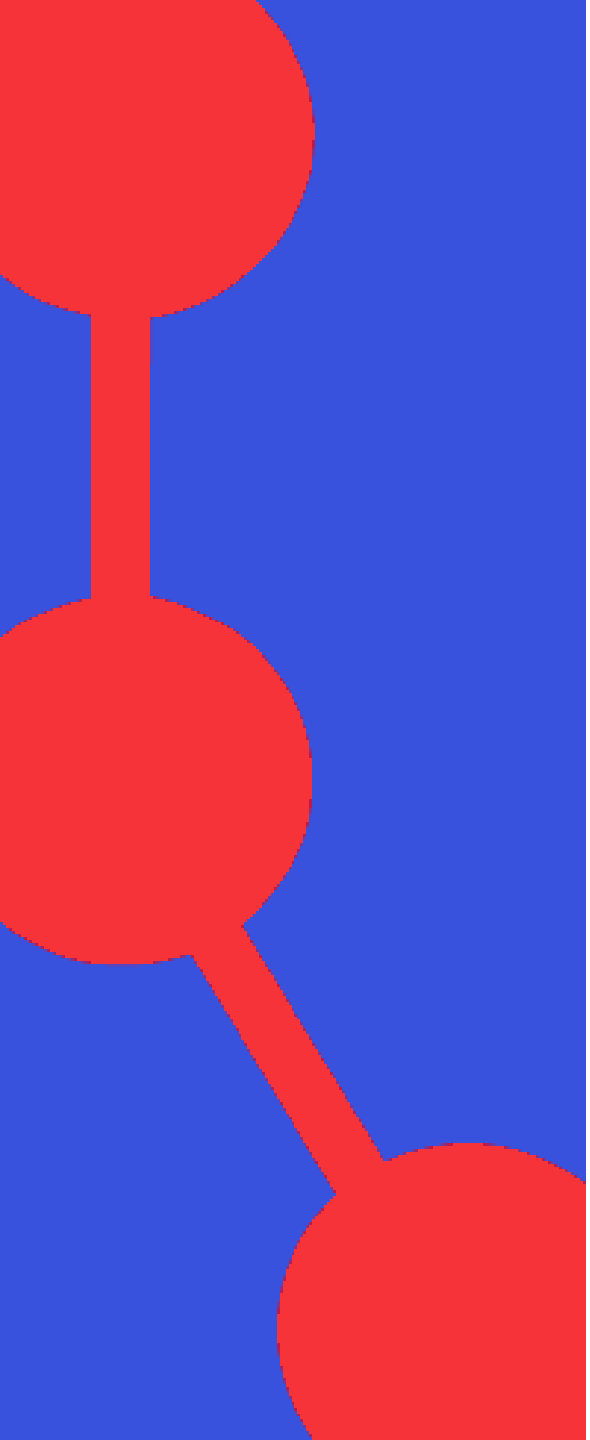

Guidelines

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Content: Anti Patterns

- AntiPatterns= Common errors made by ontology developer
- 3 sets of elementary antipatterns
  1. Logical Anti-Patterns (LAP): 9 antipatterns
     - Inconsistencies detected by the reasoner
  2. Non-Logical Anti-patterns (NLAP): 9 antipatterns
     - Cognitive or modeling problems not detected by the reasoner
  3. Guidelines (G): 4 Antipatterns
     - Complex expressions not detected by the reasoner, improve the readability of the formal axioms
- Combination of elementary unit antipattern
  - Association of antipatterns that may lead to inconsistencies
- Strategy to use the antipatterns

Logical Anti-Patterns (LAP)

- *AndIsOr (AIO)*
- *EquivalenceIsDifference (EID)*
- *OnlynessIsLoneliness (OIL)*
- *OnlynessIsLonelinessWithInheritance (OILWI)*
- *OnlynessIsLonelinessWithPropertyInheritance (OILWPI)*
- *UniversalExistence (UE)*
- *UniversalExistenceWithInheritance1 (UEWI_1)*
- *UniversalExistenceWithInheritance2 (UEWI_2)*
- *UniversalExistenceWithPropertyInheritance1 (UEWPI_1)*

Non-Logical Anti-patterns (NLAP)

- *SynonymeOfEquivalence (SOE)*
- *OnlynessIsLonelinessWithInverseProperty (OILWIP)*
- *UniversalExistenceWithPropertyInheritance2 (UEWPI_2)*
- *UniversalExistenceWithInverseProperty (UEWIP)*
- *SumOfSom (SOS)*
- *SumOfSomWithInheritage (SOSWI)*
- *SumOfSomWithPropertyInheritance (SOSWPI)*
- *SumOfSomWithInverseProperty (SOSWIP)*
- *SomeMeansAtLeastOne (SMALO)*

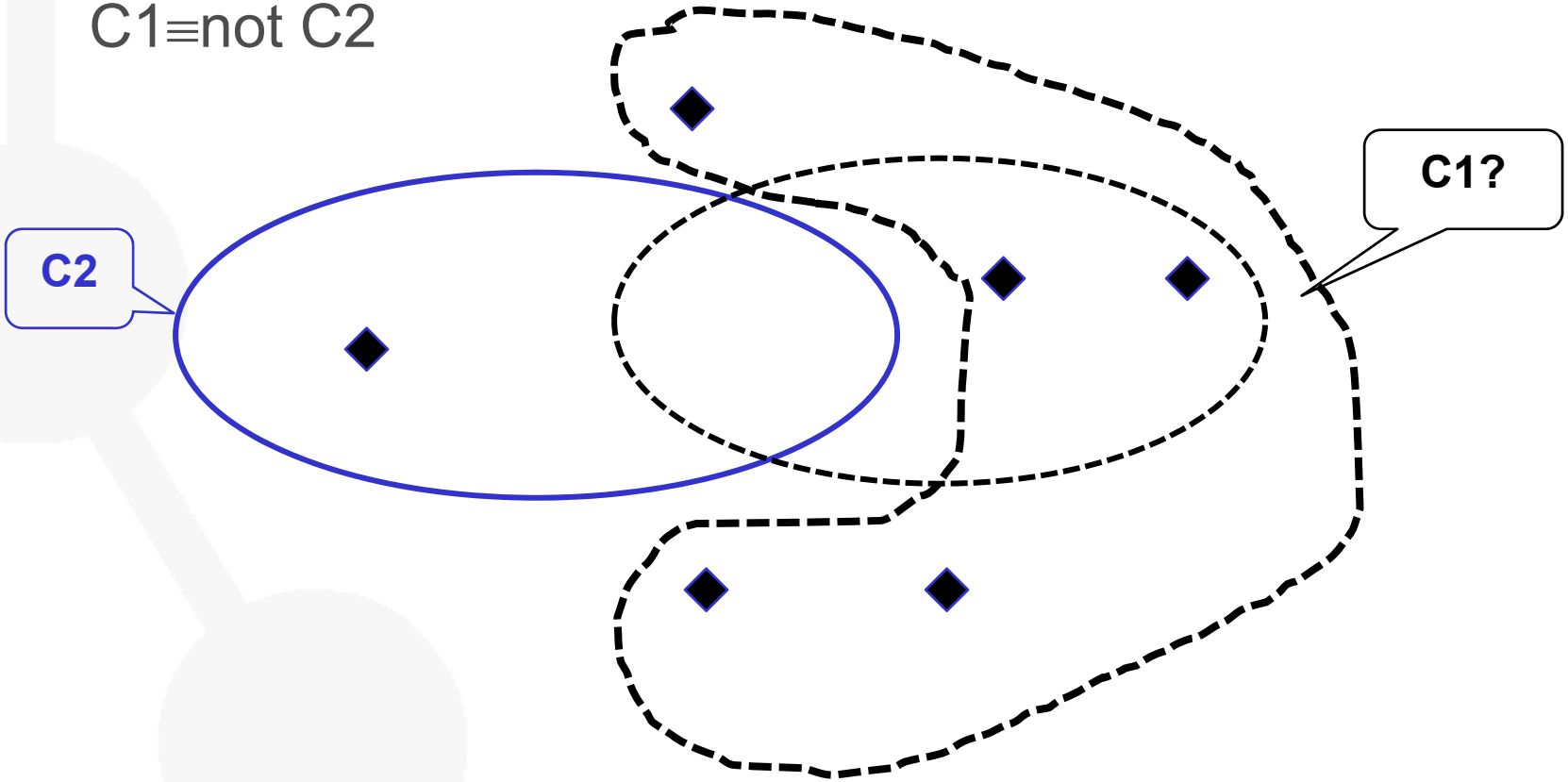
Guidelines (G)

- *DisjointnessOfComplement (DOC)*
- *Domain&CardinalityConstraints (DCC)*
- *GroupAxioms (GA)*
- *MinIsZero (MIZ)*

DisjointnessOfComplement

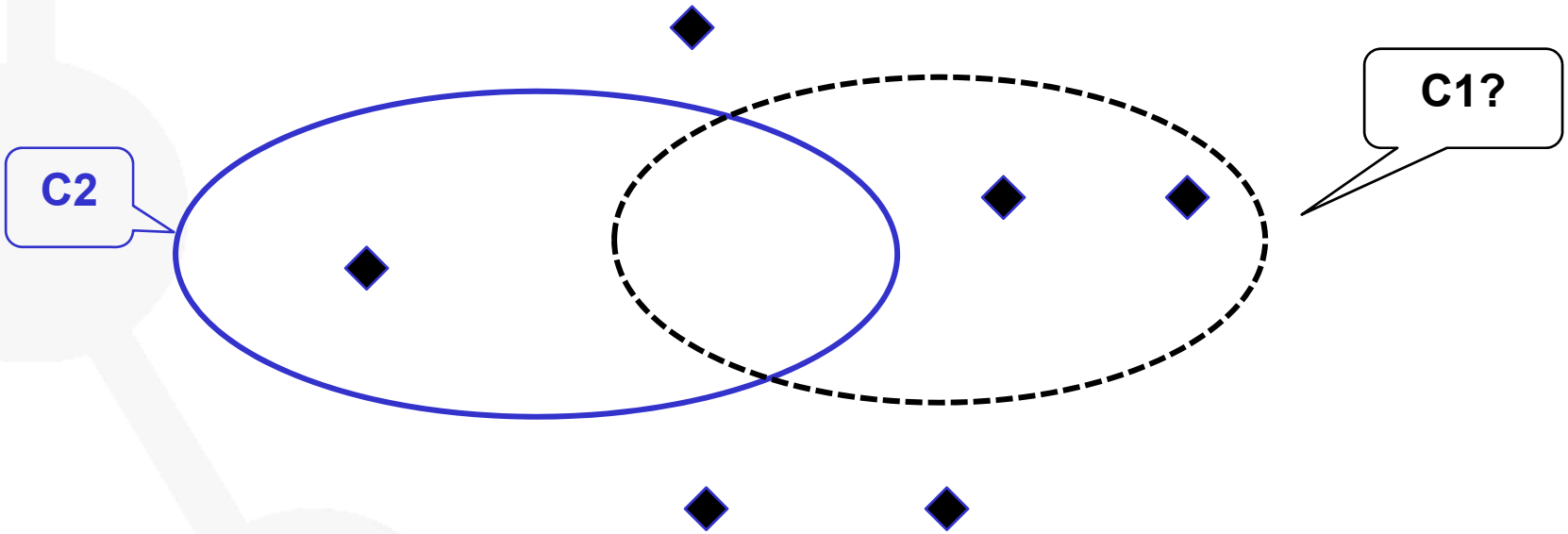
The ontology developer wants to say that C1 and C2 can not share instances

C1≡not C2



Main Recommendation

Disj(C1,C2)

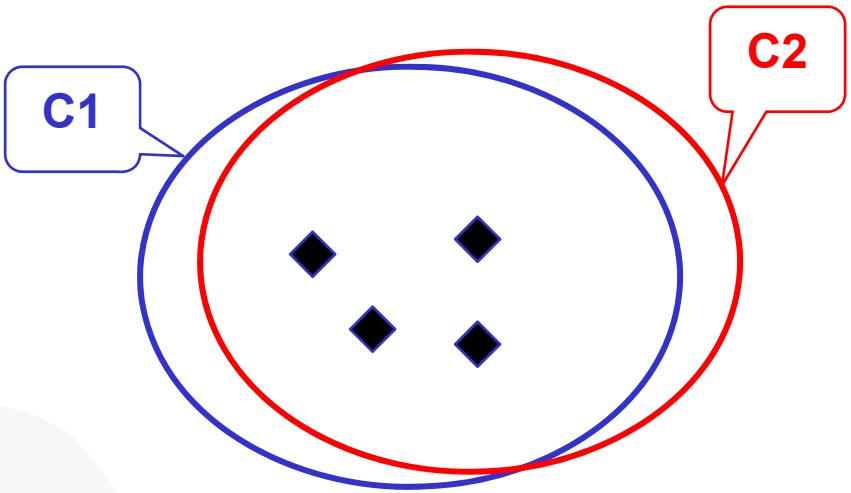


SynonymeOfEquivalence

Represent a terminological synonymy relation

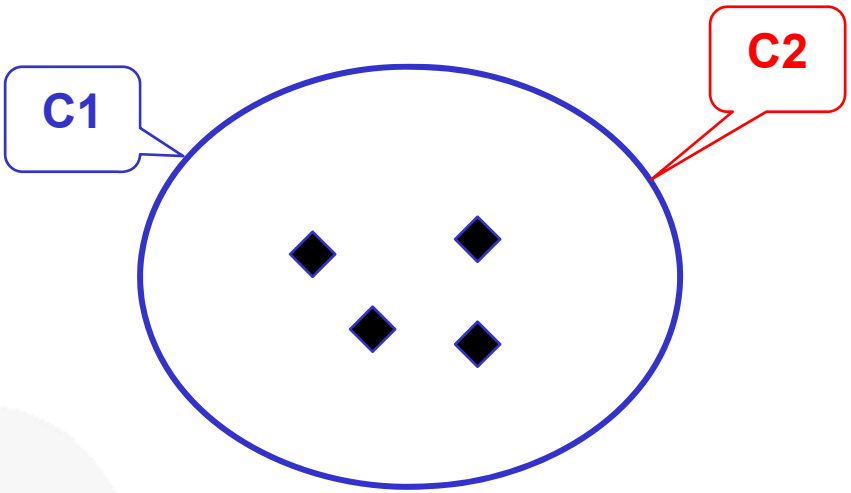
Not useful in a single ontology

C1≡C2



Main Recommendation

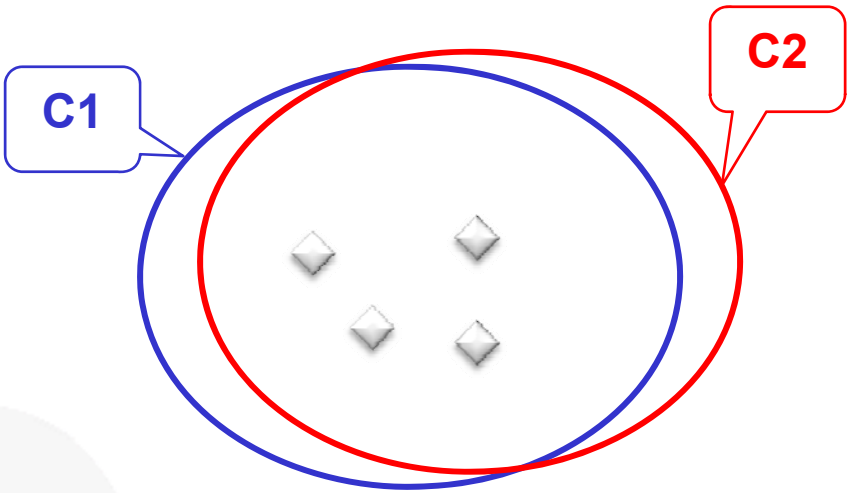
C2 is a label of C1



EquivalenceIsDifference

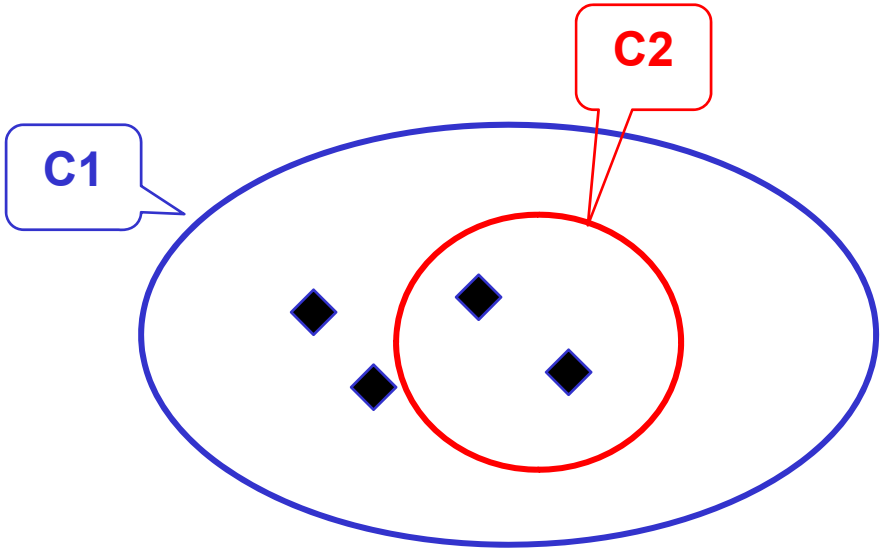
Concepts share some common properties but have also differences

C1≡C2, Disj(C1,C2)



