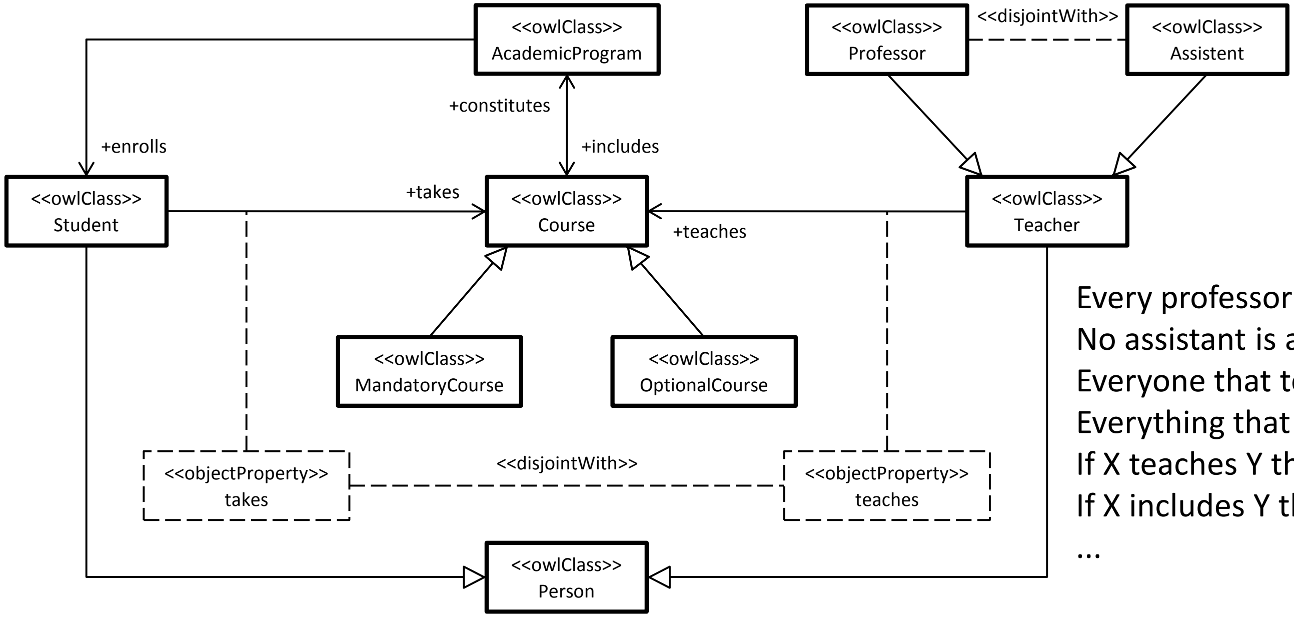
Mākslīgā intelekta laboratorija
LU MII

Verbalizing Ontologies in Controlled Baltic Languages

Normunds Grūzītis, Gunta Nešpore, Baiba Saulīte
Institute of Mathematics and Computer Science
University of Latvia

HUMAN LANGUAGE TECHNOLOGIES — THE BALTIC PERSPECTIVE
Riga, October 7-8, 2010

Sample Ontology



Every professor is a teacher.
No assistant is a professor.
Everyone that teaches something is a teacher.
Everything that is taught by someone is a course.
If X teaches Y then X does not take Y.
If X includes Y then X is constituted by Y.
...

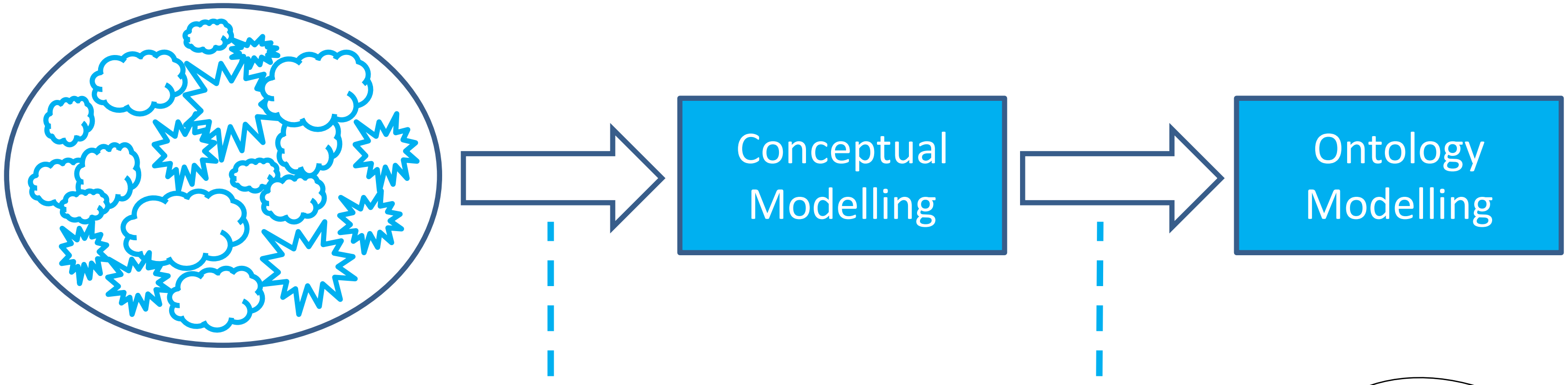
```
Class: owl:Thing and (teaches some MandatoryCourse)
       SubClassOf: Professor
```

