Managing Multiple Ontologies in Protégé

(and the PROMPT tools)

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Ontology-Management Tasks and Protégé

Pr
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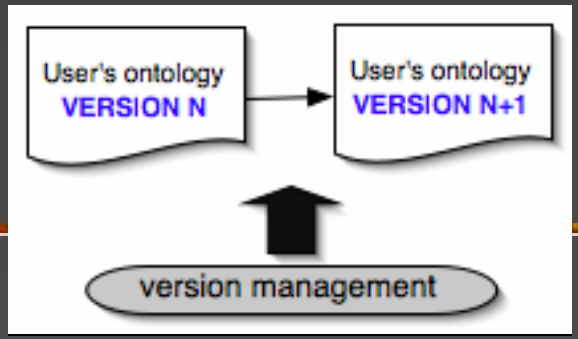
Different back ends

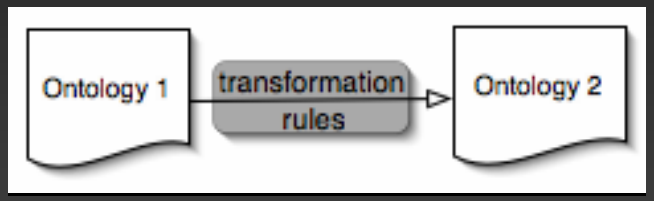
Provide support for ontology versioning

Project inclusion mechanism

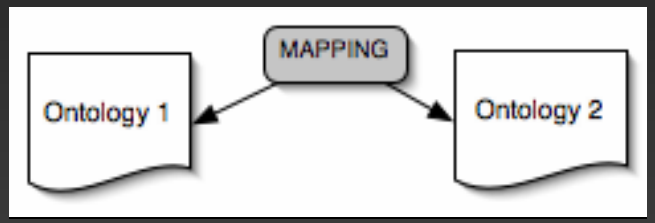


Ontology-Management Tasks (II)

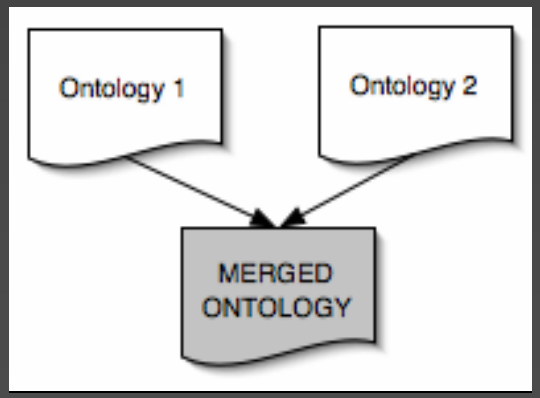
Specify transformation rules for instance data



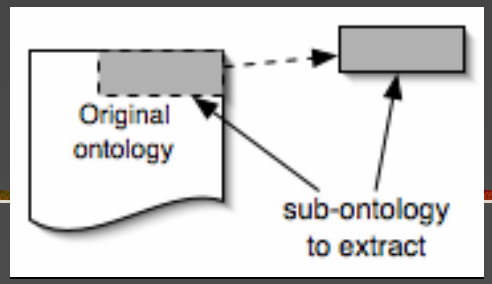
Align and map ontologies



Merge ontologies



Extract self-contained parts of an ontology

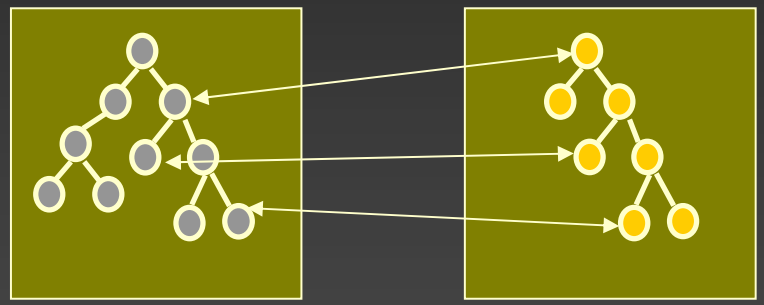


The PROMPT suite of tools

- Merging
- Alignment
- Versioning
- Extraction
- Re-organization

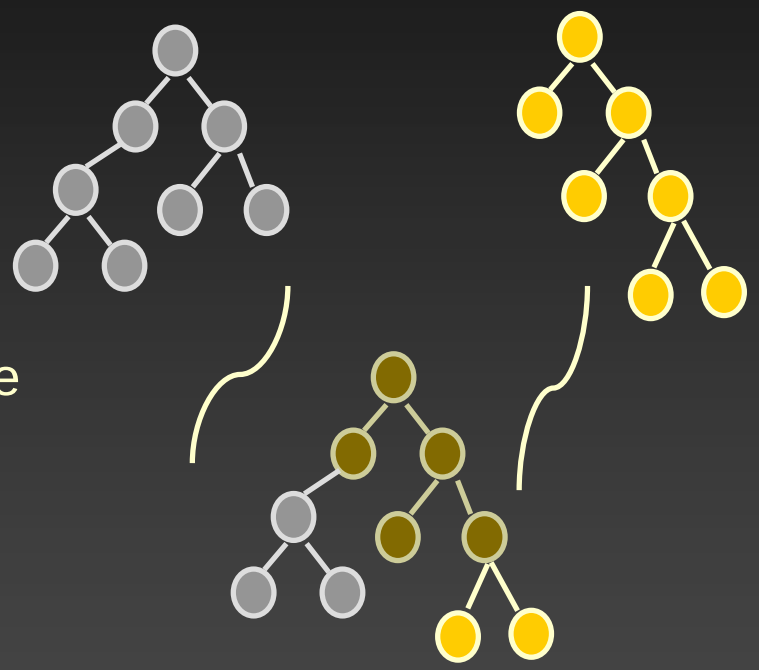
General Problem: Ontology Matching

- Compare ontologies
- Find similarities and differences
  - Merging: similarities
  - Mapping: similarities
  - Versioning: differences

