INF3580 – Semantic Technologies – Spring 2011

Lecture 1: Introduction

Martin Giese

25th January 2011

Department of Informatics

University of Oslo

INF3170 – Logikk

- It has been dedicded on short notice that

  INF3170 – Logikk

  will be held!
- Tuesdays, 12:15–14:00 in Lille Aud. (old ifi building)
- Detailed information about theoretical background of Semantic Technologies:
  - Logic
  - Model Semantics
  - Reasoning

Today's Plan

1. Practicalities
2. Software
3. Introduction to Semantic Technologies

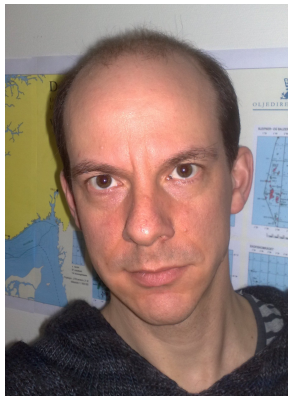
Outline

When, Where, and Who

When and Where

- Lectures Tuesdays 14:15–16:00 in Prolog (2465).
- No lecture 19. April (Easter break) and 17. May
- Homepage:
  `http://www.uio.no/studier/emner/matnat/ifi/INF3580/`

Lecturer



Martin Giese (`martingi@ifi.uio.no`)

Additional Lecturers

Martin G. Skjæveland
(martige@ifi.uio.no)

Audun Stolpe
(audus@ifi.uio.no)

Kjetil Kjernsmo
(kjekje@ifi.uio.no)

Exercises

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- Practical exercises every week,
- Fortress (3468), Fridays 12:15–14:00, starting this week
- Exercises available on website well in advance. Come prepared!
- Consider bringing your laptop!

Teachers

Håvard M. Ottestad
(haavarot@ifi.uio.no)

Martin G. Skjæveland
(martige@ifi.uio.no)

Mandatory Assignments, Exam

Assignments

- Probably five mandatory assignments
- Corrected by teachers
- Pass/Fail
- Must have passed all assignments in order to attend exam
- First three assignments:
  - Small, one per week (first one published on 1.2.)
  - Automated correction
  - One attempt
- Fourth and Fifth assignment:
  - More substantial, timing will be announced
  - Manual correction
  - Two attempts

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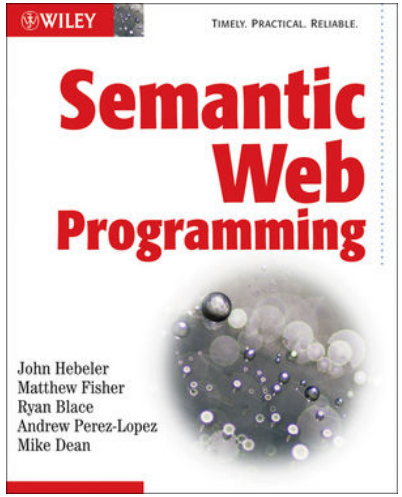
Exam

- Three hours written Exam
- Grades A–F

Reading

- For practical aspects:

  Semantic Web Programming.
  Hebeler, Fisher, Blace, Perez-Lopez.
  Wiley 2009



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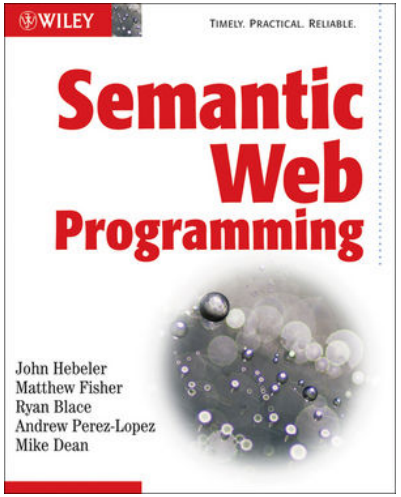

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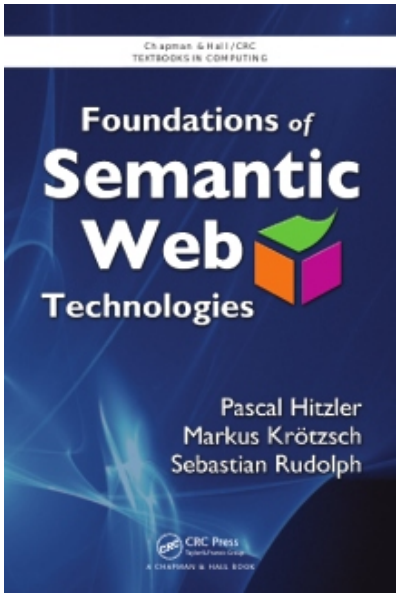

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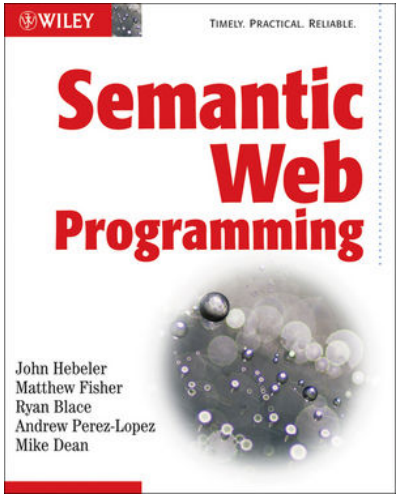