Everyone that teaches a mandatory course is a professor.

```
ObjectProperty: enrolls SubPropertyChain: includes o inverse (takes)
```

If X includes something that is taken by Y then X enrolls Y.

Motivation



Conceptual Modelling

Ontology Modelling

Domain experts

Knowledge engineers

“Logic is a wonderful thing, but doesn’t always beat actual thought.”

Terry Pratchet

“This Guide is definitive. Reality is frequently inaccurate.”

Douglas Adams

I.Holt, C.Dolbear, P.Engelbrecht, J.Goodwin, G.Hart: *Exploiting Semantics in Information Integration: a National Mapping Agency Perspective*. In: 2nd Workshop on Challenges and Promise of the Semantic Web, 2007

R.Denaux, V.Dimitrova, A.Cohn, C.Dolbear, G.Hart: *Rabbit to OWL: Ontology Authoring with a CNL-based Tool.* In: Workshop on Controlled Natural Language, 2009

Type of CNL

- Naturalist approach
  - A simpler form of the full natural language (NL)
  - Ambiguity resides to a lesser extent
  - Search for a best parse and interpretation
    - Heuristics for PP-attachment, WordNet-based WSD, etc.
  - CPL
- **Formalist approach**
  - An NL-like formal language
  - Well-defined and predictable (deterministic)
    - Fixed interpretation rules (in terms of the underlying formalism)
  - A monosemous lexicon
  - ACE, PENG, Rabbit

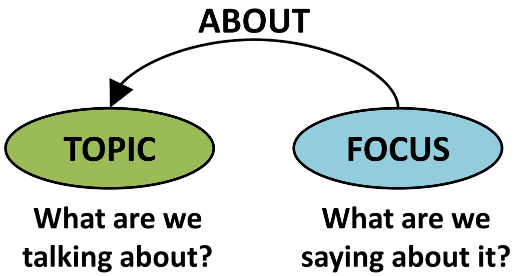
P.Clark, P.Harrison, W.Murray, J.Thompson: *Naturalness vs. Predictability: A Key Debate in Controlled Languages*. In: Workshop on Controlled Natural Language, CEUR Workshop Proceedings, vol. 448, 2009

Baltic Languages

- **Highly synthetic**: rich morphology, free word order
  - **Explicit** linguistic markers, indicating which information is already given (anaphors) and which is new (antecedents), in general, are **not** available
    - “Articles” are rarely used and are “compensated” by more **implicit** linguistic markers; typically, by changes in the word **word order**
    - The **definiteness** feature is **not** encoded even in noun endings
    - Definiteness feature **is** encoded in adjective and participle endings, however, these markers are **non-reliable** even in controlled language
- Closest sibling to the **Slavic** language group

Information Structure

- **Synthetic** language
  - Syntactically **free** word order
  - Semantically **fixed** word order



- Inspiring from the Prague Linguistic School:
  - Exploitation of the concept of **topic-focus articulation** for controlled synthetic language
    - **TOPIC** – given information – **to the left** from the verb
    - **FOCUS** – new information – **to the right** from the verb
  - Hypothesis: in controlled synthetic language “articles” can be reliably “reconstructed” from the **word order**:
    - **Intuitively** satisfiable by a human user
    - Ensures the **deterministic** automatic parsing

Survey

- The aim:
  - Test the hypothesis that TFA is a reliable method in the case of CNL
  - Find the most **natural** and **intuitive** syntactic patterns that preserve the **predictive** (unambiguous) interpretation in OWL
- Evaluation of 15–17 statements of various complexity
  - Each statement was verbalized in two or three slightly different ways
  - Alternatives were ranked being either ***good***, ***acceptable*** or ***poor***
  - Respondents were able to propose their own **suggestions**
- ~**80** Latvian and ~**40** Lithuanian respondents
  - ~75% evaluated all examples; others — at least one third

