Capturing Requests and Context for ODRL-based Access and Usage Control

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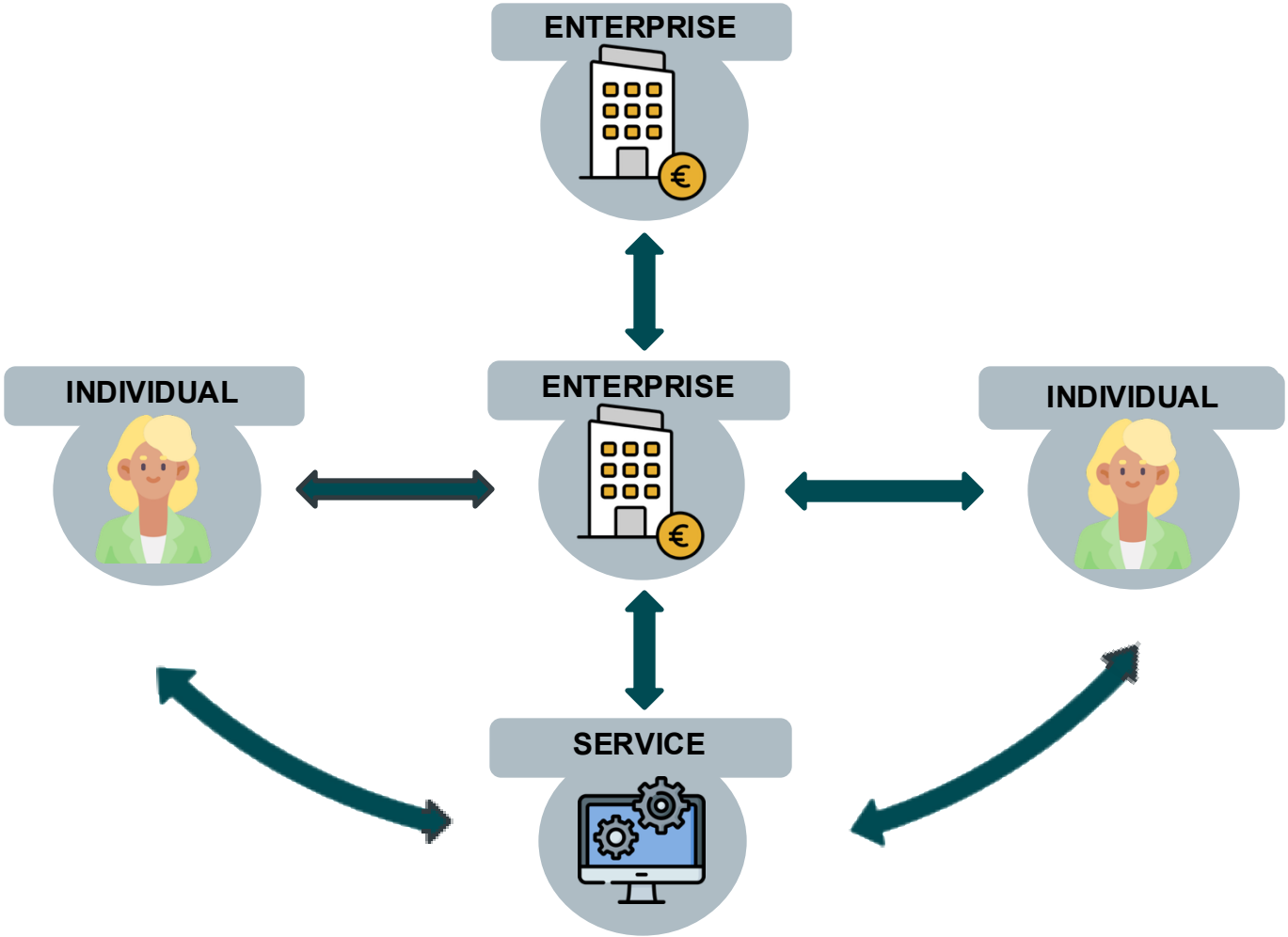
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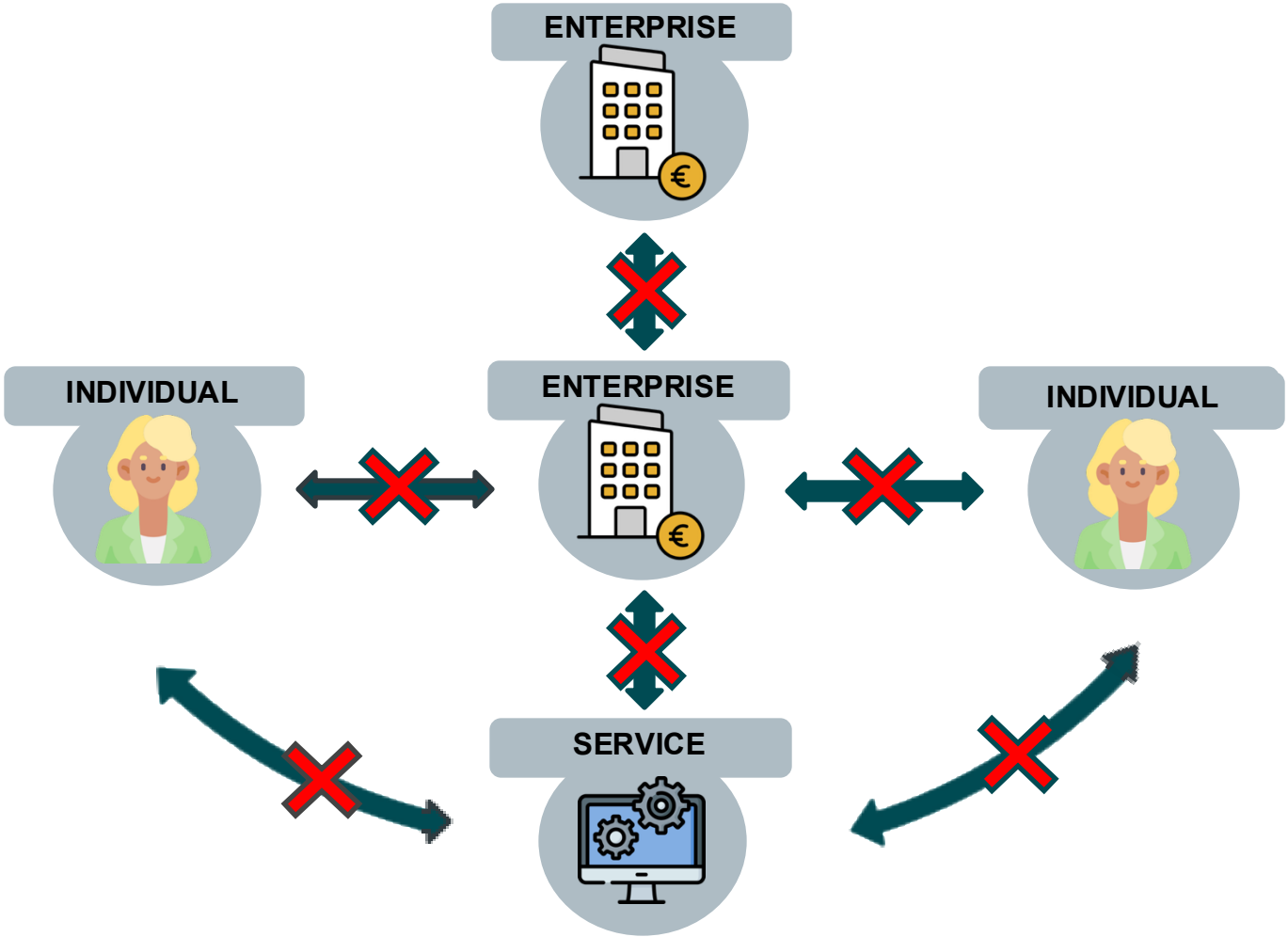
INDIVIDUAL
ENTERPRISE
INDIVIDUAL
SERVICE


