



软件工程
国家重点实验室(武汉大学)
STATE KEY LAB OF SOFTWARE ENGINEERING (WUHAN UNIVERSITY)

MFI-3 Ontology Evolution Metamodel

HE Keqing ,HE Yangfan
SKLSE, Wuhan University
2007,12

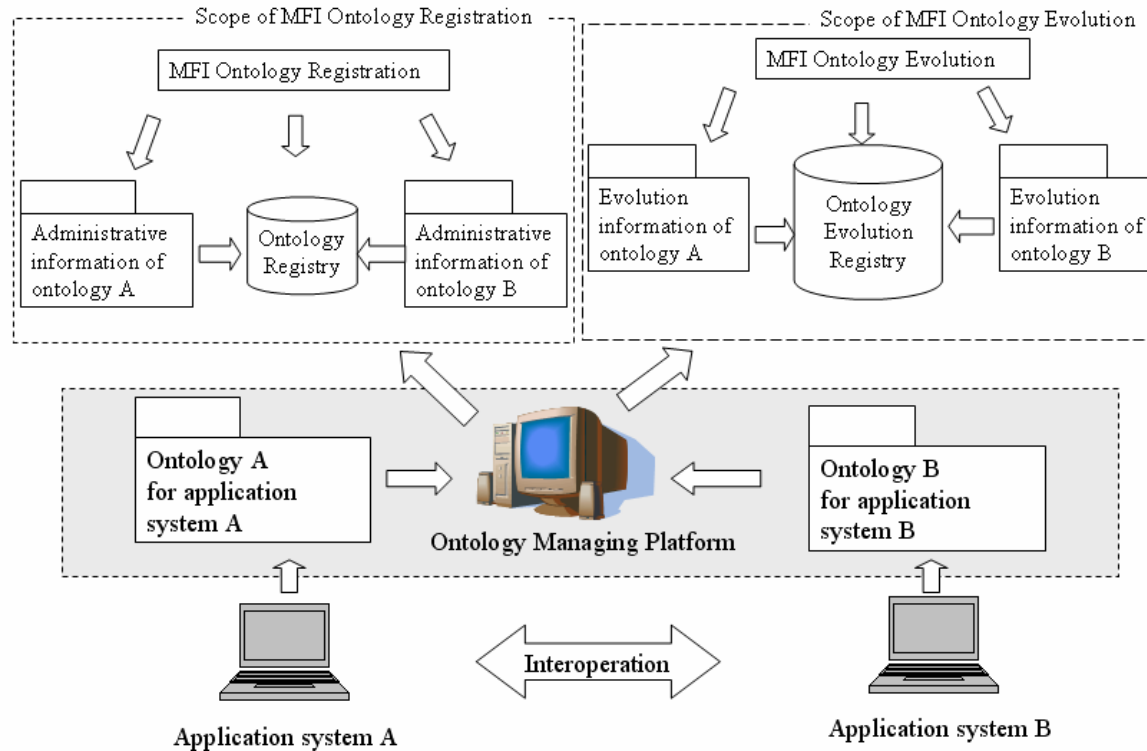
Content

- Our proposal
- Relationship between Masao's proposal and ours

Ontology Evolution

- Ontology explicitly express the meaning of concepts in a specific domain.
- Possible reasons for ontology evolution
 - For ontology based info systems, when application domains and user's needs are changing...
- Ontology evolution is the timely adaptation of an ontology and the consistent propagation of the changes to dependent artifacts .

Scope of MFI Ontology Evolution



- Comprehensive ontology management
 - ontology registration
 - ontology evolution
 - ontology mapping
 - ...
- MFI-3 2nd edition
 - provide facilities to record the key information during ontology evolution process

