national center for ontological research
ncor

Survey of the Field

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Outline

- ODP/W3C/Manchester Survey
- BFO/CCO Design Patterns
- Not a Drill, Drill

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- ODP/W3C/Manchester Survey
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- Not a Drill, Drill

Ontology Design Patterns (ODP)

- Ontology groups have been developing design patterns since the dawn of the semantic web

- Early groups defined an **ontology design pattern** as:

A reusable successful solution to a recurrent modeling problem

Varieties of ODPs

- **Content ODP** – Represent domain-specific patterns
- **Logical ODP** – Represent OWL-specific patterns
- **Correspondence ODP** – Represent reengineering and mapping patterns
- **Reasoning ODP** – Represent reasoning procedure patterns
- **Lexico-Syntactic ODP** – Represent translation patterns between natural language and ontologies

ontologydesignpatterns.org

- Contains over **100 patterns** categorized into 6 groups of patterns hosted on **Semantic Web Portal** dedicated to ODPs

- Claims to provide a "*review process for creation of certified patterns*."

http://ontologydesignpatterns.org

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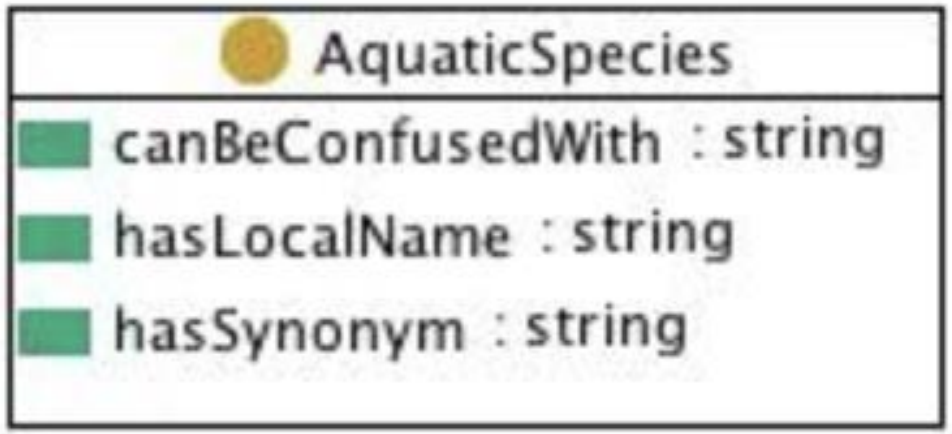
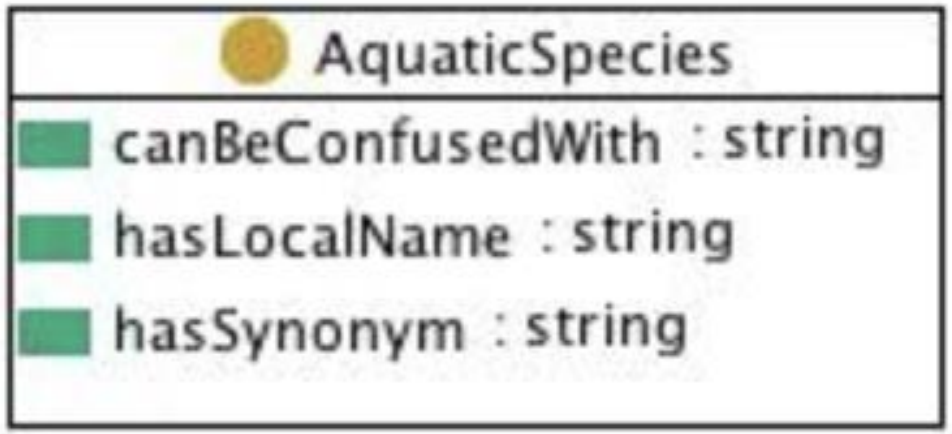
Group Exercise



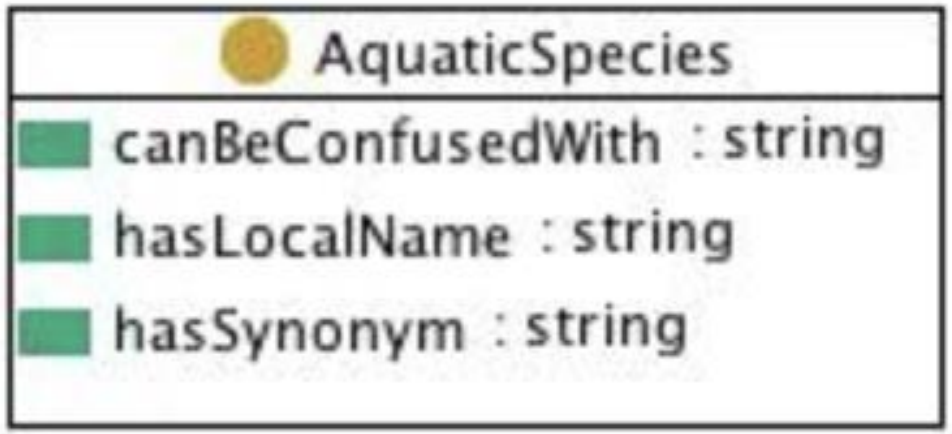
WHAT DOES THIS PATTERN REPRESENT?

Group Exercise



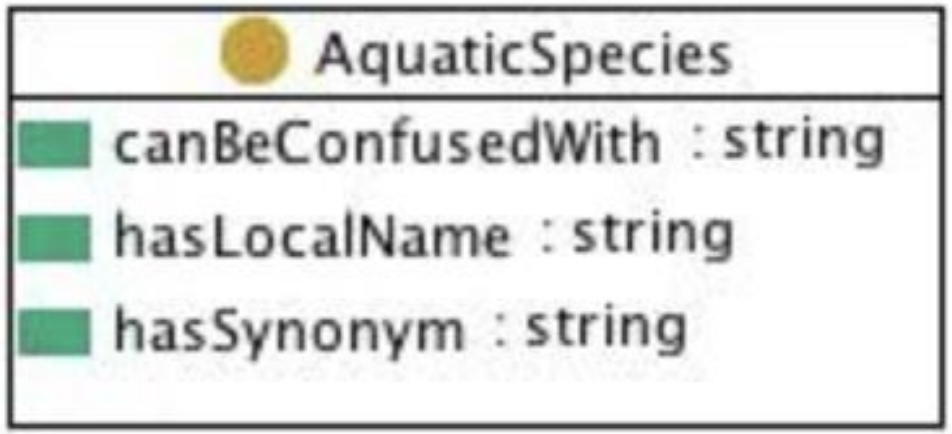
"To express the terminological variants and the conceptual similarity that can be sources of confusion between species."