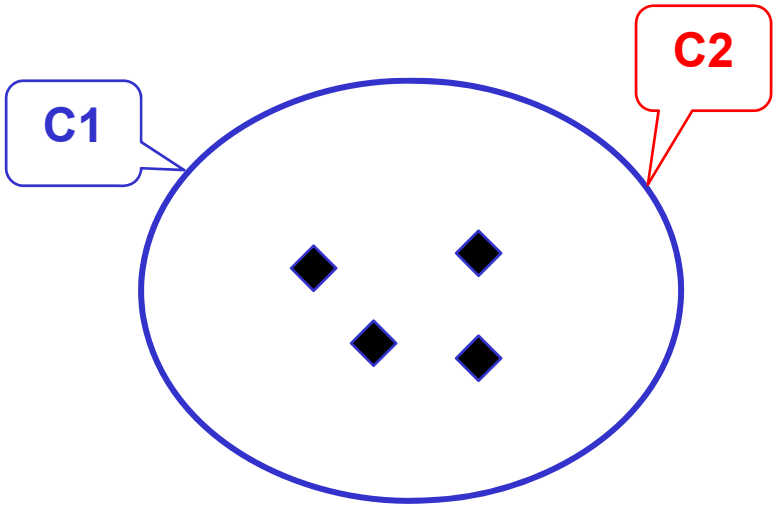
Main recommendation

- **C1⊆C2**



Other recommendation

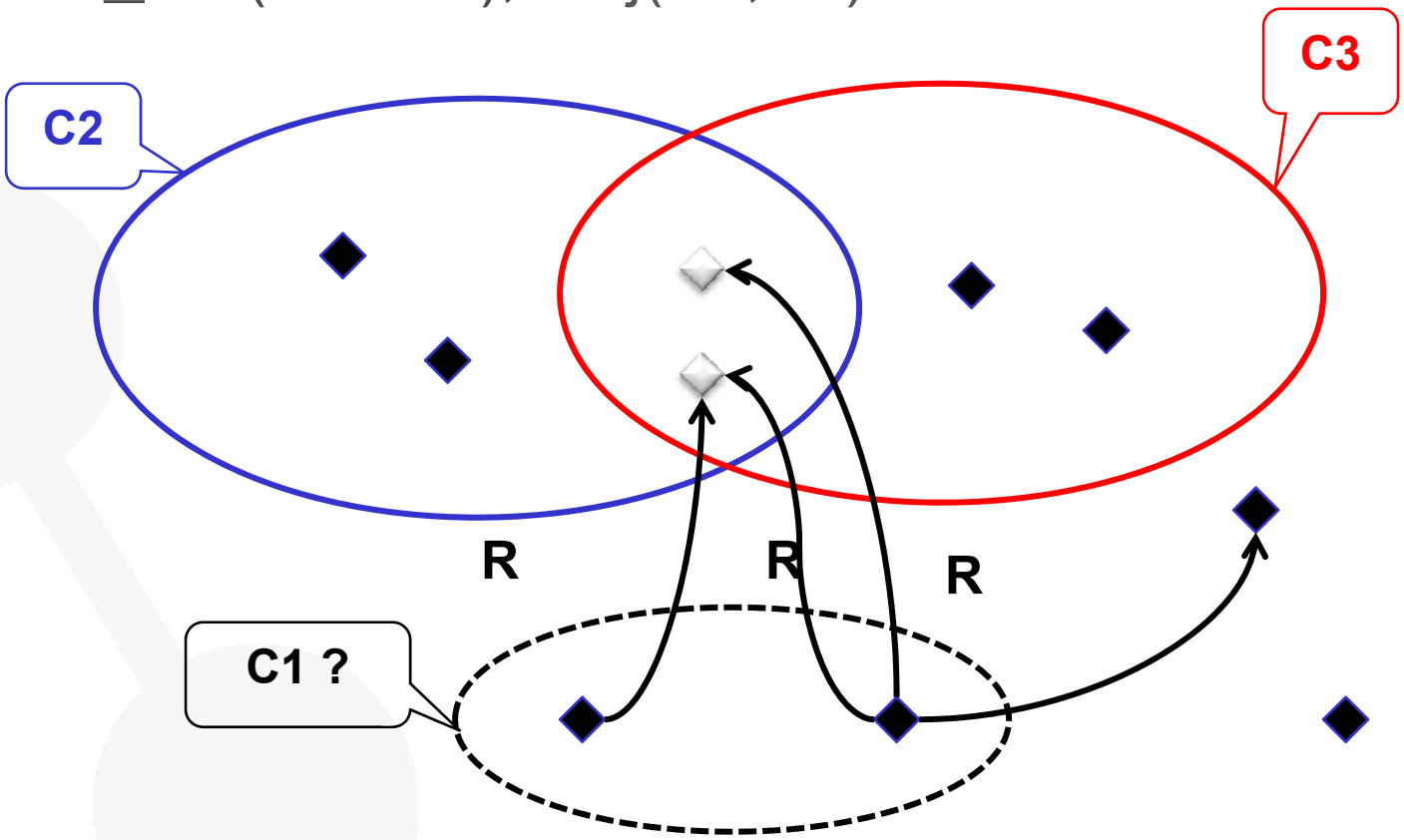
- **C2 is label of C1**



AndIsOr

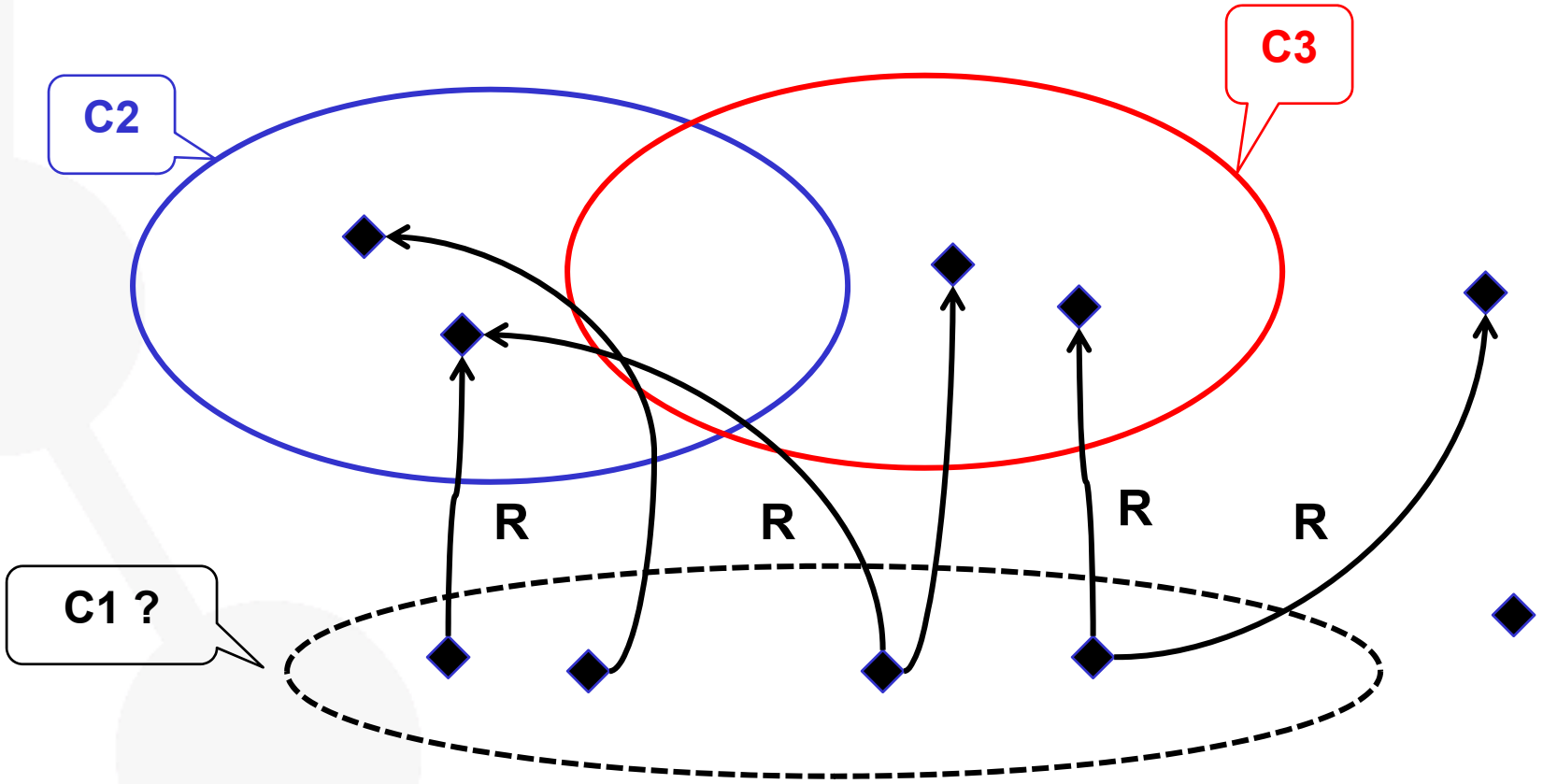
misunderstanding of logical “and” and “or”

$C1 \subseteq \exists R.(C2 \cap C3)$, $Disj(C2,C3)$



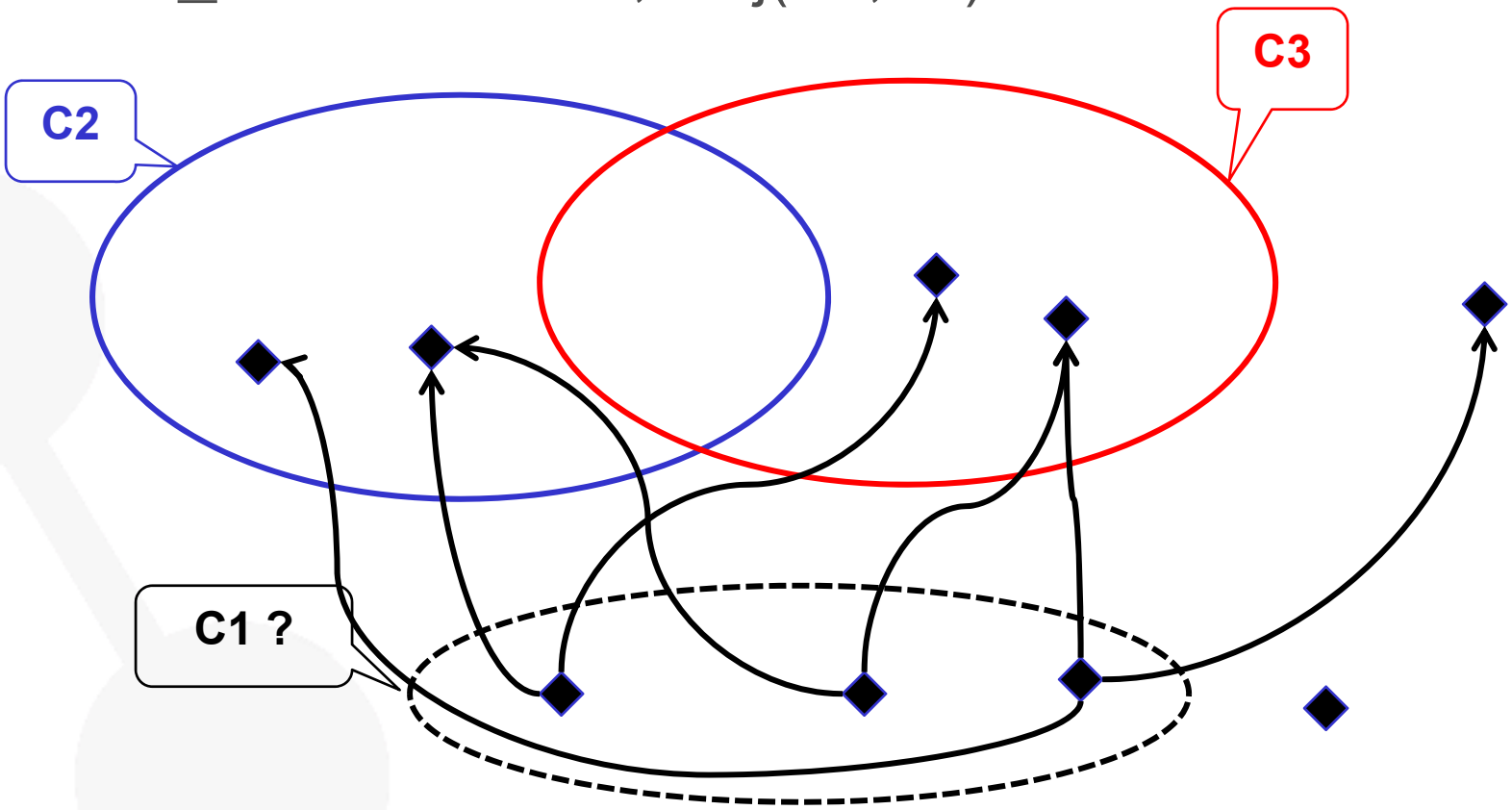
The main recommendation

$C1 \subseteq \exists R.(\mathbf{C2} \cup \mathbf{C3})$, Disj(C2,C3)



Recommendations

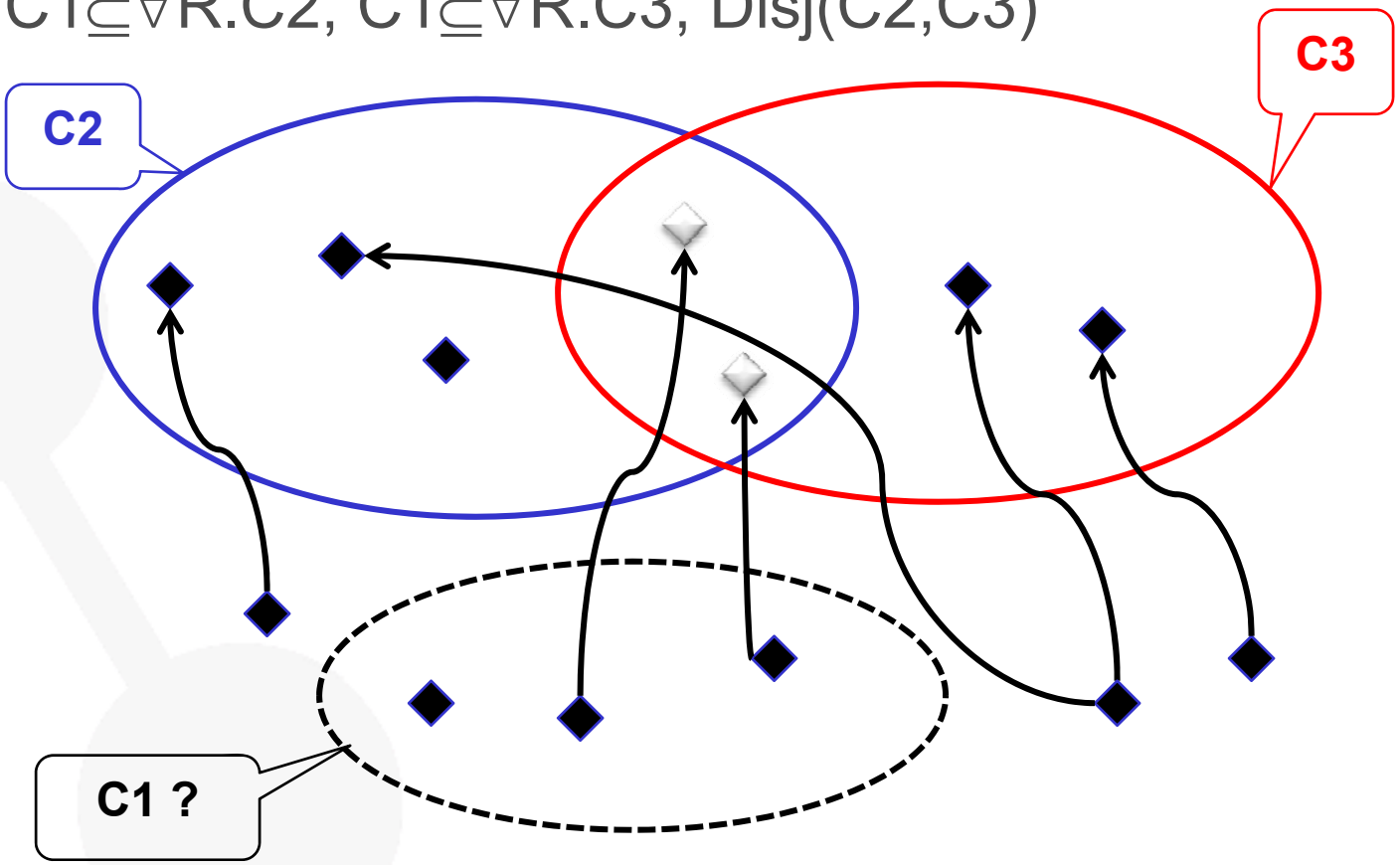
- C1⊆∃R.(**C2**∪**C3**) , Disj(C2,C3)
- C1⊆ ∃**R.C2**∩∃**R.C3**, Disj(C2,C3)



OnlynessIsLoneliness

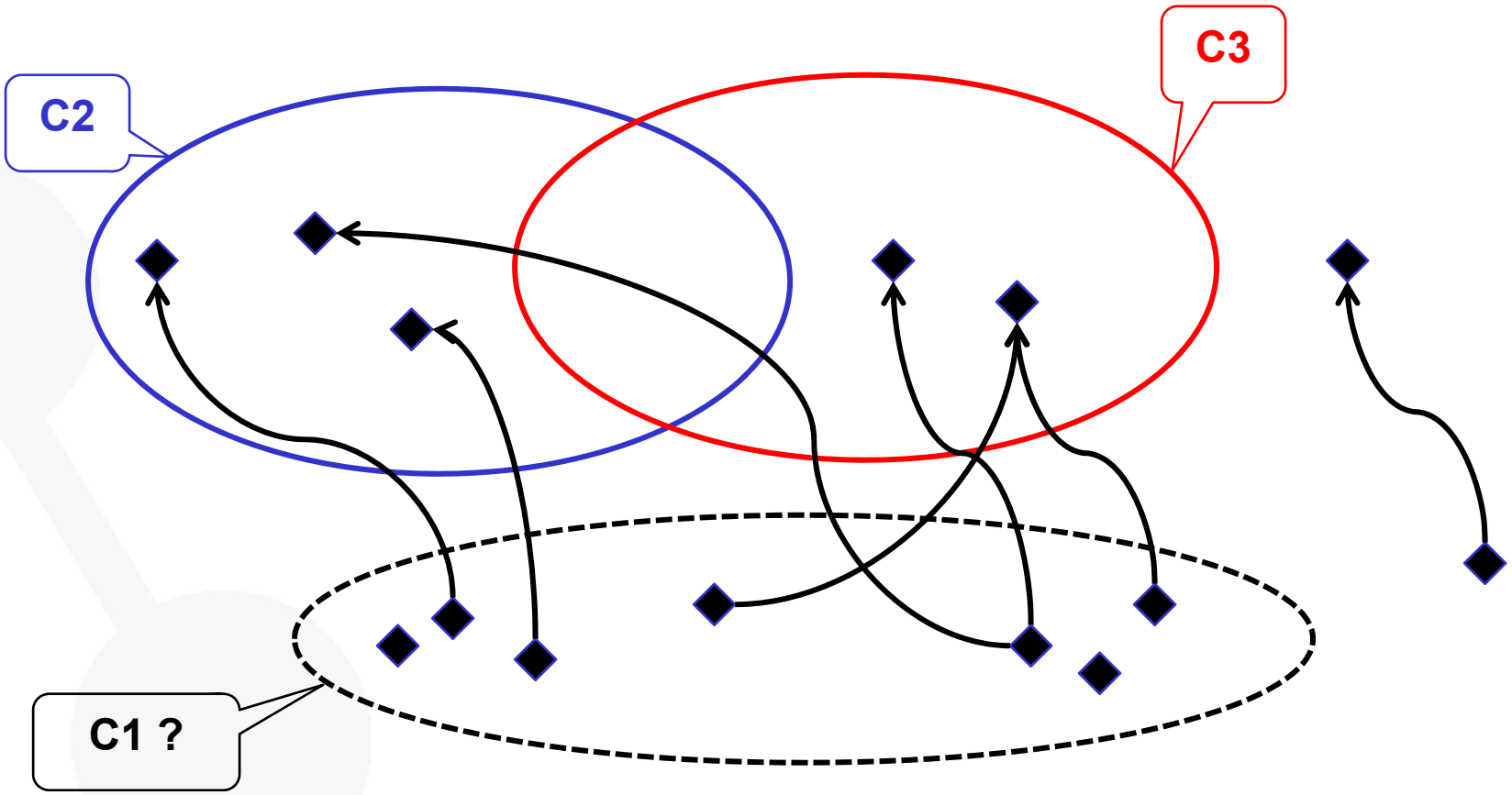
Forget one of the axiom during the development of the ontology.