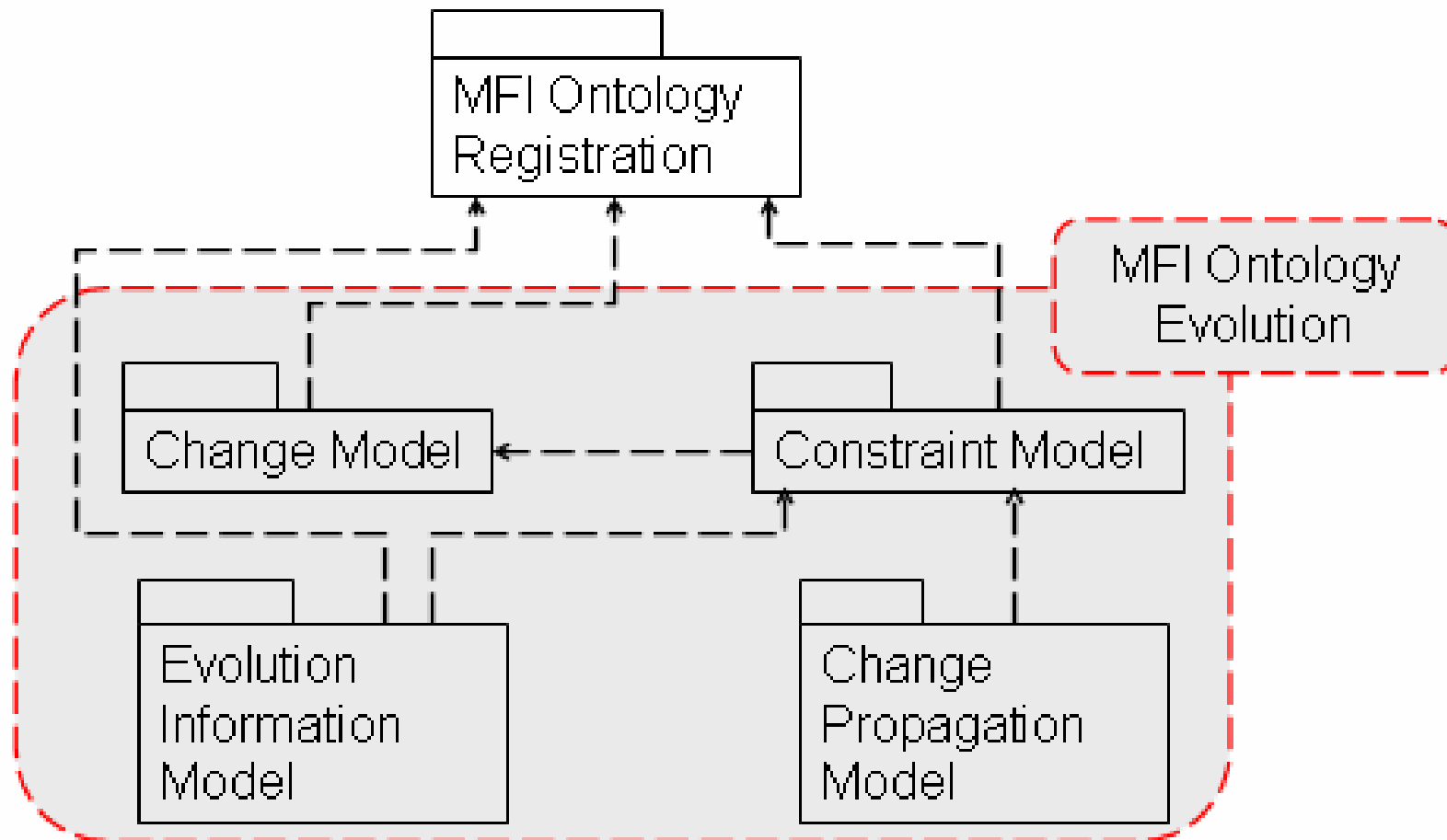
Key Problems

- How to registrate ontologies?
- What kind of change can be identified and described by MFI-3?
- How to realign the dependent ontologies during the evolution process?
- How to keep the evolution information about ontologies

Our Solution (1/2)

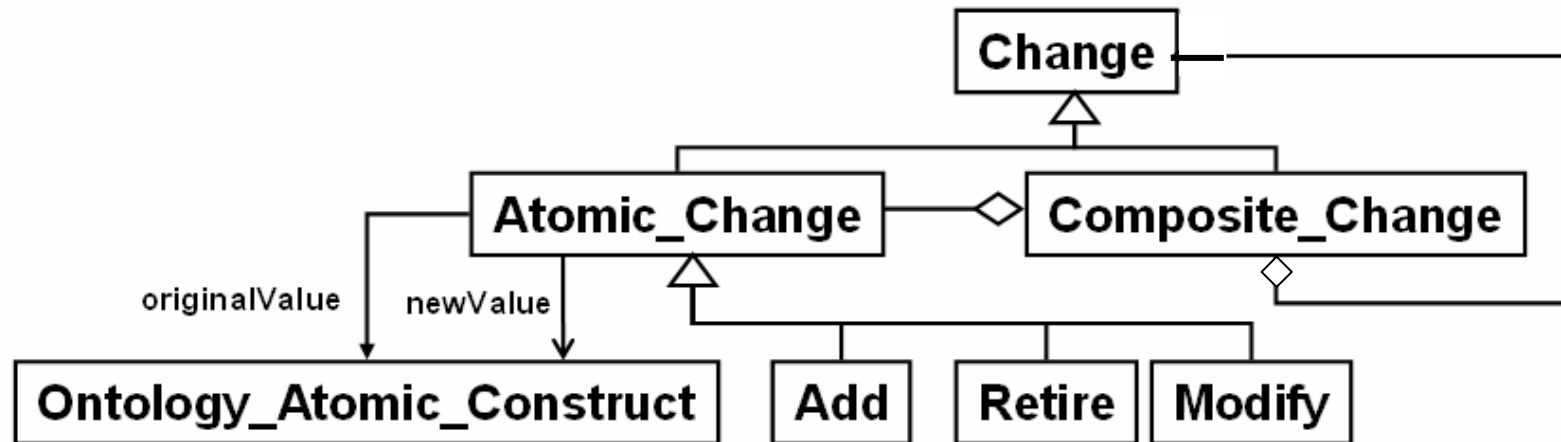
- How to registrate ontologies? **1st Edition**
- What kind of change can be identified and described by MFI-3? **Change Model**
- How to realign the dependent ontologies during the evolution process? **Constraint Model**
- How to keep the evolution information about ontologies **Change Propagation Model**
- How to keep the evolution information about ontologies **Evolution Information Model**

Our Solution (2/2)



