Bridging the Semantic Gap between Ontology Versions

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Bridging ..

Based on a paper

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Evolving Ontologies

Ontologies Defined

- An ontology is an explicit specification of a conceptualization [Gruber 1993].

- An ontology thus specifies explicitly a representation of a piece of conceptualized knowledge.

Ontologies Evolve

- There are a lot of different revisioning needs for an ontology [Heflin and Hendler 2000]:

  1. Correct errors

  2. Accommodate new information

  3. Adjust the representation of a particular domain

  $\longrightarrow$ a strong need to revise ontologies.

Ontology versions Ov_1 and Ov_2
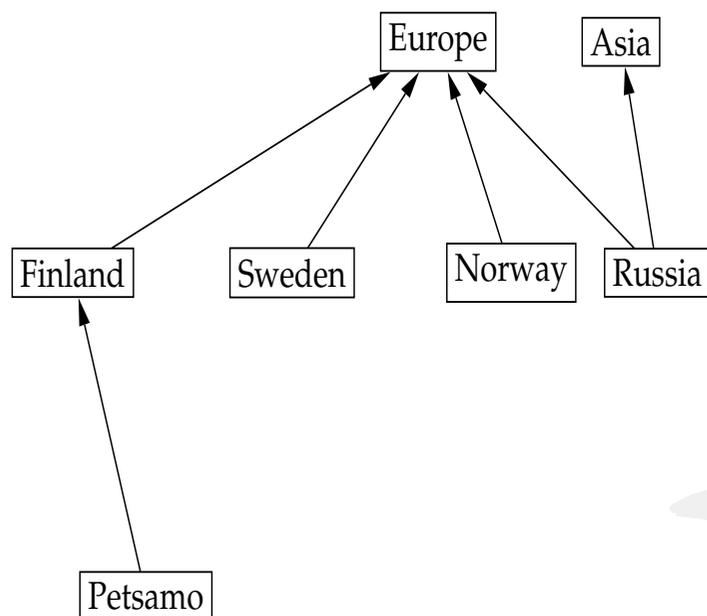
Version Ov_1   **Version Ov_2**
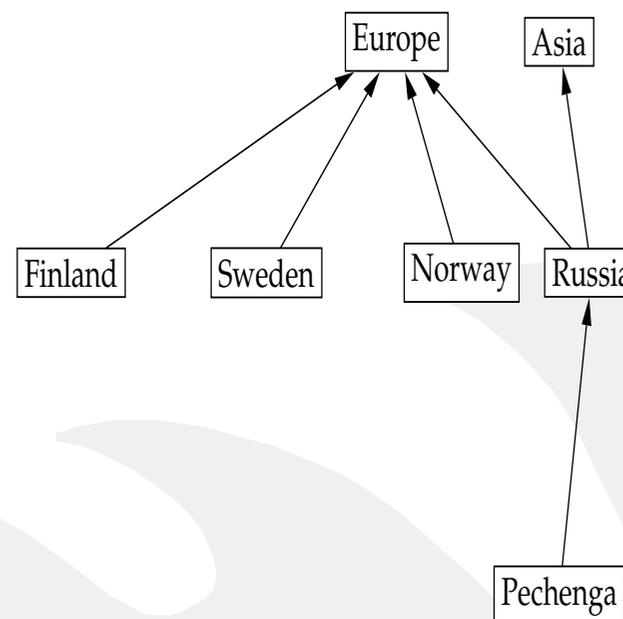

- ■ An ontology before and after the World War II.
  - • The directed edges represent part of -relations.
- ■ How to say this in a Semantic Web ontology?

Change Bridges — The Theory

Change Bridges for Bridging

- A *change bridge* is a mapping between resource sets Rv_1 and Rv_2 of two successive ontology versions Ov_1 and Ov_2, respectively.

- A change bridge defines how Rv_1 relate with Rv_2.

- Change bridges are individuals of different *change bridge classes*.

- If there are many changes between Ov_1 and Ov_2, a set of change bridges called a *version bridge* can be used to express all of them.

