A Framework to Specify Agent-Based Models Using ODD* Protocol

Cédric Grueau [1], Thyago Bendo [1,2], Alan Gavioli [2], João Araújo [3]

1 Polytechnic Institute of Setúbal, Portugal
2 Paraná Federal University Of Technology, Brazil
3 Department of Computer Sciences NOVA School of Science and Technology, Lisbon, Portugal

Contact email: cedric.grueau@estsetubal.ips.pt

October 5, 2021 [03:00pm Barcelona, 09:00am EST]

IPS Instituto Politécnico de Setúbal

UTFPR UNIVERSIDADE TECNOLÓGICA FEDERAL DO PARANÁ

NOVA SCHOOL OF SCIENCE & TECHNOLOGY

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IARIA

hello!

I am Cédric Grueau

I am an Assistant Professor at

Polytechnic Institute of Setúbal, Portugal - http://ips.pt/

EUDRES² European University - https://www.eudres.eu/

My research interest are: Domain Specific Modelling, Context Aware Decision Support Systems, Agent-Based Modelling, Data Visualization.

You can reach me at cedric.grueau@estsetubal.ips.pt

About the Authors

Thyago Bendo

Master Student

Institute of Setúbal, Portugal / Federal University of Technology - Paraná/Brazil

Alan Gavioli

Associate Professor

Federal University of Technology - Paraná/Brazil

Principal research interests: Clustering Algorithms, Principal Component Analysis, Precision Agriculture, Software Engineering, Databases and Information Systems

João Araújo

Associate Professor

Department of Informatics at the Universidade Nova de Lisboa, Portugal

NOVA LINCS Research Center, Lisbon, Portugal

Principal research interests: Requirements Engineering (RE), Advanced Modularity, Model-Driven Engineering (MDE), and Software Product Lines (SPL).

Motivation 1/2

Agent-Based Models are models in which representations of humans and groups interact in virtual environments. See presentation by Prof. Stefan Bosse - SIMUL 2021)

- Used as Virtual laboratories
- Many domain applications.

See examples from the SIMUL 2021 conference: waste management (Yuanhui Huang), Travel Demand Simulation (Antje von Schmidt)

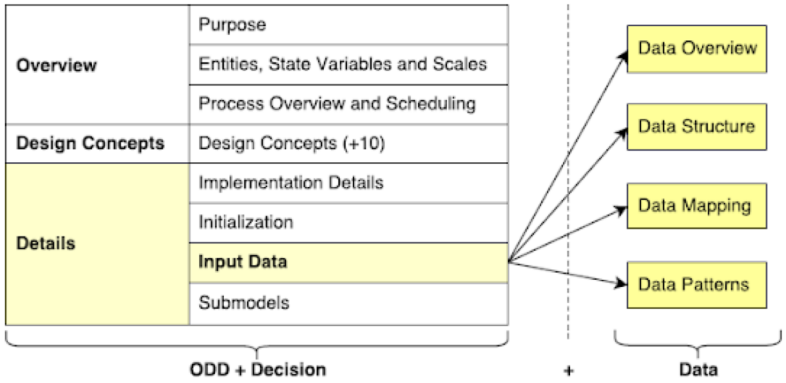
Motivation 2/2

ODD Protocol

a protocol used in specific domains to describe ABM and the results of their simulations.

- ODD (Overview, Design Concepts e Details) Grimm et al. (2006) e Grimm et al. (2010);
- ODD+D (Overview, Design Concepts, Details e Decision) Muller et al. (2013);
- ODD+2D (Overview, Design Concepts, Details, Decision e Data) Laatabi et al. (2018);

ODD Protocol Examples



ODD+D for a NetLogo version of Abelson's and Bernstein's community referendum simulation model

Klaus G. Troitzsch

This document describes one of the first models which can nowadays be qualified as agent-based and published first as [Abelson and Bernstein, 1963] and programmed in the now obsolete FAP language (FORTRAN Assembly Program, [Ferguson and Moore, 1961]) as well as a replication programmed in NetLogo [Wilensky, 1999] for a book chapter *Formal design methods and the relation between simulation models and theory: A philosophy of science point of view* to appear in [Rudás and Péli, 2020].

