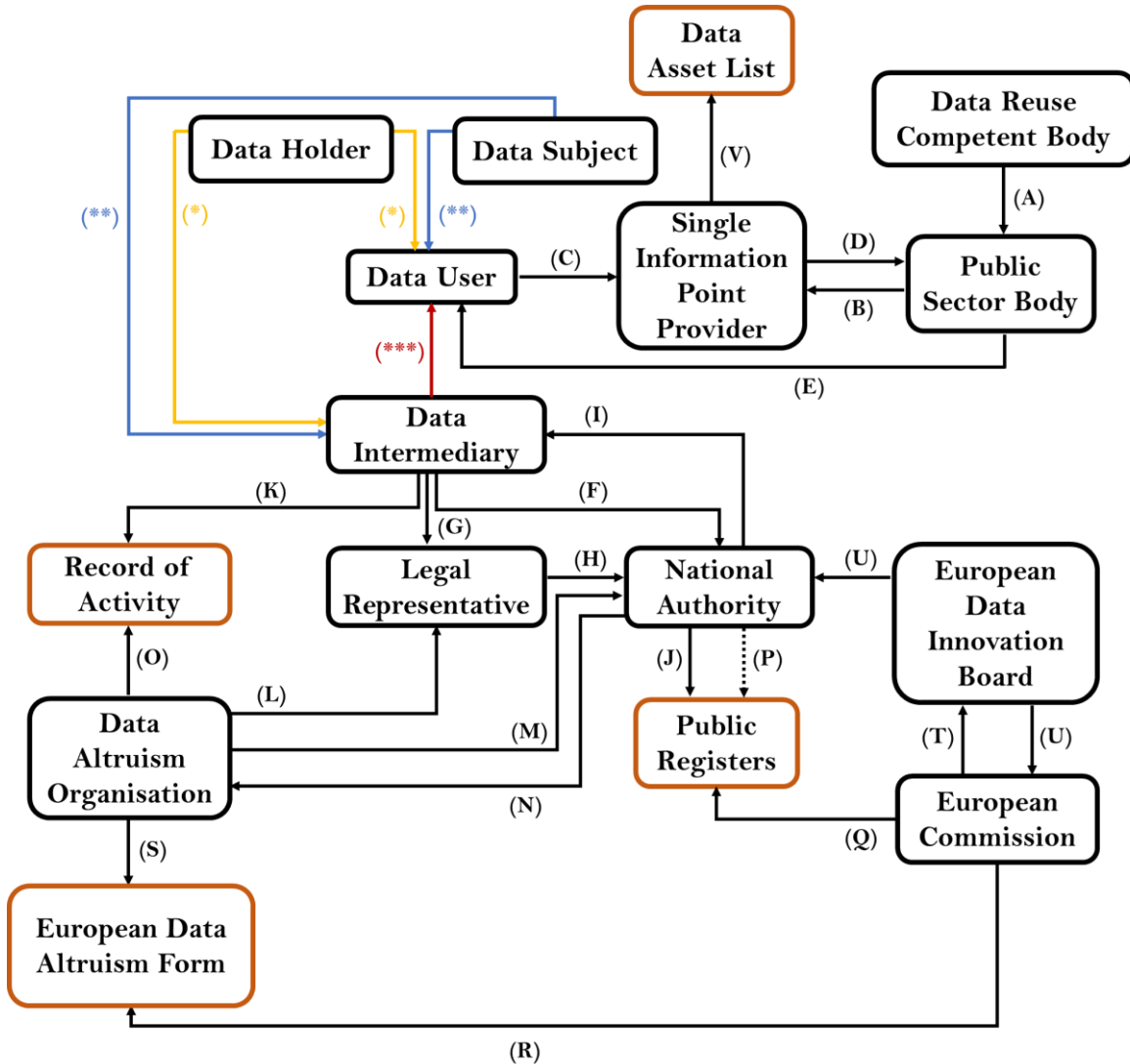


Information Flows in the Data Governance Act





Information Flows in the Data Governance Act



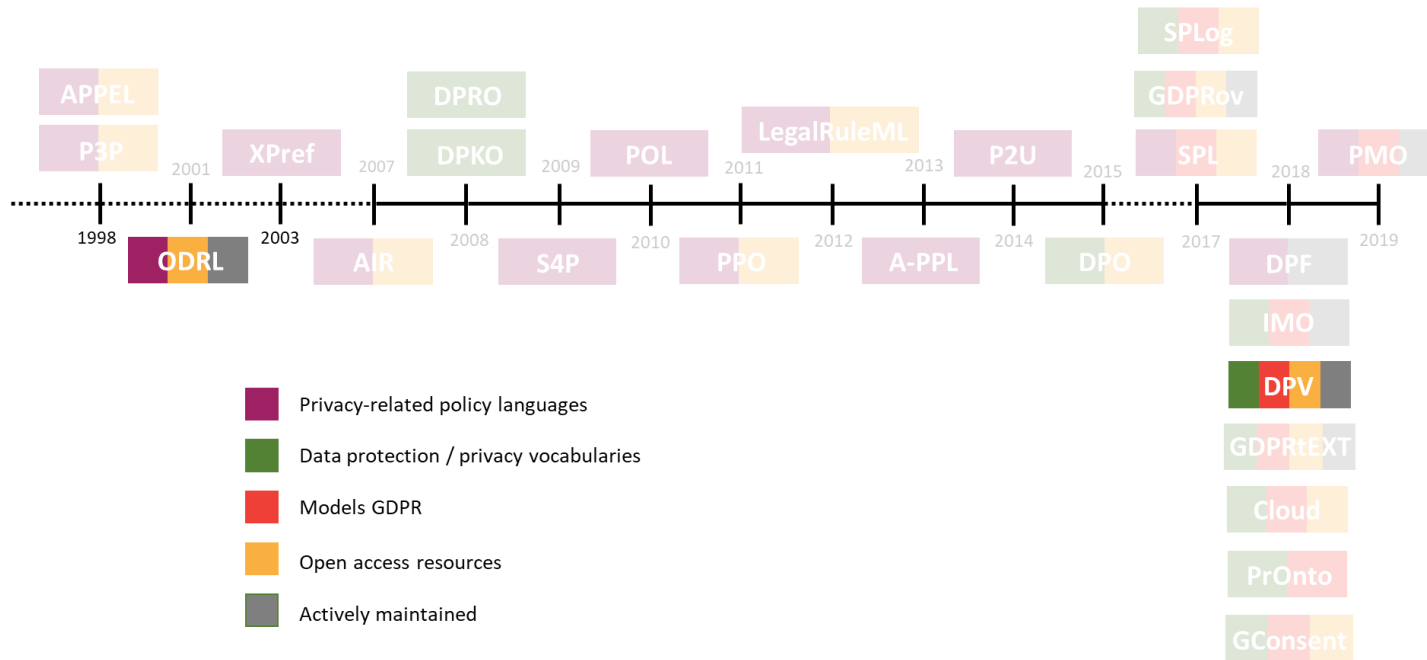
Use Cases

UC1. Conditions for the Reuse of Public Data

UC2. Registers of Altruistic and Intermediation Activities

UC3. Allowing Data Altruism

Related Work

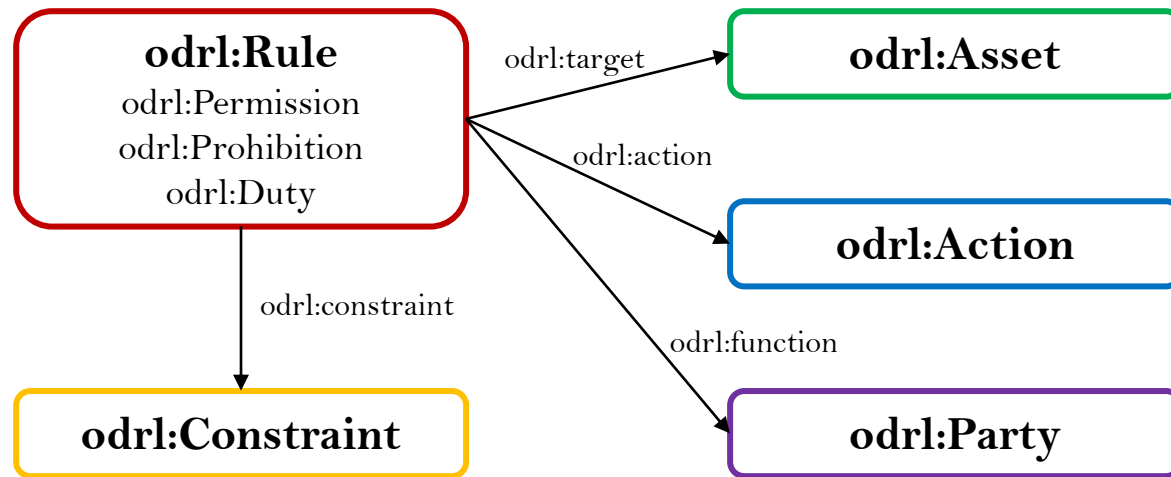


W3C Recommendation to represent “Policies that express Permissions, Prohibitions and Duties related to the usage of Asset resources”
<https://www.w3.org/TR/odrl-model/>

W3C Community Group Report to express “machine-readable metadata about the use and processing of personal data based on legislative requirements such as the GDPR”
<https://w3id.org/dpv>

Esteves, B. and Rodríguez-Doncel, V., “Analysis of Ontologies and Policy Languages to Represent Information Flows in GDPR”. *Semantic Web Journal*, vol. 2022.
<https://content.iospress.com/articles/semantic-web/sw223009>

Open Digital Rights Language (ODRL)