$C1 \subseteq \forall R.C2$, $C1 \subseteq \forall R.C3$, $Disj(C2,C3)$



Main recommendation

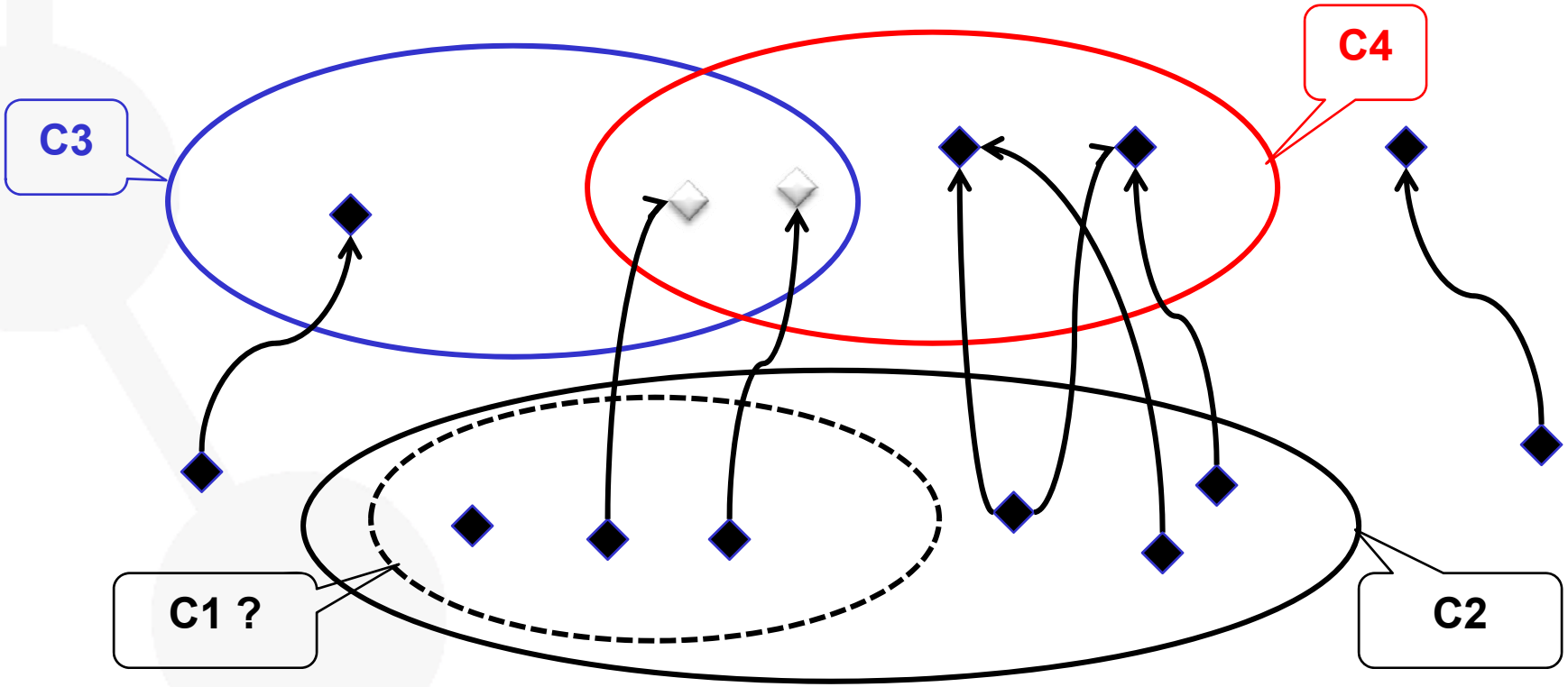
$C1 \subseteq \forall R.(\mathbf{C2} \cup \mathbf{C3})$, Disj(C2,C3)



OnlynessIsLonelinessWithInheritance

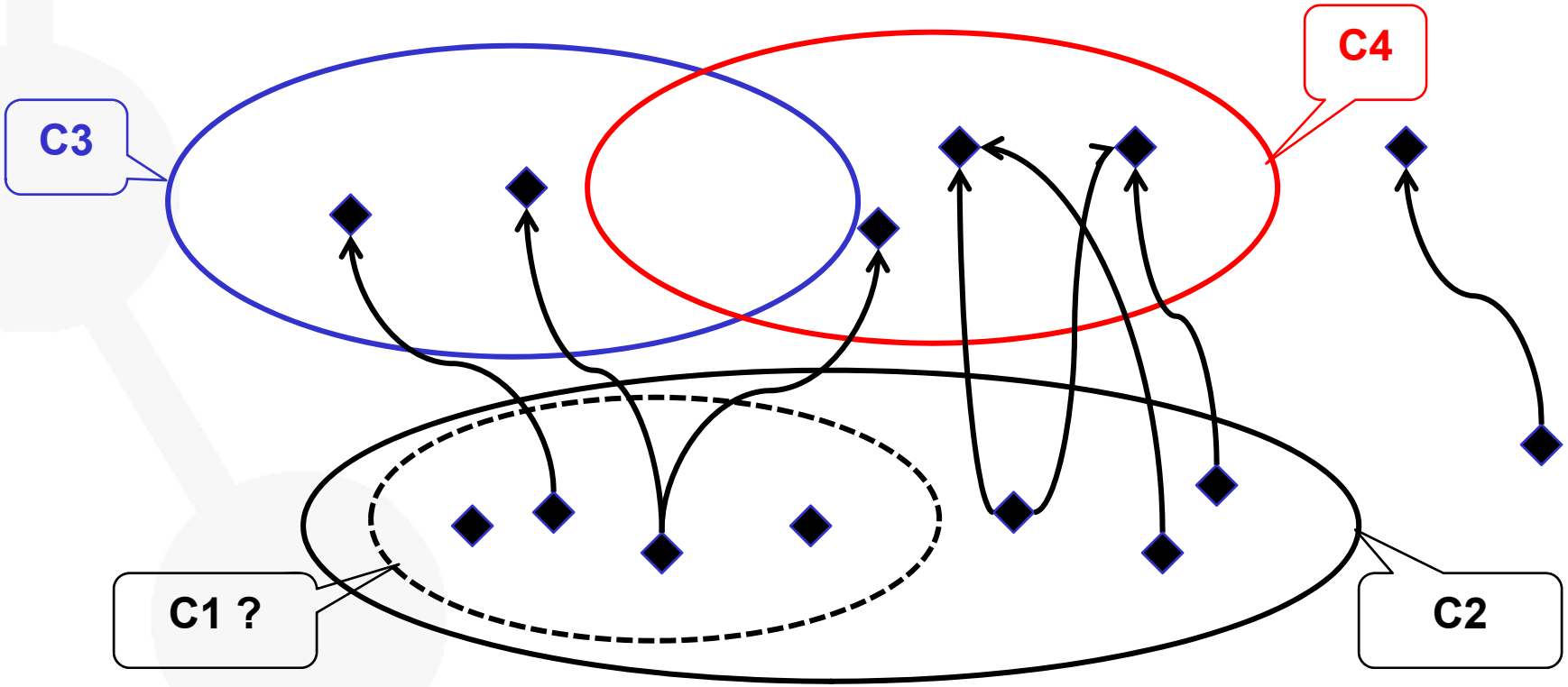
Forget one of the axiom during the development of the ontology.

C1⊆ C2, C1⊆∀R.C3, C2⊆∀R.C4, Disj(C3,C4)



Main recommendation

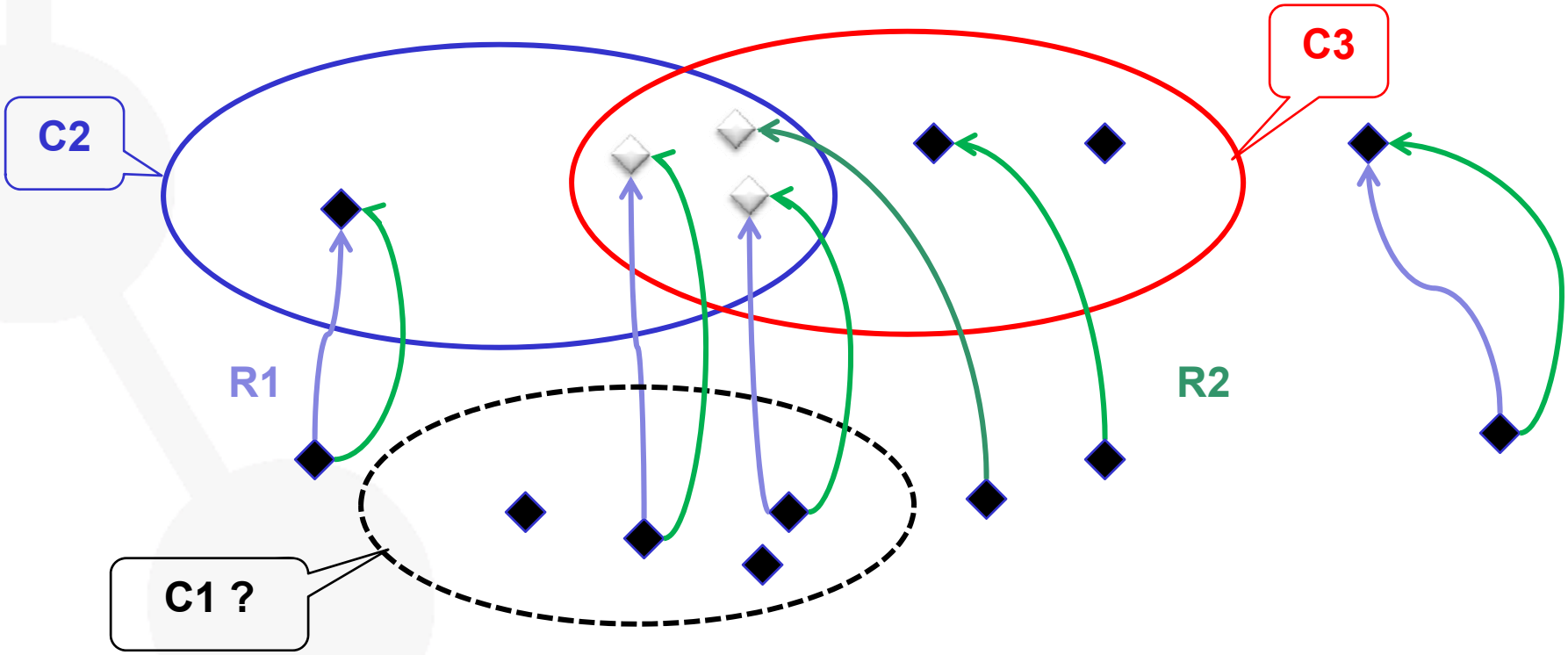
C1⊆ C2, C1⊆∀R.C3, **C2⊆∀R.(C3∪C4),** Disj(C3,C4)



OnlynessIsLonelinessWithPropertyInheritance

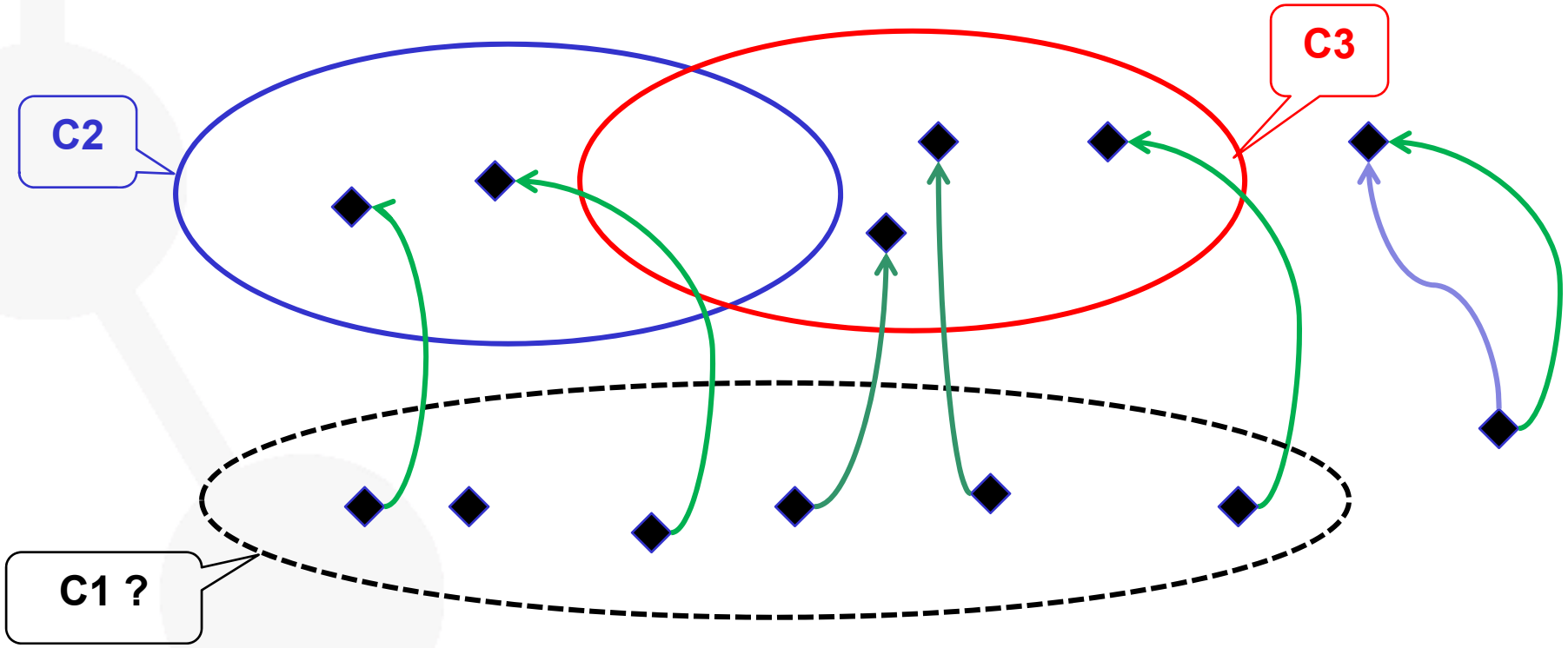
Misunderstanding of subproperty relation

$R1 \subseteq R2$, $C1 \subseteq \forall R1.C2$, $C1 \subseteq \forall R2.C3$, $Disj(C2,C3)$



Main recommendation

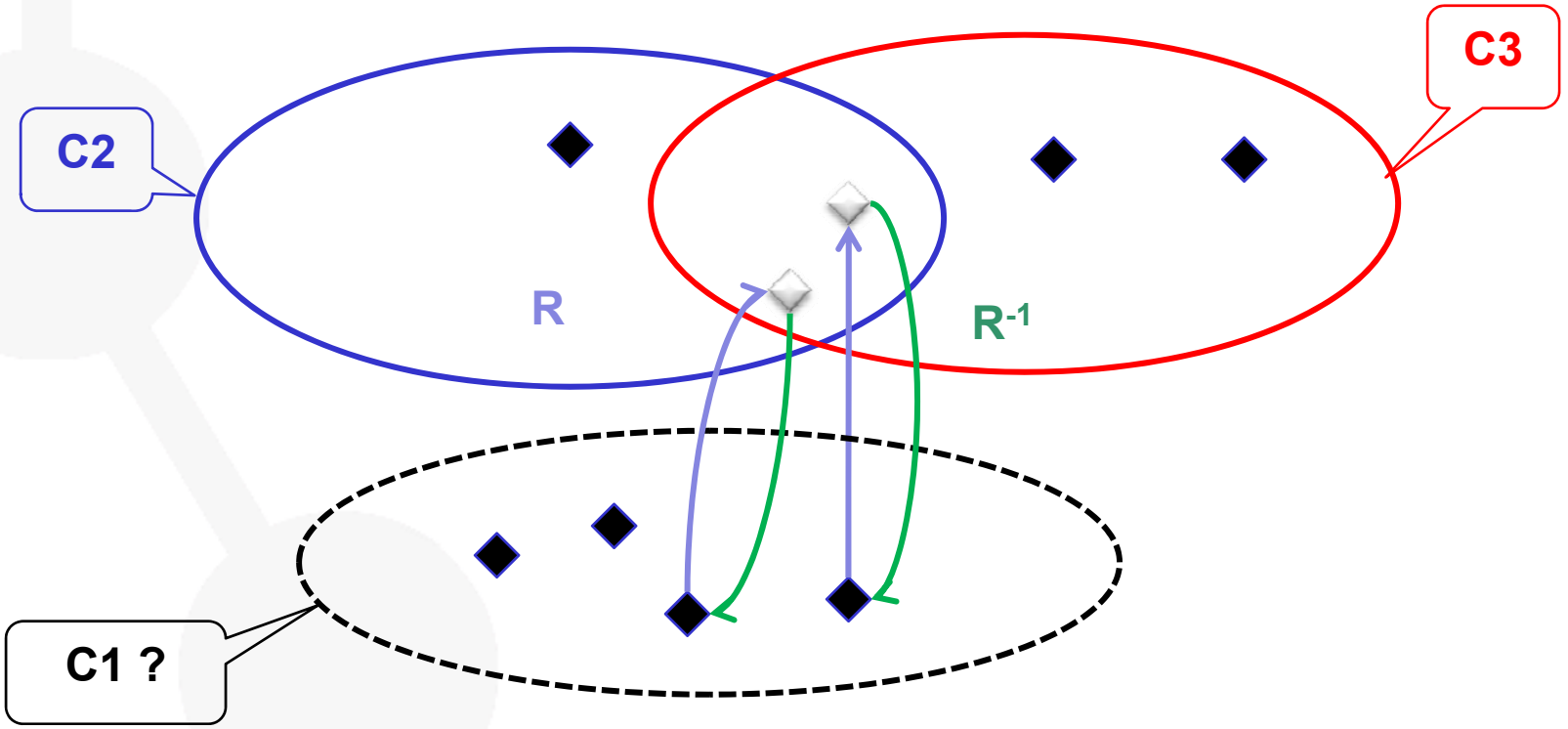
R1⊆R2, C1⊆∀**R2.(C2∪C3),** Disj(C2,C3)