Group Exercise



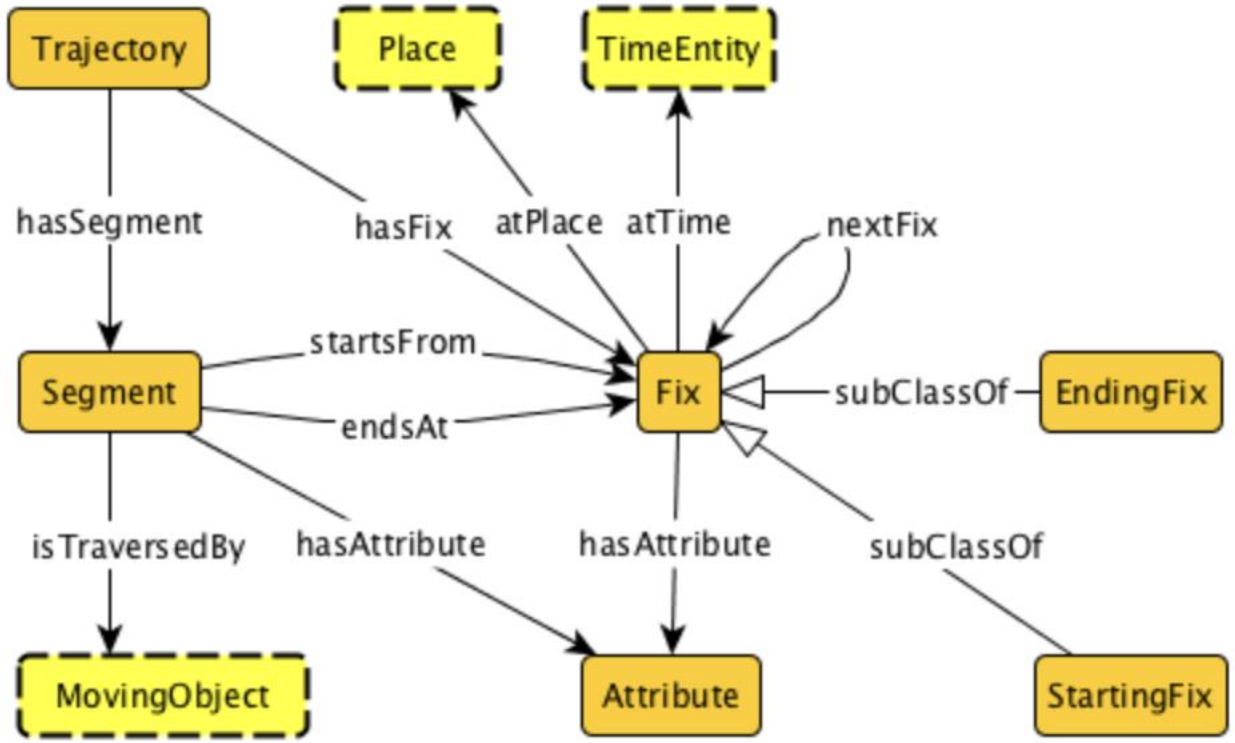
WHAT COMPETENCY QUESTIONS MIGHT THIS ANSWER?

Group Exercise



What local names are used for that species?
What synonyms exist for that species?
Can that species be confused with some other one?

Group Exercise



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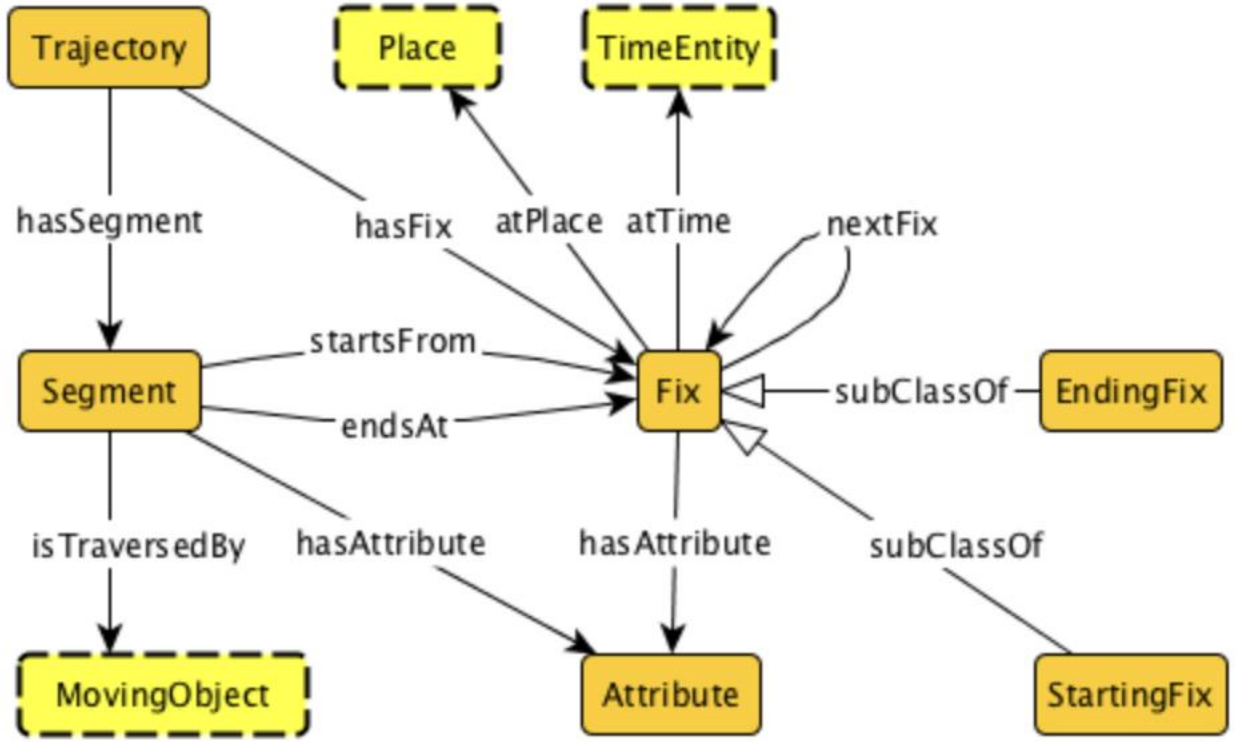

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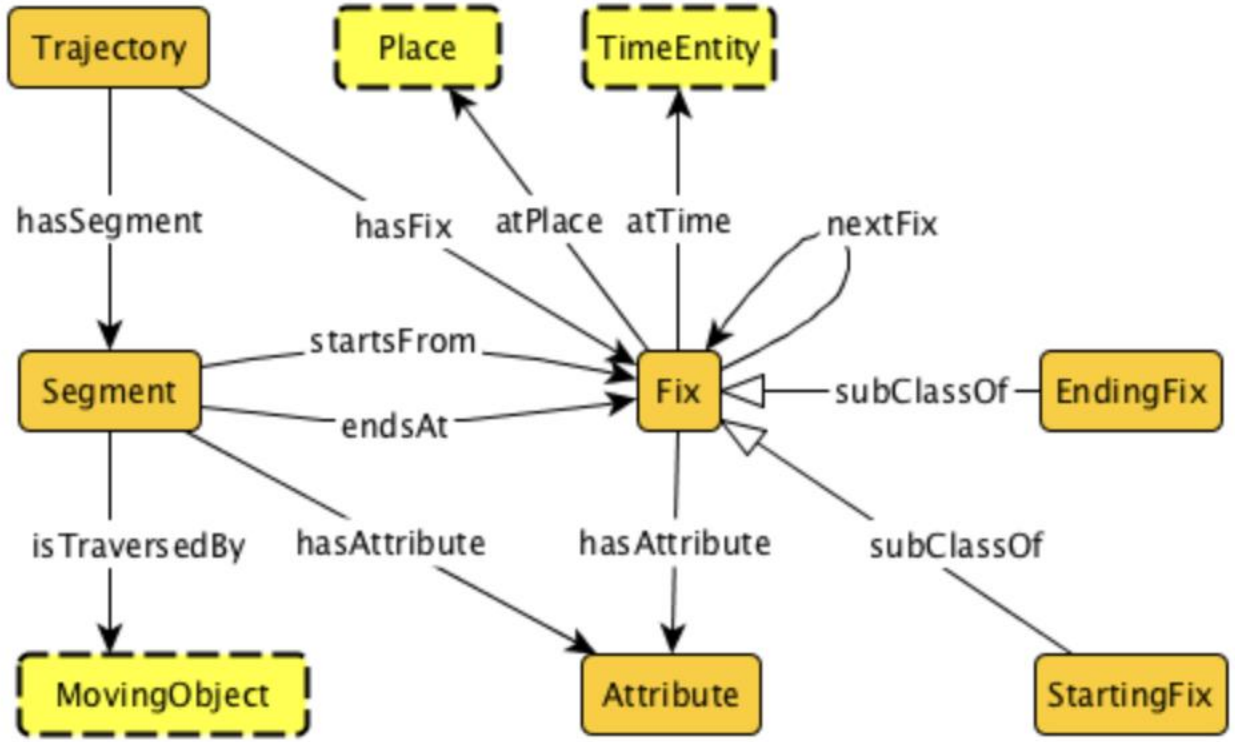

Model of trajectory, which is understood as a sequence of spatiotemporal points.