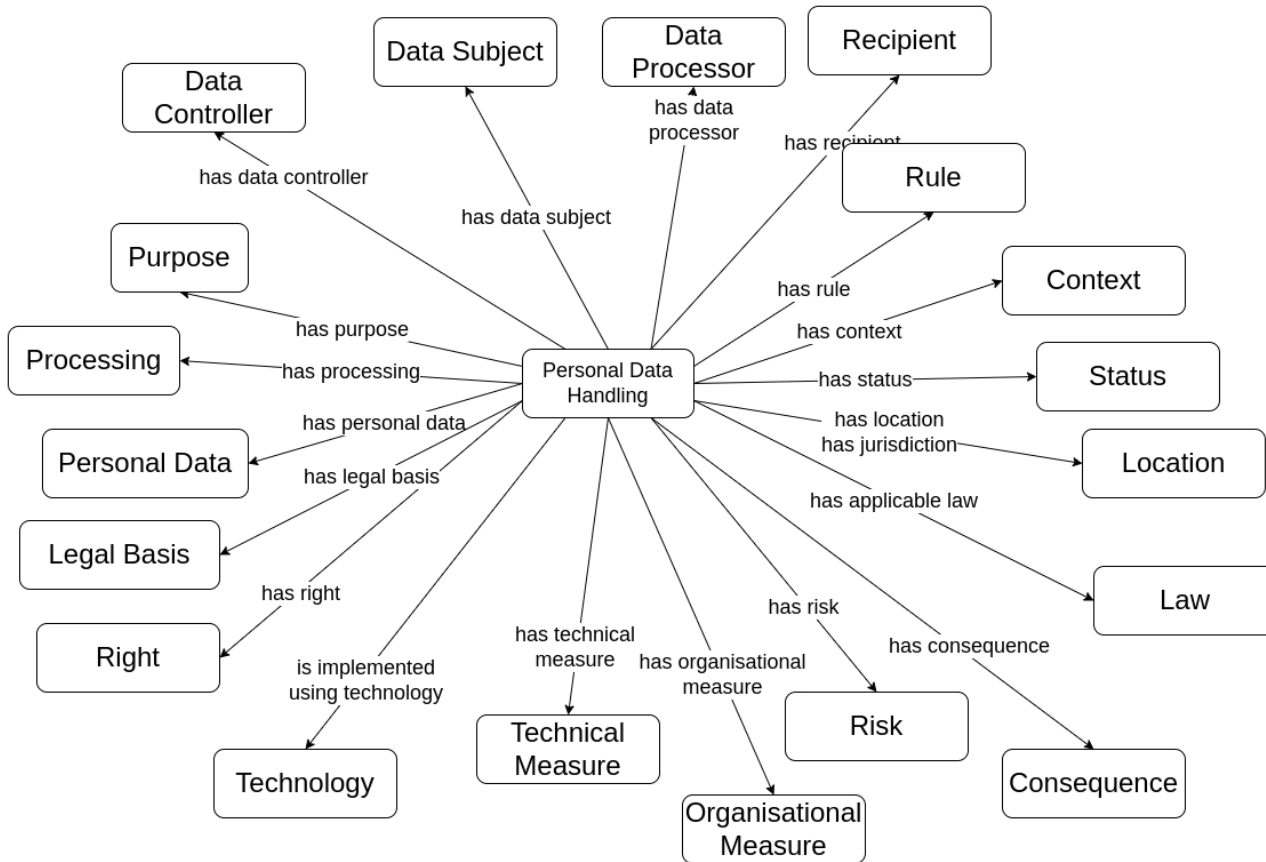


Who [can | cannot | must] act what
in which resource how

Target asset may be distributed until 2024-01-01

```
<#policy1> a odrl:Offer ;  
odrl:permission [  
  odrl:assigner <http://example.com/org:43>;  
  odrl:target <http://example.com/document:44>;  
  odrl:action odrl:distribute;  
  odrl:constraint [  
    odrl:leftOperand odrl:dateTime;  
    odrl:operator odrl:lt;  
    odrl:rightOperand "2024-01-01"^^xsd:date  
  ]  
].
```

Data Privacy Vocabulary (DPV)



- [Primer for Data Privacy Vocabulary](#): An introductory document for DPV's concepts and taxonomies.
- Extensions to Concepts:
 - [DPV-GDPR]: for GDPR concepts; serialisations: [DPV-SKOS-GDPR], [DPV-OWL-GDPR]
 - [DPV-PD] for Personal Data concepts; serialisations: [DPV-SKOS-PD], [DPV-OWL-PD]
 - [DPV-LEGAL] for Jurisdiction-relevant concepts; serialisations: [DPV-SKOS-LEGAL], [DPV-OWL-LEGAL]
 - [DPV-TECH] for Technology concepts; serialisations: [DPV-SKOS-TECH], [DPV-OWL-TECH]
 - [RISK] for Risk Assessment and Management concepts; serialisations: [RISK-SKOS], [RISK-OWL]
- [Guidelines for Adoption and Use of DPV](#):
 - [Guide on DPV's serialisations and semantics](#) (coming soon)
 - [Guide for using DPV with RDFS and SKOS](#) (coming soon)
 - [Guide for using DPV in OWL2](#)
 - [Guide for Privacy Notices using DPV](#) (coming soon)
 - [Guide for Consent Records using DPV](#) (being updated for v1)
 - [Guide for GDPR DPIA's using DPV](#) (being updated for v1)
 - [Guide for GDPR ROPA's using DPV](#) (being updated for v1)
- Other Resources:
 - [DPV Use-Cases and Requirements](#)
 - [DPV Examples](#)
 - [NACE Taxonomy serialised in RDFS](#)
 - [Extension providing EU Rights](#) serialisations: [RIGHTS-EU-SKOS], [RIGHTS-EU-OWL]