Suggestions

- Use of the **indefinite** and demonstrative **pronouns** in certain cases improves the reading (in Latvian)
  - *Ikvienu kursu māca **kāds** pasniedzējs*. (*Every course is taught by **a** teacher*.)
  - *Ikvienu kursu māca pasniedzējs, **kas*** .. (*Every course is taught by **a** teacher **that*** ..)
- Simple vs. **present perfect** tense
  - Ikviena akadēmiskā programma **ir uzņēmusi/uzņem** kādu studentu.
    - Every academic program **has enrolled/enrolls** a student.
- Direct object vs. **adverbial modifier** of place
  - Ikviens students ir uzņemts kād**ā** akadēmiskaj**ā** programm**ā**.
    - Every student is enrolled **in** an academic program.
- Relative clause vs. **attribute**
  - Ikviens kurss, **kas** ir iekļauts kādā akadēmiskajā programmā, ..
    - Every course **that** is included in an academic program ..
  - Ikviens kādā akadēmiskajā programmā iekļautais kurss ..
    - Every academic-program-included course ..

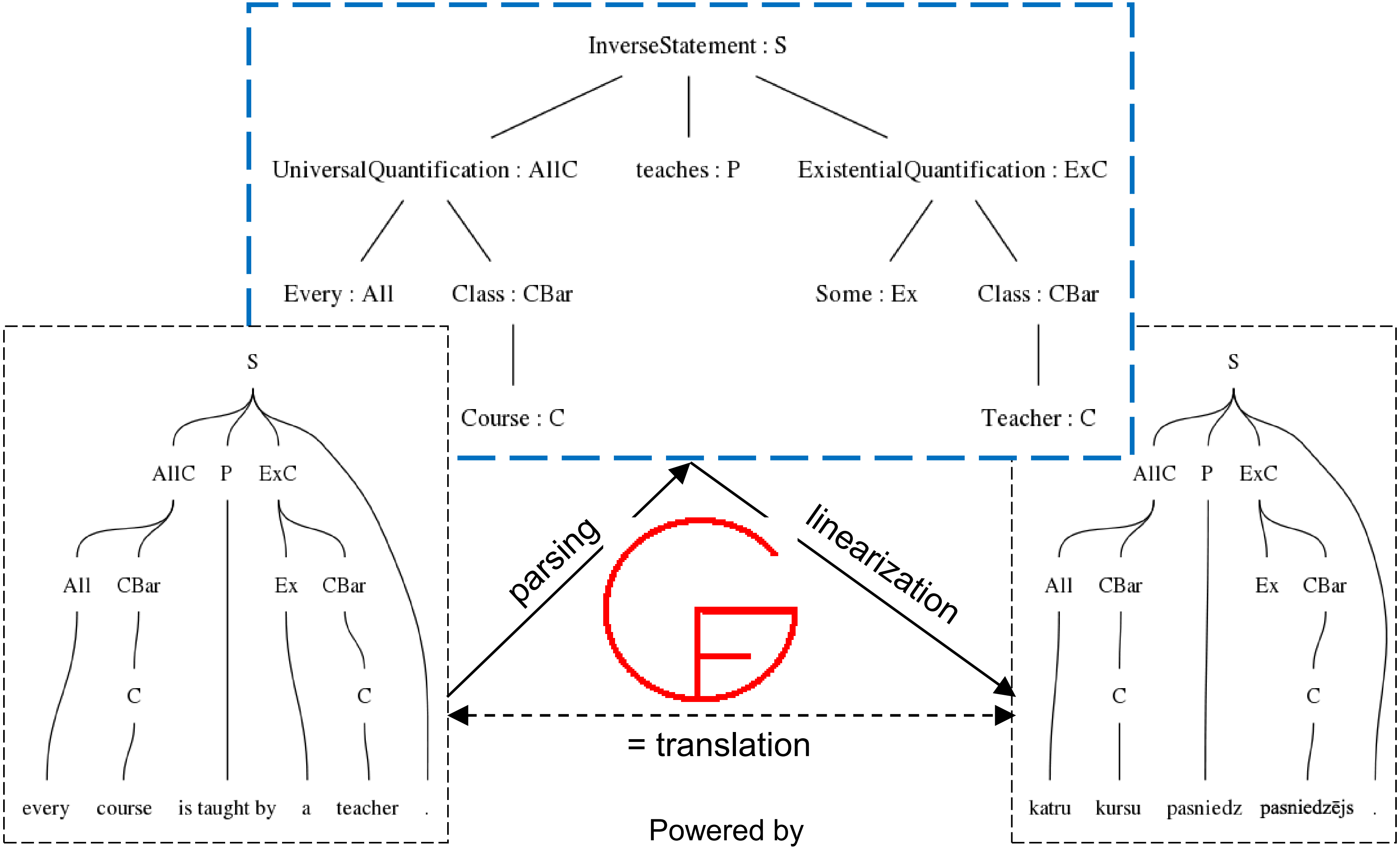
Pseudo-SVO Statements

- At the OWL level – SVO tripples only
- At the CNL level, it can be very hard or even impossible :
  - to come up with an appropriate verb
  - to use an object (accusative case), so that the statement remains natural

- Predicate nominals (roles)
  - Of-constructions in English
  - Genitive (possessive) constructions in Baltic languages

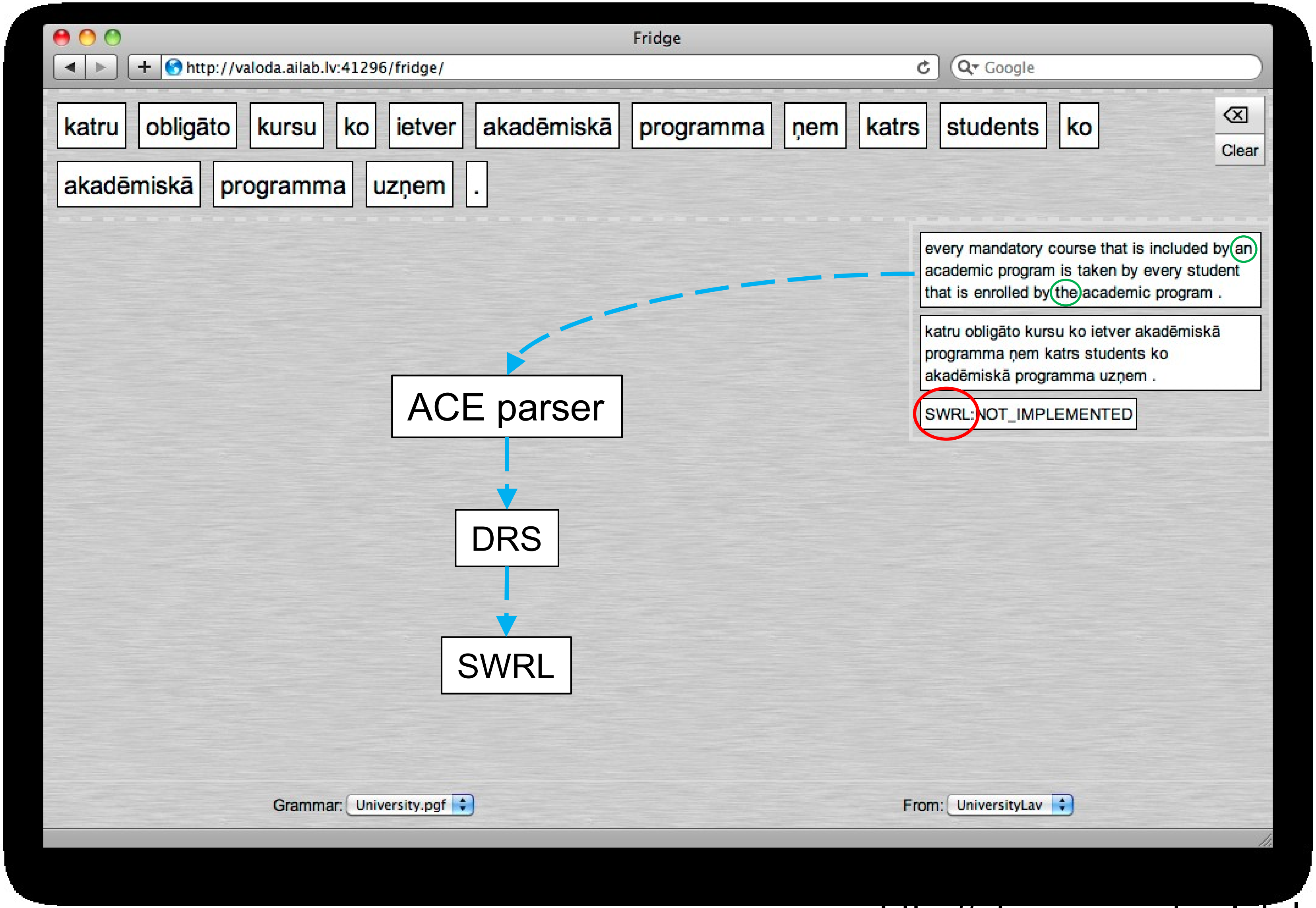
- Adverbial modifiers (of place)
  - Currently we are considering only such modifiers that do not require a preposition, but are expressed by the locative case
    - In English, the preposition “in” or “at” is used