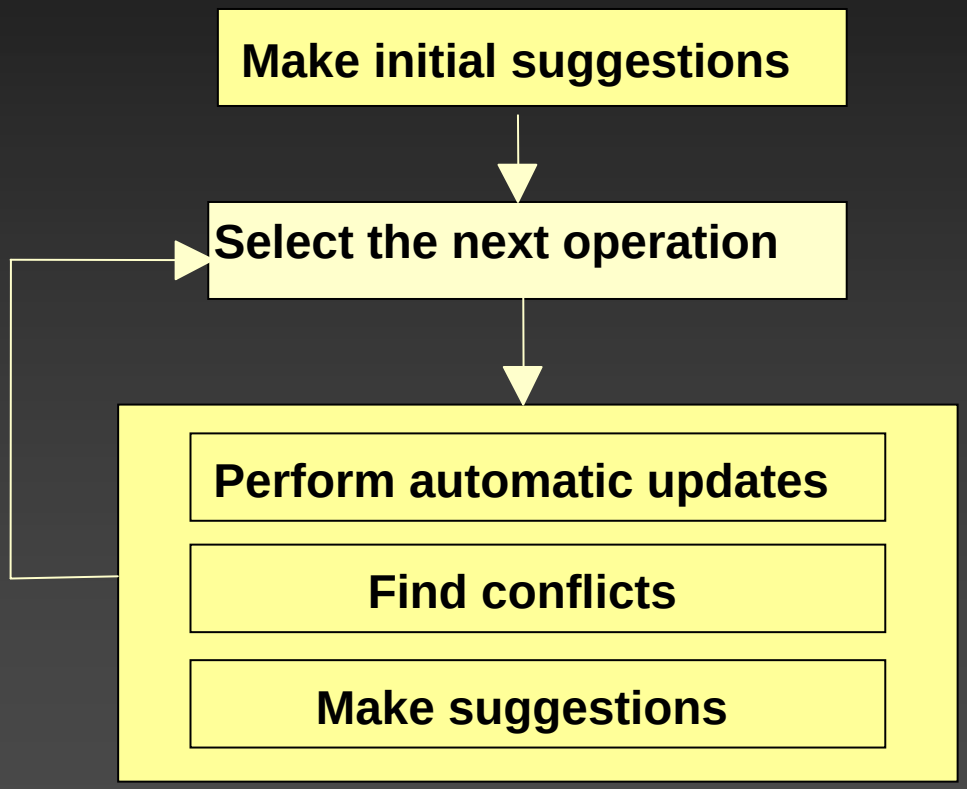


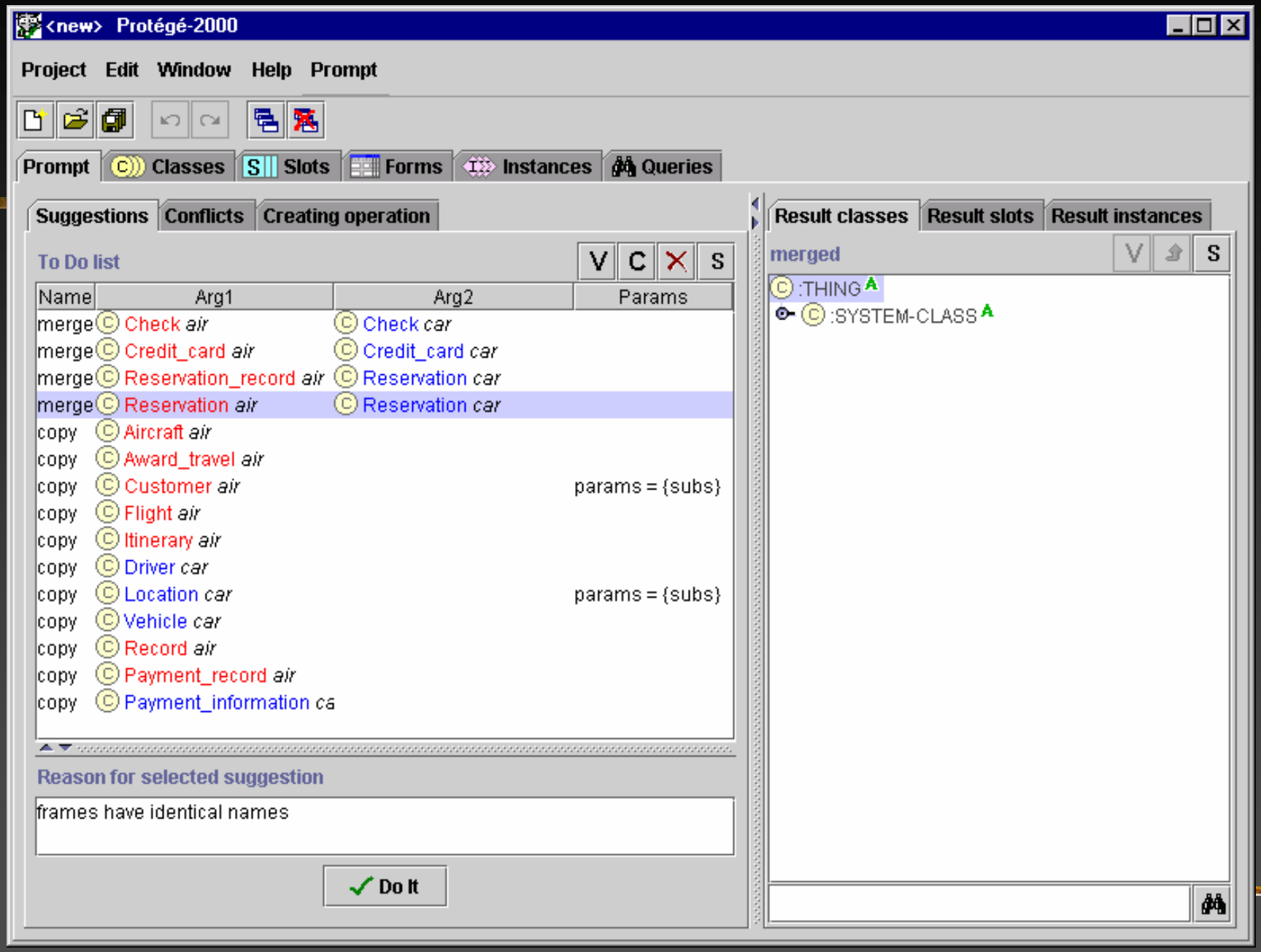
PROMPT: An Interactive Ontology-Merging Tool