OnlynessIsLonelinessWithInverseProperty

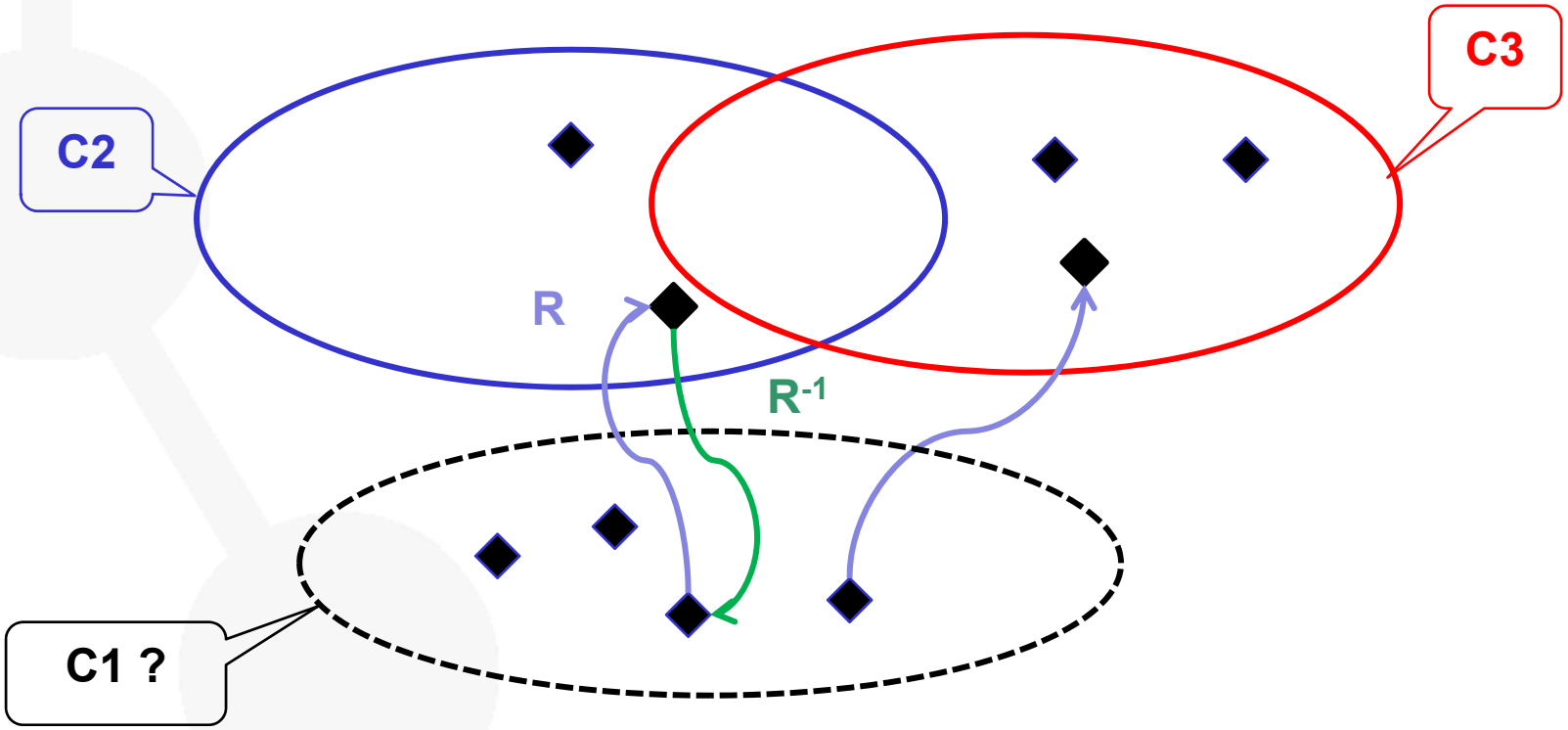
Forget one of the axiom during the development of the ontology.

$C2 \subseteq \forall R^{-1}.C1$, $C1 \subseteq \forall R.C3$, $Disj(C2,C3)$



Main Recommendation

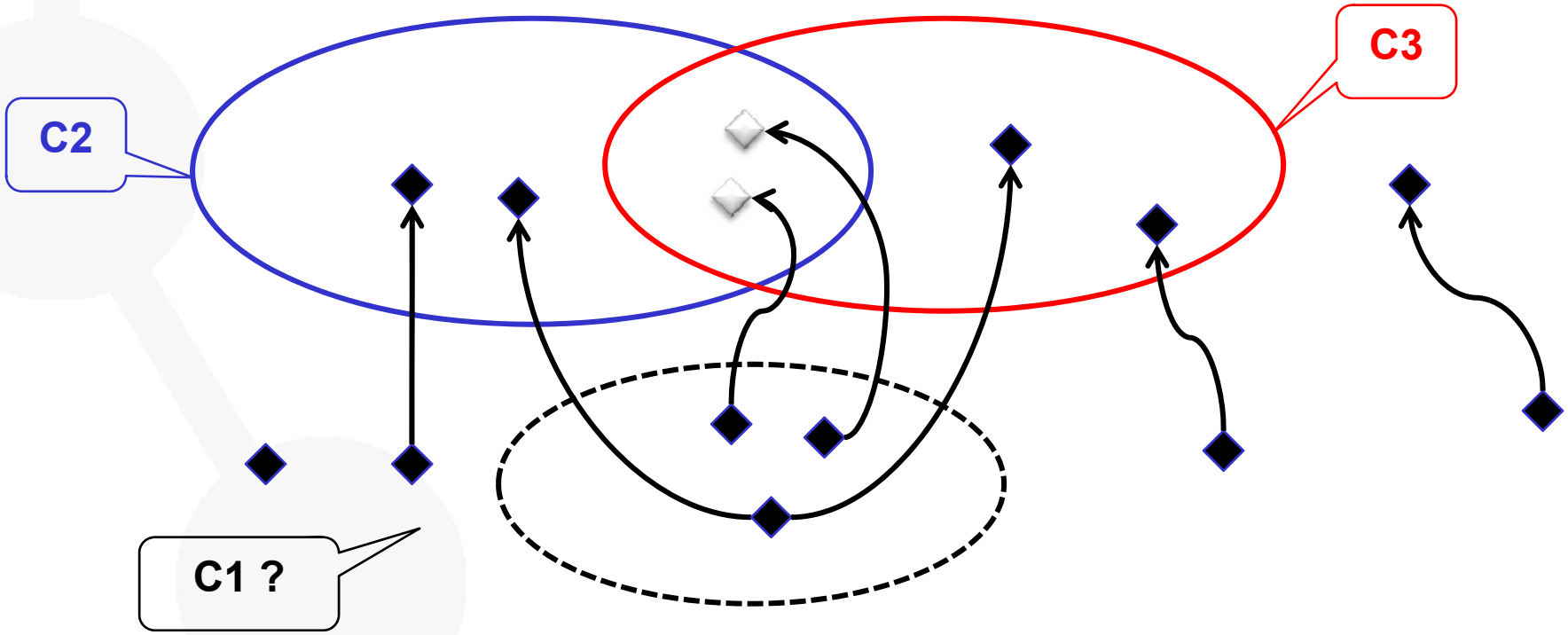
$C2 \subseteq \forall R^{-1}.C1$, $C1 \subseteq \forall R.(\mathbf{C2} \cup \mathbf{C3})$, $Disj(C2,C3)$



SumOfSom

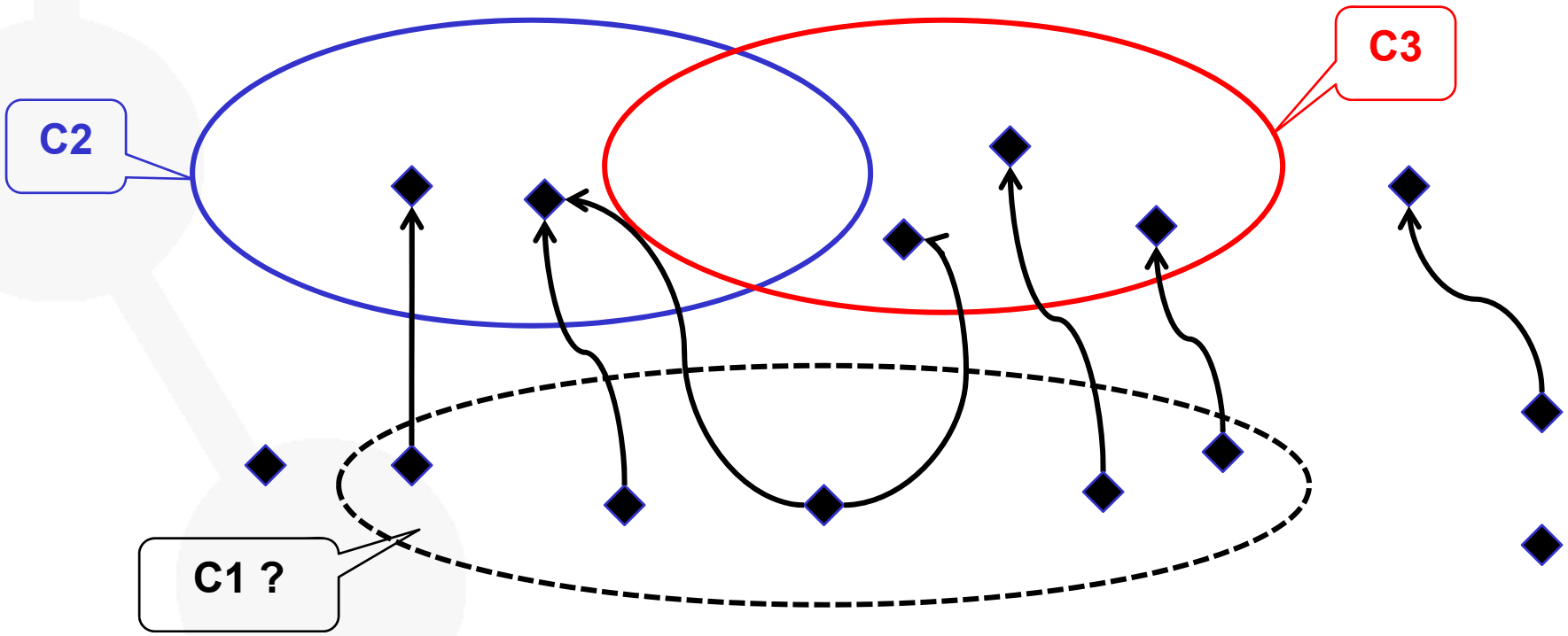
Forget one of the axiom during the development of the ontology.

$C1 \subseteq \exists R.C2$, $C1 \subseteq \exists R.C3$, $Disj(C2,C3)$



Main Recommendation

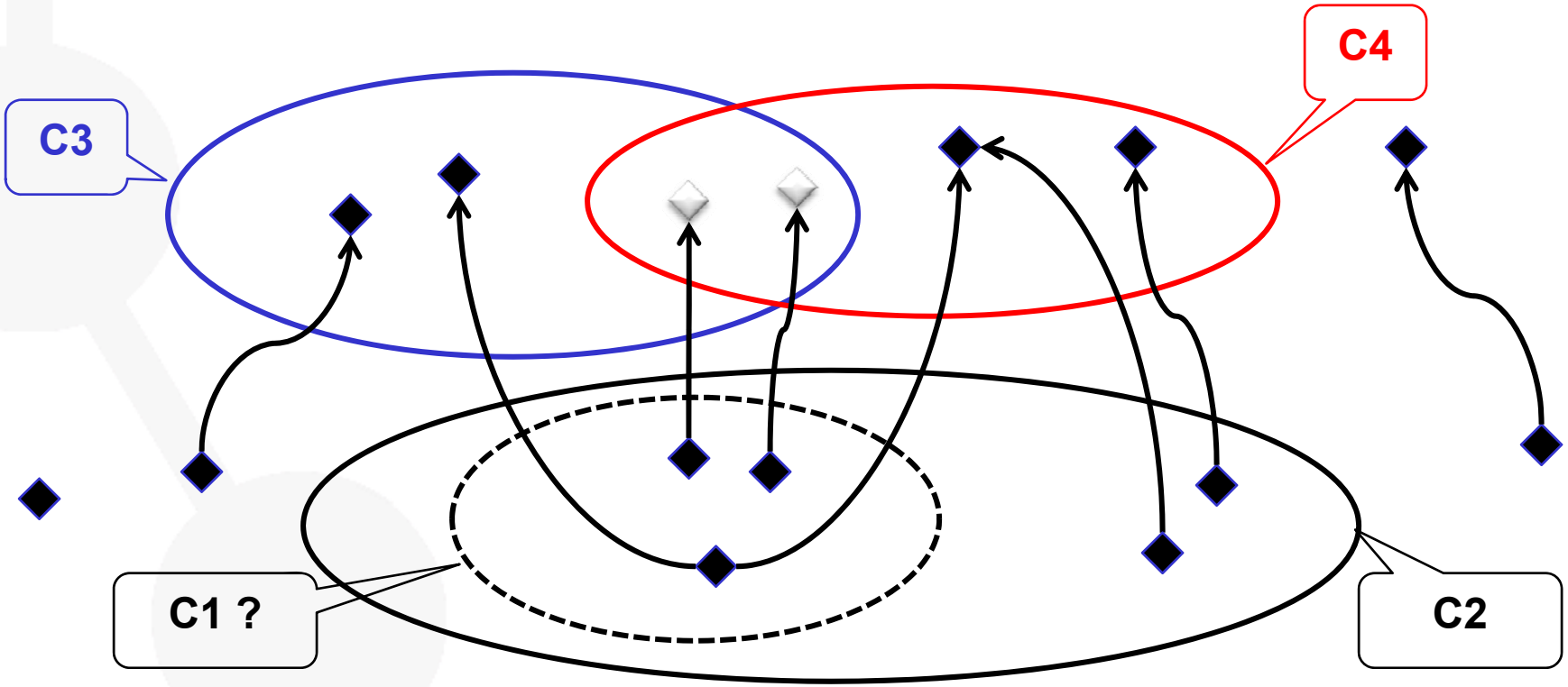
C1⊆∃R.(C2∪C3), Disj(C2,C3)?



SumOfSomWithInheritage

Forget one of the axiom during the development of the ontology.

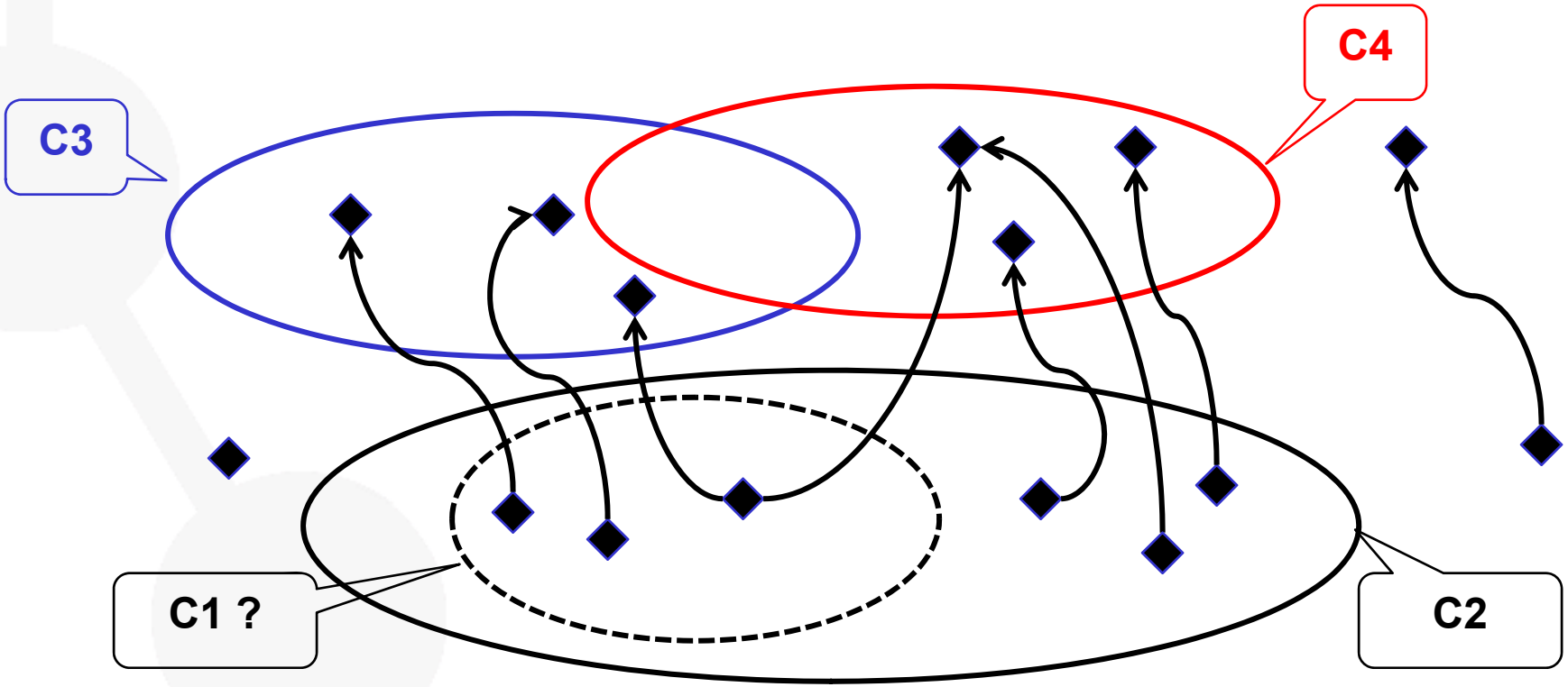
C1⊆ C2, C1⊆∃ R.C3, C2⊆∃R.C4, Disj(C3,C4)



Main Recommendations

Forget one of the axiom during the development of the ontology.

