

OntoVIP: an ontology for the annotation of object models used for medical image simulation

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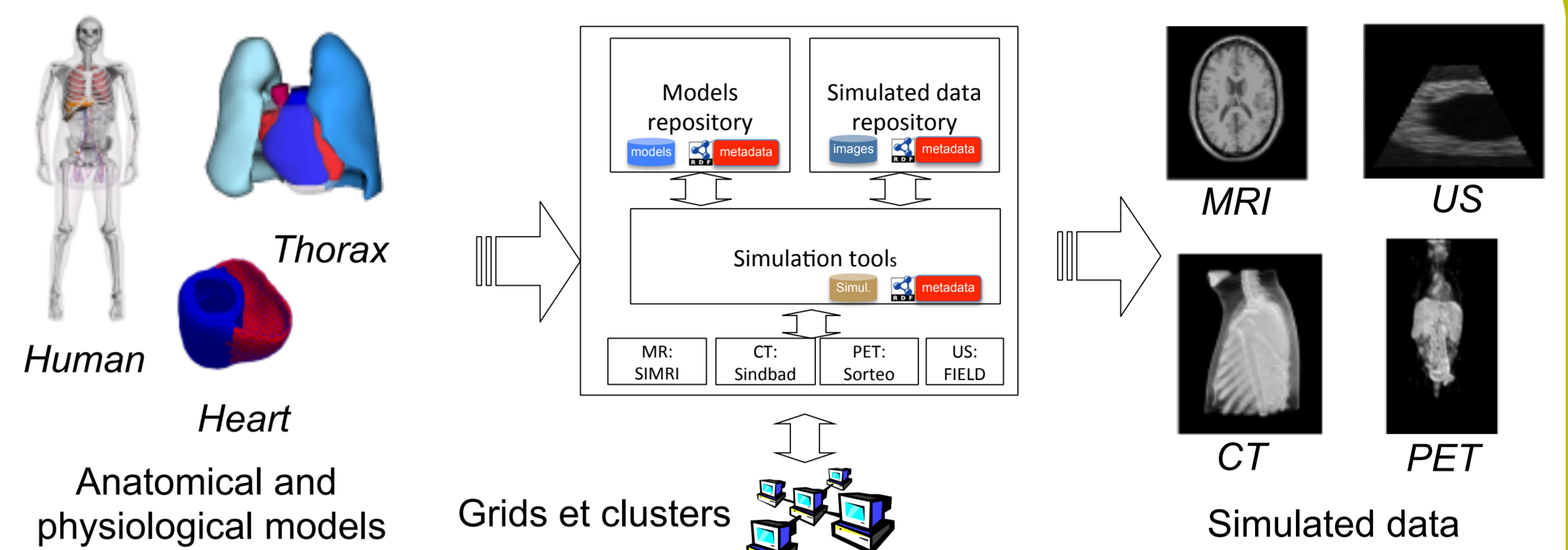
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Context:

- Medical image simulation produces virtual images from software representations of imaging devices and virtual object models representing the human body. Object models consist of the geometry of the objects (e.g. organs, tissues, pathological structures, etc.) and of their physical parameters used for the simulation.
- The VIP platform aims at supporting the sharing of image simulation resources [1,2]



Goal: create an application ontology that can be used to annotate the object models in the VIP platform's model repository, to facilitate their sharing and reuse.

