

Honeywell



ILSA Home Ontology

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>
- 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

The screenshot shows the CHOP Protégé-2000 interface. On the left, a class hierarchy is displayed under the 'Relationship' tab, with 'IR_BASED_LOCATION_SENSOR' selected. On the right, the 'IR_BASED_LOCATION_SENSOR' class is detailed, showing its name, documentation, role, and a list of template slots.

Name	Type	Cardinality	Other Facets
accuracy	Float	single	minimum=0.0, maximum=1.0
horizontal_coverage_area	Float	single	
id	Integer	single	
mass	Float	single	
operation_level	String	single	
output_communication_medium	String	single	
output_data_rate	Integer	single	
output_data_type	String	single	
power_type	String	single	
range	Integer	single	
sample_rate	Float	single	
sensed_event_type	String	single	
size_of_data_output	Integer	single	
vertical_coverage_area	Float	single	

Class hierarchy

Slots for selected class



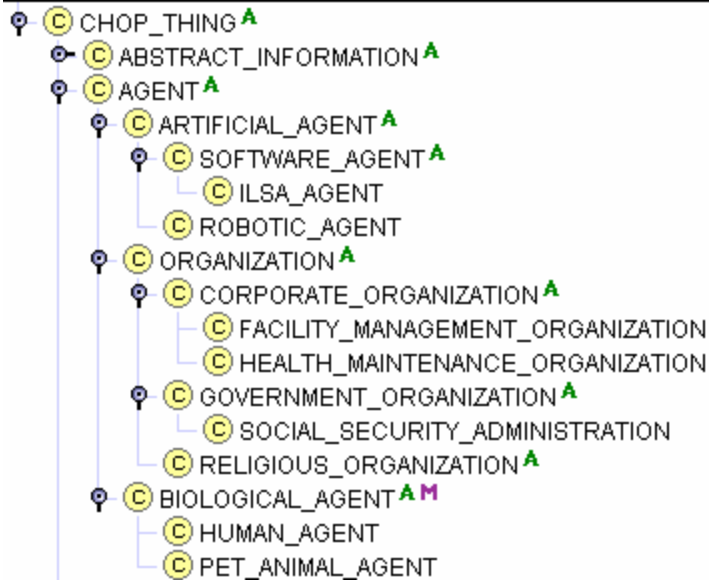
CHOP Overview

- 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

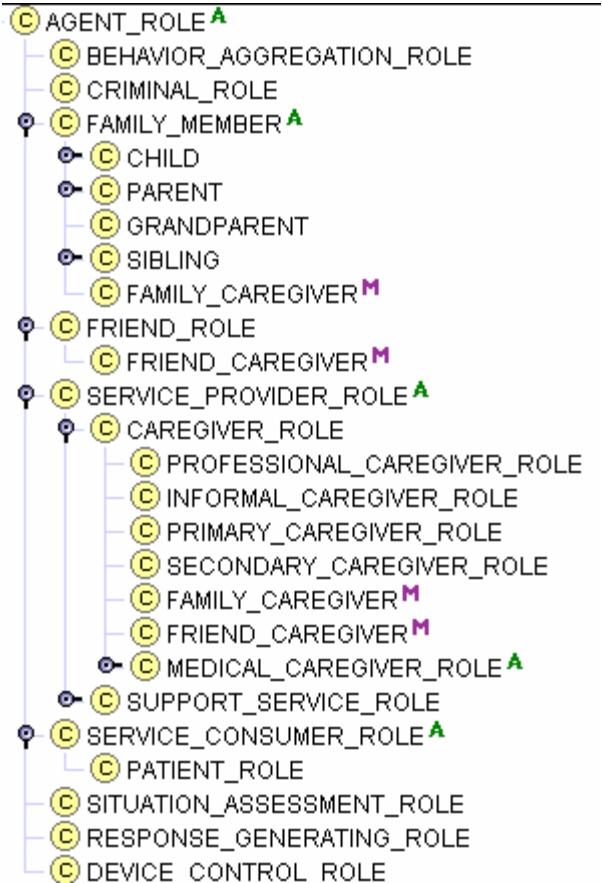


AGENT classes describe actors-- entities with some autonomy--to whom ILSA may need to refer

- Biological agents such as people and animals
- Software agents-- parts of ILSA itself
- Organizations that may be treated as agents



