SIG MMT

Modelling, Methods, and Technology

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Plan

1. What is the purpose of SIG MMT?

2. The POSC Caesar Trac as a tool for collaboration in SIG's

3. Using templates to create rich and reliable semantic structures

POSC Caesar Special Interest Groups

- From the POSC Caesar web:

  For assuring high quality of the reference data, PCA has established SIGs for some business domains in the upstream sector of Oil and Gas industry and for descipline areas in Process Plants. The SIGs are accountable for their domains.

- The focus of SIG MMT is ontology development in general rather than a particular domain
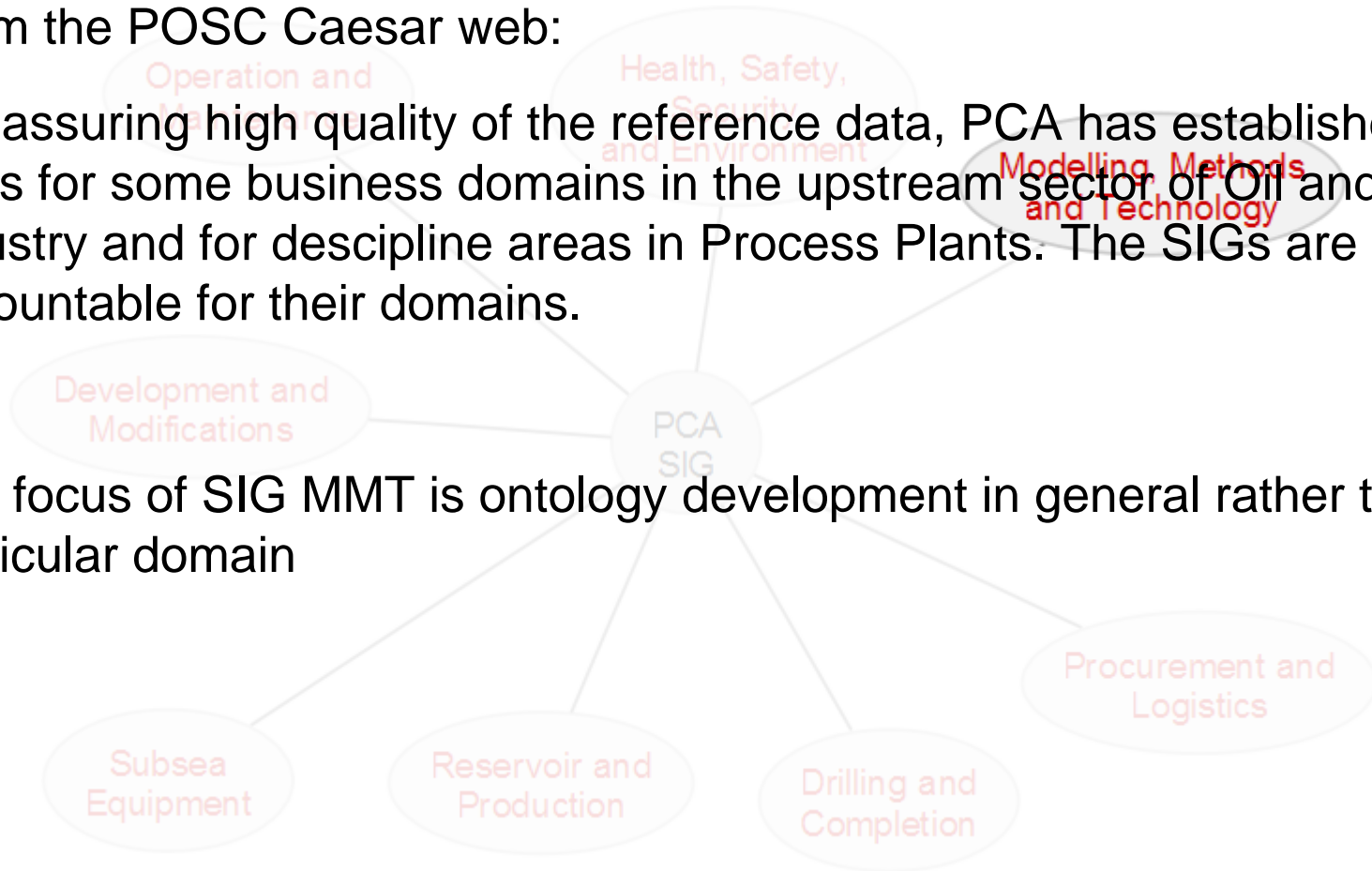
Purpose of SIG MMT

