A Privacy Preference Ontology (PPO) for Linked Data

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Context

- Linking Open Data community
  - Encourages people to publish formatted data on the Web
  - The data does not include any metadata that describes privacy restrictions
  - Hence: the data is easily accessible

- Access Control Lists (ACL)
  - Specify access control to the whole RDF "document"
  - Described using Web Access Control (WAC) Vocabulary
    - Read / Write / Control

Context

- Protecting Data
  - Does not only mean granting full access or not
  - Requires fine-grained access control mechanisms

- Current Linked Open Data environments:
  - Lack mechanisms for creating fine-grained access control
  - Discourages people and organisations to publish sensitive personal information

Use Cases

- Protecting a FOAF based Social Network where users:
  - Would feel more confident when publishing their personal information
  - Would be in full control
    - Which specific personal information can be shared
    - Who can access their data
  - Example: A user wants to restrict a phone number to whoever works at DERI

Use Cases

- Protecting sharing of microblog posts in SMOB
  - Microblogs in SMOB: described in RDF using ontologies such as FOAF and SIOC
  - SMOB provides tagging posts with concepts from GeoNames and DBpedia
  - Fine-grained privacy settings are required to restrict access to:
    - User's specific information
    - Posts to users that have similar interest to the annotated concept
  - Example: A user wants to restrict a microblog post tagged with the concept of Linked Data to users that have a similar interest

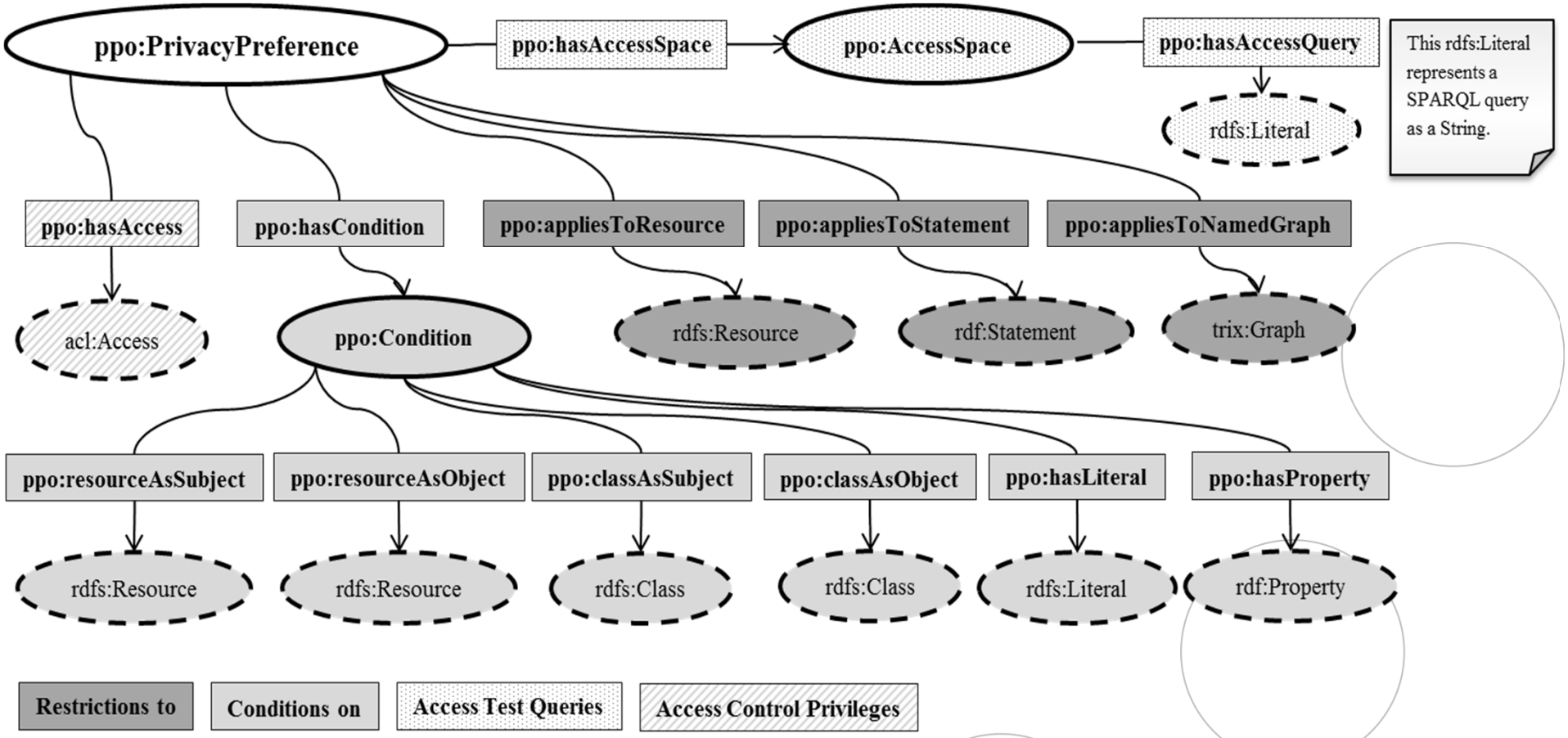
Privacy Preference Ontology

- A light weight vocabulary for defining fine-grained privacy preferences for RDF data
  - The lightweight vocabulary should be able to restrict:
    1. A particular statement; or
    2. A group of statements (i.e. as an RDF graph); or
    3. A resource – either as a subject or as an object of a particular statement
  - The Web Access Control (WAC) vocabulary is used to describe the access privilege to the data:
    - Read
    - Write
    - Control