ENTERPRISE
INDIVIDUAL
ENTERPRISE
INDIVIDUAL
SERVICE

Challenges to Web data exchanges

Human-centric preferences

Broad and narrow permissions

Handle conflicts

Understandability

Handle legal compliance

Automate processes

Derive new insights

Personalise services

How to ensure that the meaning of exchanged data, including its conditions of use, is preserved and consistently interpreted by all parties involved in the exchange?

Human-centric preferences

Broad and narrow permissions

Handle conflicts

Understandability

Standards

Handle legal compliance

Automate processes

Derive new insights

Personalise services

Interoperability

Capturing Requests and Context for ODRL-based Access and Usage Control

- Why ODRL?
- Background on ODRL evaluation & contextual inputs
- ODPs for evaluation requests and SotW
- ODRL coverage & future challenges
- Conclusions

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Why ODRL?

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ODRL coverage & future challenges

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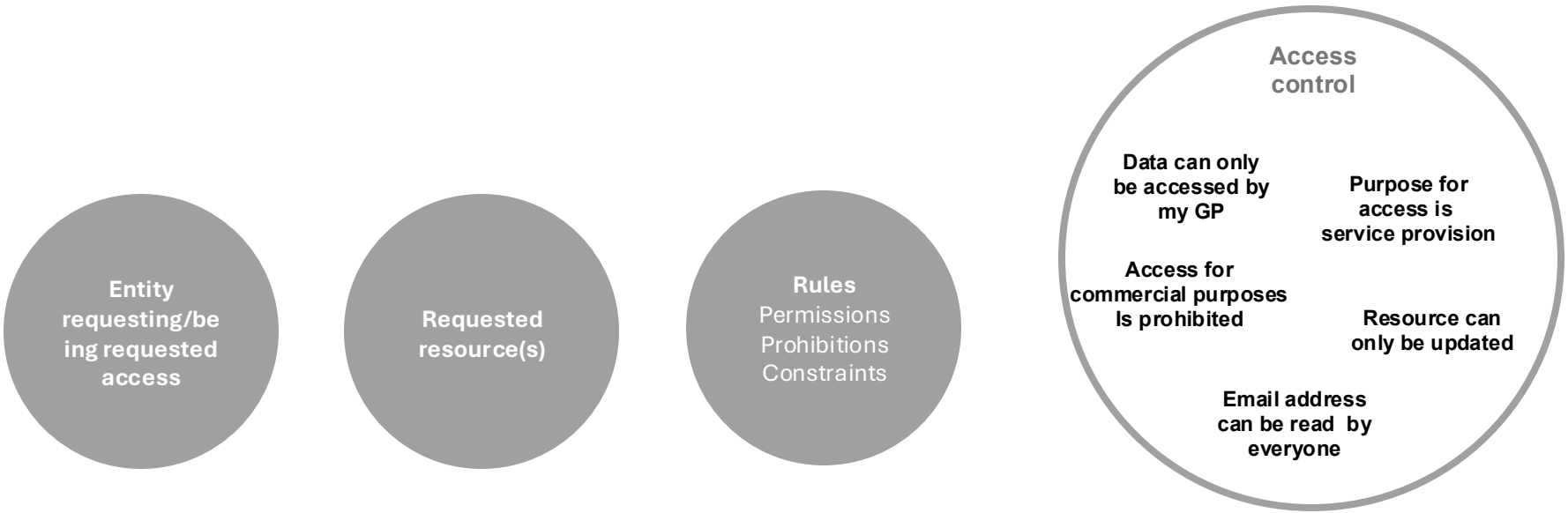
Open Digital Rights Language (ODRL)