Change Model

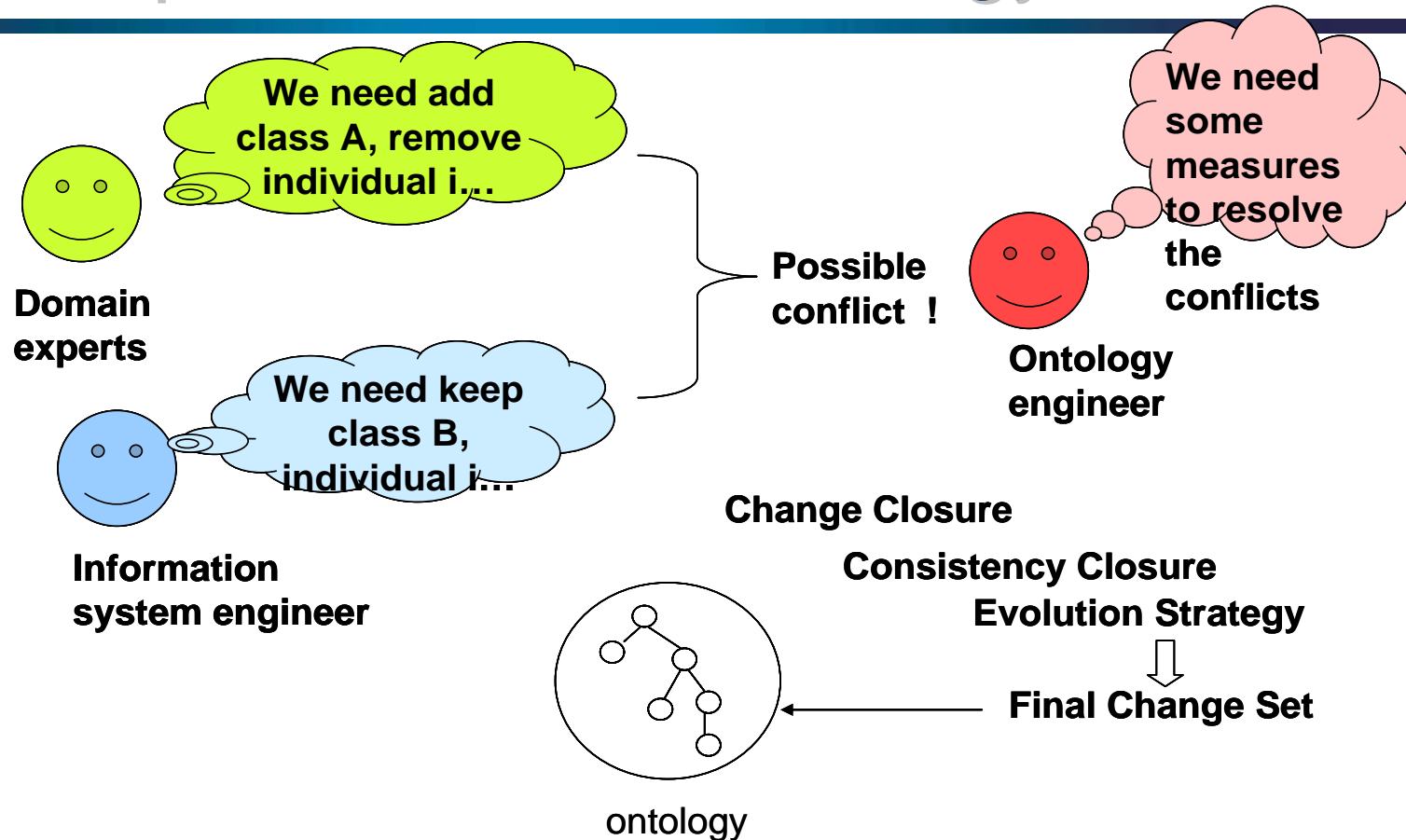
Change Model



- Two types of changes
 - atomic change and composite change
 - composite change can be decomposed of a consequence of atomic changes
- Atomic change
 - applied on ontology atomic construct
 - 3 basic types
 - ◆ add, retire, modify

Constraint Model (1/9)

Requirements for ontology evolution



- Ontology represent people' s common understanding of a domain
 - multiple stake holders
 - domain experts, onto-based info system users, ontology engineers
 - Possible conflict between requirements
 - ◆ some ask for change, some argue for consistency
 - ◆ need to express, analyze and harmanize them
 - closure, strategy ...

Constraint Model (2/9)

Basic resolution provided by MFI-3

- Requirements about **changes**
 - Usually proposed by domain experts
 - Incomplete → **Change Constraint** → **Change Closure**
- Requirements about **consistency**
 - Usually proposed by information system* engineer
 - Incomplete → **Consistency Constraint** → **Consistency Closure**
- Possible conflict between various requirements
 - **Evolution Strategy**