Ontology versions Ov_1 and Ov_2
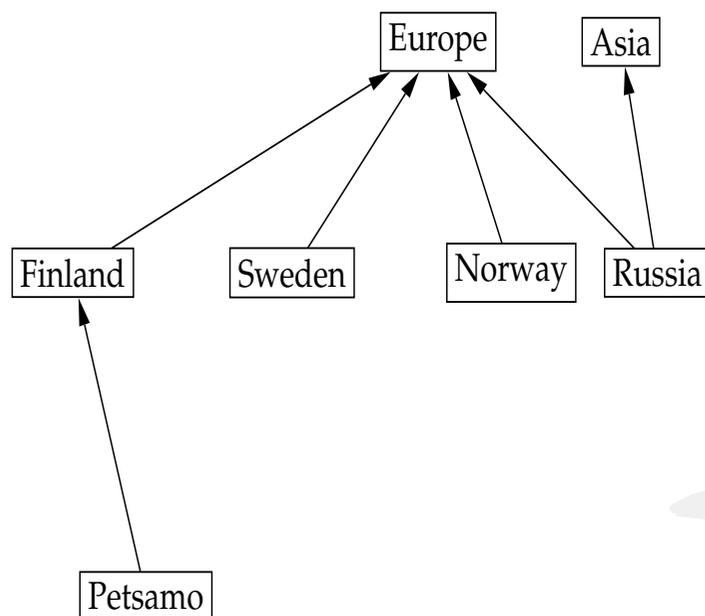
Version Ov_1   **Version Ov_2**
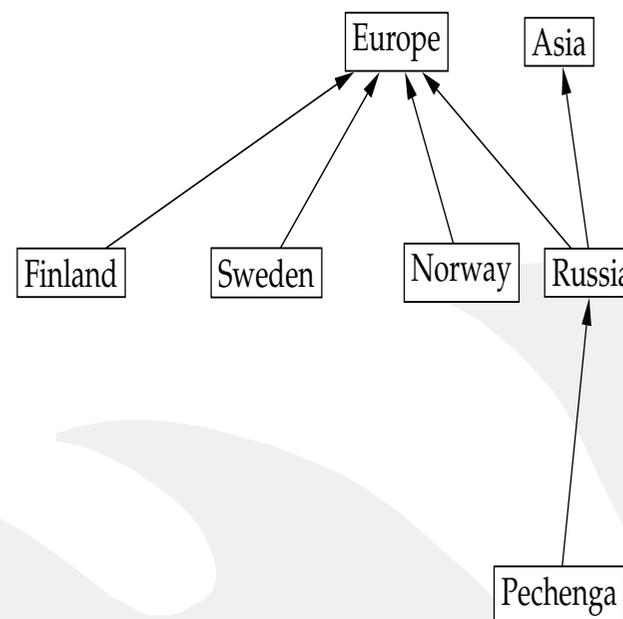
■ Seems that Pechenga used to be Petsamo before year 1944 $\longrightarrow$ a solution: create a change bridge between Petsamo and Pechenga