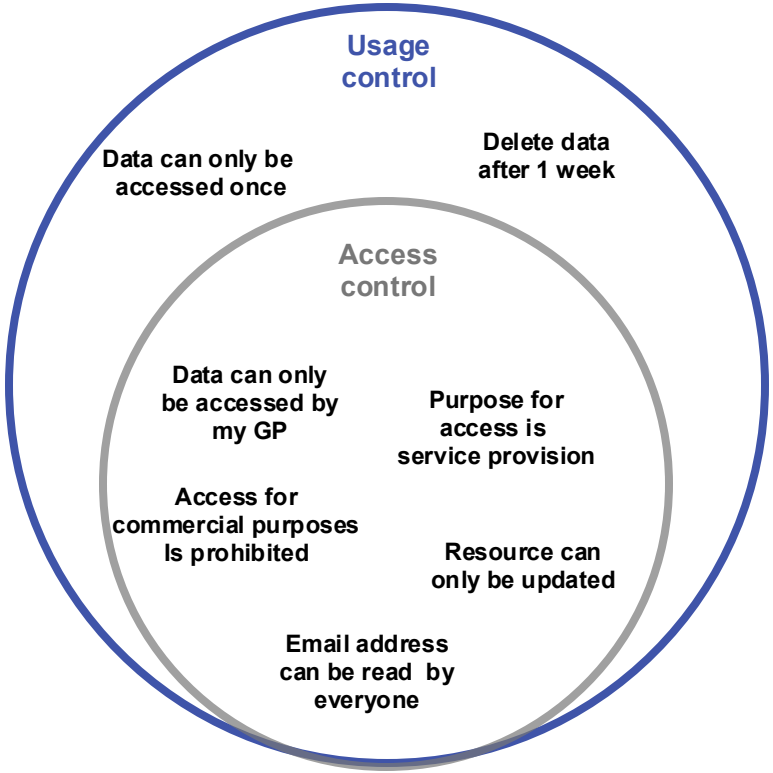


Open Digital Rights Language (ODRL)

Entity requesting/being requested access

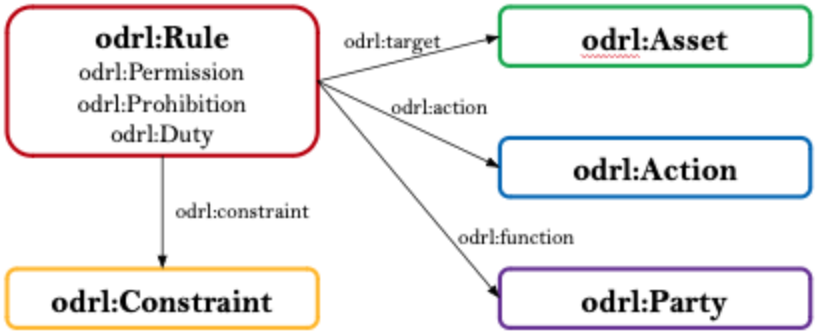
Requested resource(s)

Rules
Permissions
Prohibitions
Constraints



Open Digital Rights Language (ODRL)

- Standard for the expression of policies
  - ODRL Information Model – W3C Recommendation
  - ODRL Core Vocabulary – W3C Recommendation
- Maintained by the W3C ODRL Community Group
- Composed by several other specifications
  - ODRL Implementation Best Practices
  - ODRL Profile Best Practices
  - ODRL Formal Semantics [Under development]
  - ODRL Community Vocabulary [Under development]
- Easily extendable through the use of ODRL profiles



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

Open Digital Rights Language (ODRL)

```
@prefix dcterms:       <http://purl.org/dc/terms/> .
@prefix dpv:           <https://w3id.org/dpv#> .
@prefix dpv-odrl:      <https://w3id.org/dpv/mappings/odrl#> .
@prefix ex:            <https://example.org/> .
@prefix odrl:          <http://www.w3.org/ns/odrl/2/> .

ex:read-multiple-purposes a odrl:Set ;
    odrl:uid ex:read-multiple-purposes ;
    odrl:profile dpv-odrl: ;
    dcterms:description "User A allows Company B to read to its contact details."@en ;
    odrl:permission [
        odrl:action odrl:read ;
        odrl:target <https://example.org/userA/contacts> ;
        odrl:assigner ex:userA ;
        odrl:assignee faqir:companyB ;
        odrl:constraint [
            odrl:leftOperand dpv-odrl:Purpose ;
            odrl:operator odrl:isAnyOf ;
            odrl:rightOperand dpv:ServiceProvision, dpv:NonCommercialResearch ] ] .
```

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Why ODRL?

