

4 Dimensional Data Modelling: An Ontological Approach

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Information Junction

Agenda

- What is ontology, or an ontology?
- Common causes of problems in data models
- Ontological vs Normalisation approach to data modelling
- An introduction to 4 Dimensionalism (very brief)
- Space-Time diagrams
- Modelling Change
- Modelling Roles
- Sets and classes
- Some practical consequences



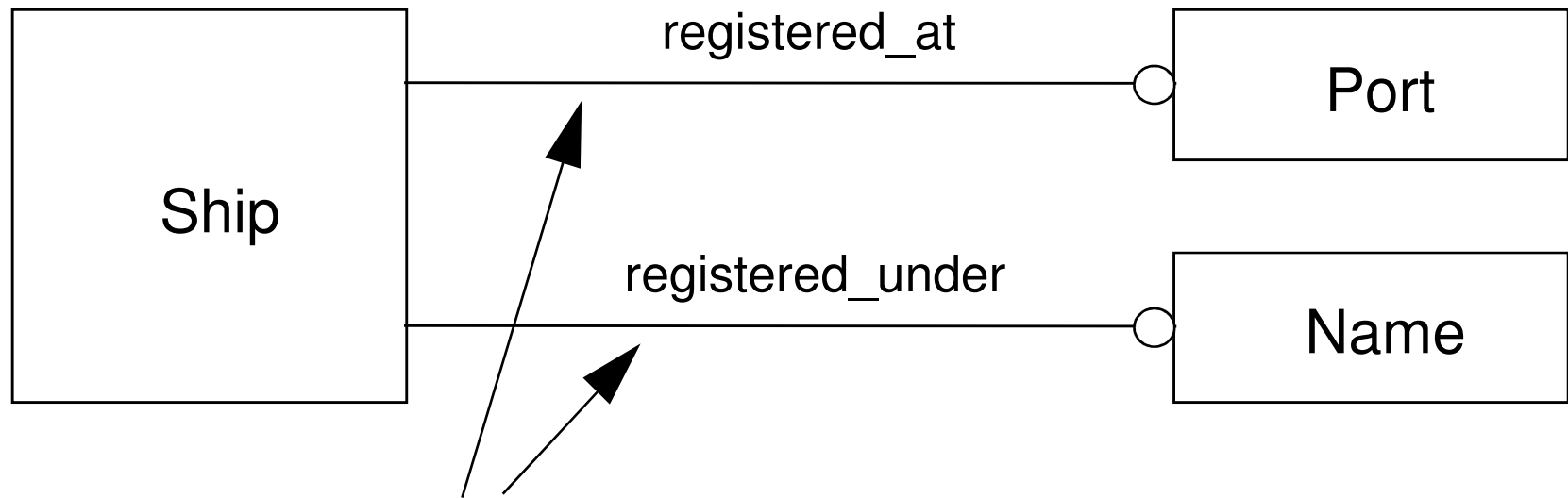
What is Ontology (and an ontology)?

- Ontology – the study of being (what exists)
 - A part of metaphysics
- An ontology – a theory of what exists
 - The sorts of things that exist, and
 - The rules that govern them

Very relevant to data modelling, since data models generally represent the things of interest to an enterprise



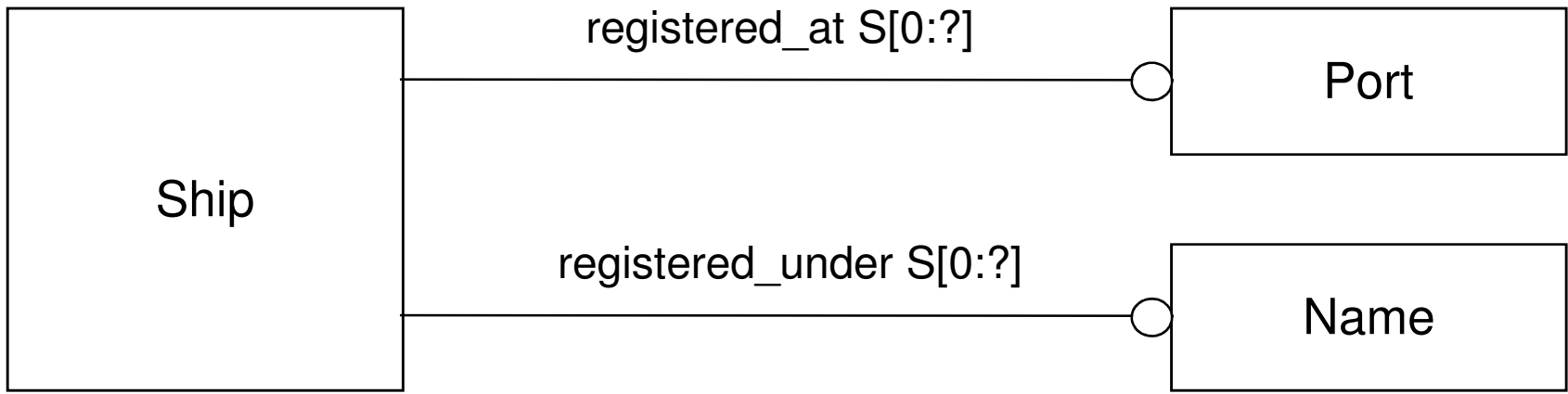
Some problems with data models



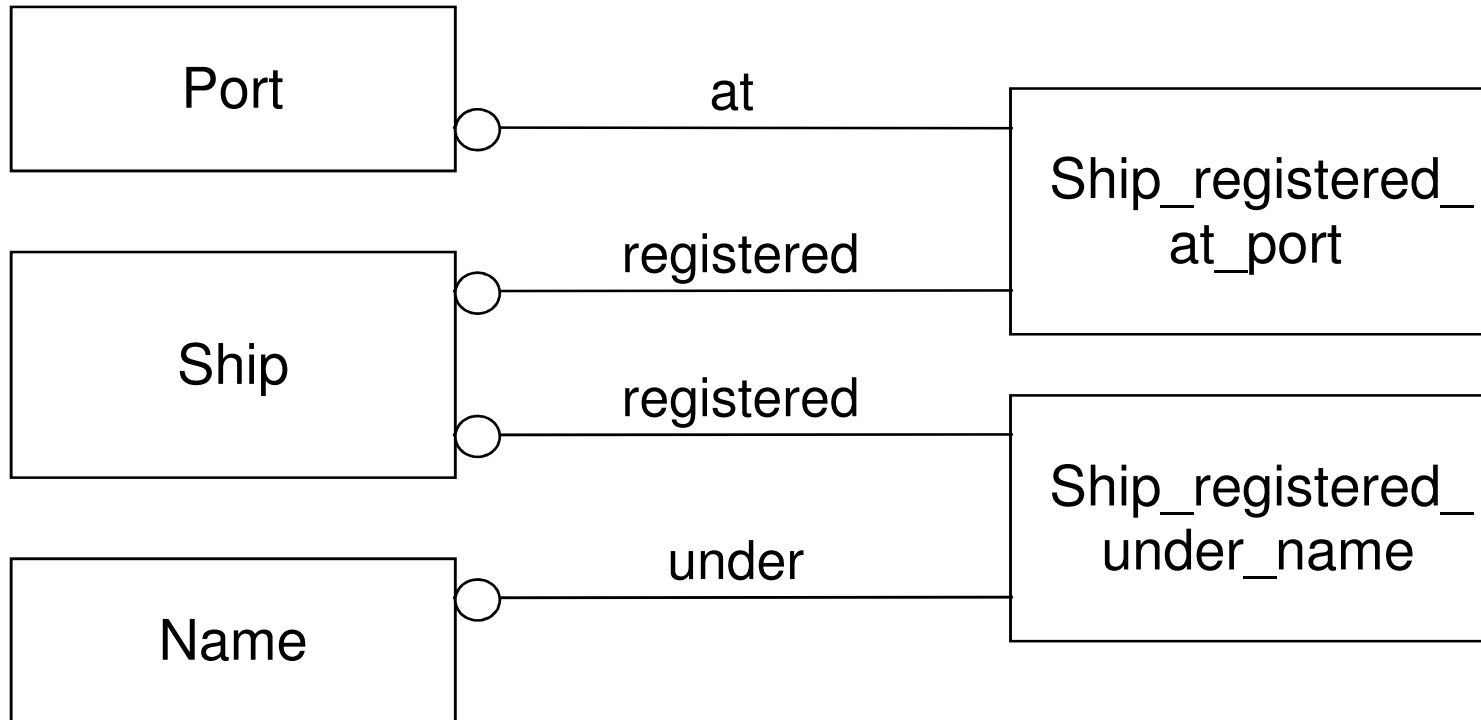
Transferable relationships



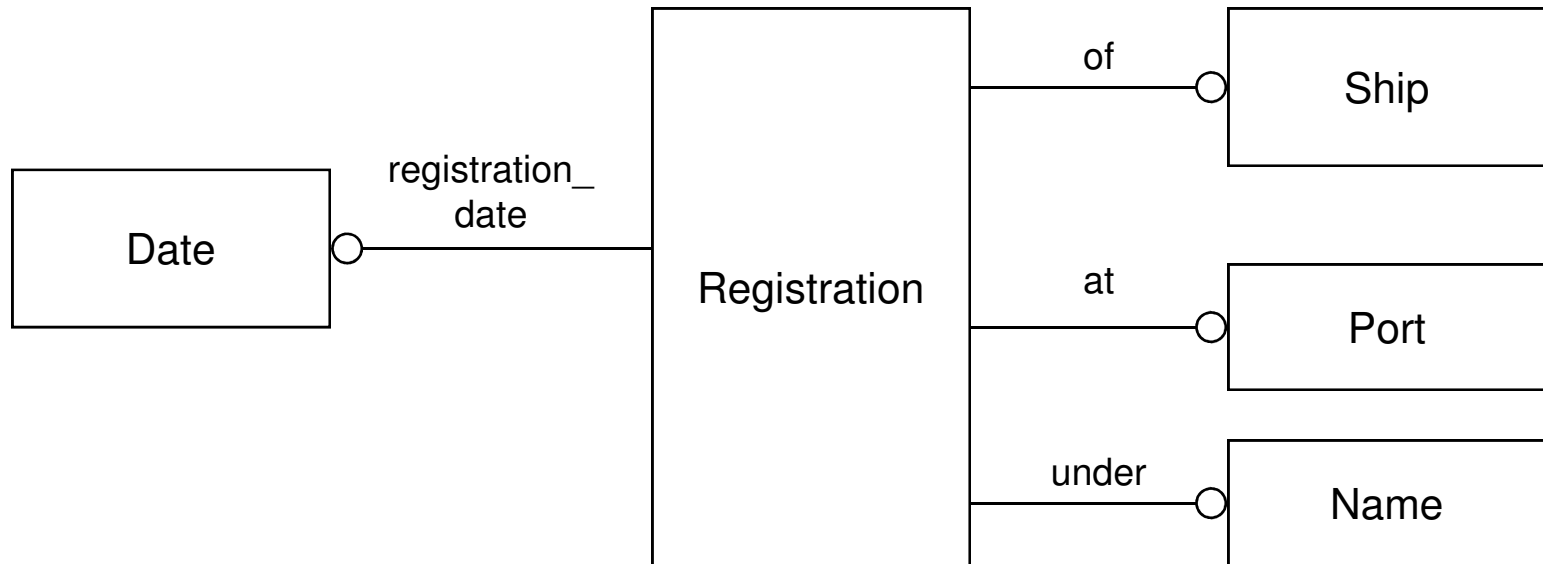
Recognising transferable relationships as many-to-many



