Databases

Graph Databases

Foundations

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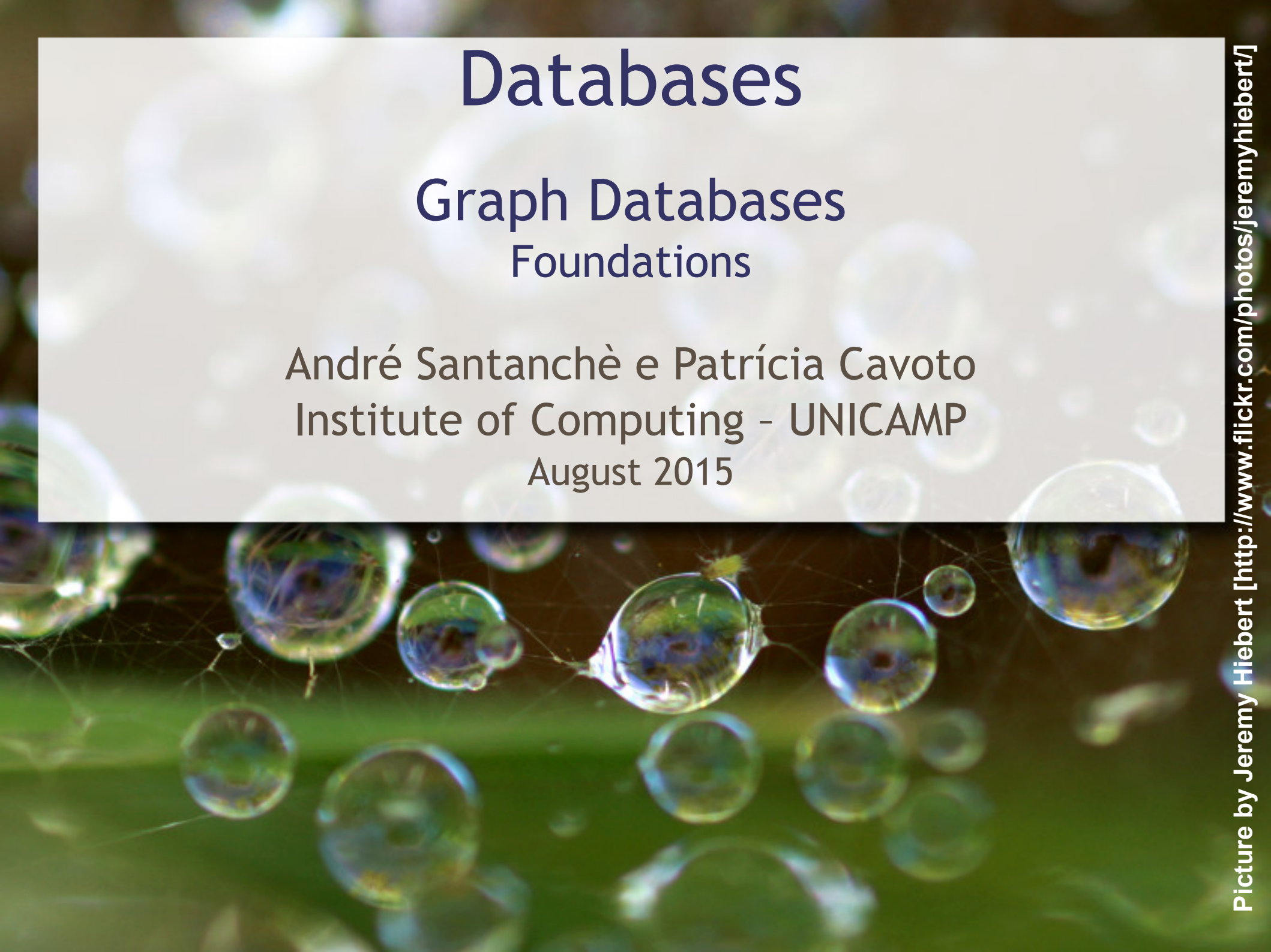
Institute of Computing – UNICAMP

August 2015



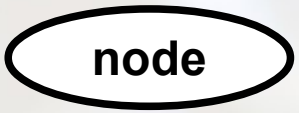
Picture by Jeremy Hiebert [http://www.flickr.com/photos/jeremyhiebert/]

Graph Model

Graph Model

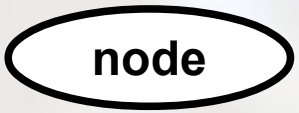
Property Graph

Property Graph

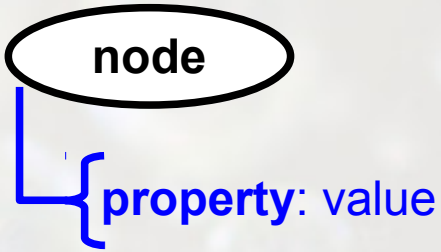
- (node) 

Property Graph

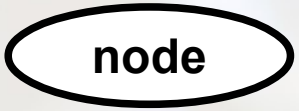
- (node)



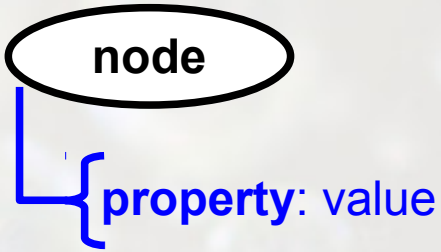
  - Nodes can have properties
    (node { property: value })



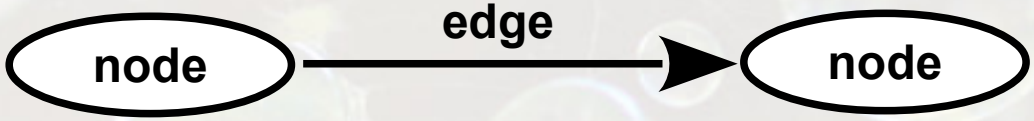
Property Graph

- (node) 

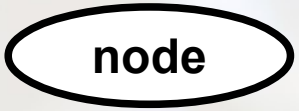
  - Nodes can have properties
    (node { property: value })



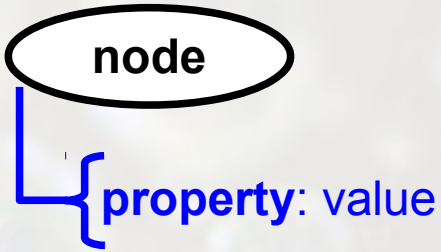
- (node)-[edge]->(node)



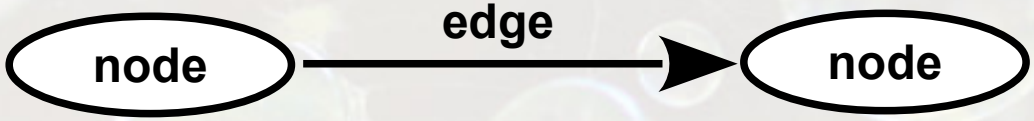
Property Graph

- (node) 

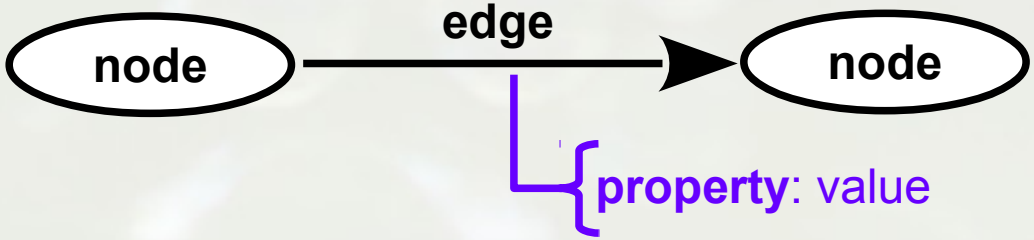
  - Nodes can have properties
    (node { property: value })



- (node)-[edge]->(node)



  - Edges can have properties
    (node)-[edge {property:value}]->(node)



Plesiosaurus in a Property Graph

MNHN A. C. 8592

Plesiosaurus in a Property Graph

MNHN A. C. 8592

size: 5
recognized: 1830

Plesiosaurus in a Property Graph

Plesiosaurus dolichodeirus

is a

MNHN A. C. 8592

size: 5
recognized: 1830

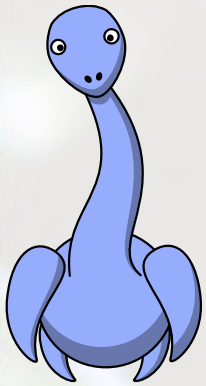
origin

Lyme Regis

country

England

LSID Surrogate



LSID:123456

label: Plesiosaurus dolichodeirus
popular@pt-BR: Plesiossauro

is a

MNHN A. C. 8592

size: 5
recognized: 1830

origin

Lyme Regis

country

England

URI Identifiers

LSID:123456

label: Plesiosaurus dolichodeirus
popular@pt-BR: Plesiossauro

is a

MNHN A. C. 8592

size: 5
recognized: 1830

origin

wiki:Lyme_Regis

label: Lyme Regis

country

wiki:England

label: England

Property in the `origin` edge

LSID:123456

label: Plesiosaurus dolichodeirus
popular@pt-BR: Plesiossauro

is a

MNHN A. C. 8592

size: 5
recognized: 1830

discovered: 1824

origin

wiki:Lyme_Regis

label: Lyme Regis

country

wiki:England

label: England

Back to the Property Graph

MNHN A. C. 8592

is a

LSID:123456

label

Plesiosaurus dolichodeirus

popular: pt-BR

Plesiossauro

size

5

recognized

1830

origin

wiki: Lyme_Regis

Two properties for `origin`

MNHN A. C. 8592

is a

LSID:123456

label

Plesiosaurus dolichodeirus

popular: pt-BR

Plesiossauro

size

5

recognized

1830

origin

place

wiki:Lyme_Regis

discovered

1824

Processing the Query

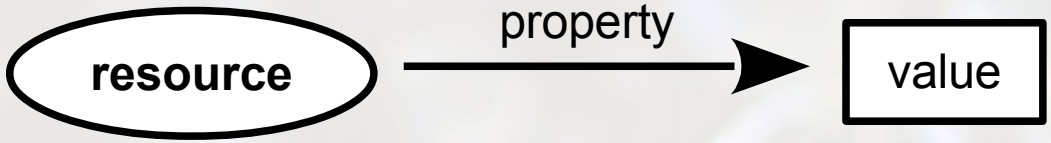
- Process by pattern
  - Find [species] whose [origin] → (0..*) part of → EUA
- Process by inference
  - Find [species] whose [origin] → EUA
  - Rules:
    - If (A) origin (B) and (B) part of (C) => (A) origin (C)
    - If (A) part of (B) and (B) part of (C) => (A) part of (C)

