Chapter 2
Semantic Modeling

Internet Database Lab.
SNU

2009 Winter

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Introduction
- Introduction(1/2)

- Semantic Web
  - A world any number of people can speak
  - Unexpected contribution
  - Large group trying to understand a complex phenomenon
  - This sort of chaos has existed since people first tried to make sense of the world around them
- Model
  - Helping people understand their world
  - Abstract description
    - Hiding certain details
    - Illuminating others

Introduction
- Introduction(2/2)

- Models assist in three essential ways
  - Helping people communicate
  - Explaining and making predictions
  - Mediating among multiple viewpoints



Modeling for Human Communication
- Modeling for Human Communication(1/3)

- Models used for human communication
  - Having a great advantage over models that are intended for use by computers
  - The human capacity to interpret signs to give them meaning
  - Can be written in a wide variety forms
  - Double-edged sword
    - All manner of abuse

- Informal model
  - Relying on the context of its reader for interpretation
  - Helping people communicate about the organization of the information in the document web

Modeling for Human Communication
- Modeling for Human Communication(2/3)

- Document modeling
  - Collaborative style comes in the form of *community tagging*
- Tag
  - A single word or short phrase
  - Describing some aspect of contents
- Tagging systems
  - Providing informal organization
  - Ex> Flicker for photos
  - Ex> del.icio.us for Web bookmarks
- Community tagging
  - Each individual describes contents using tags of their own choosing
  - Evolution by artificial selection
    - A self-organizing character
    - Popular tags become more popular

- Girls-generation
- Tae-yeon
- Korean-Singer

flickr

delicious
social bookmarking

The tastiest bookmarks on the web.
Save your own or see what's fresh now!

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Modeling for Human Communication
- Modeling for Human Communication(3/3)

- Informal organization
  - The interpretation of the tags requires human processing
  - Communication power degrades
    - Being used more and more context
    - Since there isn't an objective description of the meaning
- Formality of a model
  - Not a black-and-white judgment
  - But there can be degrees of formality
  - Legal system
    - Having several layers of legislation
    - Each one giving objective context for the next
    - Even though all these models are expressed in natural language

Explanation and Prediction

- Explanation and Prediction(1/2)

- Models are used to organize human thought
  - The form of *explanation*
    - The key to understanding
    - Making it easier to reuse a model in whole or in part in the context of the Semantic Web
  - When a model provides an adequate explanation
    - To be used to make predictions
- Explanation and prediction
  - Requiring more formality than is required for human communication
  - ※ Fomalism
    - Not depend on interpretation by the consumer
    - But instead are in some *objective form* that stands outside the communication

Explanation and Prediction
- Explanation and Prediction(2/2)

- Formal modeling has a very different social dynamic than informal modeling
  - because there is an objective reference to the model (the formalism), there is no need for the layers of interpretation that result in Talmudic modeling
- the Semantic Web standards include a small variety of modeling formalisms
- because they are formalisms, modeling in the Semantic Web need not become a process of layering interpretation on interpretation
- also, because they are formalisms, it is possible to couch explanations in the Semantic Web in the form of proofs and to use that proof mechanism to make

Explanation and Prediction
- Mediating Variability(1/2)

- Variability
  - The dynamics of the network effect
    - Requiring the ability to represent a variety of opinions
- Good model
  - Organizes those opinions
    - Common can be represented together
    - Distinct can be represented as well
  - Ex> Pluto example
    - IAU(International Astronomical Union) has decided it should be considered a member of a new category called a "dwarf planet!"
    - But astrologers continued to consider Pluto a planet

Explanation and Prediction
- Mediating Variability(2/2)