Resolving the many-to-many relationship



Recognising there is an activity behind the relationships



Ontological vs Normalisation approach to data modelling

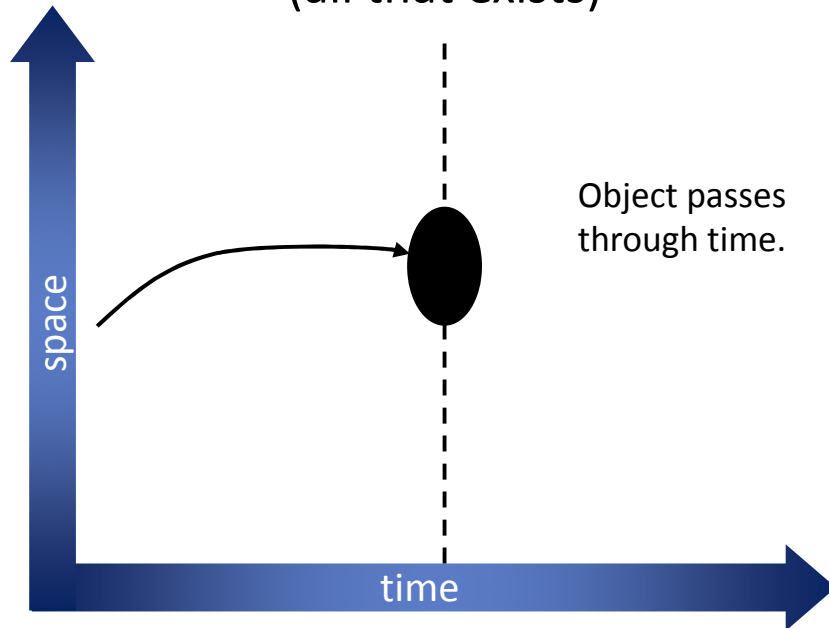
- A normalisation approach starts from the data requirements
 - But what if some are missing?
- An ontological approach looks at the objects and the processes in the enterprise

I prefer the latter, but if you are doing it that way, you should do it properly

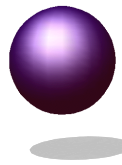


3D

The present
(all that exists)



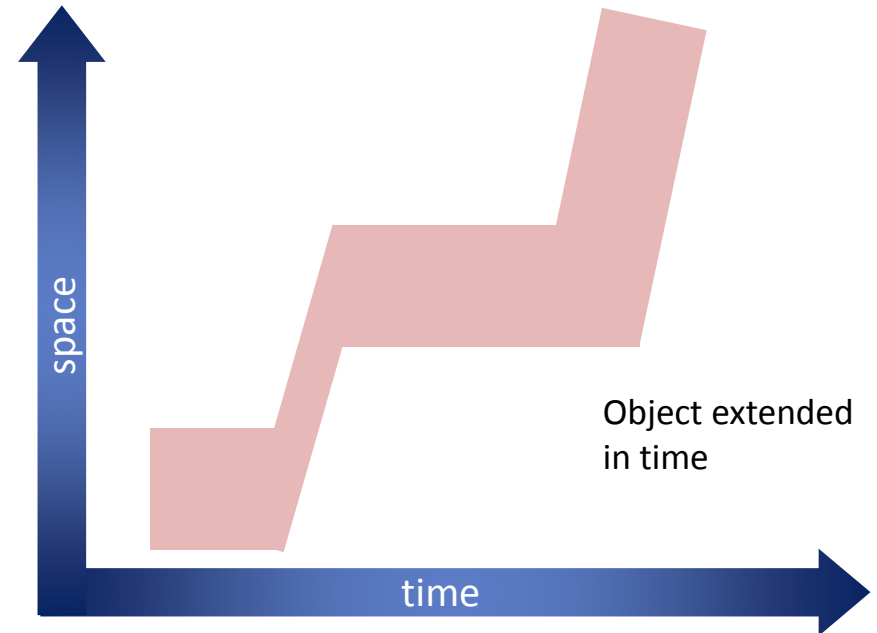
1. Physical objects do not have temporal parts.
2. Different physical objects may coincide (non-extensional).



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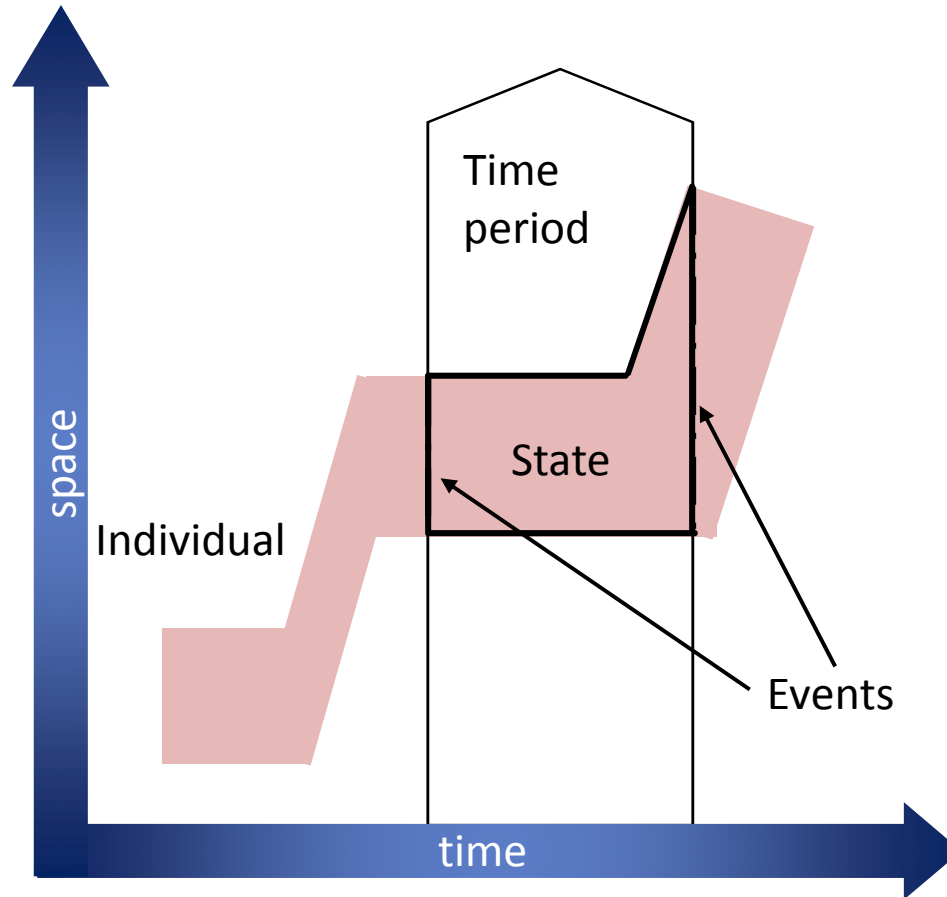
4D + Extensionalism

The past and the future exist
as well as the present



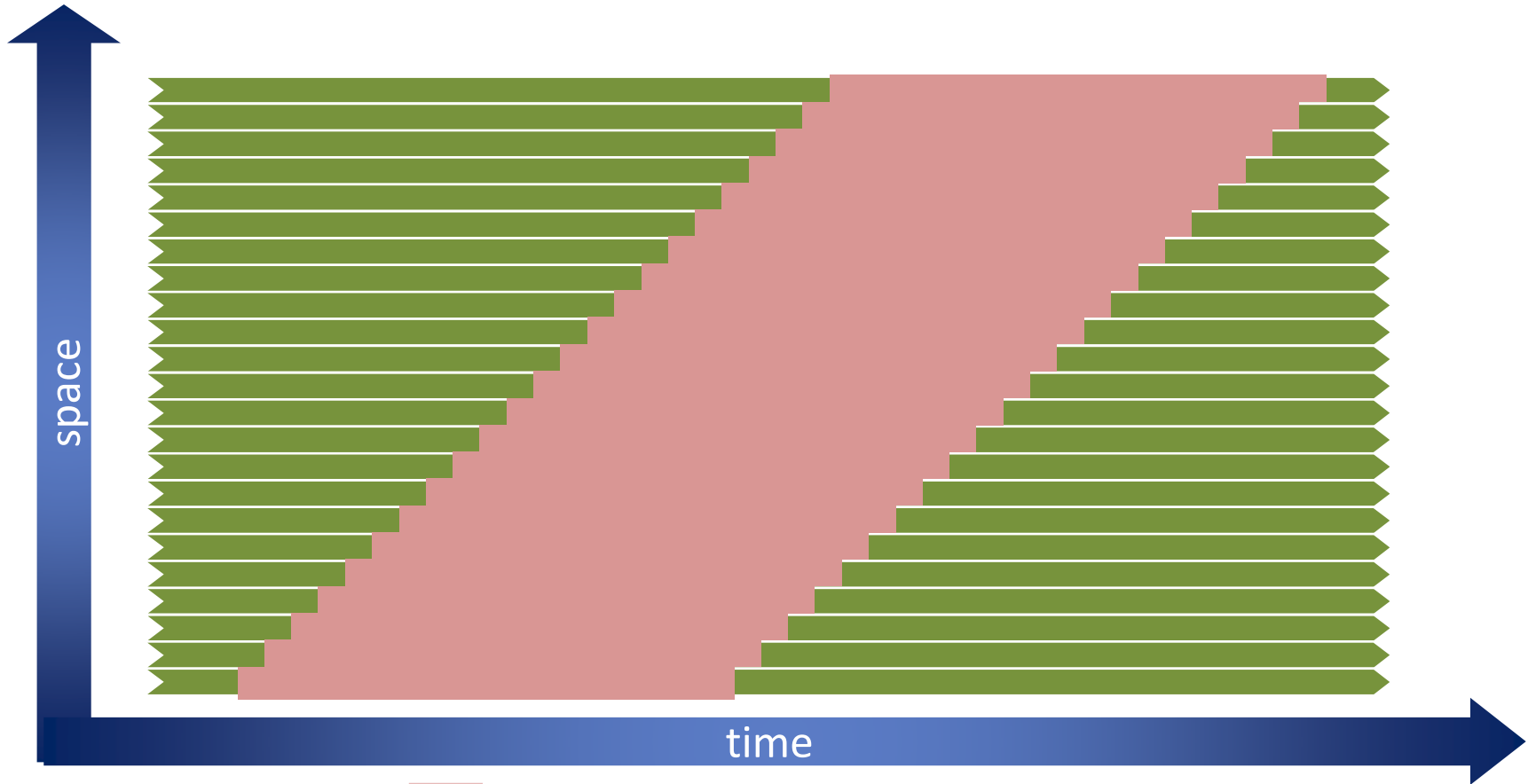
1. Individuals extend in time as well as space and have both temporal parts and spatial parts.
2. When two individuals have the same spatio-temporal extent they are the same thing (extensionalism).