Graph Model

RDF Graph

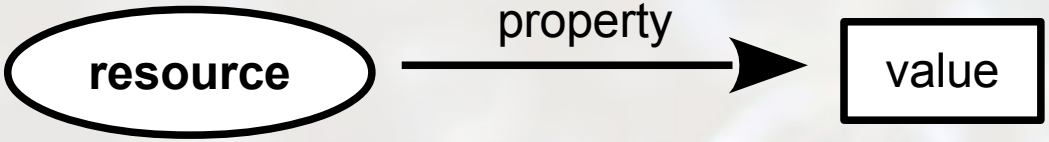
RDF Graph

- Triple model: resource, property, value

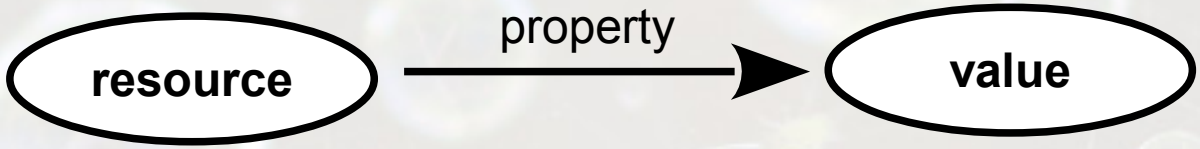


RDF Graph

- Triple model: resource, property, value

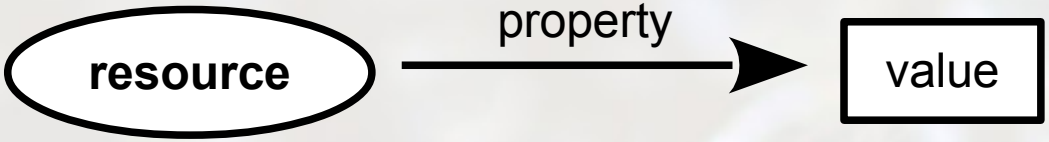


- The value can be another resource

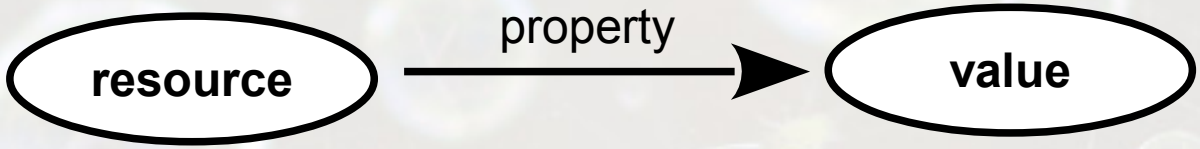


RDF Graph

- Triple model: resource, property, value



- The value can be another resource



- … described by a property,value

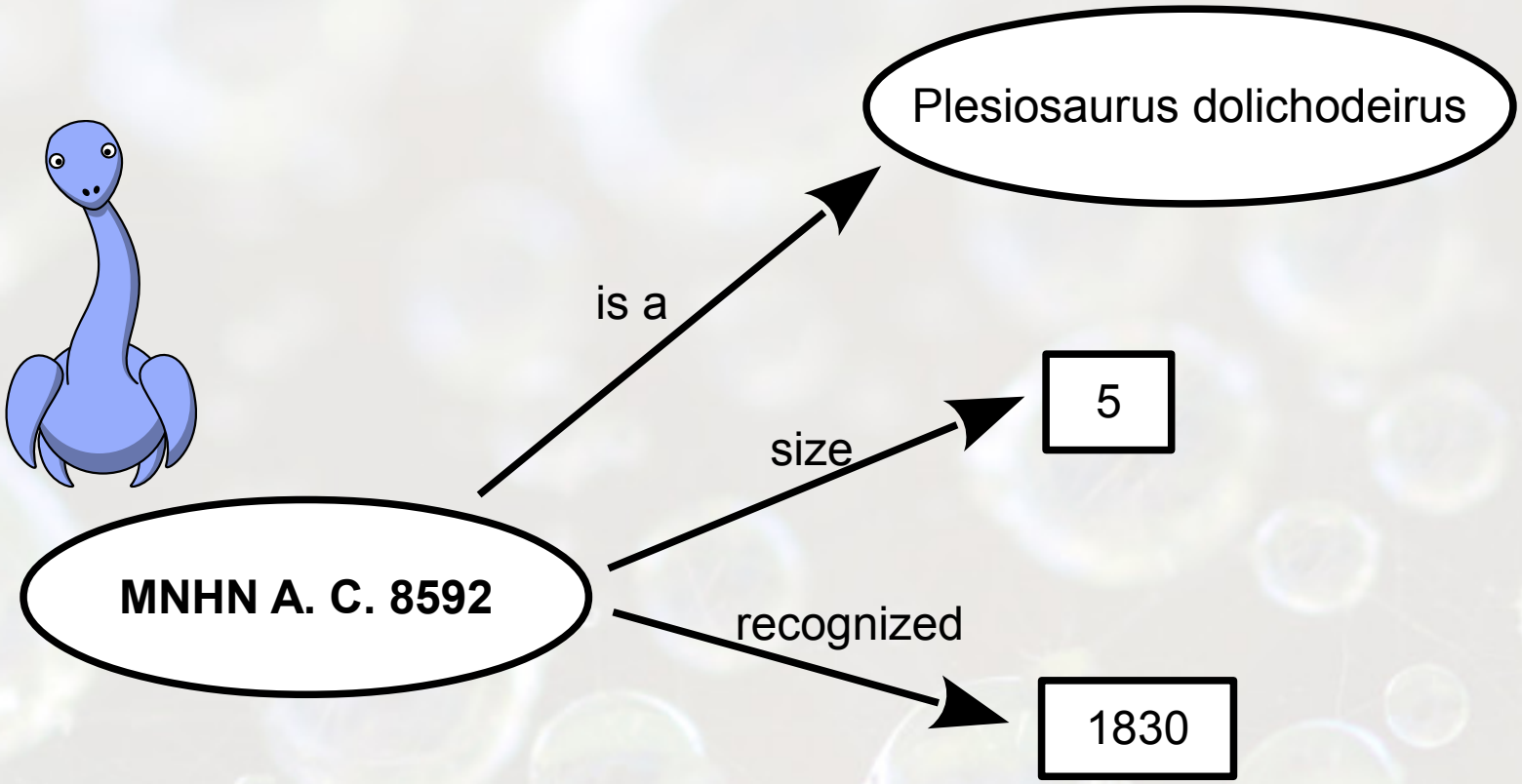
Plesiosaurus dolichodeirus in RDF

- Triple: <MNHN A. C. 8592>, size, 5

Plesiosaurus dolichodeirus in RDF

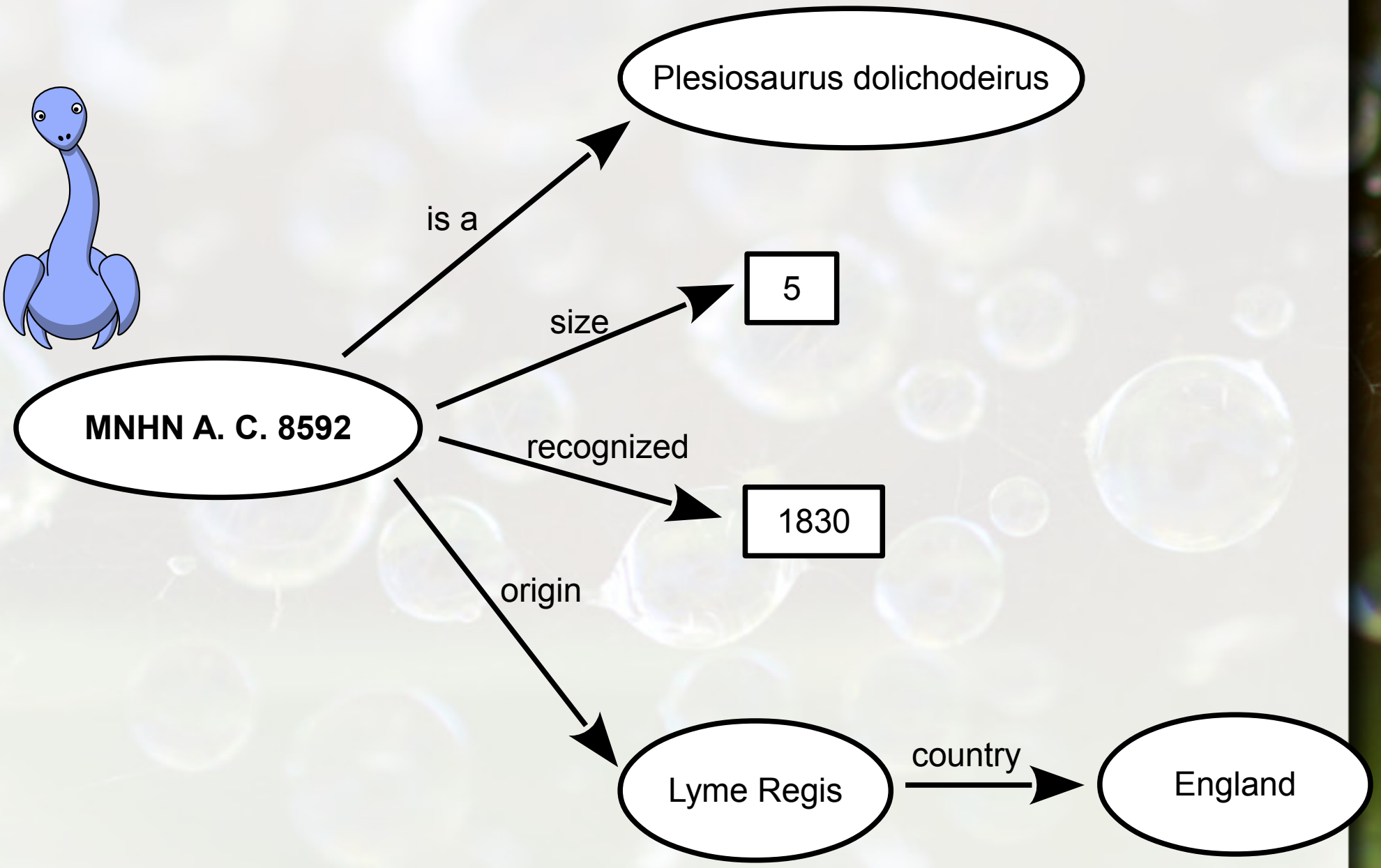
- Triple: <MNHN A. C. 8592>, size, 5
- Triple: <MNHN A. C. 8592>, recognized, 1830