- Investigate ISO 15926 Part 2 and propose changes

- Identify best practises in modelling

- Give advice on technologies for the implementation and practical application of ISO 15926

- ISO 15926 Part 2 is a data model and an upper ontology
  - Generic categories such as *Class*, *Event*, *Parthood*
  - Canonical version in Express (ISO 10303)
  - Current implementations tend to prefer RDF and OWL

- The POSC Caesar Reference Data Library (RDL) conforms to this model

- Criticism has been directed at the upper ontology
  - Some ontological categories could be added to it
  - More constraints would be beneficial

- Recent work has shown that we can get a lot done with what we have

- Improving the standard is not crucial in the short term

Identify best practises in modelling

- **Widespread adoption of semantic modelling is something new**

- **Basic ontology concepts need to be understood by contributors**
  - Class versus individual
  - Comparison to OO approaches: Relations versus attributes
  - Open World
  - Expressive limitations versus programming languages
  - (Description) Logic
  - etc.

- **Complexity is unavoidable**
  - Semantic models require more structure to be made explicit

- **Standardization of representation patterns is highly desirable**

MANAGING RISK

- ■ Tools specific to the POSC Caesar Reference Data Library
  - Reference Data Editor
  - Browsers

- ■ Generic ontology tools
  - A wide array of tools for working with ontologies
  - Formats are standardized (W3C), but maturity varies widely
  - A mix of commercial and open-source/free software

- ■ Ontologies
  - ISO 15926-2 is available in OWL, close to Express version
  - Translations into formats for specific use is required, e.g.
  - Visualization, taxonomy checks

- ■ A core set of tools is clearly desired

The POSC Caesar Trac: **trac.posccaesar.org**
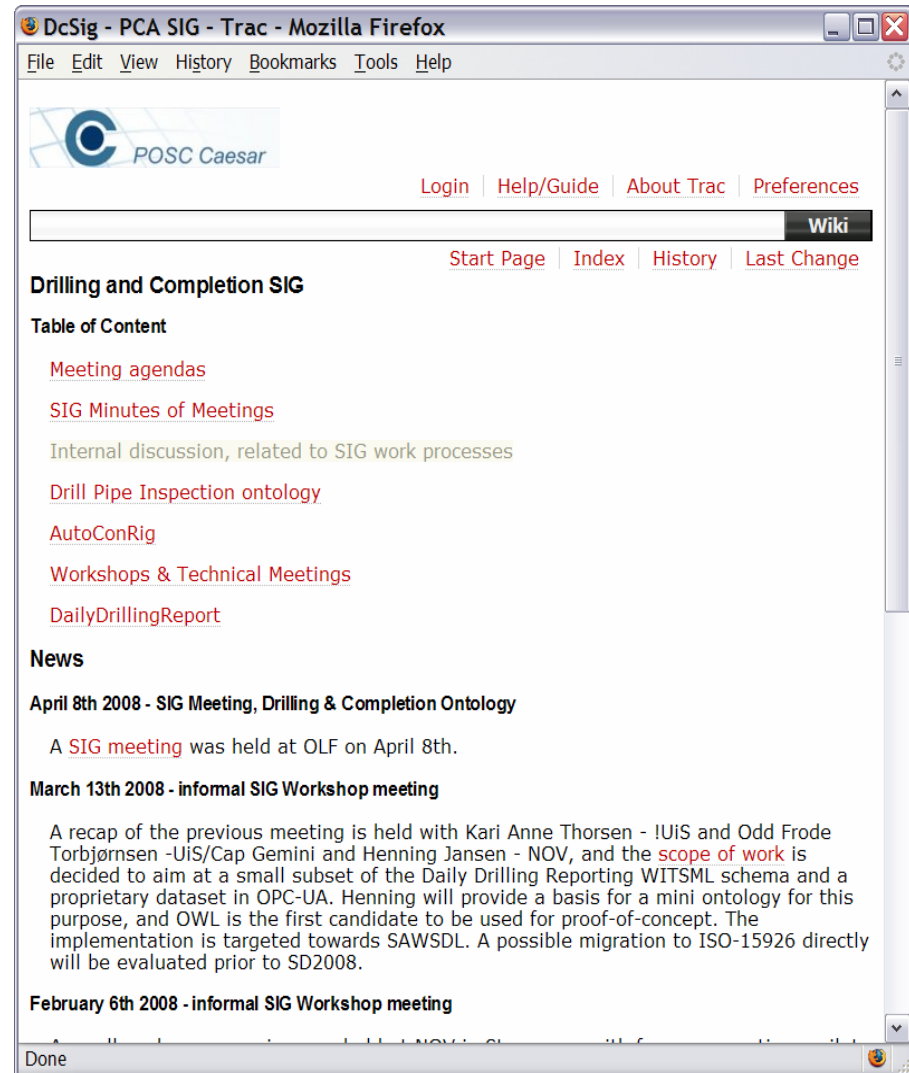
- Trac is a tool for software development