Multilingual Grammar



Powered by
Grammatical Framework

ACE as Interlingua



every mandatory course that is included by an academic program is taken by every student that is enrolled by the academic program .

katru obligāto kursu ko ietver akadēmiskā programma ņem katrs students ko akadēmiskā programma uzņem .

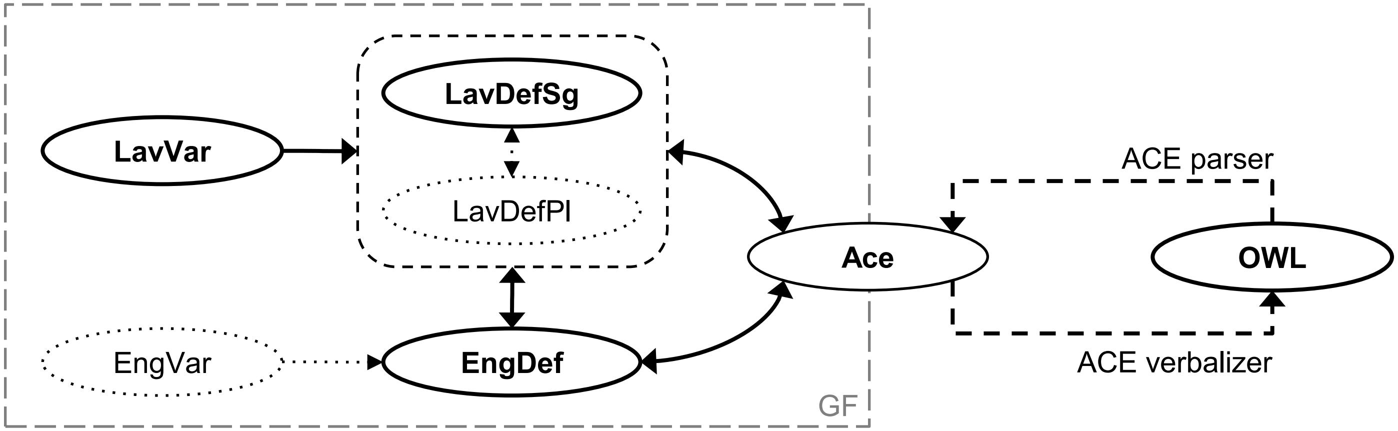
SWRL: NOT_IMPLEMENTED

Grammar: University.pgf

From: UniversityLav

http://eksperimenti.ailab.lv/cnl/

Implementation



Tas, kas kaut ko māca, ir pasniedzējs.

Tas, ko kāds māca, ir kurss.

Ikviens kurss ir kādas akadēmiskās programmas daļa.

Jebkas, kura daļa ir kurss, ir akadēmiskā programma.

`LavVar`

Everyone that teaches something is a teacher.

Everything that is taught by someone is a course.

Every course is a part of an academic program.

Everything that has a course as a part is an academic program.

`EngDef`

Everything that **v:teaches** something is a **n:teacher**.

Everything that is **v:teaches** by something is a **n:course**.

Every **n:course** **v:part-of** an **n:academic_program**.

Everything that is **v:part-of** by a **n:course** is an **n:academic_program**.

`Ace`

Conclusion

- In controlled Latvian, which is a highly synthetic CNL, where definite and indefinite articles are not used, the **topic-focus articulation** can be reflected by **systematic** changes in the neutral **word order**
  - A **simple** and **reliable** mechanism
  - **Native speakers** tend to follow such guidelines rather **intuitively**
- The **two-level translation** approach has allowed us to develop a rather sophisticated controlled Latvian on the top of the very restricted ACE subset for OWL
- No good solution for the problem of **animate/inanimate** things
- TODO:
  - **Plural sentences**: more intuitive in many cases, no indefinite pronouns
  - **Prepositional phrases** (other than *-in* and *-of*)
  - Assertional statements
  - Prototype implementation for **Lithuanian** language

Thank you!