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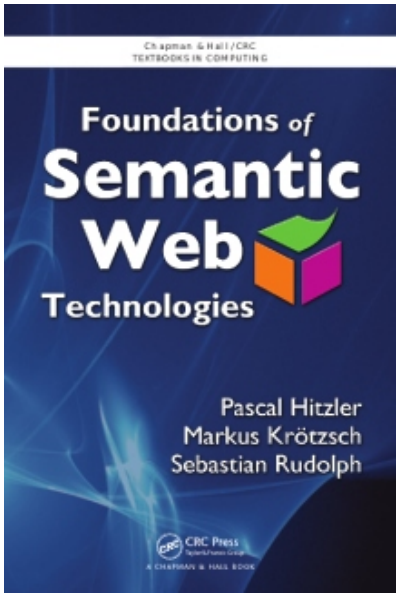

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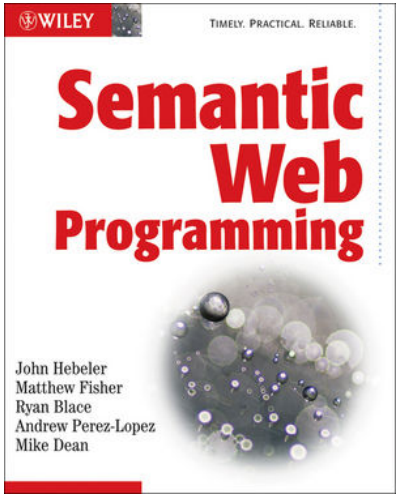

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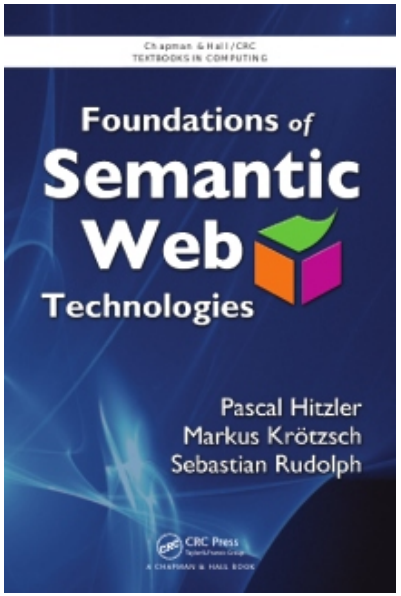

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- Slides available on course homepage

Outline

Software

- Programming-oriented course.
- With non-trivial theoretical components.
- Various off-the-shelf software required to work on exercises.
- Installation help in weekly exercises and exercise sessions.
- Most software already installed on ifi machines.

Software: Java

In principle, any programming language can be used for semantic web programming, but...

- Will explain Sem. Web programming using Java libraries
- The textbook concentrates on Java
- Exercises are built around Java

So: get JDK6 from

`http://java.sun.com/`

Software: Eclipse

In principle, you can use any environment to develop Java programs, but...

- The Eclipse IDE is free, open source software
- It is particularly suited for Java development
- We will use the Eclipse IDE for demonstrations
- We will be able to help you with Eclipse problems

So: get the Eclipse IDE from

`http://www.eclipse.org/`

Software: Jena

There are various Java libraries for Sem. Web programming out there, but...

- The textbook uses Jena
- It is one of the most used and mature Java libraries for Sem. Web
- It is powerful enough for our purposes

So: get Jena 2.6.4 from

`http://jena.sourceforge.net/`

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Alternatives:

- Sesame, `http://www.openrdf.org/`
- OWL API, `http://owlapi.sourceforge.net/`
- Redland RDF Libraries (C), `http://librdf.org/`
- etc., Google for "RDF library"...

Software: Pellet

There are several reasoning systems around, but...

- The textbook uses Pellet
- It is open source software
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Alternatives:

- FaCT++, `http://owl.man.ac.uk/factplusplus/`
- RacerPro, `http://www.racer-systems.com/`
- Hermit, `http://hermit-reasoner.com/`
- etc., `http://en.wikipedia.org/wiki/Semantic_reasoner`

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There are several ontology editors available, but...

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- It is the most widely used ontology editor
- Probably the best non-commercial one

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Alternatives:

- see `http://en.wikipedia.org/wiki/Ontology_editor`

Outline

The Vision of a Semantic Web

A vision

I have a dream for the Web [in which computers] become capable of analyzing all the data on the Web—the content, links, and transactions between people and computers. A 'Semantic Web', which should make this possible, has yet to emerge, but when it does, the day-to-day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines. The 'intelligent agents' people have touted for ages will finally materialize.

Tim Berners-Lee

Quoted from: *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web.* Tim Berners-Lee with Mark Fischetti. Harper San Francisco, 1999.