Some basic elements



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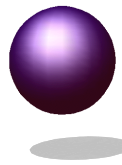
A new look at time



local_day

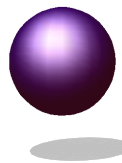
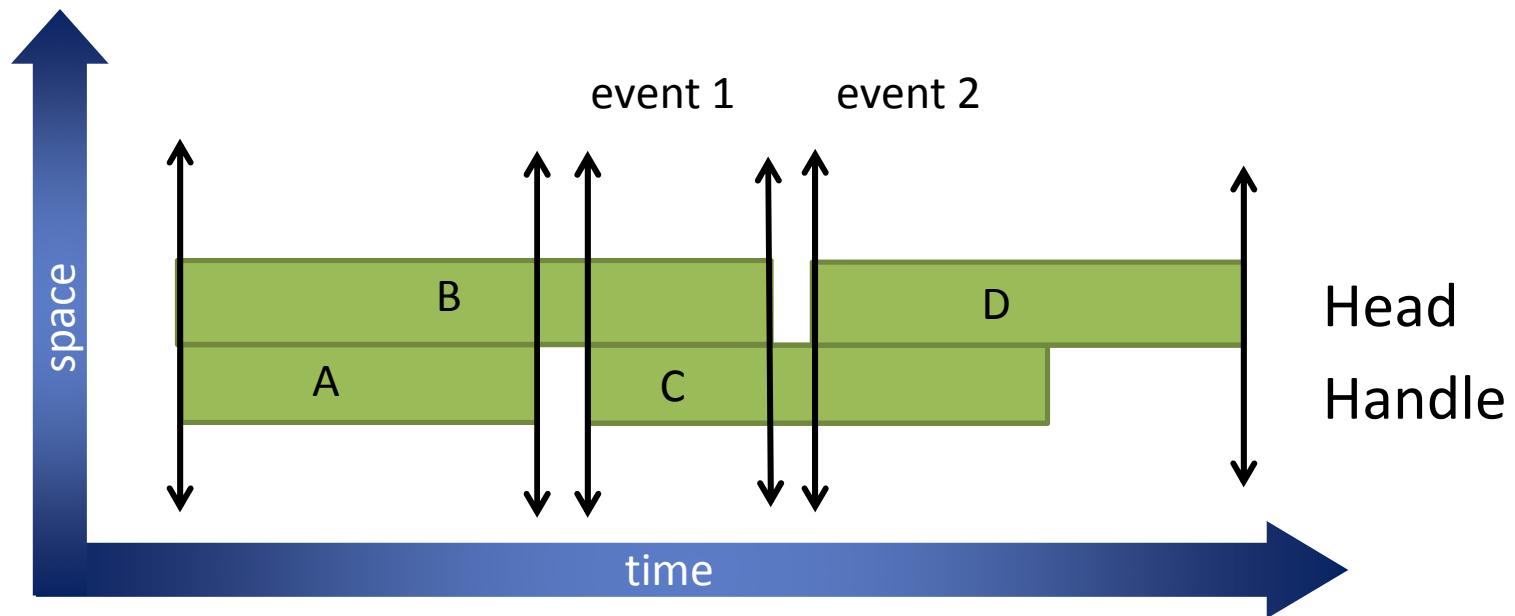
global_local_day

geopolitical_area (time zone)

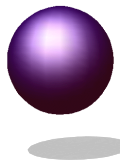
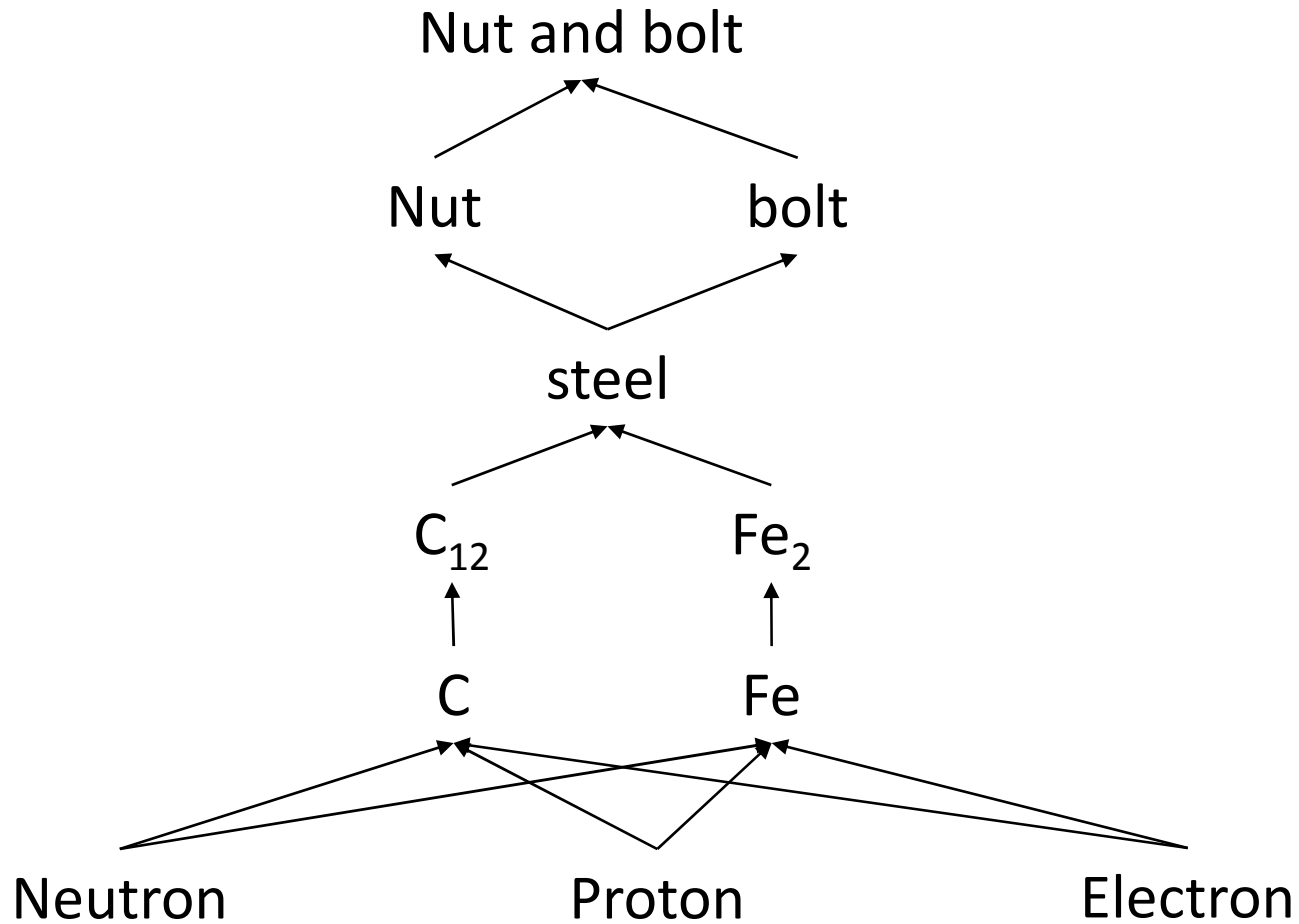


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A basic pattern - The life of a Broom

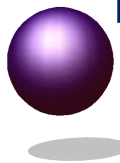
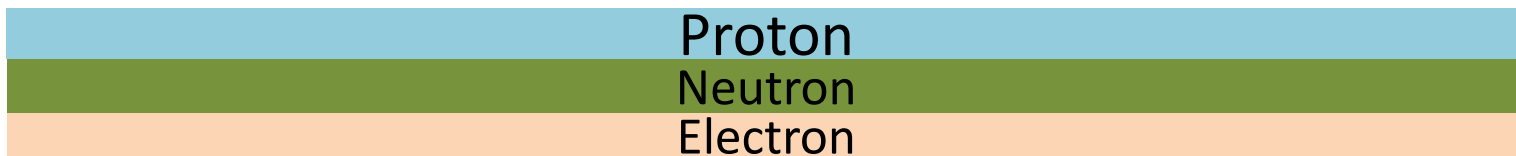
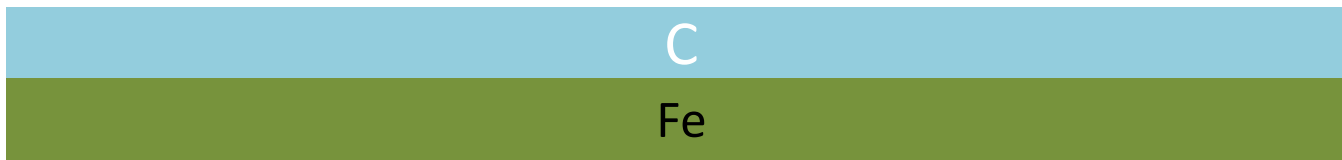


Levels of reality – or what things are made from



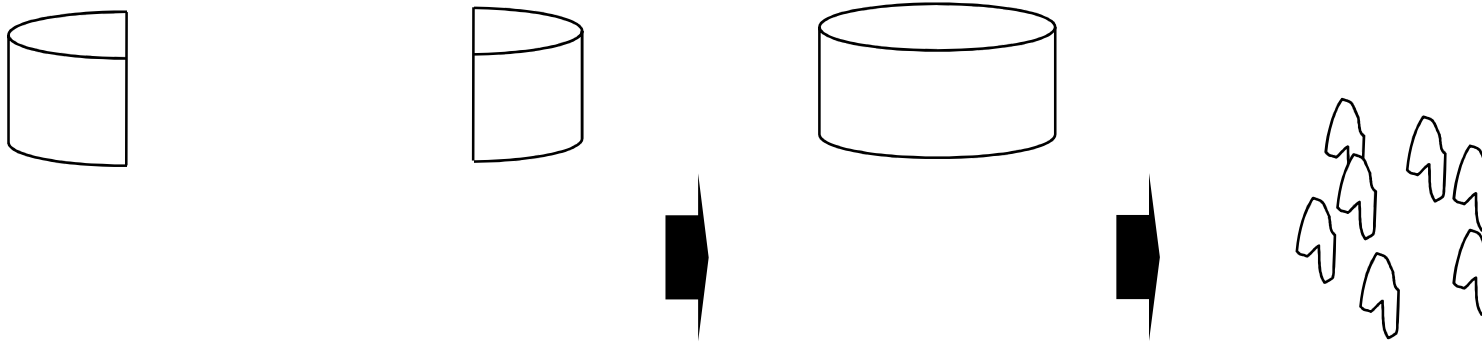
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How Levels of Reality work



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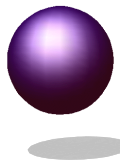
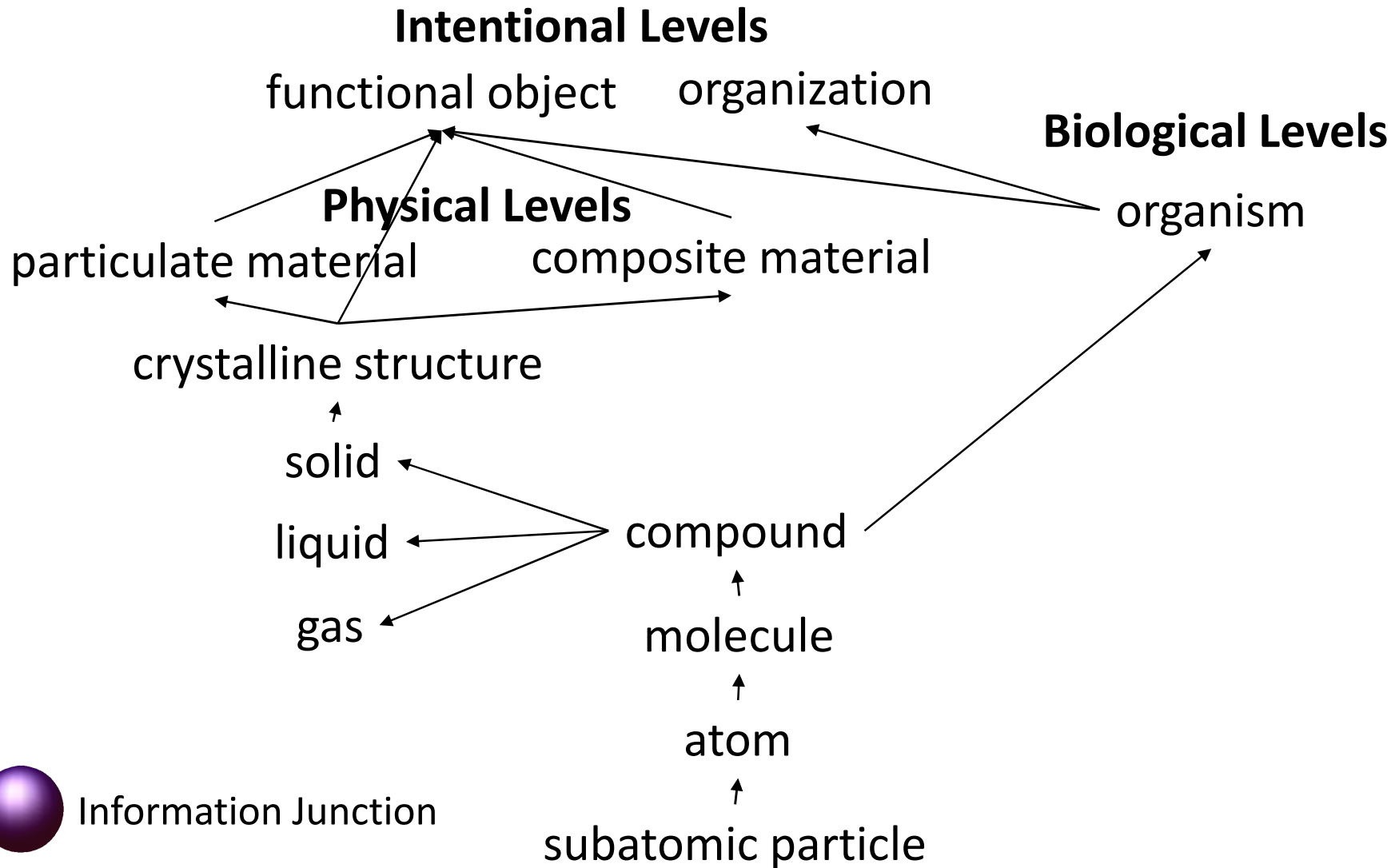
Different levels can accidentally coincide



