Traceability in Viewpoint Merging: A Model Management Perspective

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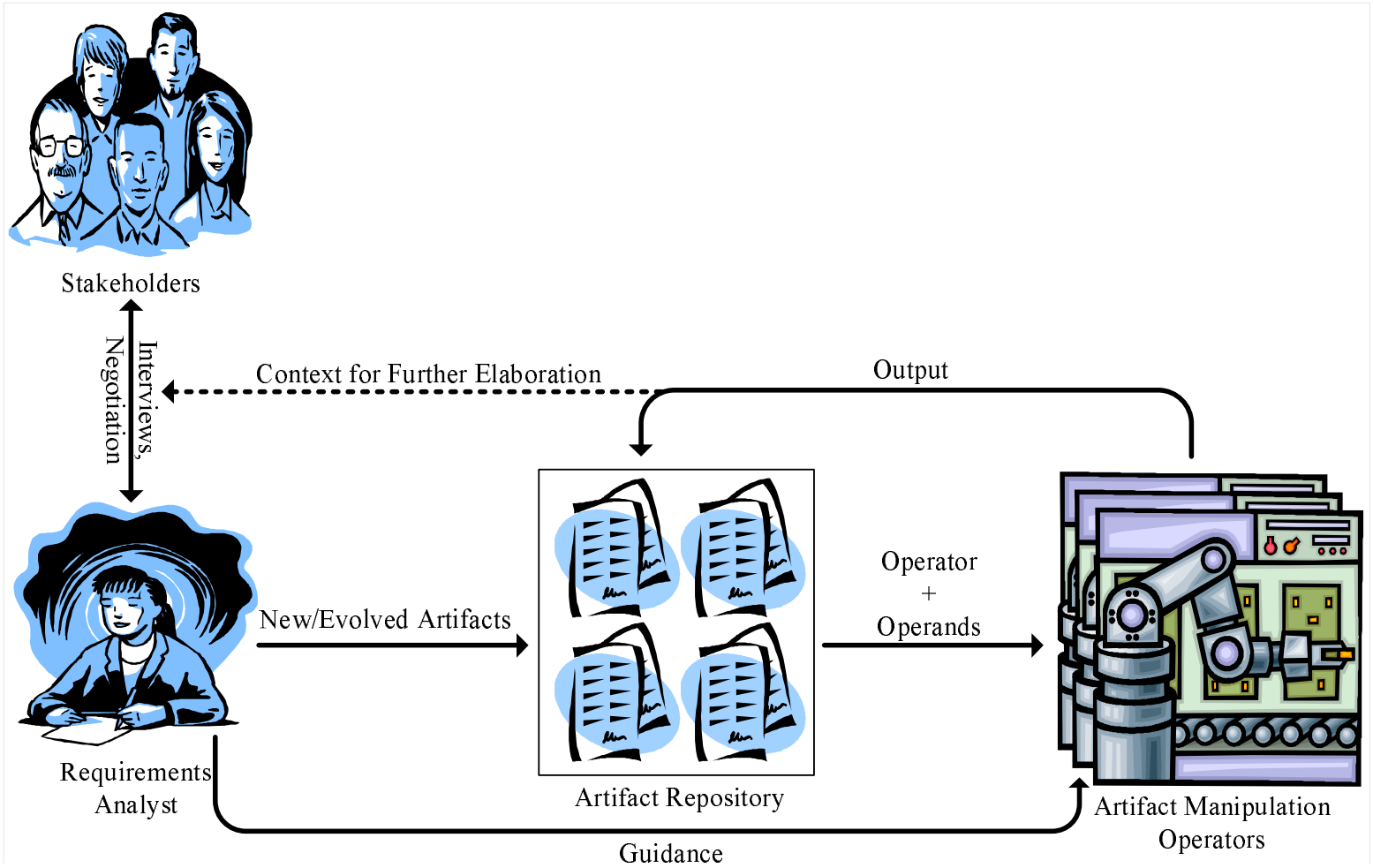
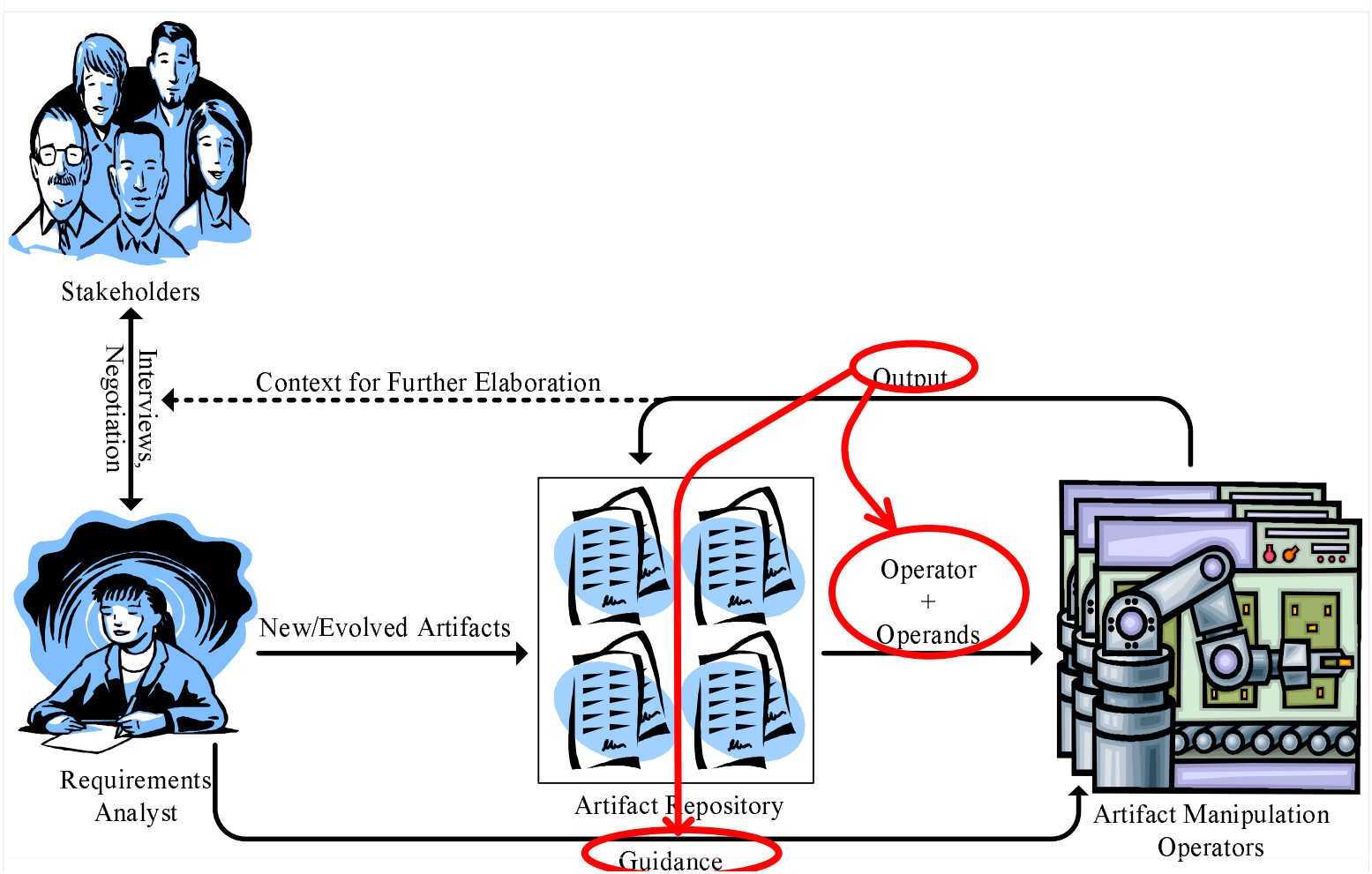
Synopsis


