Modeling and Matching Digital Data Marketplace Policies

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Digital Data Marketplaces (DDM)

• Data sharing can be used to generate significant value, enhance collaboration and transparency.

• Digital collaboration and data sharing among different scientific and commercial organizations is important for lasting benefits for cooperating organizations.

• The digital collaboration takes place in a Digital Data Marketplace.
Digital data marketplace framework

https://dl4ld.nl/
Goals

• Use semantic modelling to represent data sharing policies agreed between partners in a DDM

• Demonstrate checking a user request against the usage policies
DDM Application

- Two kinds of resources can be shared in the proposed DDM system
  - Algorithm
  - Data
    - Input Data
    - Output Data
DDM Archetype

• A Scenario that determines the permitted transmissions of the shared digital resources.
Request Handling in a DDM
Semantic Model Requirements

• Describe how resources can be shared and used by different parties

• Required permissions to support archetypes
  • Copying the asset to a particular location
  • Moving the asset to a particular location
  • Execution on a particular location
  • Moving the results of the whole operation (output) to a particular location
ODRL: Open Digital Rights Language

• An ontology designed to model permissions, obligations, and prohibitions concerning digital resources.
• The main classes are:
  • Asset: a digital resource, e.g., data or algorithms
  • Action: an activity performed on an Asset
  • Rule: constrains an Action performed on an Asset.

[https://www.w3.org/TR/odrl-model]
Example archetype
Permissions for input

![Diagram of Input Permissions for input]
Permissions for algorithm
Permissions for output
Matching Module

• Automatic management of user request:
  • Users can submit a request to use specific datasets or algorithms, specifying the location of execution.

• The request must be matched with the available archetypes in DDM.

• Matching module verifies whether the request is permitted and approve or reject it.
Matching algorithm

Algorithm 1: Matching Algorithm

Input: Algorithm1, Data1, Execution Location, Output Location

Function moveAllowed(Asset, Location)

1. if location(Asset) ≠ Location then
2. return whether Asset may be moved to Location
3. end
4. return (True)
5. end

6. Output1 = outputOf(Algorithm1, Data1);
7. if moveAllowed(Algorithm1, Execution Location) and moveAllowed(Data1, Execution Location) and moveAllowed(Output1, Output Location) then
8. Accept the Request;
9. else
10. Reject the Request;
11. end
Discussion

• The system must provide sufficiently broad access
  • ODRL is a powerful rights description language, and the use of semantic technology makes it easy to extend the ontology if needed.

• It must ensure accountability of all parties involved
  • To ensure accountability of users, requests need to be matched against the archetypes specified in the contracts.

• It must be practicable
  • The present implementation could be improved upon by support for more archetypes and more complex workflows and more flexible matching.

Summary and future work

• Enabling algorithm and data sharing in the eScience community
• Proposing a semantic model to represent DDM policies
• Our framework is an essential component in DDMs

Future work
• Extending the model to cover more complex workflows and policies
• Extending the matching algorithm to be sure that it can deal with all of the possible policies and select the best
• User interface to guide user towards a permitted request

https://www.esciencecenter.nl/