- Wiki for creating shared documents

- Document repository

- Supports the aim of making the ontology accessible

- Administered by SIG MMT

The POSC Caesar Trac: **trac.posccaesar.org**

- **Each SIG has a home page and a storage domain**

- **Everything is version controlled**
  - Web pages
  - Stored documents

- **Registered users can create and edit pages, store documents**

- **Guests can browse the Wiki pages**

- **Restricted areas may be set up for "internal affairs"**

- **The Trac is suitable for collaboration as well as publication of results**

The POSC Caesar Trac : **trac.posccaesar.org**

- Documenting modelling decisions

- Links to standards organizations

- Visualization of RDL structures

- Making ontology files available

- Publication with minimal effort

The MMT page at trac.posccaesar.org

- We intend to make the MMT page a useful resource for other SIG's

- Links to sources of information about modelling with ISO 15926

- Links to general ontology sources

- Recommendations on software tools

- Advice on using, maintaining, and extending the ontology

MANAGING RISK

- The domain-specific SIG's will be working to extend the POSC Caesar Reference Data Library

- Typical tools used include
  - Reference Data Editor
  - Spreadsheets

Current practice and tools I: *RDE*

- Reference Data Editor

- Compliant with ISO 15926-2

- Available at
  rds.posccaesar.com

- A tool for ISO 15926 experts, not so
  much for O & G domain experts

Current practice and tools II: *MS Excel*

- Spreadsheets are still in wide use for defining reference data

- Advantage: Domain experts tend to like tables

- Disadvantage: Complete lack of support for building correct structures