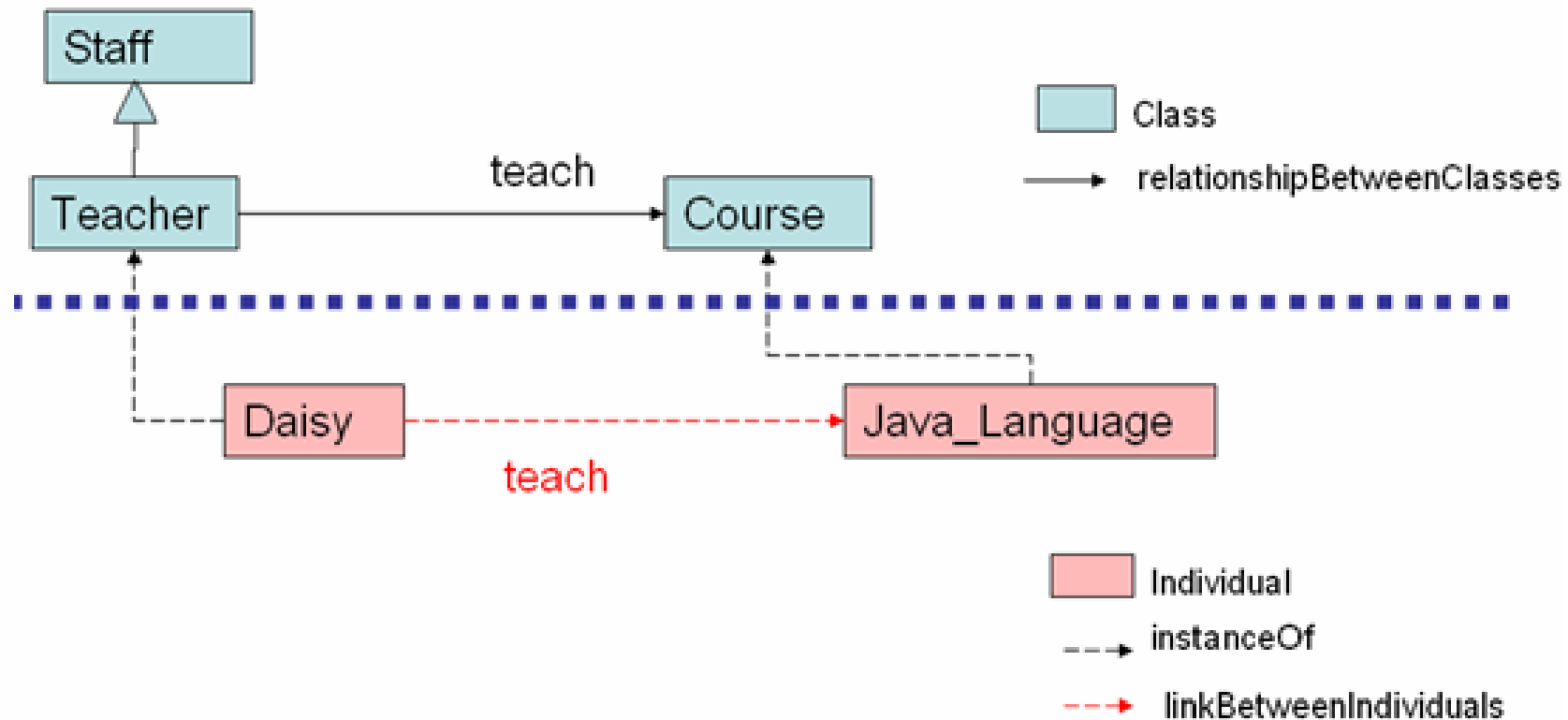
*Ontology based information systems

How to get Constraints

- **Ontology Metamodel**
 - **Consistency_Constraint**
 - ▣ designating the dependency between
Ontology_Atomic_Constructs
 - **Change_Constraint**
 - ▣ designating the dependency between Changes

Constraint Model(4/9)

An example-Ontology



Daisy is a teacher and she teaches Java_Language

An example-Change

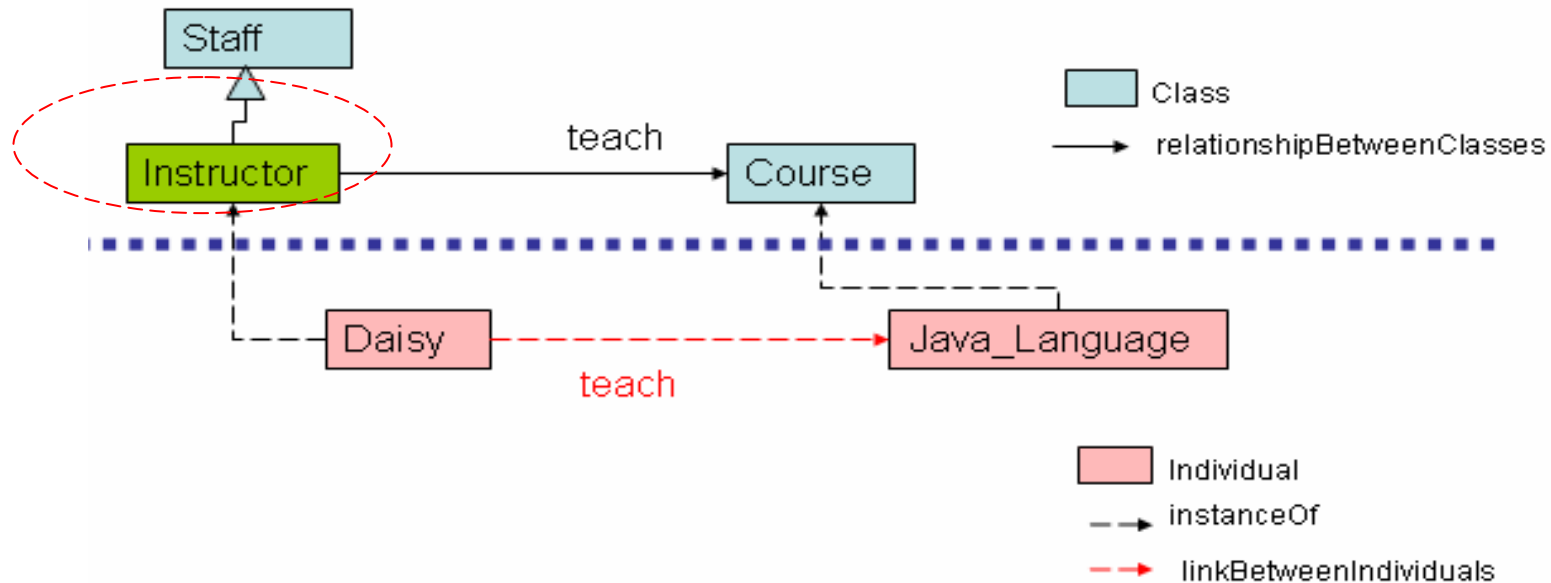
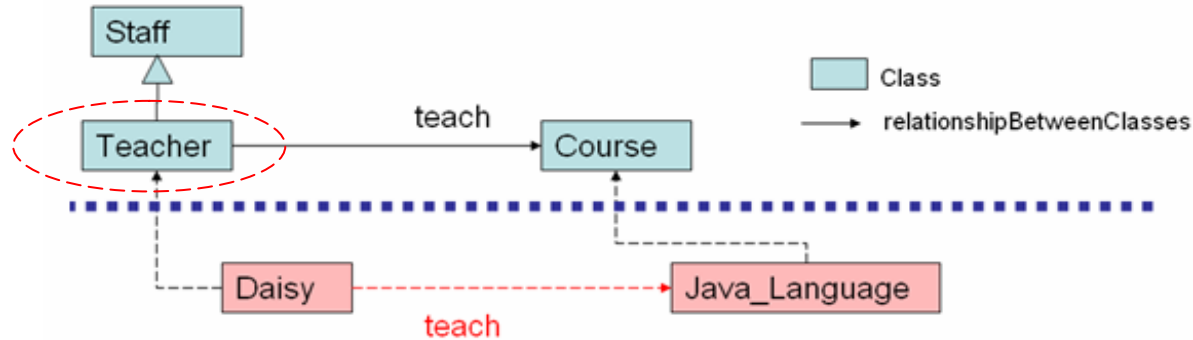
- Change_Constraint
 - `<Retire(Individual),Retire(instanceOf(Class,Individual))>`
 - `<Retire(Individual),Retire(Link(Individual,Individual))>`
- User_Requested_Change
 - `{Retire(Daisy)}`
- Change_Closure
 - `{Retire(Daisy),`
 - `Retire(instanceOf(Teacher,Daisy)),`
 - `Retire(teach(Daisy,Java_Language))}`