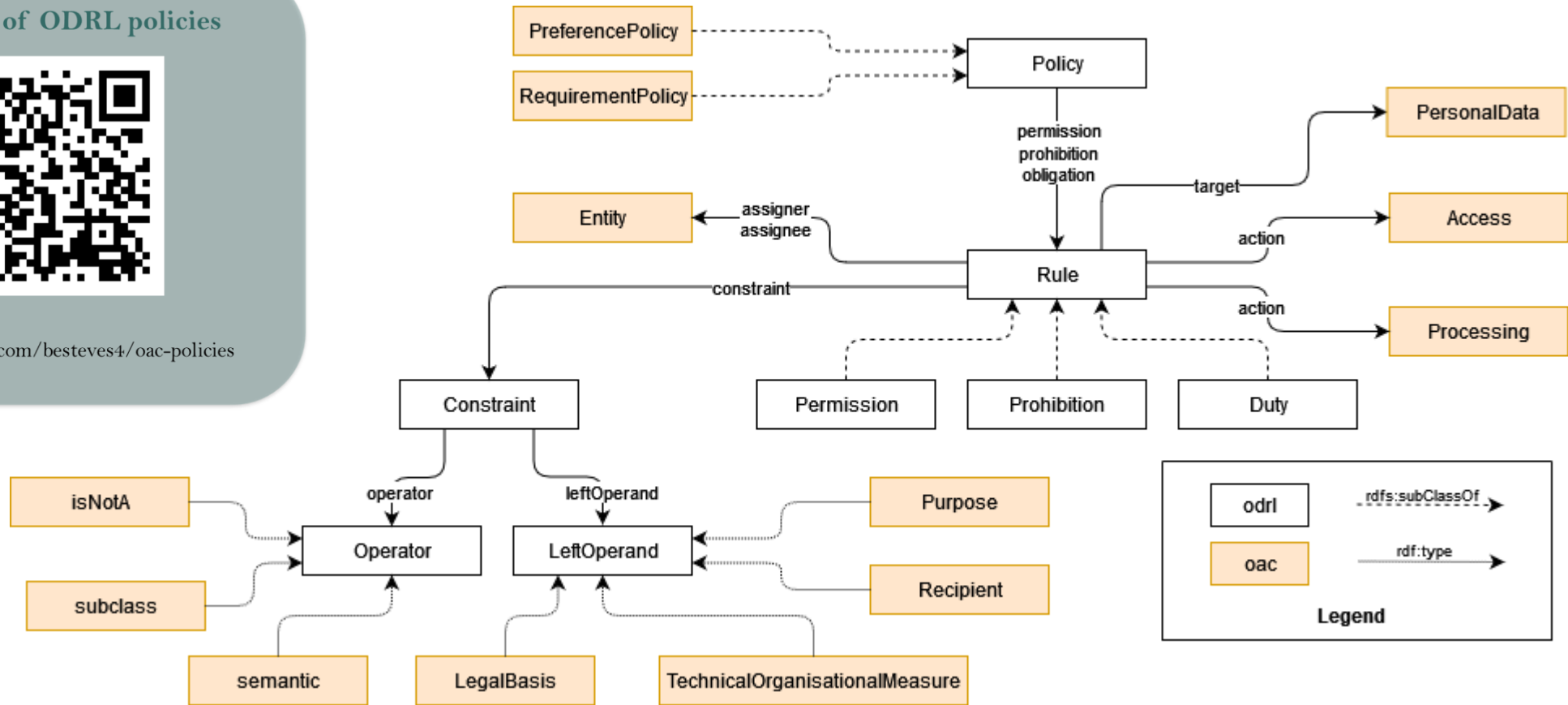


ODRL profile for Access Control (OAC)

