An Introduction to CHOP: the Common Home Ontology in Protege

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What is an Ontology?

- A common vocabulary that lets individuals communicate with precision about some aspect of the world (domain)
  - The individuals may be persons, computer programs, or both
- It provides standard interpretations for words
  - that might otherwise be dangerously ambiguous
- It structures the domain knowledge in ways that allow it to be analyzed,
  - making assumptions more explicit
- Share some motivation with standards work done by NIST and ISO for various industries, e.g. STEP
What is CHOP?

- The ILSA program has developed an ontology called “CHOP” for the client home environment and the ILSA support systems.
- This ontology is very important in the agent-based ILSA software.
  - Agents use CHOP terms to communicate clearly with each other.
- CHOP has roughly 800 frames, mostly classes.
- CHOP was built in and is maintained in a software tool called Protégé.
What is Protégé?

- Protégé-2000 is a graphical tool to construct and maintain an ontology
  - Written entirely in Java and will run on many platforms
  - Extensible with graphical widgets for tables, diagrams...
  - Freely available under the Mozilla Public License
  - See: [http://protege.stanford.edu](http://protege.stanford.edu)

- Protégé ontologies can be written as:
  - CLIPS style fact bases
  - RDF (Resource Description Framework, XML)
  - JDBC compliant database
  - Java beans
Ontology Elements

- **Classes**
  - Define types of things and their attributes, e.g. “Cats”, “color”
  - May be specializations of one or more abstract classes, inheriting their attributes. Classes form an “a-kind-of” hierarchy

- **Slots**
  - Describe attributes of things, e.g. “Fur-color”
  - Have some number of values of given types

- **Instances**
  - Describe individual things, e.g. “My-cat-Puff” w. Fur-color=White

- **Forms**
  - Provide convenient data entry for instances
Sample Protégé Screen for CHOP

Class hierarchy

Slots for selected class
CHOP Overview

- CHOP class hierarchy nests up to 5 levels deep under the top level class CHOP_THING
- Top level classes shown at right
- Subsequent slides tour of some interesting subclasses

- ABSTRACT_INFORMATION
- AGENT
- AGENT_ROLE
- COMPOSITE_ATTRIBUTE_TYPE
- COMMUNICATION_ACT
- PHYSICAL_OBJECT
- MEASURABLE_ATTRIBUTE_TYPE
- MENTAL_OBJECT
- PLACE
- PREDICATE
- PROCESS
- SITUATION
- RELATION_TYPE
- TEMPORAL_OBJECT
- TRUTH_VALUE
AGENT classes describe actors--entities with some autonomy--to whom ILSA may need to refer

- Biological agents such as people and animals
- Software agents--parts of ILSA itself
- Organizations that may be treated as agents
AGENT_ROLEs define functional relationships between agents or special jobs for agents

- Familial relationships
- Professional relationships
- Internal roles in ILSA software
PHYSICAL OBJECT

- PHYSICAL_OBJECTs are roughly “things with mass”
- Includes plants and animals, parts thereof
- Consumable items such as fuels, energy, food
- Artifacts are machines and artificial substances
- Contrast with MENTAL_OBJECTs, things that exist in an agent’s mind.
PLACE classes capture various aspects of the concept “place”

Some classes such as PORTAL appear in multiple parts of the construction, denoted by ‘M’ in the figure.
abstract information

Classes describe mathematical concepts of various kinds including plans and schedules, languages and protocols, mental objects such as memories and sensations.
These terms are used to refer to physical measures including time, space, mass, energy, etc.
PROCESSes are things that exist by virtue of their temporal extent. The (being form of ) action verbs tend to rest here. They may be referenced by events or capabilities.

This category includes lots of things that people do in their homes.
CHOP forms a lingua franca for ILSA agents

- CHOP acts as an abstract interface for high-level conversations over coordination computations.
- CHOP in conjunction with a standard content language, such as SL(X), allows an agent developer to easily begin communicating with other ILSA agents.
- CHOP isa-relations between terms can form the basis of isa-inferences in the ILSA system: animal(x) -> feedRegularly(x); animal = isa(cat-1); feedRegularly(cat-1).

CHOP is presently mediated by an Ontology Agent which can answer questions about a term or terms in the ontology posed by other agents in the system.

CHOP is used by our Java Agent Development Environment agents by creating a Java class hierarchy through a generator provided by the University of Amsterdam’s Department of Social Informatics (http://www.swi.psy.uva.nl/usr/aart/ontobean/index.html)
A new environmental control agent arrives in an ILSA installation.

It asks the agent system’s Directory Facilitator (DF) agent about the Ontology agent and any device control agents.

Through conversations with the DF and ontology agent it discovers the temperature sensing and thermostat control agents.

It then communicates with those agents directly to obtain information about and control of the environment.

A new agent can ask ISA questions about agents in the system to find those appropriate to help it with its functions.
Ontologies are standard vocabularies that enable agents to communicate on some domain of discourse.

Protégé is a software tool to create and maintain an ontology.

CHOP is an ontology created by the ILSA program to cover the household domain.

CHOP’s hundreds of classes and attributes are used by ILSA agents for communicating about events in the home.