An example-Consistency

- Consistency_Constraint
 - $\langle \text{Individual}, \text{instanceOf}(\text{Class}, \text{Individual}) \rangle$
 - $\langle \text{Individual}, \text{link}(\text{Individual}, \text{Individual}) \rangle$
- User_Requested_Consistency
 - {Java_Language}
- Consistency_Closure
 - {Java_Language, Course, $\text{instanceOf}(\text{Course}, \text{Java_Language})$ }

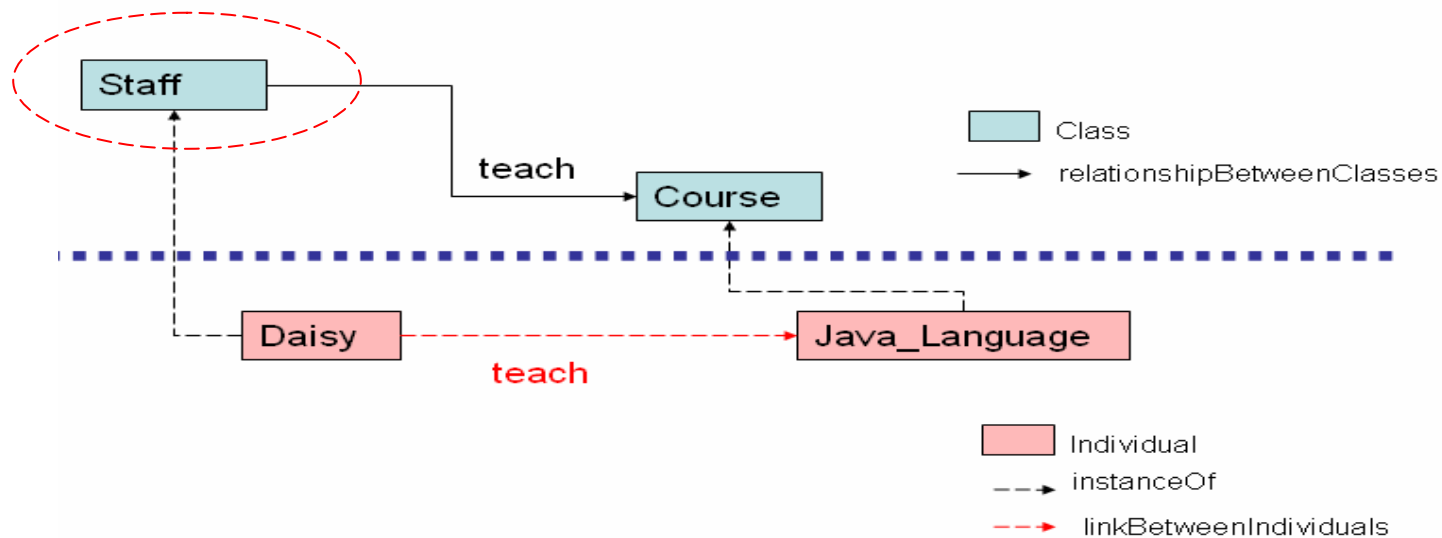
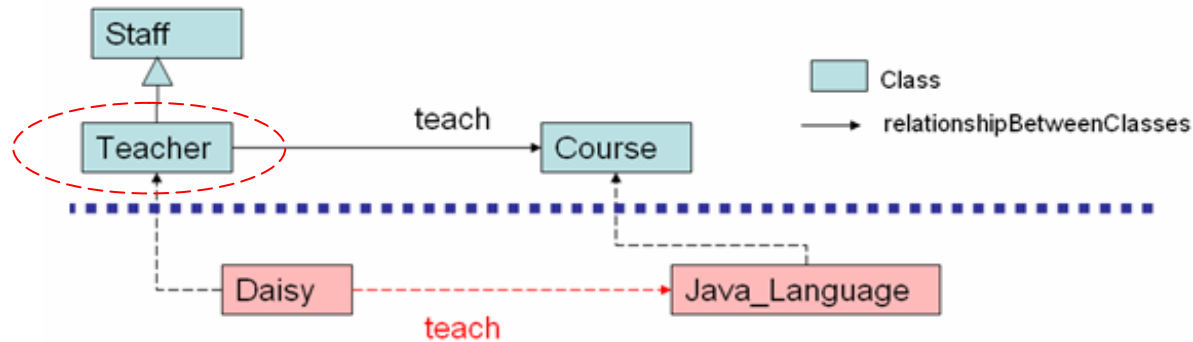
Constraint Model(7/9)

An example-Evolution Strategy 1/2



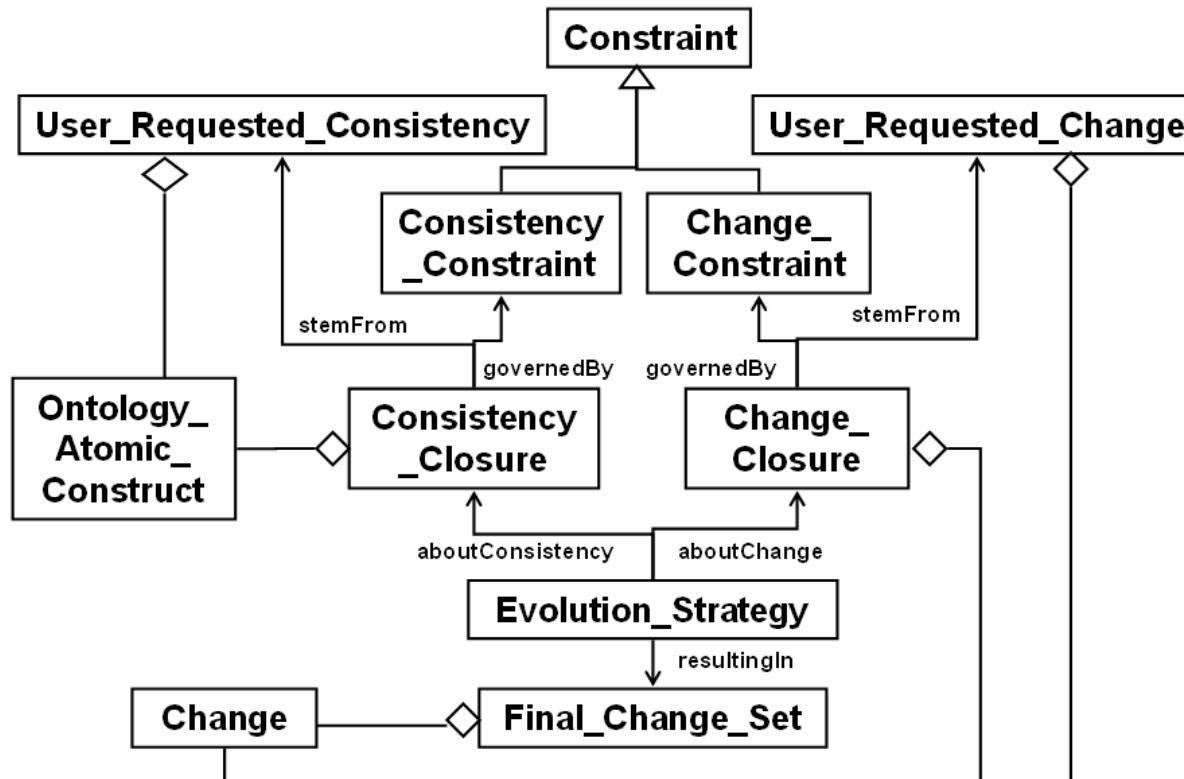
Constraint Model(8/9)

