



LIRE Laboratory, Mentouri University of Constantine, Algeria



# Ontological Re-Classification of Individuals: A Multi-viewpoints Approach

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## **1. Introduction**

- Context and Objectives

## **2. Presentation of our Approach**

- Multi-Viewpoints Ontology Representation
- A Multi-Viewpoints Individual Relocalisation Process

## **3. Conclusion & Perspectives**

# Introduction

## -Context-

- An ontology captures and structures the **knowledge** in a domain, and by doing so captures the **meaning of concepts**.
  - Organizing them hierarchically
  - Defining their property
  - => This through the use of a knowledge representation formalism
  
- Generally there are **several ways of apprehending knowledge** of a domain



Therefore, the representation of ontologies **is not an easy task**.

# Introduction

## - Representation of Ontologies -



The difficulty of representing ontologies is mainly related to the existence of several user communities who can be interested in the **same domain** but with **different viewpoints**



Size



Different perceptions

Finance

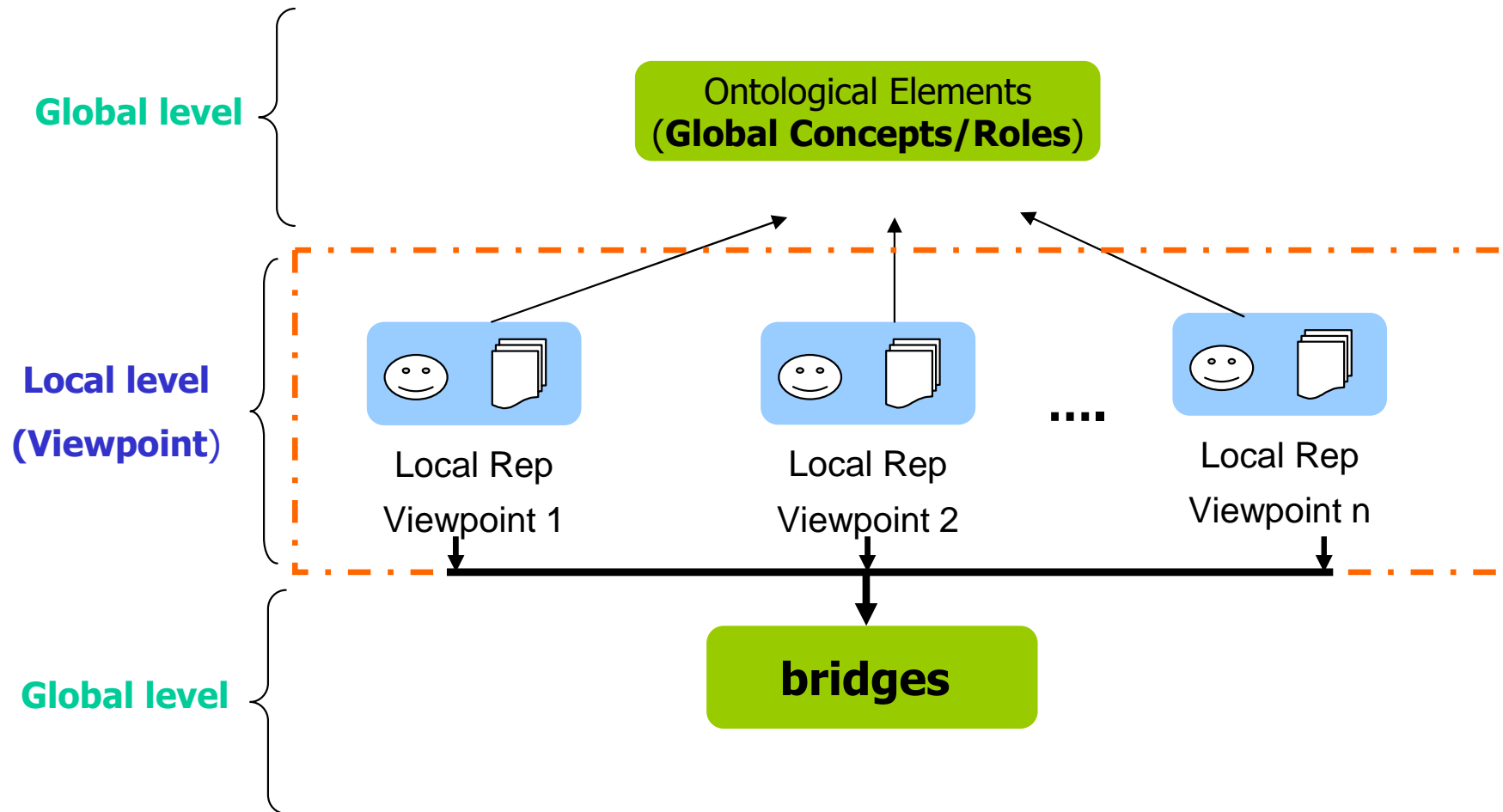
Knowledge Domain



several user communities

# Problem addressed -Ontology + Viewpoint-

- Representing an ontology in heterogeneous environment



**Multi-viewpoints ontology**

1. Definition of a **multi-viewpoints knowledge model** based on viewpoint and ontology notions.

- The multi-viewpoints knowledge model is used to formalize the multi-viewpoints ontology in **description logics**.