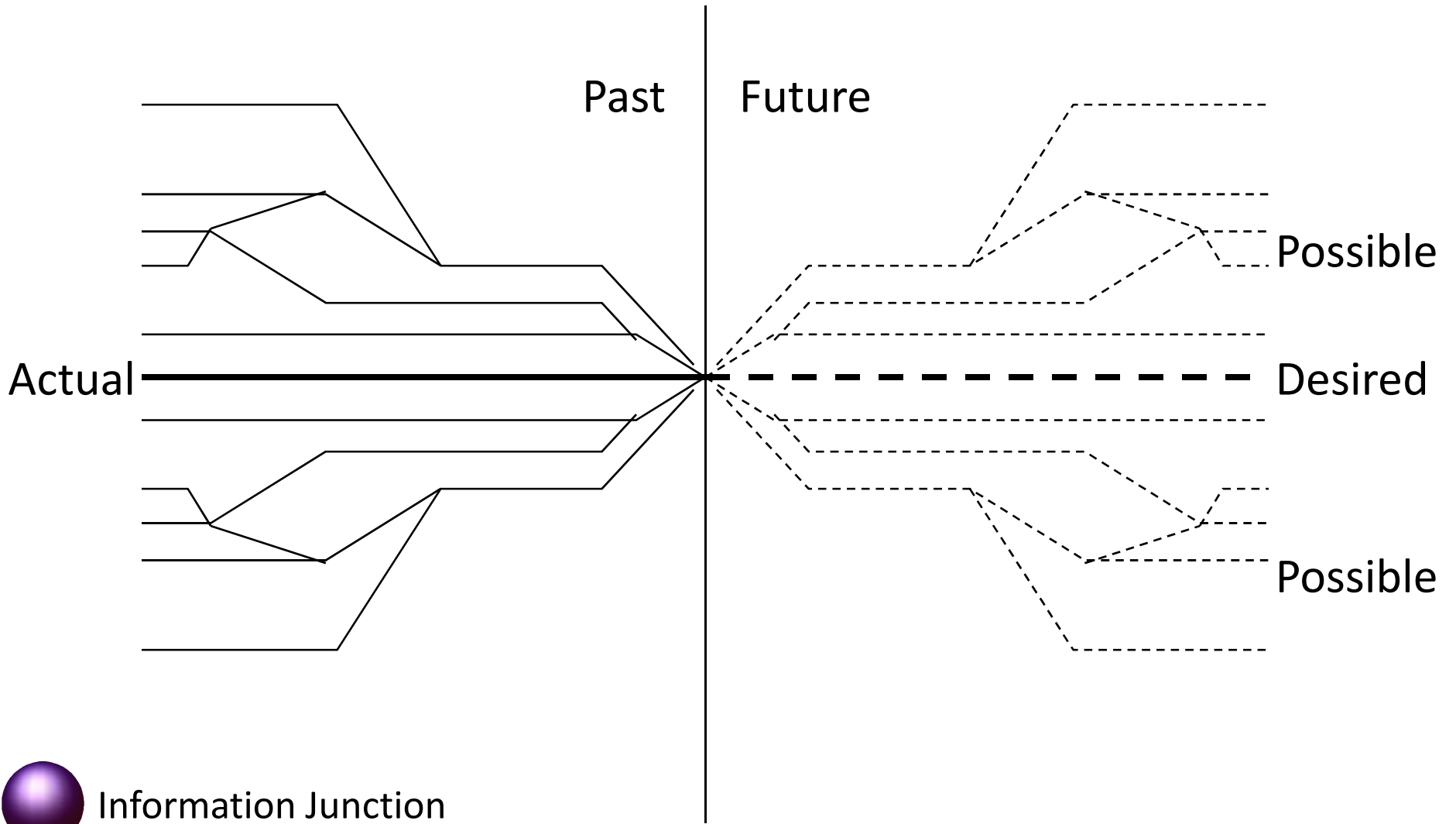
There isn't anything you can say about the vase that would not be true of the clay it was made of (or vice-versa)