Stakeholders
Interviews,
Negotiation
Context for Further Elaboration
Output
New/Evolved Artifacts
Operator
+
Operands
Requirements
Analyst
Artifact Repository
Artifact Manipulation
Operators
Guidance

Synopsis



➜ **Problem: Traceability from the output of an operator to its input**

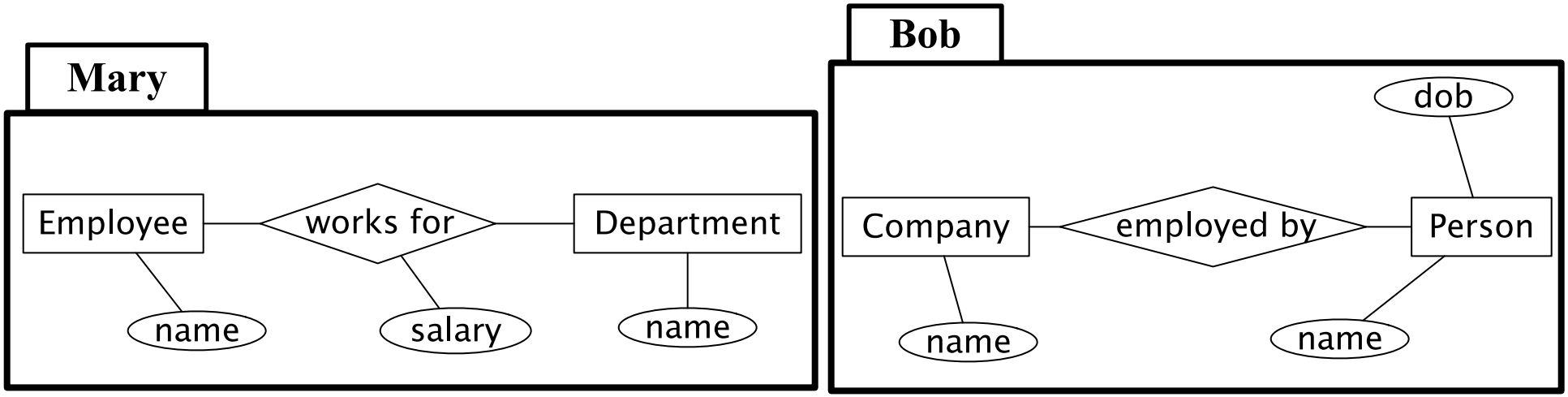
Model Management

➜ What is model management?