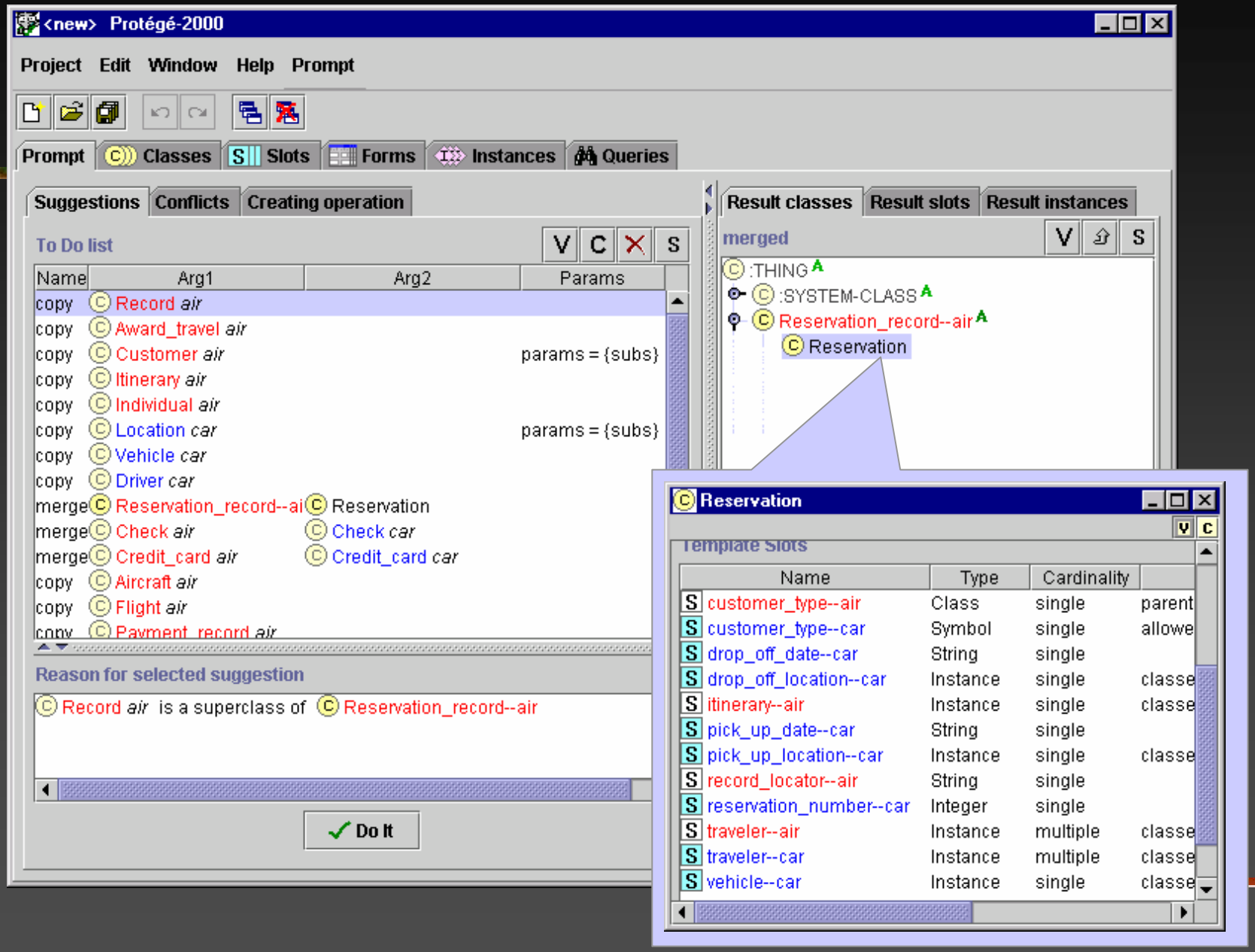
- PROMPT *is*:
  - Partial automation
  - Algorithms based on
    - concept-representation structure
    - relations between concepts
    - user's actions
- PROMPT *is not*:
  - Complete automation
  - Algorithm for matching concept names