Table 1 An ODD Protocol for Abelson's and Bernstein's early work

Outline	Guiding questions	Description
		I. Overview
I.i Purpose	I.i.a What is the purpose of the study?	"to describe the specific features of this particular simulation model, bringing several levels of theory and both experimental and field phenomena to bear upon the total conception; to illustrate the properties of the model by giving some results of a preliminary trial upon artificial, albeit realistic, data; to discuss some of the broad problems that are likely to be encountered in this type of approach; and finally, thus, to elucidate the general character of simulation technique, which seems to offer eventual promise of uniting theories of individual behavior with theories of group behavior." [Abelson and Bernstein, 1963, p. 93]
	I.i.b For whom is the model designed?	Scientists, students/teachers
I.ii Entities, state variables and scales	I.ii.a What kinds of entities are in the model?	Citizen agents, news channels, sources, places (where citizens meet and exchange information) are the active entities, i.e. agents, of the model. Beside these, there are assertions (as passive objects, for short called memos in Table 2 and in the NetLogo model) (pp. 94–95). These are implemented as a list of the following structure: [`from` S `via` X `at` t `opinion` o `aspect` a `state` s `forgettability` f] where the S denotes the source or citizen which generated the memo, X is the channel or place between sender and receiver, t is the time of generation, o denotes whether the memo is pro or con, a is the aspect of the issue which the memo refers to, whereas s shows whether the memo was accepted or rejected (or not yet decided upon) and f is an auxiliary item which carries on whether the memo can be forgotten later within the current period. Hence a complete assertion or memo might represent a sentence spoken by a natural person S_1 at place X and understood by another person S_2 with the following content: "S_1 told me (S_2) about her current opinion at t = five minutes ago was o = pro with respect to aspect a = harmfulness, and — s = 1, i.e. I agree with her and I am unlikely (f = 0.2) to forget about her opinion." More details can be found in Figure 1 which gives all information about the entities, their instance variables and their methods, in terms, however, of the NetLogo replication, as the original code is lost (and

Challenges

- How to search and access models?
  - repositories: Scientific journals, CoMSES

- How to compare models and its simulation results?

- How to reuse a model?

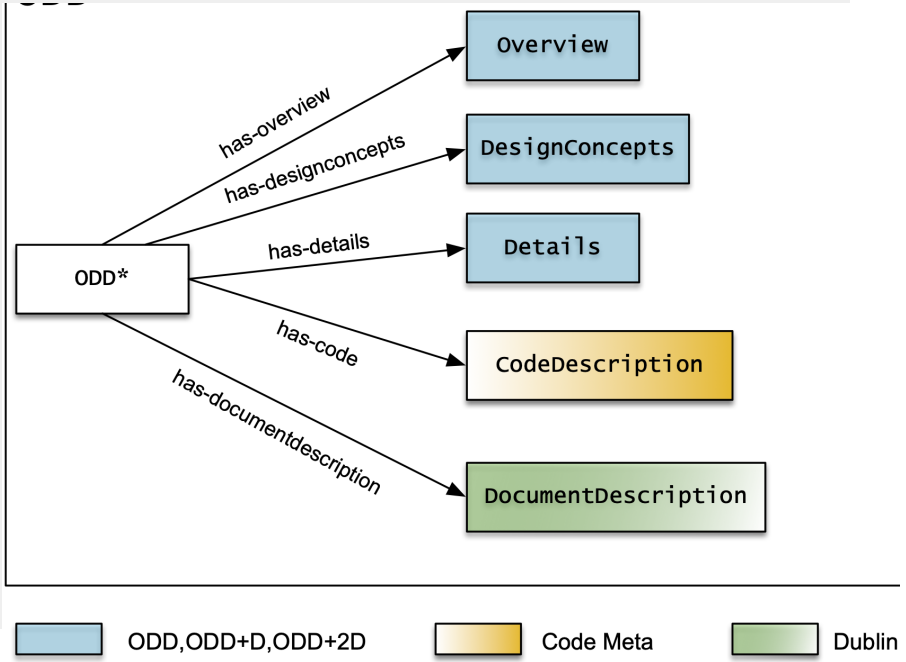
Proposal

- Ontological model to represent ABM in ODD format
  - ODD*: ODD,ODD+D,ODD+2D, …
- Extend model description with
  - Traceability: Provenance
  - Software / code metadata
- A platform to access ABM descriptions in a machine and human friendly format