2. Proposal of a process for the **relocation of an individual** in a multi-viewpoints ontology.

- The Individuals relocation concerns the reclassification of an individual, already classified, who sees its data change.
- The reclassification is necessary when the knowledge of the individual evolves.

# Proposed approach

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Multi-viewpoints ontologies representation

□ For our requirements of multi-viewpoints ontology representation, we introduce in [description logics](#) the following notions:

### 1. Multi-Viewpoints Ontology :

- ✓ Is a multiple description of the same universe of discourse according to various viewpoints.
- ✓ Defined as a 4-tuple  $\mathbf{O} = \langle \mathbf{C}^G, \mathbf{R}^G, \mathbf{Vp}, \mathbf{M} \rangle$ :
  - $\mathbf{C}^G$  a set of global concepts
  - $\mathbf{R}^G$  a set of global roles
  - $\mathbf{Vp}$  a set of viewpoints
  - $\mathbf{M}$  a set of bridge rules



□ For our requirements of multi-viewpoints ontology representation, we introduce in description logics the following notions:

## 2. Viewpoint:

- ✓ Is a partial description of a universe of discourse according to a particular viewpoint.
- ✓ Defined as a triple  $VP_k = \langle C^L, R^L, A^L \rangle$ :
  - $C^L$  a set of local concepts
  - $R^L$  a set of local roles
  - $A^L$  a set of local individuals

□ For our requirements of multi-viewpoints ontology representation, we introduce in description logics the following notions:

3. **Global Concept** → Observed from two or several viewpoints, at the same time, with common attributes
4. **Local Concept** → Viewed and described locally according to a given point of view
5. **Global Role** → Relationship between two local concepts defined in two different viewpoints
6. **Local Role** → Relationship between two local concepts defined in the same point of view.

- For our requirements of multi-viewpoints ontology representation, we introduce in description logics the following notions:

## 7. Local Hierarchy

- ✓ Defined by a triplet  $(C^L, \partial, \sqsubseteq)$  :

$C^L$  A set of local concepts ,

$\partial$  Function which associates each root local concept to one global concept,

$\sqsubseteq$  Subsumption relationship used to express a partial ordering relation according to the 2 forms :

$$vp_i: D \sqsubseteq vp_i: C$$

$$vp_i: S \sqsubseteq C^{\hat{o}}$$

□ For our requirements of multi-viewpoints ontology representation, we introduce in description logics the following notions:

**8. Bridge Rule** → Allows representing links between local concepts of different viewpoints

➤ A bridge is a statement of one of the 4 following forms :

$$vp_i: X \xrightarrow{\hat{\circ}} vp_j: Y \quad (\text{Inclusion})$$

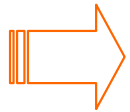
$$vp_1: X_1 \sqcap \dots \sqcap vp_k: X_k \xrightarrow{\hat{\circ}} vp_j: Y \quad (\text{Inclusion with several sources})$$

$$vp_i: X \xleftrightarrow{=} vp_j: Y \quad (\text{Equality})$$

$$vp_i: X \xleftrightarrow{\perp} vp_j: Y \quad (\text{Exclusion})$$

□ For our requirements of multi-viewpoints ontology representation, we introduce in **description logics** the following notions:

**9. Multi-Instantiation** → An individual is an instance of a global concept and instance of one or several local concepts defined in one or several viewpoints



An individual has a basic description and may be described partially according to one or several VP