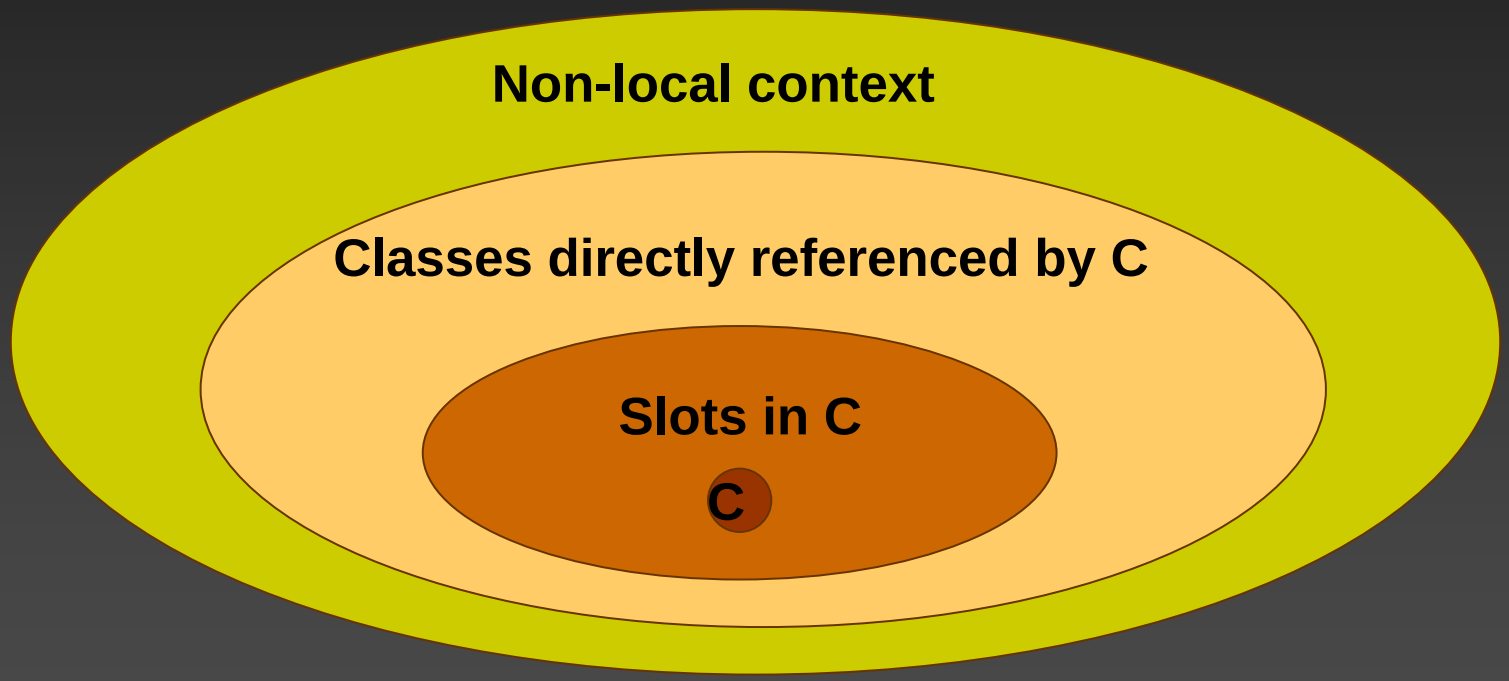
The PROMPT Algorithm



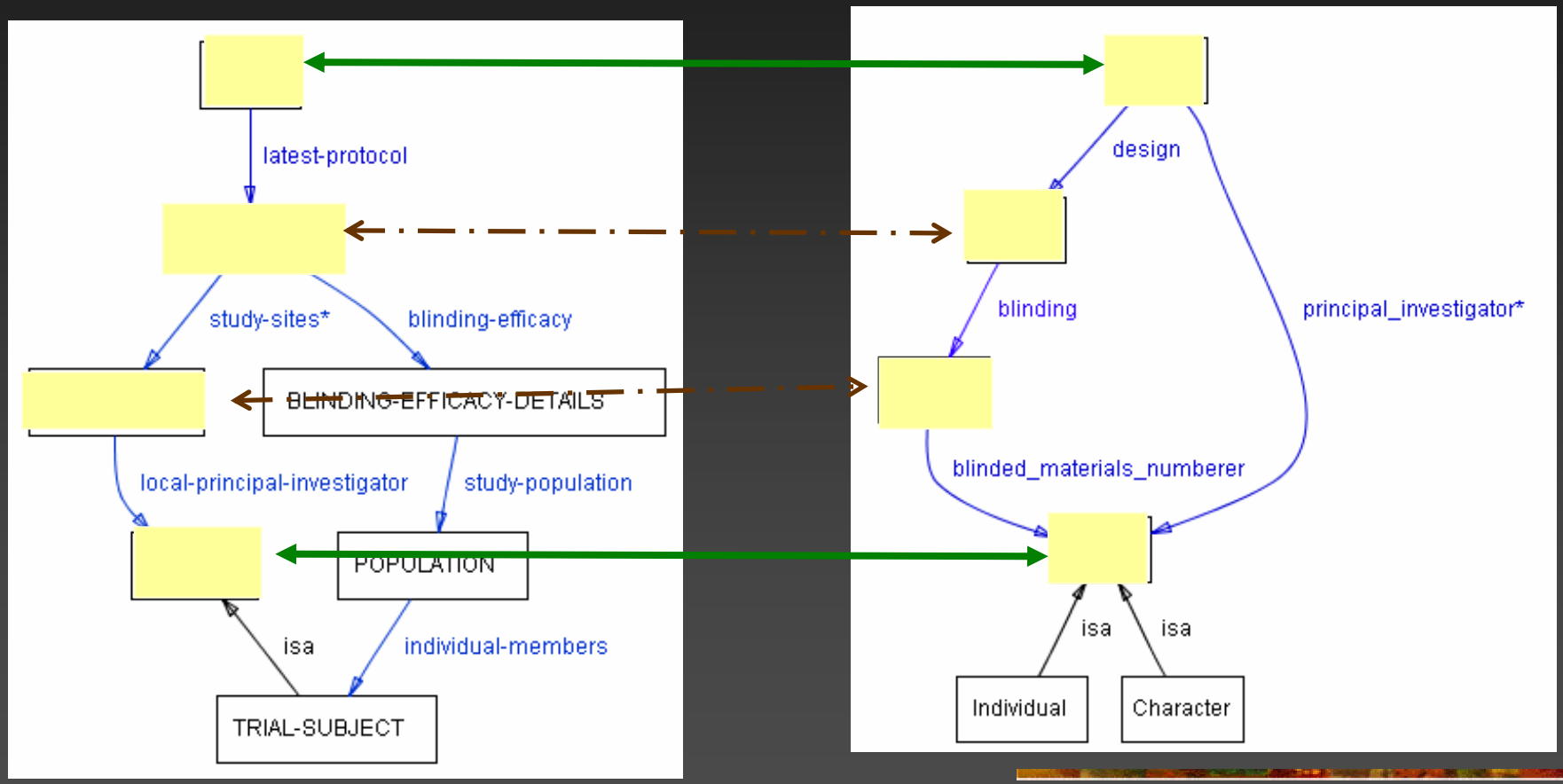

<new> Protégé-2000
Project Edit Window Help Prompt
Prompt Classes Slots Forms Instances Queries
Suggestions Conflicts Creating operation
To Do list
V C S
Name Arg1 Arg2 Params
merge Check air Check car
merge Credit_card air Credit_card car
merge Reservation_record air Reservation car
merge Reservation air Reservation car
copy Aircraft air
copy Award_travel air
copy Customer air params = {subs}
copy Flight air
copy Itinerary air
copy Driver car
copy Location car params = {subs}
copy Vehicle car
copy Record air
copy Payment_record air
copy Payment_information ca
Reason for selected suggestion
frames have identical names
Do It
Result classes Result slots Result instances
merged
V S
:THING A
:SYSTEM-CLASS A


<new> Protégé-2000
Project Edit Window Help Prompt
Prompt Classes Slots Forms Instances Queries
Suggestions Conflicts Creating operation
To Do list
Name Arg1 Arg2 Params
copy Record air
copy Award_travel air
copy Customer air params = {subs}
copy Itinerary air
copy Individual air
copy Location car params = {subs}
copy Vehicle car
copy Driver car
merge Reservation_record--ai Reservation
merge Check air Check car
merge Credit_card air Credit_card car
copy Aircraft air
copy Flight air
Reason for selected suggestion
Record air is a superclass of Reservation_record--air
Do It
Result classes Result slots Result instances
merged
:THING
:SYSTEM-CLASS
Reservation_record--air
Reservation
Reservation
Template Slots
Name Type Cardinality
customer_type--air Class single parent
customer_type--car Symbol single allowe
drop_off_date--car String single
drop_off_location--car Instance single classe
itinerary--air Instance single classe
pick_up_date--car String single
pick_up_location--car Instance single classe
record_locator--air String single
reservation_number--car Integer single
traveler--air Instance multiple classe
traveler--car Instance multiple classe
vehicle--car Instance single classe