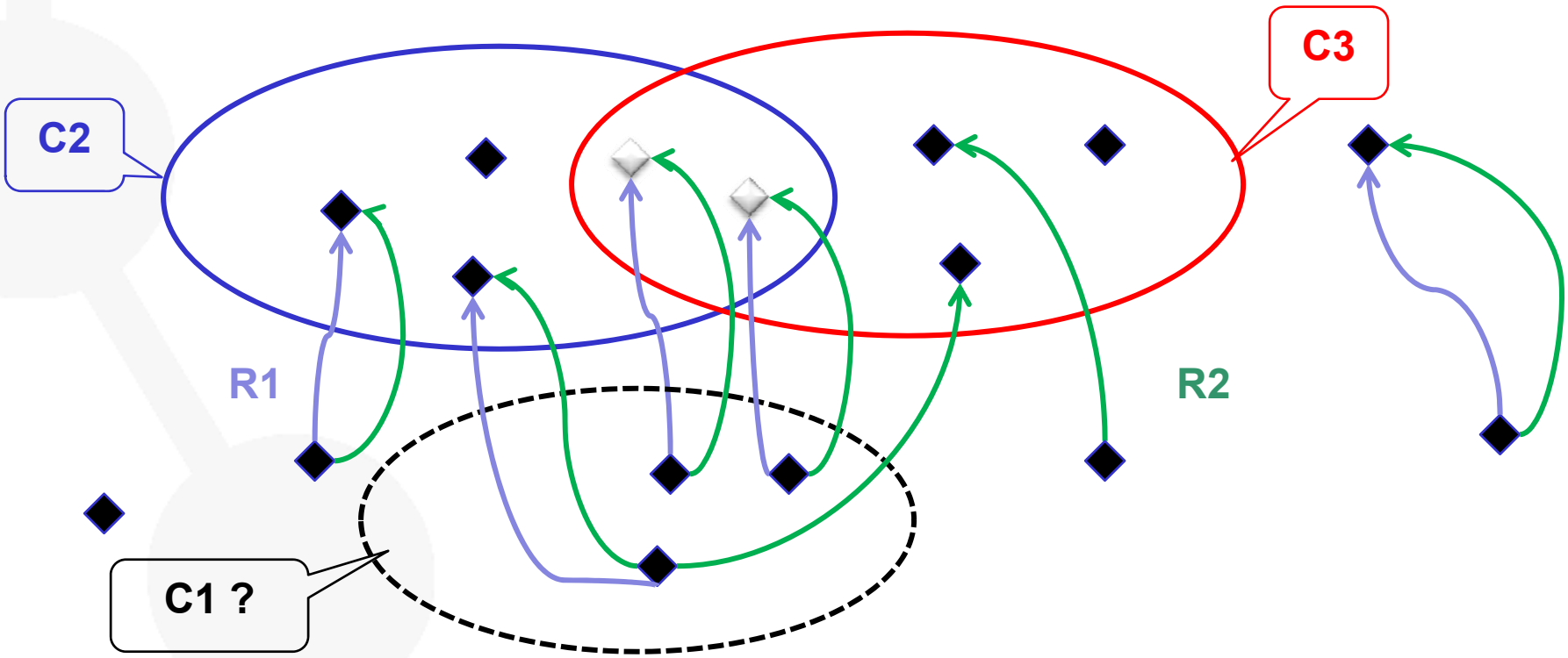
C1⊑ C2, C1⊑∃ R.C3, **C2⊑∃R.(C3∪C4)**, Disj(C3,C4)



SumOfSomWithPropertyInheritance

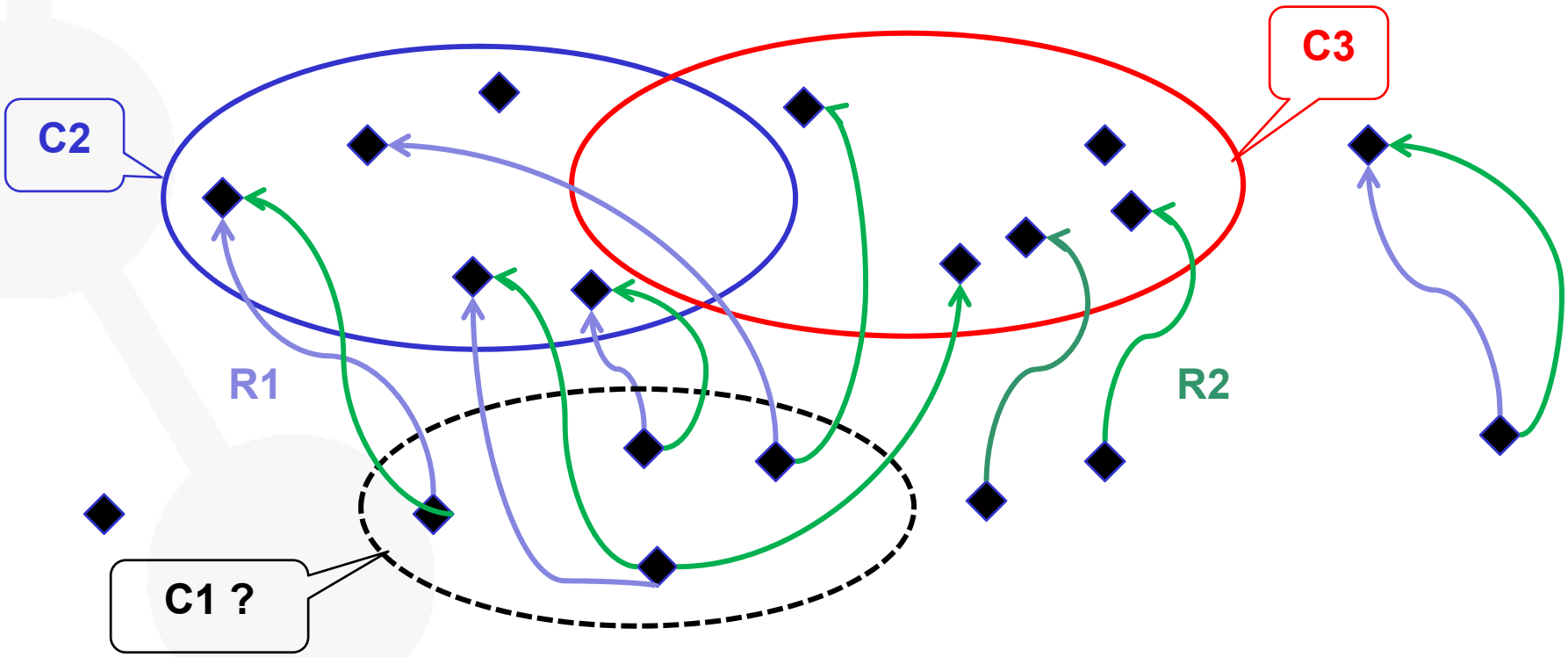
Misunderstanding of subproperty relation

$R1 \subseteq R2$, $C1 \subseteq \exists R1.C2$, $C1 \subseteq \exists R2.C3$, $Disj(C2,C3)$



Main Recommendation

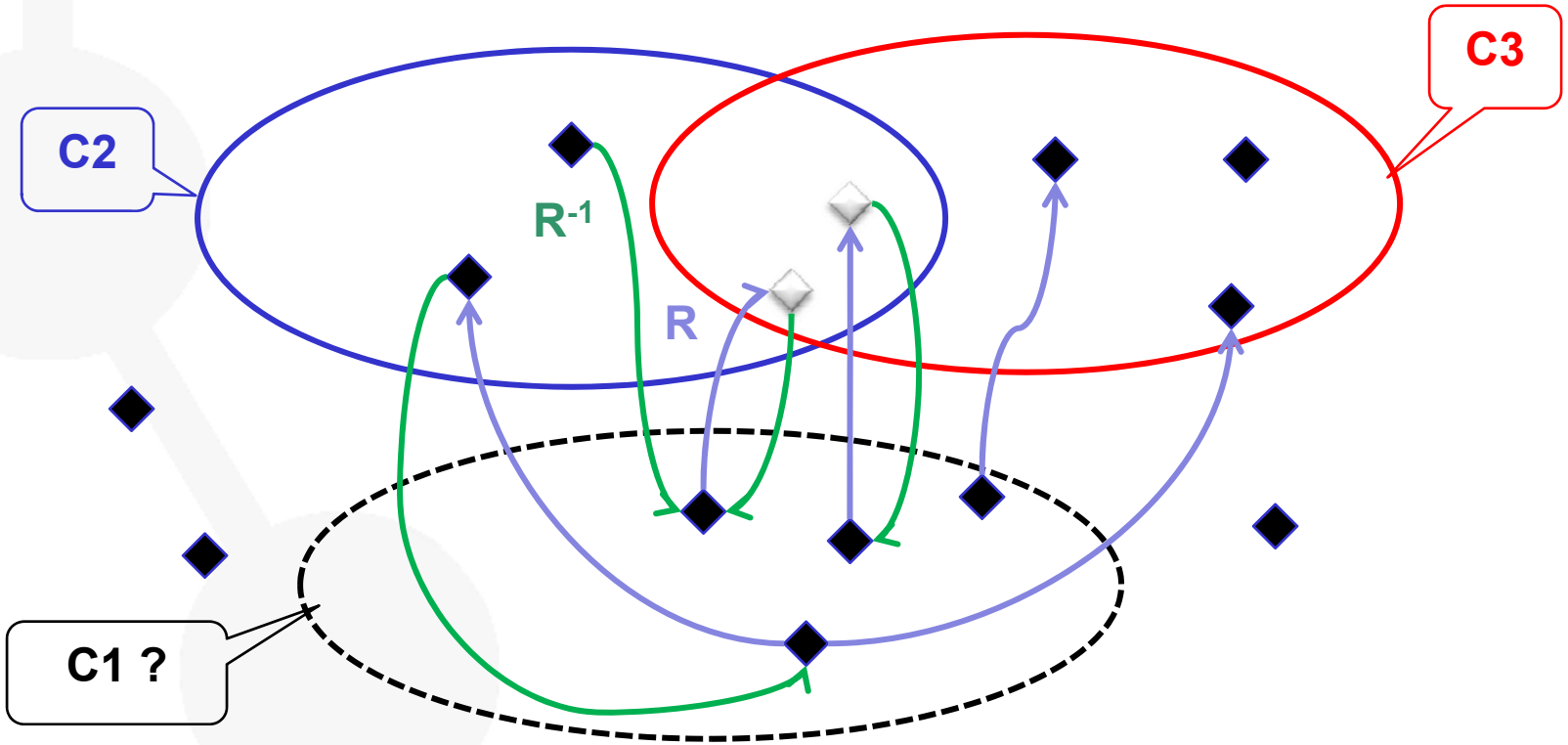
R1⊆R2, C1⊆∃R1.(C2), C1⊆∃R2.**(C2∪C3)**, Disj(C2,C3)



SumOfSomWithInverseProperty

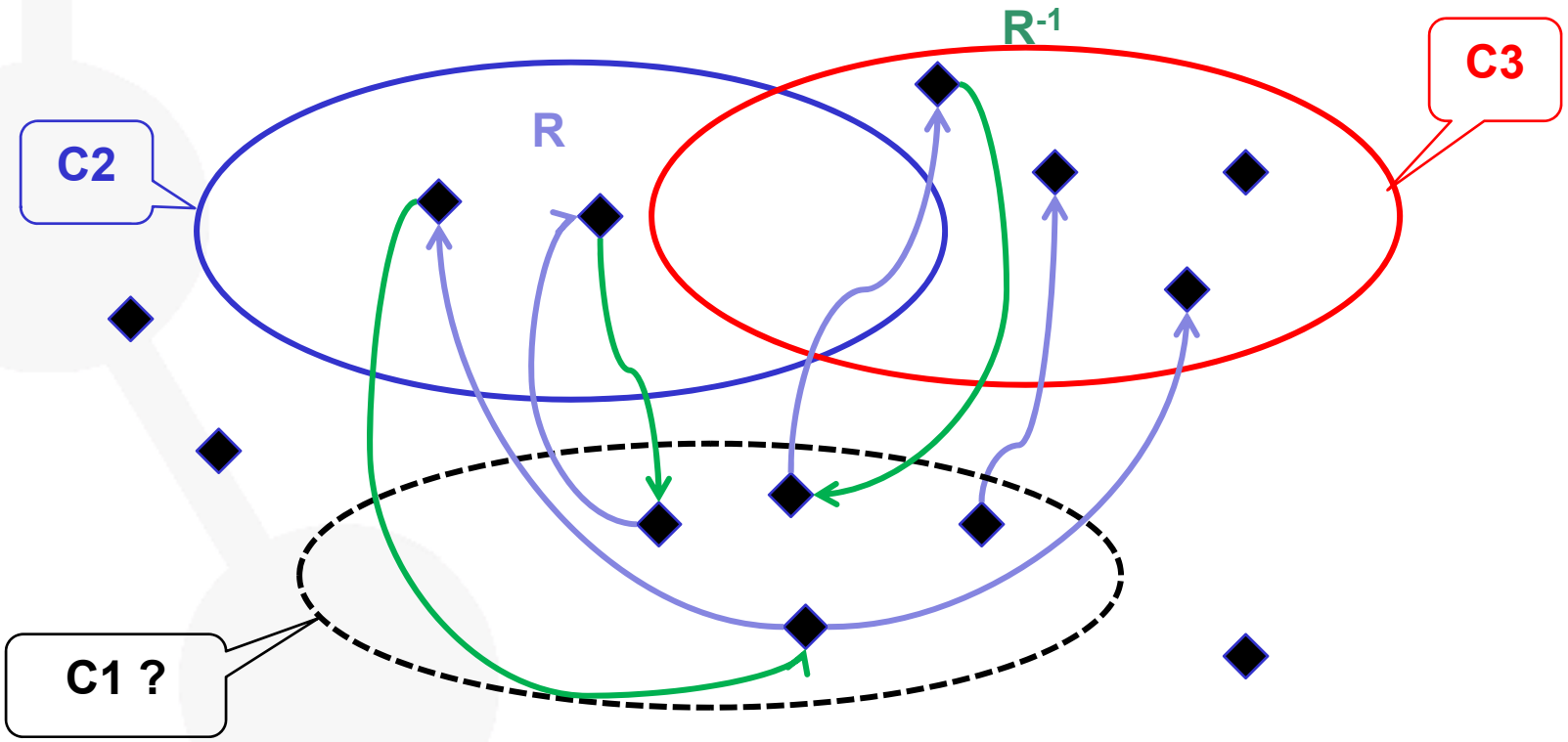
Forget one of the axiom during the development of the ontology.

$C2 \subseteq \exists R^{-1}.C1$, $C1 \subseteq \exists R.C3$, $Disj(C2,C3)$



Main Recommendations

$C2 \subseteq \exists R^{-1}.C1$, $\mathbf{C1 \subseteq \exists R.(C2 \cup C3)}$, Disj(C2,C3)

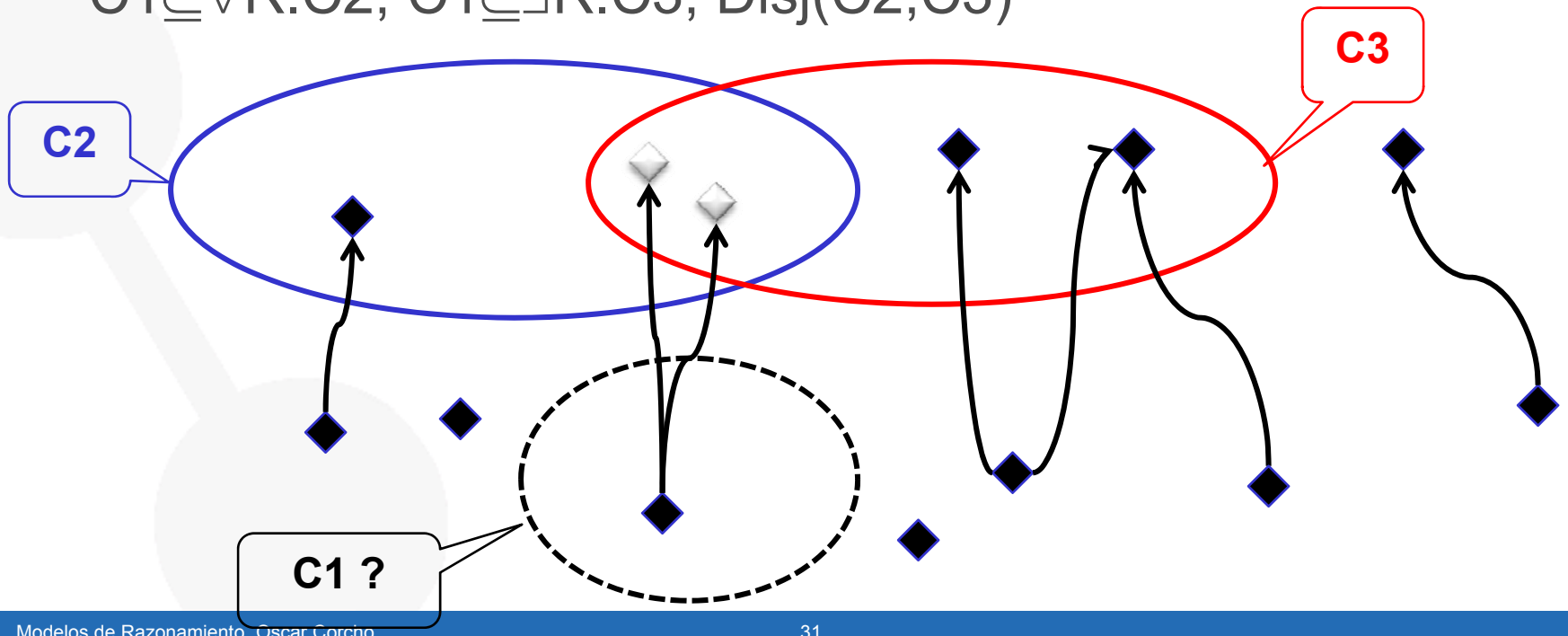


UniversalExistence

Forget one of the axiom during the development of the ontology.