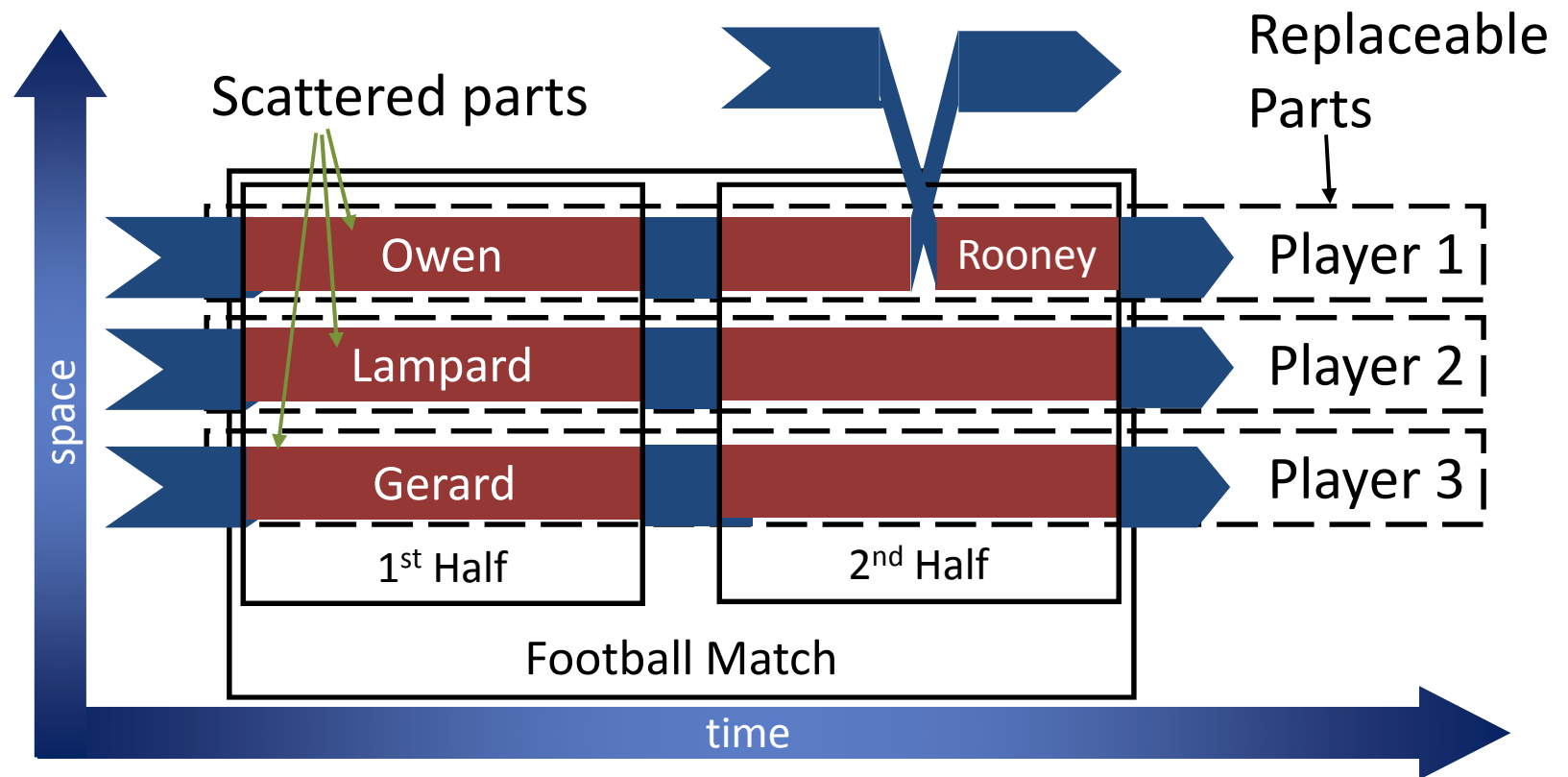
Levels of Reality in ISO 15926



Possible Worlds

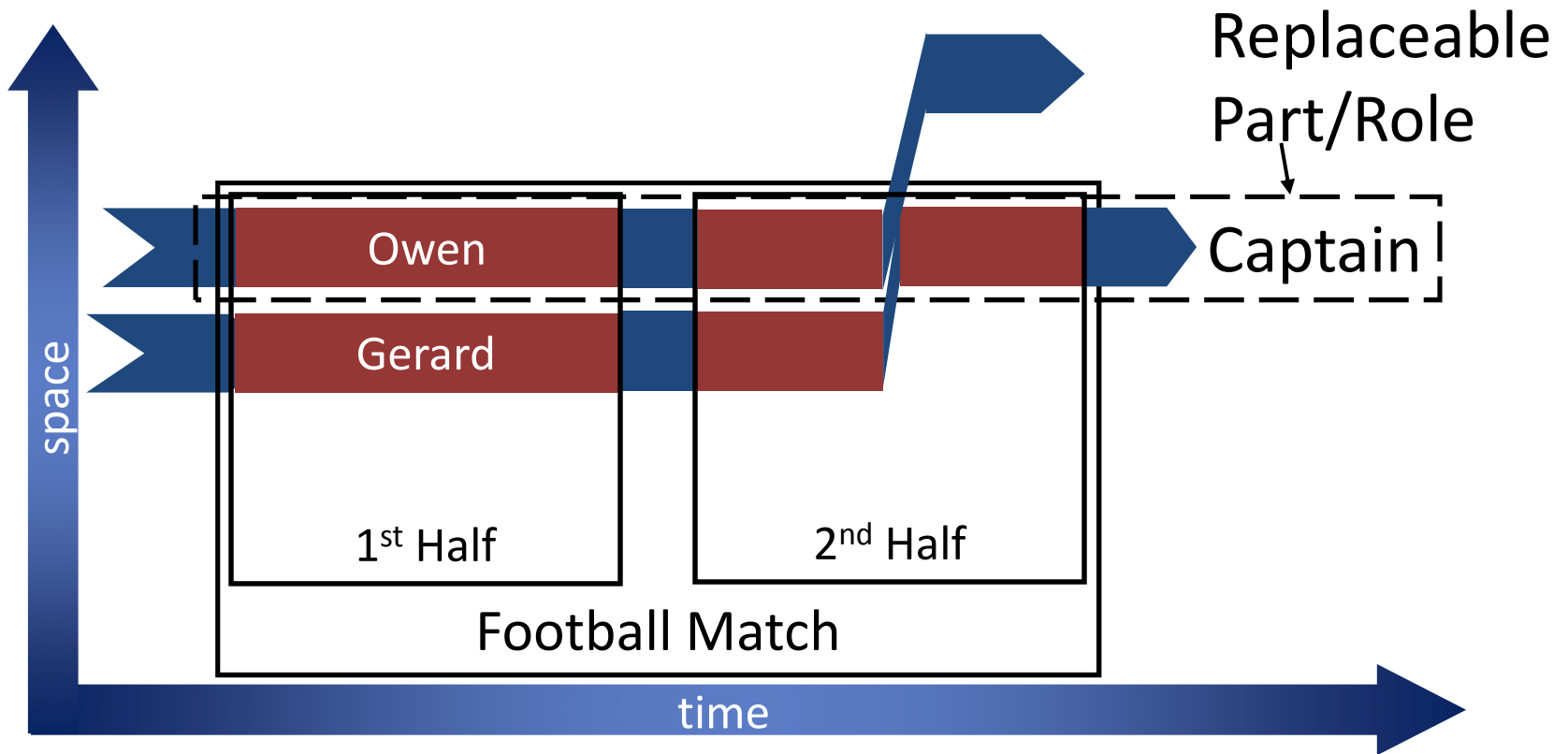


Activities and Roles/Replaceable Parts



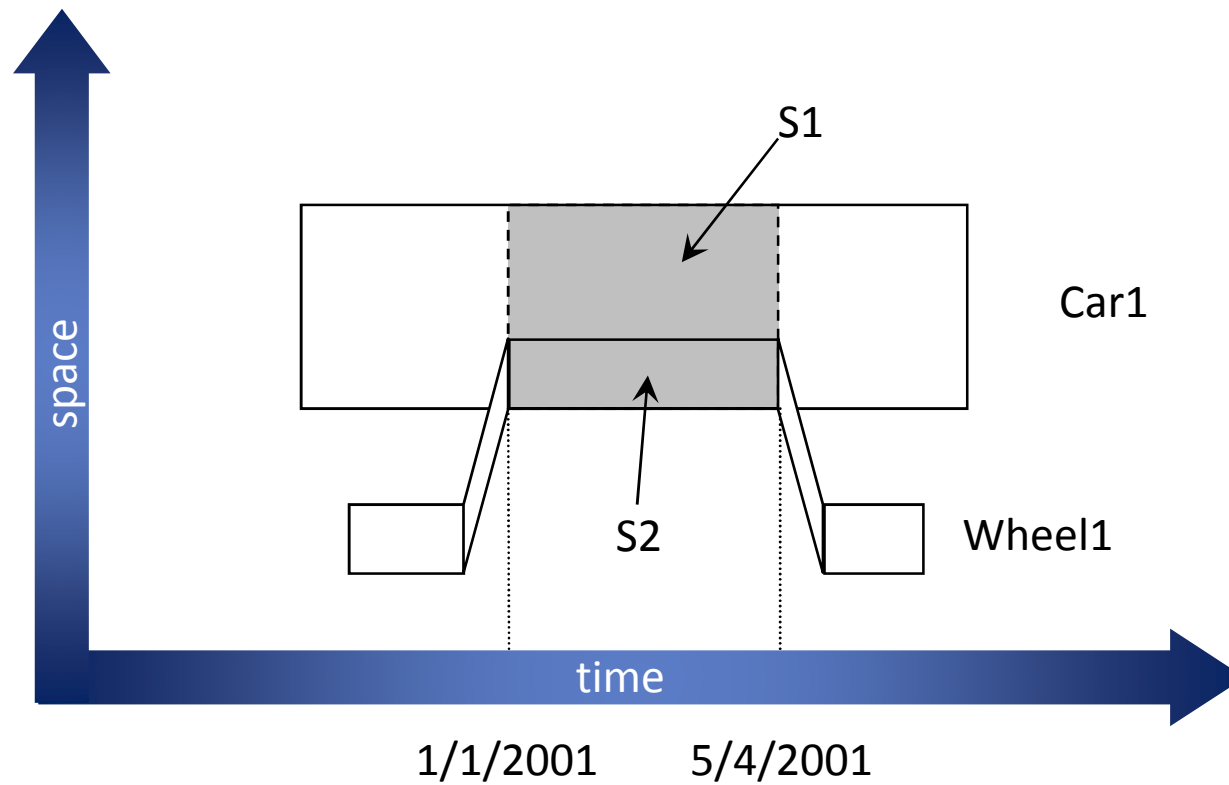
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Changing Roleplayer



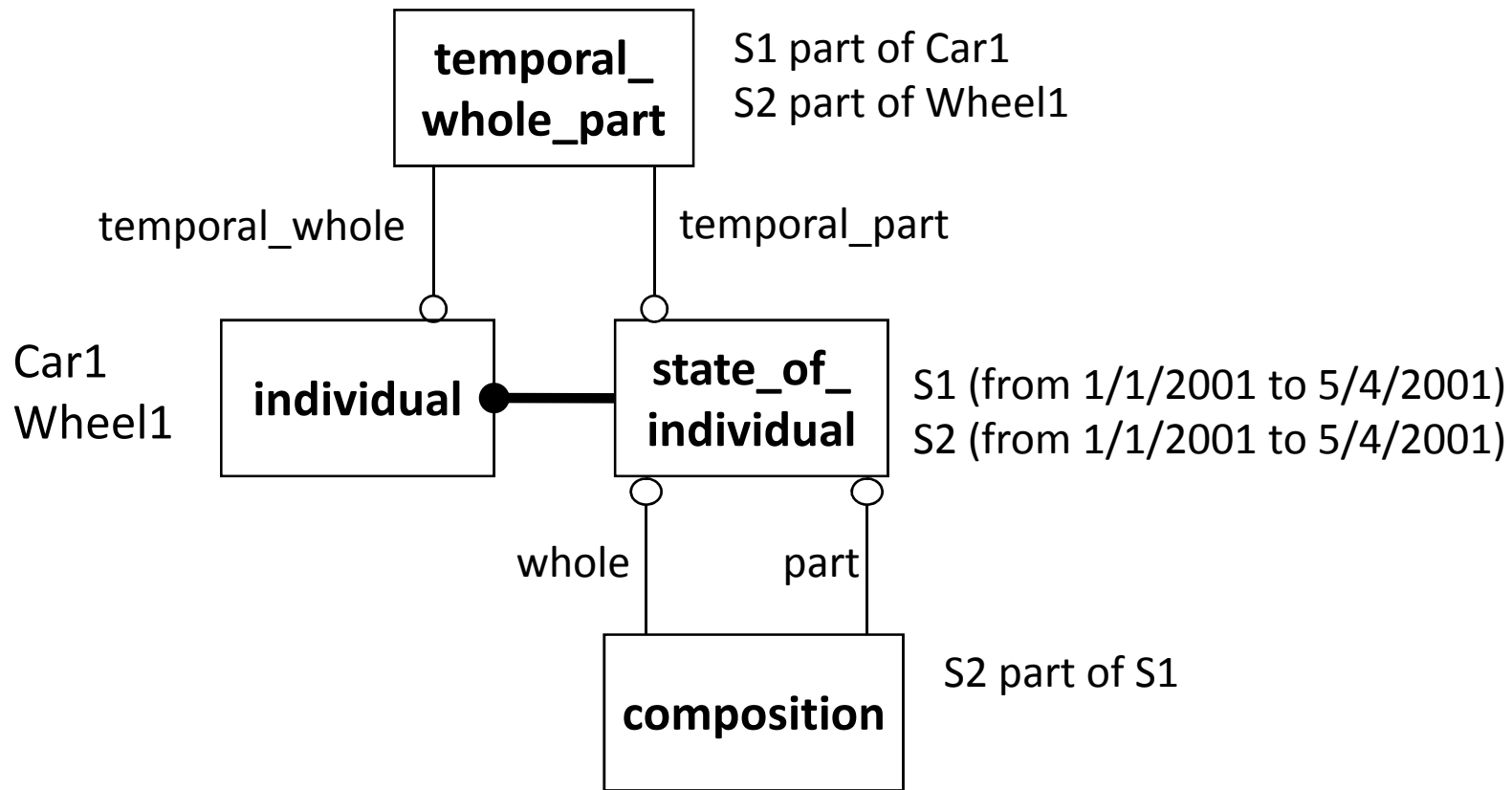
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Composition