- ➥ Keeping track of model interrelationships and providing a set of model manipulation operations
  - ➤ **Idea:**
    - ➠ Capturing conceptual data using independent but interrelated units
    - ➠ Describing interrelations by explicit mappings
  - ➤ **Major operations:**
    - ➠ Matching: finding correspondences between models
    - ➠ Differencing: finding discrepancies between models
    - ➠ Merging: consolidating models w.r.t. known relationships between them

Traceability in Viewpoint Merging

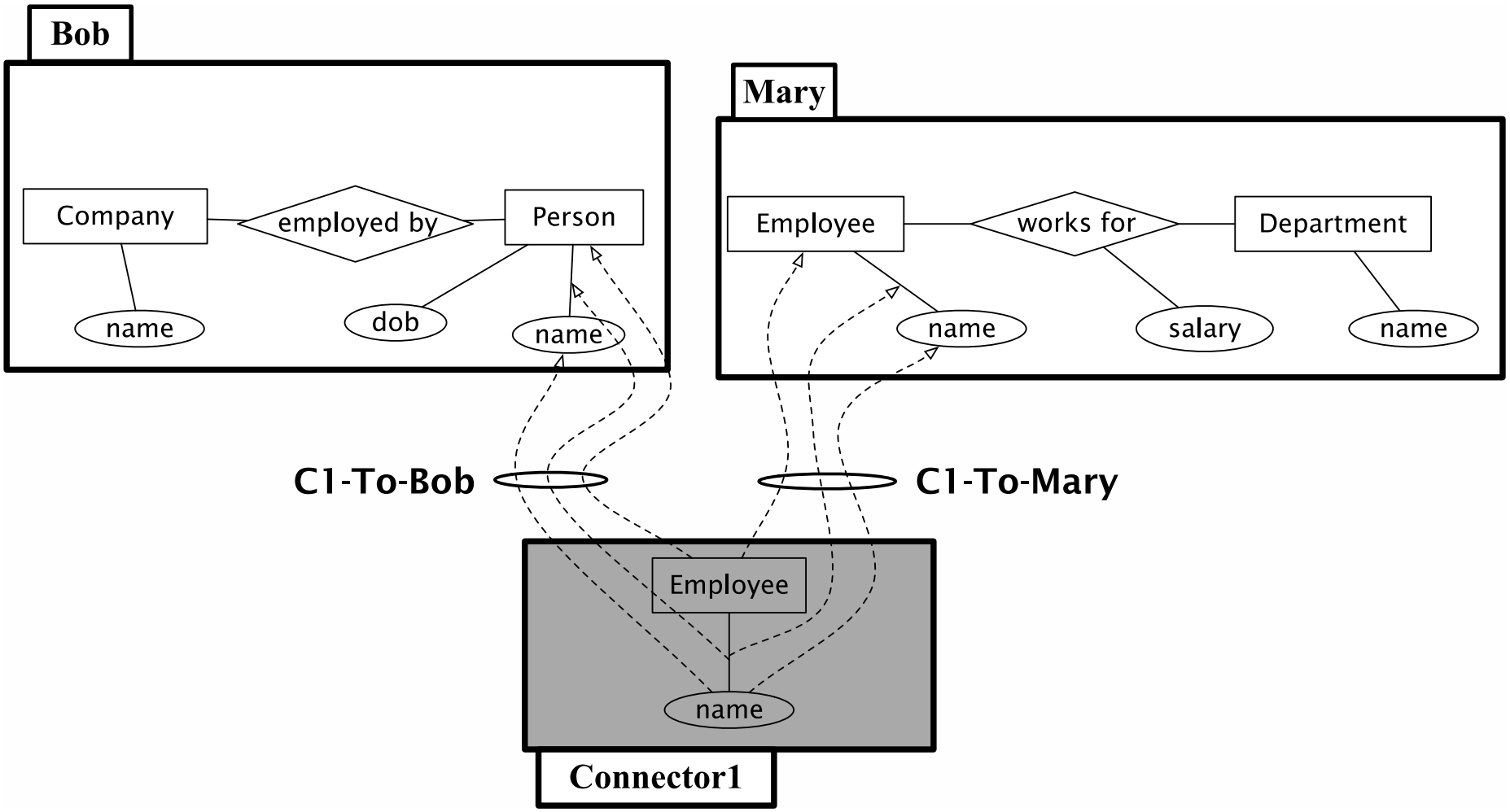
➜ **Example: Merging ER Viewpoints**



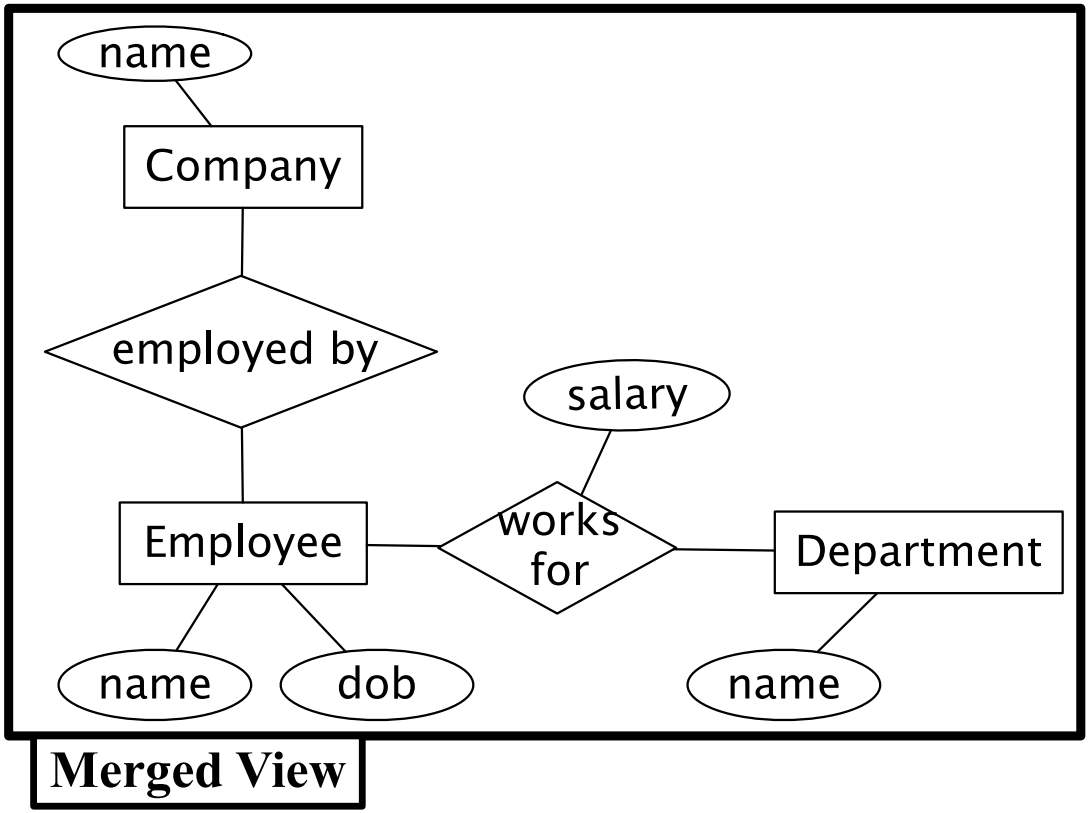
(i) (ii)