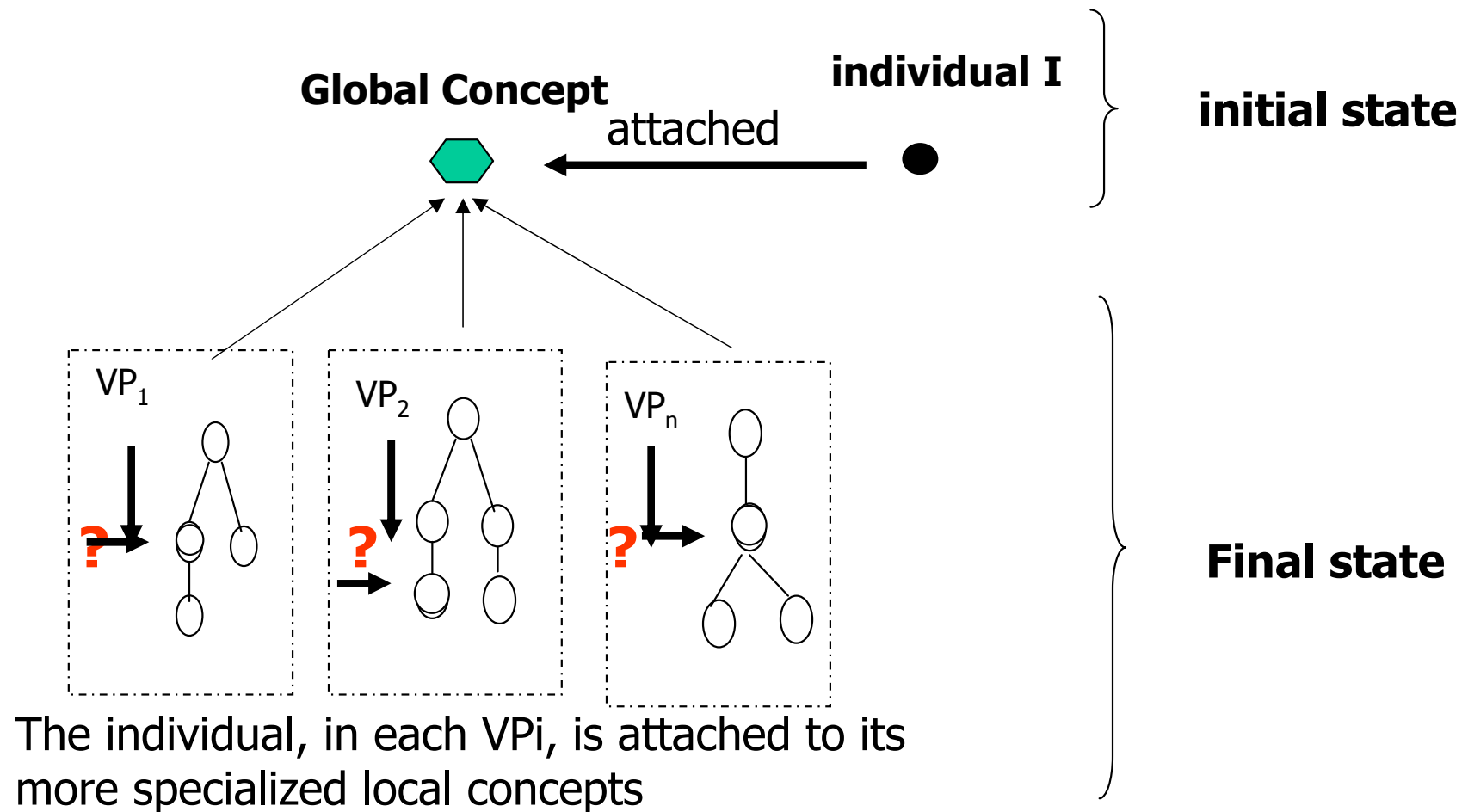
# Proposed approach

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Multi-viewpoints classification process

## Multi-viewpoints classification process (1/3)




- The fundamental mechanism based on the multi-viewpoints knowledge model is the **classification of individual**



## Multi-viewpoints classification process (2/3)

❑ The multi-viewpoints classification process is based primarily on a **matching mechanism** between an individual and a local concept.

❑ Matching mechanism characterize local concepts in three categories :

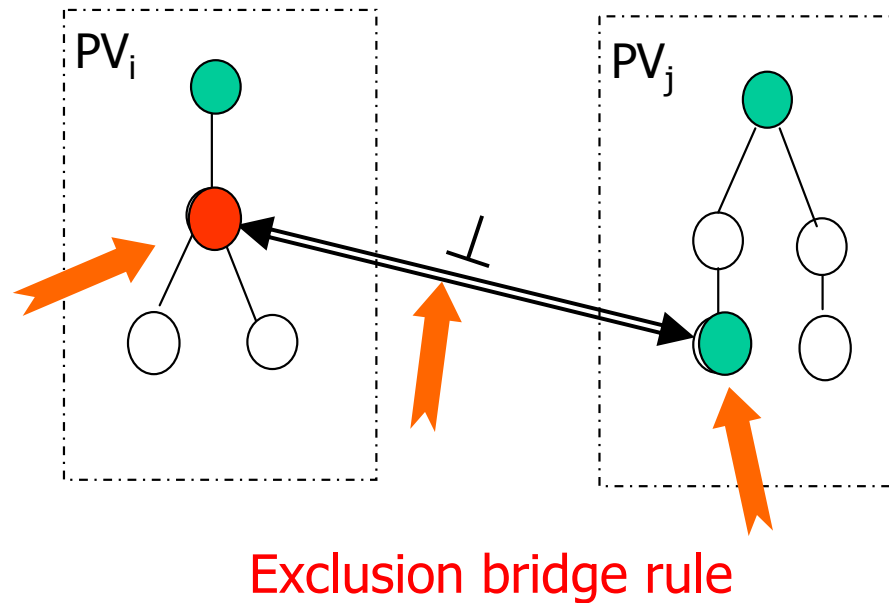
-  admissible
-  potential
-  prohibited

❑ The matching results are used to **mark** local concepts as admissible, potential or prohibited.