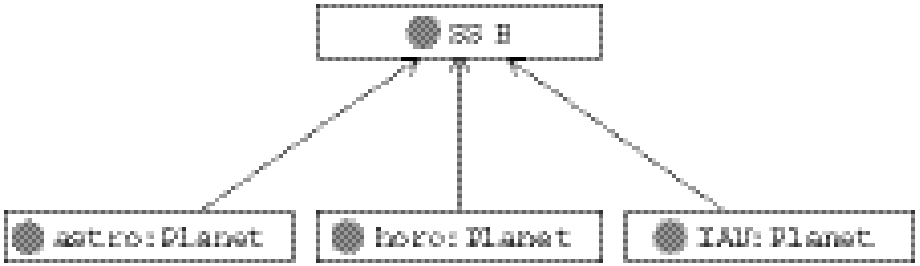
- How can we accommodate variations of opinion on the Web?
  - To make a decision as to which one is "preferred" and to control the Web only that is supported
    - Ex> Corporate data center
      - The database administrator decides what data are allowed to live
    - Not appropriate for the Web
    - Because of the AAA slogan (see Ch1) leads to the network effect
  - To allow each one to be represented separately, with no reference to one another at all
    - Responsibility of the consumer to understand how these things
    - Basis of an informal approach
    - Ex> Pluto Example
      - Some call it a planet while some call it a dwarf planet
    - Describing the state of the document web

Explanation and Prediction
- Variation and Classes(1/4)

- How can a model describe what is common
  - Astrological versus astronomical notion of a planet
- This problem is not a new one
  - Object-Oriented Programming
    - Means of organizing variability in software component
    - Organizing tools is the notion of a hierarchy of classes and subclasses
    - Classes high up in the hierarchy
      - Representing functionality that is common to a large number
    - Classes down in a hierarchy
      - Representing more specific functionality
- The Semantic Web standards
  - Also use this idea of class hierarchy

Explanation and Prediction
- Variation and Classes(3/4)

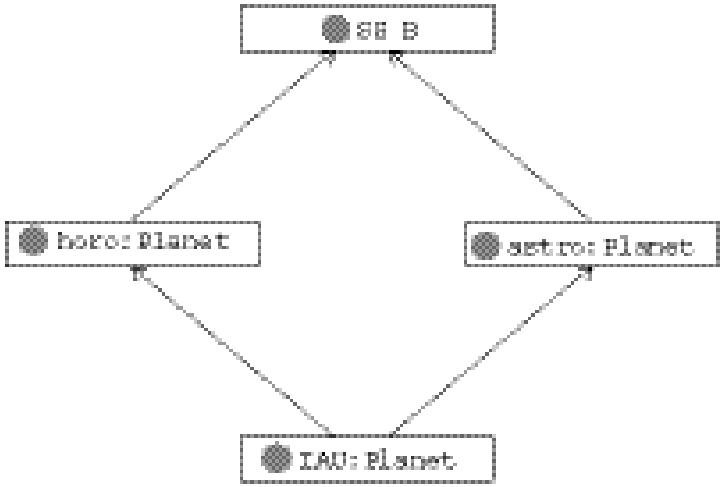
- twentieth-century astronomy and astrology are not quite as organized as this
- we can define a class of the things that orbit the sun, which we may as well as call solar system body, or SSB for short



Subclass diagram for different notions of planet

Explanation and Prediction
- Variation and Classes(4/4)

- we can go further in this modeling when we observe that there are only eight IAU:Planets, and each one is also a horo:Planet and an astro:Planet
- thus, we can say that IAU:Planet is a subclass of both horo:Planet and astro:Planet