An example-Evolution Strategy 2/2



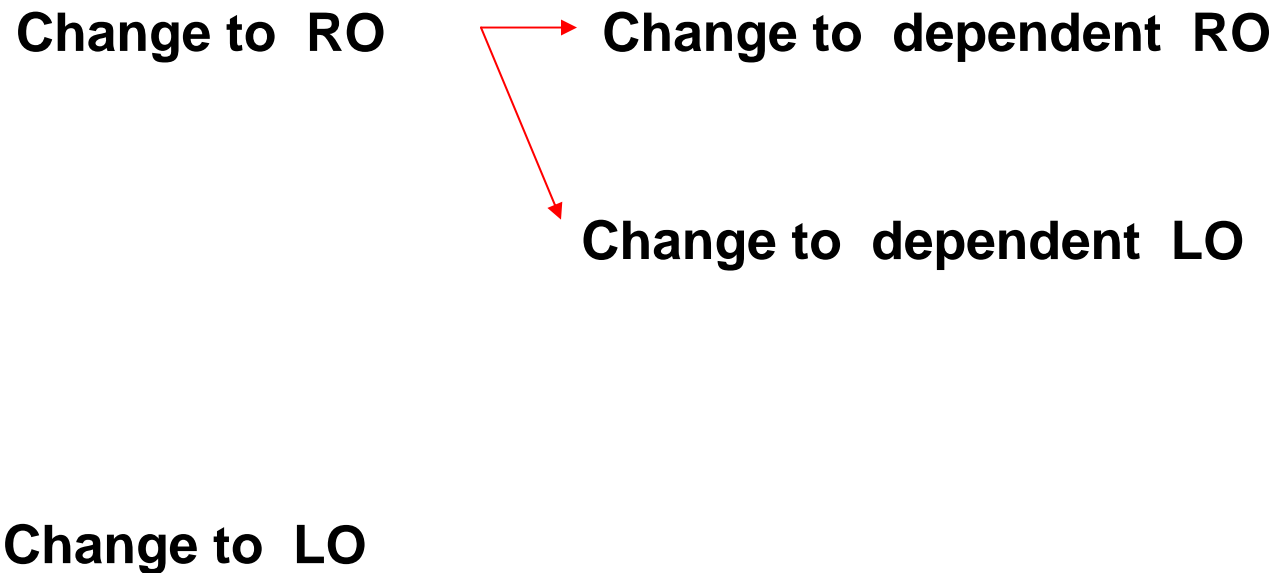
Constraint Model(9/9)

Constraint Model



- Two kinds of constraints
 - consistency constraint and change constraint
 - both of them based on the metamodel of ontology
- Closure is calculated based on constraints
- Evolution strategy
 - used to harmonize change and consistency requirements