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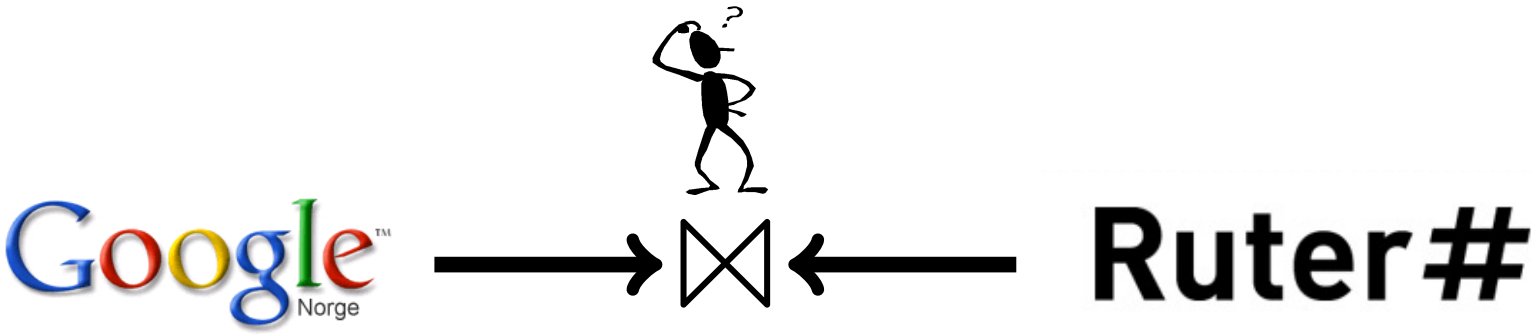
- Essentially a database join!



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- Can hardly wait for a separate mashup for each useful combination!

A Web of Data!

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- All those websites publish their information in a machine-readable format.
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- Enough domain knowledge is available to machines to make use of the information
- User-agents can find and combine published information in appropriate ways to answer the user's information needs.

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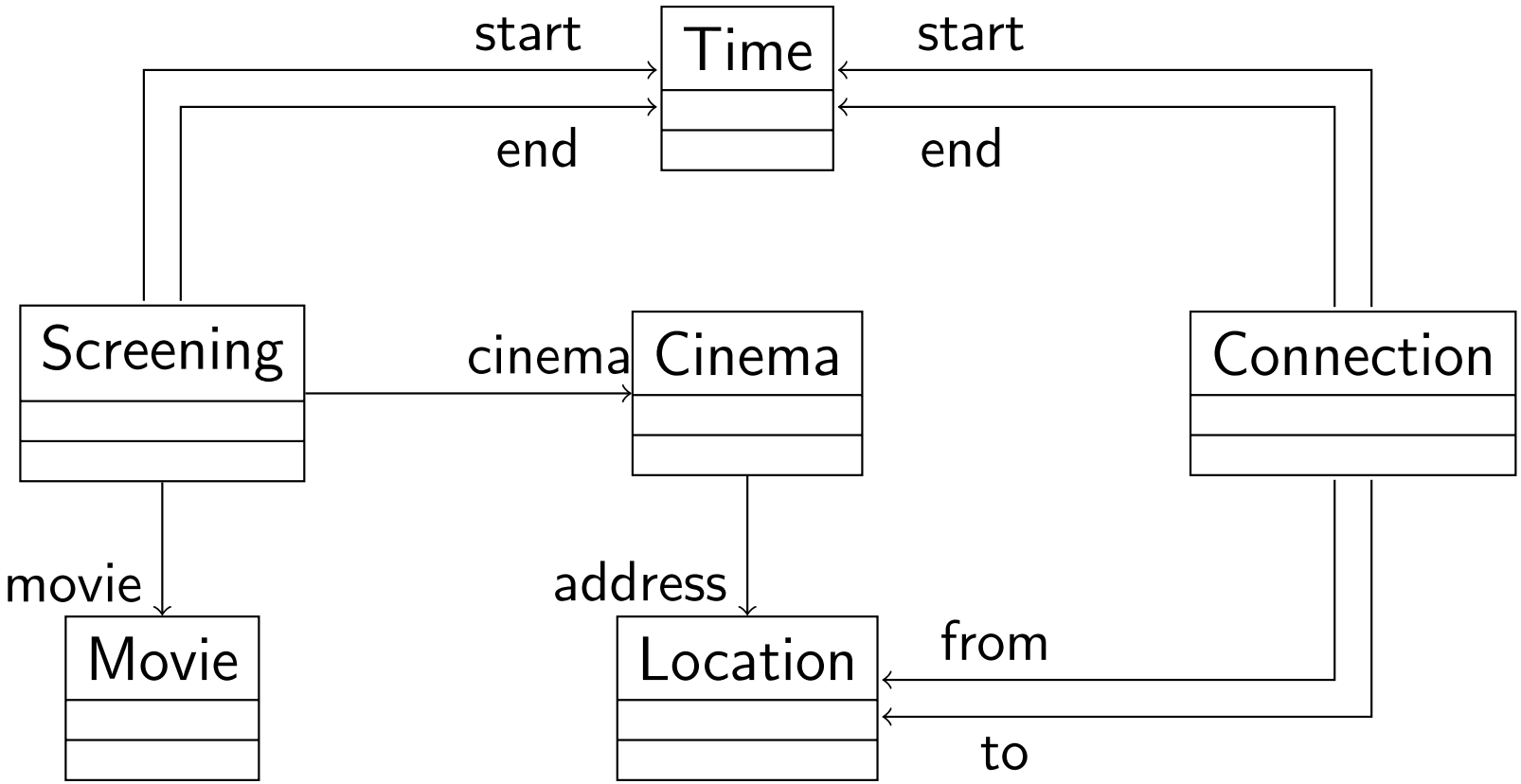
  - Domain models, e.g. in UML
  - Numerical Models (Newtonian mechanics, Quantum mechanics)