Background on ODRL evaluation & contextual inputs

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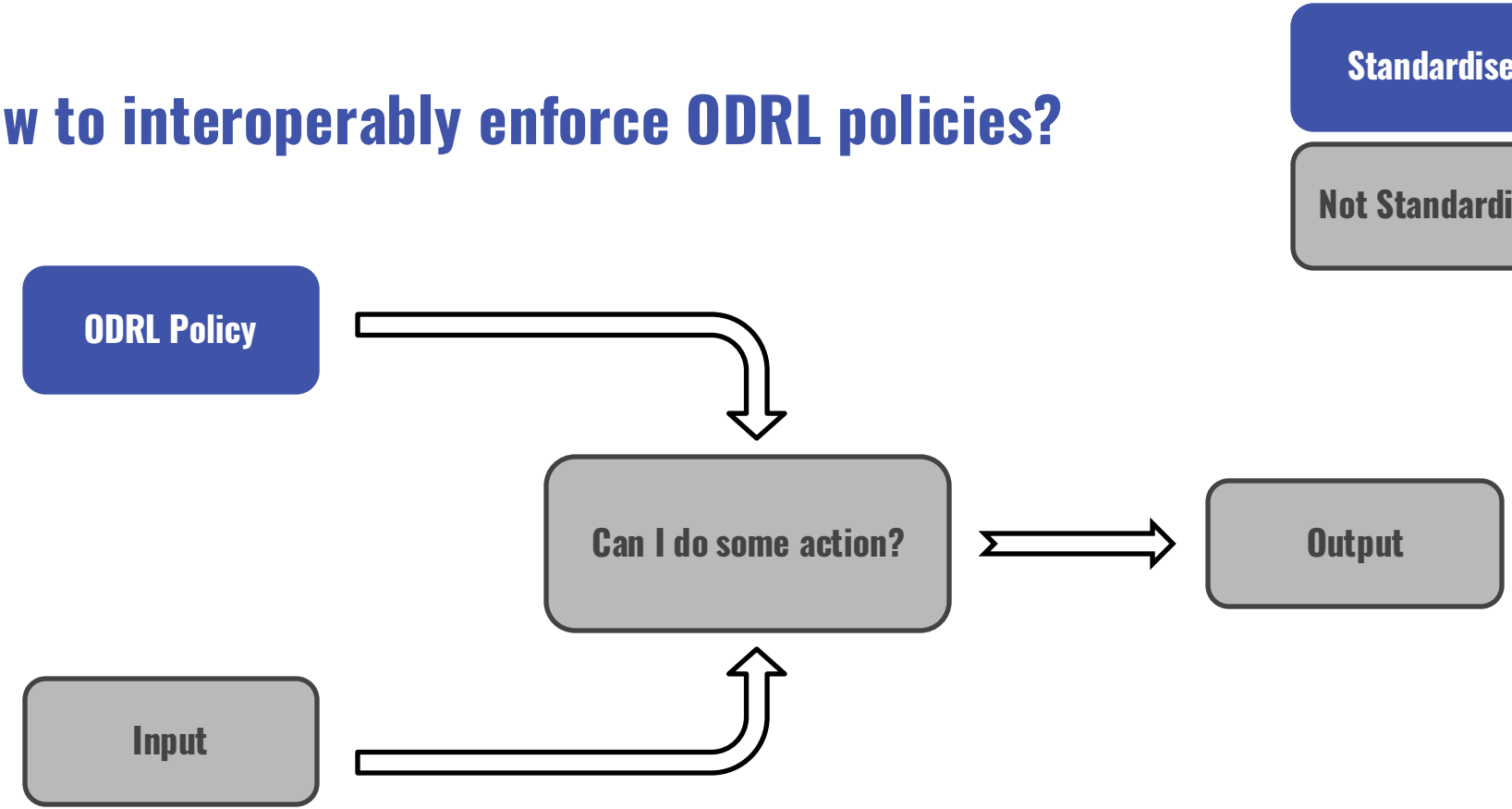
How to interoperably enforce ODRL policies?