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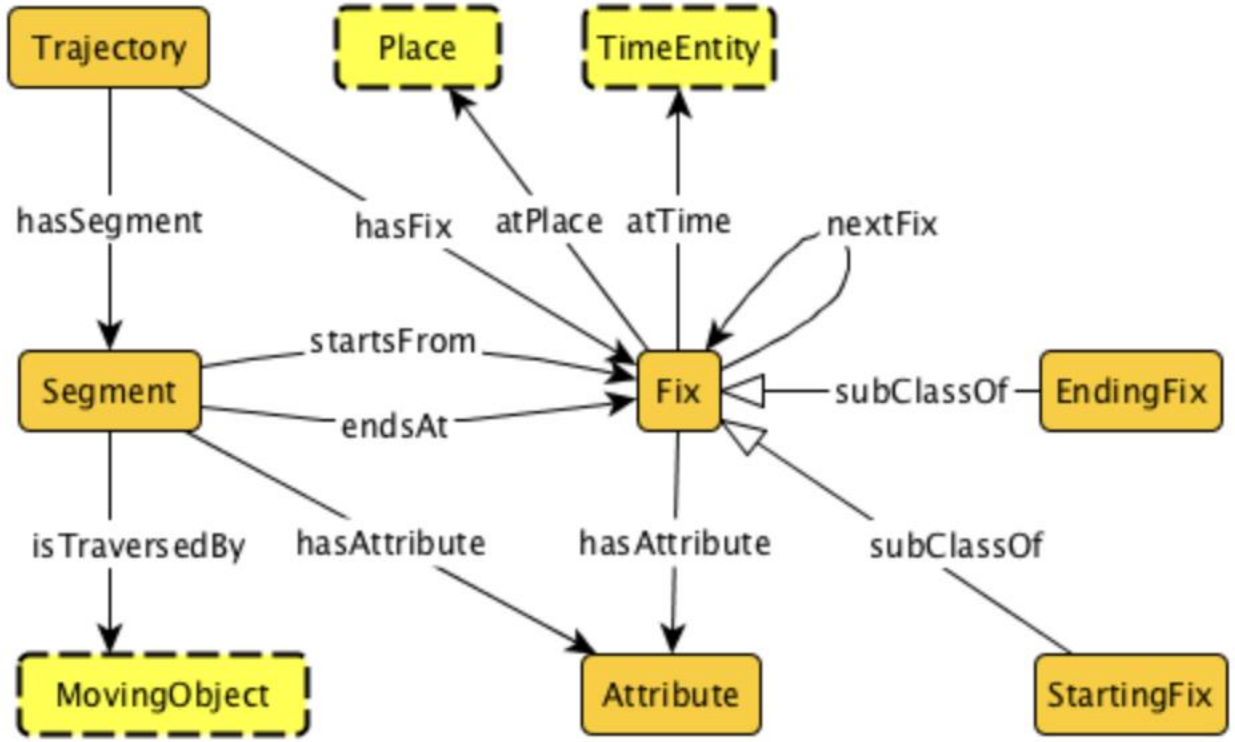

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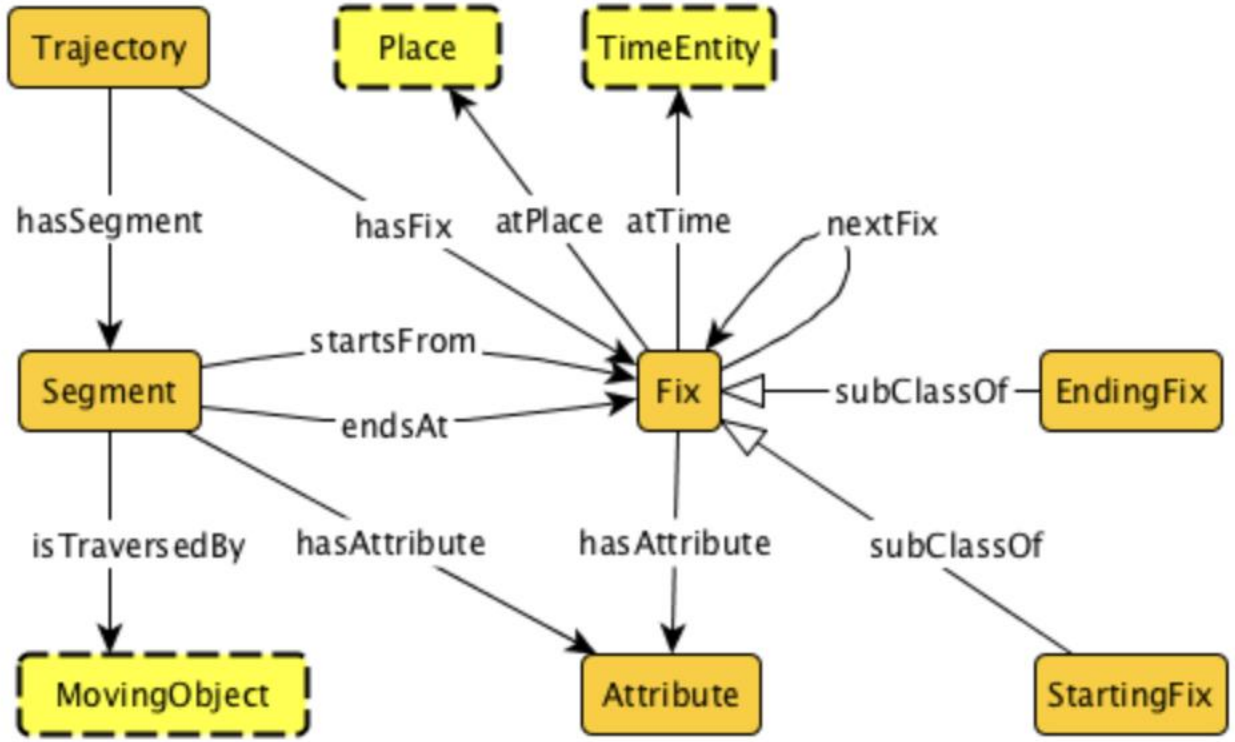

Show the birds which move at a ground speed of 0.4 m/s.

Show the trajectories of rivers which cross national parks.

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Manchester Design Patterns

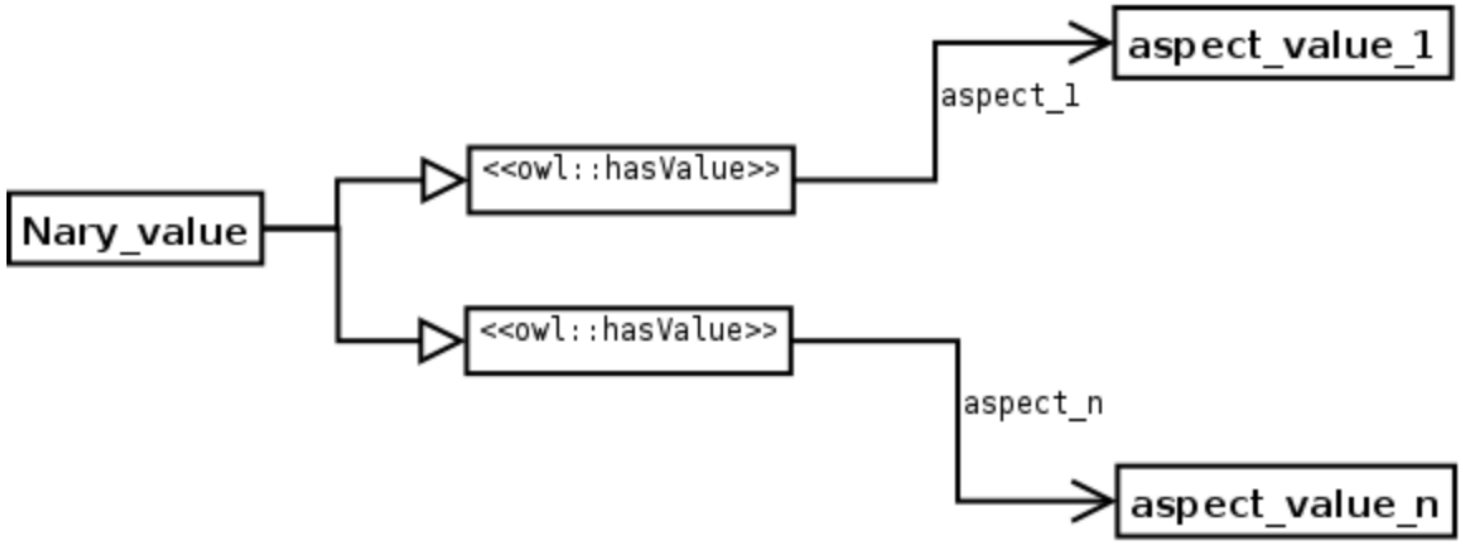
- University of Manchester researchers curated 17 patterns, several of which fall into the category of logical ODPs