Plesiosaurus dolichodeirus in RDF



- <MNHN A. C. 8592>, is_a, <Plesiosaurus dolichodeirus>

Plesiosaurus dolichodeirus in RDF



MNHN A. C. 8592

is a

LSID:123456

label

Plesiosaurus dolichodeirus

popular@pt-BR

Plesiossauro

size

5

recognized

1830

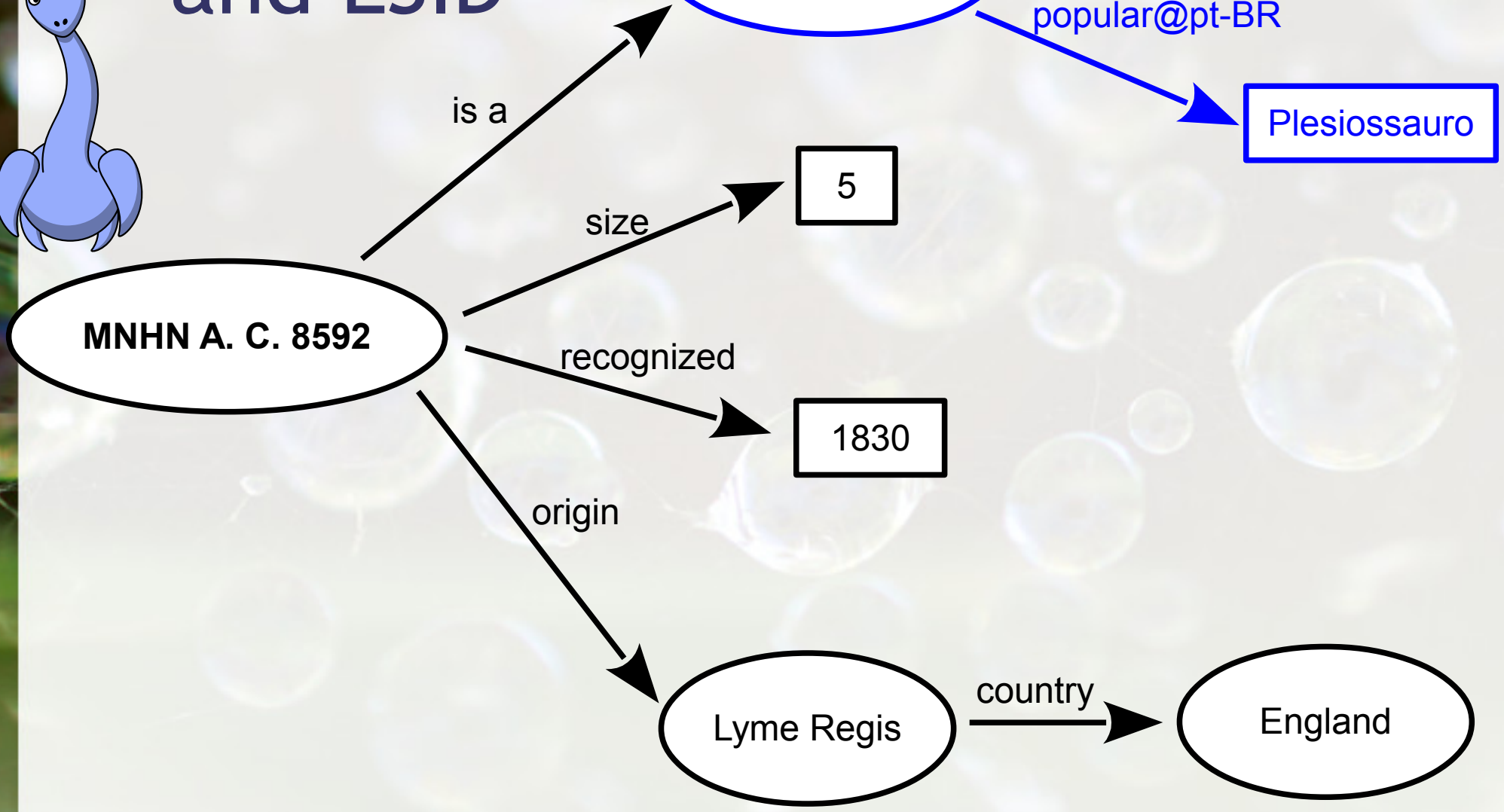
origin

Lyme Regis

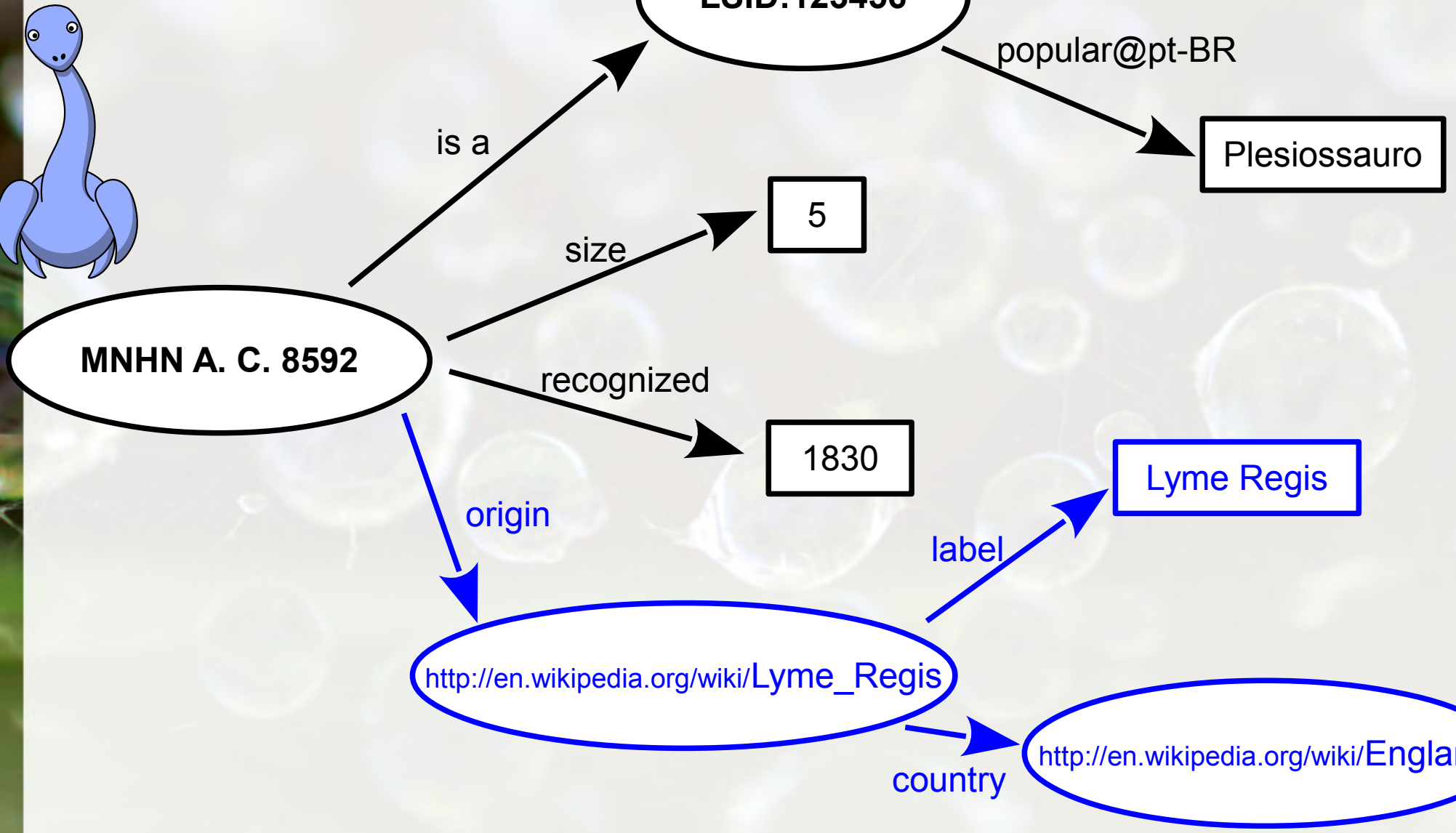
country

England

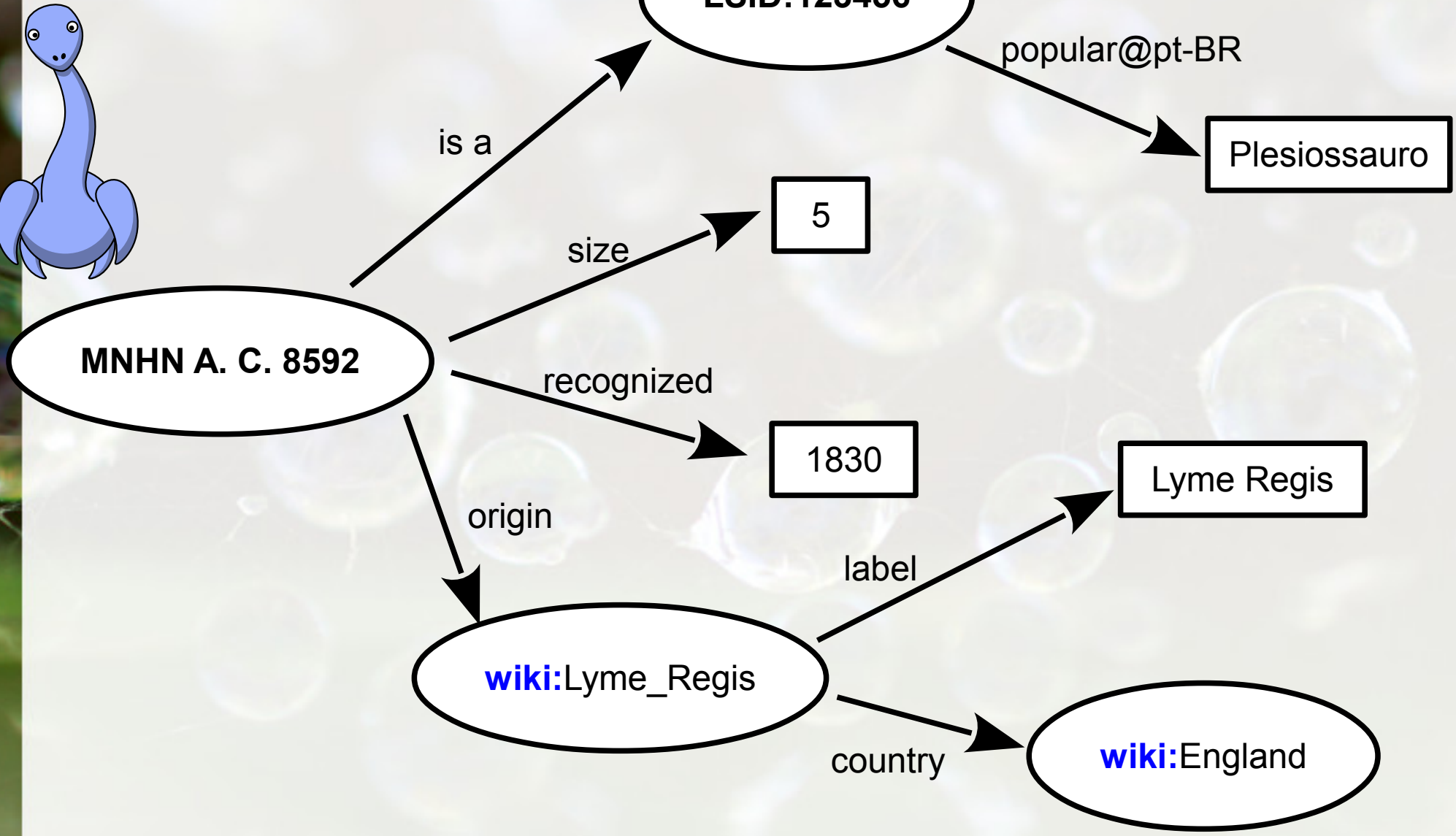
Identifying by surrogates and LSID



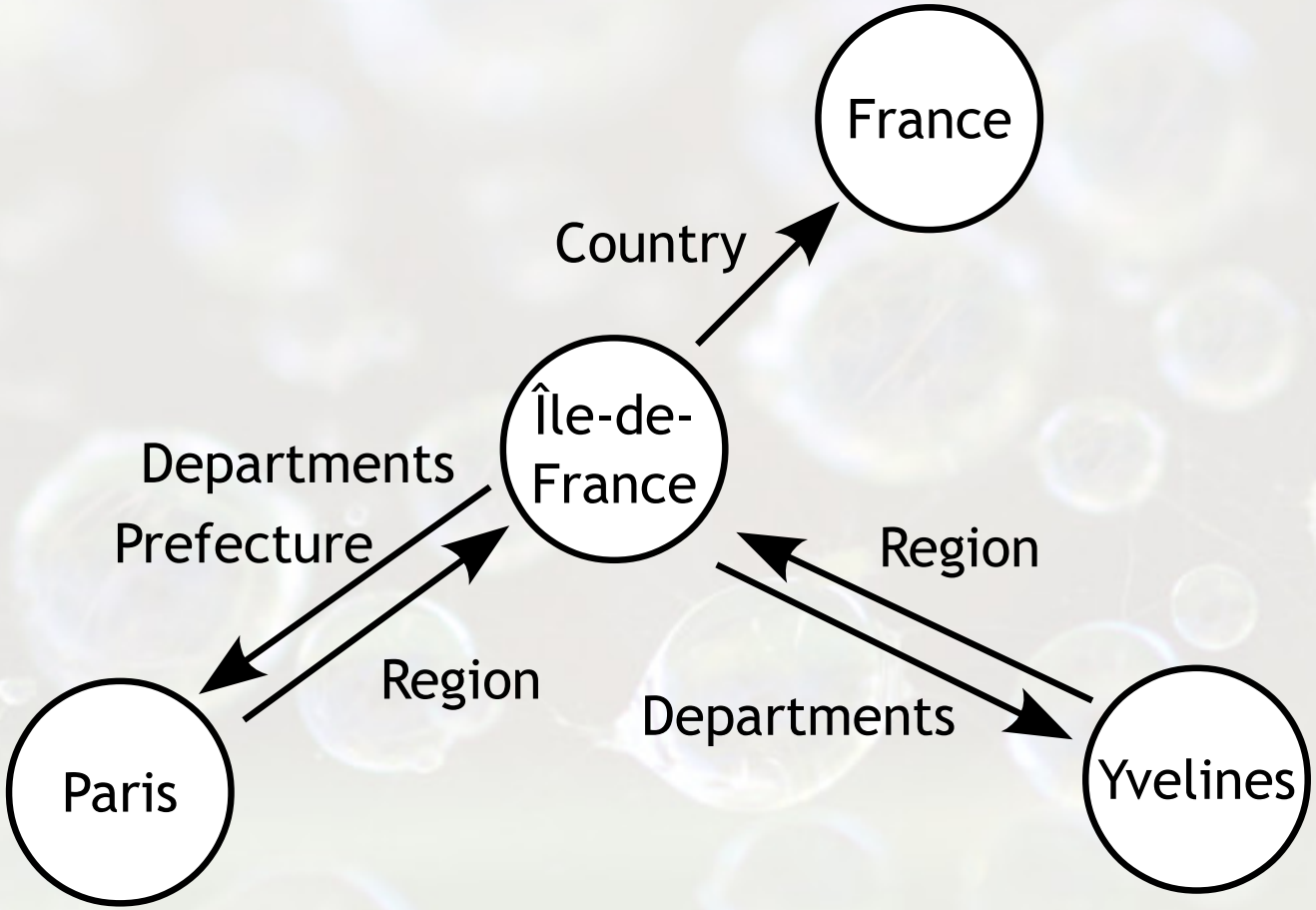
Identifying by URIs



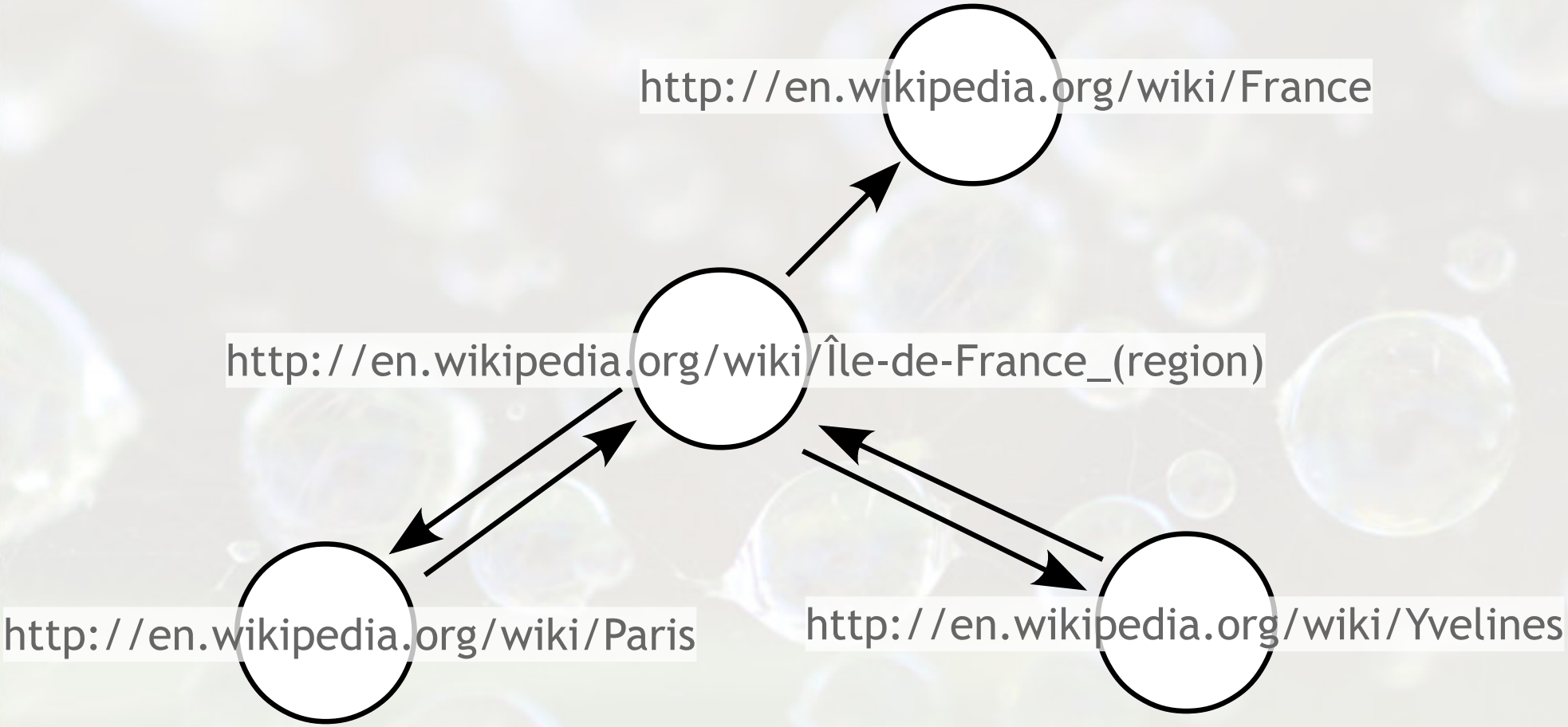
Short URIs (namespaces)



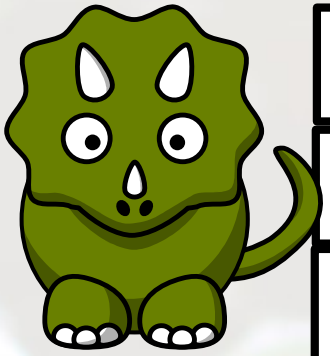
DBPedia


France
Country
Île-de-France
Departments
Prefecture
Region
Region
Departments
Paris
Yvelines

DBPedia (URIs)