- Creating a good ontology using spreadsheets is practically impossible

Current practice and tools III: *Protégé*

- A generic ontology editor

- Supports loading ISO 15926 Part 2 in OWL format

- Supports loading RDL in OWL format
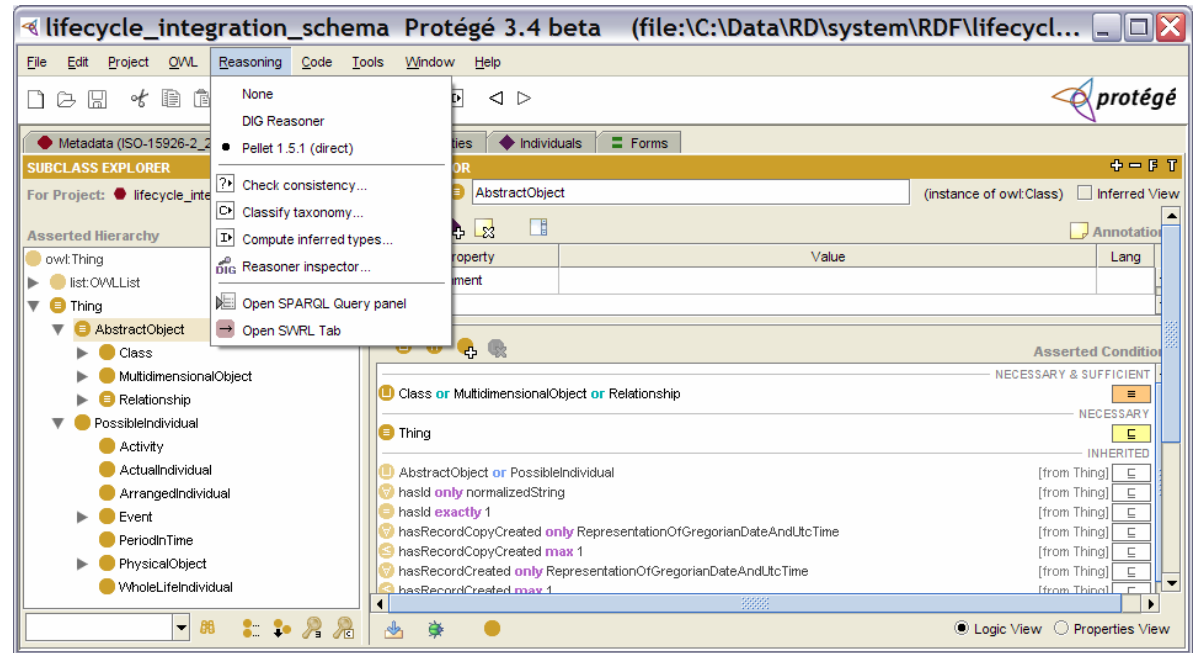
- Like the RDE, mainly an expert tool

Simple, intelligent tools wanted

- Standardized modelling practice

- Tools that are familiar to domain experts
  - Protégé, RDE are out

- Tools that support the user and check correctness
  - Excel is out

- Tools that provide for working at a suitable level of abstraction
  - Most ontology editors expose the user to too much "assembly code"

Building domain ontologies with *templates*

- An ontology is used to record *statements.* That's semantics.

- To build the RDL, we need to represent facts about a given domain using the language of ISO 15926

- Ideally, a domain expert states the facts, and the machine interprets the facts automatically

A template is a pattern for stating facts

■ A Template for ISO 15926 is a *statement form*, a *pattern for facts*

■ A template has a *signature* defining the form of a statement
  - What arguments need to be given
  - What are their types

■ Each template has an *interpretation rule* that interprets facts that fit the pattern
  - Reducing a complex statement into simpler ones
  - Eventually, to atomic statements in ISO 15926
  - Yielding an expression of the fact in the ontology language

■ Current prototype developed in the Intelligent Data Sets (IDS) project

Template example I

- Assume that any car has 3 or more wheels

- Expressed with a suitable template *Parts*

    Parts (Car, Wheel, 3) *!*

- Rules generate a set of ISO 15926 statements
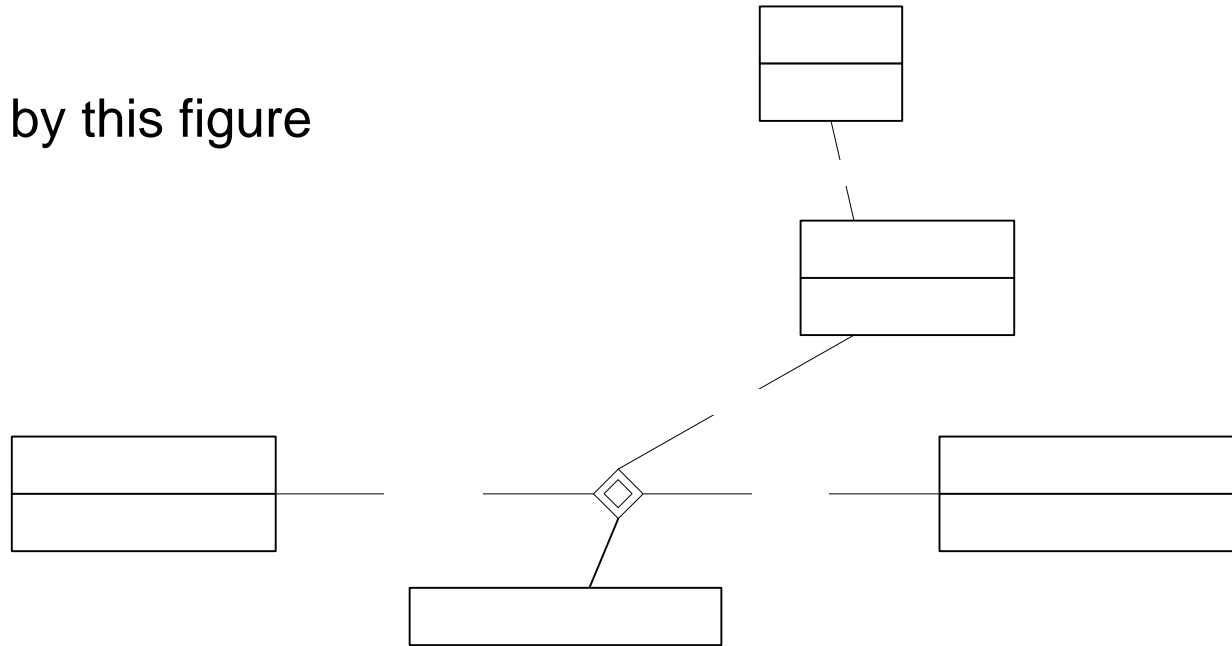