# An Example: Ov_1 and Ov_2 bridged
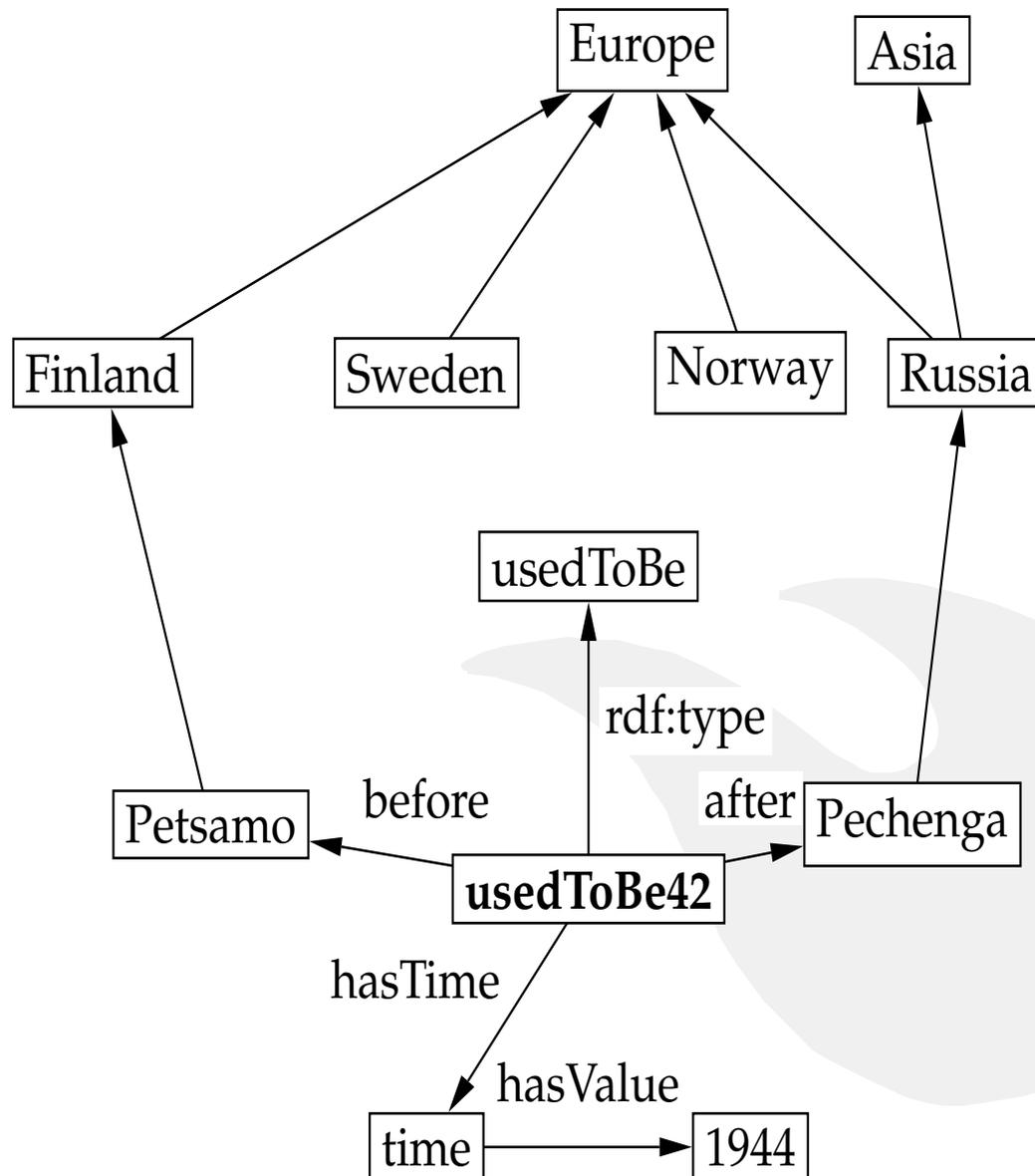
# Identifying Change Bridges

Questions to help identifying the bridges:

- ■ What has changed (in the old version Ov_1)?

- ■ What has it changed into (in the new version Ov_2)?

- ■ How can the change be explicitly expressed as of change bridge between Ov_1 and Ov_2?

- ■ How can the bridge be used to reason about the related concepts?