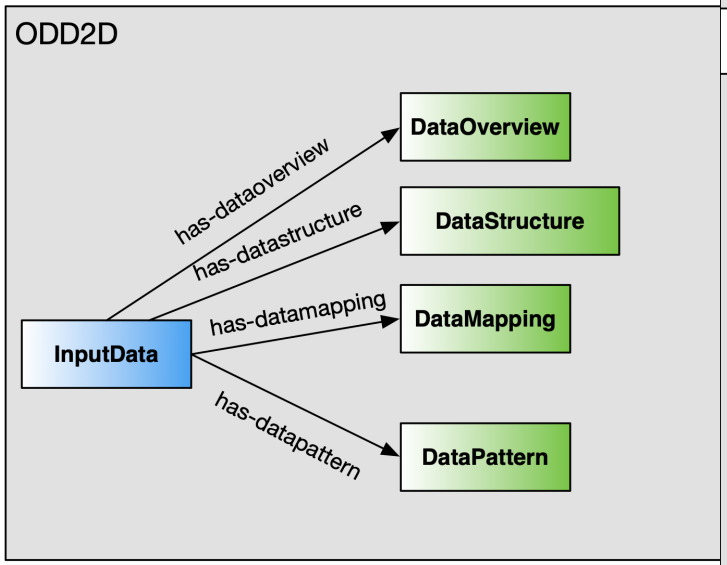
Solution:
ODD* Ontology

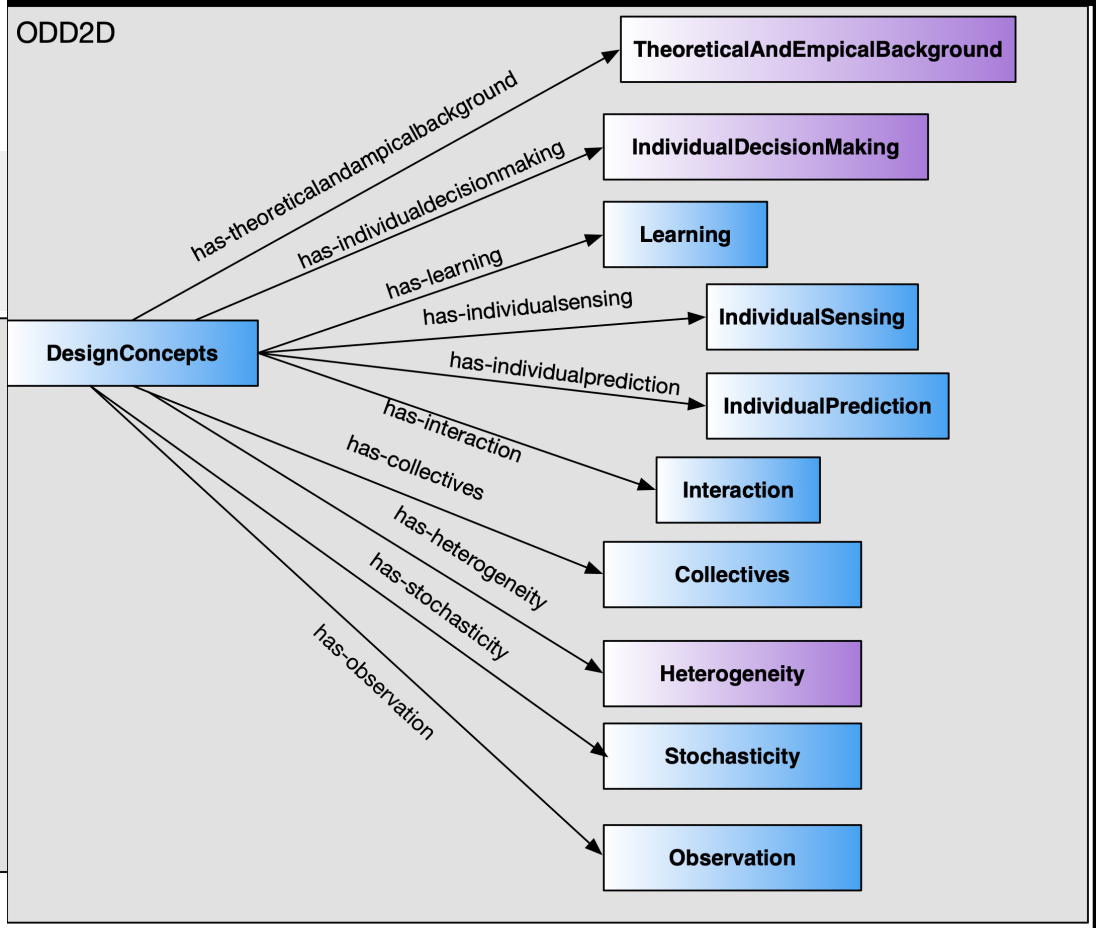
Ontology

- **Inclusions of more metadata**
  - **software: code-meta**
  - **document: Dublin Core**
- RDF format