 " The statement

    Parts (C, D, i, j)

    means that

    Any *C* has between *i* and *j D's* as parts"

- Assume that any car has 3 or more wheels

- Expressed with a suitable template *Parts*

    Parts (Car, Wheel, 3) *!*

- Rules generate a set of ISO 15926 statements

- … as illustrated by this figure

- Making the statement

    Parts (Car, Wheel, 3)

  requires no detailed knowledge about modelling

- A list of arguments can easily be stored in a table (Excel!)

- Correctness of the generated ontology structure can be checked using generic ontology tools
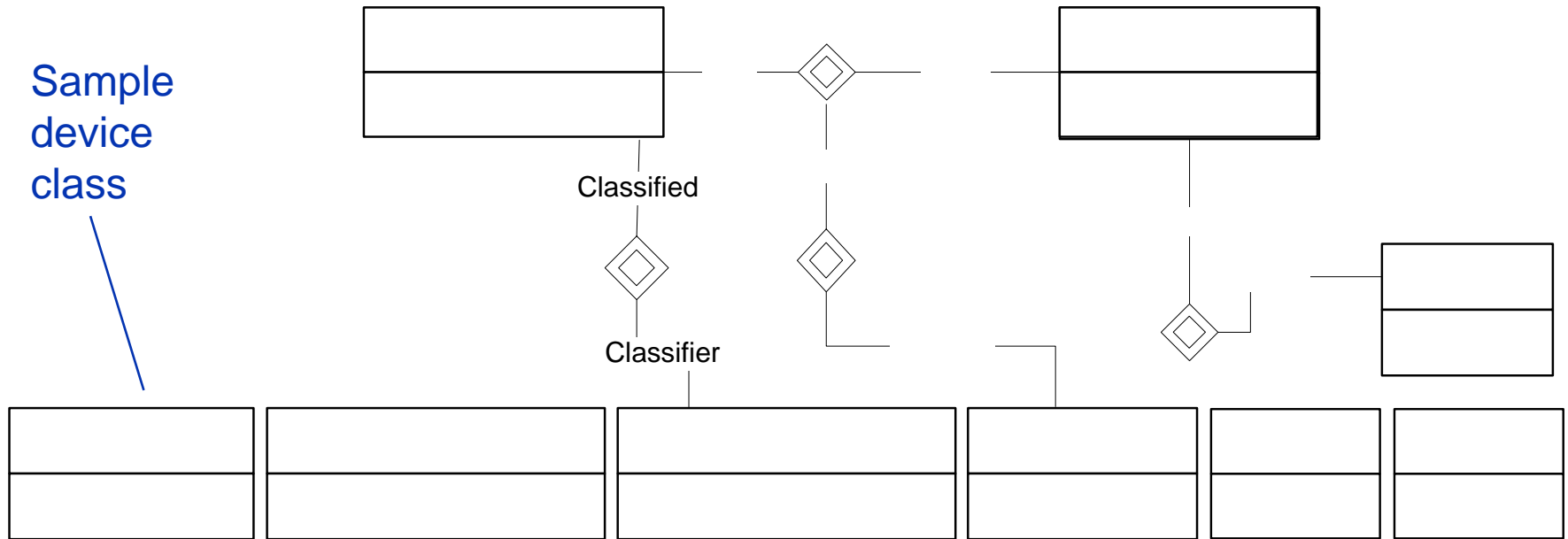
- A fairly complex claim (from IDS prototype)

  "The ambient temperature during operation of a 3051CG pressure transmitter should be within -40 and 85 degrees Celsius."