AGENT ROLE

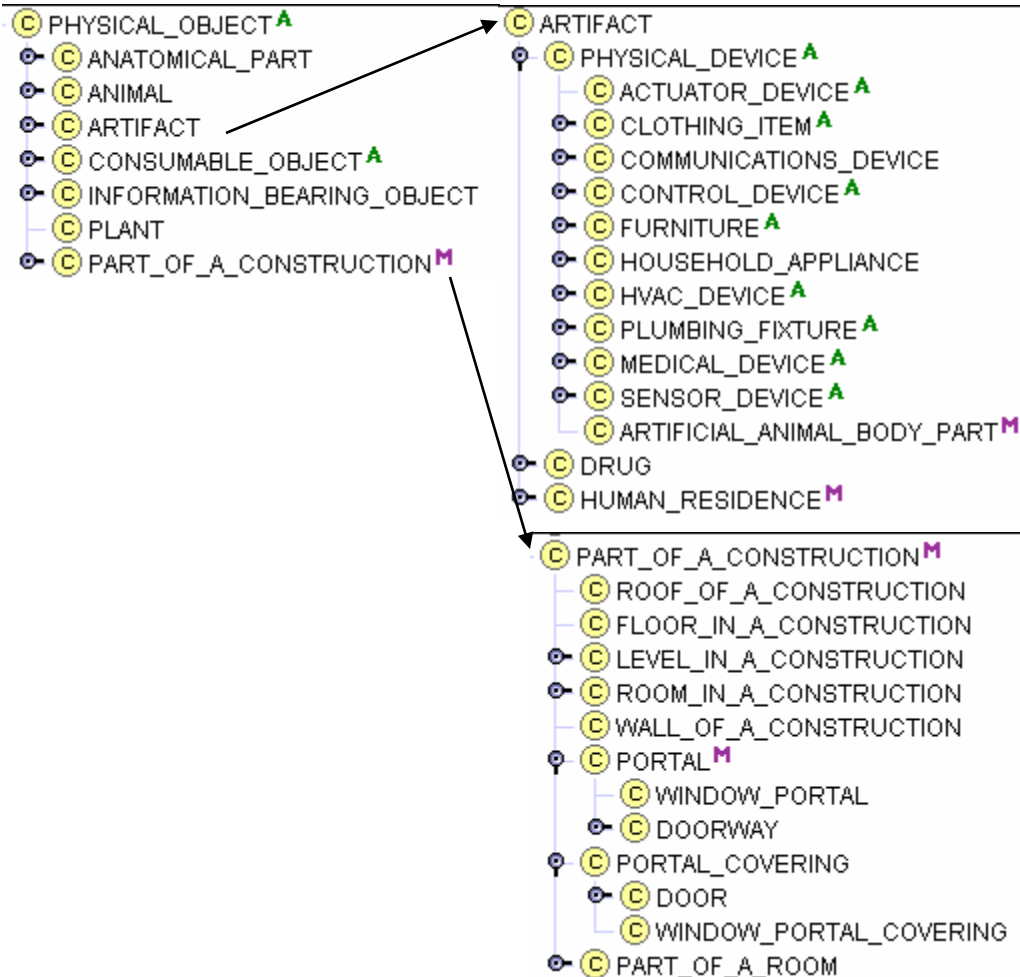


AGENT_ROLES define functional relationships between agents or special jobs for agents

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



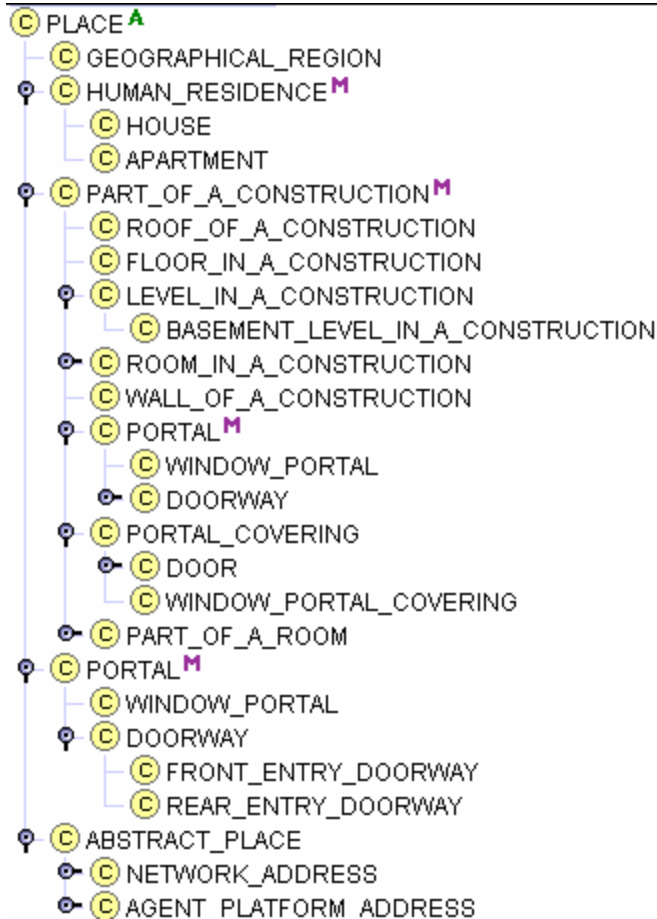
PHYSICAL OBJECT



- 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.