A Cinema Transport Model

An example of a UML domain model:



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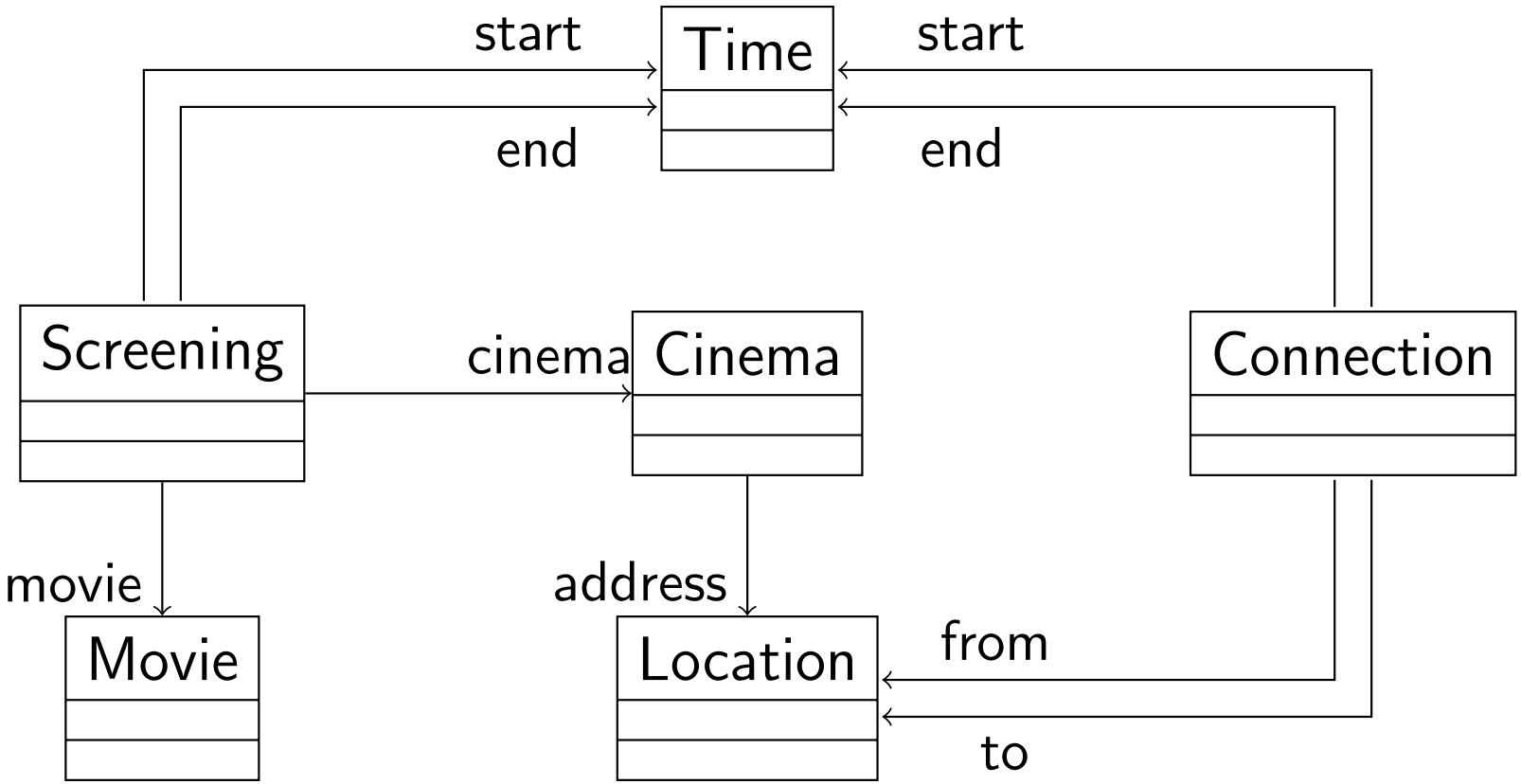