Standardised

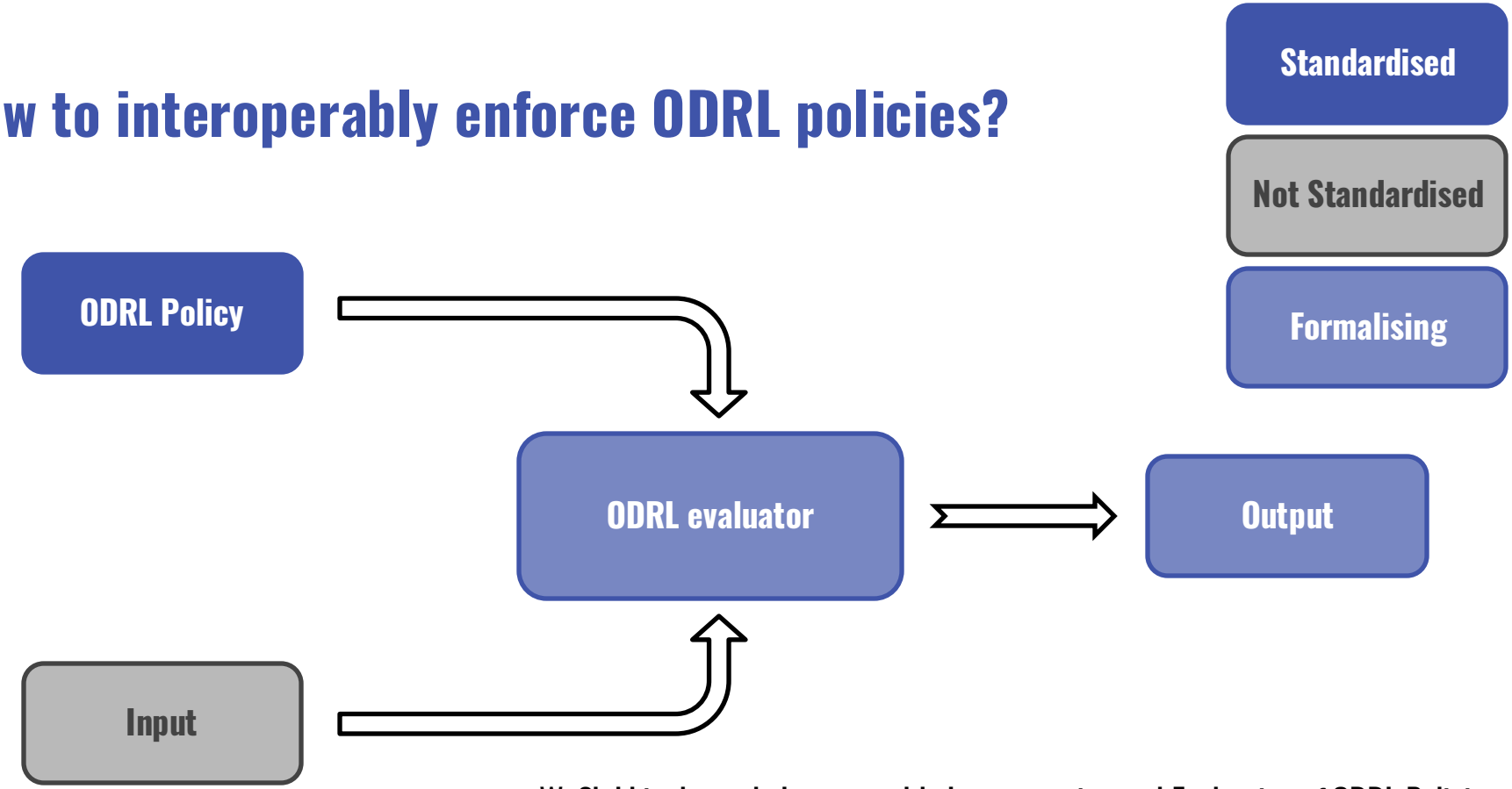
ODRL Policy

How to interoperably enforce ODRL policies?



ODRL Formal Semantics specification: https://w3c.github.io/odrl/formal-semantics/

How to interoperably enforce ODRL policies?



W. Slabbinck et. al., Interoperable Interpretation and Evaluation of ODRL Policies, The Semantic Web, 2025, pp. 192–209. DOI:10.1007/978-3-031-94578-6_11.

ODRL Formal Semantics specification: https://w3c.github.io/odrl/formal-semantics/