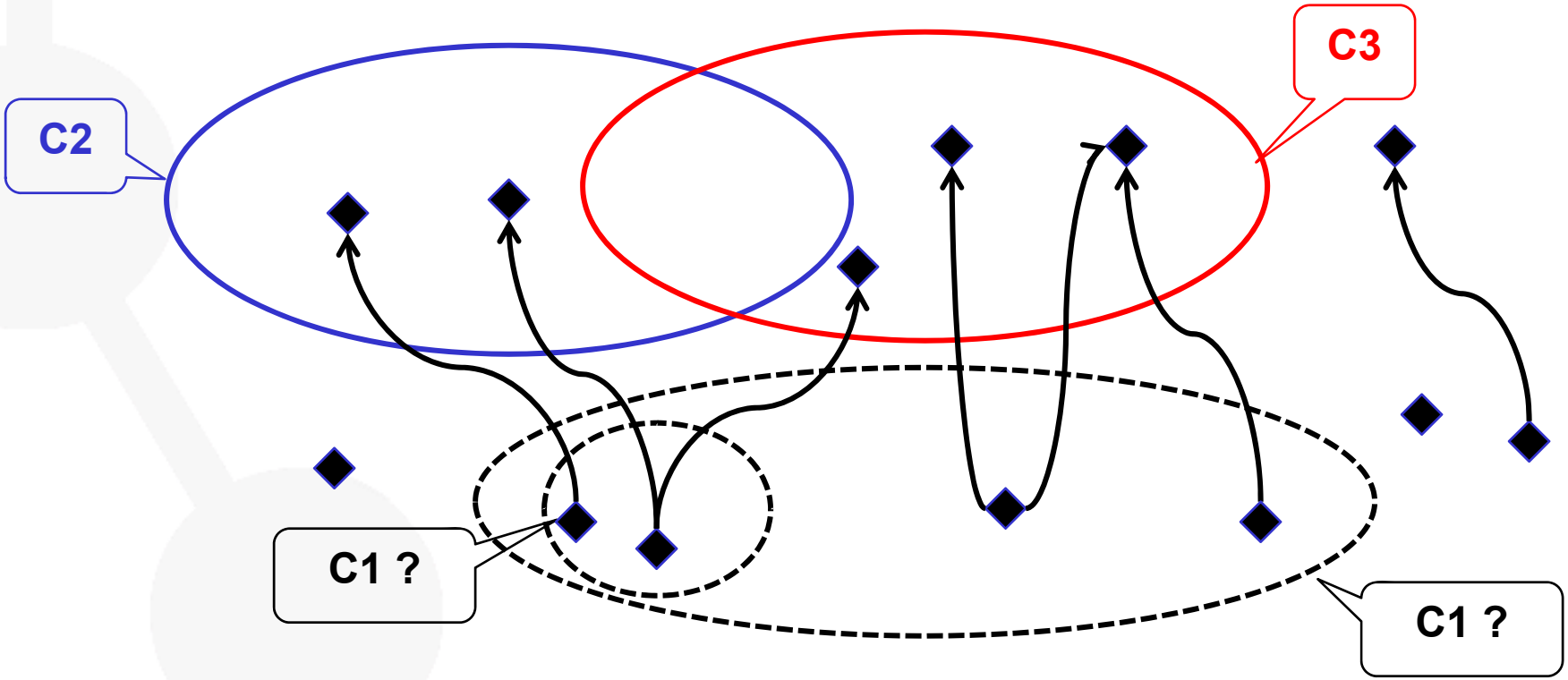
Misunderstanding of the universal and existential restrictions

$C1 \subseteq \forall R.C2$, $C1 \subseteq \exists R.C3$, $Disj(C2,C3)$



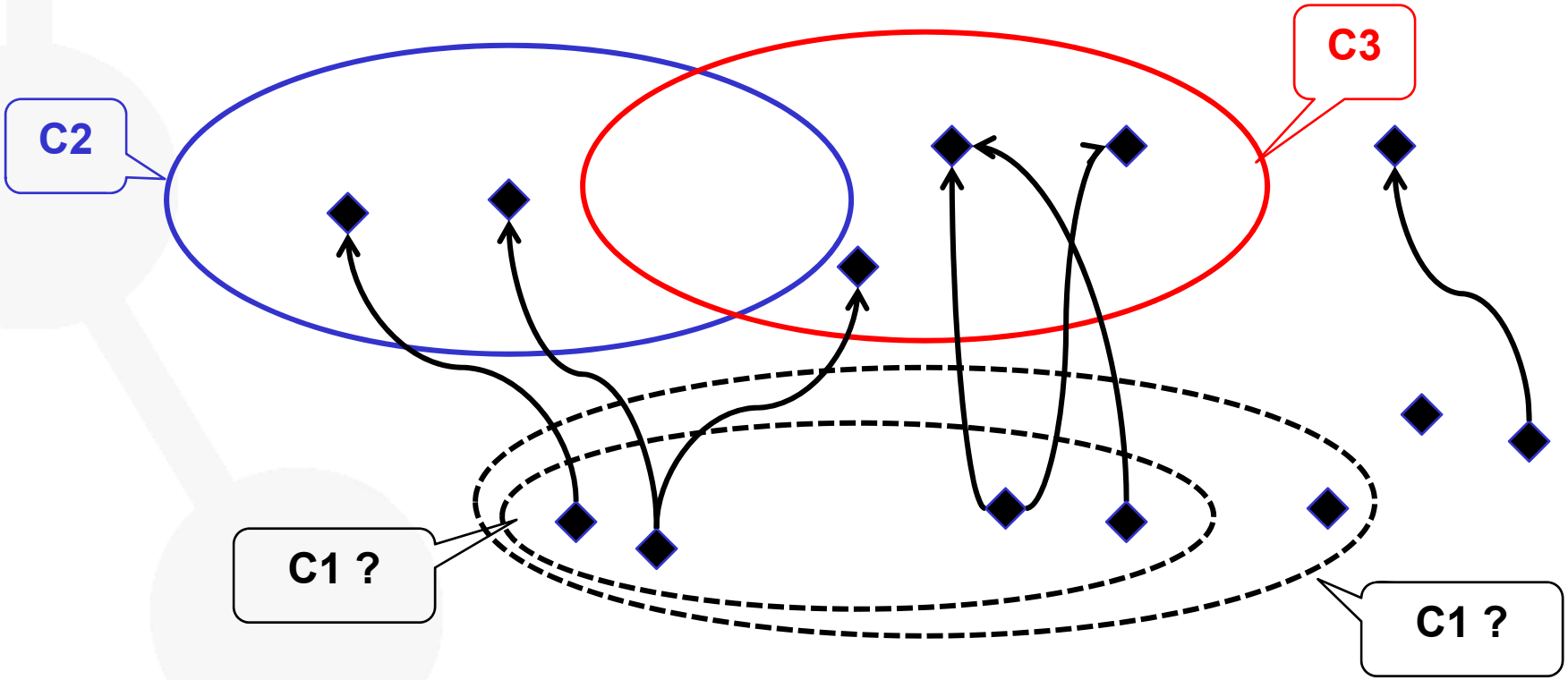
Main recommendations

- **C1⊆∀R.(C2∪C3)∩∃R.C2,** Disj(C2,C3)
- **C1⊆∀R.(C2∪C3)∩∃R.(C2∪C3)** , Disj(C2,C3)



Others recommendations

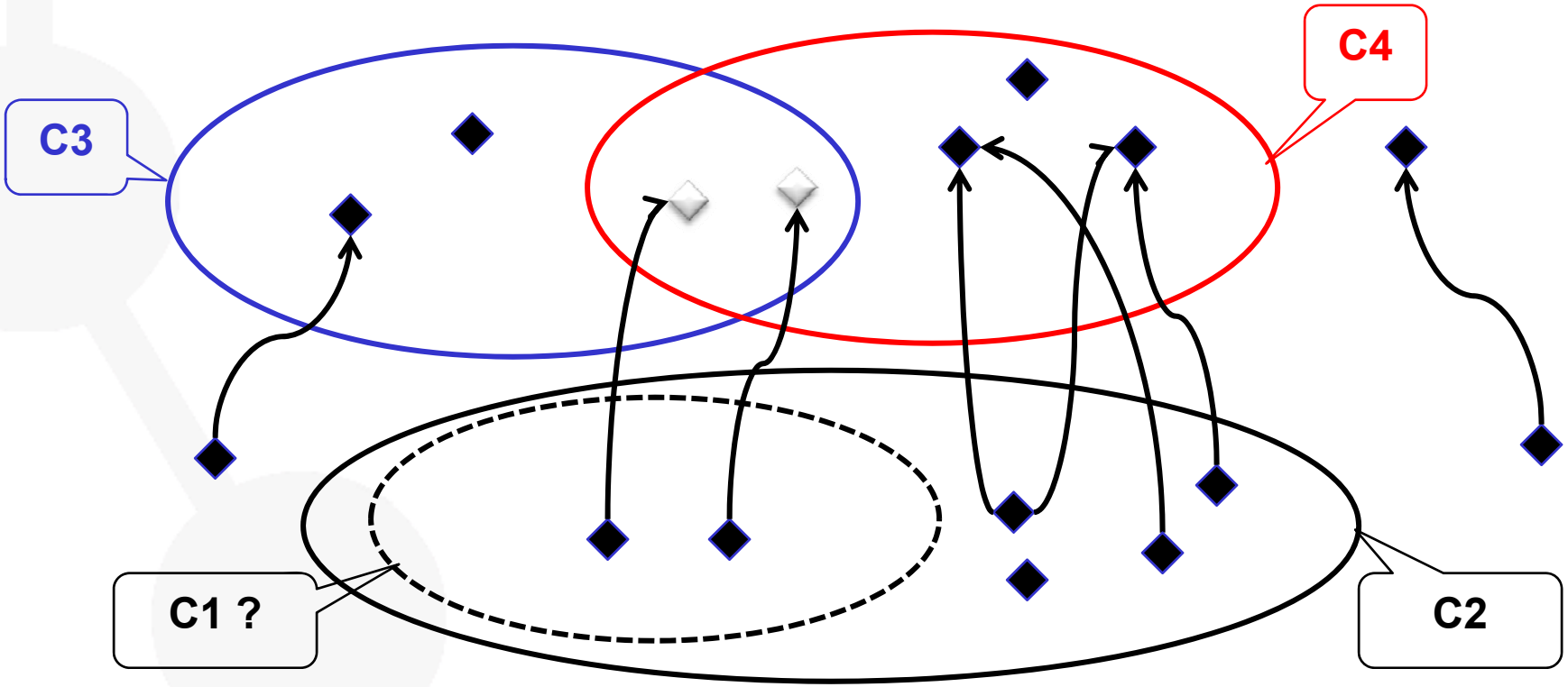
- **C1⊆∀R.(C2∪C3),** Disj(C2,C3)
- **C1⊆∃R.(C2∪C3),** Disj(C2,C3)



UniversalExistenceWithInheritance1

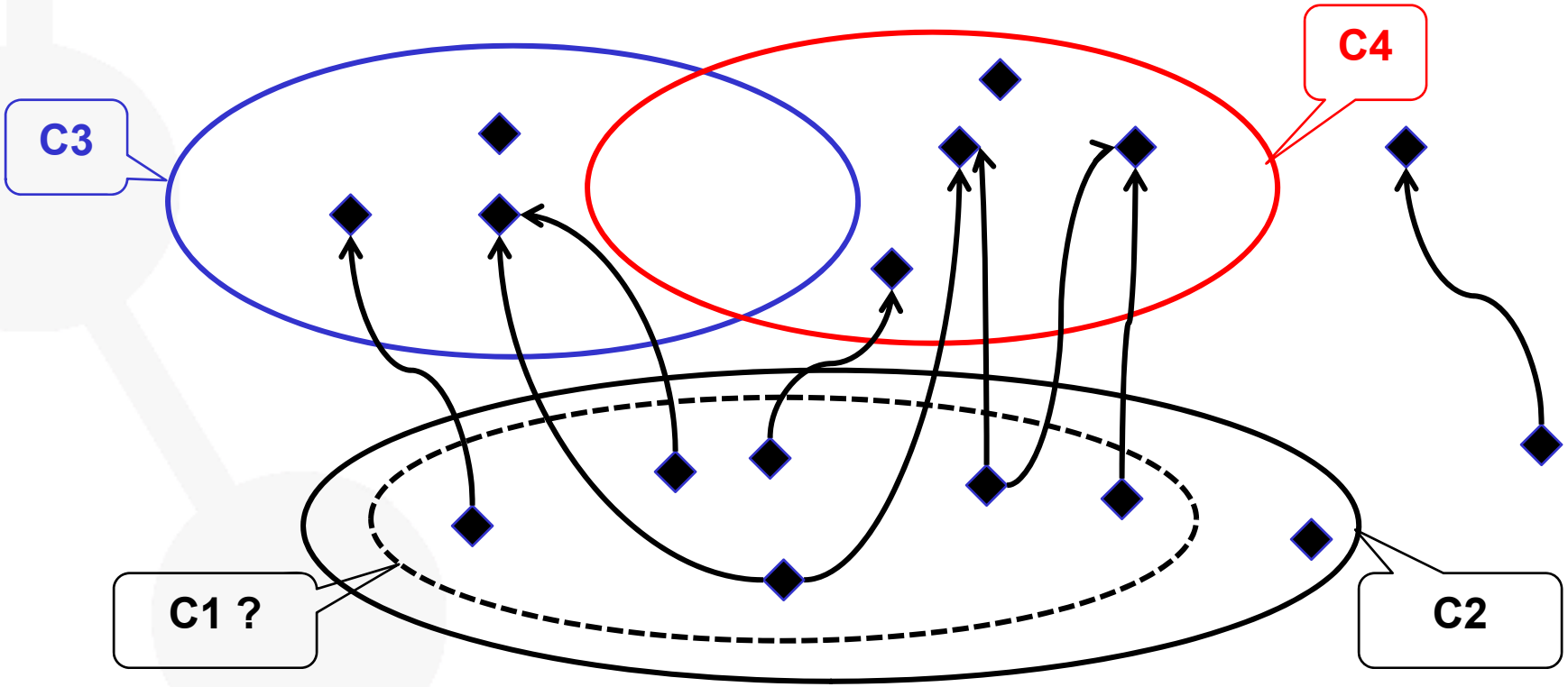
Forget one of the axiom during the development of the ontology.

$C1 \subseteq C2$, $C1 \subseteq \exists R.C3$, $C2 \subseteq \forall R.C4$, $Disj(C3,C4)$



Main recommendations

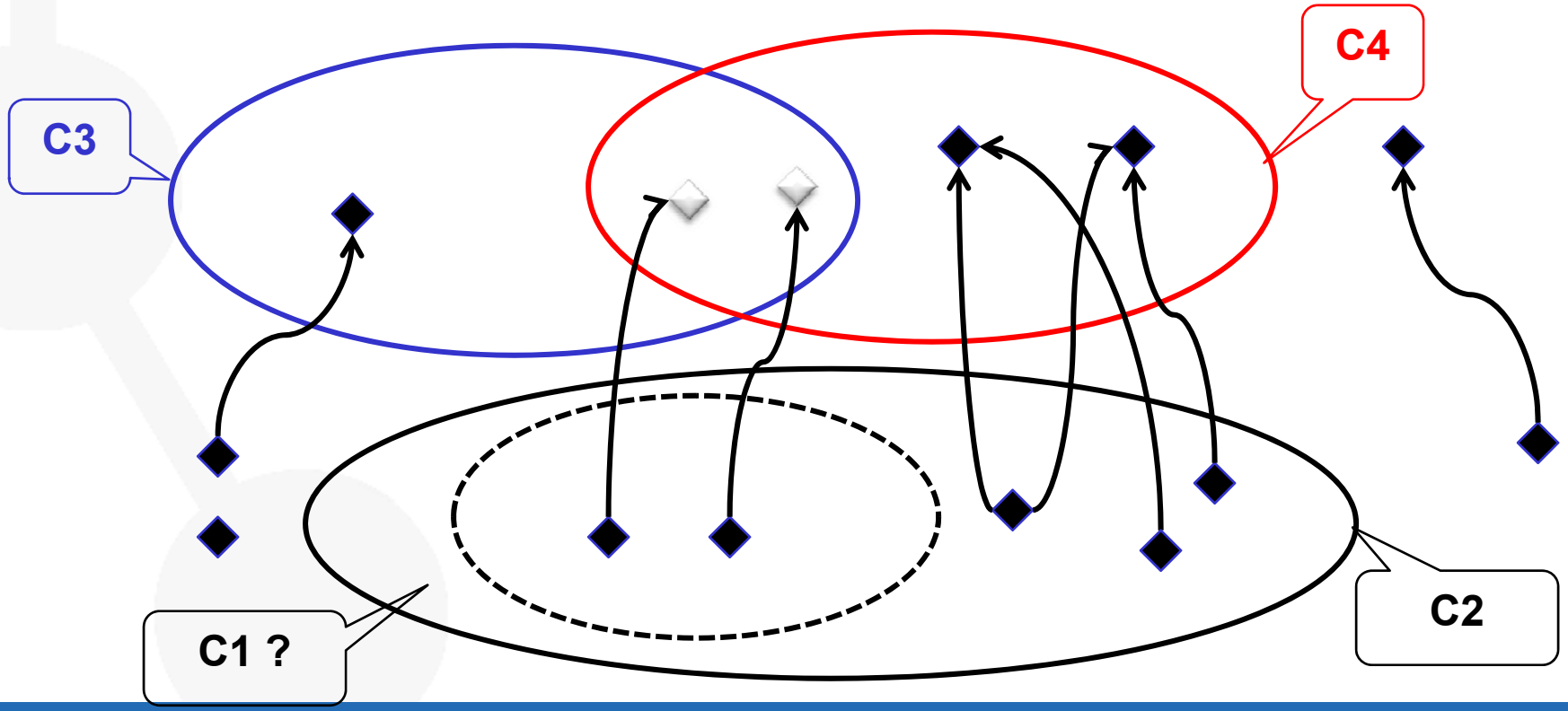
C1⊆C2, C1⊆ ∃**R.(C3∪C4),** C2⊆ ∀**R.(C3∪C4),** Disj(C3,C4)