Collection of ODRL policies



<https://github.com/besteves4/oac-policies>

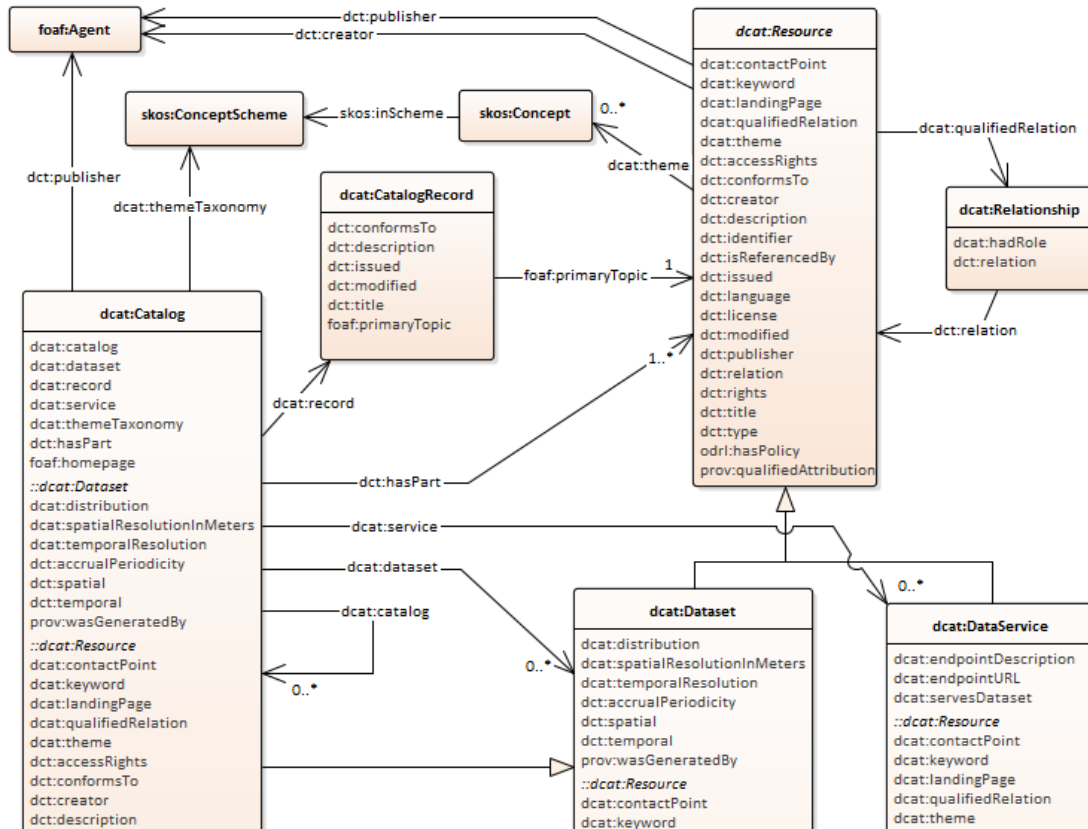


<https://w3id.org/oac>



Other metadata vocabularies

Data Catalog Vocabulary (DCAT)



DCMI Metadata Terms (DCT)

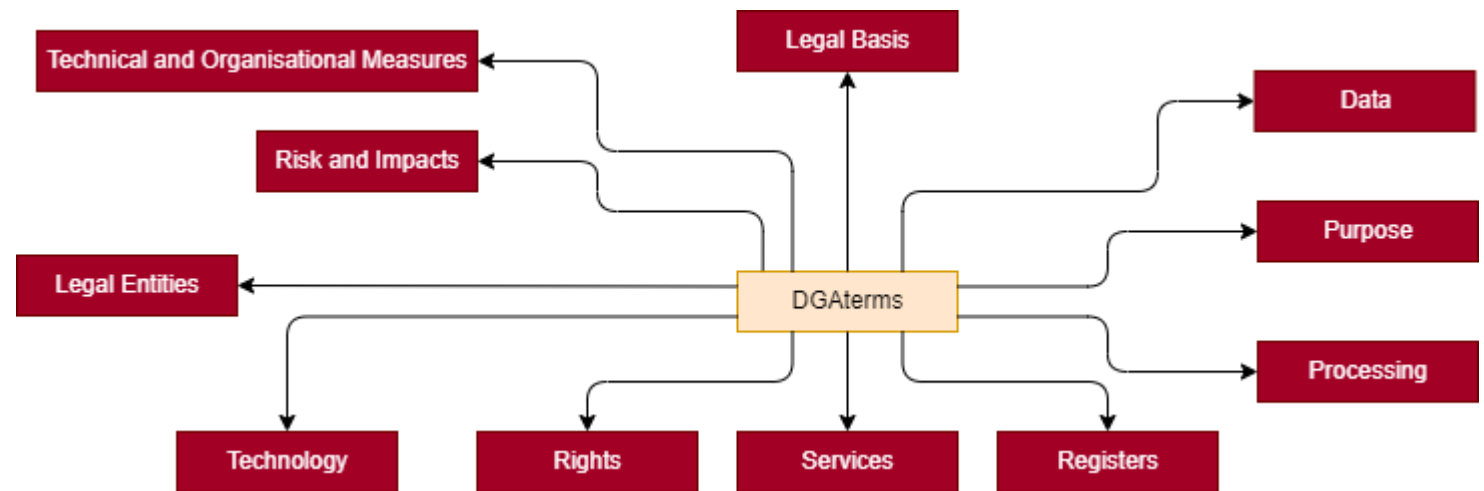
Properties in the /terms/ namespace:	abstract , accessRights , accrualMethod , accrualPeriodicity , accrualPolicy , alternative , audience , available , bibliographicCitation , conformsTo , contributor , coverage , created , creator , date , dateAccepted , dateCopyrighted , dateSubmitted , description , educationLevel , extent , format , hasFormat , hasPart , hasVersion , identifier , instructionalMethod , isFormatOf , isPartOf , isReferencedBy , isReplacedBy , isRequiredBy , issued , isVersionOf , language , license , mediator , medium , modified , provenance , publisher , references , relation , replaces , requires , rights , rightsHolder , source , spatial , subject , tableOfContents , temporal , title , type , valid
Properties in the /elements/1.1/ namespace:	contributor , coverage , creator , date , description , format , identifier , language , publisher , relation , rights , source , subject , title , type
Vocabulary Encoding Schemes:	DCMIType , DDC , IMI , LCC , LCSH , MESH , NLM , TGN , UDC
Syntax Encoding Schemes:	Box , ISO3166 , ISO639-2 , ISO639-3 , Period , Point , RFC1766 , RFC3066 , RFC4646 , RFC5646 , URI , W3CDTF
Classes:	Agent , AgentClass , BibliographicResource , FileFormat , Frequency , Jurisdiction , LicenseDocument , LinguisticSystem , Location , LocationPeriodOrJurisdiction , MediaType , MediaTypeOrExtent , MethodOfAccrual , MethodOfInstruction , PeriodOfTime , PhysicalMedium , PhysicalResource , Policy , ProvenanceStatement , RightsStatement , SizeOrDuration , Standard
DCMI Type Vocabulary:	Collection , Dataset , Event , Image , InteractiveResource , MovingImage , PhysicalObject , Service , Software , Sound , StillImage , Text