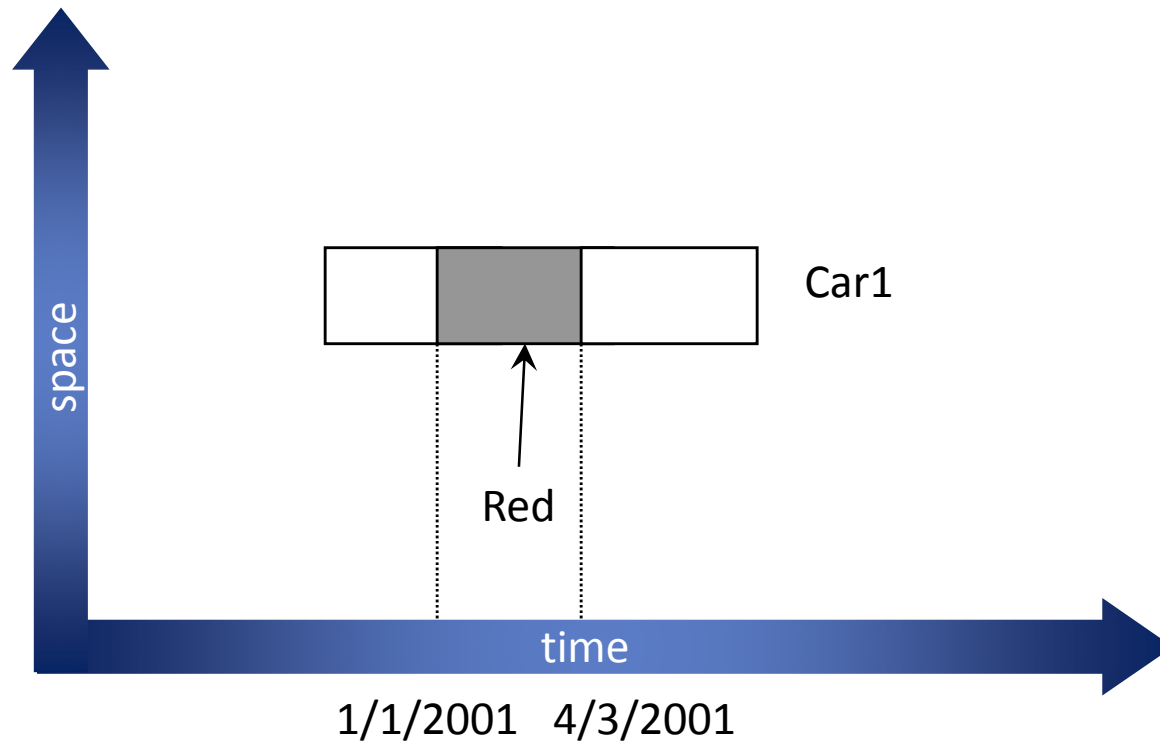


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Conceptual Data Model

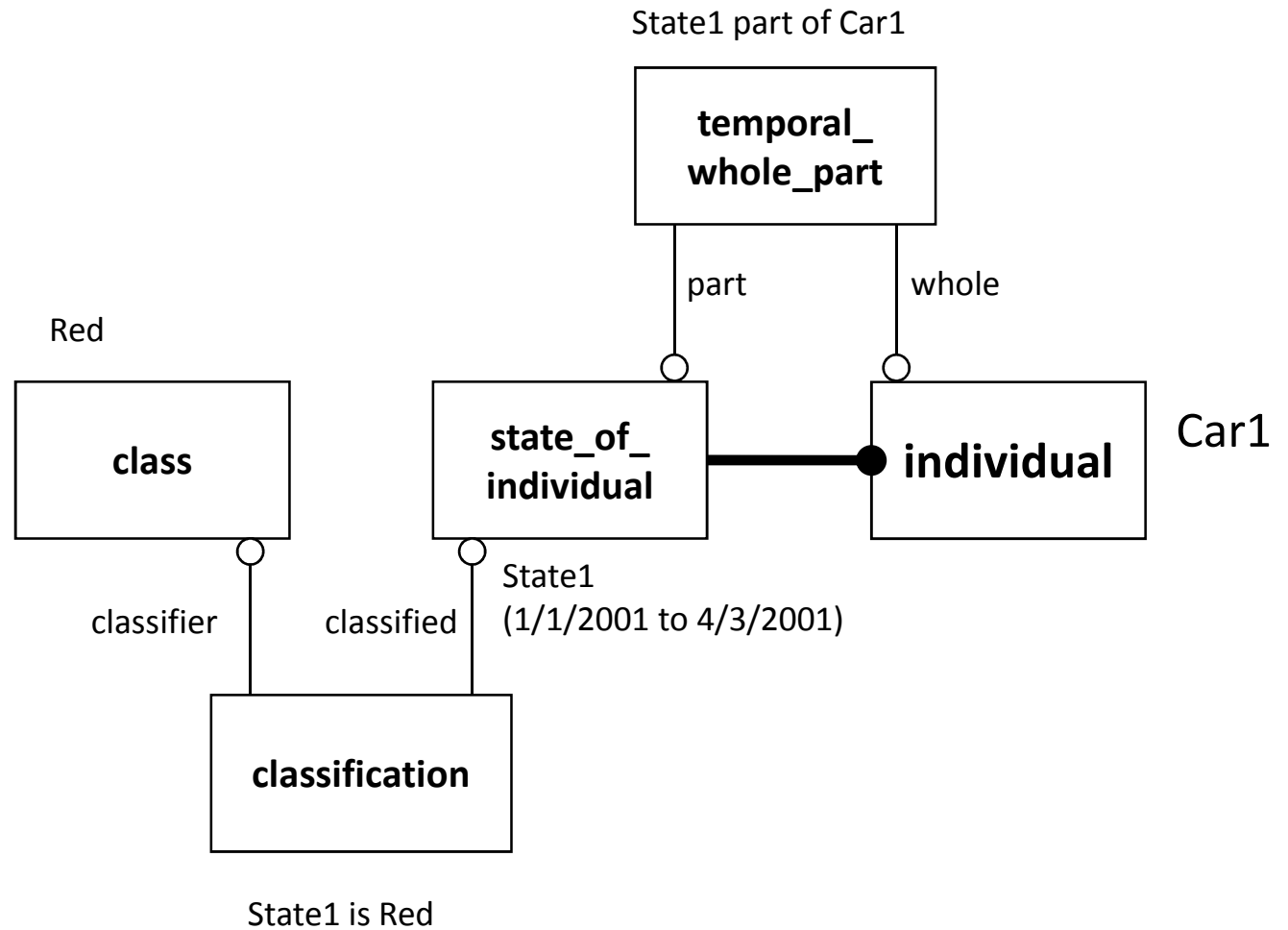


Classification

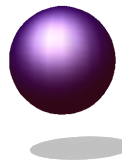
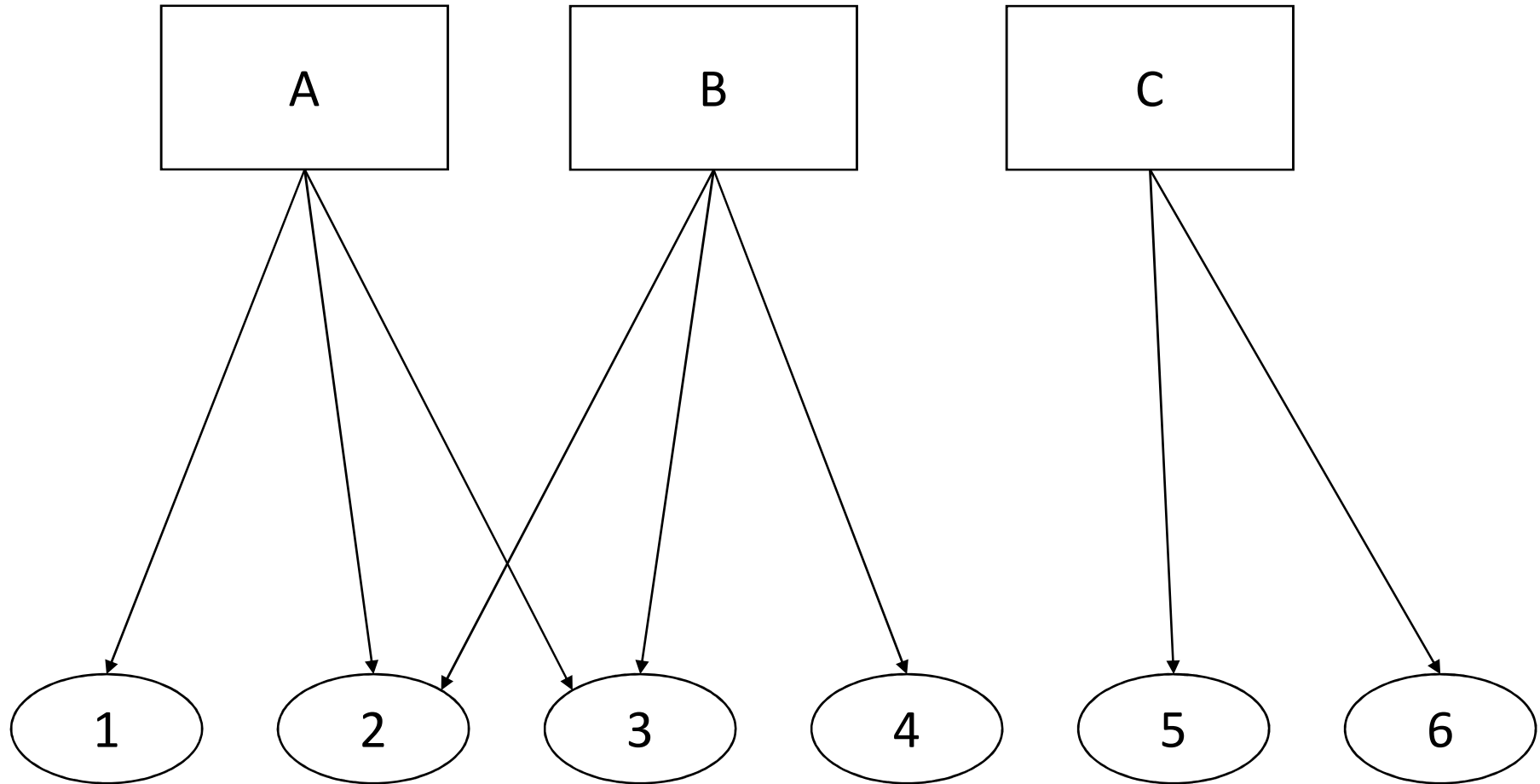