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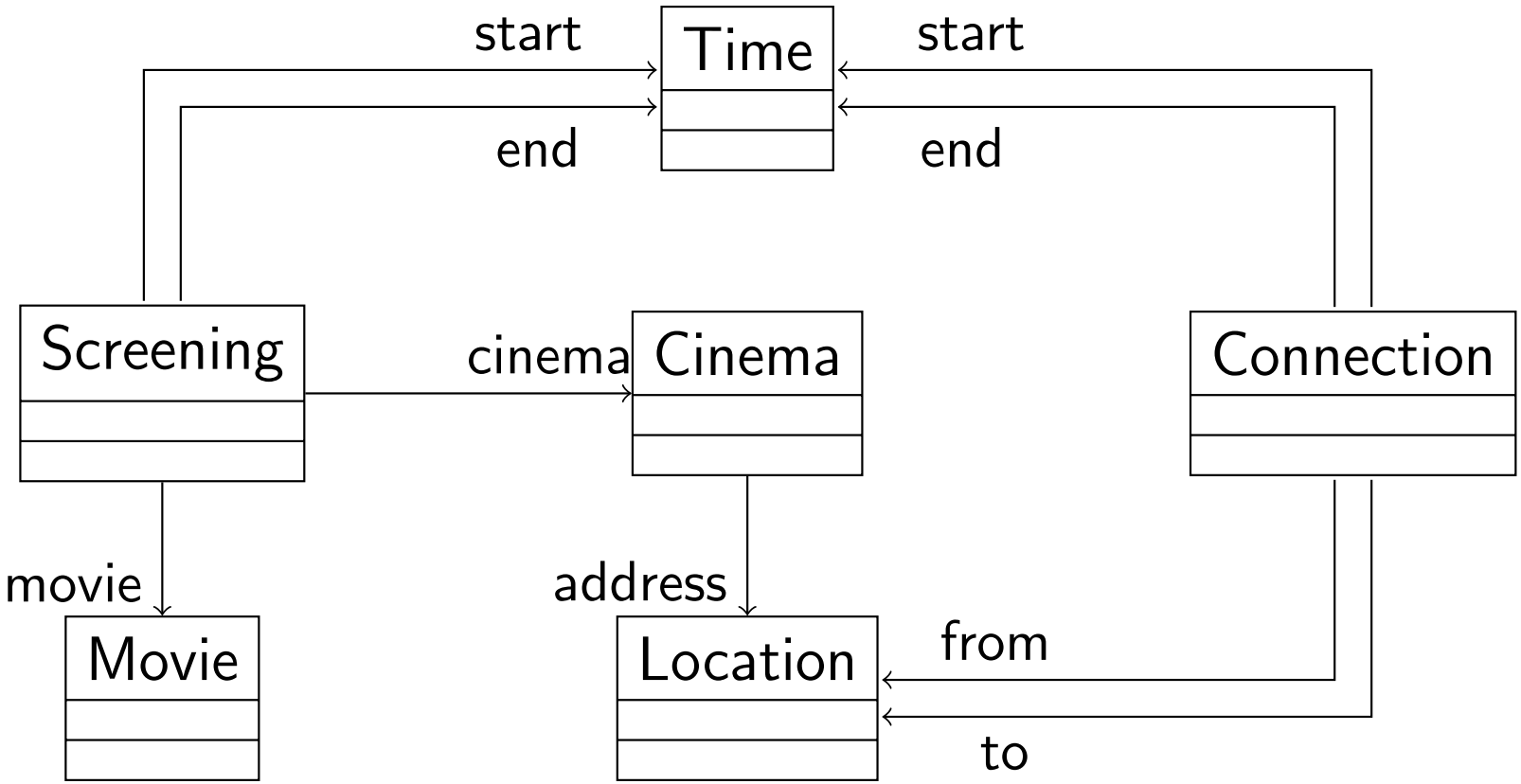

- What is the vocabulary?
- How is it connected?

A Query

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Find s, k, l, c, cStart, cEnd, sStart satisfying this and we have the answer!

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Find s, k, l, c, cStart, cEnd, sStart satisfying this and we have the answer!

- Maybe not the easiest way to ask, but it's a start.
- Models are an important part of a Web of Data!
- Need to connect models from different domains.

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- What is calculation?

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$$\frac{\begin{array}{c} A \text{ owns } x \ B\text{s} \\ A \text{ gets another } y \ B\text{s} \end{array}}{A \text{ now owns } (x + y) \ B\text{s}}$$

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- Calculation is algorithmic manipulation of numbers...
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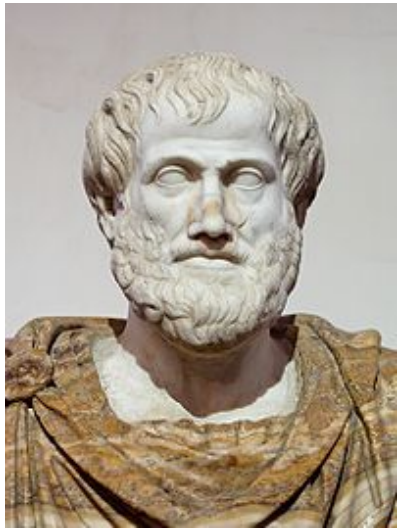
- Can calculate $1 + 4 = 5$ without knowing what is counted
- Abstraction!

Calculating with Knowledge

- Can be traced back to Aristotle (384–322 BC)



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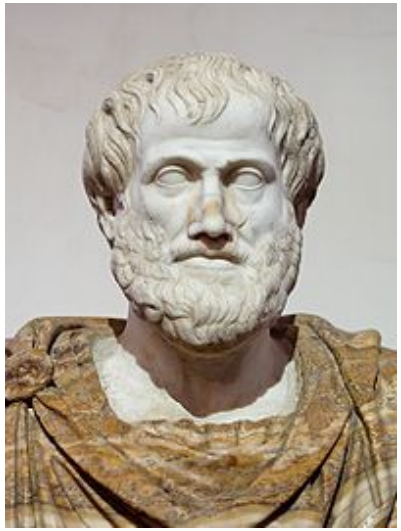

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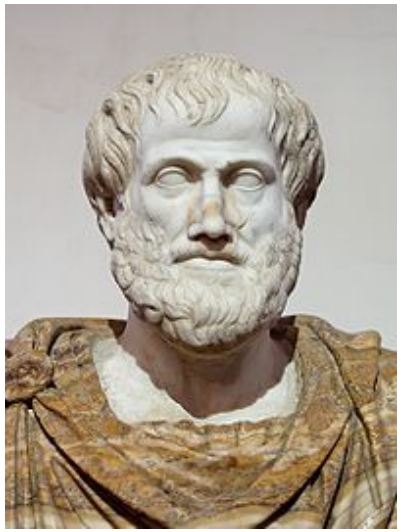