Extending W3C vocabularies to cover DGA requirements



<https://w3id.org/dgaterms>

DGAterms - A vocabulary to describe information flows in the Data Governance Act



Reusing Public Data



```
1 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
2 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
3 PREFIX dcat: <http://www.w3.org/ns/dcat#>
4 PREFIX dct: <http://purl.org/dc/terms/>
5 PREFIX odrl: <http://www.w3.org/ns/odrl/2/>
6 PREFIX dpv: <https://w3id.org/dpv#>
7 PREFIX dpv-pd: <https://w3id.org/dpv/dpv-pd#>
8 PREFIX dpv-gdpr: <https://w3id.org/dpv/dpv-gdpr#>
9 PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
10 PREFIX ex: <https://example.com/>
11 PREFIX : <https://w3id.org/dgaterms#>
12
13 ex:policy_001 a odrl:Offer, :DataReusePolicy ;
14   odrl:permission [
15     odrl:target ex:dataset_001 ; odrl:action :Reuse ;
16     odrl:assigner ex:publicsectorbodyX ;
17     odrl:constraint [
18       odrl:and [
19         odrl:leftOperand odrl:dateTime ;
20         odrl:operator odrl:lteq ;
21         odrl:rightOperand "2023-12-31"^^xsd:date ], [
22         odrl:leftOperand odrl:purpose ;
23         odrl:operator odrl:isA ;
24         odrl:rightOperand :ScientificResearch ] ] ] .
25 ex:publicsectorbodyX a :PublicSectorBody ;
26   dpv:hasName "Public Sector Body X" ;
27   dpv:hasContact "mailto:publicsectorbodyX@email.com" ;
28   :hasCompetentBody [
29     a :DataReuseCompetentBody ; dpv:hasName "Competent Body X" ;
30     dpv:hasContact "mailto:competentbodyX@email.com" ] .
```

Reusing Public Data



```
1 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
2 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
3 PREFIX dcat: <http://www.w3.org/ns/dcat#>
4 PREFIX dct: <http://purl.org/dc/terms/>
5 PREFIX odrl: <http://www.w3.org/ns/odrl/2/>
6 PREFIX dpv: <https://w3id.org/dpv#>
7 PREFIX dpv-pd: <https://w3id.org/dpv/dpv-pd#>
8 PREFIX dpv-gdpr: <https://w3id.org/dpv/dpv-gdpr#>
9 PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
10 PREFIX ex: <https://example.com/>
11 PREFIX : <https://w3id.org/dgaterms#>
12
13 ex:policy_001 a odrl:Offer, :DataReusePolicy ;
14   odrl:permission [
15     odrl:target ex:dataset_001 ; odrl:action :Reuse ;
16     odrl:assigner ex:publicsectorbodyX ;
17     odrl:constraint [
18       odrl:and [
19         odrl:leftOperand odrl:dateTime ;
20         odrl:operator odrl:lteq ;
21         odrl:rightOperand "2023-12-31"^^xsd:date ], [
22         odrl:leftOperand odrl:purpose ;
23         odrl:operator odrl:isA ;
24         odrl:rightOperand :ScientificResearch ] ] ] .
25 ex:publicsectorbodyX a :PublicSectorBody ;
26   dpv:hasName "Public Sector Body X" ;
27   dpv:hasContact "mailto:publicsectorbodyX@email.com" ;
28   :hasCompetentBody [
29     a :DataReuseCompetentBody ; dpv:hasName "Competent Body X" ;
30     dpv:hasContact "mailto:competentbodyX@email.com" ] .
```

```
1 ex:SIPPA_assets a :DataAssetList, dcat:Catalog ;
2   dct:description "Asset list maintained by SIPPA" ;
3   dct:created "2022-12-10"^^xsd:date ;
4   dct:publisher ex:SIPPA ; dcat:dataset ex:dataset_001 .
5 ex:SIPPA a :SingleInformationPointProvider .
6 ex:dataset_001 a dcat:Dataset ; dct:publisher ex:publicsectorbodyX ;
7   dpv:hasData :StatisticallyConfidentialData ;
8   dct:description "Dataset with statistically confidential data" ;
9   dct:created "2022-12-04"^^xsd:date ;
10  odrl:hasPolicy ex:policy_001 ; :hasFee "0€"^^xsd:string ;
11  dcat:mediaType <iana.org/assignments/media-types/text/csv> ;
12  dct:extent "5.6MB"^^xsd:string .
```