ODRL evaluators

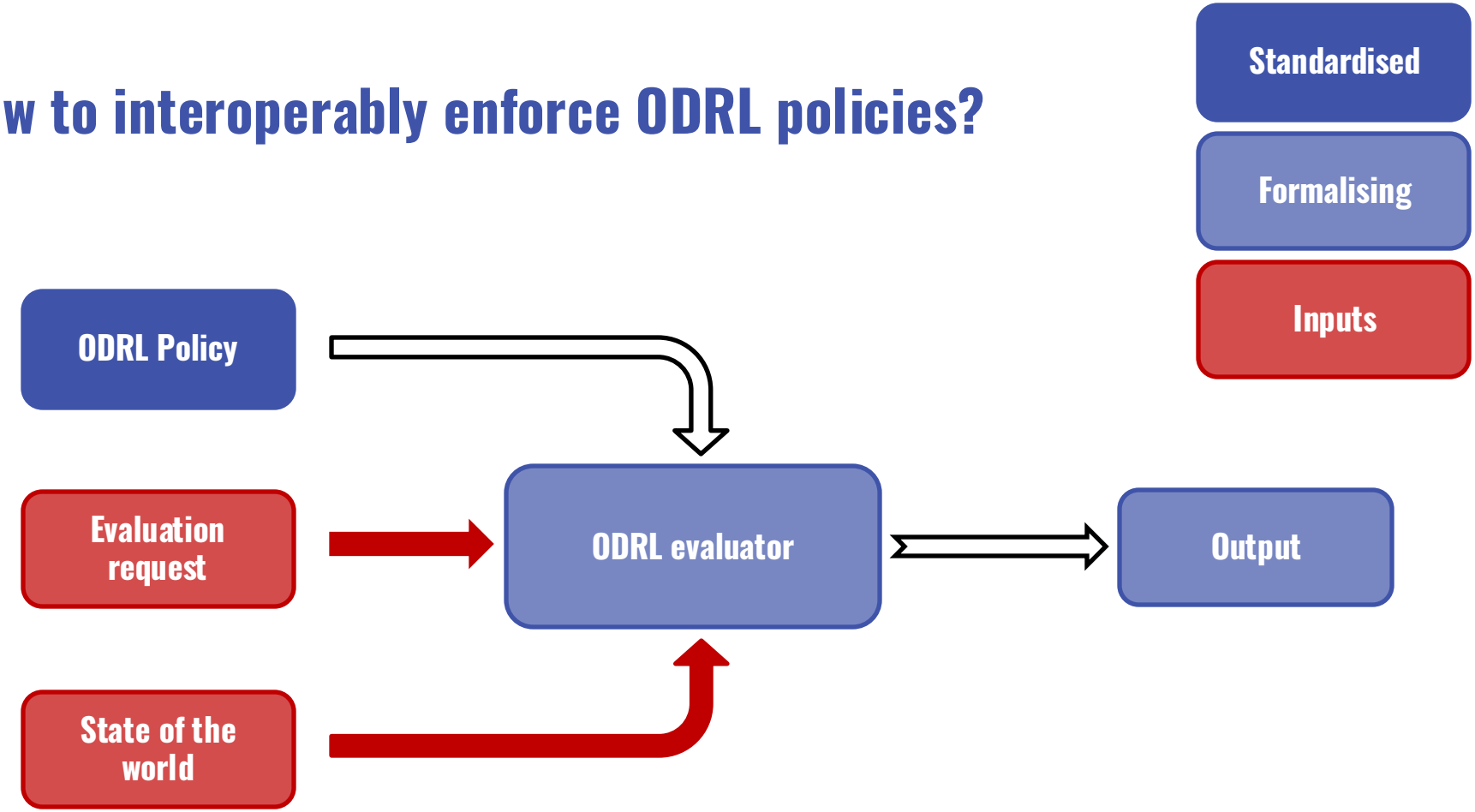
- ODRE - Open Digital Rights Enforcement (https://doi.org/10.1016/j.cose.2024.104282)
- Gaia-X Policy Decision Point (https://wizard.lab.gaia-x.eu/policyStepper)
- marketdata.md (https://marketdata.md/)
- JavaScript implementation for news information (https://github.com/nitmws/odrl-wprofile-evaltest1/)
- ODRL-PAP (https://github.com/wistefan/odrl-pap)
- MOSAICrOWN policy engine (https://github.com/mosaicrown/policy-engine)
- MYDATA Control Technologies policy engine (https://doi.org/10.5220/0008936003970405)
- Prometheus-X ODRL manager (https://github.com/Prometheus-X-association/odrl-manager)
- Polival (https://codeberg.org/elbtech/Polival)
- ODRL Evaluator Slabbinck et al. 2025 (https://w3id.org/force/evaluator)

ODRL landscape: https://w3c.github.io/odrl/landscape/

If they are to behave deterministically & interoperate,

ODRL evaluators lack a common vocabulary to represent contextual inputs

How to interoperably enforce ODRL policies?



Related work on input models

- [Priebe et al. 2006] context information for the XACML standard
- [Mustafa et al. 2014] OJADEAC (Ontology-based Access Control Model for the JADE Platform)
- [Kayes et al. 2015] OntCAAC (Ontology-based Context-Aware Access Control) framework
- [Brewster et al. 2020] OBAC (Ontology-Based Access Control for FAIR data)

Focused on particular use cases

Focused on access control

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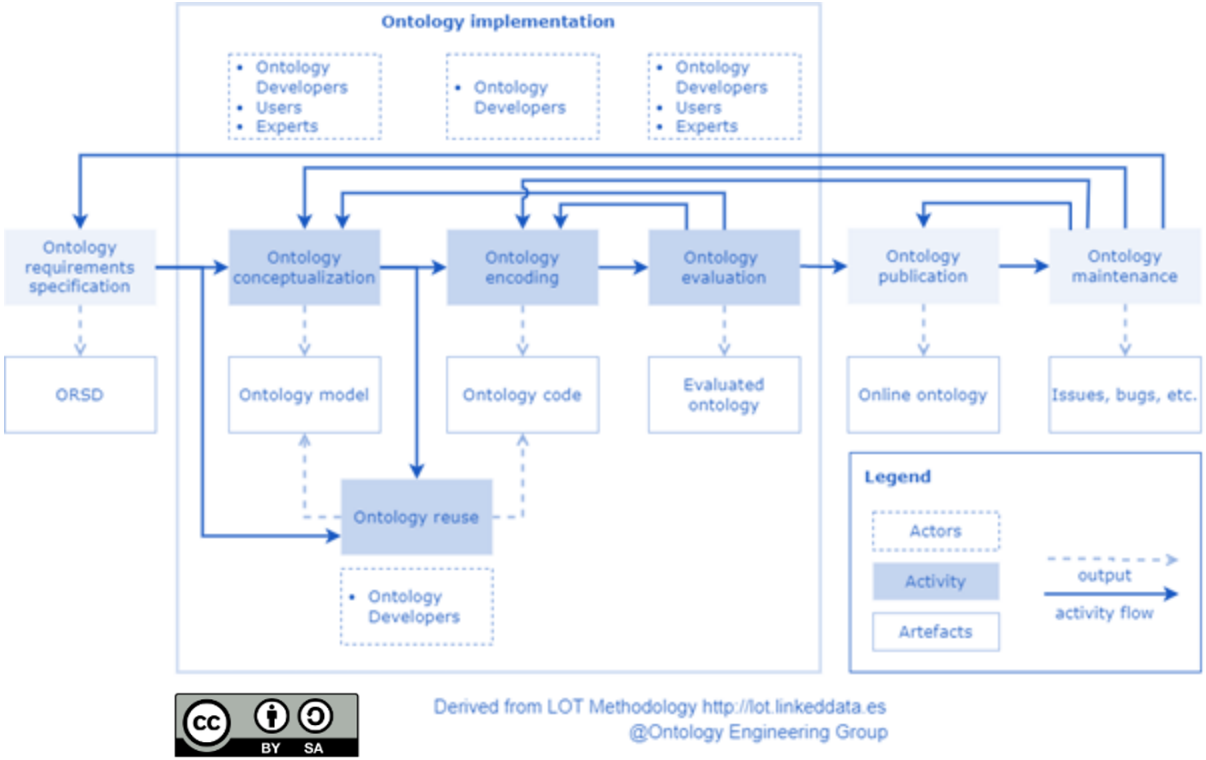
Methodology