http://www.gong.manchester.ac.uk/odp/html/

N-Ary Values Pattern

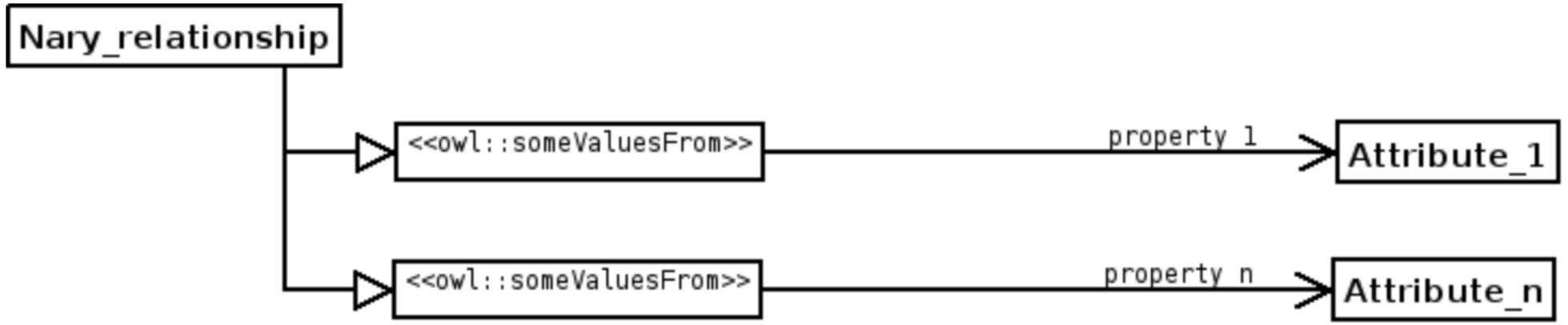
- **MOTIVATION**: Numerical values can have different aspects, e.g. boiling point has a temperature value, a pressure, etc.

- **GOAL**: Represent datatype value with more than one aspect.



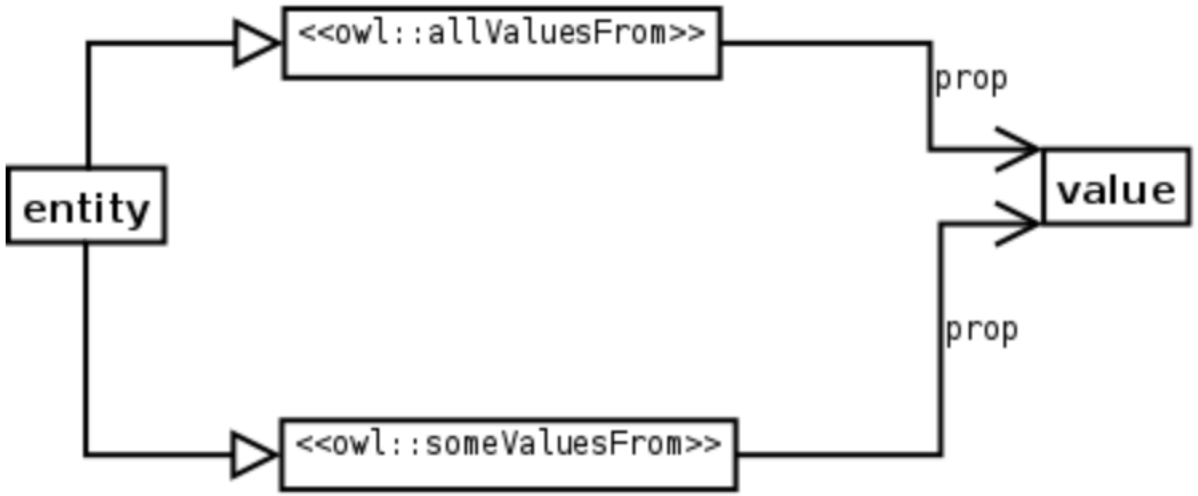
N-Ary Instances Pattern

- **MOTIVATION:** OWL only allows relating two individuals at a time, but there is a need to represent properties of relations, e.g. a diagnosis has a result, a probability, and the person who has been diagnosed.
- **AIM:** Express relationship between more than one element.



Closed World Pattern

- **MOTIVATION:** OWL adopts the **Open World Assumption**. It is not enough to say that carnivores eat some meat; one must say carnivores only eat meat.
- **AIM:** Simulate the closed world assumption in a concrete class.



W3C Vetted

- Defining N-ary Relations on the Semantic Web: Use With Individuals
- Representing Classes As Property Values on the Semantic Web
- Representing Specified Values in OWL: "value partitions" and "value sets"

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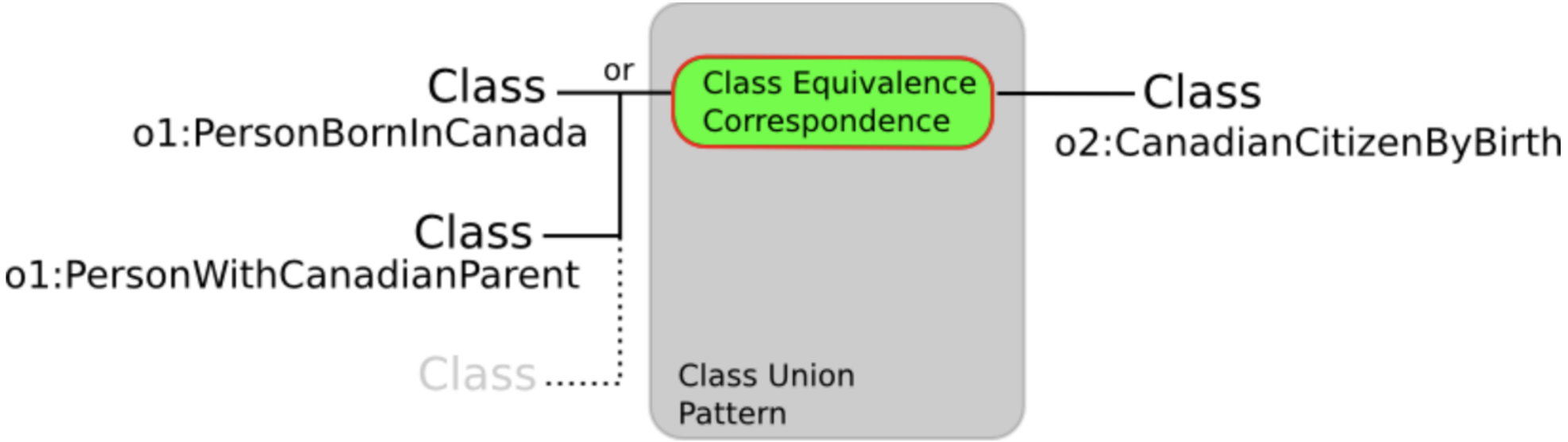
Correspondence Pattern



A class denoted in one ontology is the union of two classes in the second ontology

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LSP ODP

Description

Name	Lexico Syntactic ODPs corresponding to LocationODP
Language	English
Also known as	LSP-LO-EN
Intent	Recurrent expressions in English that state a simple bynary relation between an object and its location
Solution description	The set of Lexico-Syntactic ODPs included here have a direct correspondence to the Content ODP for modelling "Location".
Description of the correspondence relation between the LSPs and the ODPs	one LSP to one ODP

NL Formulation

- The school is located in Bocas Town.
- T-cadherin is located in the nucleus and in the centrosomes.

