

# Cartographic Approach to Knowledge Representation and Management in KaSeA

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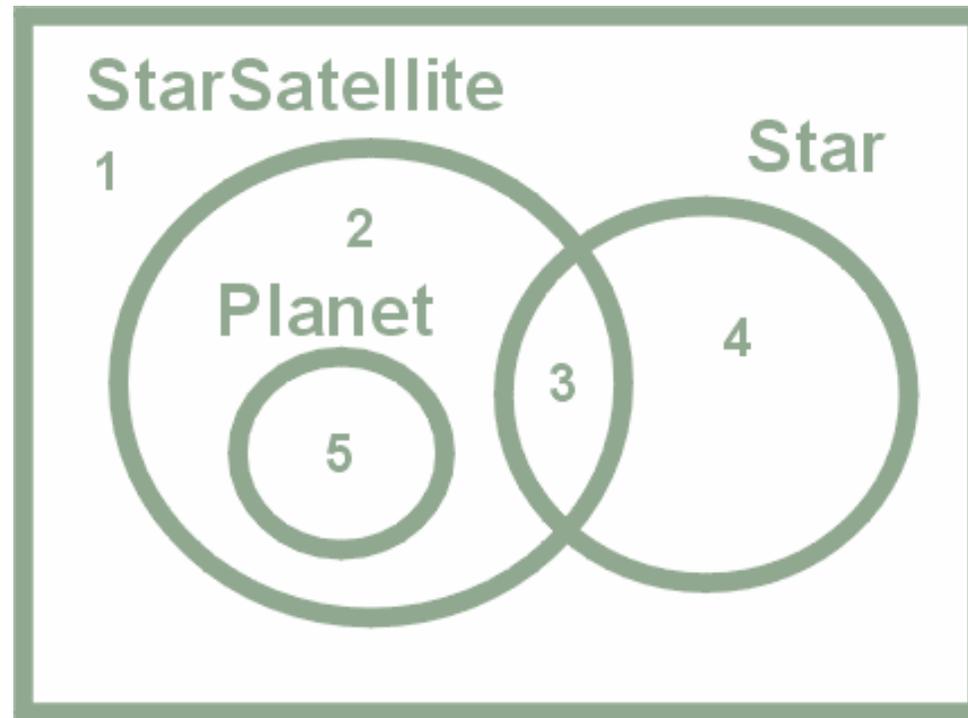
Gdańsk University of Technology



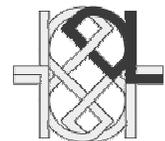
# Signatures

**Planet  $\sqsubseteq$  StarSatellite** (Every planet is a star satellite)

**Star  $\sqcap$  Planet  $\equiv \perp$**  (Stars and planets are disjoint)



StarSatellite	01101
Planet	00001
Star	00110



# Cartography in PIPS

*Higher layers*

↑ *Knowledge*

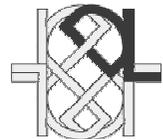
*KMS*

*KaSeA*

*RDB*

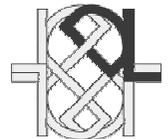
↑ *Data*

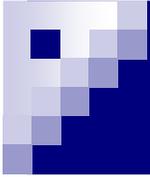
*Internet*



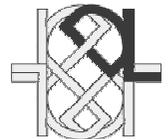
# Summary

- Binary representation allows for reasoning and storing conclusions (in RDB),
- Allows for asking questions about uncertainty,
- Cartography implemented in PIPS KMS allowed to achieve short response time (<1s) even for large number (>10000) of individuals (sublinear scalability),
- This method of representation is being exploited to develop new techniques of ontology merging.