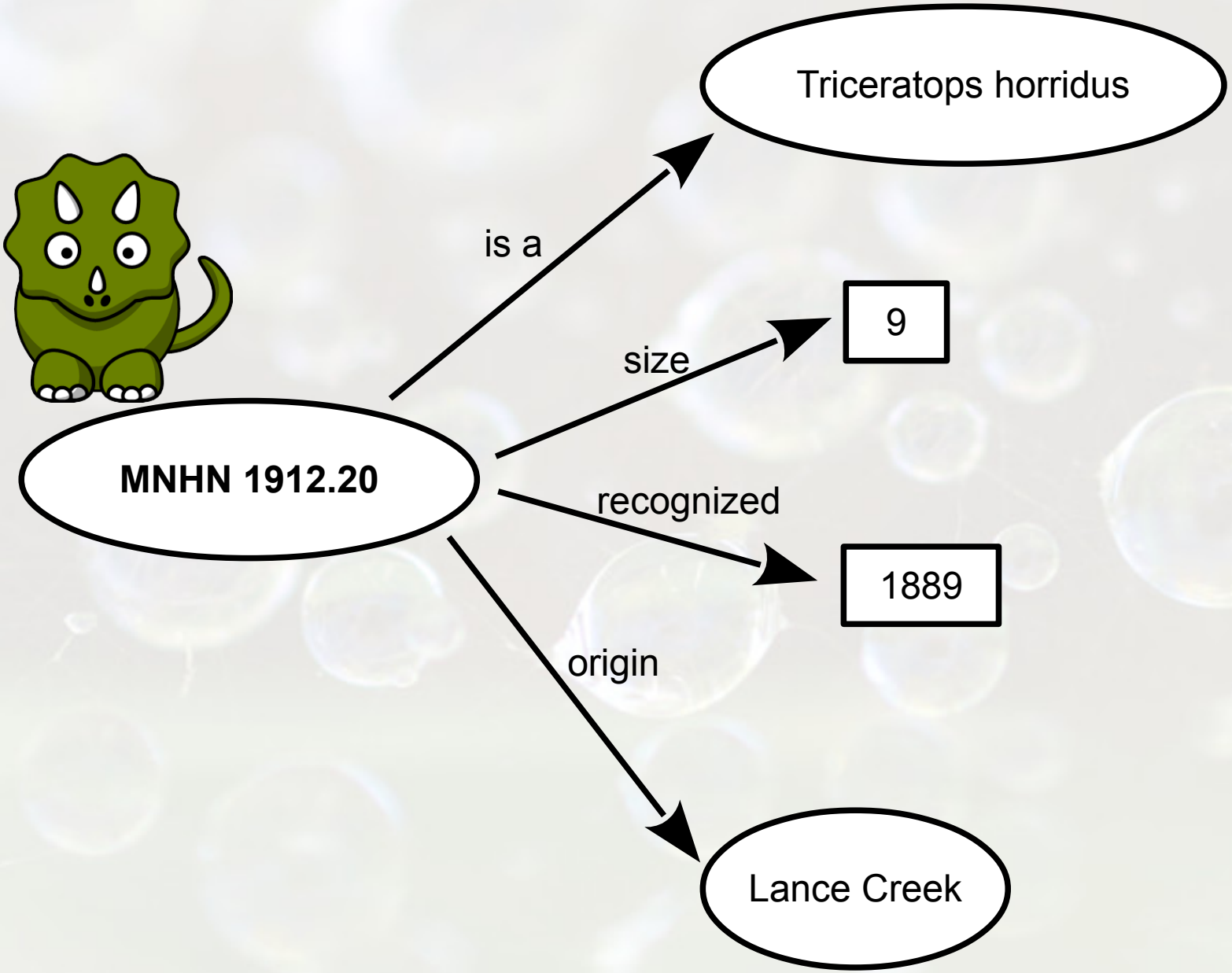


Triceratops in a Graph

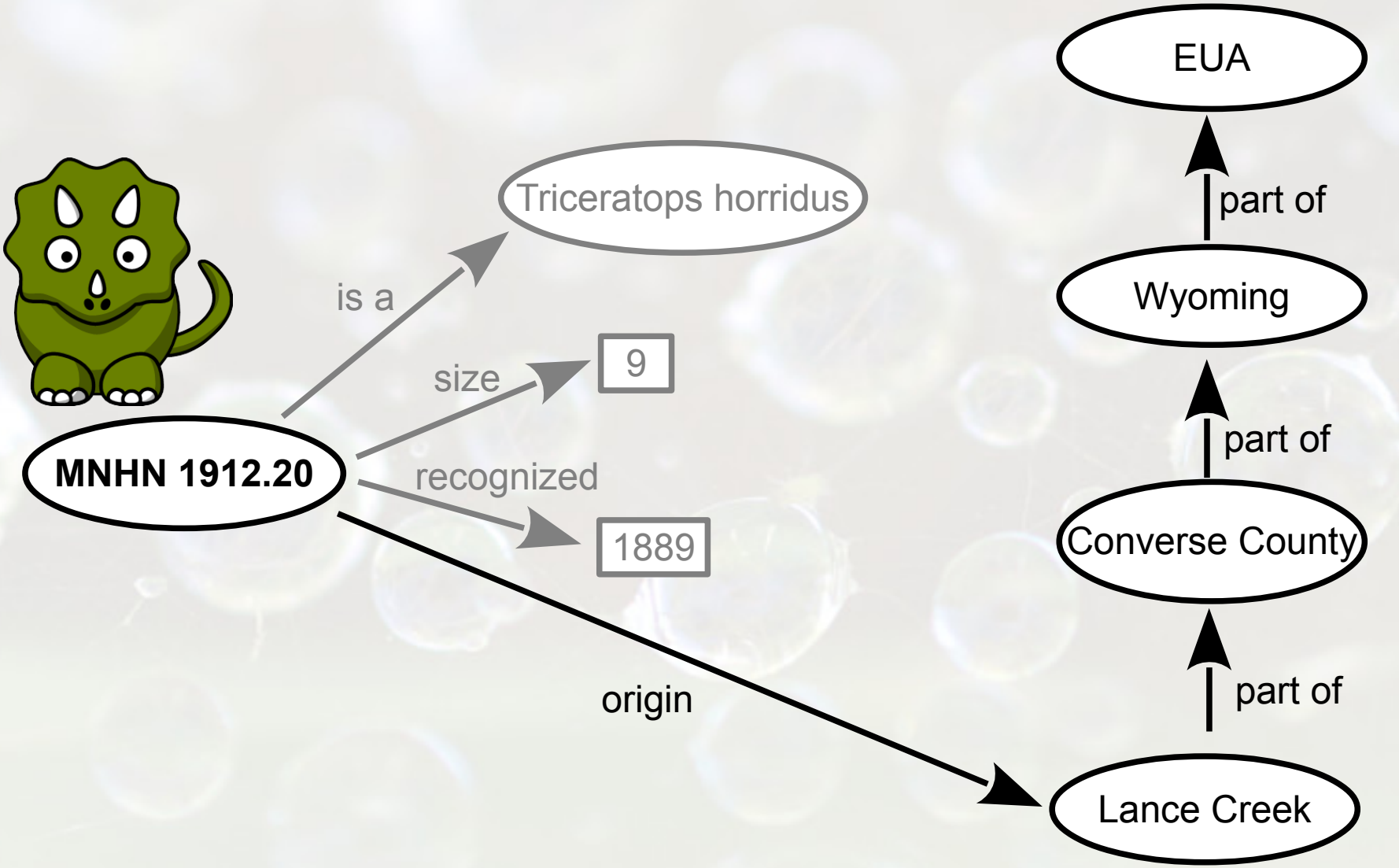


MNHN 1912.20		
Is a	Triceratops horridus	
Origin	Lance Creek	EUA
Recognized	1889	
Size	9	