LSP Formalization

```
NP<place> be/has (locate/find/set/situate/place/(a site)) in [(NP<location >,)* and] NP<location>
```

Reusable JAPE code: LO_1.jape

Summary

- Long history of design patterns in ontology spaces
- To my mind, overly broad definition of "ODP" was used to describe too many related but distinct efforts
- Only the Logical ODPs validated by the W3C, which focus on OWL, have wide use
- Other ODPs are not used often, in part because they can promote silos

This Course

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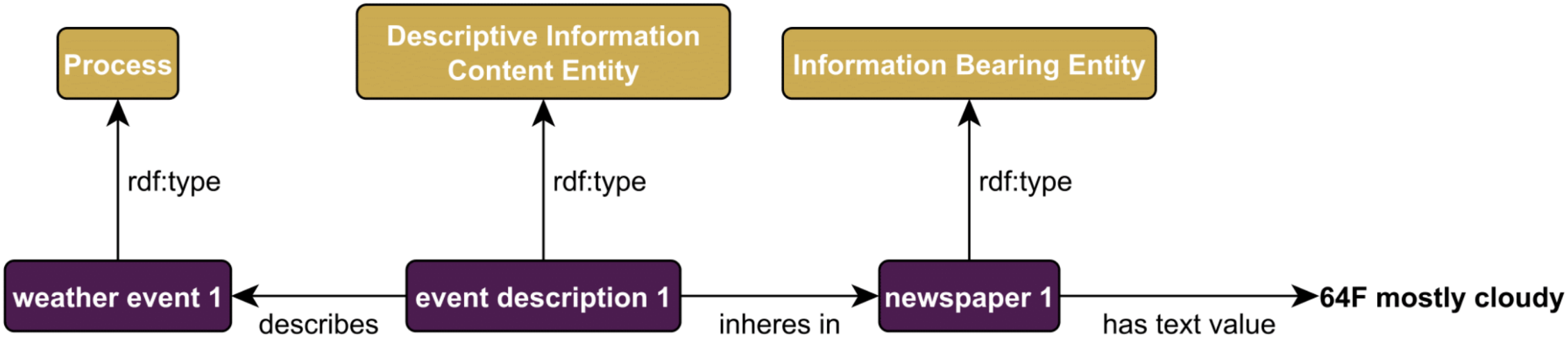

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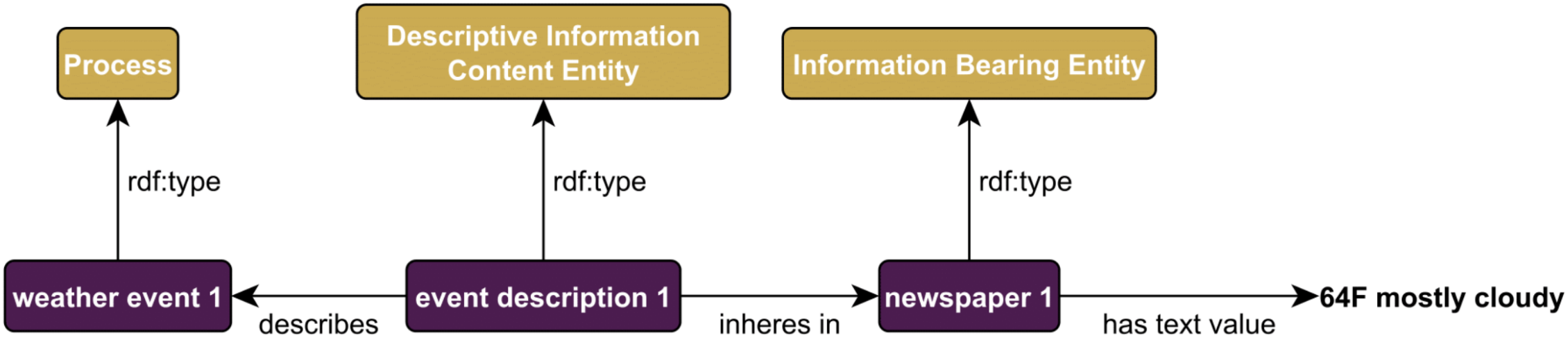

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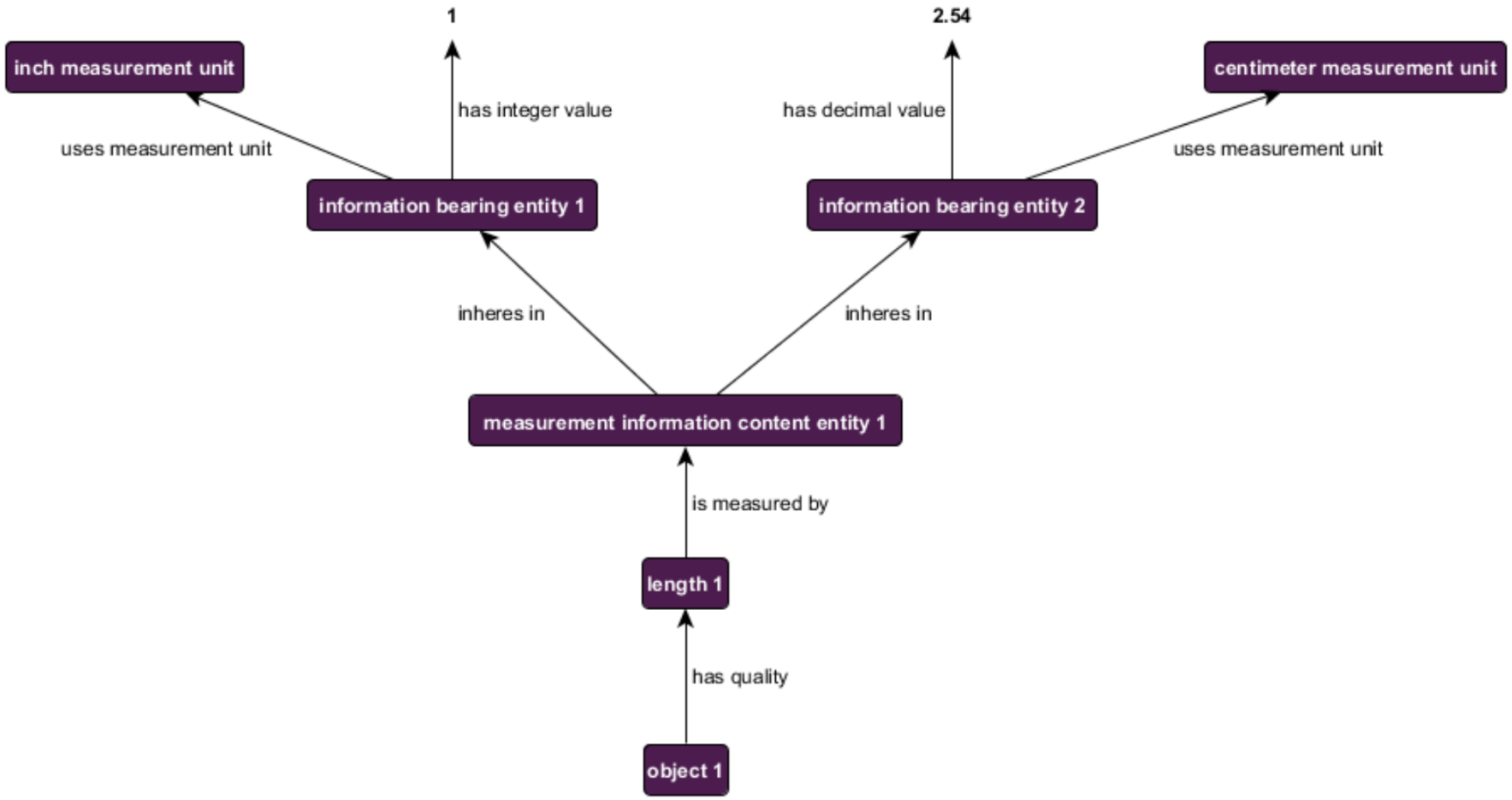