- Six arguments are required for a precise statement

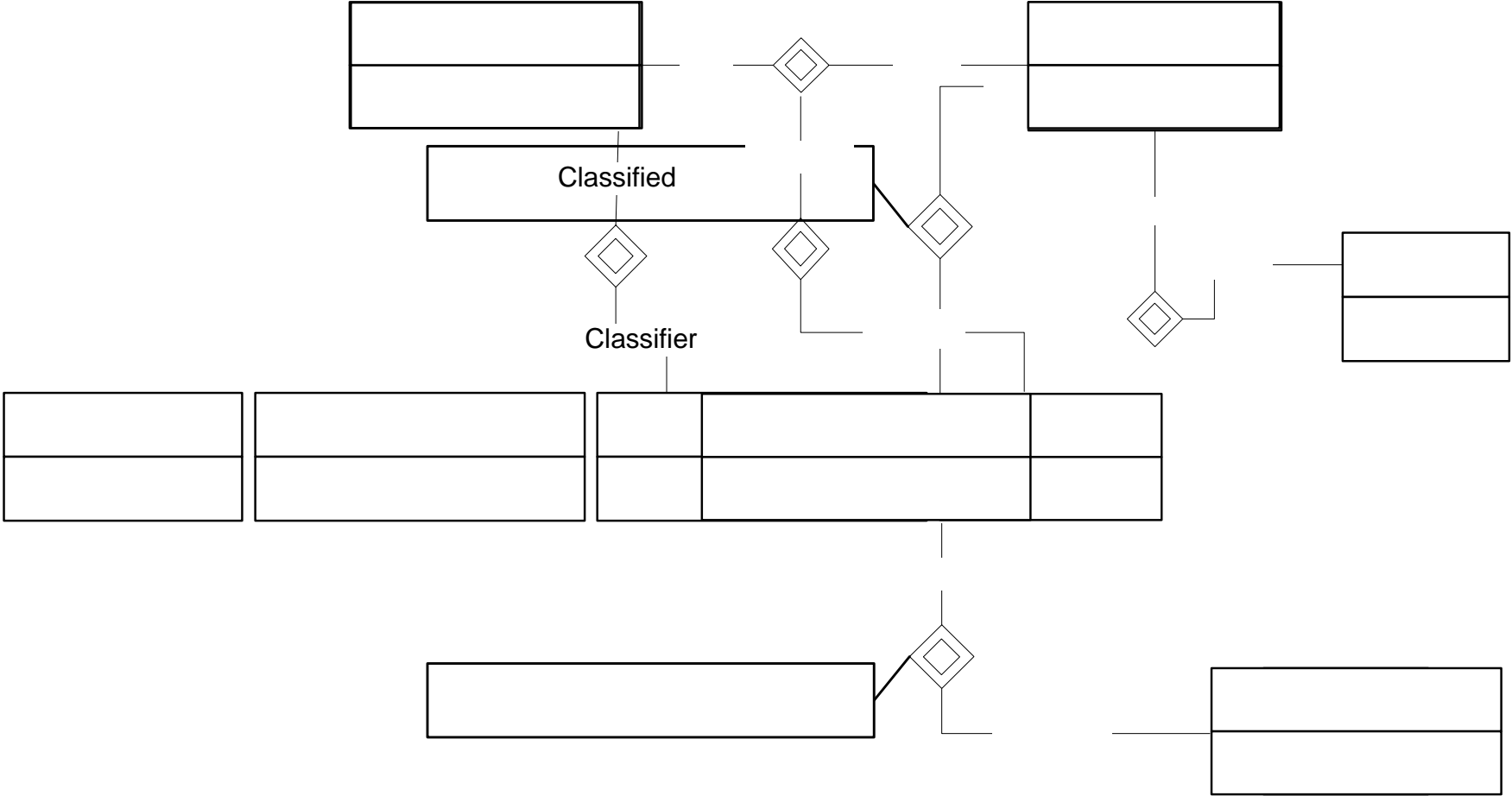 "The _body height_ of a _human_ is a _length_ property which varies from _50_ to _250 cm_"