Privacy Preference Ontology

- A privacy preference contains:
  - Which resource, statement or graph must be restricted
  - A condition that must be satisfied
  - The access control privilege (defined using WAC)
  - A SPARQL query that tests whether a user requesting information matches a graph pattern
  - Example:
    - Restrict a microblog post that contains a particular tag to the users who are interested in that tag.

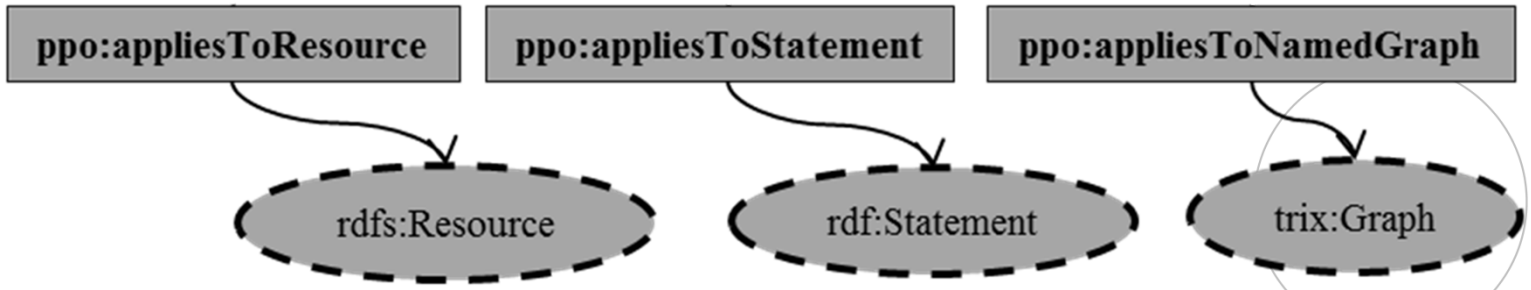
Privacy Preference Ontology



- Online: http://vocab.deri.ie/ppo#

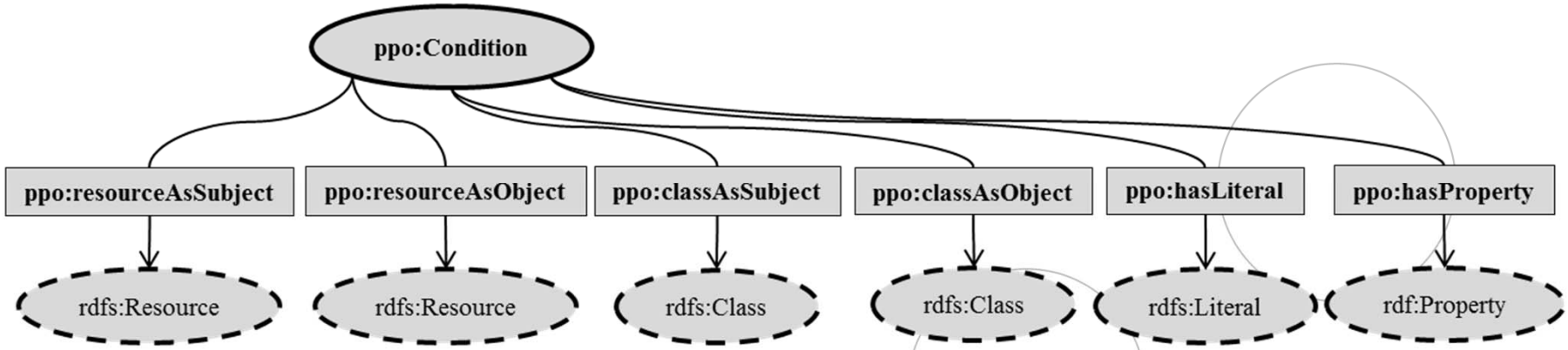
Privacy Preference Ontology

- Restrictions to:
  - ppo:appliesToResource: restricts a resource using its URI
  - ppo:appliesToStatement: restricts a particular triple by specifying the subject, predicate and object
  - ppo:appliesToNamedGraph: restricts a group of statements which are identified with a URI