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Conceptual data model



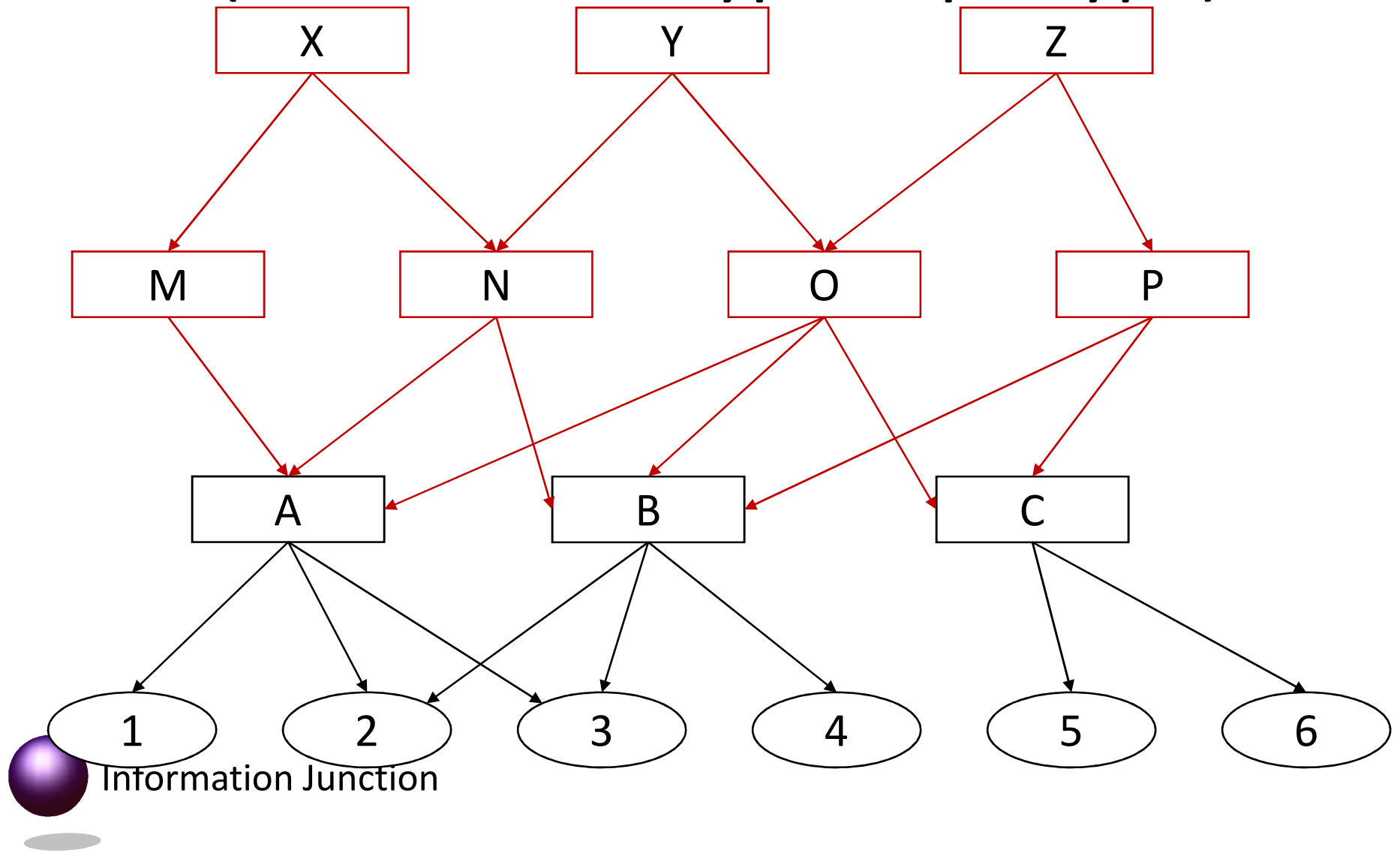
Set Theory – Entity Types and Instances



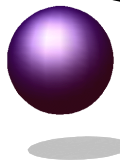
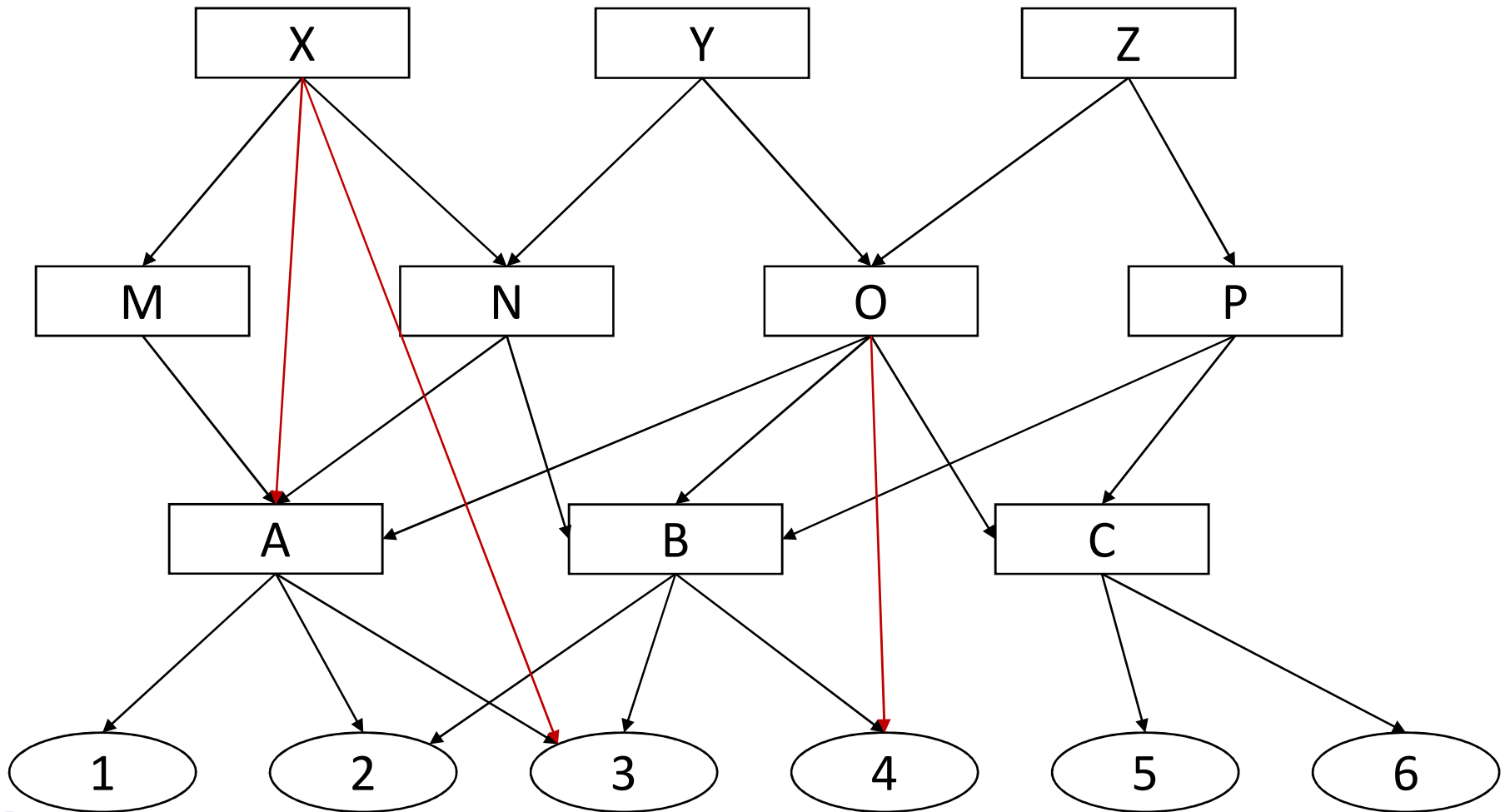
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Hierarchical Classes

(note: not subtype/supertype)

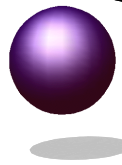
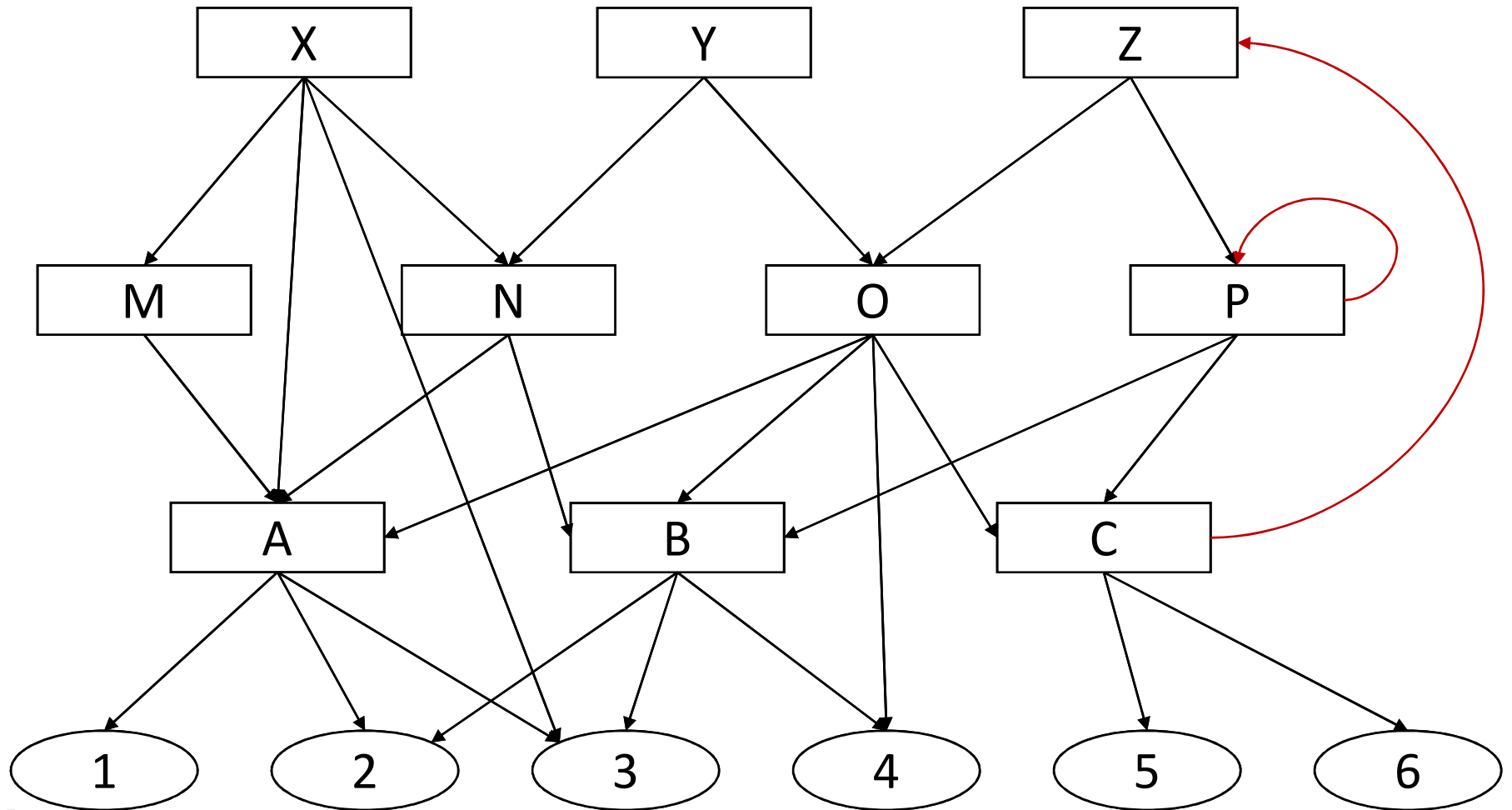


“Standard” or “Well Founded” sets



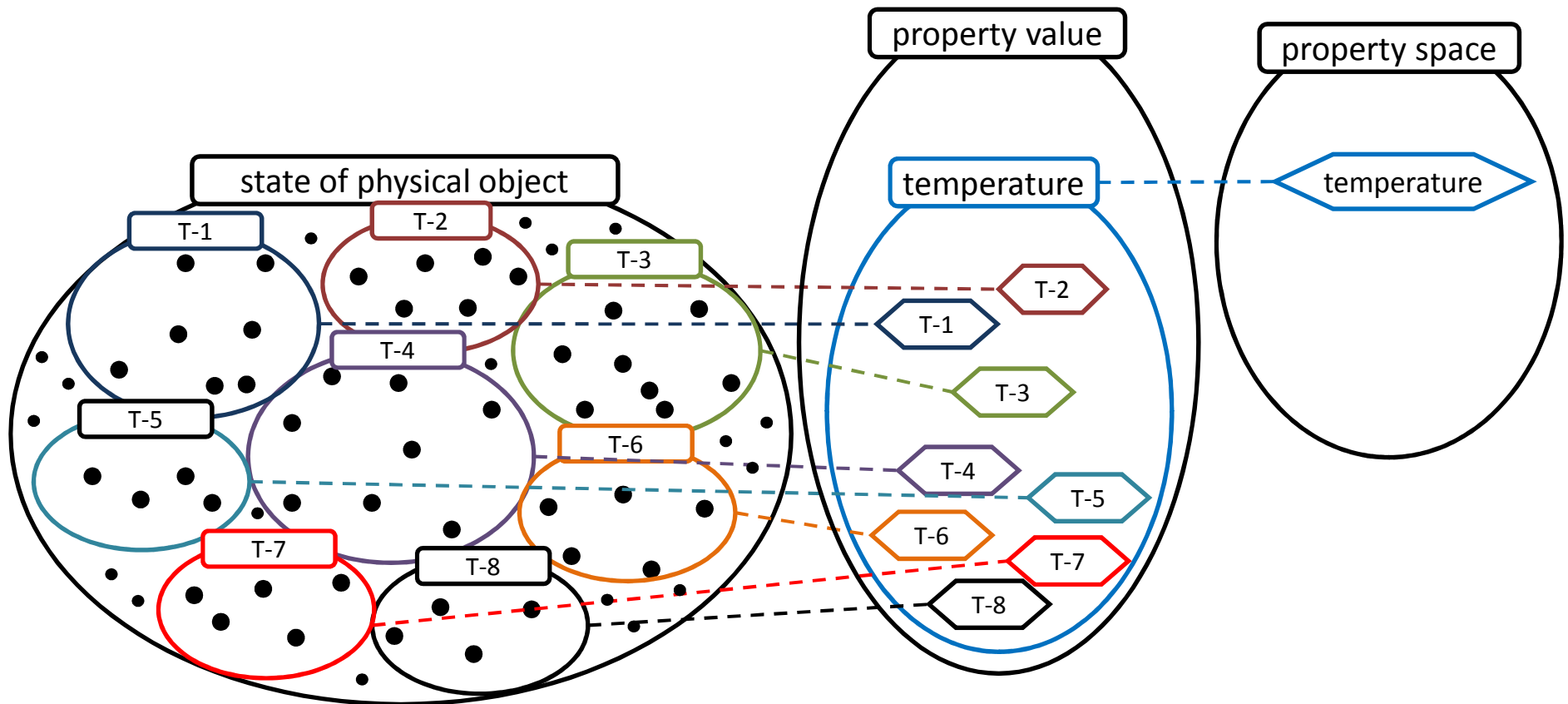
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“Non-Well-Founded” sets