Context


Non-local context
Classes directly referenced by C
Slots in C
C

Generating Paths in the Graph

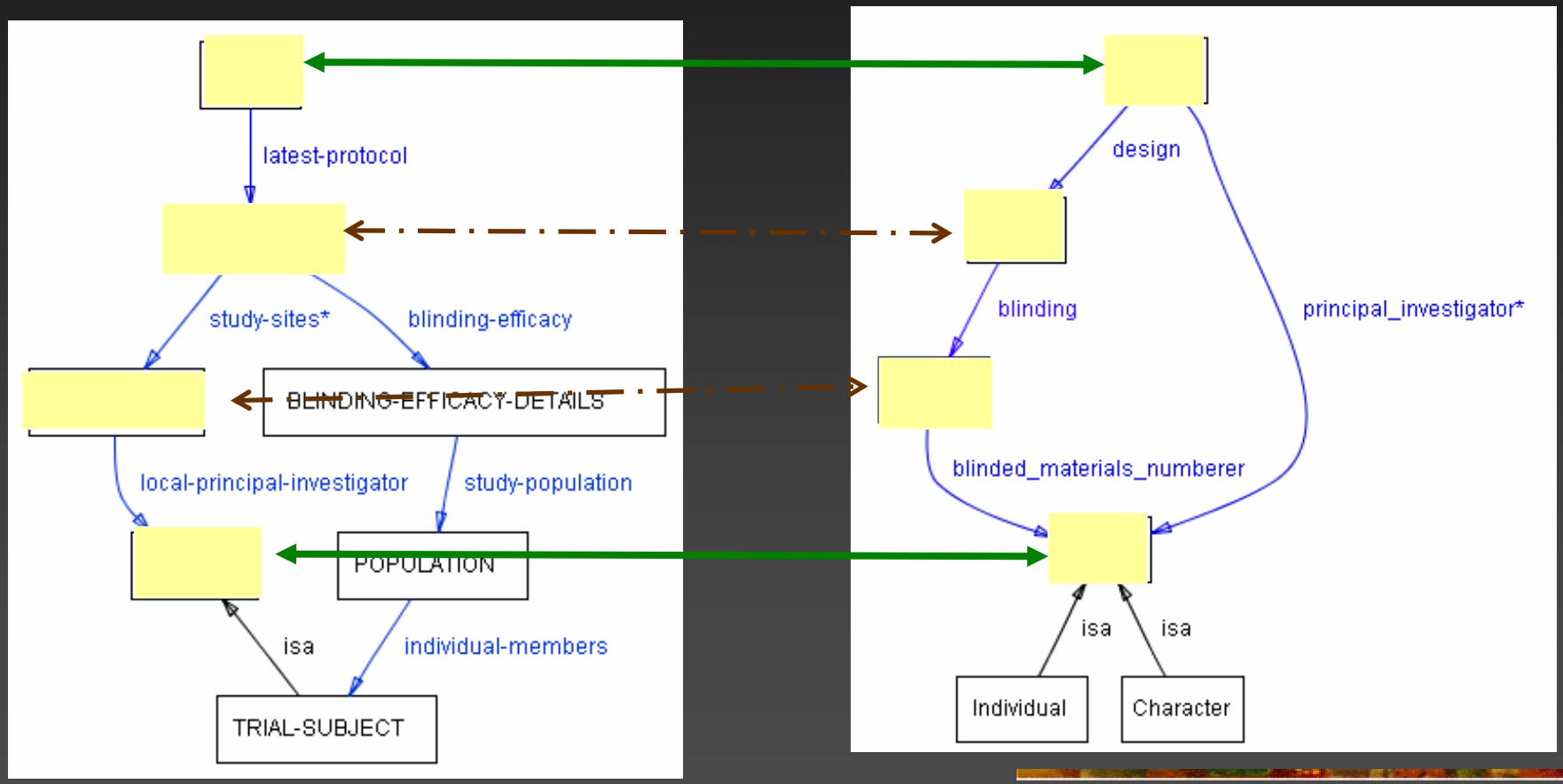


Design-a-Trial, S.Modgil, et.al.; CMT, I.Sim et.al.

Similarity Score

- Generate a set of all paths (of length < L)
- Generate a set of all possible pairs of paths of equal length
- For each pair of paths and for each pair of nodes in the identical positions in the paths, increment the similarity score
- Combine the similarity score for all the paths

Similarity Score (II)



Anchor-PROMPT: Initial Results

- TRIAL Trial
- PERSON Person
- CROSSOVER Crossover

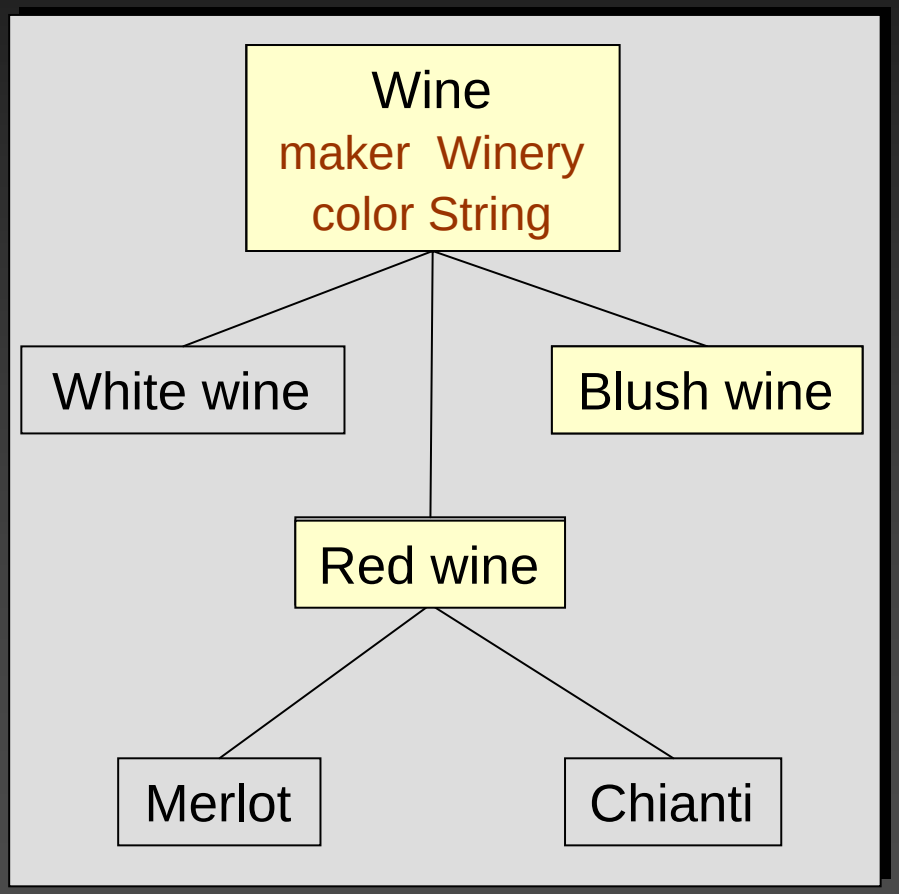
PROTOCOL	Design
TRIAL-SUBJECT	Person
INVESTIGATORS	Person
POPULATION	Action_Spec
PERSON	Character
TREATMENT-POPULATION	Crossover_arm