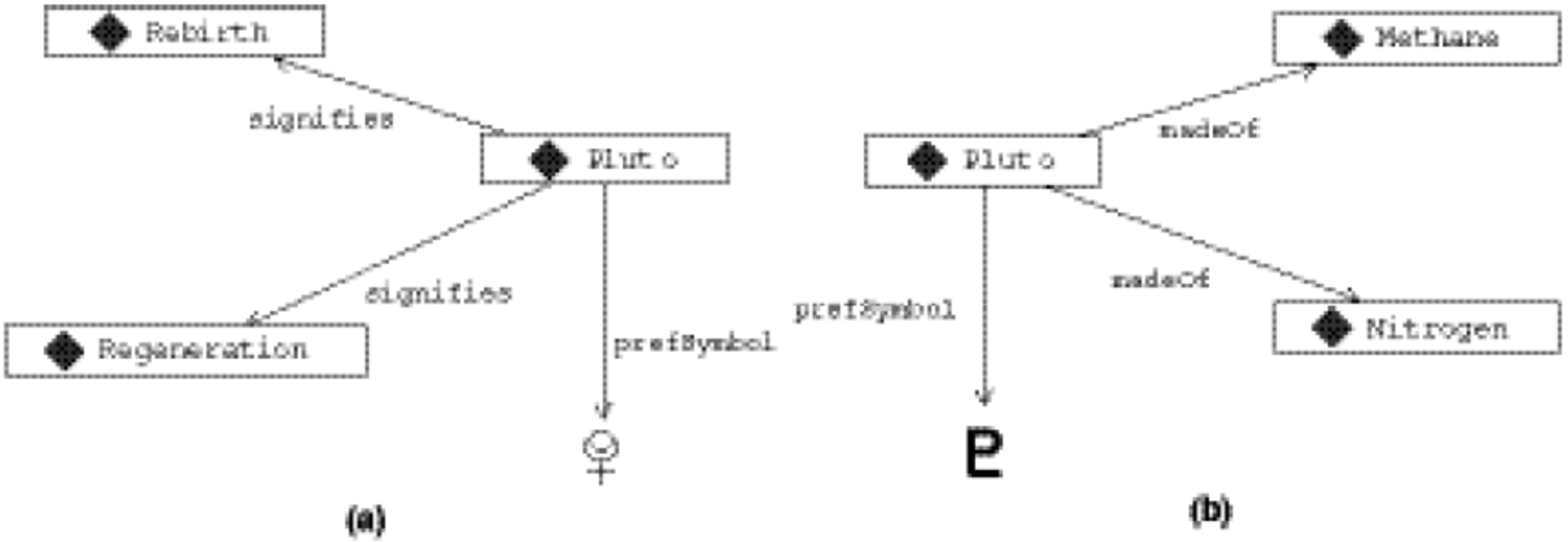


More detailed relationships between various notions of planet

Explanation and Prediction

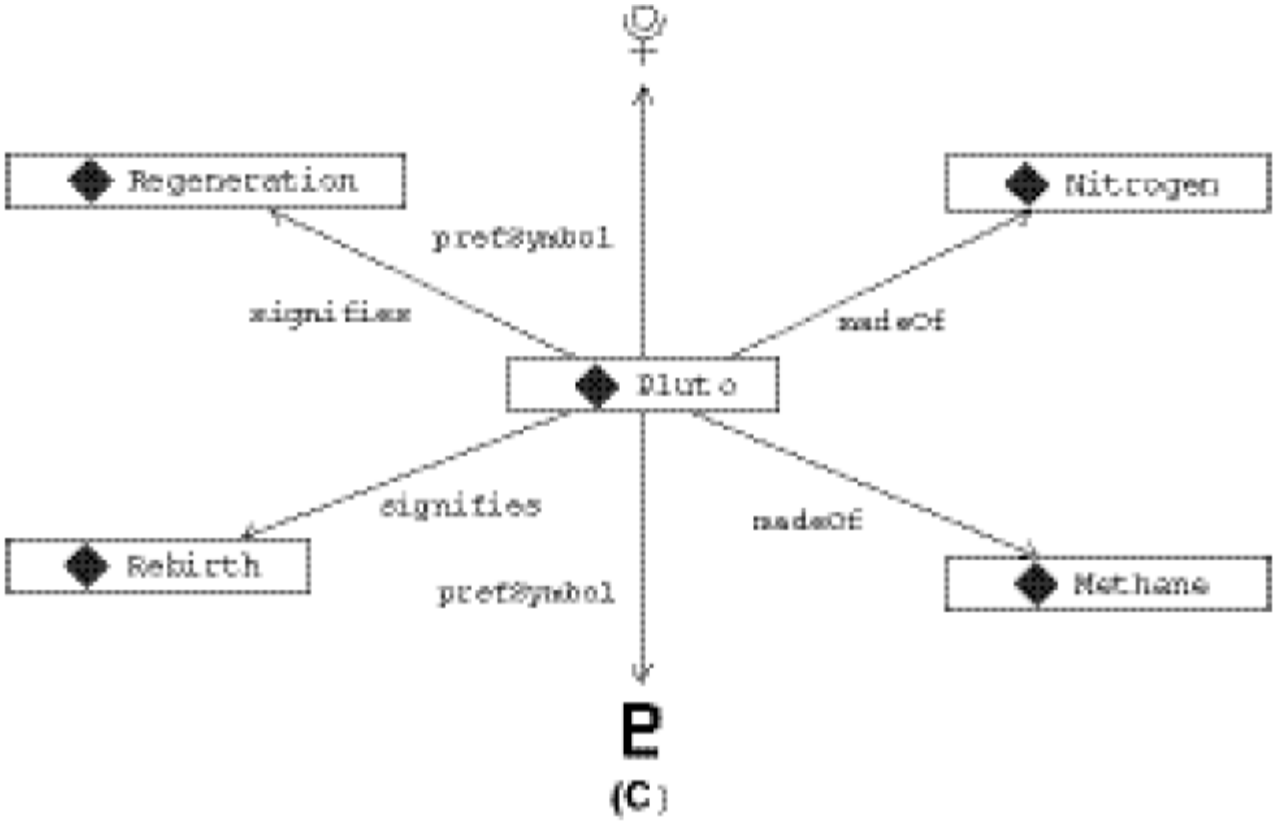
- Variation and Layers(1/1)