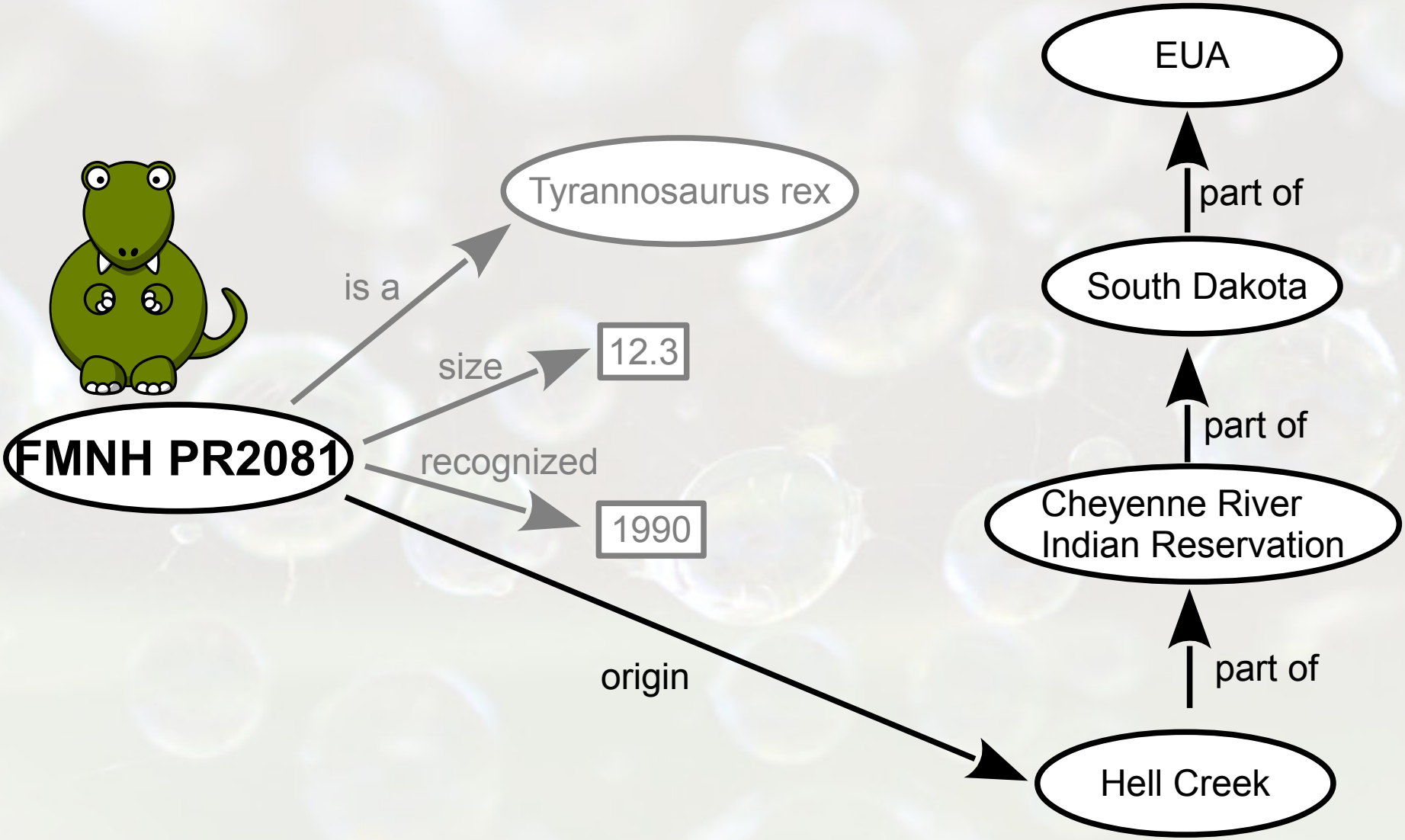
Triceratops in a Graph



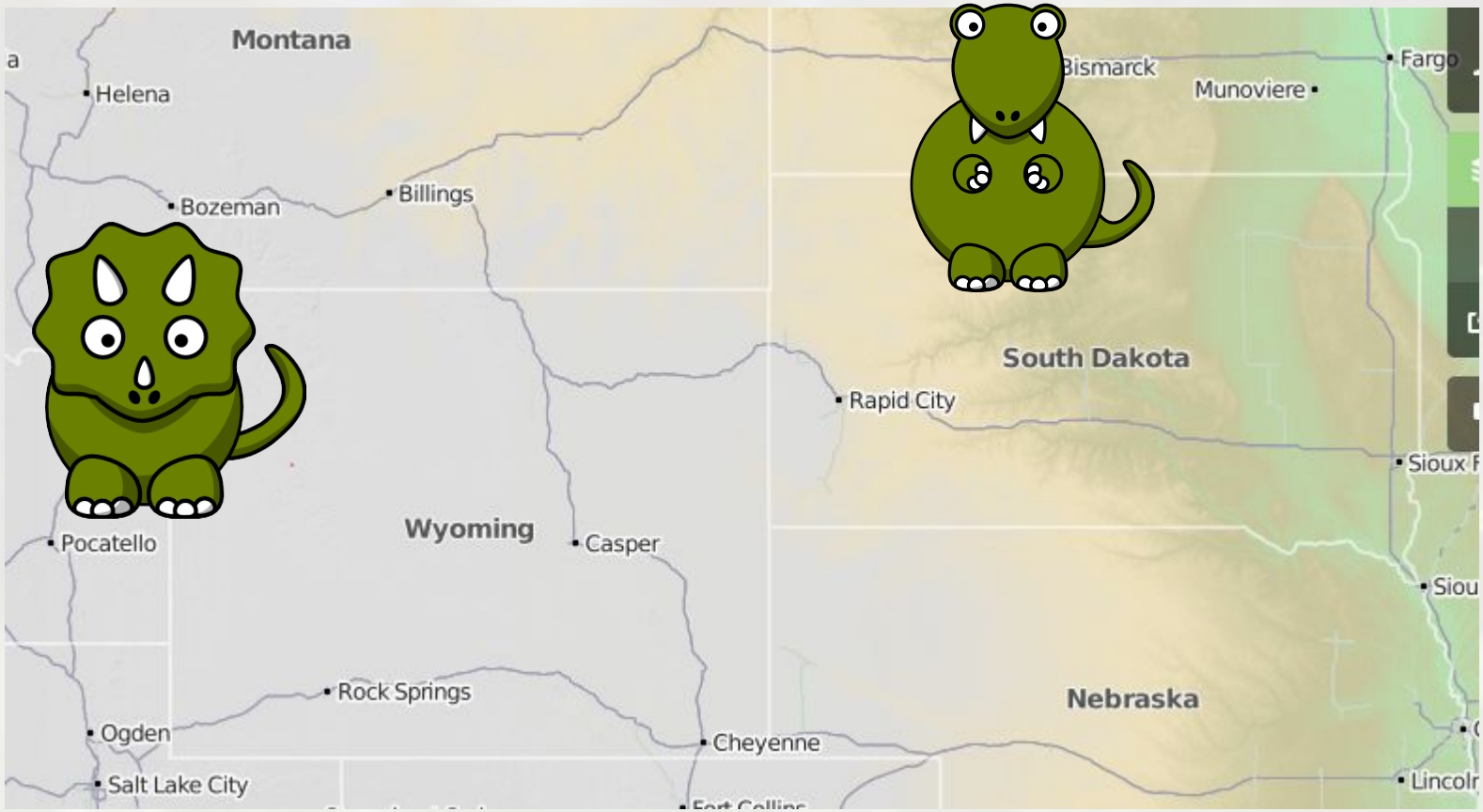
Triceratops in a Graph



Tyrannosaurus in a Graph

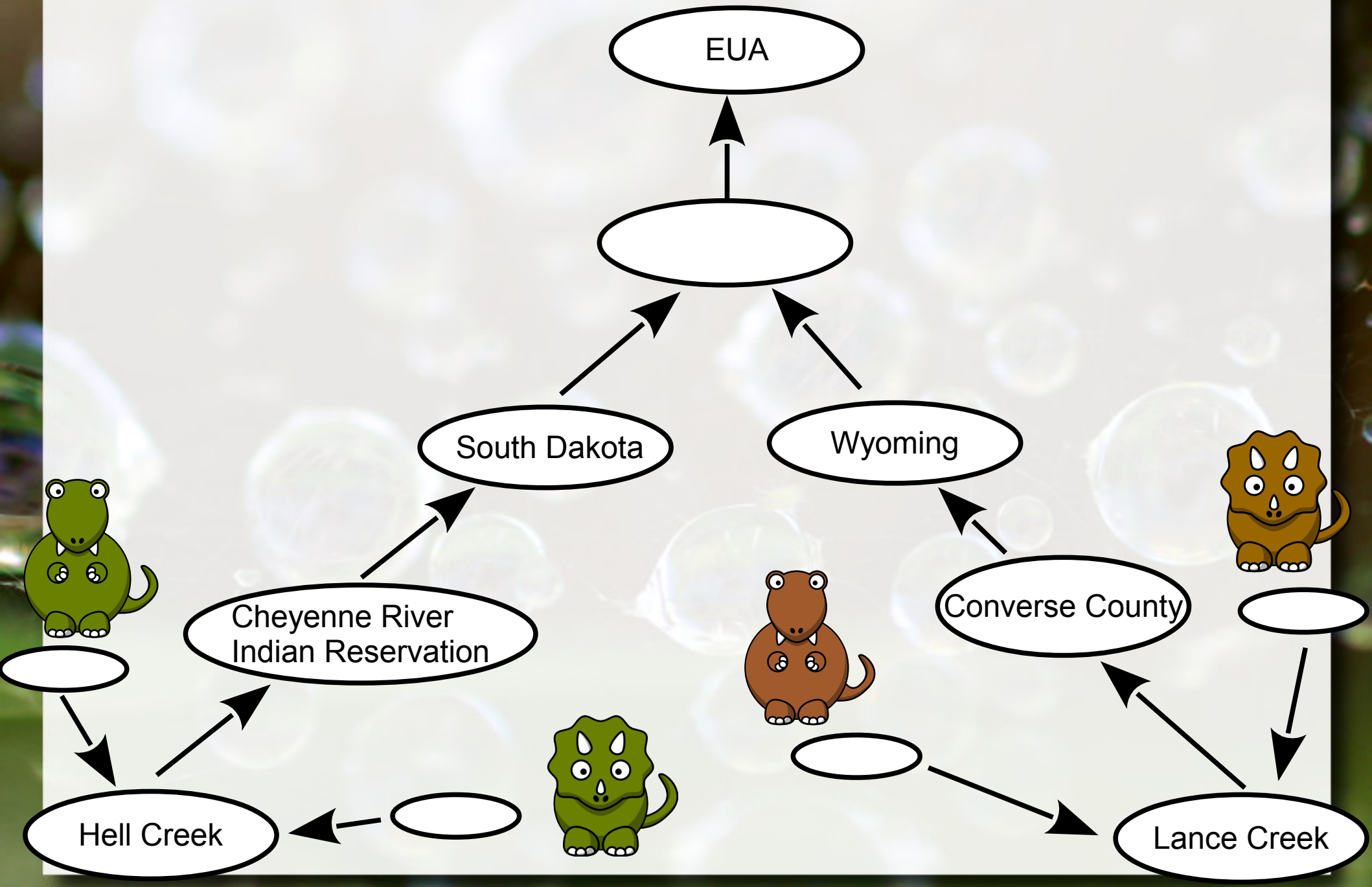


Analyzing in the Space

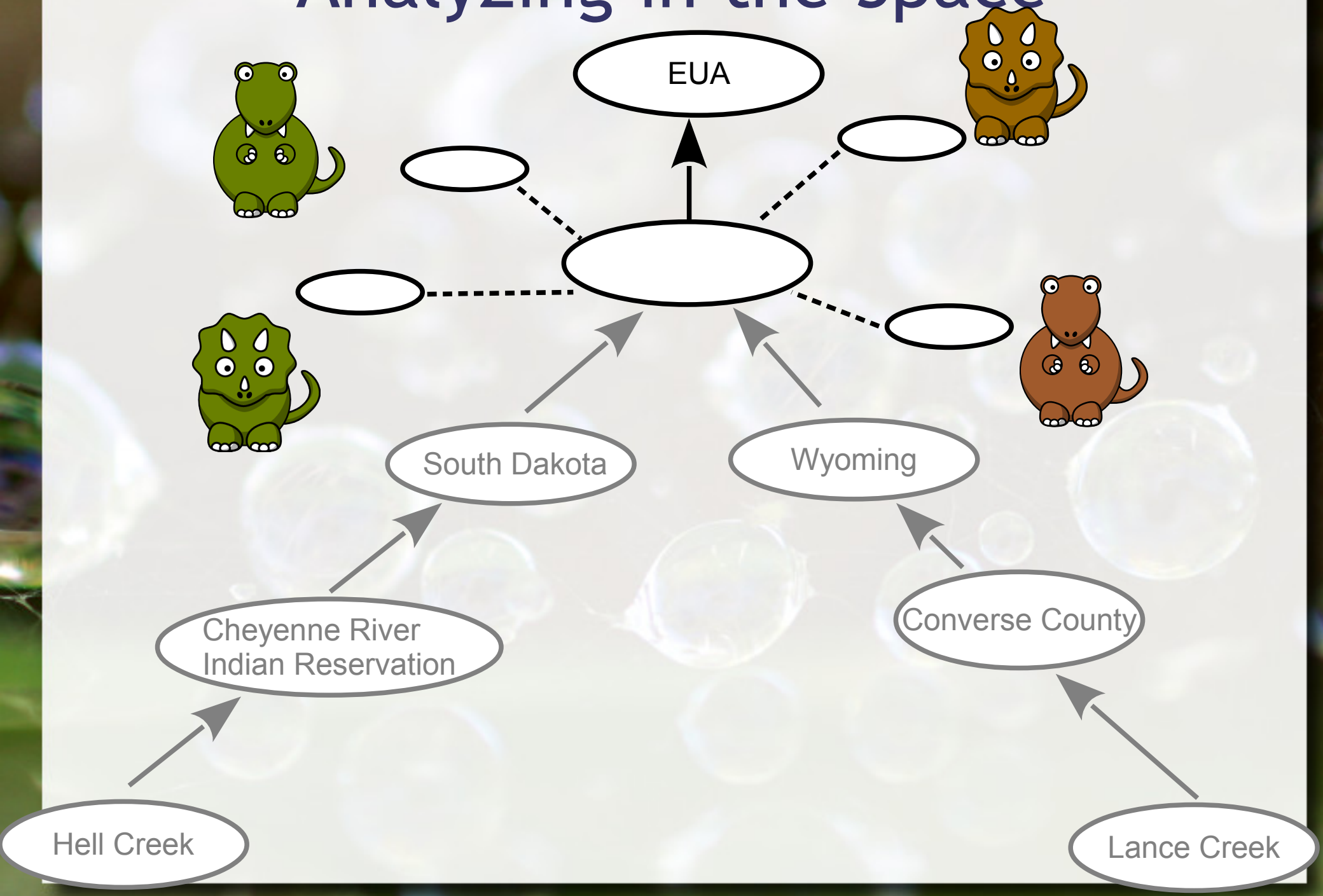


OpenStreetMap

Analyzing in the Space



Analyzing in the Space



GeoNames

MNHN 1912.20

is a

Triceratops horridus

size

9

recognized

1889

origin

United States
http://www.geonames.org/6252001

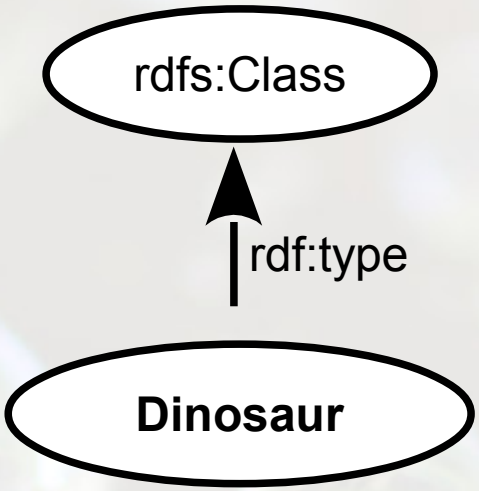
Wyoming
http://www.geonames.org/5843591

Niobrara County
http://www.geonames.org/5833446

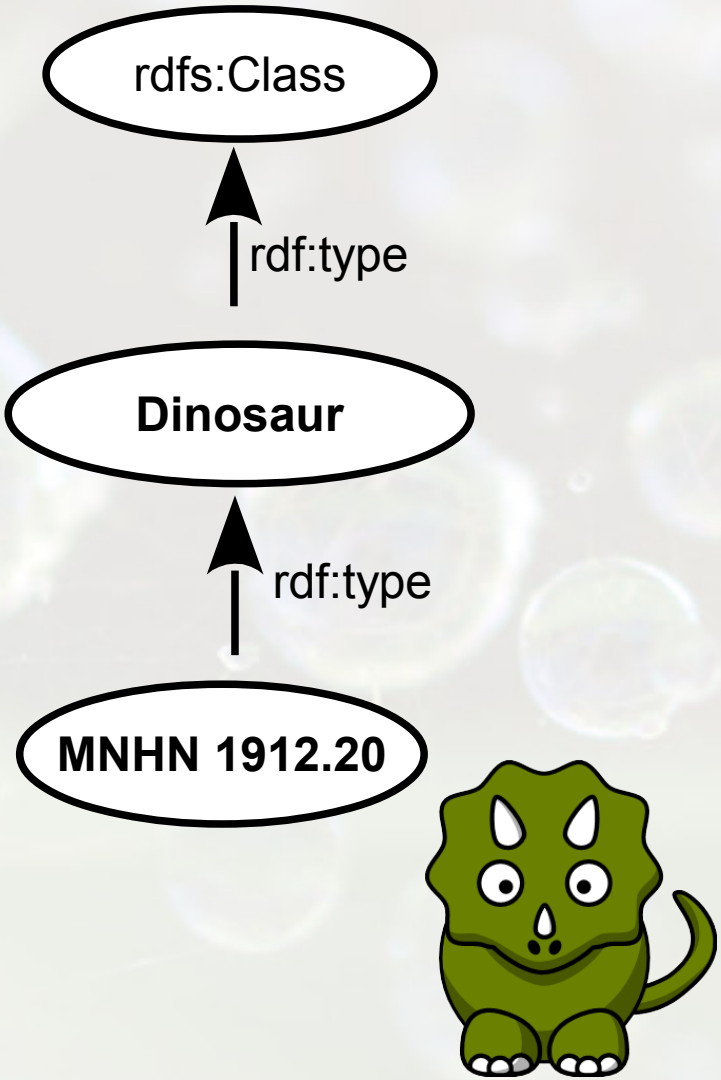
Lance Creek
http://www.geonames.org/5829995/