UniversalExistenceWithInheritance2

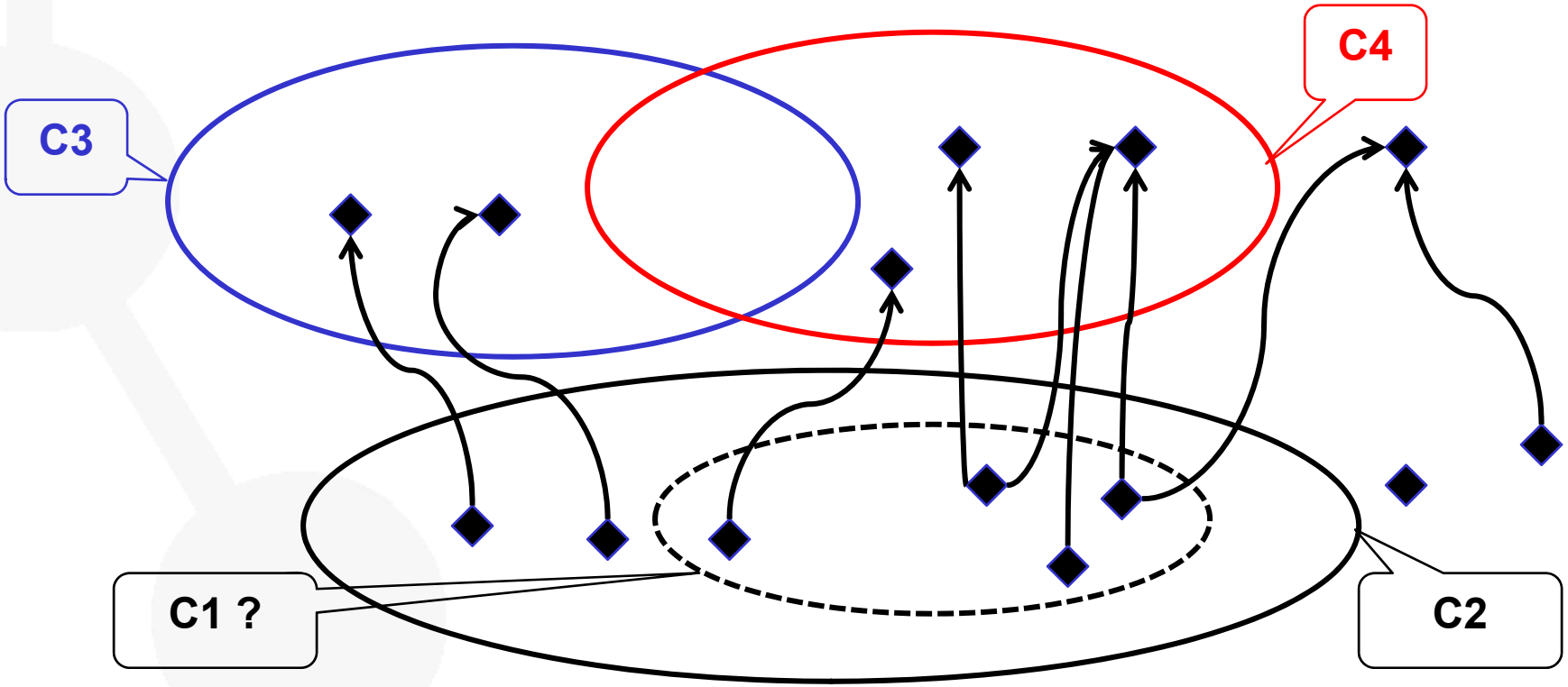
Forget one of the axiom during the development of the ontology.

C1⊆C2, C1⊆∀R.C3, C2⊆∃R.C4, Disj(C3,C4)



Main recommendations

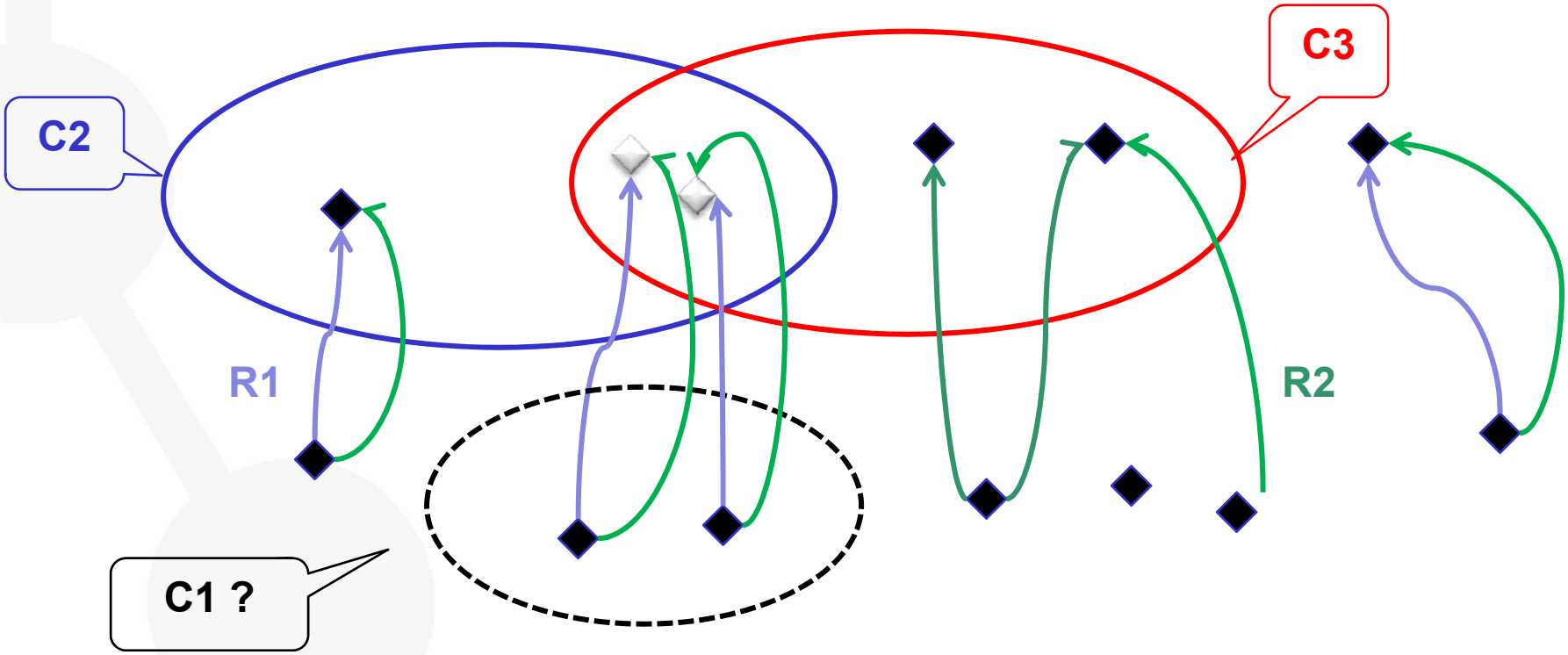
C1⊆C2, C1⊆ ∀**R.(C3∪C4)**∩∃**R.C4**, C2⊆ ∃**R.(C3∪C4)**, Disj(C3,C4)



UniversalExistenceWithPropertyInheritance1

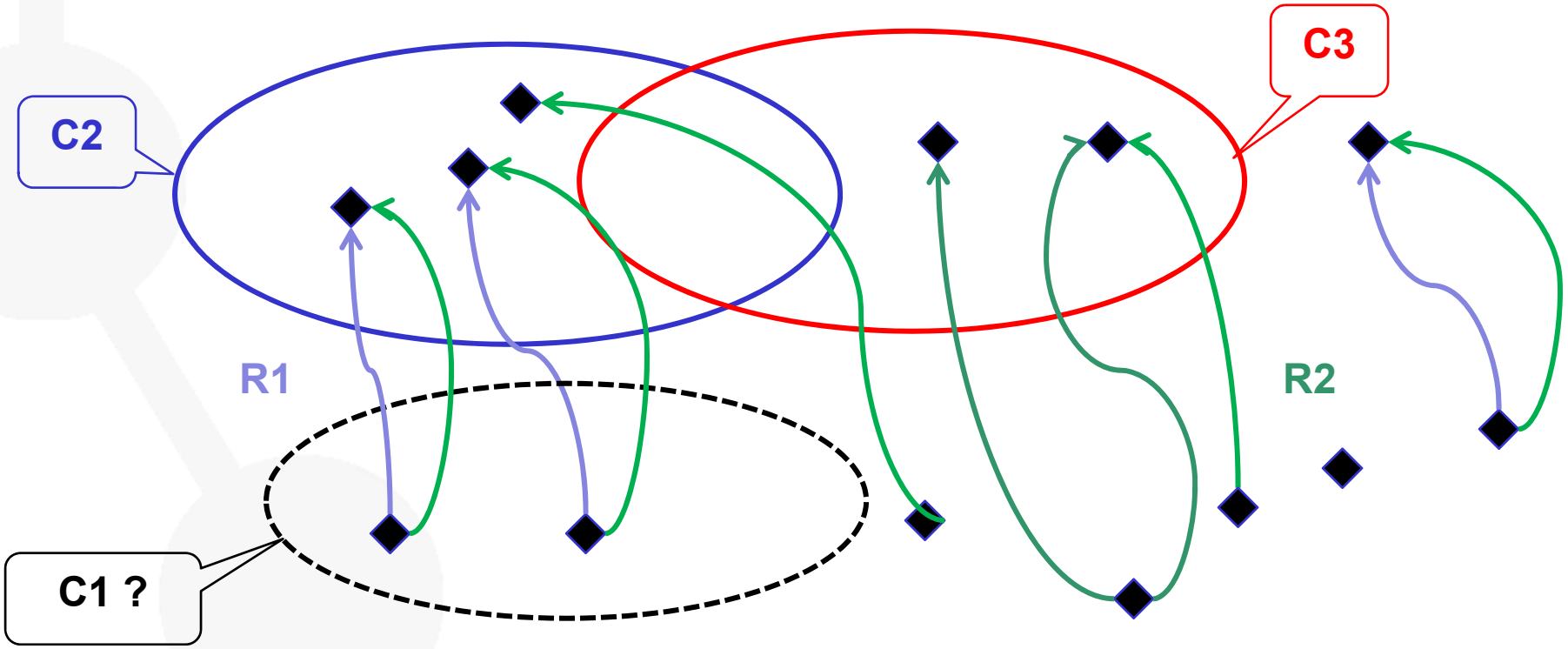
Misunderstanding of subproperty relation

$R1 \subseteq R2$, $C1 \subseteq \exists R1.C2$, $C1 \subseteq \forall R2.C3$, $Disj(C2,C3)$



Main Recommendation

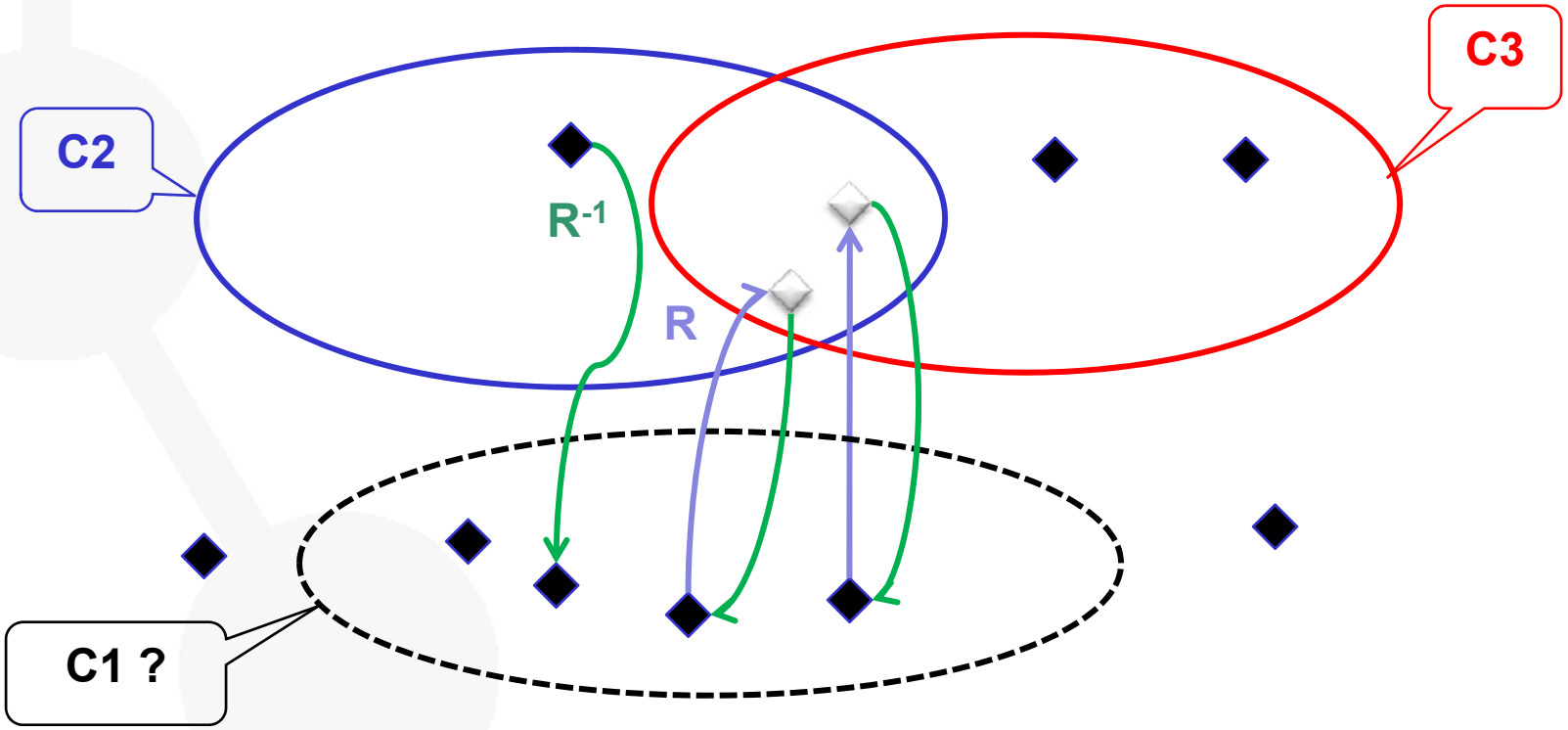
R1⊆R2, C1⊆∃R1.C2, **C1⊆∀R2.(C2∪C3)**, Disj(C2,C3)



UniversalExistenceWithInverseProperty

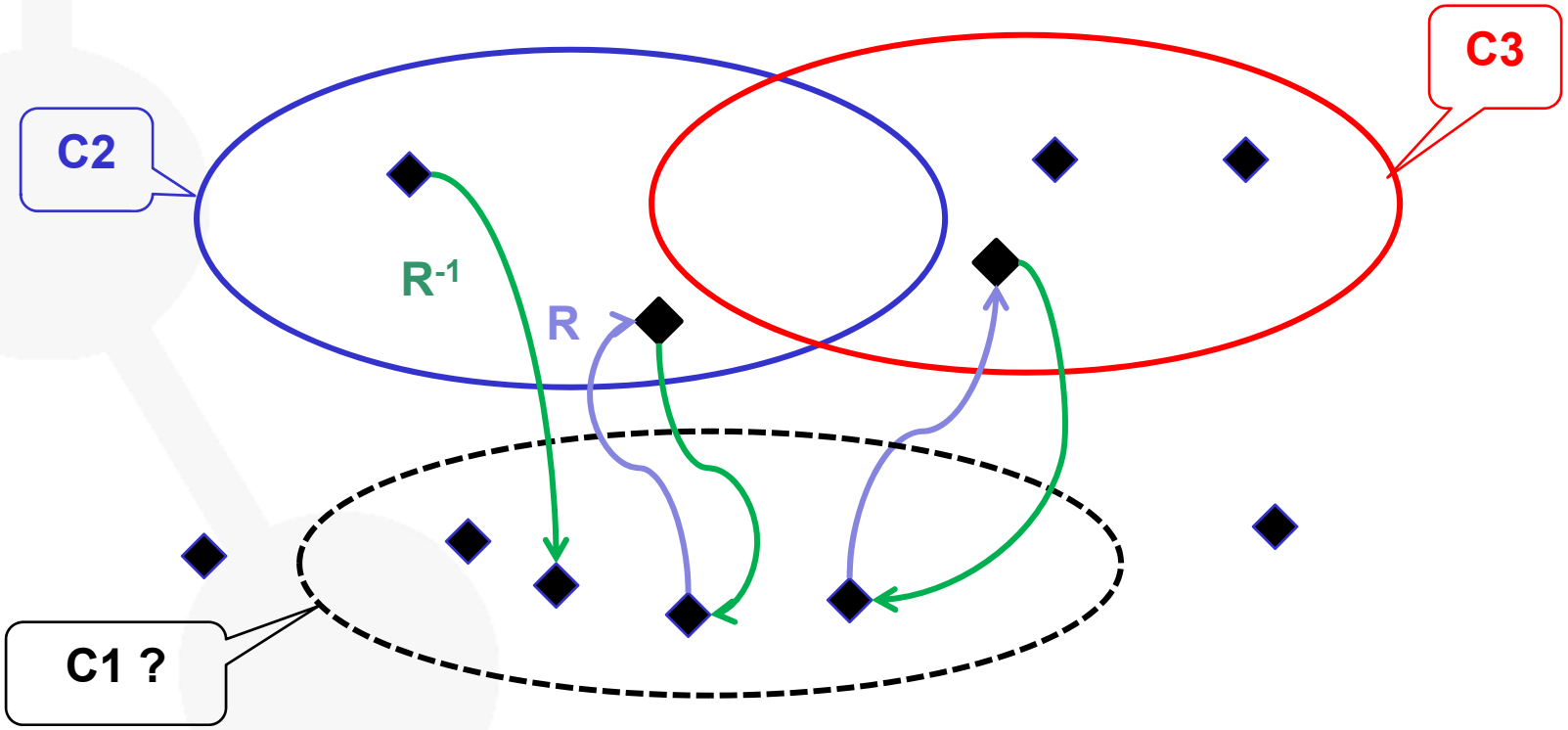
Forget one of the axiom during the development of the ontology.