***Thank you  
for your attention!***

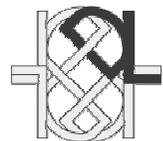


# Cartographic database details

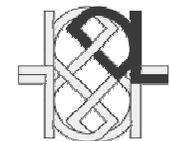
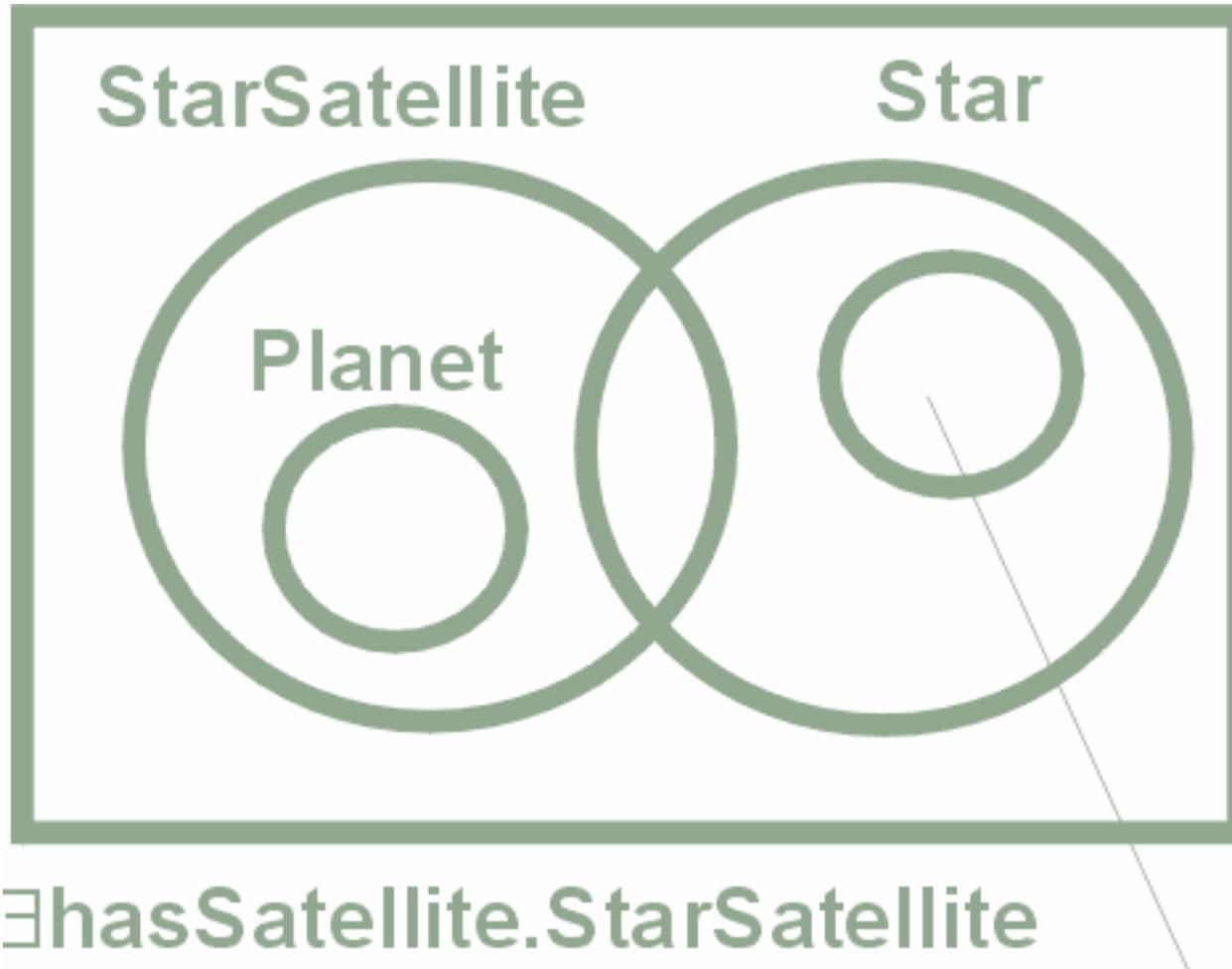


Signature\_1      0011   0001   1110  
                         2           1           3

Signature\_2      0111   0001   1100  
                         3           1           2

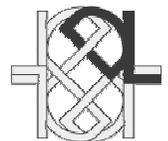


# Role support



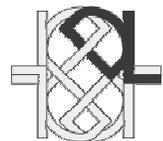
# Some open problems

- Some terminologies generate very long signatures (pessimistic signature length is  $2^n$ , where  $n$  is the number of concepts),
- Some more expressive constructs like symmetric or transitive roles are not supported.