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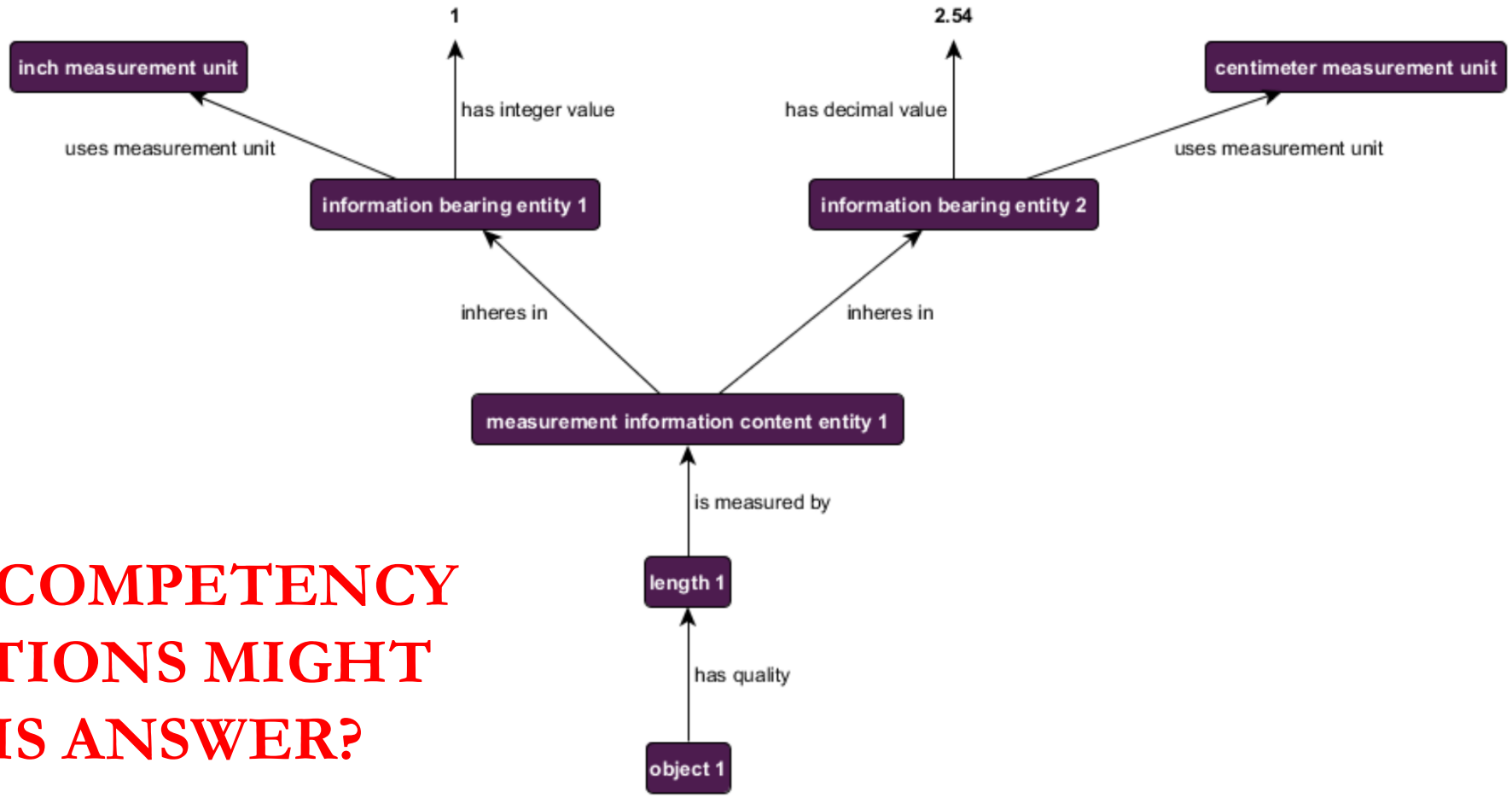

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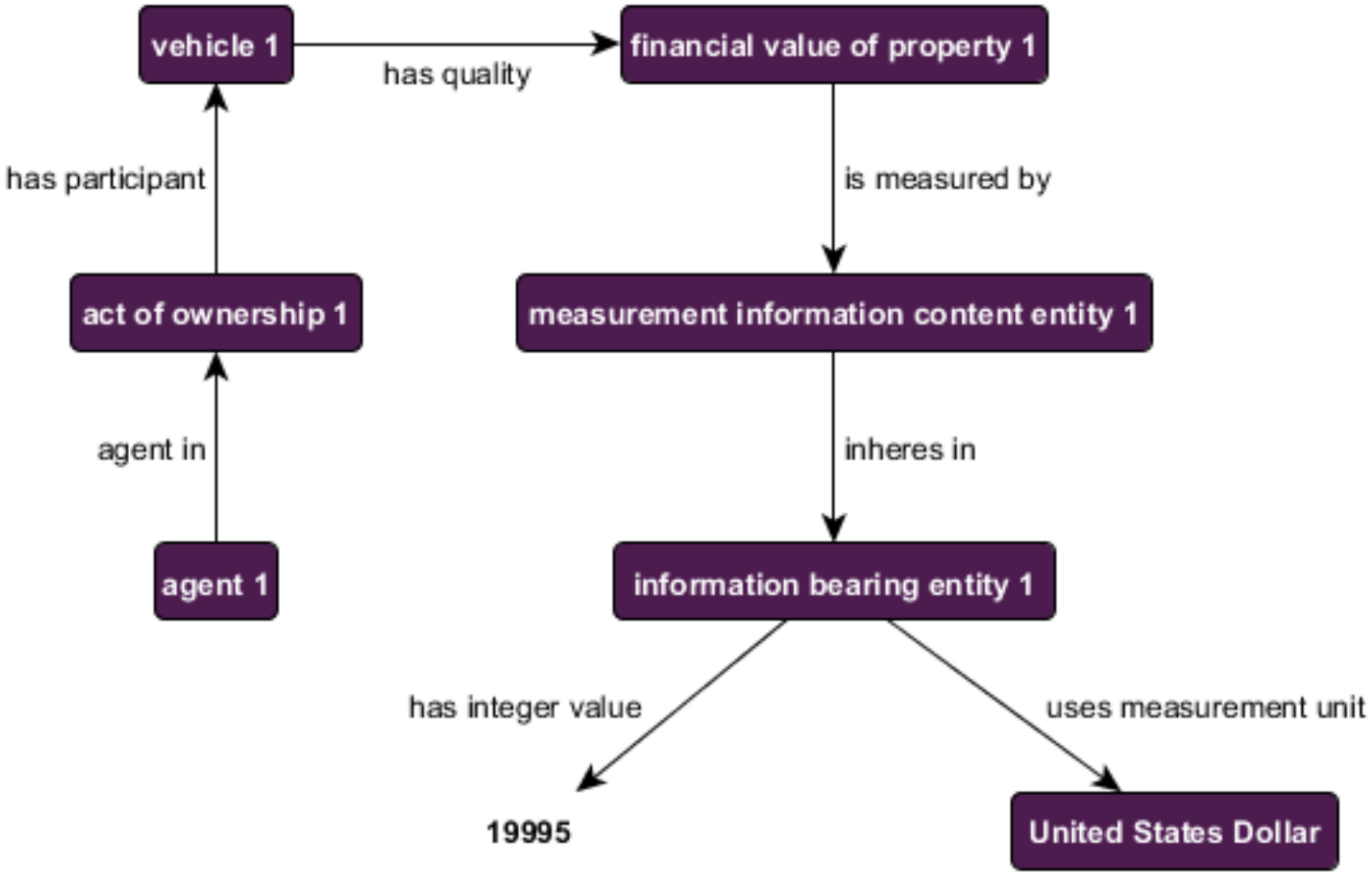