Initial viewpoints of Mary and Bob

First Merge Attempt



The Merged Viewpoint



➜ **Concern I (origin traceability):**

➥ Where did each element originate from?

Tracking Correspondence Assumptions

- Viewpoints evolve over time
  - **hence, merge scenarios may get more complex**
  - **. . . and assumptions about correspondences may be scattered across several mappings**

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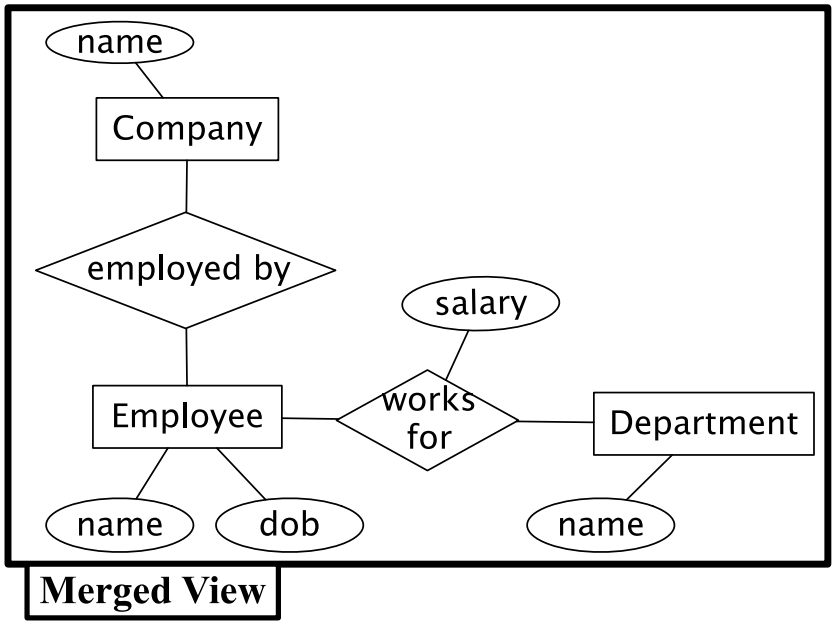
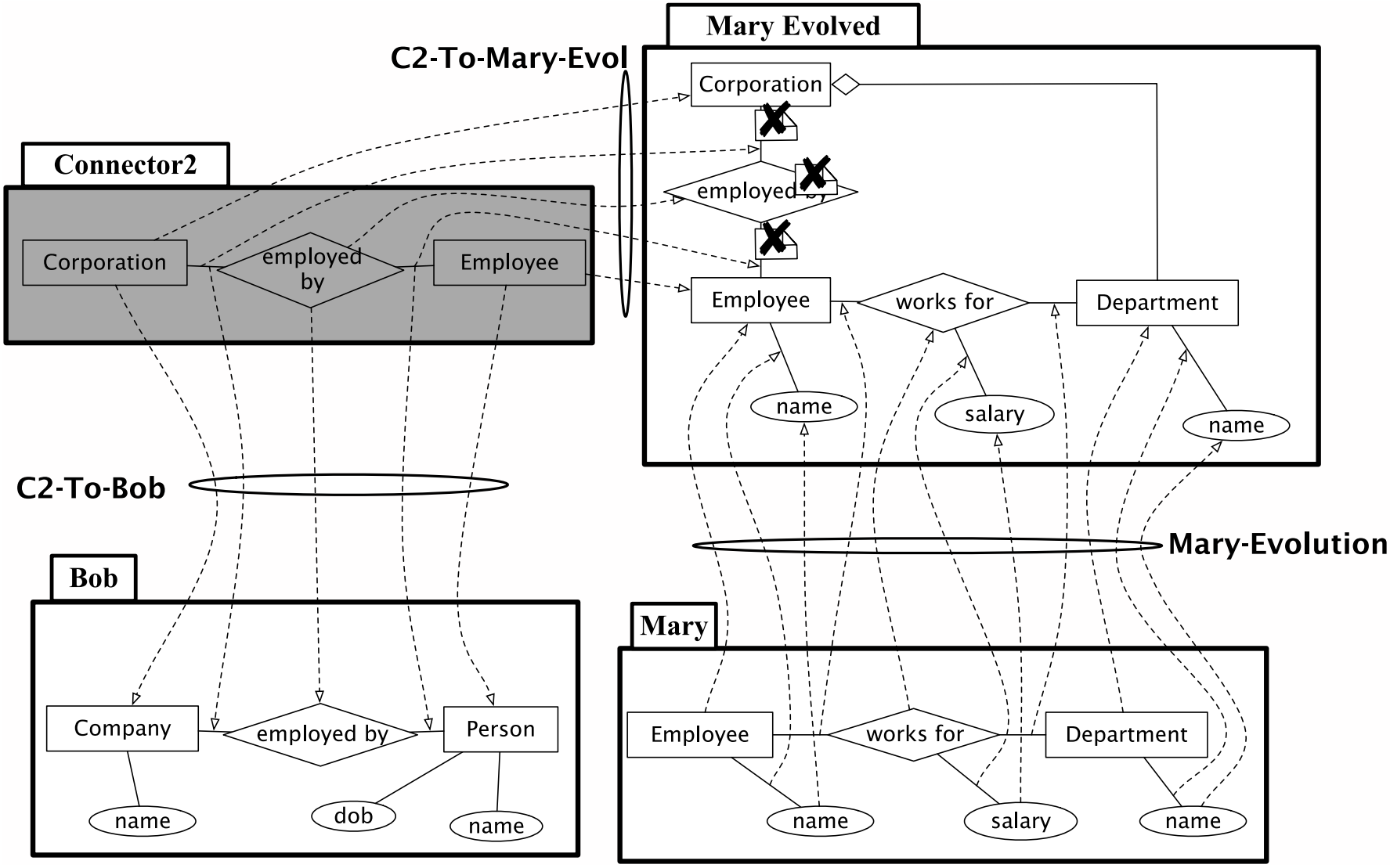
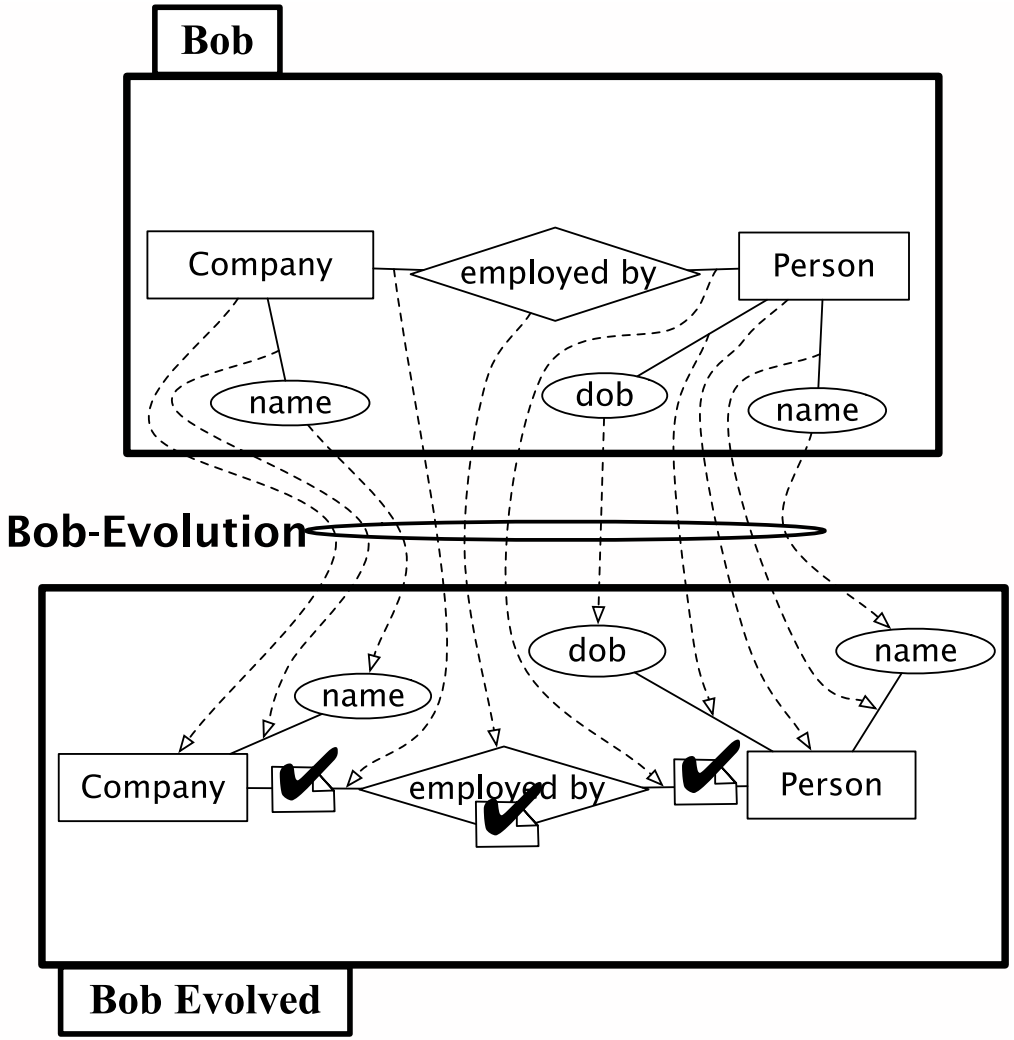