# Change Bridges — More Examples and about the Usage

An Example – Germanies

An Example – Germanies
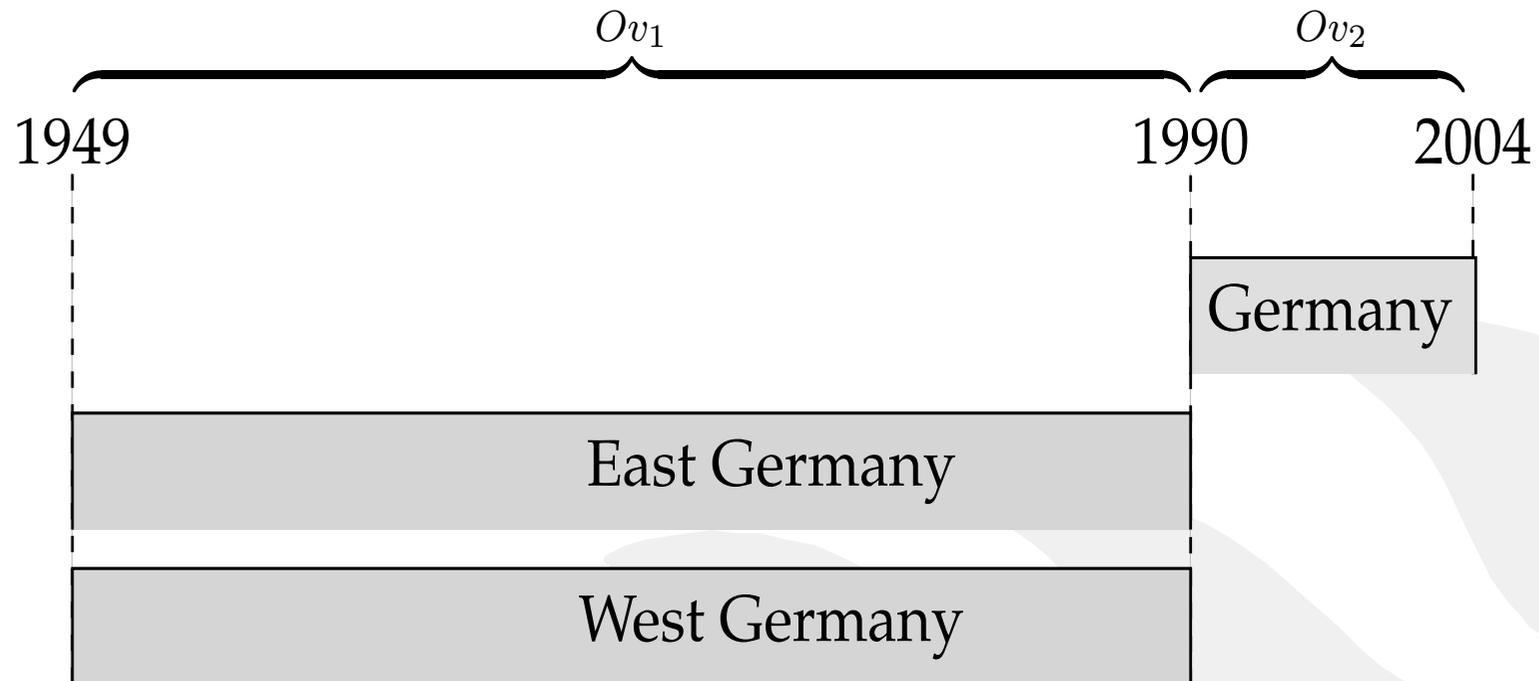
Version Ov_1 Change Bridge   Version Ov_2
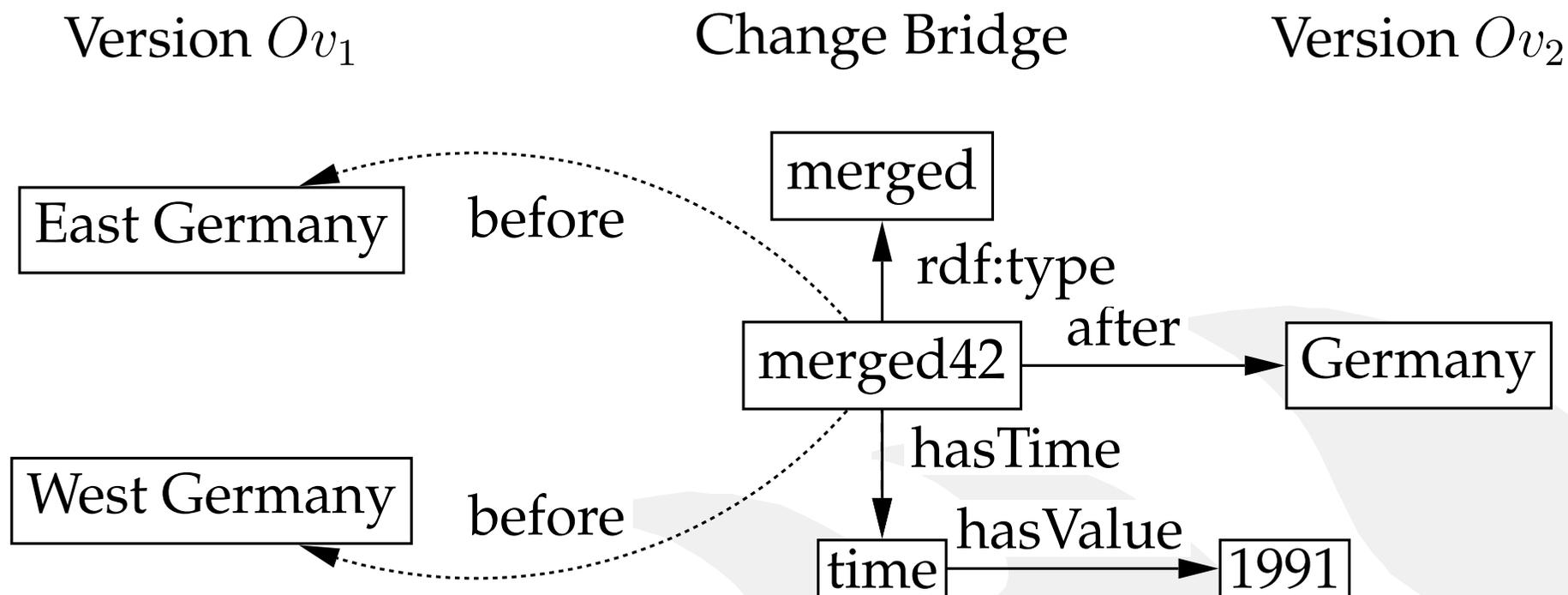
An other example