Registers of Data Intermediaries



```
1 ex:publicregistry_DI_PT a :RegisterOfDataIntermediationServiceProviders ;
2   dct:description "Public register of intermediaries working in PT" ;
3   dct:created "2023-12-15"^^xsd:date ;
4   dct:modified "2023-12-23"^^xsd:date ;
5   dct:publisher ex:nationalauthority_PT ;
6   :hasDataIntermediationServiceProvider ex:DISP_Y .
7 ex:nationalauthority_PT a :DataIntermediationAuthority ;
8   dpv:hasName "Data Intermediation Authority of Portugal" ;
9   dpv:hasContact "mailto:nationalauthority_PT@email.com" ;
10  dpv:hasJurisdiction "PT" .
11 ex:DISP_Y a :DataCooperative ;
12  dpv:hasName "Data Cooperative Y" ; dpv:hasAddress "Lisboa, Portugal" ;
13  dct:description "Provider of anonymised geolocation data" ;
14  dcat:landingPage <http://cooperativeA.com/> ;
15  dct:date "2023-12-23"^^xsd:date .
```


Registers of Data Intermediaries



```
1 ex:publicregistry_DI_PT a :RegisterOfDataIntermediationServiceProviders ;
2   dct:description "Public register of intermediaries working in PT" ;
3   dct:created "2023-12-15"^^xsd:date ;
4   dct:modified "2023-12-23"^^xsd:date ;
5   dct:publisher ex:nationalauthority_PT ;
6   :hasDataIntermediationServiceProvider ex:DISP_Y .
7 ex:nationalauthority_PT a :DataIntermediationAuthority ;
8   dpv:hasName "Data Intermediation Authority of Portugal" ;
9   dpv:hasContact "mailto:nationalauthority_PT@email.com" ;
10  dpv:hasJurisdiction "PT" .
11 ex:DISP_Y a :DataCooperative ;
12  dpv:hasName "Data Cooperative Y" ; dpv:hasAddress "Lisboa, Portugal" ;
13  dct:description "Provider of anonymised geolocation data" ;
14  dcat:landingPage <http://cooperativeA.com/> ;
15  dct:date "2023-12-23"^^xsd:date .
```

```
1 ex:altruism_logs a :RegisterOfDataAltruismActivity ;
2   dct:description "Activity logs of the Data Altruism Organisation A" ;
3   dct:created "2023-11-04"^^xsd:date ;
4   dct:modified "2023-11-13"^^xsd:date ;
5   dct:publisher ex:altruism_A ; dcat:record ex:log_001 .
6 ex:altruism_A a :DataAltruismOrganisation ;
7   dpv:hasName "Data Altruism Organisation A" ;
8   dpv:hasAddress "Lisboa, Portugal" ;
9   dcat:landingPage <http://example.com/altruism_A> .
10 ex:log_001 a dcat:CatalogRecord ;
11  dct:created "2023-11-13"^^xsd:date ;
12  :hasDataUser ex:userZ ; :hasFee "1000€"^^xsd:string ;
13  dpv:hasPersonalDataHandling [
14    dct:description "Download and reuse anonymised health records to
15      ↪ improve healthcare" ;
16    dpv:hasProcessing :Download, :Reuse ; dpv:hasDuration 6226453 ;
17    dpv:hasPurpose :DataAltruism, :ImproveHealthcare ;
18    dpv:hasPersonalData dpv-pd:HealthRecord ;
19    dpv:hasTechnicalMeasure dpv:Anonymisation ] .
20 ex:userZ a :DataUser ; dpv:hasName "Data User Z" ;
21  dpv:hasContact "mailto:user_z@email.com" .
```