ODD* Ontology





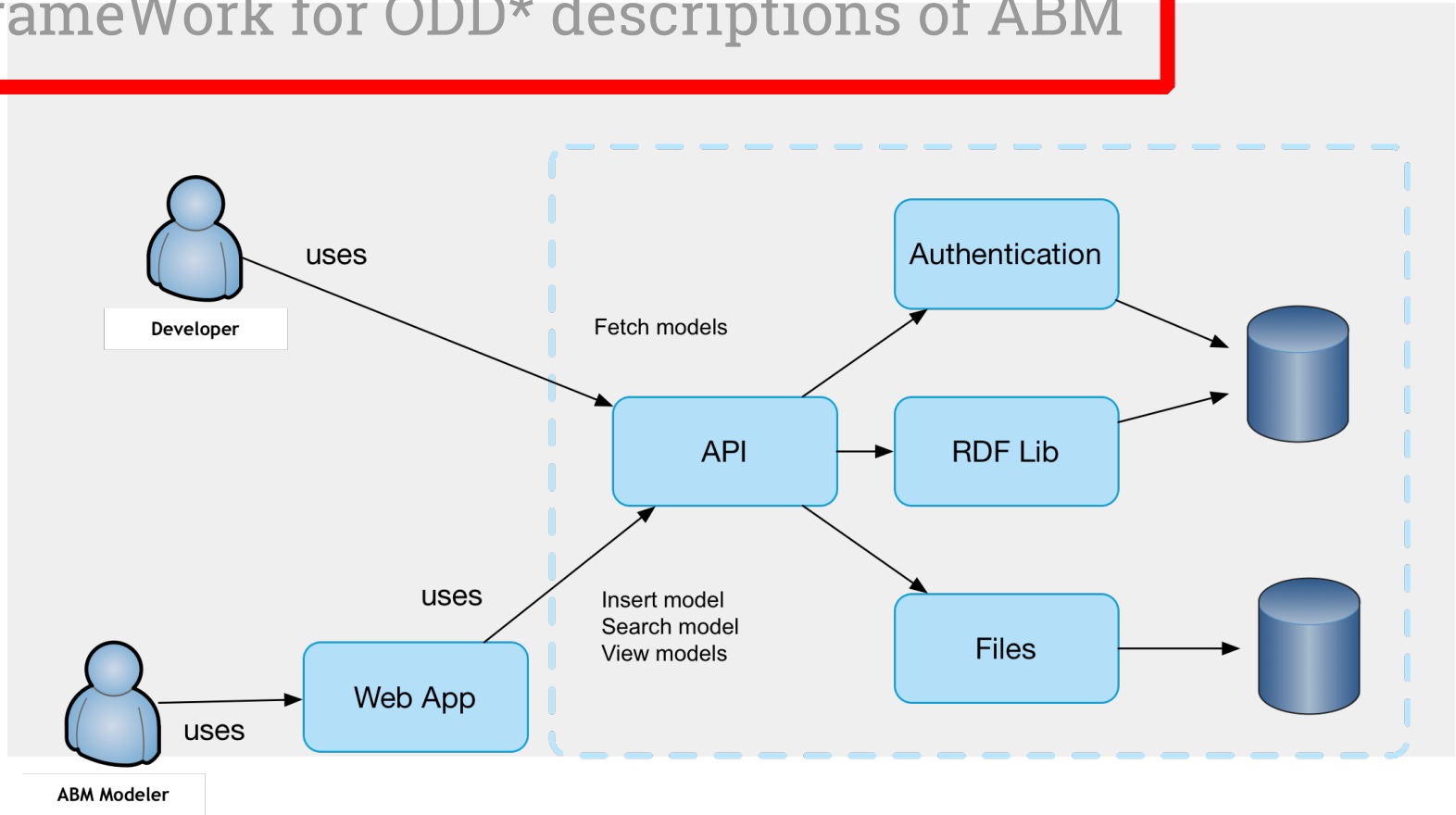
ODD

ODD+2D

ODD

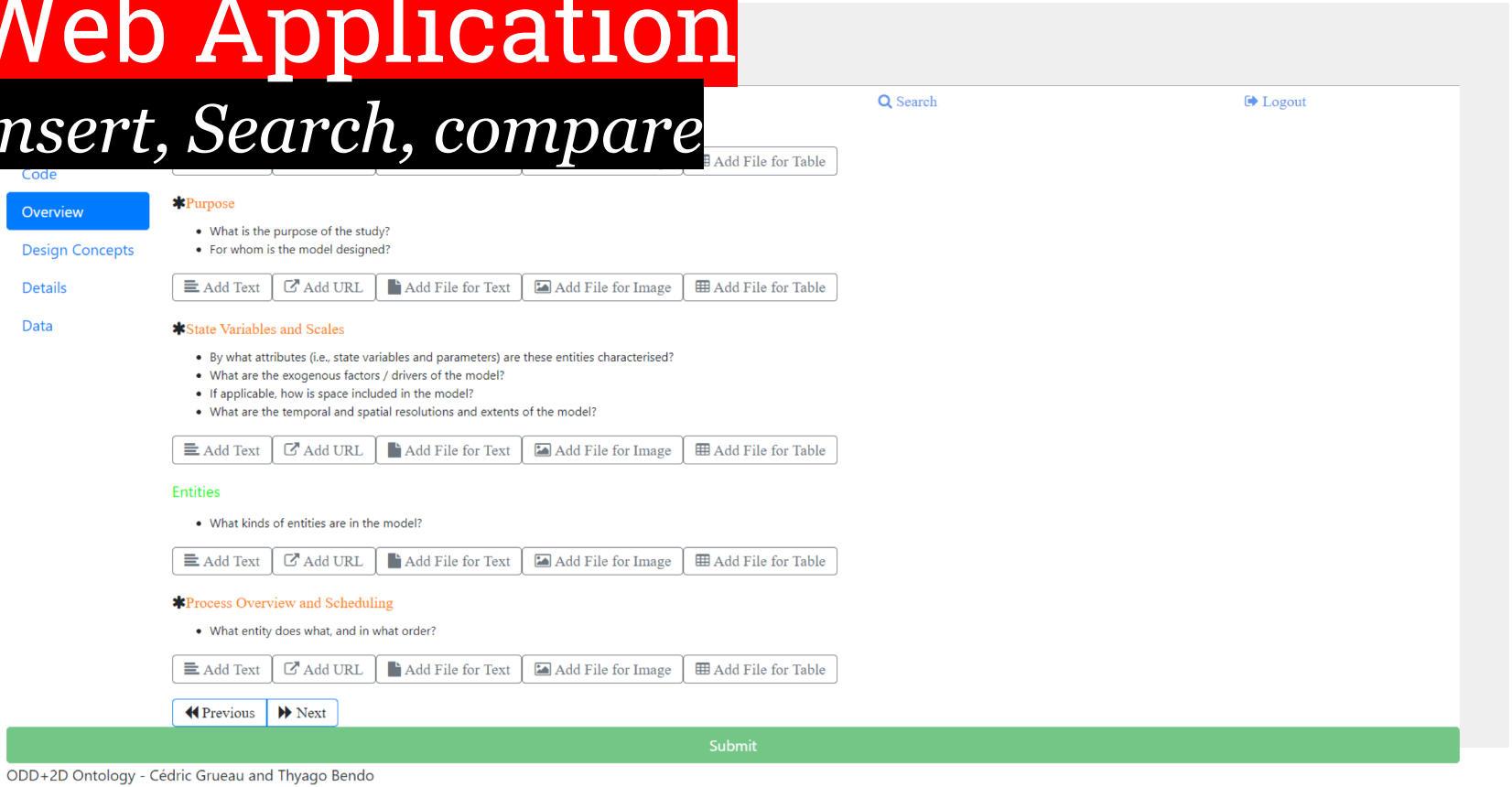
ODD+D

A frameWork for ODD* descriptions of ABM



Web Application

Insert, Search, compare



http://odd2dontology.herokuapp.com/

Conclusions

The frame has been implemented with:

- Ontology to represent ODD descriptions
  - ODD*: ODD,ODD+D,ODD+2D, …
- Extended model description for ODD with
  - Provenance
  - code metadata
- A Web Application and API to insert and access ABM described with ODD*

Future Work

- Testing Web Application Usability
  - First results show that non expert users find it difficult to insert ODD descriptions

- Testing API

- Testing framework utility with experts

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thanks!

Any questions?

You can find me at
cedric.grueau@estsetubal.ips.pt