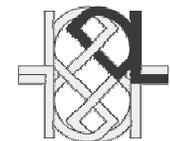
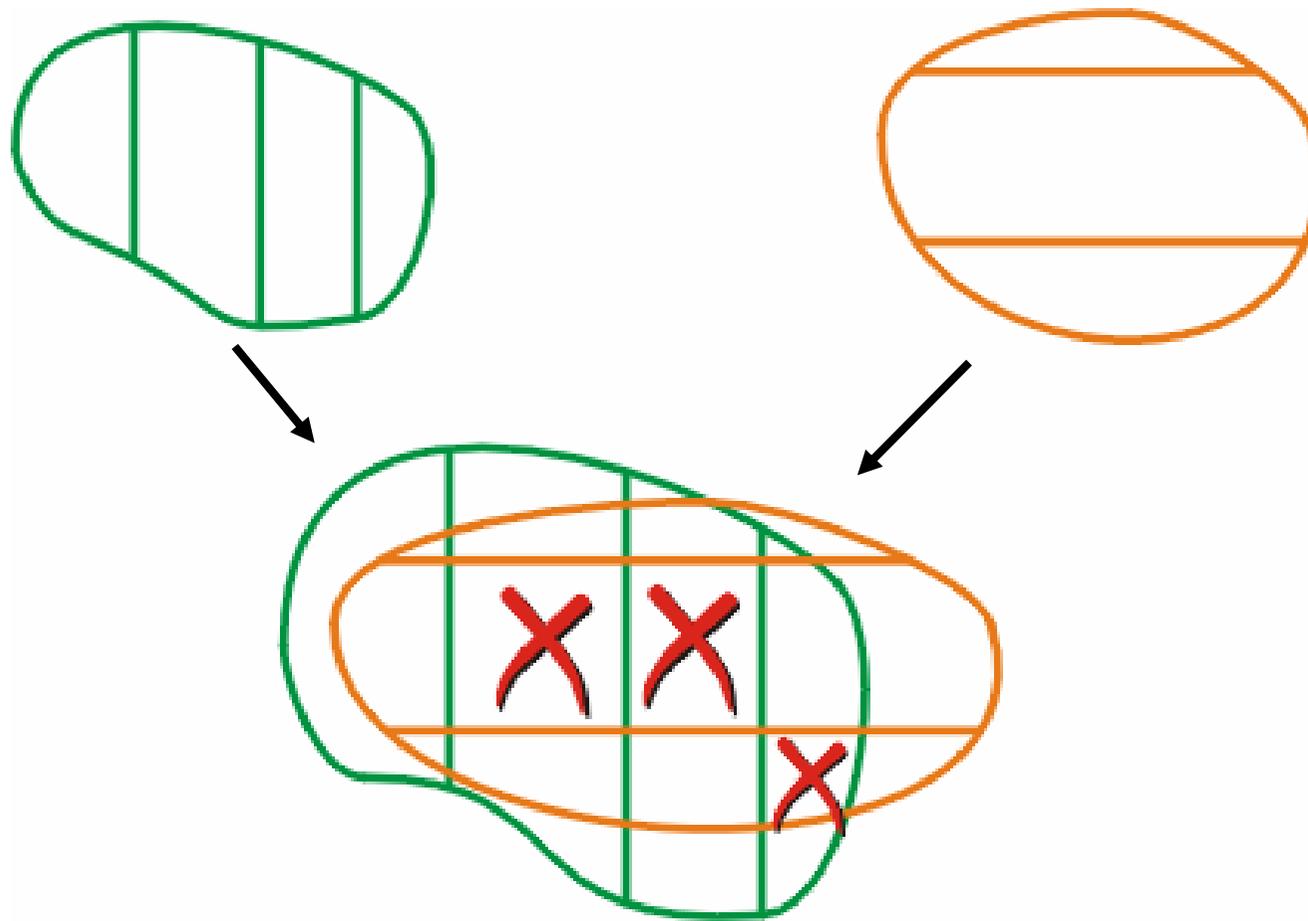


# Preliminary comparison results

Size of ABox	Loading time [s]			Query-processing time [s]		
	400	1000	3800	400	1000	3800
Jena	1	22	-	6	250	-
RACER	3	4	5	58	-	-
Cartographer	43	122	465	<1	<1	1