Version Ov_1 Change Bridge   Version Ov_2

usedToBe

rdf:type

before   after

Myanmar   ←   usedToBe42   →   Burma

hasTime

hasValue

1989 ← time

*

An Example – a Split

Version Ov_1 Change Bridge   Version Ov_2
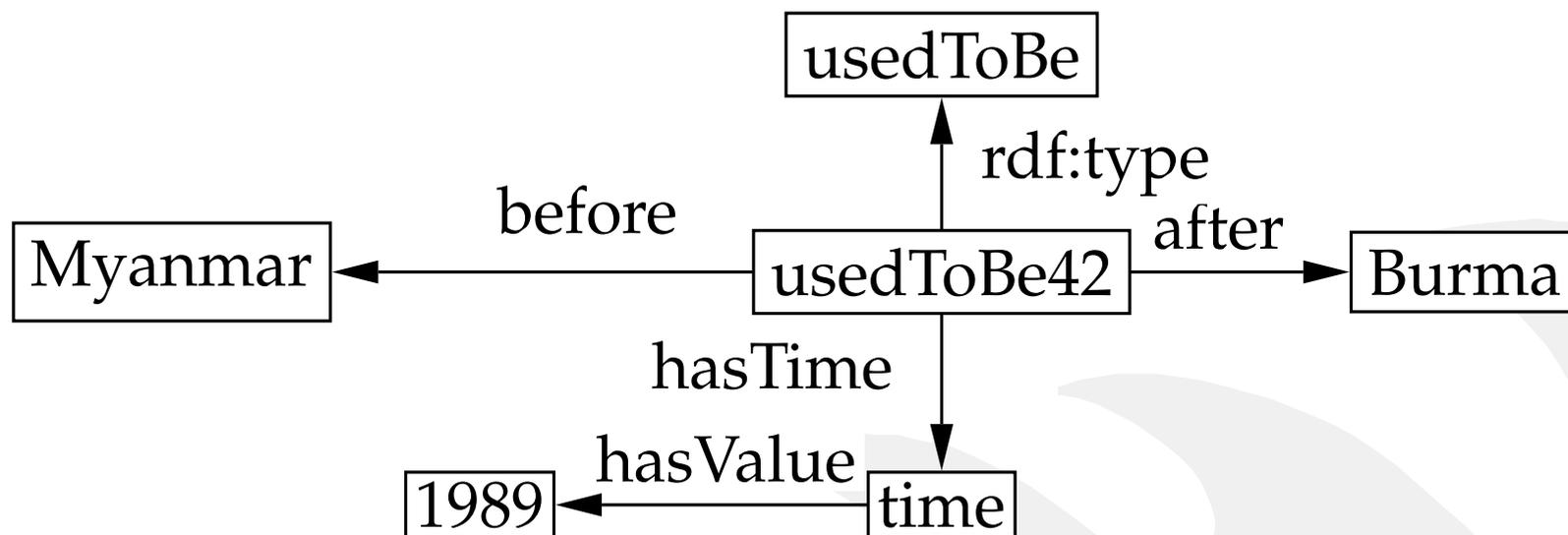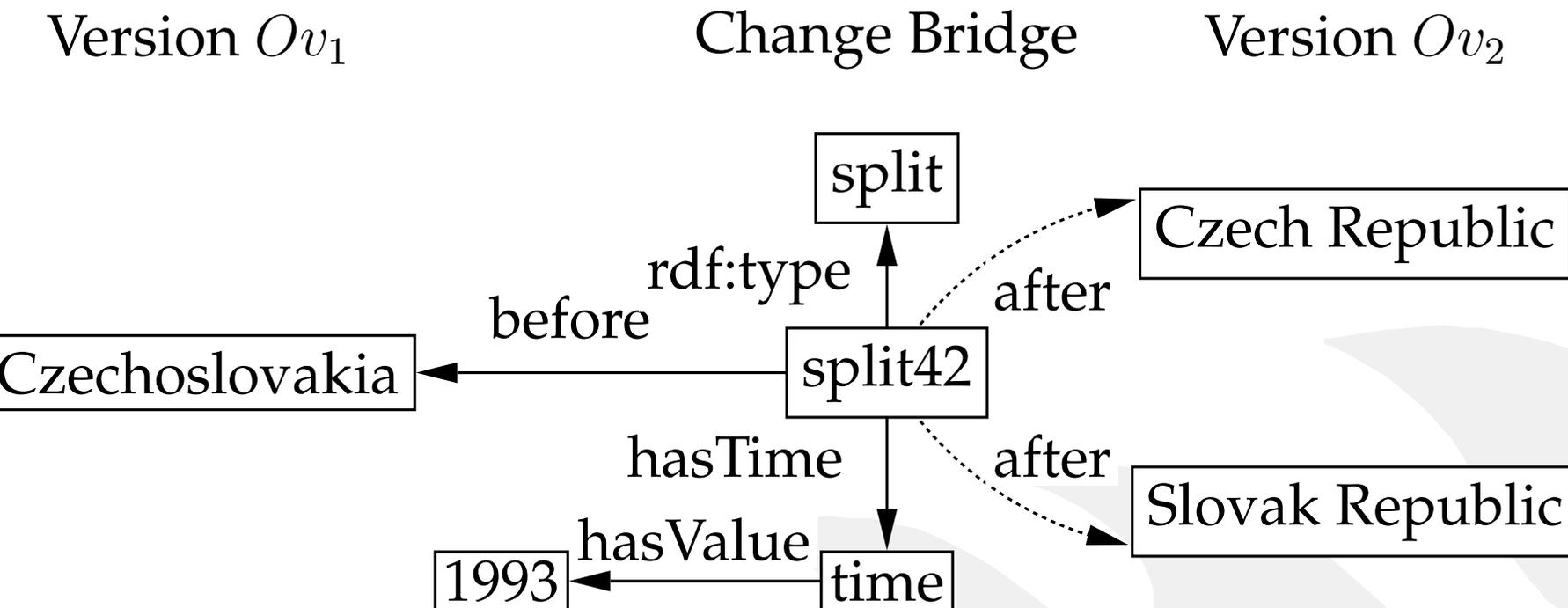
Usage Rules