Ontology Versioning

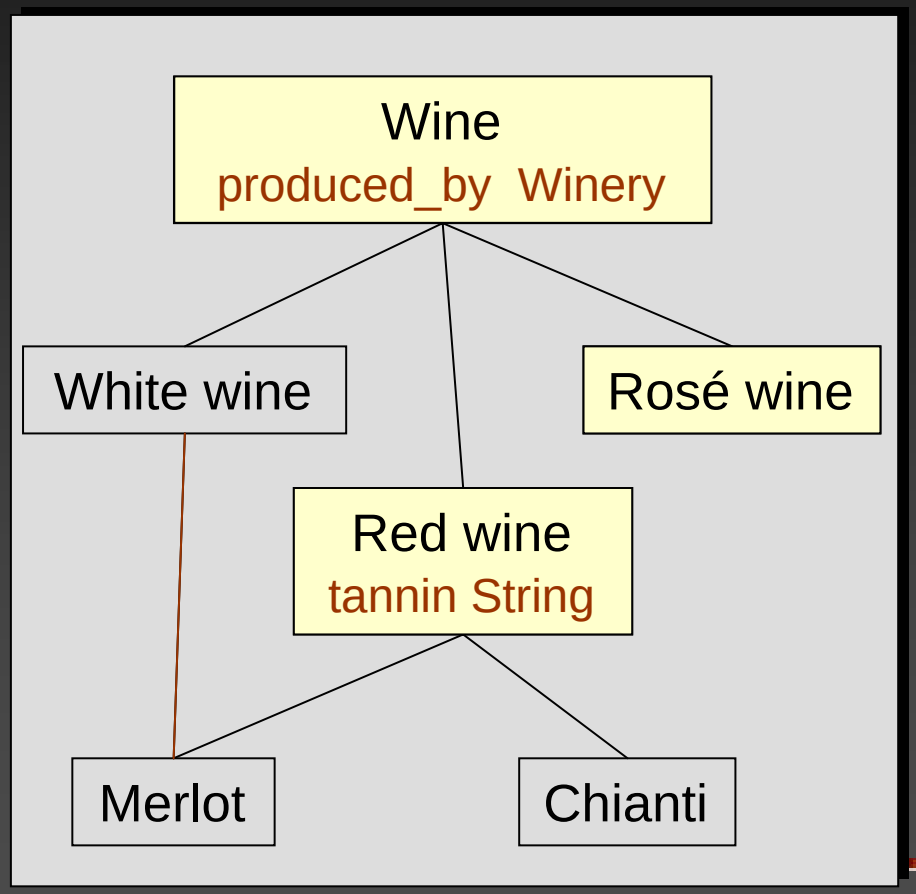
- Ontology development became a dynamic, collaborative process
  - Need to maintain different versions
- CVS-type systems
  - Repository of versions
  - Check-in/check-out mechanisms
  - Version comparison (diff)

Structural Diff

Version 1

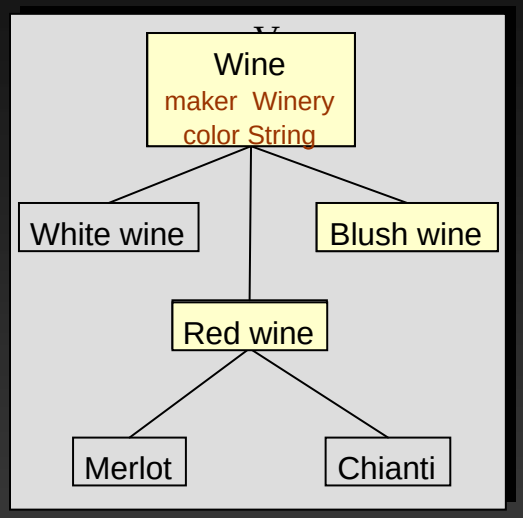


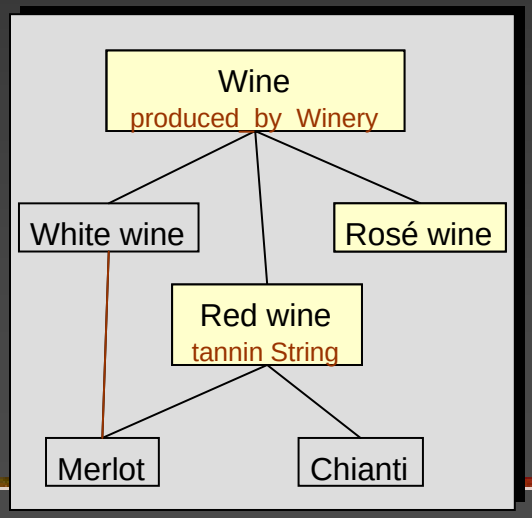
Version 2



Structural Diff (II)

f1	f2	renamed	operation
	S tannin level	No	Add
S color		No	Delete
C Blush wine	C Rosé wine	Yes	Isomorphic
S maker	S produced_by	Yes	Isomorphic
C Chianti	C Chianti	No	Isomorphic
C Merlot	C Merlot	No	Changed
C Red wine	C Red wine	No	Changed
C White wine	C White wine	No	Changed
C Wine	C Wine	No	Isomorphic
C Winery	C Winery	No	Unchanged





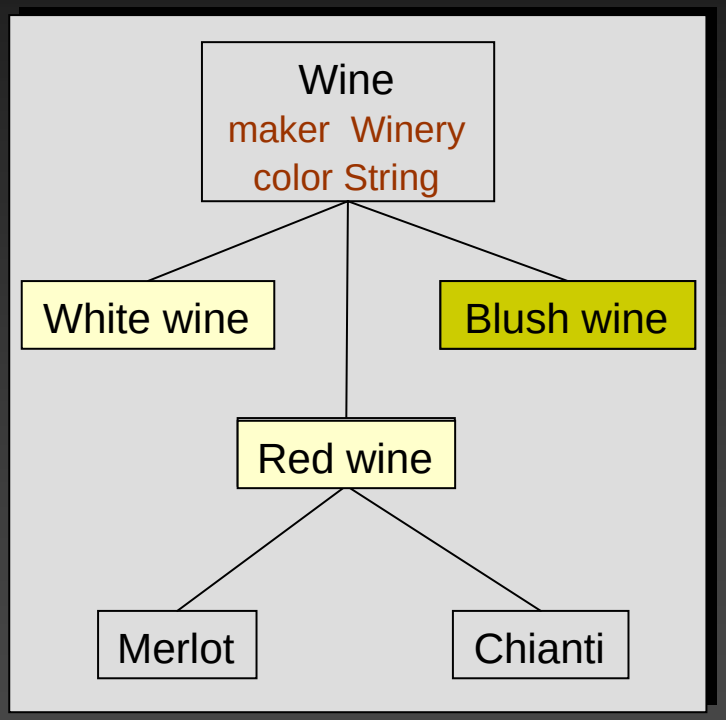
Ontology Versioning versus Ontology Alignment