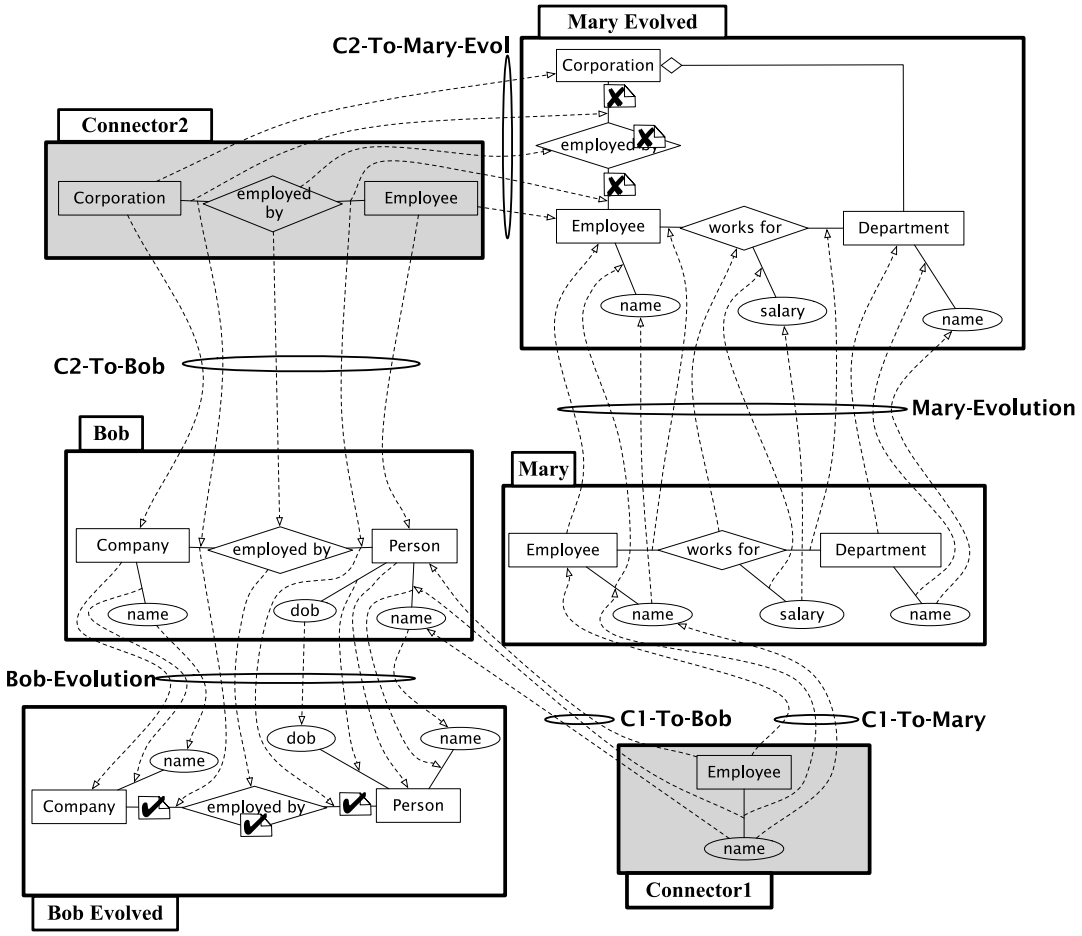
Evolution – Part I



Evolution – Part II



The New Merge Hypothesis



➜ **Concern II (assumption traceability):**

➥ What correspondence assumptions were involved in each unification?

The Merge Algorithm

➜ **Theory:**

- Based on an algebraic concept called colimit
  - **Colimits combine a set of models w.r.t. to their relationships as defined by a set of mappings**

➜ **Main idea of the algorithm:**

- Assume all model elements are distinct
- Unify elements deemed equal by the mappings

Merging Sets

$$A = \{x, y, w\} \qquad B = \{x, y, t\}$$

$$C = \{z, w\}$$

The given interconnection diagram

Merging Sets

$$A = \{x, y, w\} \qquad B = \{x, y, t\}$$

$$C = \{z, w\}$$

$$w_C$$

$$x_A \qquad y_A \qquad w_A \qquad x_B \qquad y_B \qquad t_B$$

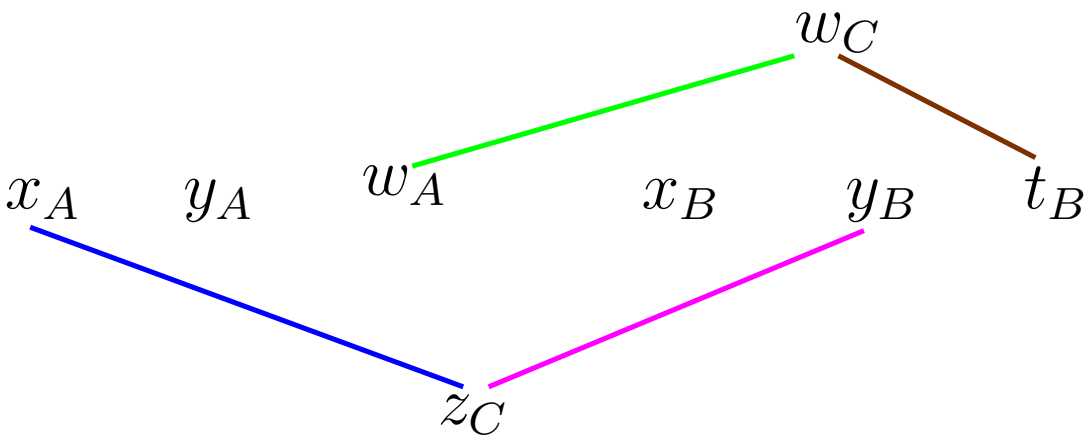
$$z_C$$

Compute the disjoint union

Merging Sets

$$A = \{x, y, w\} \qquad B = \{x, y, t\}$$

$$C = \{z, w\}$$



Connect up the related pairs
(This yields a unification graph)