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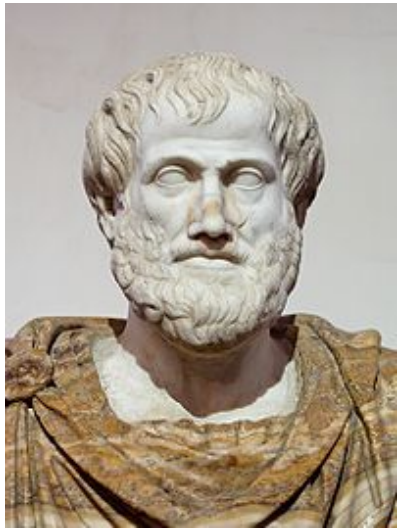

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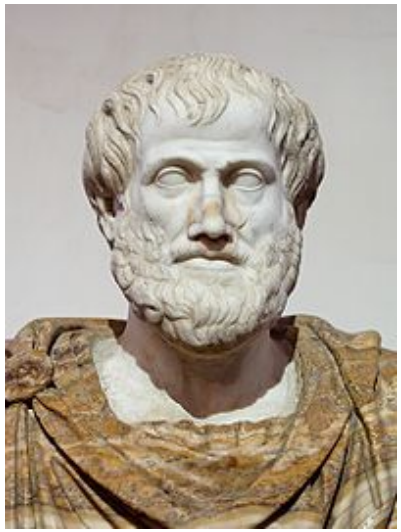

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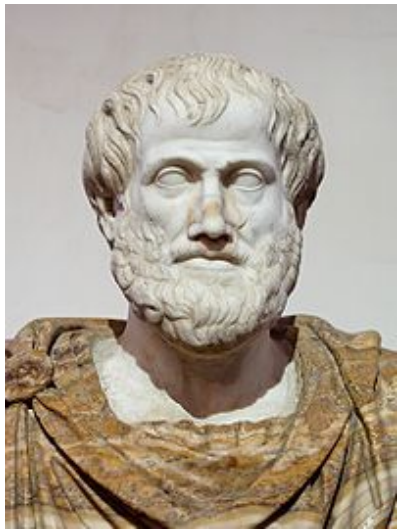

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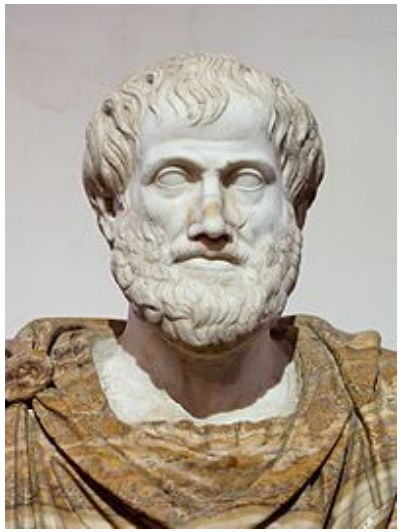

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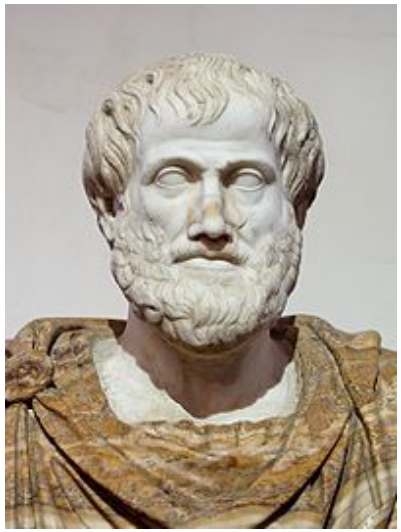

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The "Home" of the Semantic Web

See the W3C pages for the Semantic Web effort:

`http://www.w3.org/2001/sw/`

For standards (RDF, OWL, SPARQL, etc.), see:

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- Hype has brought some amount of discredit to the Semantic Web effort.