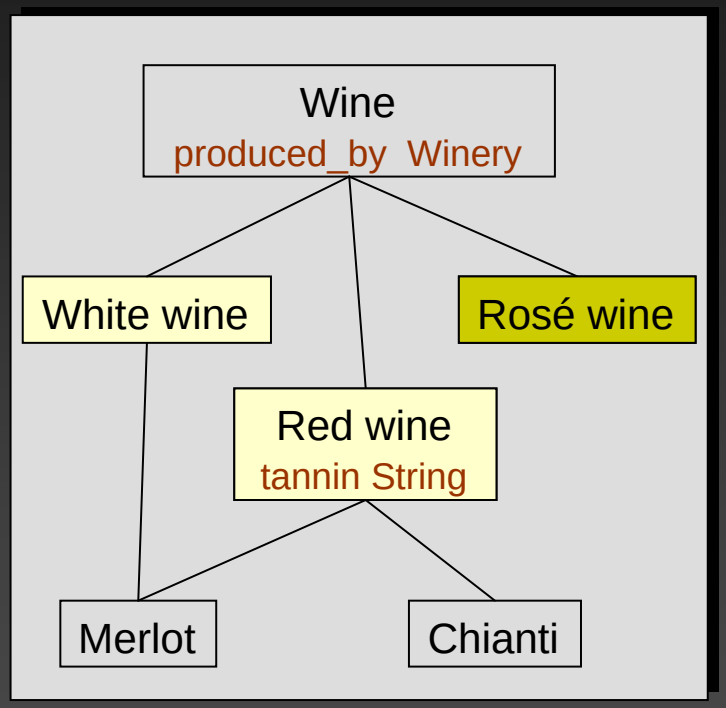
- Compare different ontologies versus compare different versions of the same ontology
- Ontology versioning: if things look similar, they probably are
- A large fraction of ontologies remains unchanged from version to version

PrompDiff Algorithm

- Consists of two parts
  1. A set of heuristic matchers
  2. A fixed-point algorithm to combine the results of the matchers
- Can be extended with any number of matchers

Single Unmatched Sibling





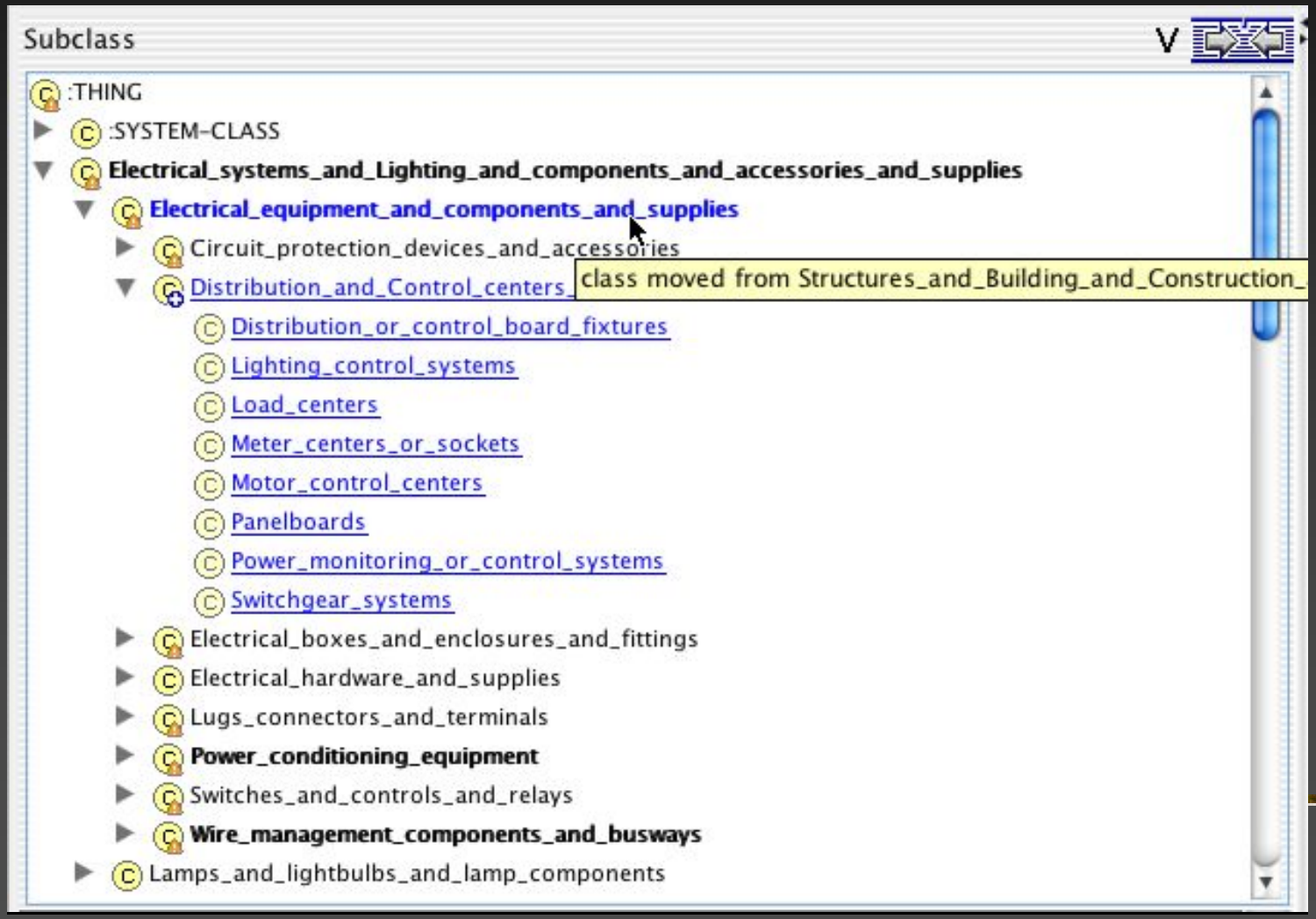
Evaluation results

- All frames that OntoDiff matched, it matched correctly
- Recall: 95%
- Precision: 91%