$C2 \subseteq \exists R^{-1}.C1$, $C1 \subseteq \forall R.C3$, $Disj(C2,C3)$



Main Recommendation

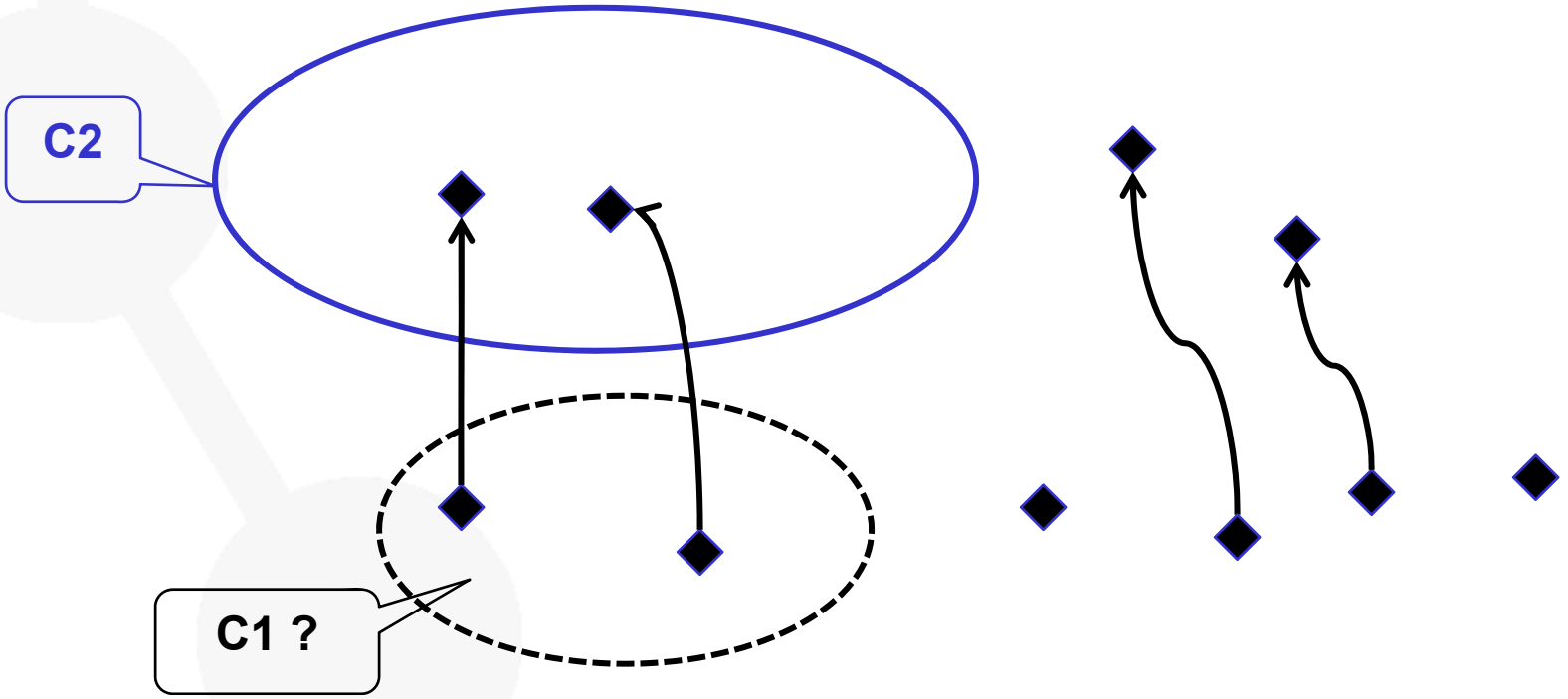
$C2 \subseteq \exists R^{-1}.C1$, $C1 \subseteq \forall R.(\mathbf{C2 \cup C3})$, Disj(C2,C3)



SomeMeansAtLeastOne

forget to remove one of the axiom

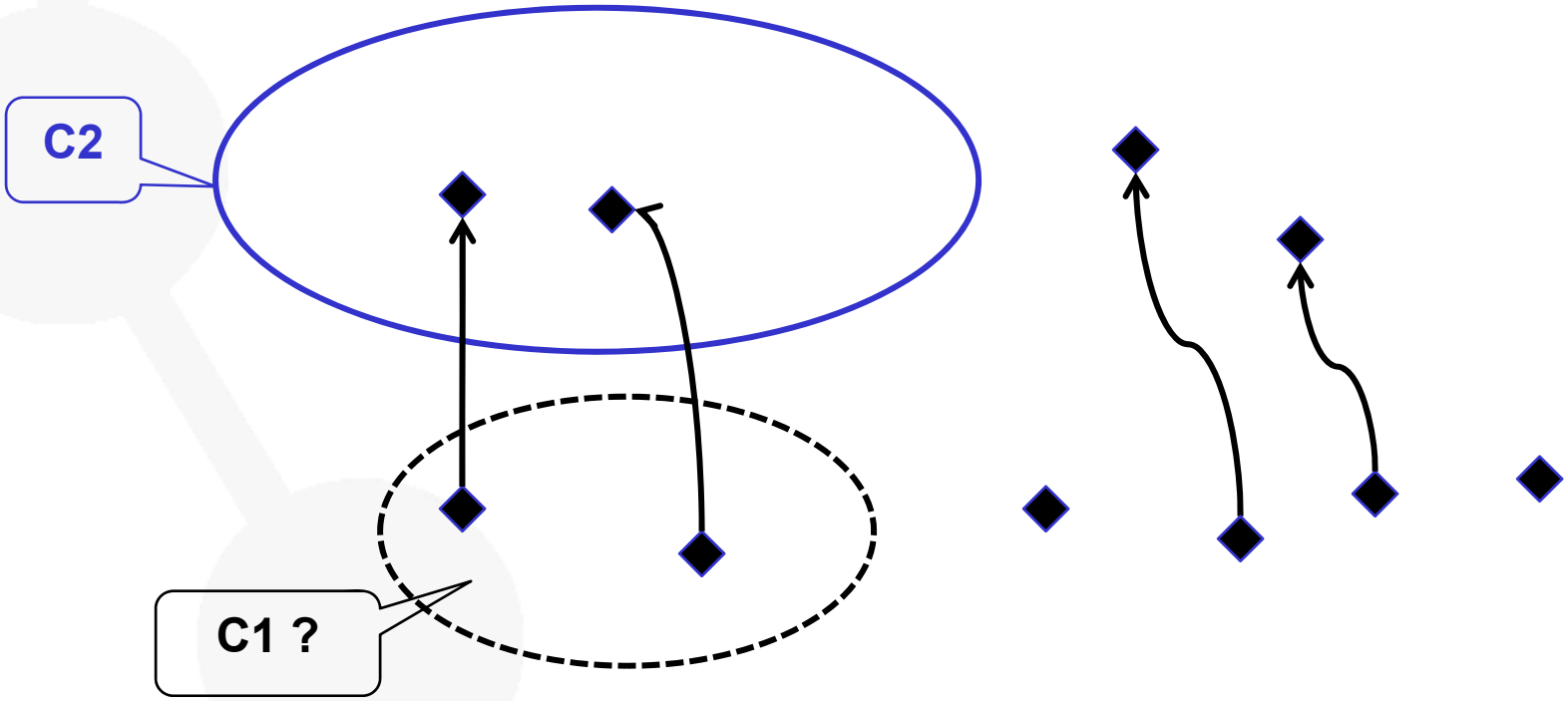
C1⊆∃R.C2, C1⊆≥1R.T



Main Recommendation

forget to remove one of the axiom

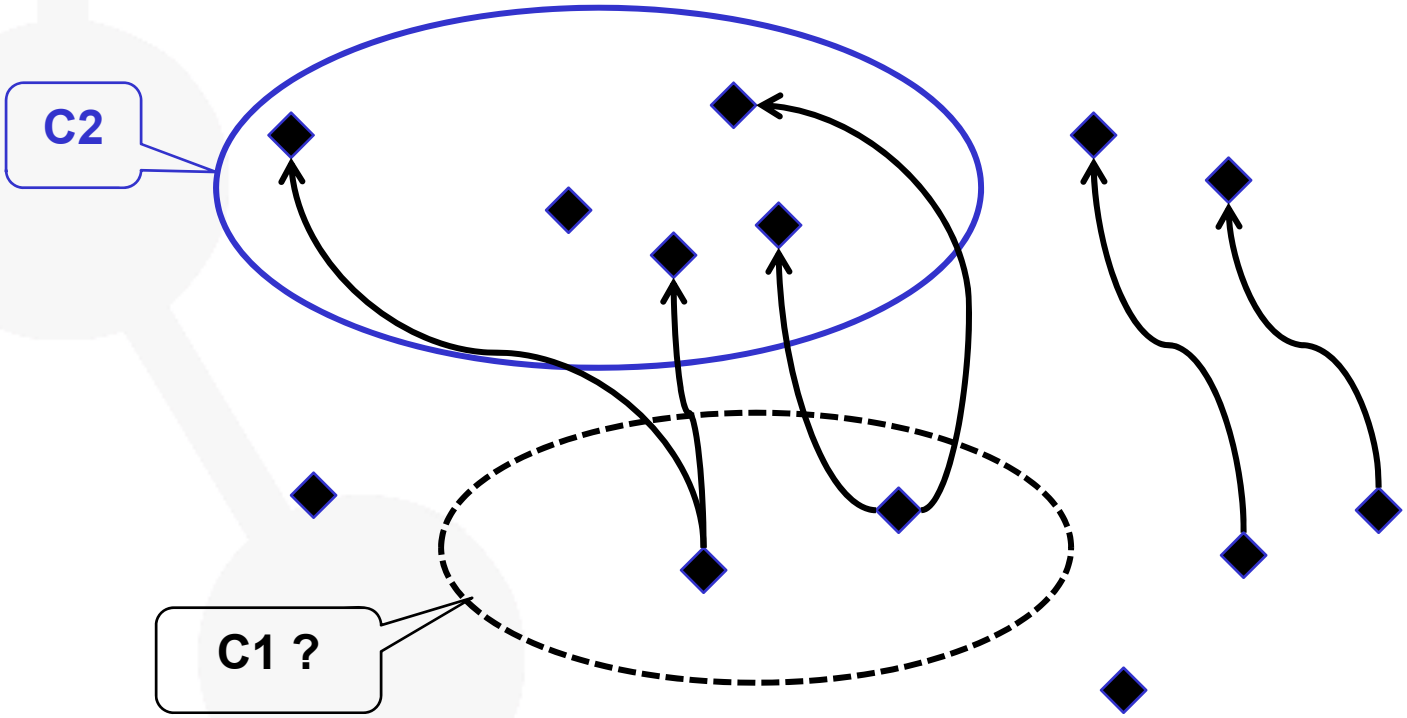
C1⊆∃R.C2, ~~C1⊆≥1R.T~~



Domain&CardinalityConstraints

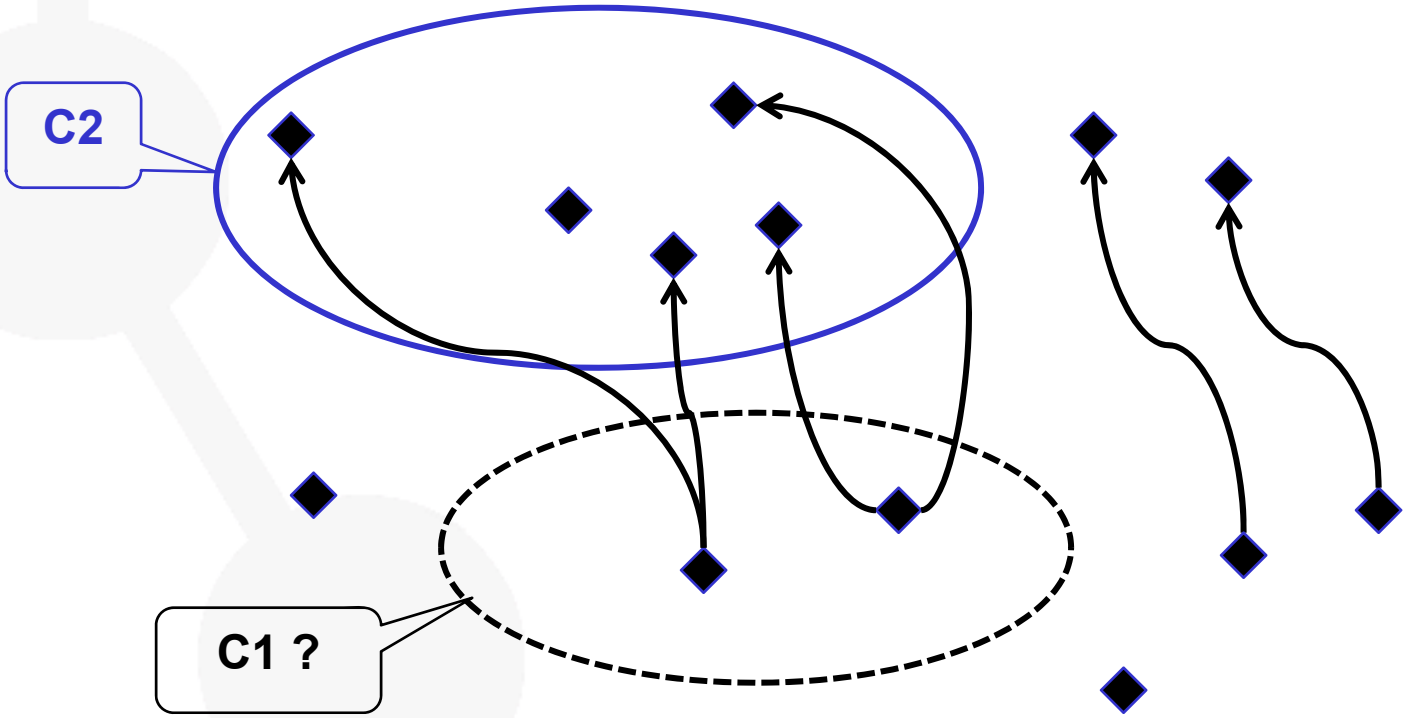
Developers may forget that existential restrictions contain a cardinality constraint

$C1 \subseteq \exists R.C2$, $C1 \subseteq (\geq 2R.T)$



Main Recommendation

C1$\subseteq\forall$**R.C2**, C1$\subseteq$(≥2R.T)



GroupAxioms

facilitate the comprehension of complex class definition

$C1 \subseteq \forall R.C2$, $C1 \subseteq (\geq 2R.T)$ (for example)

Recommendations

$C1 \subseteq (\forall R.C2) \cap (\geq 2R.T)$

MinIsZero

The ontology developer wants to say that C1 can be the domain of the R role

$C1 \subseteq (\geq 0 R.T)$

Main Recommendation

~~$C1 \subseteq (\geq 0 R.T)$~~

Complex antipatterns

AntiPattern SumOfSomIsNeverEqualToOne (SOSINETO)

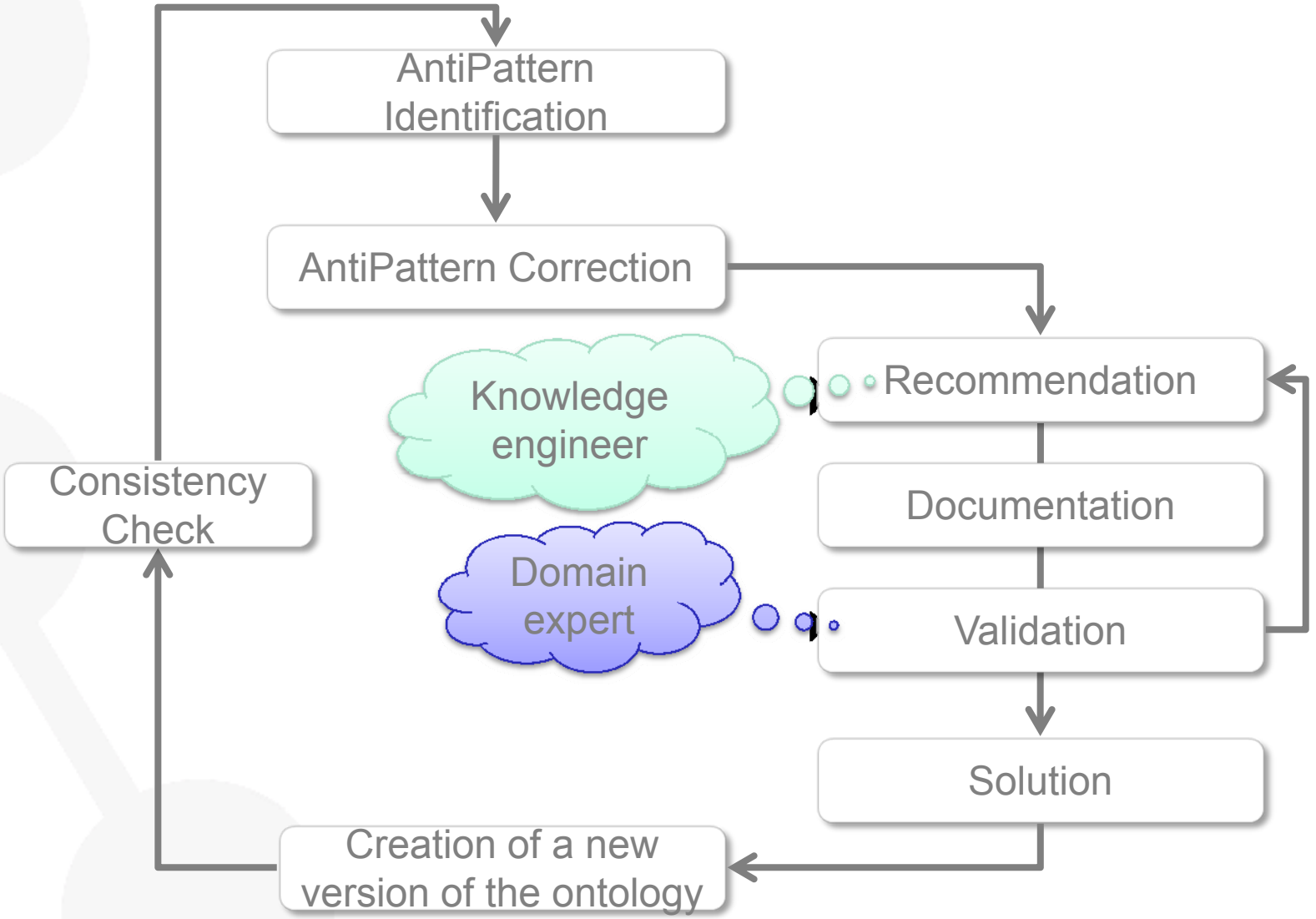
$C1 \subseteq \exists R.C2$, $C1 \subseteq \exists R.C3$, $C1 \subseteq \leq 1R.T$, $Disj(C2,C3)$

- What are the elementary antipatterns?

Recommendation

$C1 \subseteq \forall R.(C2 \cup C3)$, $C1 \subseteq \leq 1R.T$, $Disj(C2,C3)$

Global Strategy for ontology debugging



Debugging Strategy based on antipatterns

Resolve Terminological Problem NLAP SOE

Check the use of ≡ LAP EID G DOC

Find a Root Class to debug G MA

Check the Class Hierarchy G MA

Remove unuseful axiom NLAP SMALO G MIZ

More detail strategy