Classes and Properties

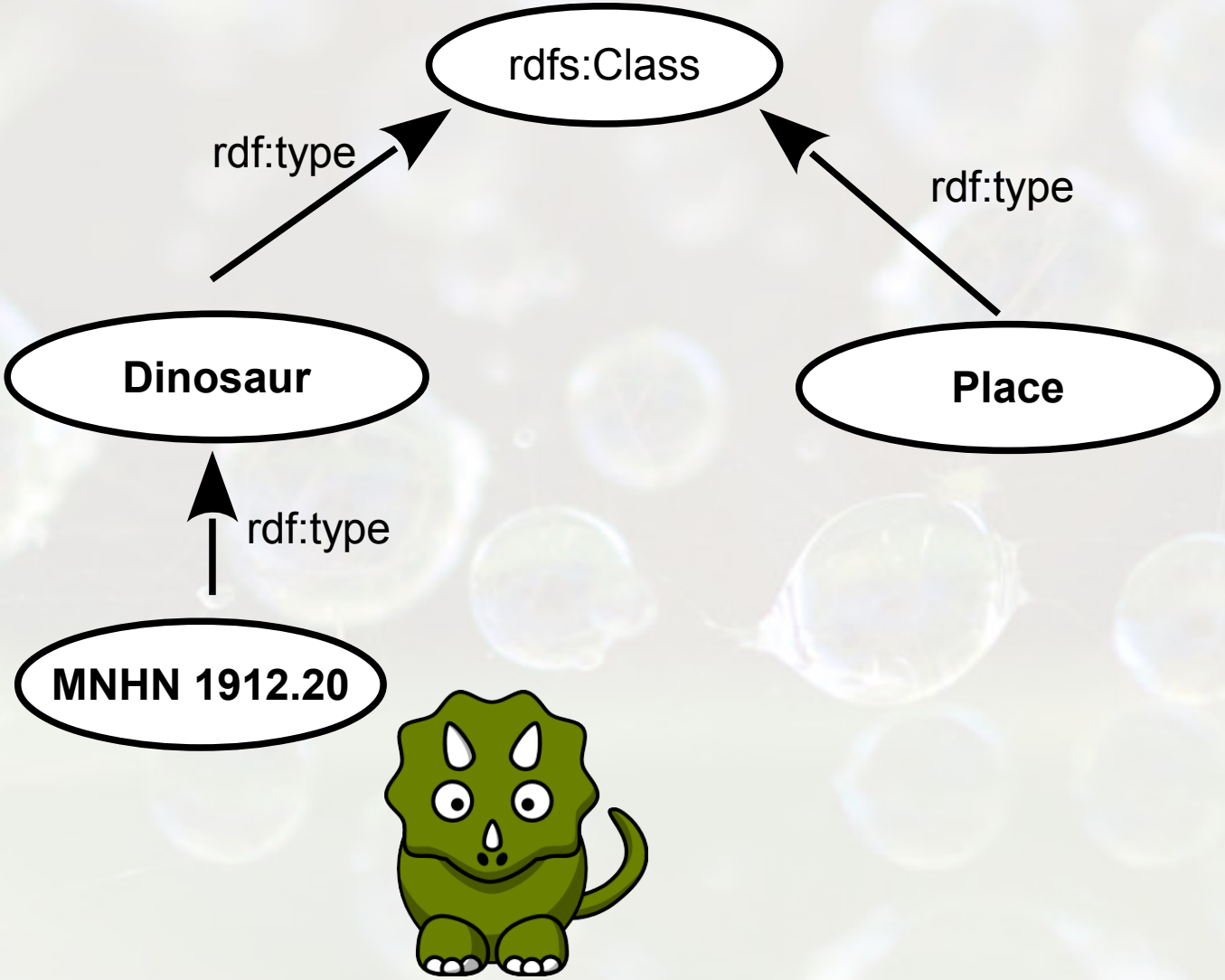
Dinosaur Class



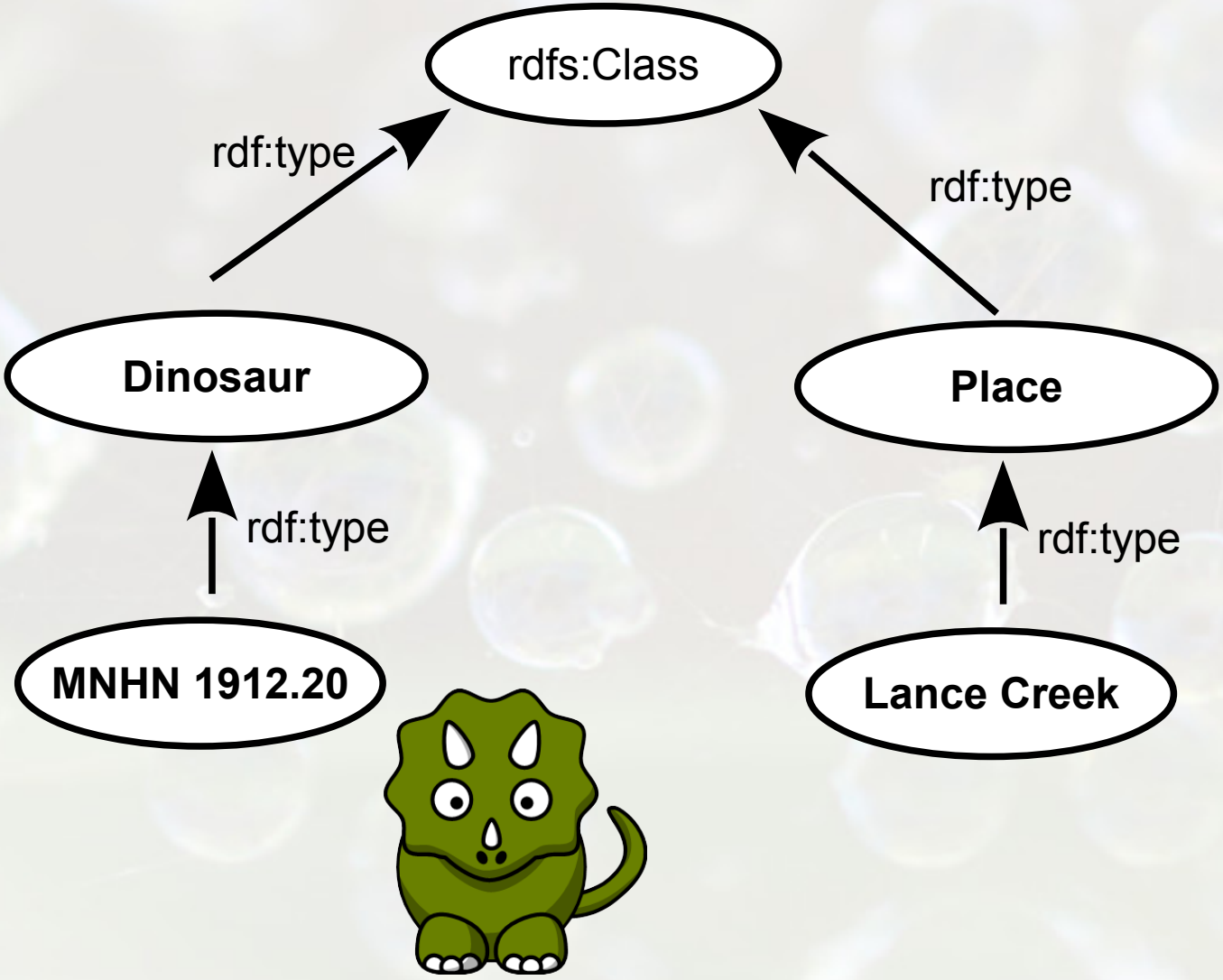
Dinosaur Instance



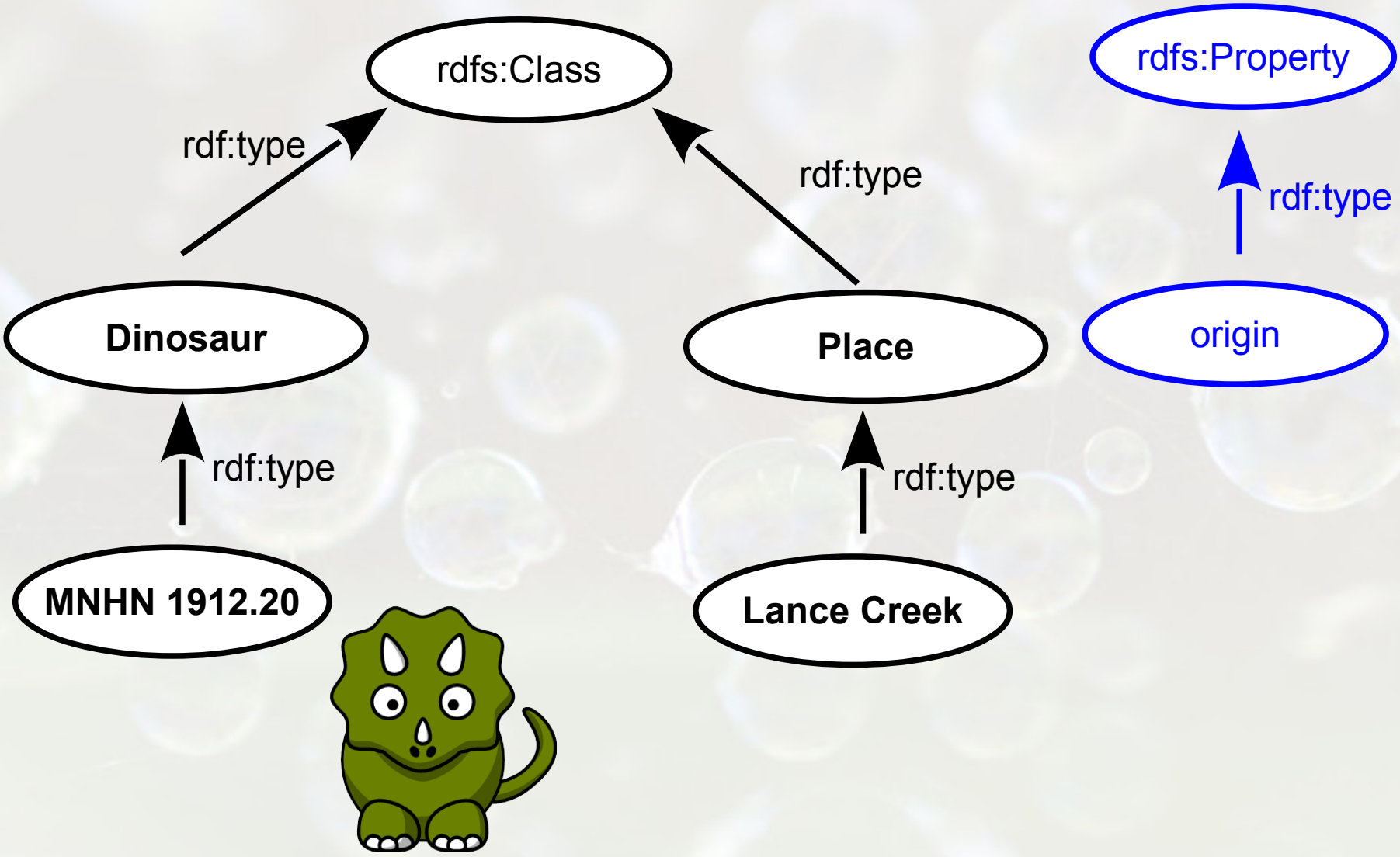
Place Class


rdfs:Class
rdf:type
rdf:type
Dinosaur
Place
rdf:type
MNHN 1912.20

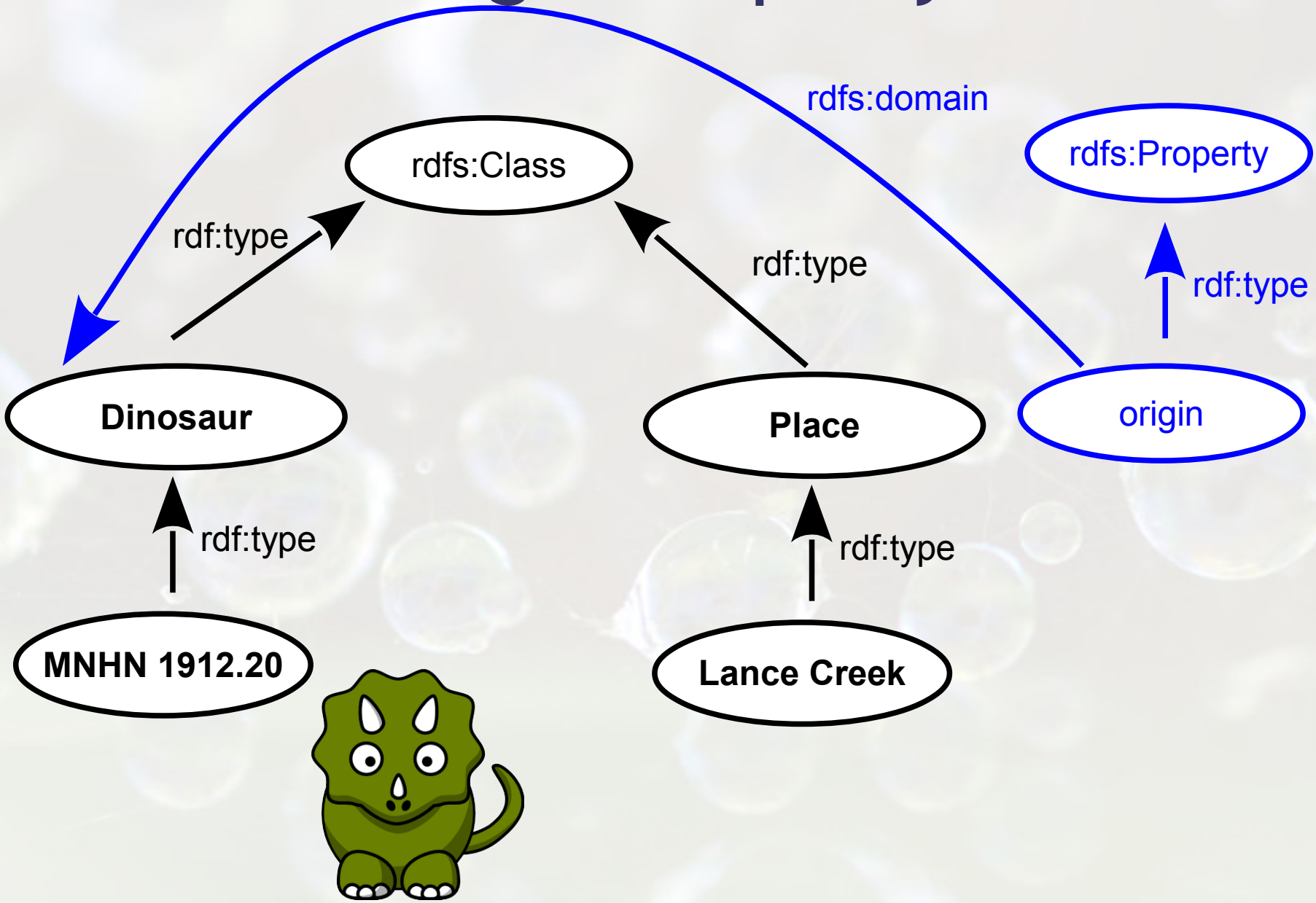
Place Instance



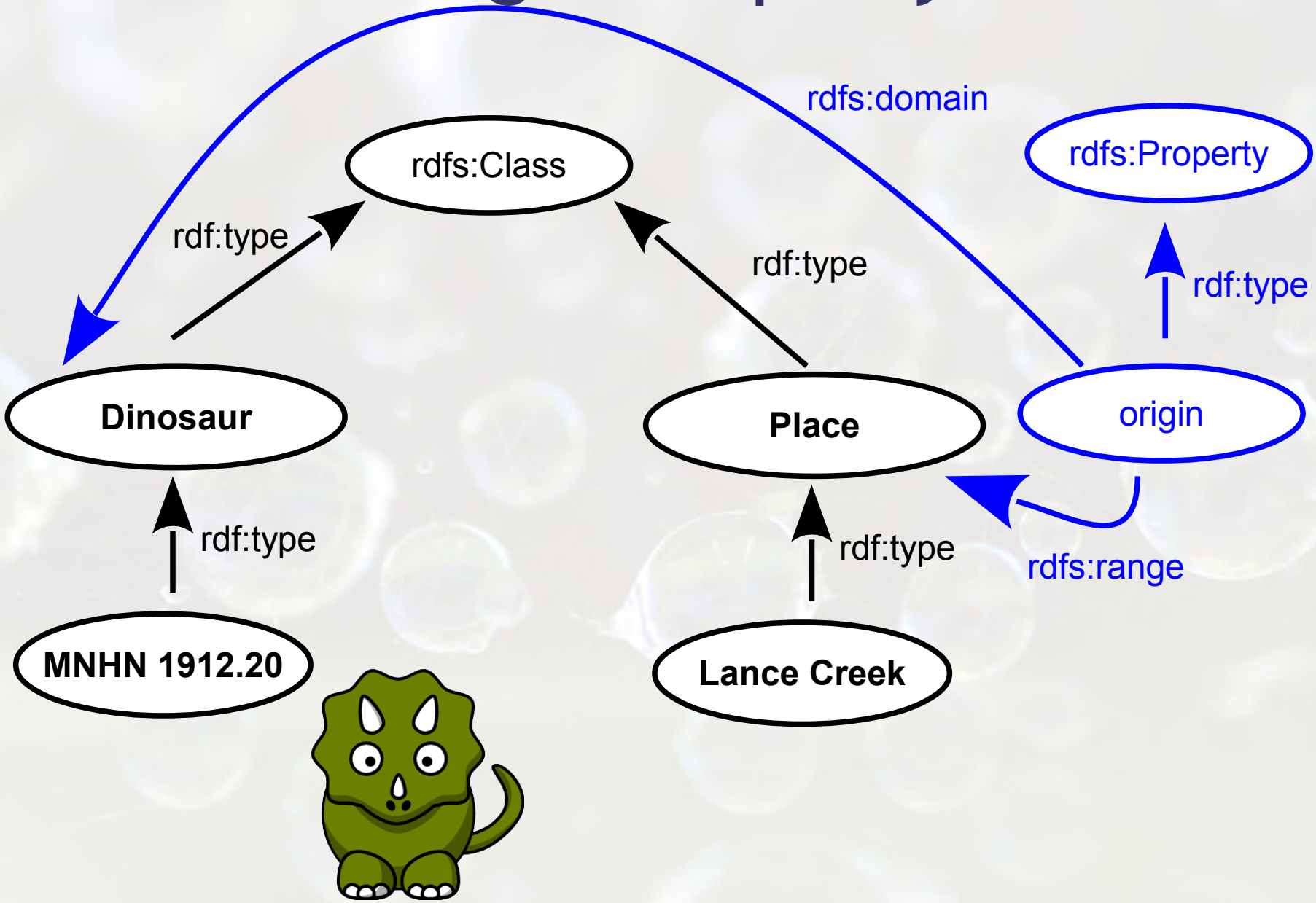
origin Property



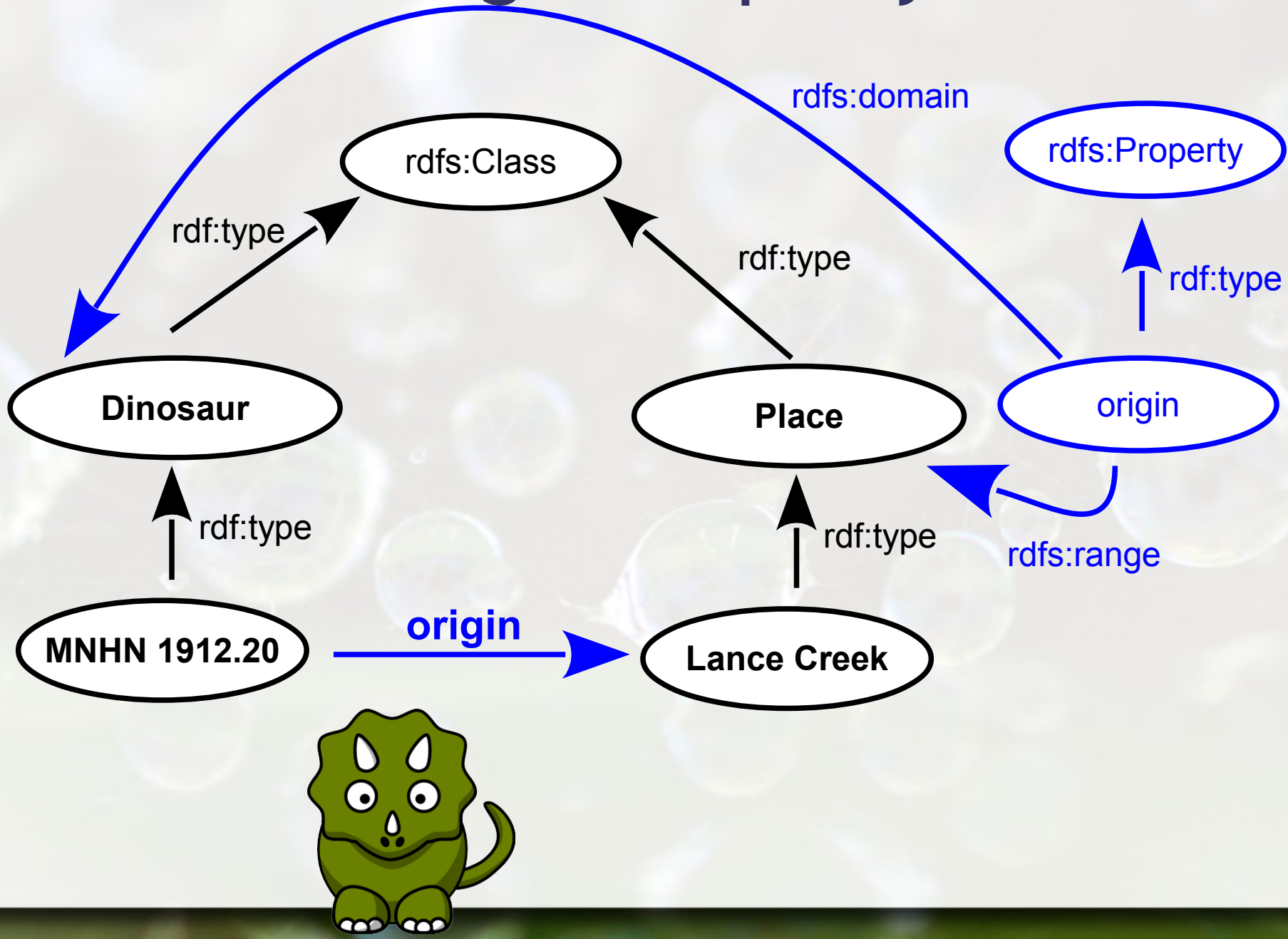
origin Property



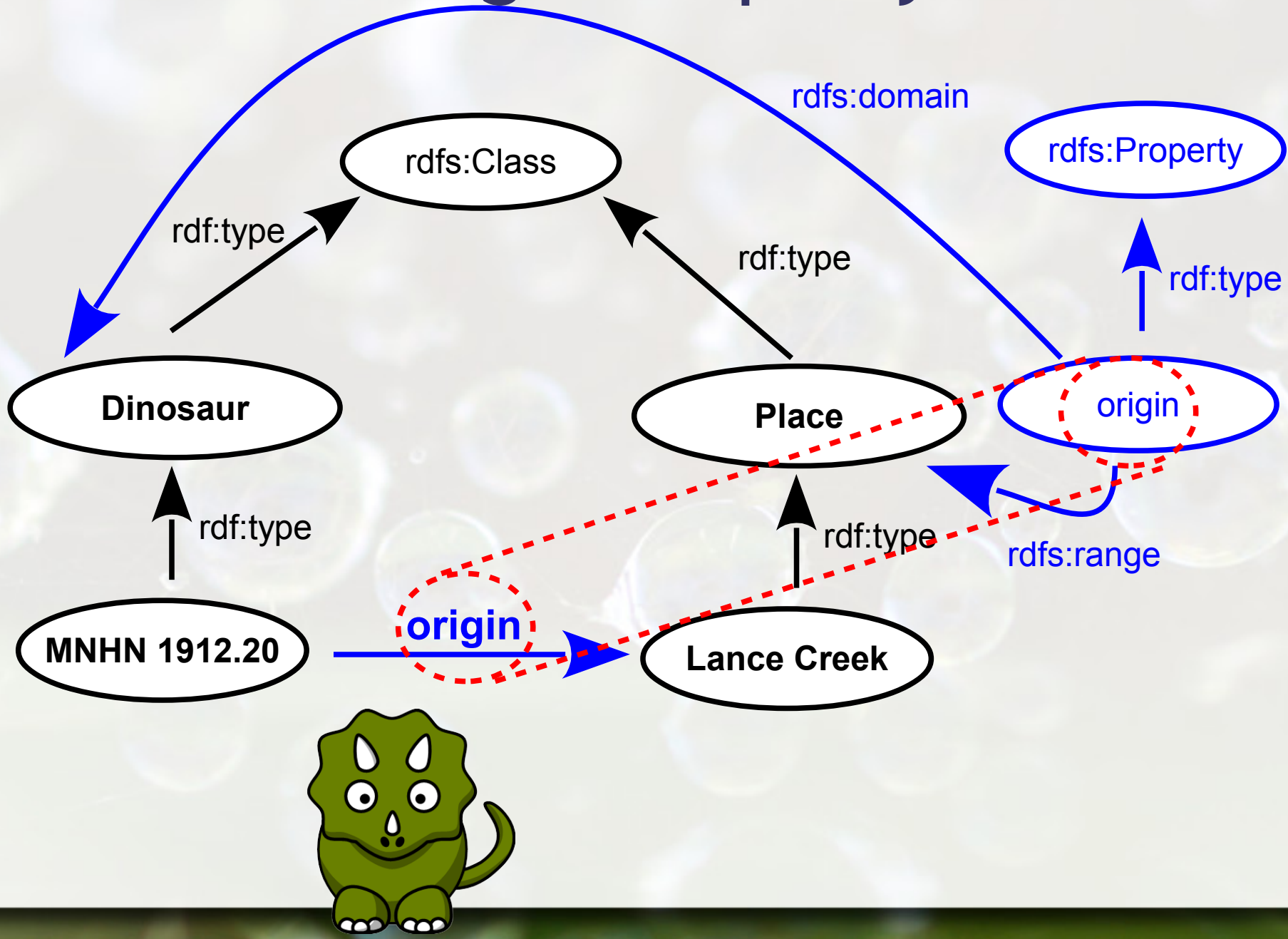
origin Property



origin Property



origin Property



RDF Graph

http://www.edissauros.com.br