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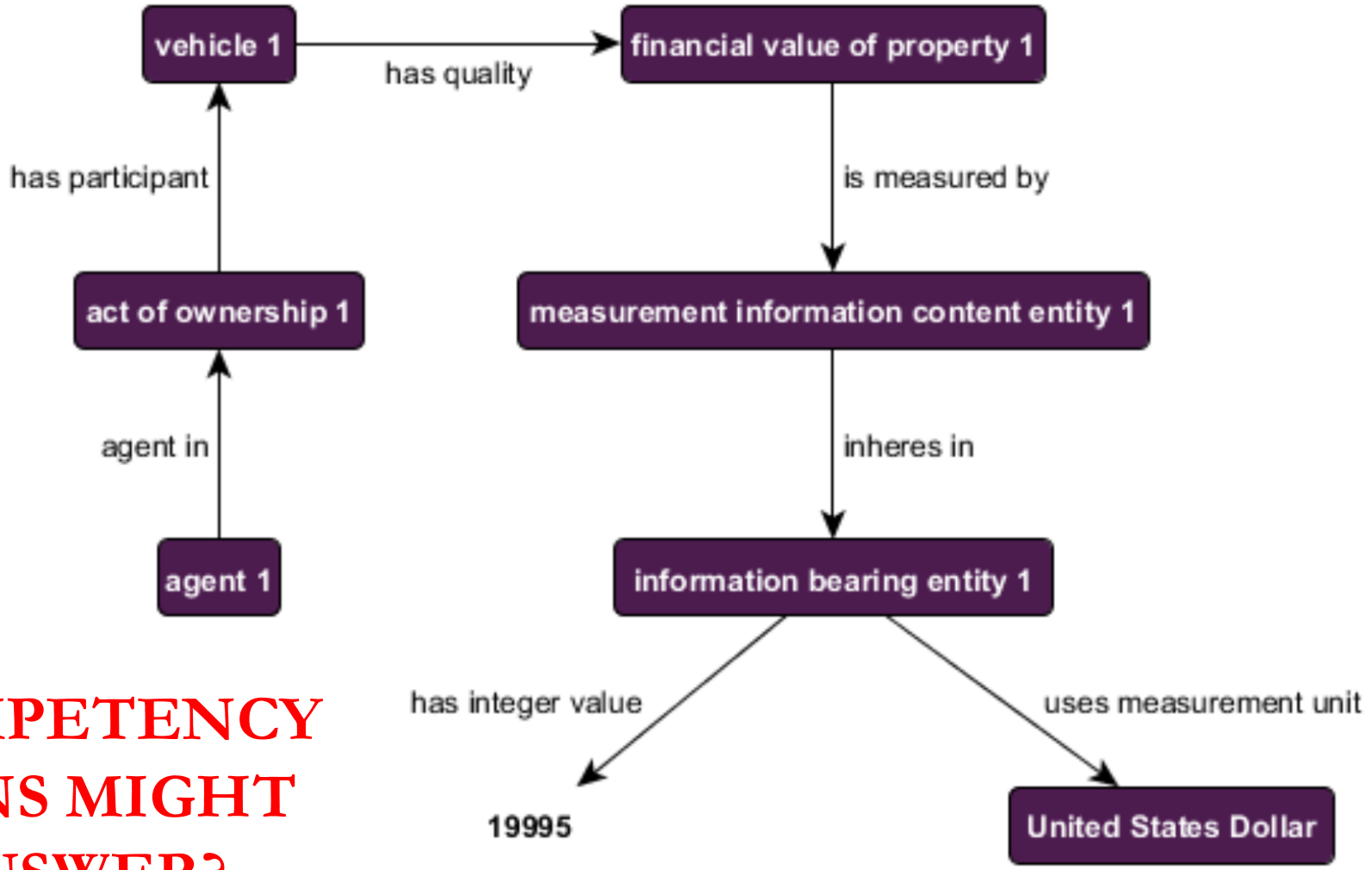

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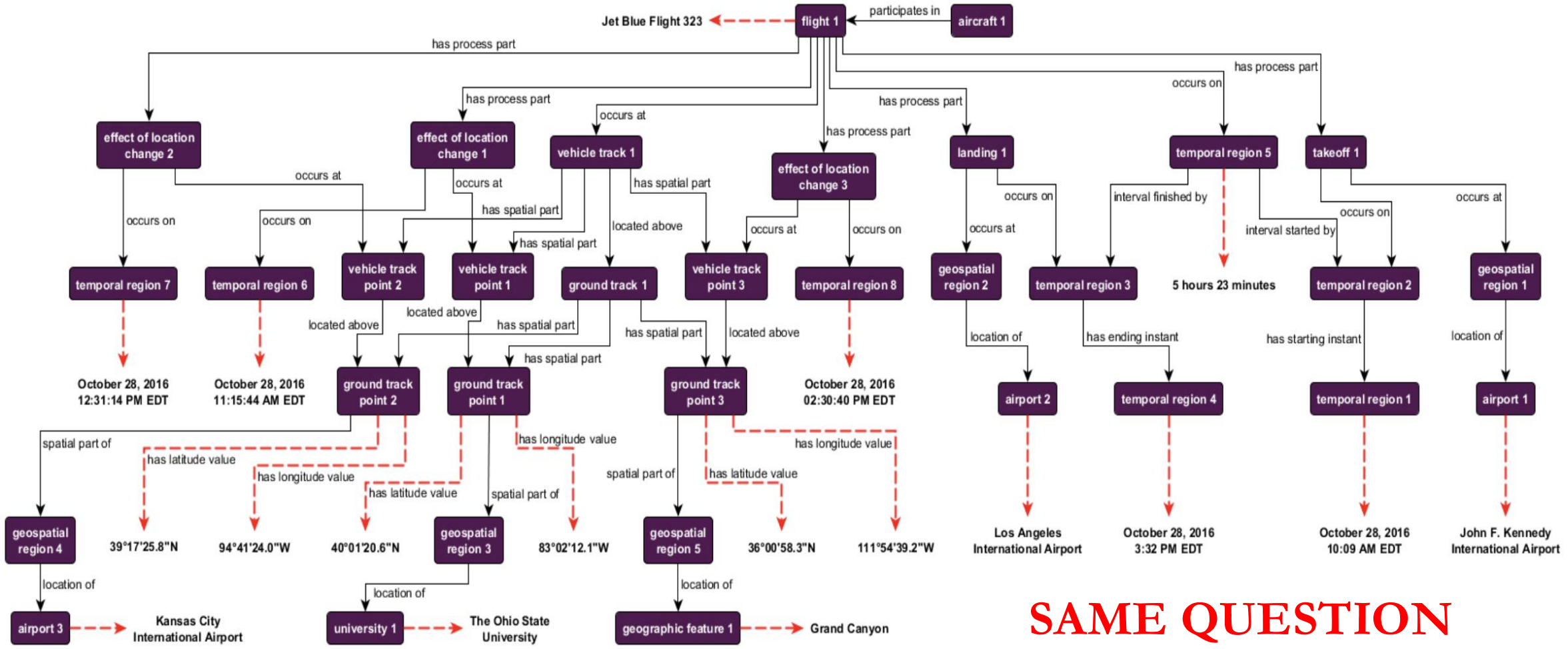