Registers of Data Intermediaries



```
1 ex:publicregistry_DI_PT a :RegisterOfDataIntermediationServiceProviders ;
2   dct:description "Public register of intermediaries working in PT" ;
3   dct:created "2023-12-15"^^xsd:date ;
4   dct:modified "2023-12-23"^^xsd:date ;
5   dct:publisher ex:nationalauthority_PT ;
6   :hasDataIntermediationServiceProvider ex:DISP_Y .
7 ex:nationalauthority_PT a :DataIntermediationAuthority ;
8   dpv:hasName "Data Intermediation Authority of Portugal" ;
9   dpv:hasContact "mailto:nationalauthority_PT@email.com" ;
10  dpv:hasJurisdiction "PT" .
11 ex:DISP_Y a :DataCooperative ;
12  dpv:hasName "Data Cooperative Y" ; dpv:hasAddress "Lisboa, Portugal" ;
13  dct:description "Provider of anonymised geolocation data" ;
14  dcat:landingPage <http://cooperativeA.com/> ;
15  dct:date "2023-12-23"^^xsd:date .
```

```
1 SELECT DISTINCT ?Provider ?Name ?Web WHERE {
2   ?Provider a :DataCooperative .
3   ?Provider dpv:hasName ?Name .
4   ?Provider dcat:landingPage ?Web . }
```

```
1 ex:altruism_logs a :RegisterOfDataAltruismActivity ;
2   dct:description "Activity logs of the Data Altruism Organisation A" ;
3   dct:created "2023-11-04"^^xsd:date ;
4   dct:modified "2023-11-13"^^xsd:date ;
5   dct:publisher ex:altruism_A ; dcat:record ex:log_001 .
6 ex:altruism_A a :DataAltruismOrganisation ;
7   dpv:hasName "Data Altruism Organisation A" ;
8   dpv:hasAddress "Lisboa, Portugal" ;
9   dcat:landingPage <http://example.com/altruism_A> .
10 ex:log_001 a dcat:CatalogRecord ;
11  dct:created "2023-11-13"^^xsd:date ;
12  :hasDataUser ex:userZ ; :hasFee "1000€"^^xsd:string ;
13  dpv:hasPersonalDataHandling [
14    dct:description "Download and reuse anonymised health records to
15      ↪ improve healthcare" ;
16    dpv:hasProcessing :Download, :Reuse ; dpv:hasDuration 6226453 ;
17    dpv:hasPurpose :DataAltruism, :ImproveHealthcare ;
18    dpv:hasPersonalData dpv-pd:HealthRecord ;
19    dpv:hasTechnicalMeasure dpv:Anonymisation ] .
20 ex:userZ a :DataUser ; dpv:hasName "Data User Z" ;
21  dpv:hasContact "mailto:user_z@email.com" .
```



```
1 ex:consentForm_001 a :EuropeanDataAltruismConsentForm ;
2   dpv:hasIdentifier <http://example.com/consentForm_001> ;
3   dpv:hasDataSubject ex:Anne ; dpv:isIndicatedBy ex:Anne ;
4   dpv:isIndicatedAtTime "2022-12-14" ;
5   dpv:hasPersonalDataHandling [
6     dpv:hasPurpose :DataAltruism, :ImproveTransportMobility ;
7     dpv:hasLegalBasis dpv-gdpr:A6-1-a ;
8     dpv:hasPersonalData dpv-pd:Location ;
9     dpv:hasProcessing dpv:Use, dpv:Store ;
10    dpv:hasDataController [
11      a dpv:DataController, :DataAltruismOrganisation ;
12      dpv:hasName "Company A" ] ] .
```



```
1 ex:consentForm_001 a :EuropeanDataAltruismConsentForm ;
2   dpv:hasIdentifier <http://example.com/consentForm_001> ;
3   dpv:hasDataSubject ex:Anne ; dpv:isIndicatedBy ex:Anne ;
4   dpv:isIndicatedAtTime "2022-12-14" ;
5   dpv:hasPersonalDataHandling [
6     dpv:hasPurpose :DataAltruism, :ImproveTransportMobility ;
7     dpv:hasLegalBasis dpv-gdpr:A6-1-a ;
8     dpv:hasPersonalData dpv-pd:Location ;
9     dpv:hasProcessing dpv:Use, dpv:Store ;
10    dpv:hasDataController [
11      a dpv:DataController, :DataAltruismOrganisation ;
12      dpv:hasName "Company A" ] ] .
```

```
1 ex:permissionForm_001 a dpv:Permission ;
2   dpv:hasIdentifier <http://example.com/permissionForm_001> ;
3   :hasDataHolder ex:dataHolderA ; dpv:isIndicatedBy ex:dataHolderA ;
4   dpv:isIndicatedAtTime "2022-12-15" ;
5   dpv:hasPersonalDataHandling [
6     dpv:hasPurpose :DataAltruism, :ProvideOfficialStatistics ;
7     dpv:hasLegalBasis :A2-6 ; dpv:hasData dpv:AnonymisedData ;
8     dpv:hasProcessing dpv:Use, dpv:Store ;
9     dpv:hasDataController [
10      a dpv:DataController, :DataAltruismOrganisation ;
11      dpv:hasName "Company A" ] ] .
```



- Semantic technologies can help forge a common understanding of the provisions in the regulation
- Machine-readable policies can be effectively represented in RDF and executed with appropriate reasoners.
- Semantic Web technologies excel at publishing policies on the Web, with JSON-LD serializations easily consumed by Web developers.
- Most of the conditions declared in the policies will not be able to be automatically enforced and the declarative nature of the policies will hopelessly lead to data misuse.



Future Work – new data regulations (Data Act, Health Data Spaces)

Sharing data for altruistic purposes



Data Holder

Government

Individuals

Business

Data User

Business

Research

Intermediary

European Data Spaces

Manufacturing

Finance

Agriculture

Green Deal

Health

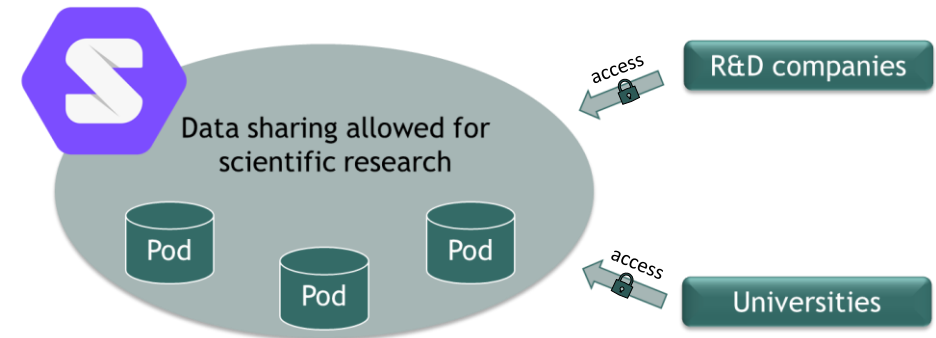
Open Science Cloud

Mobility

Public administration

Energy

Skills





This work was submitted to the Data Privacy Vocabularies and Controls Community Group (DPVCG) as a proposal to integrate the DGA within its outputs and has been recently published at <https://w3id.org/dpv/dpv-dga>.

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Protect

Semantics for Implementing Data Reuse and Altruism under EU's Data Governance Act

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