http://www.x.org/razao_social

Editora Edissauros

http://www.x.org/contratado

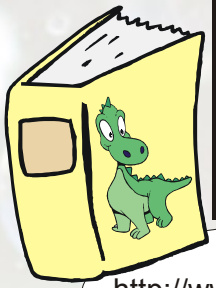
mailto:horacio@paleo.org

http://purl.org/dc/elements/1.1/publisher

http://www.x.org/nome

Horácio Montéquio

http://purl.org/dc/elements/1.1/creator



http://www.paleo.org/dinos.pdf

2ª

http://www.x.org/edicao

http://www.x.org/data_publicacao

17/05/2001

http://purl.org/dc/elements/1.1/title

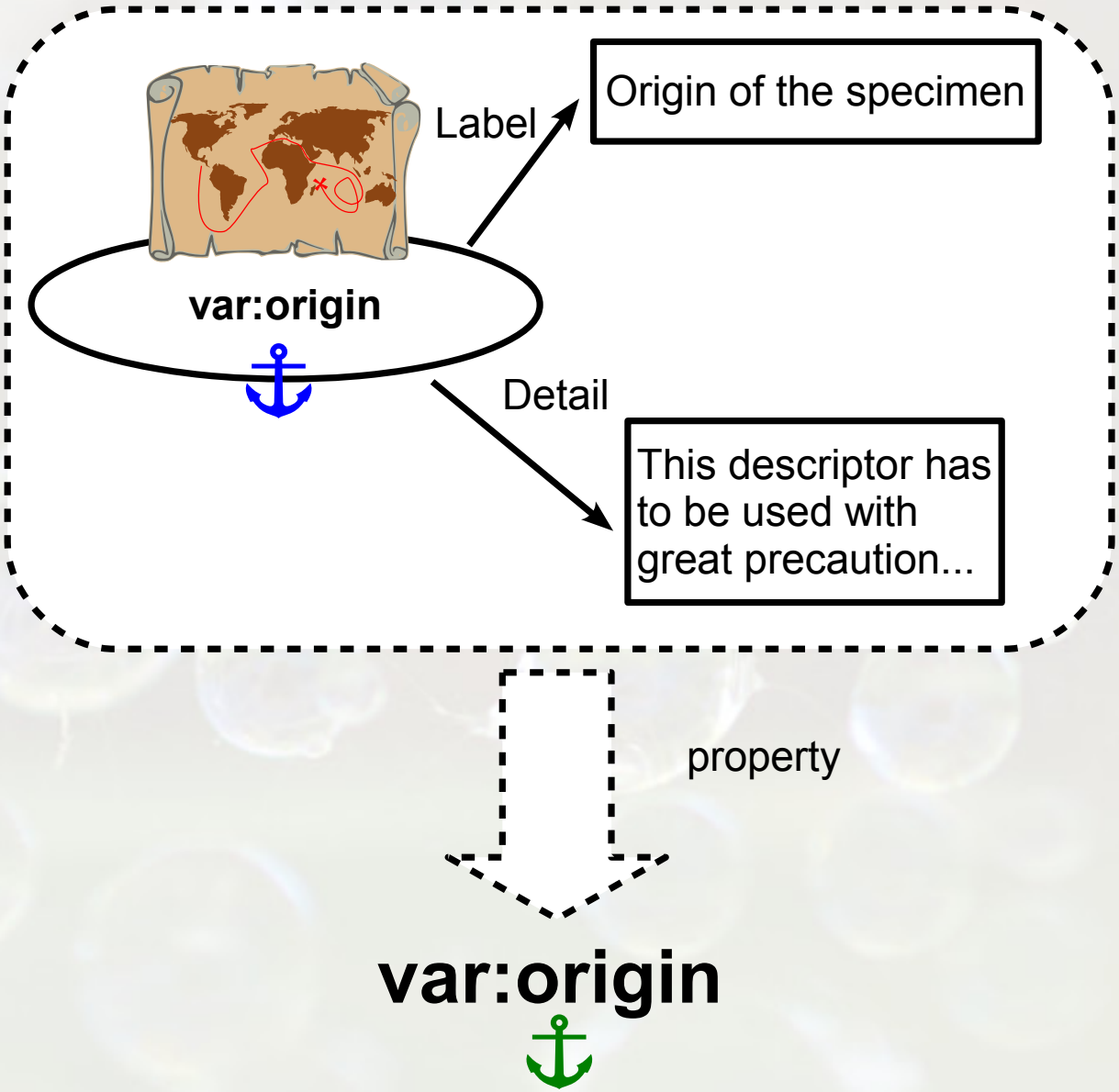
Vida dos Dinossauros

André Santanchè
http://www.ic.unicamp.br/~santanche

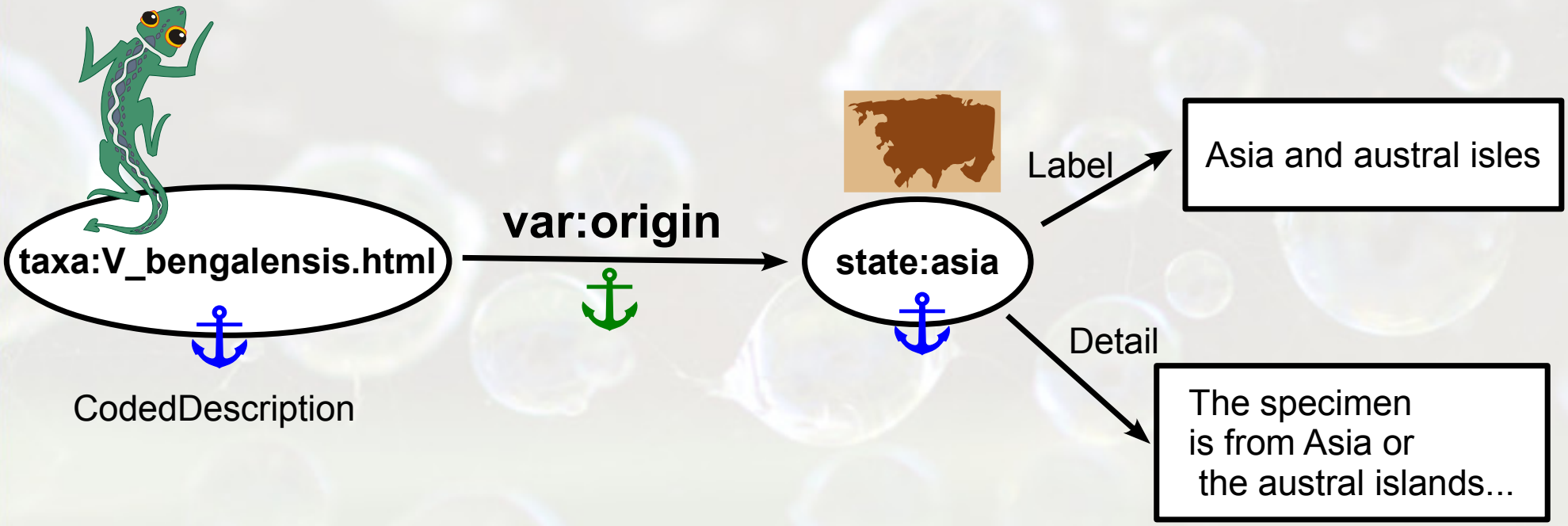
