INF3580/4580 – Semantic Technologies – Spring 2018

Lecture 1: Introduction

Martin Giese

15th January 2018

Department of Informatics

University of Oslo

Today's Plan

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

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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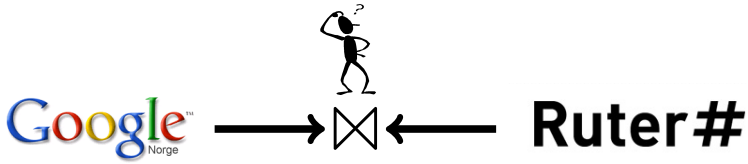
- Essentially a database join!



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

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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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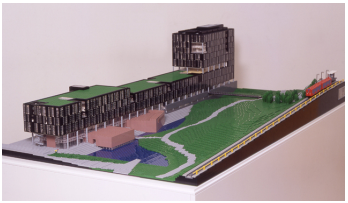

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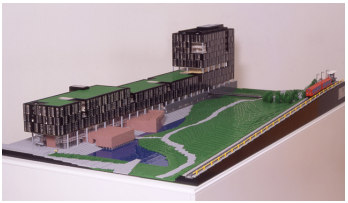

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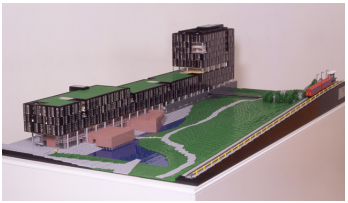

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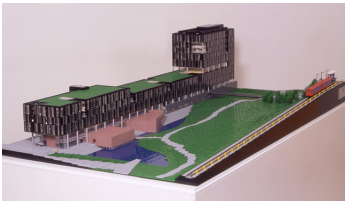

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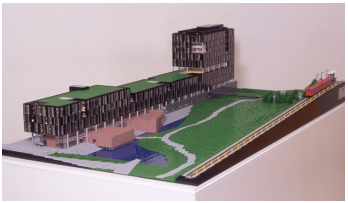

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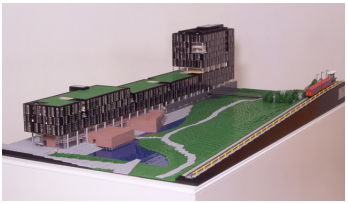

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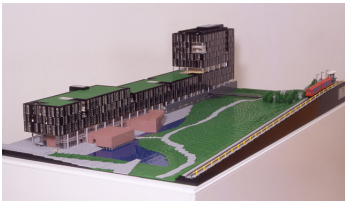

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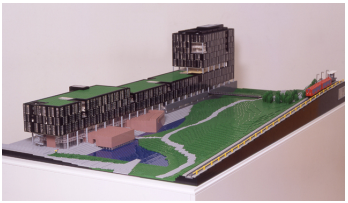

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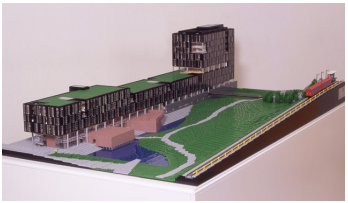

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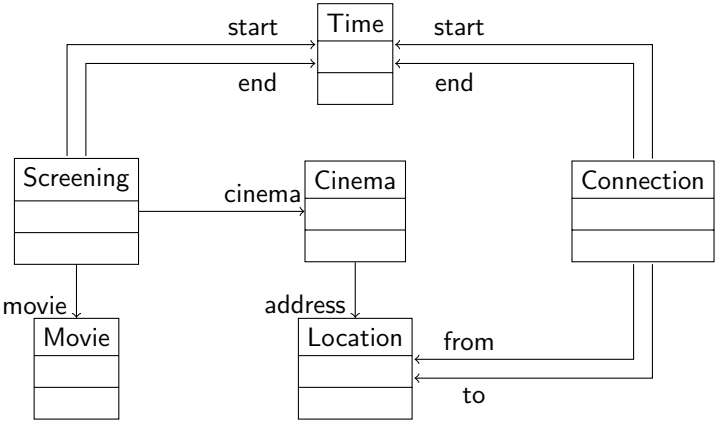
  - Numerical Models (Newtonian mechanics, Quantum mechanics)