SAME QUESTION

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Group Exercise

IDENTIFY A DOMAIN TO MODEL

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IDENTIFY COMPETENCY QUESTIONS

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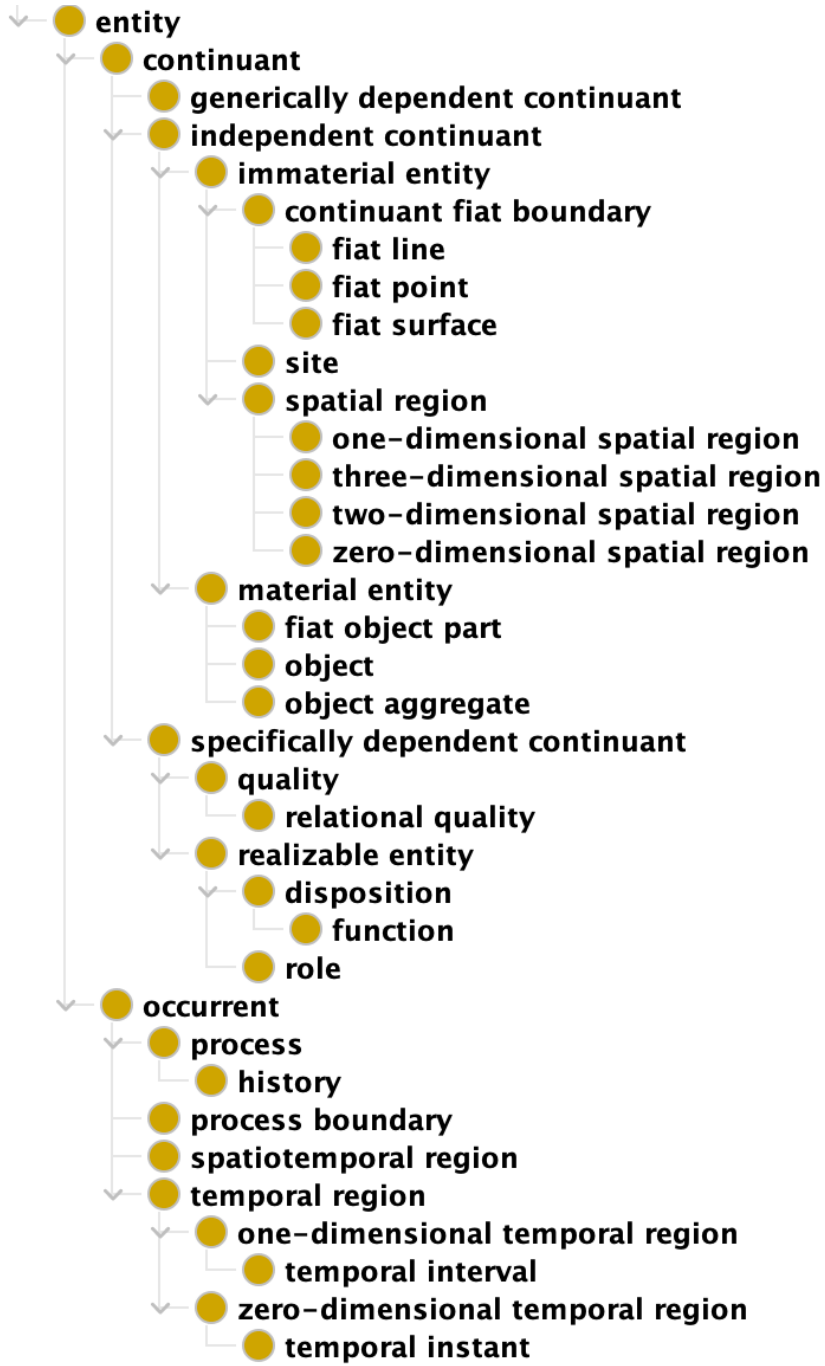
IDENTIFY A DOMAIN TO MODEL

IDENTIFY COMPETENCY QUESTIONS

IDENTIFY CLASSES & RELATIONS SATISFYING CQs


entity
continuant
generically dependent continuant
independent continuant
immaterial entity
continuant fiat boundary
fiat line
fiat point
fiat surface
site
spatial region
one-dimensional spatial region
three-dimensional spatial region
two-dimensional spatial region
zero-dimensional spatial region
material entity
fiat object part
object
object aggregate
specifically dependent continuant
quality
relational quality
realizable entity
disposition
function
role
occurrent
process
history
process boundary
spatiotemporal region
temporal region
one-dimensional temporal region
temporal interval
zero-dimensional temporal region
temporal instant


concretizes
continuant part of
member part of
environs
exists at
first instant of
generically depends on
has continuant part
has member part
has first instant
has history
has last instant
has material basis
has occurrent part
has temporal part
has participant
has realization
history of
is carrier of
is concretized by
last instant of
located in
location of
material basis of
occupies spatial region
occupies spatiotemporal region
occupies temporal region
occurrent part of
temporal part of
occurs in
participates in
preceded by
precedes
realizes
spatially projects onto
specifically depended on by
bearer of
specifically depends on
inheres in
temporally projects onto

MASTER THESE DISTINCTIONS FIRST

Analogy

- BFO is analogous to the **Python programming language**; extensions of BFO – such as CCO - are analogous to **Python libraries**

- You **could** create code that allows you to interact with, say, dataframes or you could **instead** start with Python and import a library like Pandas

- You **could** create ontology elements that allow you to model artifacts and processes or you **could** instead start with BFO and import a library like CCO

Rules of Thumb

- When identifying classes, describe:

1. Material entities within scope, i.e. **Material Entity**
2. Qualities these material entities have, i.e. **Quality**
3. What these material entities could do, i.e. **Realizable Entity**
4. What these material entities actually do, i.e. **Process**
5. Where these material entities and boundaries are located, i.e. **Immaterial Entity**
6. When these entities exist, i.e. **Temporal Region**
7. Information we use to talk about 1-6, i.e. **Generically Depedent Continuant**

https://github.com/BFO-ontology/BFO-2020

Group Exercise

IDENTIFY A DOMAIN TO MODEL

IDENTIFY COMPETENCY QUESTIONS

IDENTIFY CLASSES & RELATIONS SATISFYING CQs

DISAMBIGUATE

Disambiguation

- **Information** vs what that information **is about**, e.g. occupation code vs a holder of an occupation
- **Material** vs **immaterial** things, e.g. a given river vs the site where the river used to flow
- **Bearing properties** vs **bearers of properties**, e.g. apple's redness vs the apple
- **Processes** vs **product**, e.g. ontology engineering vs ontology produced

Rules of Thumb

- When identifying relations, describe:

1. Qualities to material entities, i.e. **inheres in**
2. Realizables to material entities, i.e. **inheres in**, **has material basis**
3. Processes to material entities, i.e **participates in**
4. Realizables to processes, i.e. **has realization**
5. Immaterial location of material entity, i.e. **located in**
6. When any such entities exist, i.e. **exists at**, **datatype property**
7. When any such entities carry information, e.g. **generically depends on**

https://github.com/BFO-ontology/BFO-2020

Group Exercise

IDENTIFY A DOMAIN TO MODEL

IDENTIFY COMPETENCY QUESTIONS

IDENTIFY CLASSES & RELATIONS SATISFYING CQs

DISAMBIGUATE

CONSTRUCT A DESIGN PATTERN

Group Exercise

SEND ME WHAT YOU CREATE BEFORE NEXT CLASS

WE WILL BEGIN BY REVIEWING YOUR SUBMISSIONS