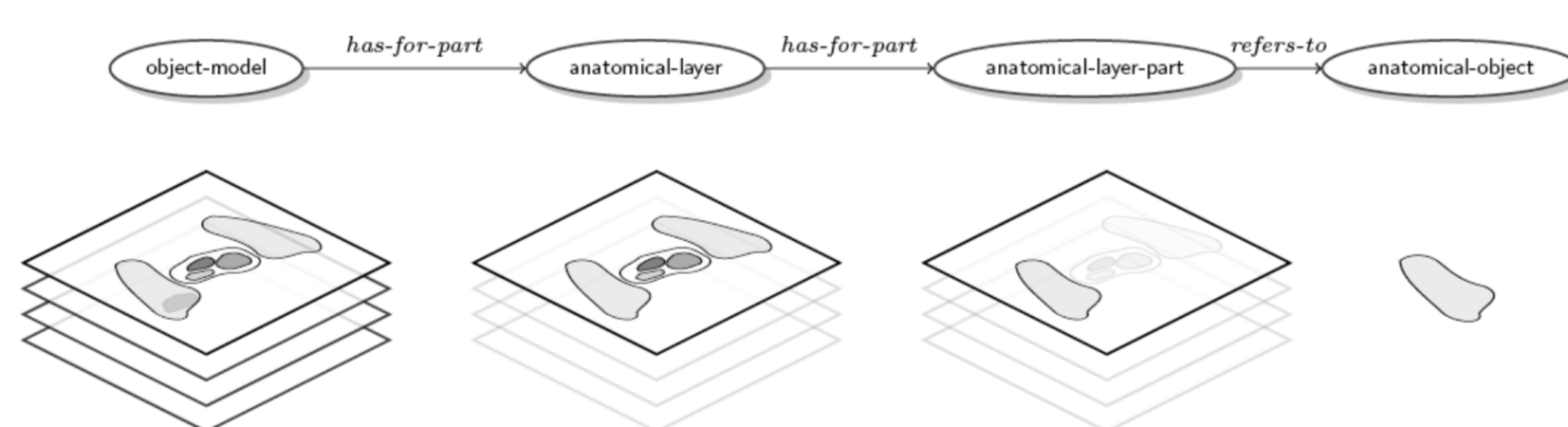
Methods:

- Use of a common integration framework provided by a foundational ontology called DOLCE, successfully used in a previous project [3]
- Development of an ontology module to depict the content of object models and their physical characteristics
- Extraction of relevant subsets of existing ontologies, using vSPARQL [4]
 - FMA v3.1: anatomy (865)
 - PATO V1.2: patho. anat. object quality (84)
 - MPATH V1.2: pathological objects (494)
 - RadLex V3.2: contrast agents (81), radiopharmaceuticals (49), foreign bodies (189)

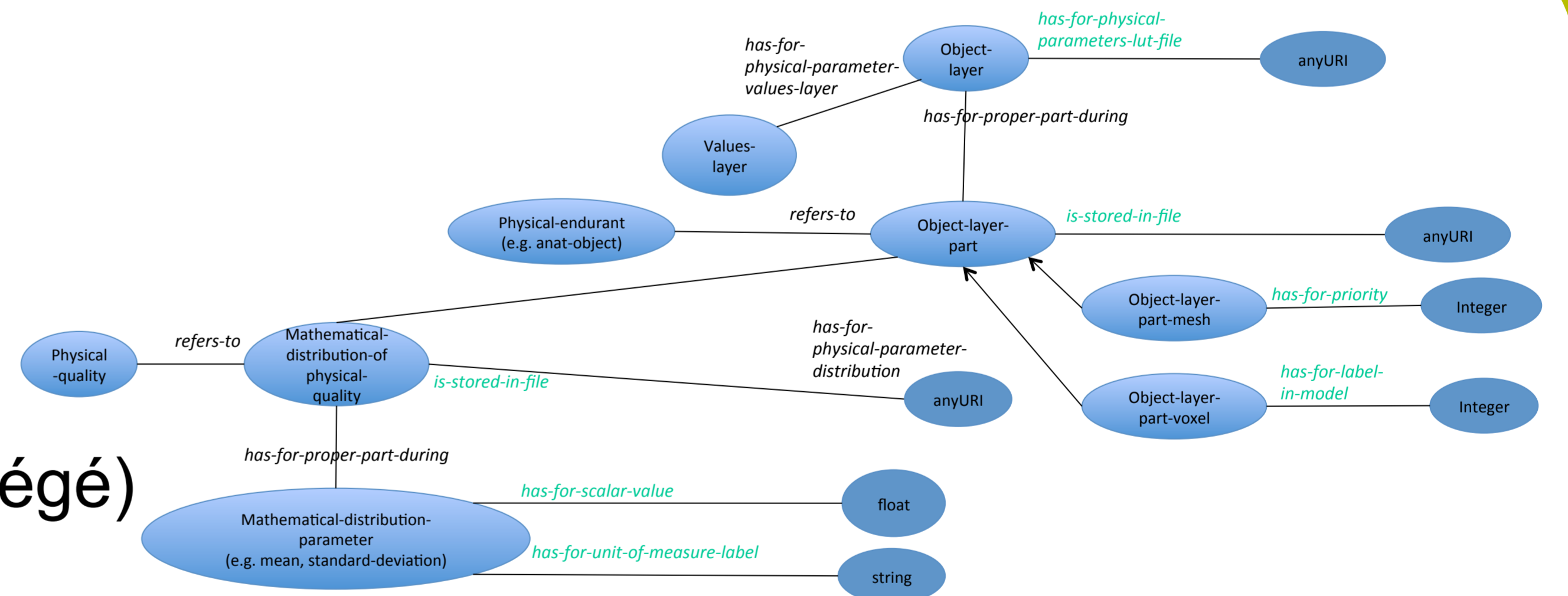
Results:

Representation of a set of layers:

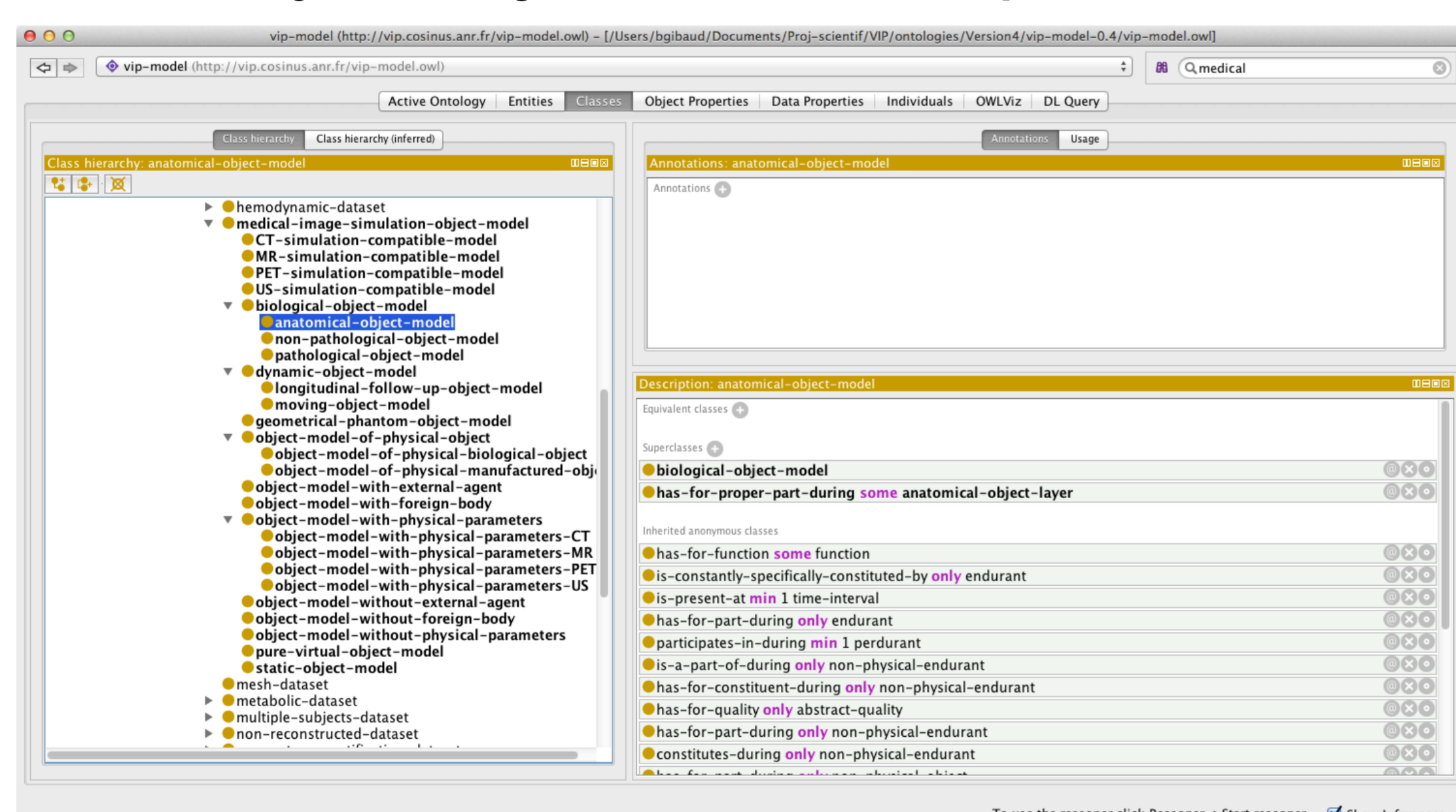
- Anatomy
- Pathology
- External agents
- Foreign bodies
- Geometrical objects