Graph Database

Graph as the basic data model of a database

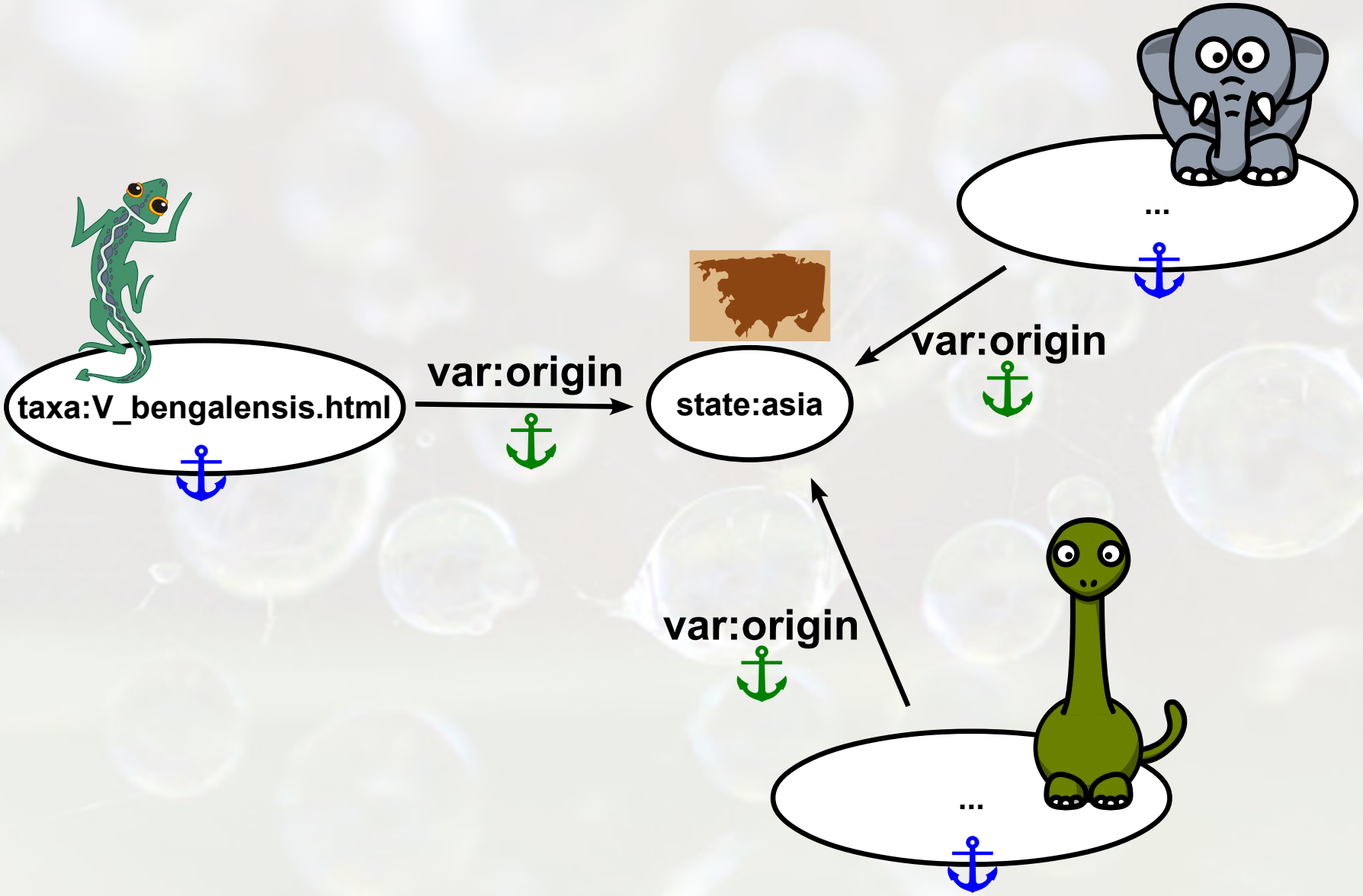
Property


Label
Origin of the specimen
var:origin
Detail
This descriptor has to be used with great precaution...
property
var:origin

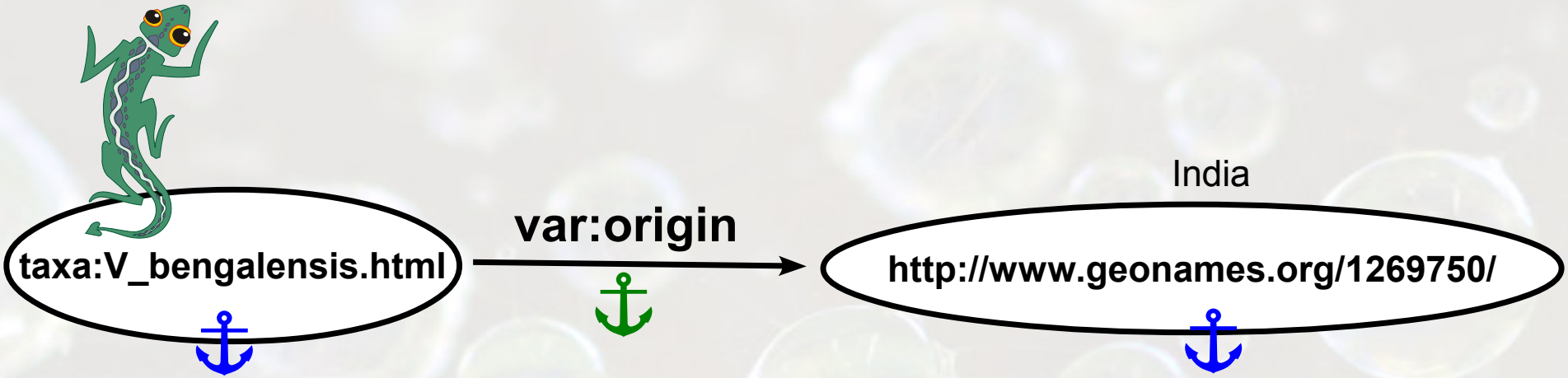
Using the Property



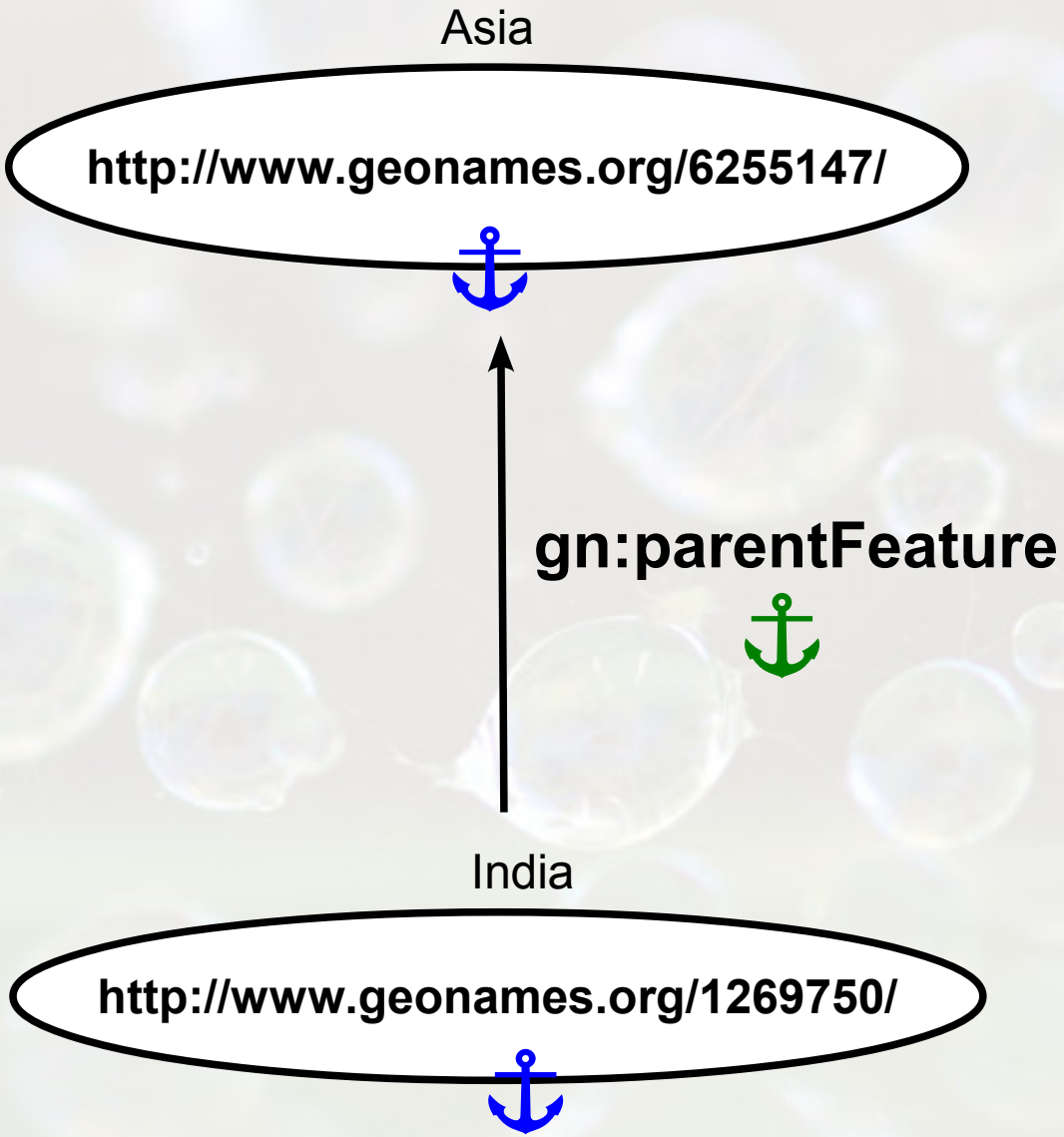
Connected Graph



Origin in GeoNames



Geo Tree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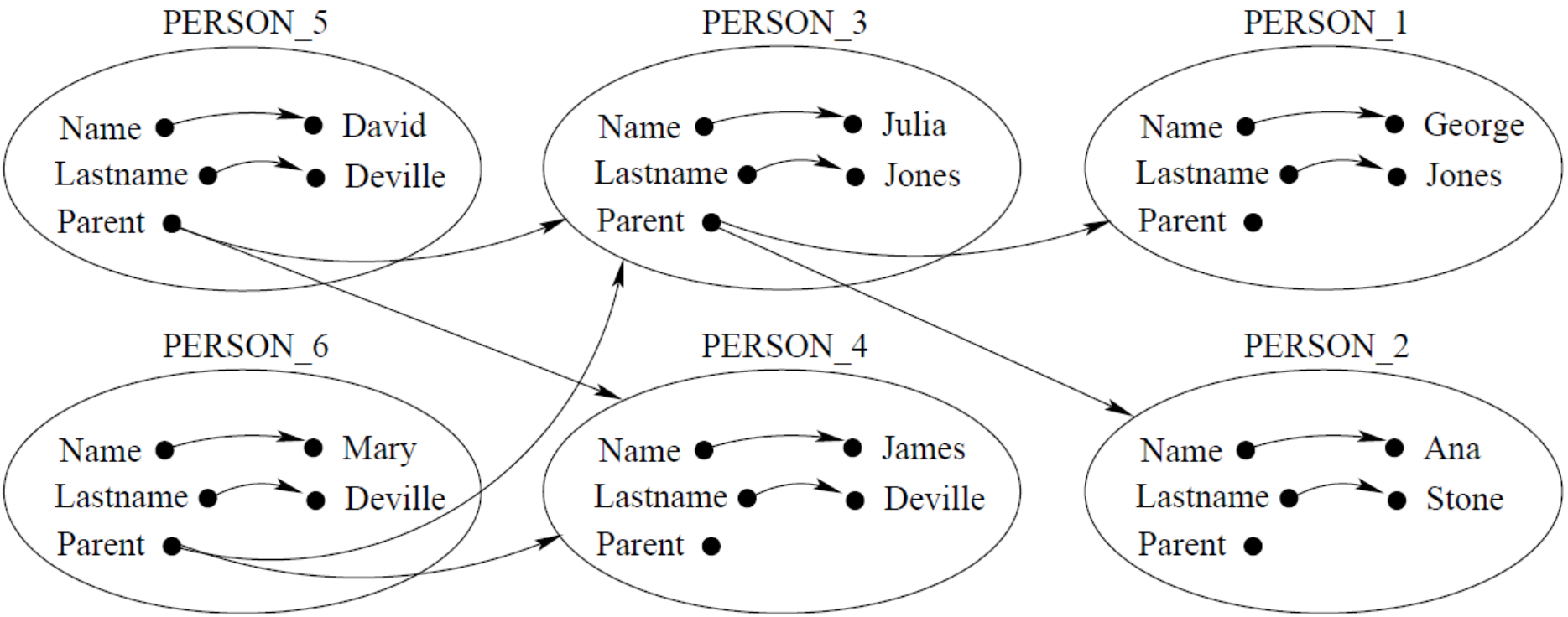
Hypernode



(Jaudete Daltio, 2013)

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