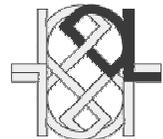


# Cartography based integration



# Knowledge Cartography

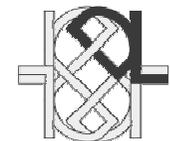
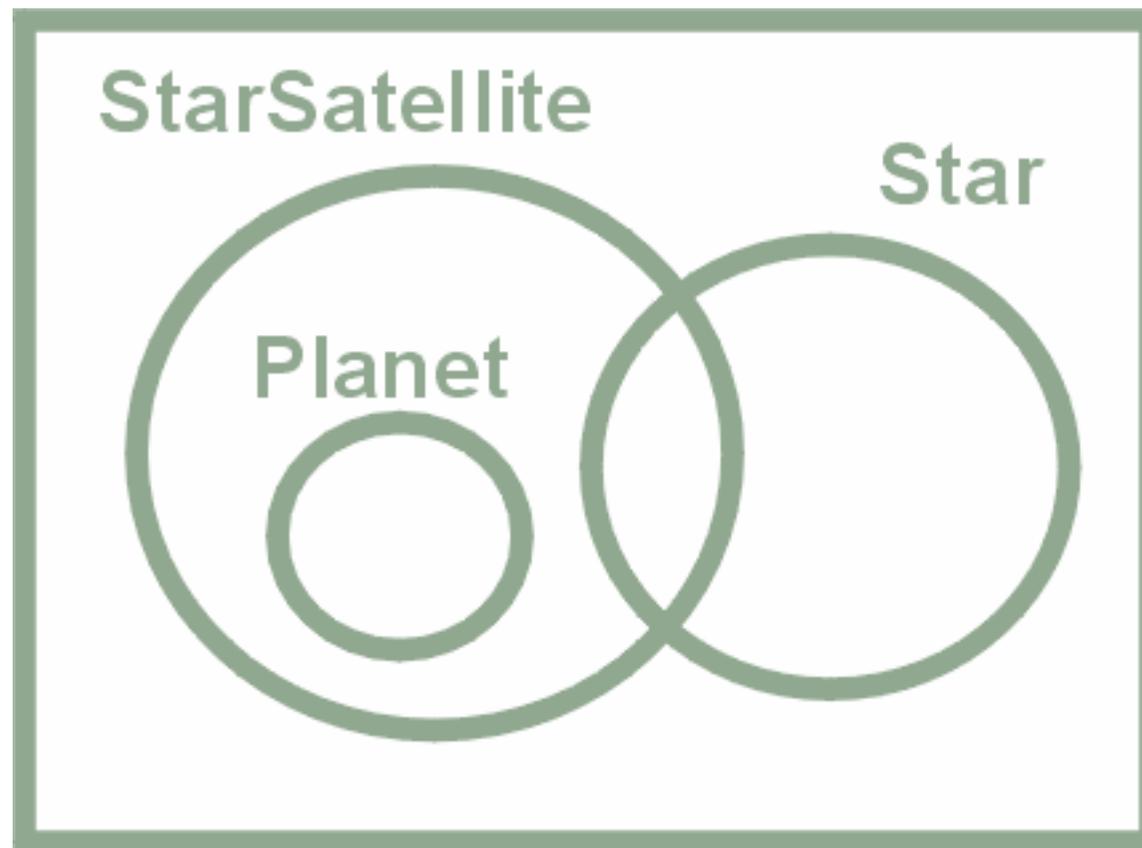
- New method of knowledge representation,
- Can be used to facilitate the process of reasoning,
- Aims at storing in the knowledge base as many conclusions as it is possible, which allows for quick query answering in ontologies containing large numbers of individuals.



# Map of concepts

**Planet**  $\sqsubseteq$  **StarSatellite** (Every planet is a star satellite)

**Star**  $\sqcap$  **Planet**  $\equiv \perp$  (Stars and planets are disjoint)





# Drawing conclusions (1)

Is every planet a star satellite?

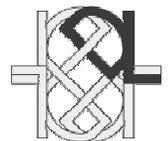
Planet	00001
StarSatellite	01101

Yes: Planet is included in StarSatellite

May a star be a star satellite?

Star	00110
StarSatellite	01101
Star $\cap$ StarSatellite	00100

Yes: Intersection of Star and StarSatellite exists



## Drawing conclusions (2)

Source 1: C47 is a StarSatellite 01101

Source 2: C47 is NOT a Star 11001

Combined information about C47 01001

Does C47 have to be a planet? **unawareness**

C47	01001
Planet	00001

No: C47 is not included in Planet

May C47 be a planet?

C47	01001
Planet	00001

Yes: C47 and Planet have an intersection



# Summary

- Signatures can be easily stored in RDB,
- Cartography implemented in PIPS KMS allowed to achieve short response time (<1s) even for large number (>10000) of individuals (sublinear scalability),
- This method of representation is being exploited to develop new techniques of ontology merging,
- Cartography has some deficiencies especially in handling more expressive constructs.