Merging Sets

$$A = \{x, y, w\} \qquad B = \{x, y, t\}$$

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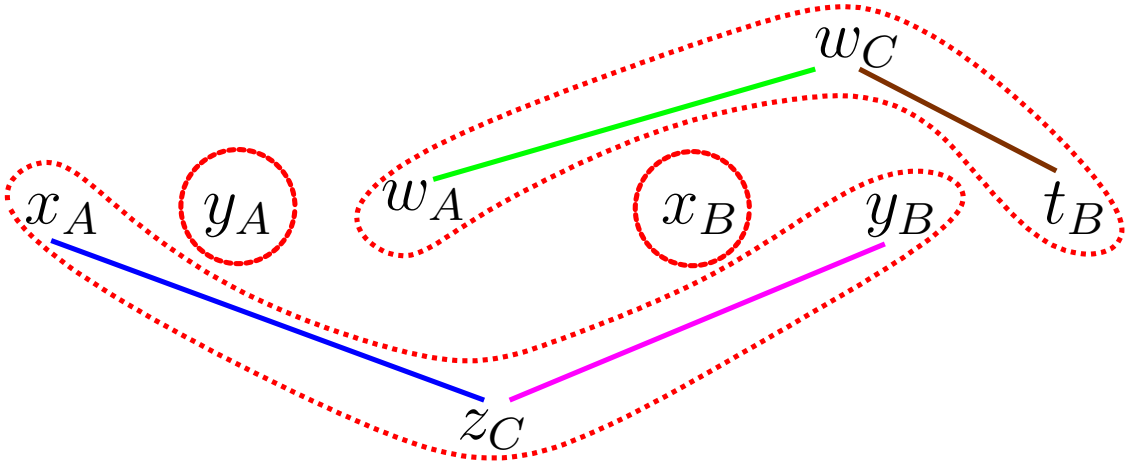


Find the connected components

Generating Traceability Links

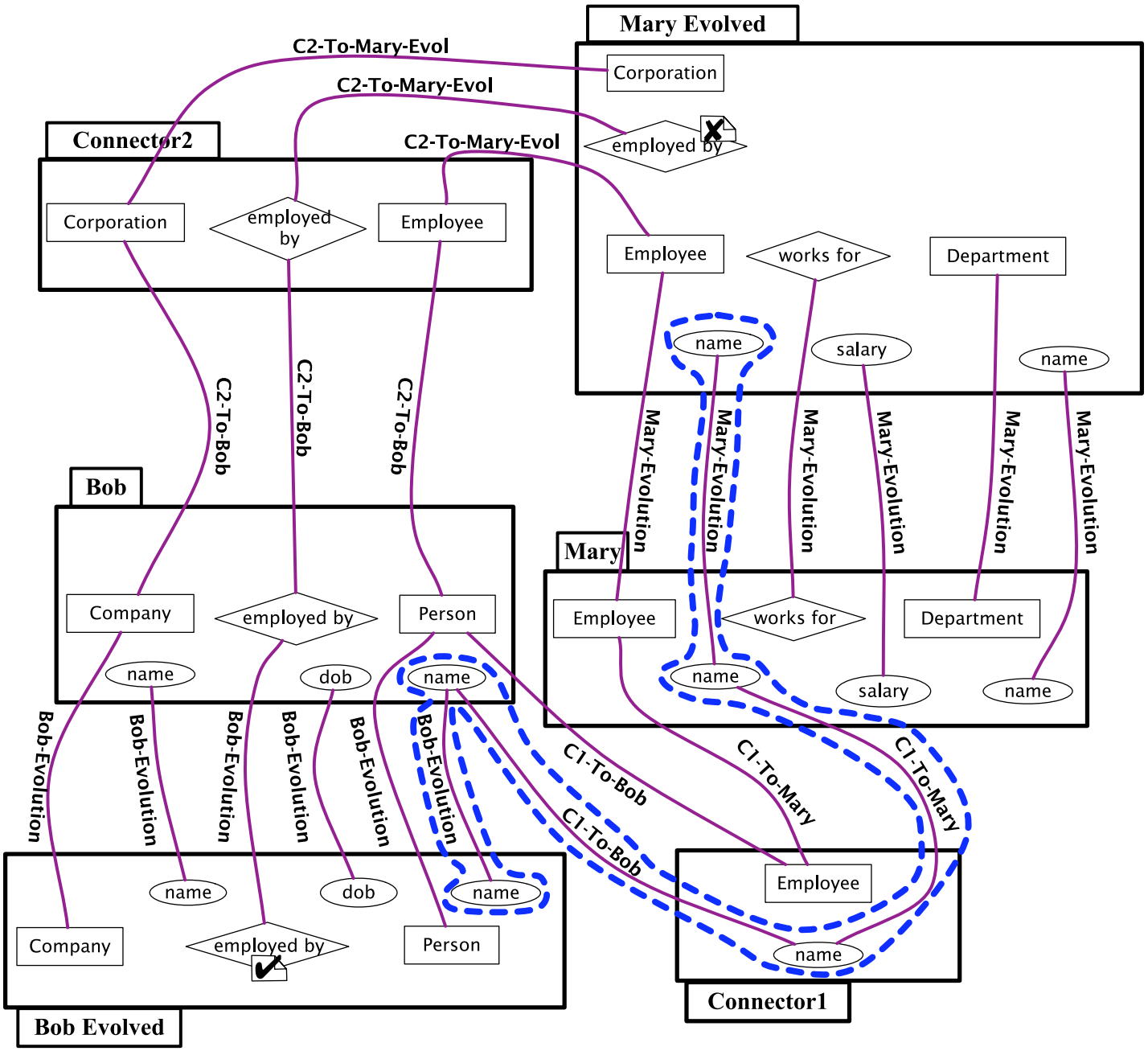
➜ Origin Traceability

- ➥ For each merged element, the set of nodes in the connected component corresponding to the element