Change Propagation

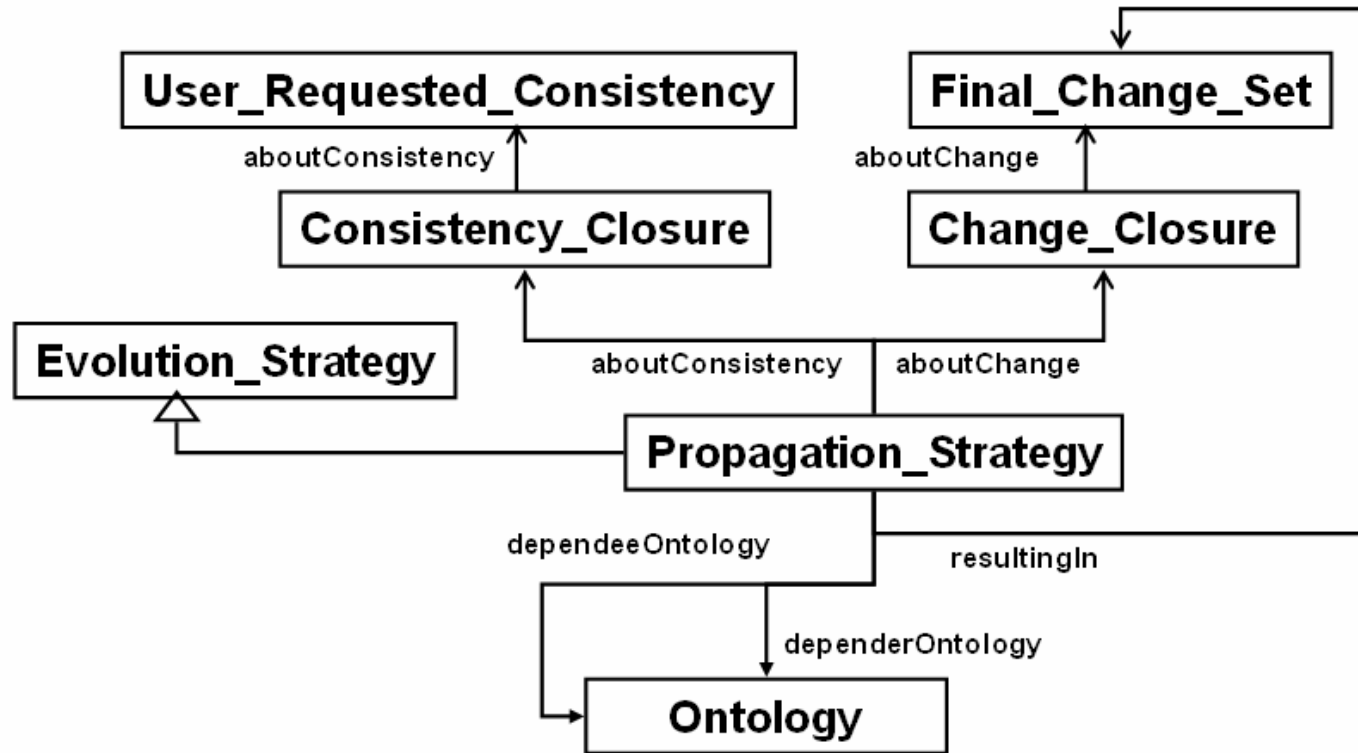


Note:

RO:Reference Ontology

LO:Local Ontology

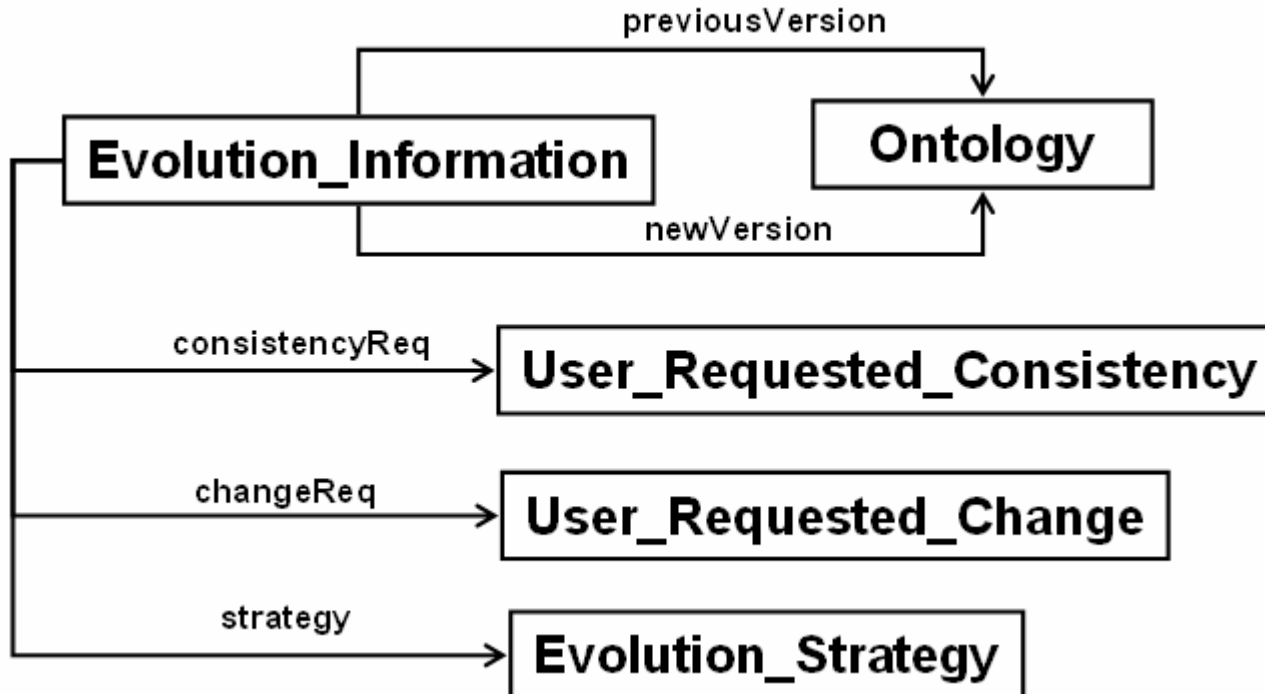
Change Propagation Model



- Change Propagation Model
 - metadata for the process to propagate changes to dependent ontologies
 - propagation strategy
 - ◆ similar to evolution strategy
 - Final change set
 - ◆ similar to user requested change