A Cinema Transport Model

An example of a UML domain model:



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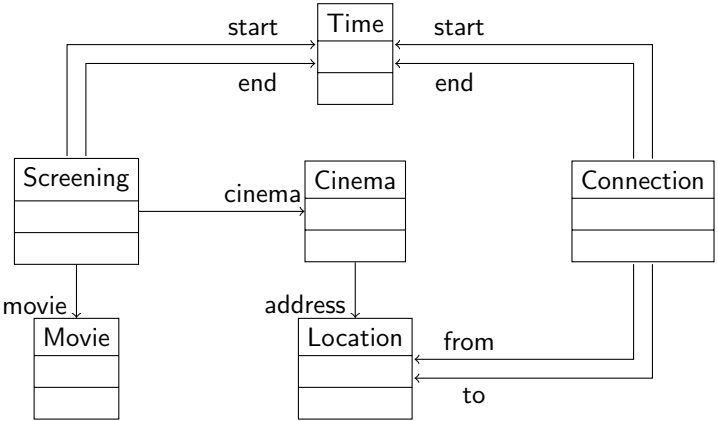

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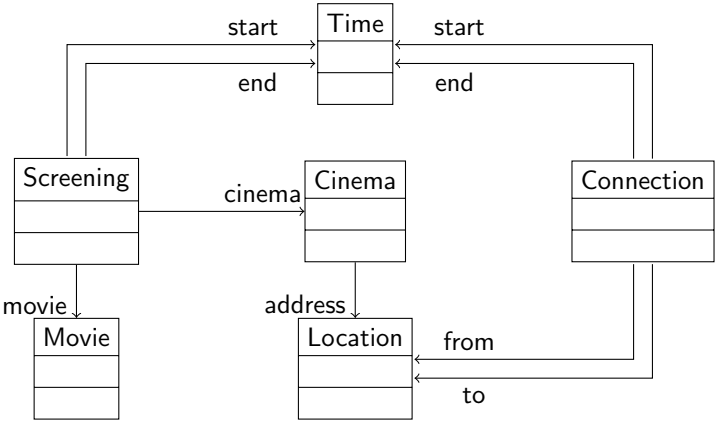

- What is the vocabulary?
- How is it connected?

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- 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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  - ...
- Queries over distributed information are at the centre of all this.

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- Abstraction!

Calculating with Knowledge

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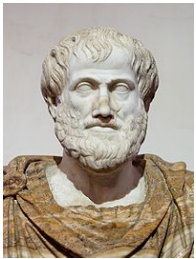

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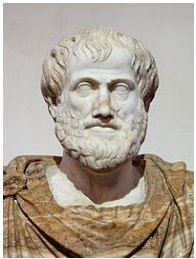

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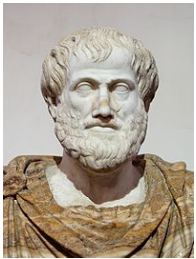

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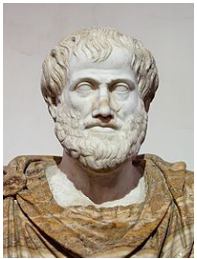

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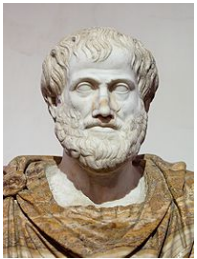

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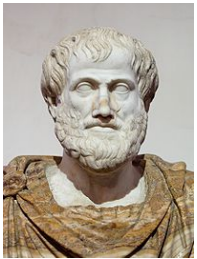

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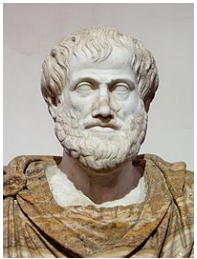

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- Also an abstraction!
- The topic of *formal logic*

Computing with Knowledge About Movies

- Query: find a *fun event* we can reach by public transport

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- Query: find a *fun event* we can reach by public transport
- Knowledge base:

Computing with Knowledge About Movies

- Query: find a *fun event* we can reach by public transport
- Knowledge base:
  1. A movie screening is an event

Computing with Knowledge About Movies

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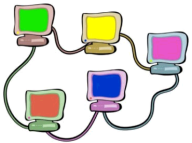
- Computing with Knowledge is an important part of a Web of Data!