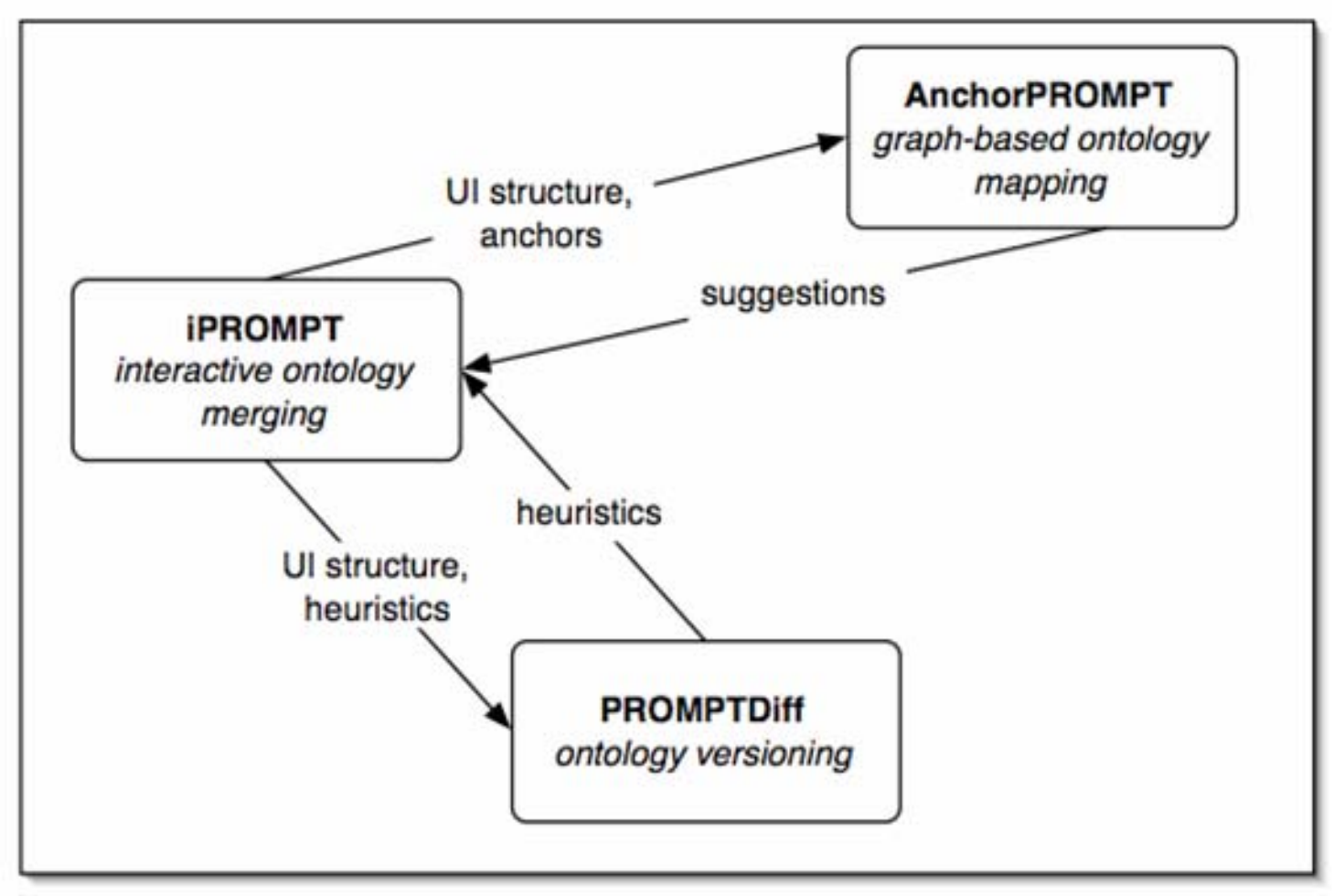
Visualizing changes

Joint work with Michel Klein

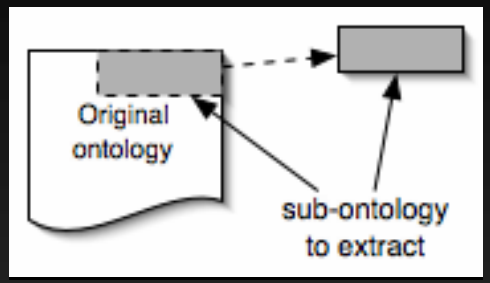
Visualizing changes (II)



Interaction among the PROMPT tools



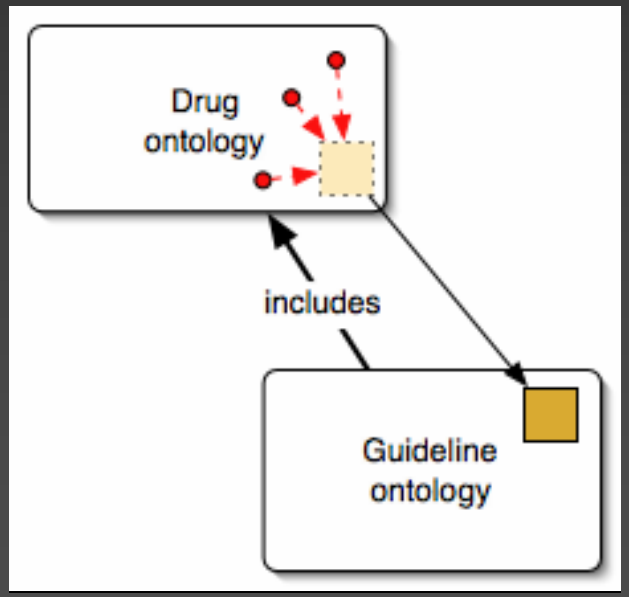
PromptFactor

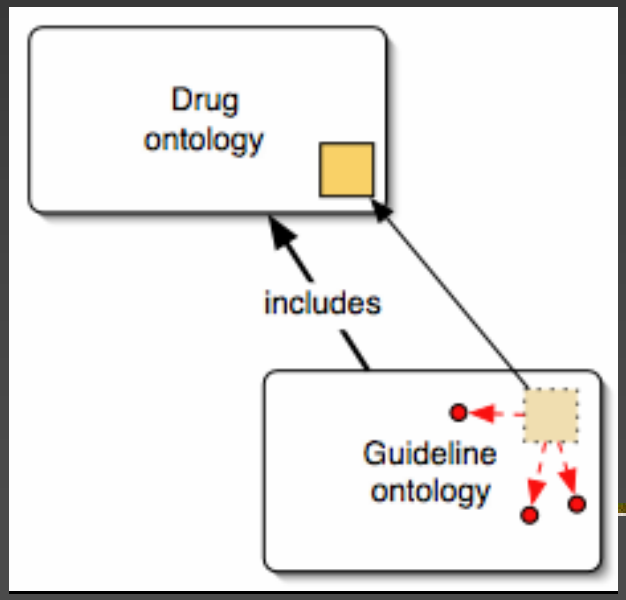


- Create a self-contained sub-ontology
  - *Extract all the information about* esophagus *from the anatomy ontology*
- Ensure that all the necessary concepts are defined in the sub-ontology
- Specify the depth of the transitive closure of relations

Included and including projects

- Move frames between included and including projects
- Ensure that no frames from the included projects reference frames in the including project





Future directions

- Ontology mapping and merging
  - Use explicit mappings to merge ontologies
  - “Eavesdrop” during interactive merging to create explicit mappings
- Ontology versioning and mapping
  - Update mappings when ontology changes
- Ontology mapping
  - Introduce uncertainty
  - Find complex mappings