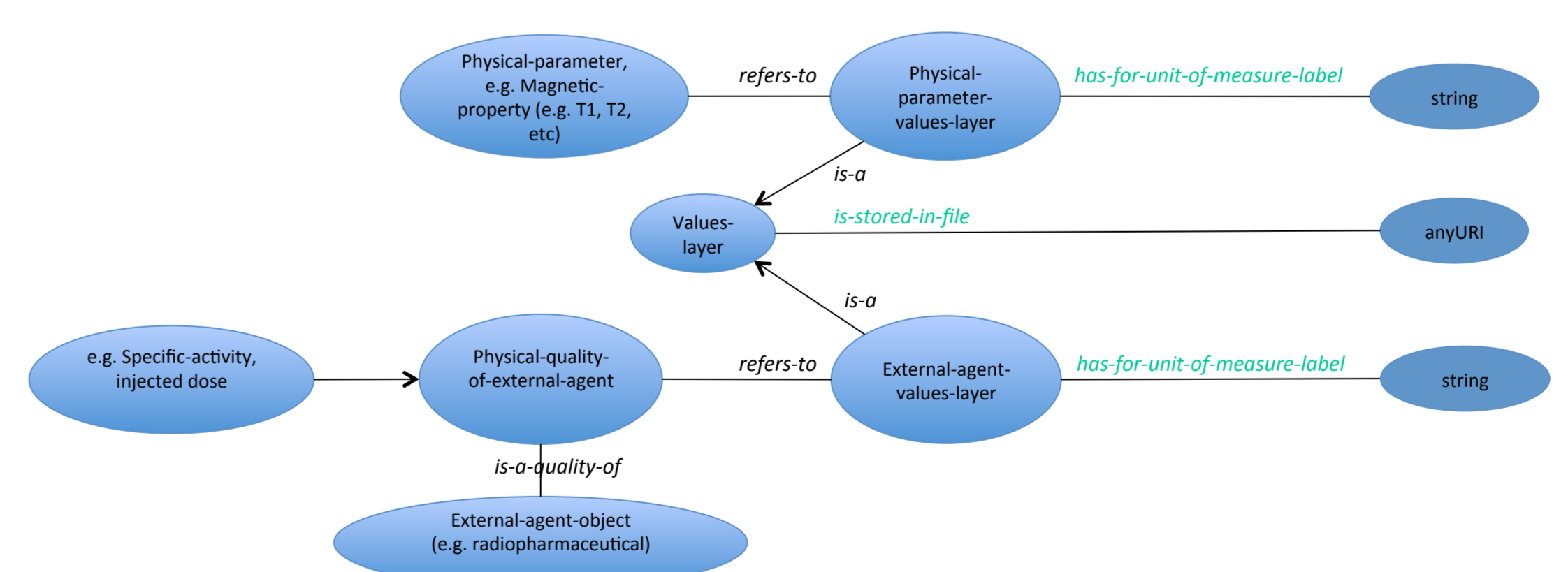
Relation to the **physical properties via object layers**



Taxonomy of object models represented in OWL (using Protégé)



Relation to the **physical properties via values layers**



Implementation: (in progress)

- Semantic annotation of object models at importation time
- Description Logics and rule-based inferencing of object models' classes
- Semantic querying of object models

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REFERENCES

1. Glatard et al. "A Virtual Imaging Platform for multi-modality medical image," IEEE TMI (in press).
2. Glatard et al. "Multi-modality image simulation with the virtual imaging platform: Illustration on cardiac MRI and echography," IEEE ISBI'2012, Barcelona, Spain.
3. Temal et al. "Towards an Ontology for Sharing Medical Images and Regions of Interest in Neuroimaging," J. of Biomedical Informatics, vol. 41, no. 5, pp. 766-778, 2008.
4. Shaw et al. "vSPARQL: A view definition language for the semantic web." J. of Biomedical Informatics, vol. 44, no. 1, pp. 102-117, 2011.