Conceptualisation: Chowlk

Encoding: VSCode

Evaluation:
- OOPS!
- FOOPS!

Publication: w3id.org

Maintenance: GitHub

Company X allows employees to access documents during weekdays only, from the EU

Evaluation requests

Definition 1 (Evaluation Request). *Formal description of a requested action by an assignee on a target asset, which can be enriched with further contextual information.*

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CQR1. What is the requested action?

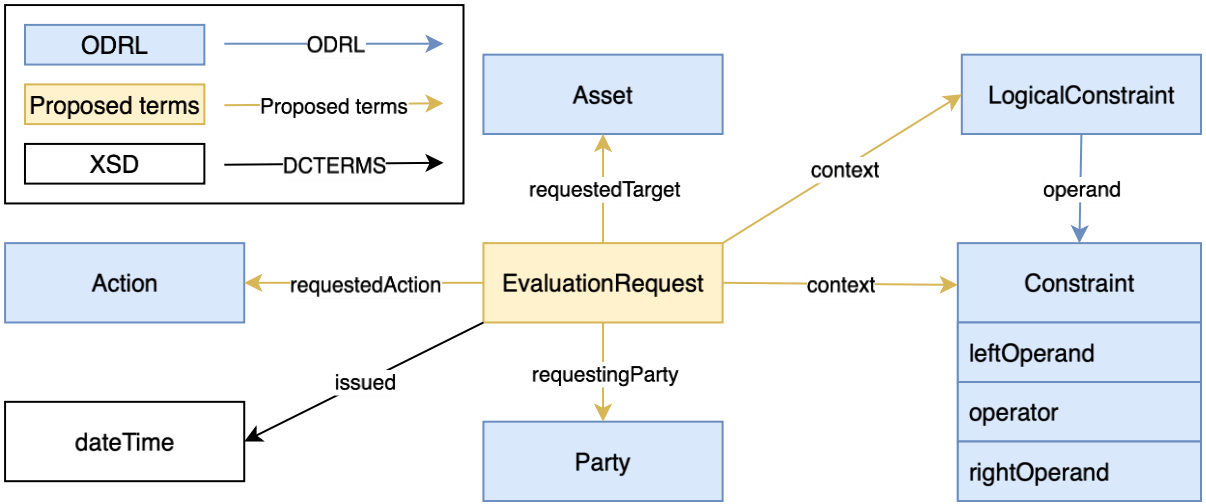
CQR2. Who is the party issuing the evaluation request?

CQR3. What is the target asset of the evaluation request?

CQR4. When was the evaluation request issued?

CQR5. What additional contextual information can be included in the evaluation request to further constrain it?

Evaluation request ODP



Evaluation request ODP

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```
@prefix dcterms:       <http://purl.org/dc/terms/> .
@prefix ex:            <https://example.org/> .
@prefix odrl:          <http://www.w3.org/ns/odrl/2/> .
@prefix xsd:           <http://www.w3.org/2001/XMLSchema#> .
@prefix :              <https://w3id.org/force/sotw#> .