Exchanging Information



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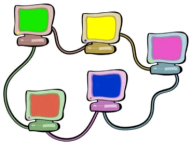

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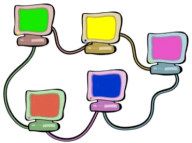

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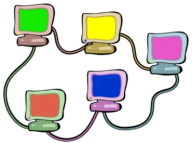

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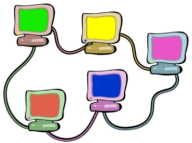

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- Semantic Web standards are being managed by W3C.

The "Home" of the Semantic Web

See the W3C pages for the Semantic Web effort:

`http://www.w3.org/2013/data/`

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

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

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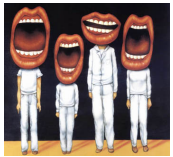
The AAA slogan



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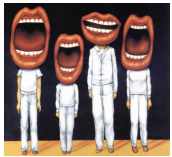

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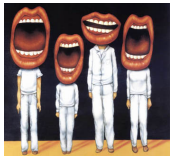

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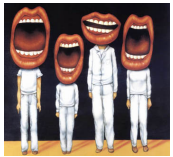

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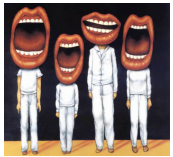

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- Hype has brought some amount of discredit to the Semantic Web effort.

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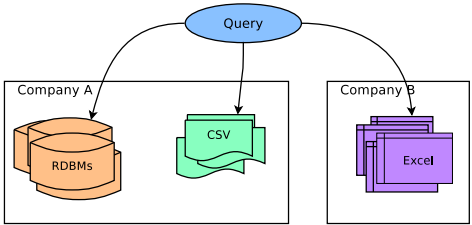

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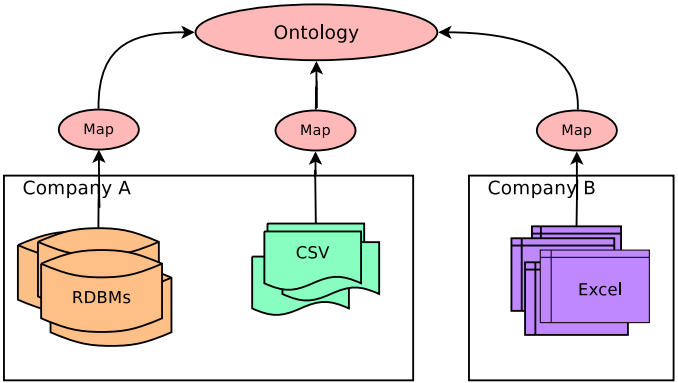

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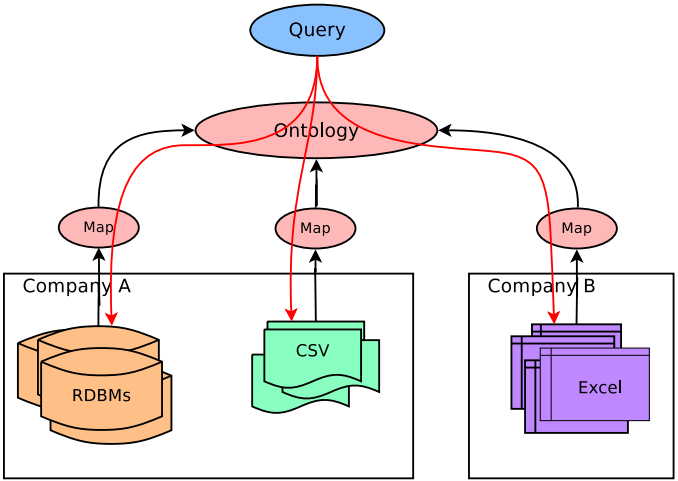

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The LogID group – Logic and Intelligent Data

- Resarch in semantic technologies, mostly around Ontology-based Data Access.
- Optique `http://www.optique-project.eu/`
  - 4 year EU project (just finished), led by LogID
  - Ontology Based Data-Access
  - Industry: Siemens, Statoil, DNV, fluid Ops
  - Universities: Oxford, Hamburg, Bolzano, Rome, Athens
- Sirius `http://www.sirius-labs.no/`
  - Center for Scalable Data Access in the Oil&Gas Domain
  - 8 years funding, 7 left
  - UiO, NTNU, Statoil, Oracle, IBM, Computas, Numascale ...
- BigMed: personalised medicine
- Great opportunities for both practically and theoretically oriented MSc theses, PhD work,... with strong connections to industry and public sector!