Evolution Info Model

Evolution Information Model

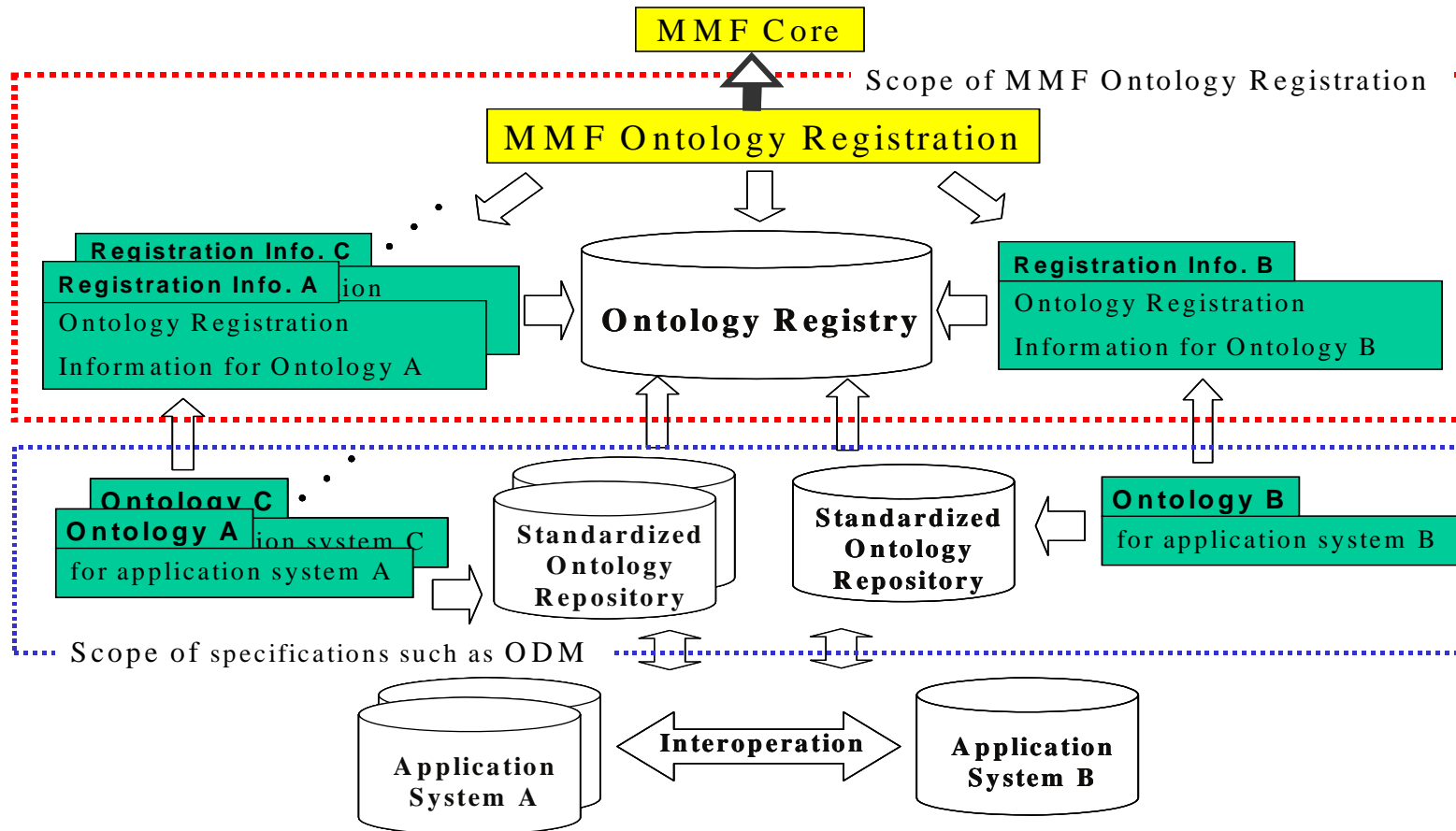


- Evolution Information Model
 - key information about information process
 - use some metaclasses in the other models

Content

- Our proposal
- Relationship between Masao's proposal and ours

Scope of MFI Ontology Registration



■ Generic

- Independent on Language specific details
 - ▣ MFI-3 1st edition does not support different versions of ontology
 - ▣ Several ways to show the difference of different versions
 - ✓ All should be supported in MFI-3 2nd edition
- Version control is one issue that matters in the ontology evolution process
- There are many others, we list out some of them tentatively
 - ▣ Several issues→several models
 - ✓ May be too much to be added all together
 - ✓ merge some, discard some... Step by step,
 - ✓ Find our the priority between these issues
 - ✓ Version control as the 1st one to be handled?

Our viewpoint of MFI-3 2nd edition

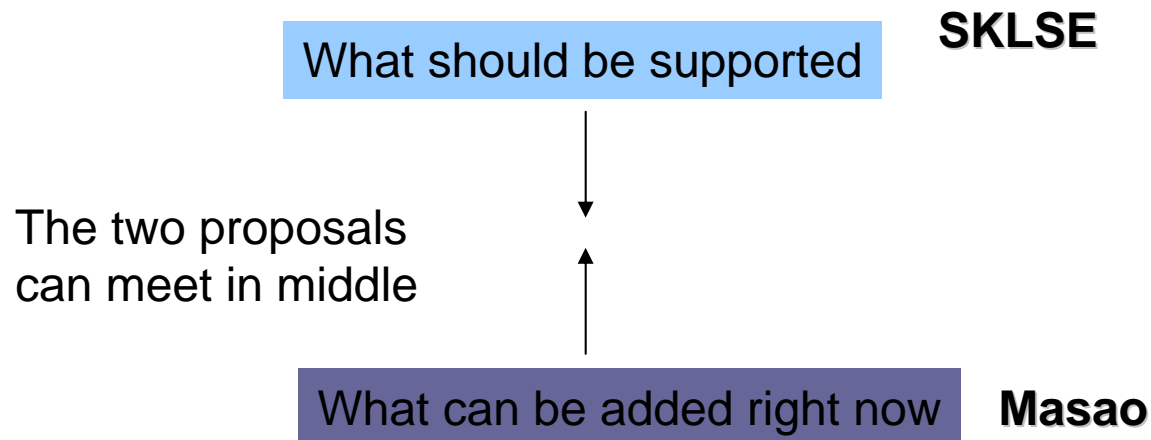
- Based on our vision of the development direction of Semantic Web
 - Trustability
 - Key issue in network era
 - RO-LO
 - Need more detailed change management facility
 - ✓ Adding some evolution related metadata is a must for this task
- Based on our vision of the role ontology plays in networked software
 - Personalized requirement
 - Many stake holders
 - Possible conflict requirement
 - Quicker info-system forming and adaptation
 - Ontology changes more frequently
- Influenced by the other initiatives like Inference Web

Our proposal

- Top down
 - ▣ What should be supported
 - ✓ Add some metadata
 - ✓ Decompose them into related models
- Problem
 - ▣ All these issues are needed for ontology evolution?
 - ✓ Any more issues?
 - ▣ Is the decomposition good enough?
 - ▣ Can they be expressed with simpler models?

Masao san's proposal

- Bottom up
 - Based on what has been provided by MFI-3
- What can be added right now



Thank You!

hekeqing@public.wh.hb.cn

heyangfan927@163.com

wangchong_w hu@yahoo.com.cn