- (a) some information about Pluto that is common among astrologers
- (b) some information that is of concern to astronomers



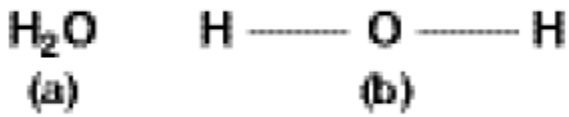
Explanation and Prediction
- Variation and Layers(2/2)

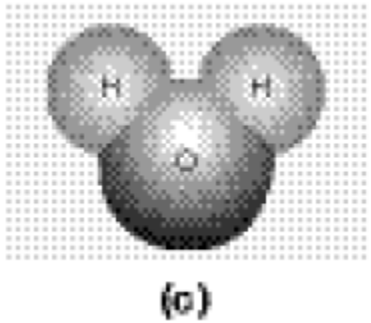
- (c) the simplest way is to simply merge the two models into a single one that includes all the information from each model



Explanation and Prediction
- Expressivity in Modeling (1/3)

- Trade-off when we model
  - Not everyone will want to say certain things
  - Need different tool
  - Level of expressivity





- The Semantic Web
  - providing a number of modeling languages that differ in their level of expressivity

Explanation and Prediction
- Expressivity in Modeling (2/3)

- RDF(Resource Description Framework) ch3, ch4, ch5
  - The basic framework
  - providing a mechanism for
    - Allowing anyone to make a basic statement about anything
    - Layering these statements into a single model
  - Having been a recommendation from the W3C since 2003
- RDFS(RDF Schema Language) ch6
  - A language with the expressivity
    - to describe the basic notions of commonality and variability
    - Familiar form object languages and other class systems-namely classes, subclasses, and properties
  - RDFS has been a W3C recommendation since 2003

Explanation and Prediction
- Expressivity in Modeling (3/3)

- RDF-PLUS ch7, ch8
  - A subset of OWL
  - More expressive than RDFS
  - Without the complexity of OWL
- OWL(Web Ontology Language) ch9, ch10, ch 11, ch12, ch13
  - Brings the expressivity of logic to the Semantic Web
  - To allow modelers to express detailed constraints between classes, entities, and properties
  - Being adopted as a recommendation by the W3C in 2003