Privacy Preference Ontology

- Conditions - ppo:Condition
  - ppo:resourceAsSubject / resourceAsObject: to restrict the resource's URI when it is either a subject or an object
  - ppo:classAsSubject / classAsObject: to restrict instances of classes that are either as a subject or an object
  - ppo:hasProperty: to restrict instances of properties
  - ppo:hasLiteral: to restrict particular values

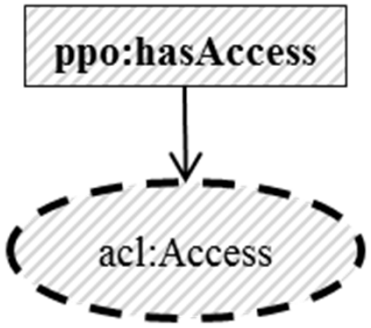


Privacy Preference Ontology

- Access Test Queries
  - ppo:AccessSpace: defines SPARQL ASK queries that test a user's information if it matches the graph pattern
  - Advantages:
    - User's don't need to specify friends for each privacy preference
    - Since users' information change over time, the access space ensures that the correct type of users access the information

Privacy Preference Ontology

- Access Control Privileges
  - ppo:hasAccess: Defines the access privilege(s) which is granted within a privacy preference
    - Read / Write access to statements
    - Defined using Web Access Control (WAC) Vocabulary



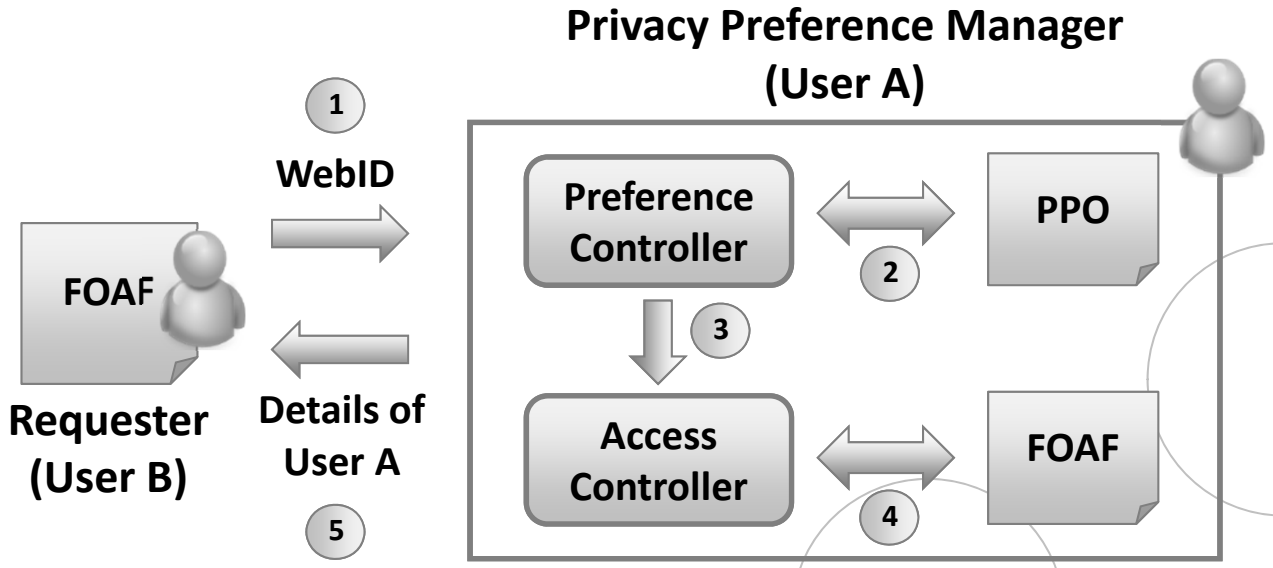
Privacy Preference Ontology

- Example:
  - A user wants to restrict a microblog post tagged with the concept of Linked Data to users that have a similar interest

```
 <http://www.example.org/pp3> a ppo:PrivacyPreference;
ppo:appliesToResource <http://smob.me/user/xyz/post1>;
ppo:assignAccess acl:Read
ppo:hasCondition [
ppo:hasProperty tag:Tag;
ppo:resourceAsObject
    <http://dbpedia.org/resource/Linked_Data> ];
ppo:hasAccessSpace [
ppo:hasAccessQuery
"ASK {
?x foaf:topic_interest
<http://dbpedia.org/resource/Linked_Data> }"
].
```

Privacy Preference Ontology

- Applying the Privacy Preference Ontology
  - A Privacy Preference Manager that provides users to specify privacy preferences for their FOAF files
  - The privacy preference manager grants other users which information to access



Progress and Future Work

- Progress so far:
  - We developed the PPO
  - Currently, the Privacy Preference Manager is being developed
- Future Work:
  - To Extend the PPO to restrict actions
    - For instance: Allow messages sent from work colleagues and restrict any messages who are not work colleagues, if I am busy
  - To cater for conflicting privacy preferences
  - To investigate relationships with RDFS and OWL entailments