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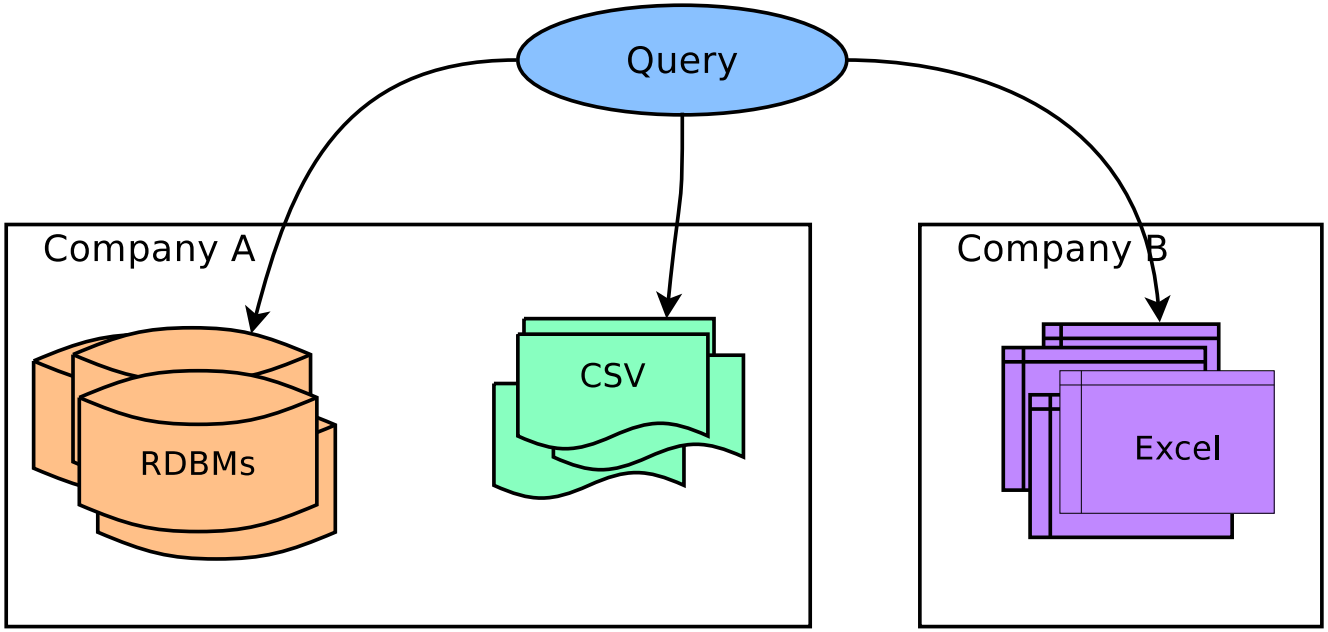

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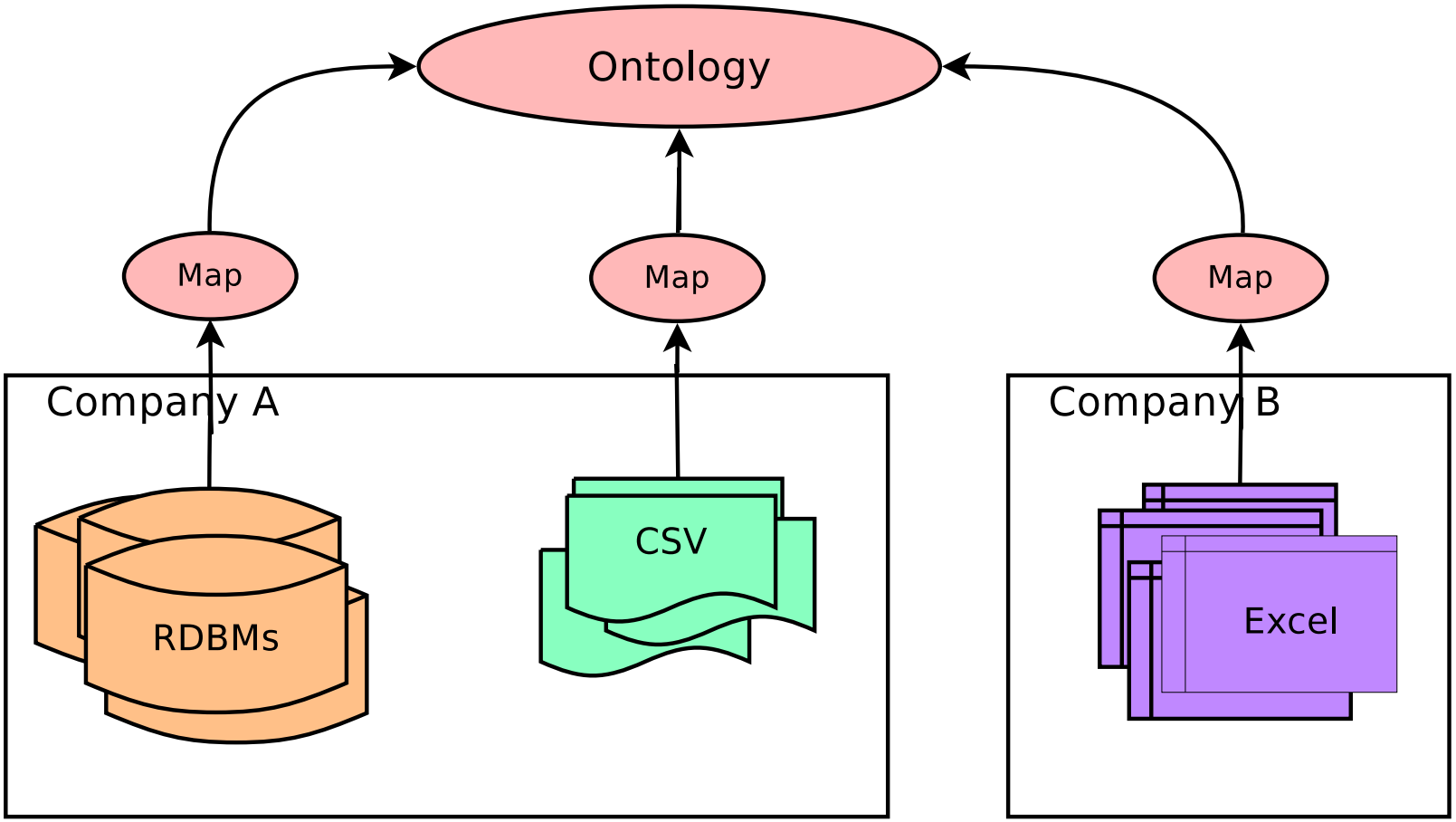