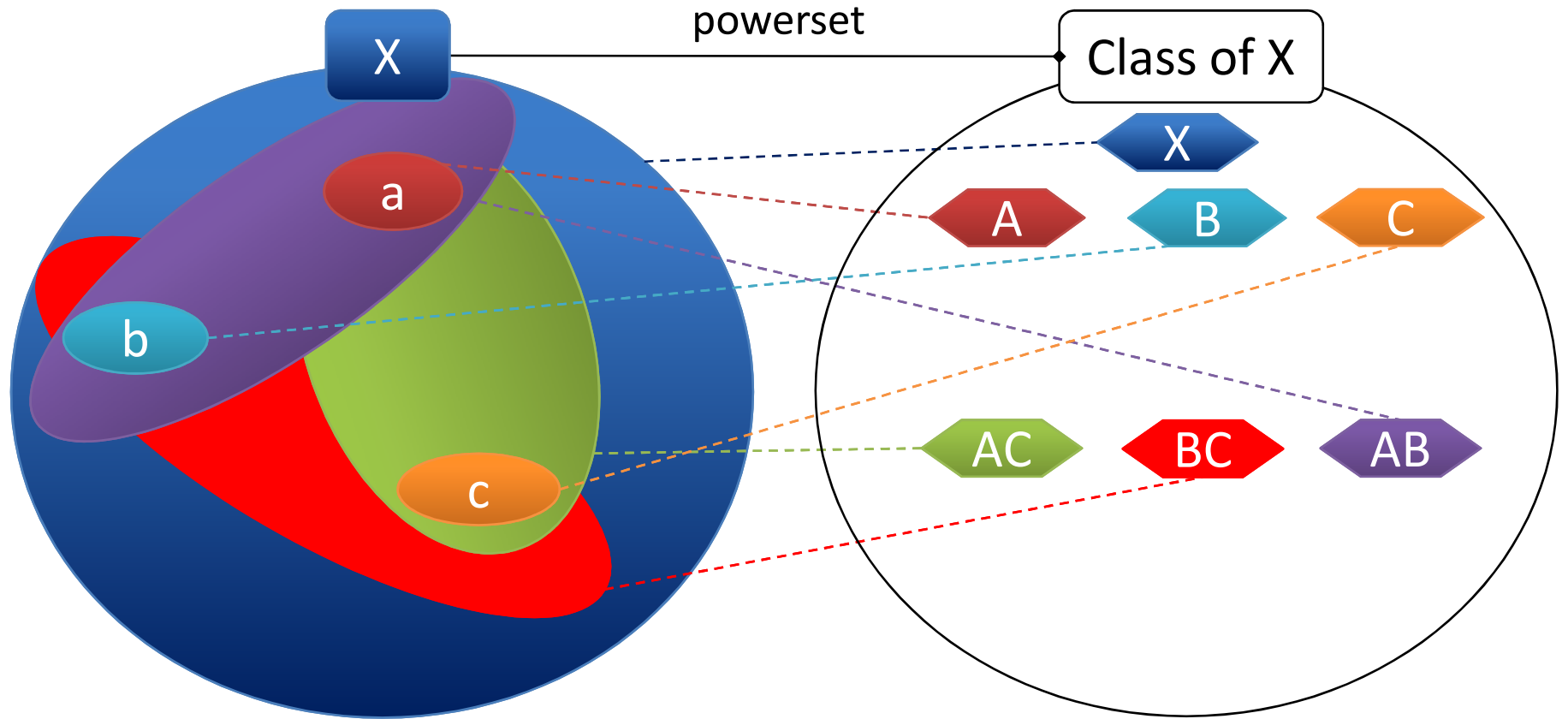
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A practical example of hierarchical sets

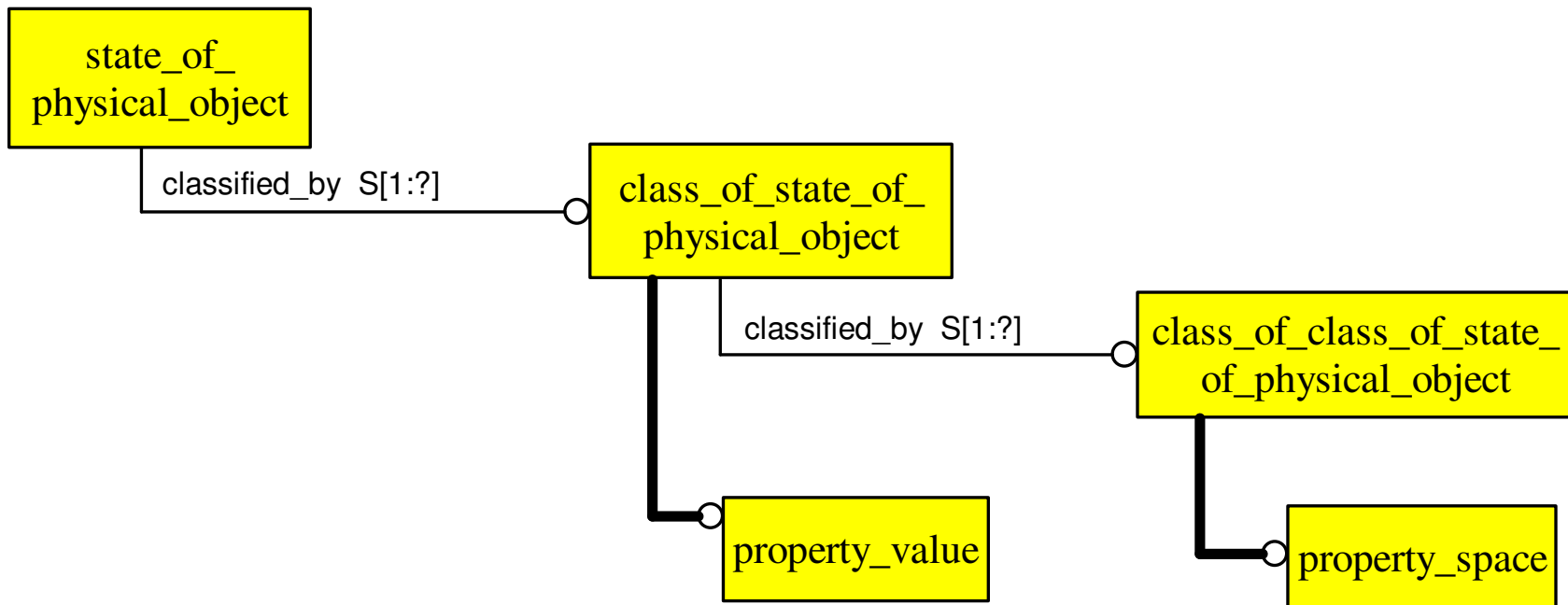


The Power Set - Class of X

All the possible subtypes of X

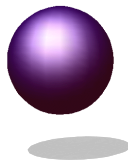


A starter data model for physical properties



Some consequences

- Your data model is automatically in 6th Normal Form
 - Roughly 5NF, but after change is accounted for
- You can develop a conceptual data model capable of large scale integration (ISO 15926)
- There are no updates (if you do not denormalise the conceptual data model)
 - There are a lot of records, but they are small, and the total data held to meet specific requirements is low because of the normalisation
- The model can (of course) be denormalised to meet the needs of particular applications

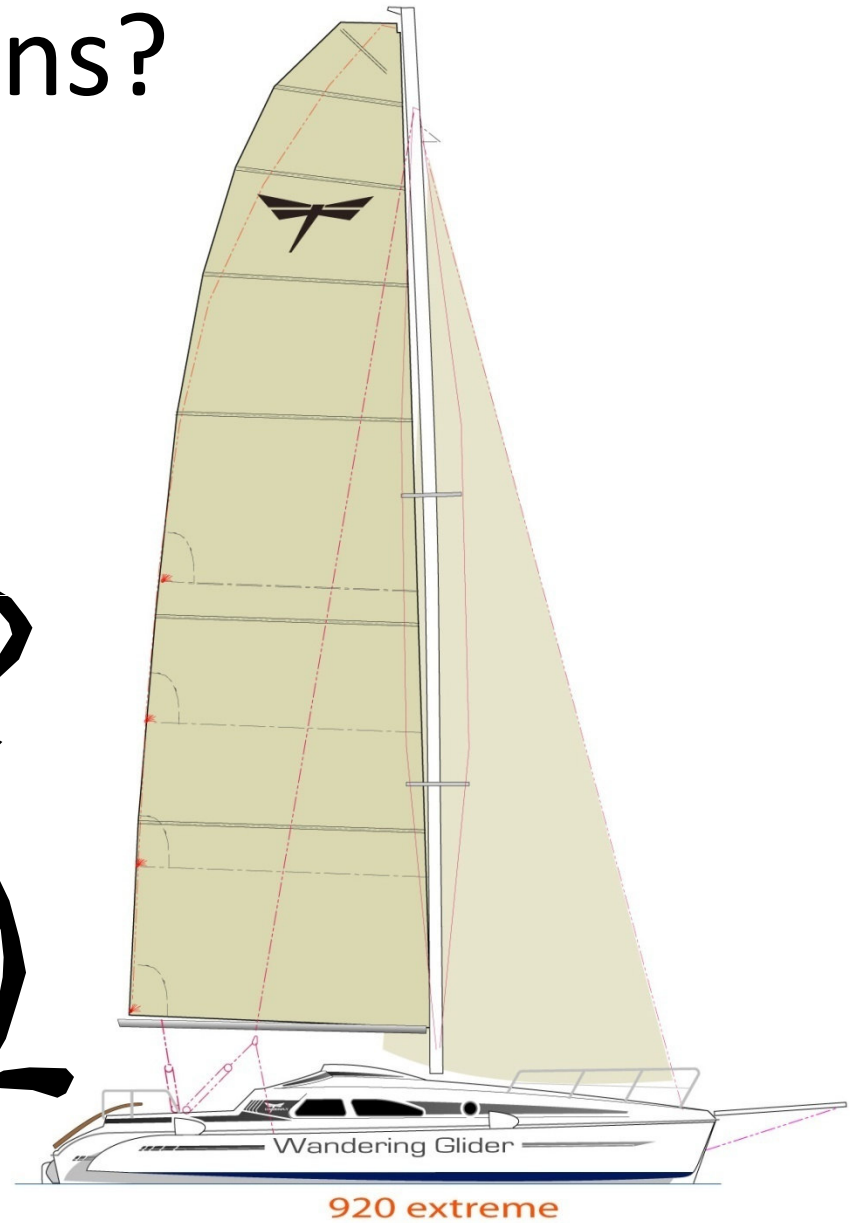
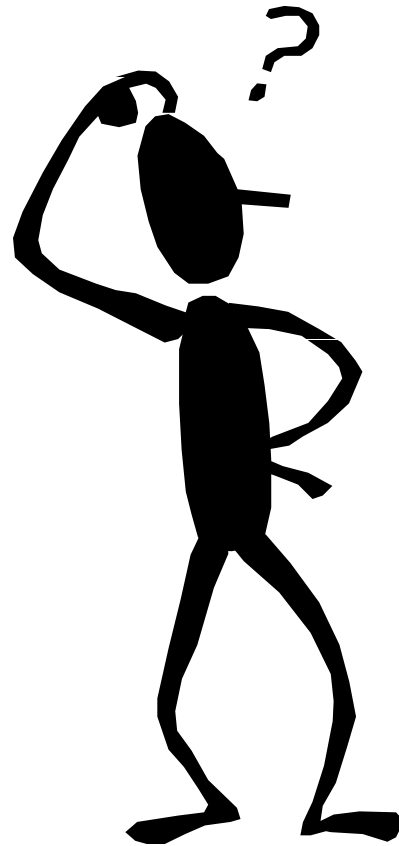


Conclusions

- You have been introduced to 4-Dimensionalism
 - An ontological paradigm that can be applied to developing data models
- It automatically takes account of change
- It helps to explain some difficult concepts like roles
- Through a consistent and rigorous approach it also enables large scale integration



Questions?



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