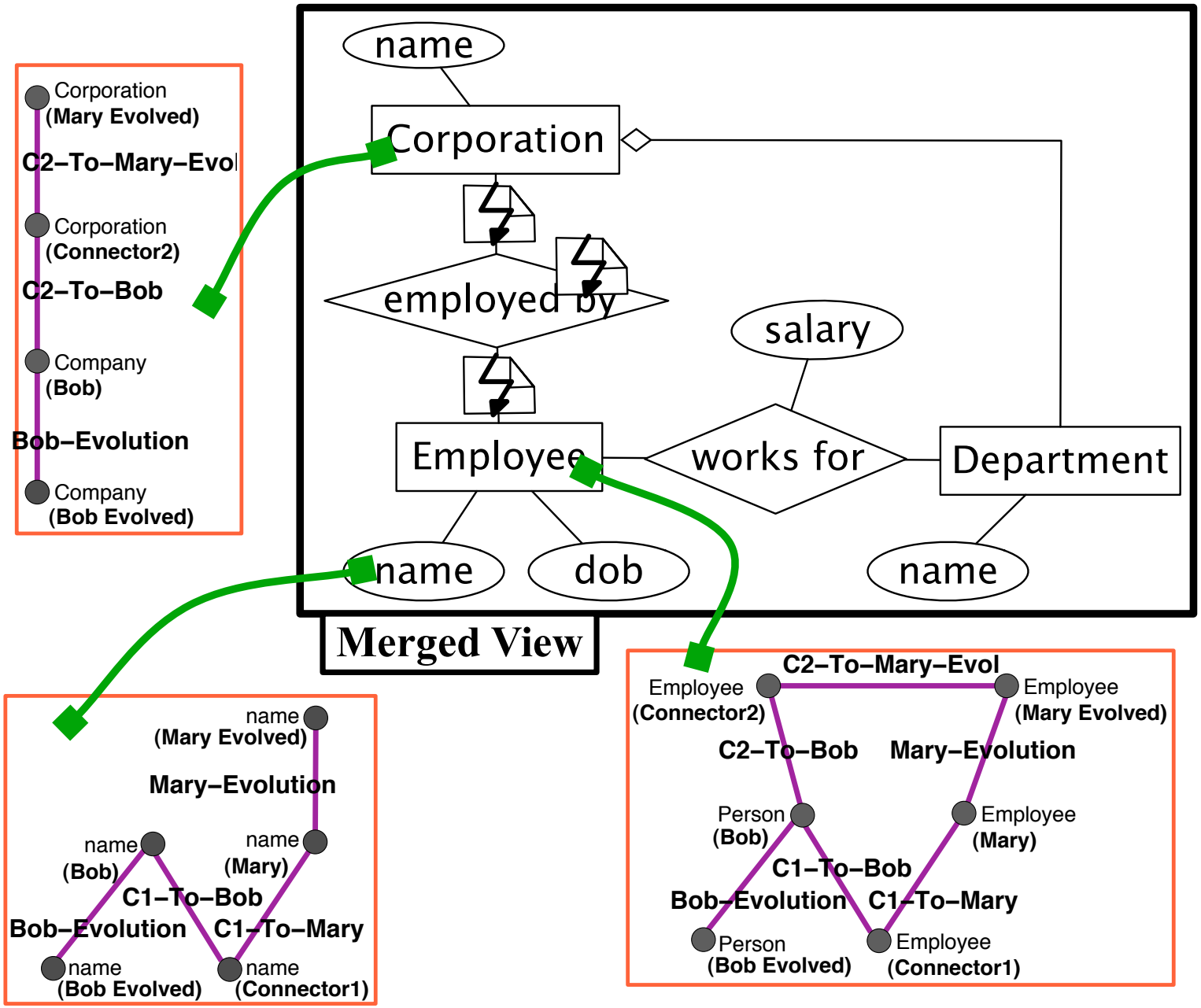
➜ Assumption Traceability

- ➥ Problem: we did not keep track of which mapping induced each edge in the unification graph
  - ➤ **Need to label each edge in the unification graph with the name of the mapping that induces it**

Unification Graph Example



Stored Traceability Links



Recap

➜ Summary

- ➥ **A traceability framework for viewpoint merging**
  - ➤ **independent of any particular modeling language**
  - ➤ **scalable to arbitrary number of viewpoints and mappings**

➜ Limitations and weaknesses

- ➥ Mappings are purely syntactic
  - ➤ **. . . hence, semantics-based traceability concerns need to be addressed separately**

Future Work

- Extending our viewpoint merging tool to:
  - **generate and visualize traceability links**
  - **support model-to-model navigation**
- Doing further experiments to surface other potential traceability concerns in viewpoint merging
- Exploiting traceability links for adaptive analysis of viewpoints
  - **Simple examples include: filtering and layout of the merges based on traceability data and stakeholders' preferences**

Thank You!

Questions?