## Multi-viewpoints classification process (3/3)

- ❑ The procedure **Marks-Propagation** proceeds a propagation of labels admissible, potential or prohibited on local concepts of different viewpoints.
- ❑ This marking, based on the **semantics of bridge rules**, reduces future matching



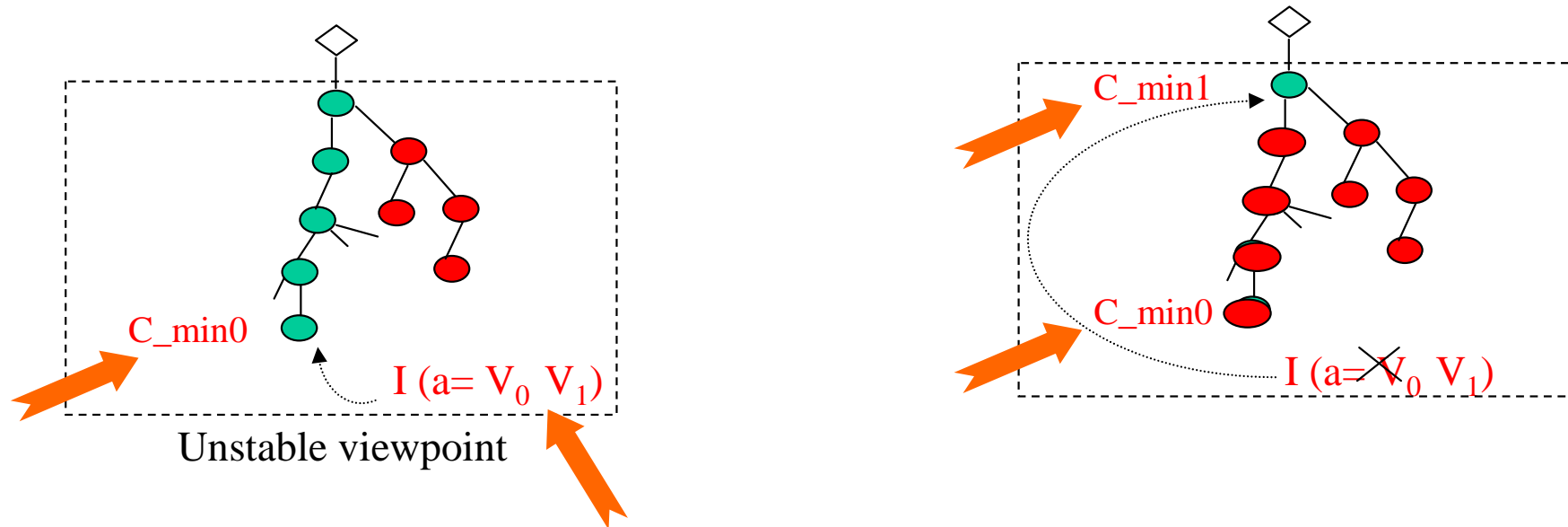
# Proposed approach

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**Multi-Viewpoints Individuals Relocation Process**



## □ Ascent of the individual



- The mark of all local concepts between  $C_{min0}$  and  $C_{min1}$  changed from admissible to prohibited.

□ **Propagation of the Ascent.** When an individual is raised in a viewpoint, certain of its ancient admissible local concepts become **prohibited**.

- Consists to identify the list of bridges for which at least one of its concepts (source or target) has changed mark form admissible to prohibited.
- Proceeds a propagation of the prohibited mark on local concepts of different viewpoints.

## ❑ Descent of the individual

➤ Tries to descend the individual to the maximum in the different viewpoints

❑ Part of a stable state and consists to invoke, from this state, the **classification procedure**

- Presentation of an approach for representing and reasoning with multiple viewpoints in description logic ontologies.
- Description of such ontology, without eliminating heterogeneity but by merging **heterogeneity** (at local level) and **consensus** (at global level).
- Reasoning mechanisms operate locally on each viewpoint, or on assemblies of these viewpoints.
  - The reasoning mechanism used is the re-classification of individual
  - This re-classification takes into account the characteristics of the multi-viewpoints model: **global concept**, **viewpoint** and **bridge**.
- **Perspectives**
  - Validate and test the proposed approach in the domain of urbanism
  - A link with the Ontology Web Language -OWL- will be established in the future phase of our study.



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Thank you  
for your attention ...