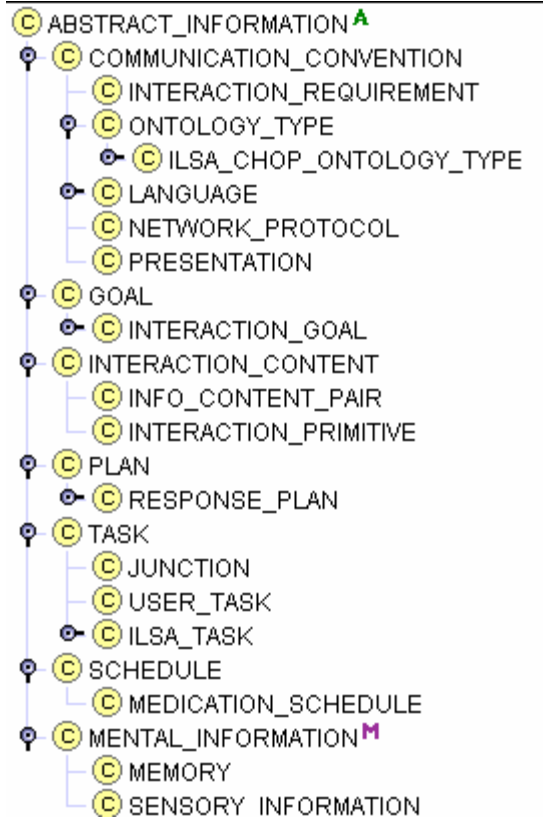
PLACE



- 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.



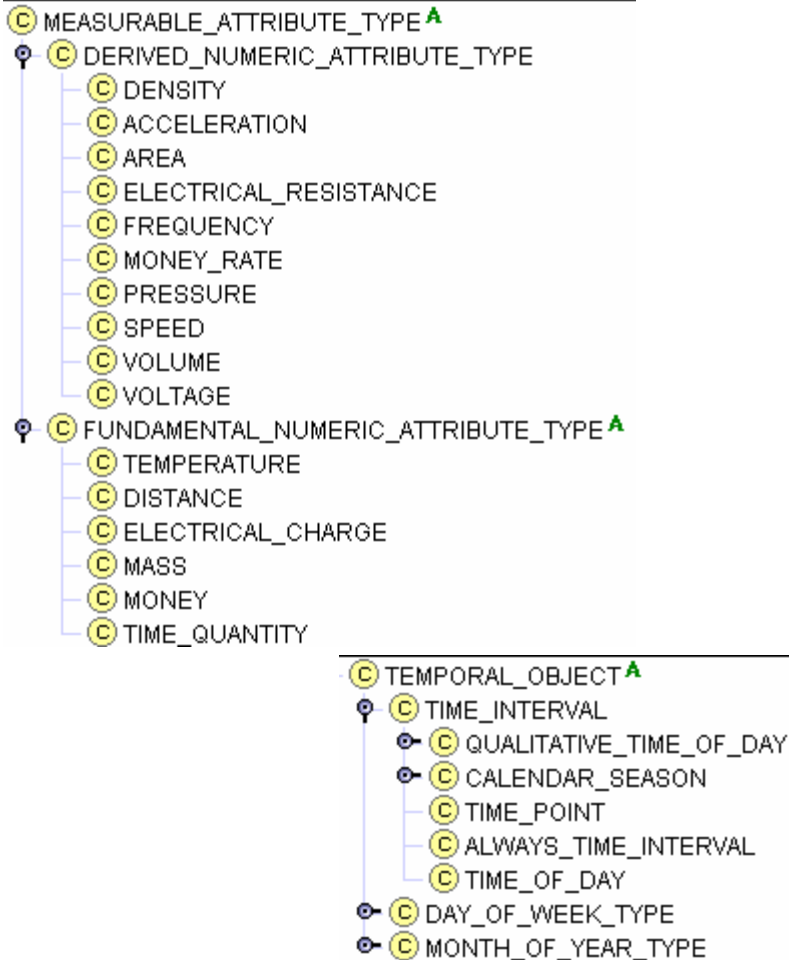
ABSTRACT INFORMATION



- **ABSTRACT INFORMATION** classes describe mathematical concepts of various kinds including plans and schedules, languages and protocols, mental objects such as memories and sensations