- Relations between resources in versions Ov_1 and Ov_2 are expressed using the change bridge ontology by creating instances of its classes.

- The bridges are stored in a separate annotation file.

- The arcs point from the bridge class instances to resources in versions Ov_1 and Ov_2 of the ontology.

Usage Rules (continued)

- Mappings can be made either between the entities of versions Ov_1 and Ov_2 of the ontology or between the entities found only in Ov_2.

- Complete mappings — no halfway bridges having only partial information are allowed.

- A revision ontology is used to automatically get identification, status, author and other important identification information from the versioning system in use.

Change Bridge Ontology

Change type	
resourceChange	resourcesDeclaredDisjoint
	differentFrom
	merged
	sameAs
	split
	usedToBe
hierarchyChange	classMovedDown
	classMovedUp
	propertyMovedDown
	propertyMovedUp
	subclassSuperclassLinkAdded
	subclassSuperclassLinkRemoved
propertyChange	narrowedPropertyRestriction
	samePropertyAs
	widenedPropertyRestriction
typeChange	classRe-classifiedAsInstance
	instanceRe-classifiedAsClass
	setOfPropertiesEncapsulatedIntoNewClass

Conclusions and Future Work

Conclusions

- It is important to explicate changes, in classes, instances, and their properties in an ontology.

- It is also necessary to identify what change operations have produced the changes and further express the change as a mapping between evolved entities.

- Change bridges can be used to map between ontology versions.

Future Work

- To complete the change bridge ontology.

- Application of change bridges to build a Finnish temporal region ontology (Suomen Ajallinen PaikkaOntologia, SAPO).
  - SAPO is planned to define different Finnish regions from the beginning of the 20th Century and the various changes there have been over the time.

- Automating the process of indentifying possible bridges between ontology versions.

- To use spatio-temporal change bridge knowledge in reasoning.

References

[Gruber 1993] T. R. Gruber. *A Translation Approach to Portable Ontology Specifications.* Knowledge Acquisition Journal, volume 5, 1993.

[Heflin and Hendler 2000] Jeff Heflin and James Hendler. Dynamic Ontologies on the Web. Proceedings of the Seventeenth National Conference on Artificial Intelligence (AAAI-2000), AAAI/MIT Press, Menlo Park, CA, 2000. More references in the paper.

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