Outline

When, Where, and Who

When and Where

- Lectures Tuesdays 12:15–14:00 in OJD 2458, Postscript.
- No lecture 27 March (Easter break), and 1 May
- Guest Lecture: not clarified yet.

Lecturers

Martin Giese
(martingi@ifi.uio.no)

Leif Harald Karlsen
(leifhka@ifi.uio.no)

Ernesto Jiménez-Ruiz
(ernestoj@ifi.uio.no)

Exercises

Exercises

- Practical exercises every week,
- Fortress (3468), Mondays 14:15–16:00, starting **next** week
- Exercises available on website well in advance. Come prepared!
- First session: help with setting up software. Bring your laptop!
- In general: part repetition of lectures, part exercises

Teacher

Bård Christer Johnsen
(baardcj@student.matnat.uio.no)

Mandatory Assignments

Assignments

- Six mandatory assignments
- Corrected by teachers. **Tell us if you don't get feedback!**
- Pass/Fail
- Must have passed all assignments in order to attend exam
- First four assignments:
  - Small, about one per week (first one published on 23.1.)
  - (semi-)automated correction
  - One attempt
- Fifth and Sixth assignment:
  - More substantial, timing will be announced
  - Manual correction
  - Two attempts
- For INF4580:
  - more substantial assignments five and six

Piazza

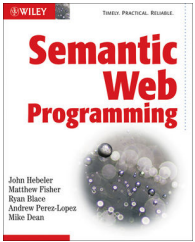
Exam

- Four hours written Exam
- Same exam for INF3580 and INF4580
- Grades A–F
- Probably 6 June – Check semester page!

Reading

- For practical aspects:

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



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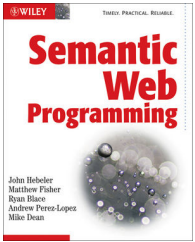

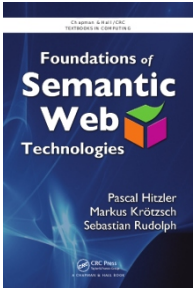

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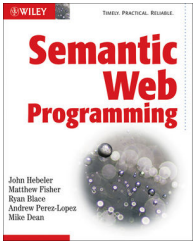

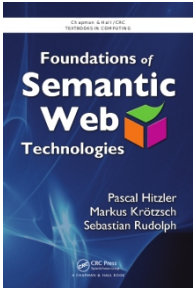

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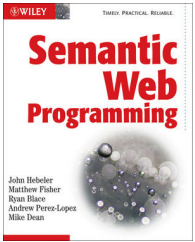
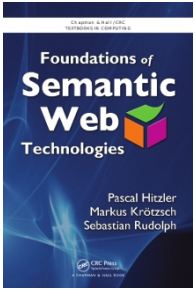
- Slides available on course homepage





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 JDK 9 from

`http://www.oracle.com/technetwork/java/javase/downloads/index.html`

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 Oxygen 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

Download Jena 3.6.0 from:
`http://jena.apache.org/`

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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
- It has a direct interface to Jena
- It is one of the more mature and comprehensive reasoners
- It is powerful enough for our purposes

Pellet sources are available from:

`https://github.com/complexible/pellet`

But wait a bit... maybe we can offer a precompiled package.

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But wait a bit... maybe we can offer a precompiled package. 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`

Software: Protégé

There are several ontology editors available, but...

- The textbook uses Protégé
- It is open source software
- It is the most widely used ontology editor
- Probably the best non-commercial one

So: get Protégé 5.2 from

`http://protege.stanford.edu/`

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Alternatives:

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

Next weeks...

- RDF – knowledge representation – Leif Harald
- Jena – Java API for RDF – Martin
- SPARQL – Query Language – Ernesto
- Maths & Logic – Martin
- ... reasoning and semantics