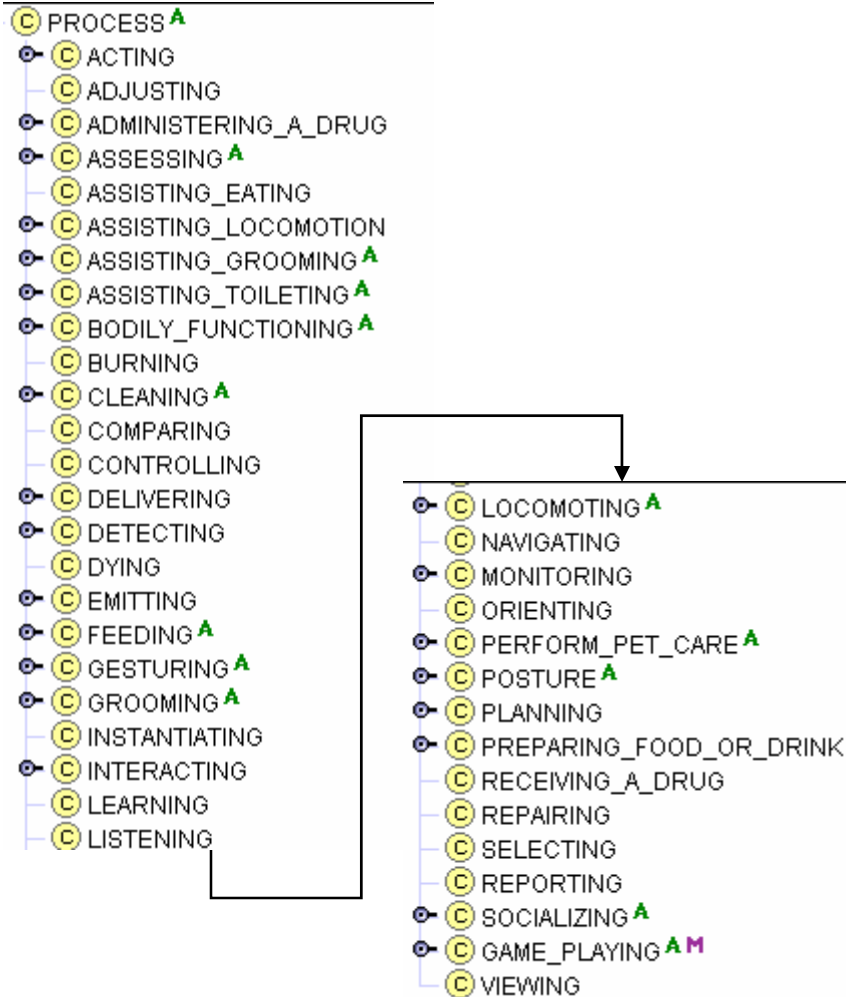
TIME, SPACE, MEASURE



- These terms are used to refer to physical measures including time space, mass energy etc.



PROCESS



- 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

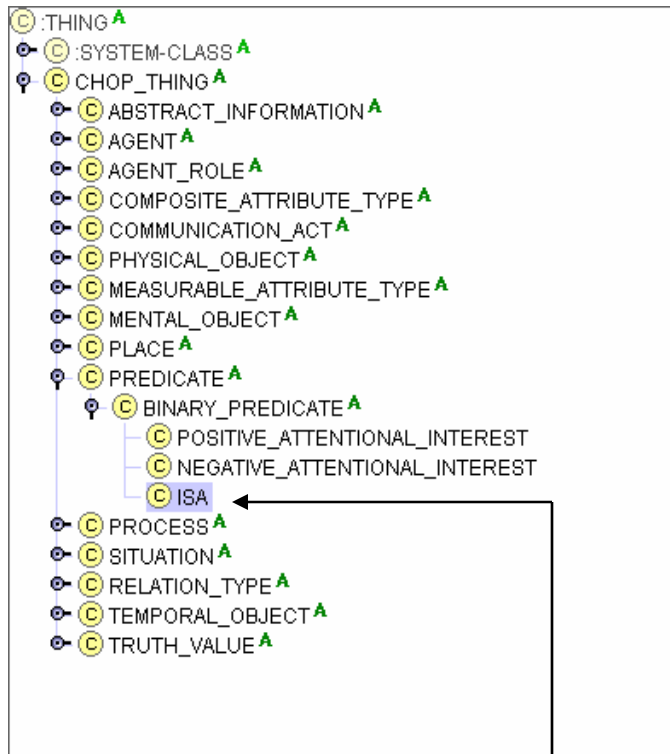


CHOP for ILSA Agents

- 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 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 Deveopment 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>)



Agent Example



A new agent can ask ISA questions about agents in the system to find those appropriate to help it with its functions.

- 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.



SUMMARY

- **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**