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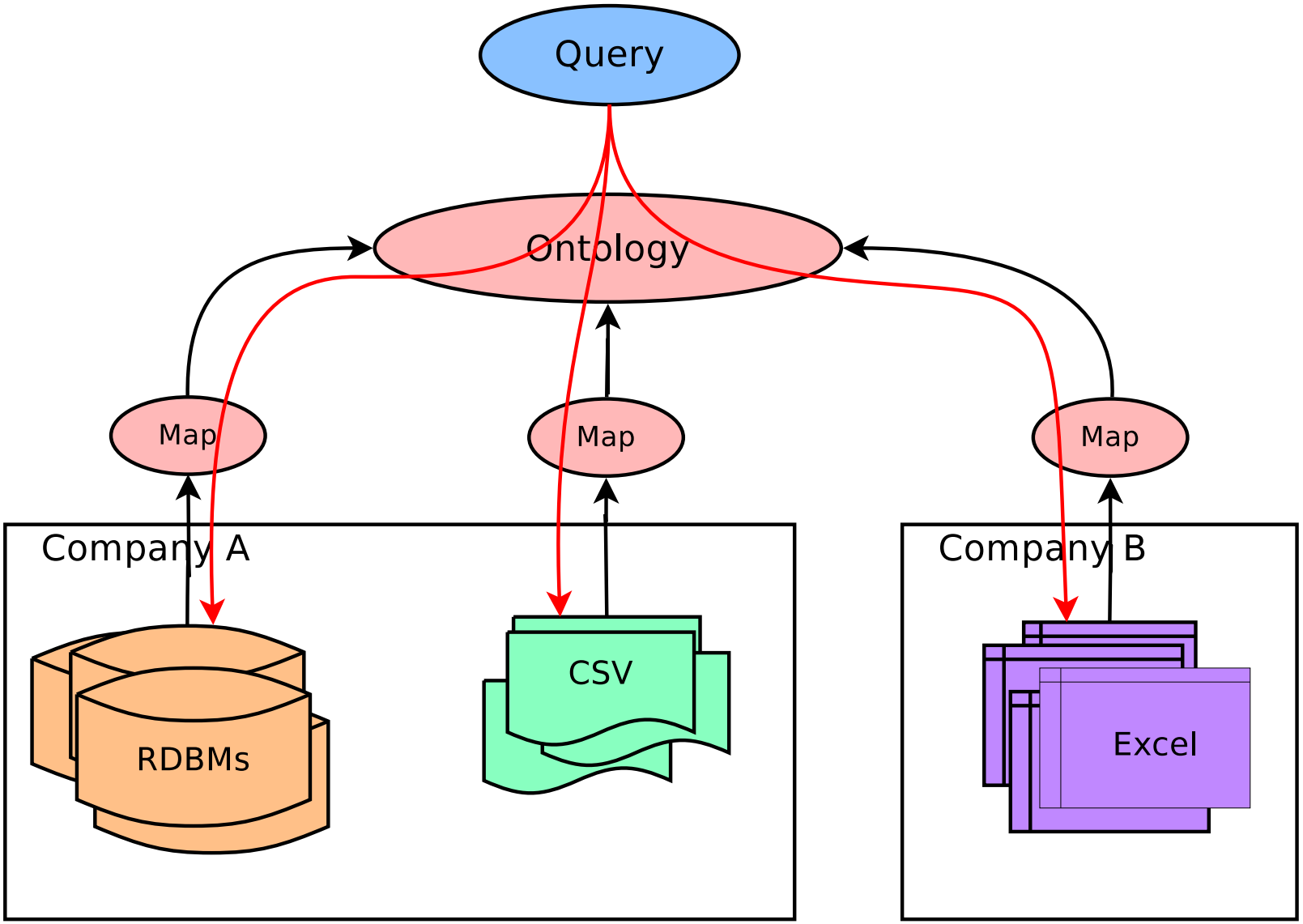

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This course

The aim of this course is to teach you...

- ...enough of the semantics in semantic technologies (logic, reasoning) for you to get an idea of what this is all about, what can and cannot be done.
- ...enough of the technology in semantic technologies (standards, languages, programming interfaces) for you to be able to use them in practice.
- ...enough overview for you to know where to look and what to read when you need a deeper understanding of either side.

If you want to learn more:

- Contact us for possible MSc degree topics

Semantic Technologies at ifi

- Currently 1 professor, 2 post-docs, 3 PhD-students, ∼6 MSc students directly concerned with semantic technologies in OMS group.
- Semicolon
  - Data exchange between public sector institutions in Norway
  - Publication and interlinking of public data.
  - User partners: Brønnøysundregistrene, Helsedirektoratet, Skattedirektoratet, Statistisk sentralbyrå, ...
- IOHN (Integrated Operations in the High North)
  - Partners include two oil companies, major software vendors like IBM, SAP, Siemens
  - Data exchange and integration for the oil industry
- Great opportunities for both practically and theoretically oriented MSc theses, PhD work,... with strong connections to industry and public sector!