ex:request a :EvaluationRequest ;
    dcterms:issued "2025-11-03T10:20:10.999Z"^^xsd:dateTime ;
    :requestedAction odrl:read ;
    :requestingParty ex:employeeY ;
    :requestedTarget ex:document-companyX ;
    :context [
        odrl:leftOperand odrl:purpose ;
        odrl:operator odrl:eq ;
        odrl:rightOperand "Perform task A" ] .
```

State of the world

Definition 2 (State of the World). *Knowledge representing real-world information aiding the evaluation of ODRL Policies.*

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CQS1. What is the current time?

CQS2. What is the location of a party?

CQS3. What assets are part of the asset collection of the policy that is being evaluated?

CQS4. Which parties are part of the party collection of the policy that is being evaluated?

CQS5. What actions were already performed or attempted?

CQS6. How many times has a rule been exercised?

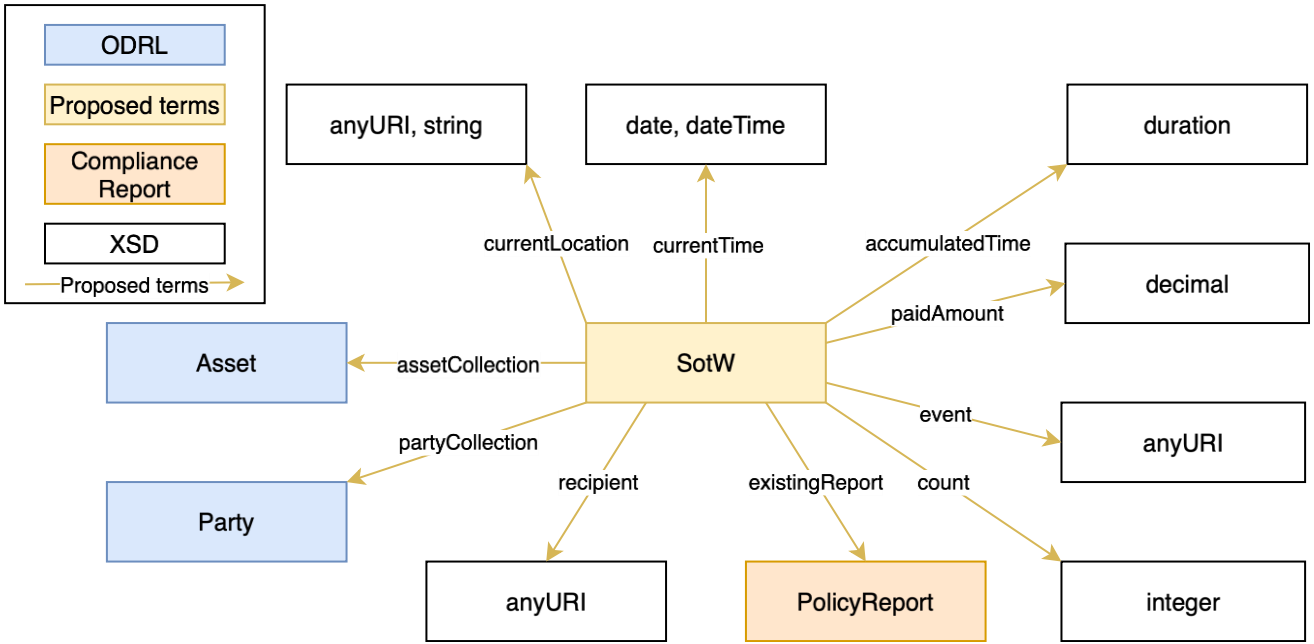
CQS7. What information is available about an event that has occurred?

CQS8. How long has a rule been exercised?

CQS9. Which recipients or categories of recipients can receive the result of the rule that has been exercised?

CQS10. Has a financial payment been made? What was the amount paid?

State of the world ODP



State of the world ODP

Company X allows employees to access documents during weekdays only, from the EU

```
@prefix ex:             <https://example.org/> .
@prefix odrl:           <http://www.w3.org/ns/odrl/2/> .
@prefix xsd:            <http://www.w3.org/2001/XMLSchema#> .
@prefix :               <https://w3id.org/force/sotw#> .

ex:sotw a :SotW ;
    :currentTime "2025-11-03T10:20:10.999Z"^^xsd:dateTime
    :currentLocation <https://www.iso.org/obp/ui/#iso:code:3166:BE> ;
    :partyCollection ex:employeeY .

ex:employeeY odrl:partOf ex:companyX .
```

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ODRL 2.2 coverage

CQ	Proposed Terms	ODRL 2.2
CQS1	currentTime	dateTime, delayPeriod, elapsedTime, timeInterval
CQS2	currentLocation	spatial, spatialCoordinates
CQS3	assetCollection	AssetCollection
CQS4	partyCollection	PartyCollection
CQS5	existingReport	Duty, Action
CQS6	count	count
CQS7	event	event
CQS8	accumulatedTime	meteredTime
CQS9	recipient	recipient
CQS10	paidAmount	payAmount
CQR1	requestedAction	Action
CQR2	requestingParty	Party
CQR3	requestedTarget	Asset
CQR4	dcterms:issued	—
CQR5	context	Constraint, LogicalConstraint

Other challenges

- Representing values that may change over time, i.e., **dynamic values**, related to certain policy constraints, e.g., current time or the GPS coordinates of a party who is moving
    - Introducing a meta-language on top of the ODRL policies to represent variables that are injected on the fly during the evaluation
    - Adopting ODRL dynamic constraint extension
- **Behaviour of the system** in case a requested or attempted action is neither permitted nor prohibited by the Policy being evaluated
    - Open: in case of an open system, anything that is not prohibited is permitted
    - Closed: in case of a closed system, anything that is not permitted is prohibited

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https://w3id.org/force/sotw

Conclusions & future work

- The formalisation of fundamental concepts such as the ***Evaluation Request*** and the ***State of the World*** enables reliable evaluation of ODRL policies, independent of the underlying evaluator architecture or implementation technology.

- Presented models are currently part of the ongoing discussions within the W3C ODRL Community Group, particularly in the context of the Formal Semantics document.

Integrate with existing evaluators

Test in real-world use cases (and extend the model)

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