Property with Scale and Quantification

Sample
device
class

Classified

Classifier

Te

"The ambient temperature during operation of a 3051CG pressure transmitter should be within -40 and 85 degrees Celsius."
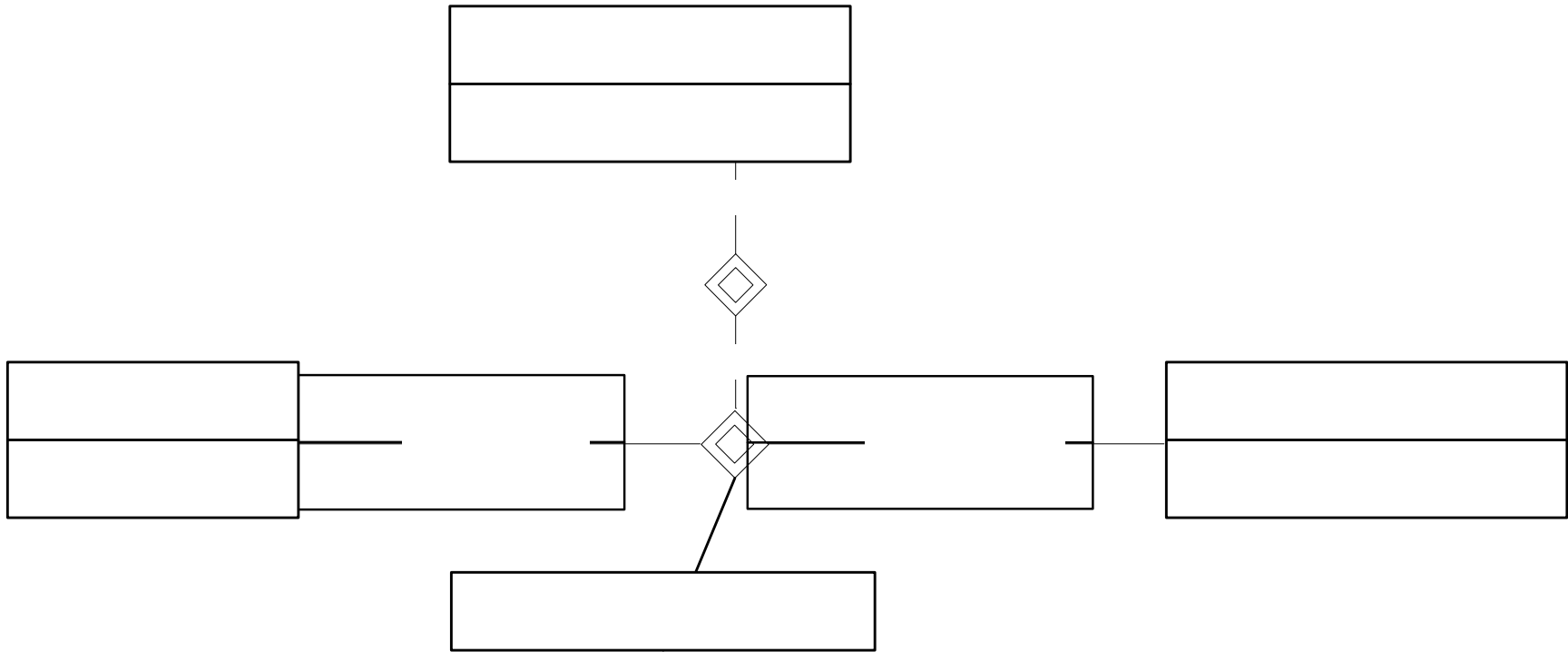
Property Range

Classified

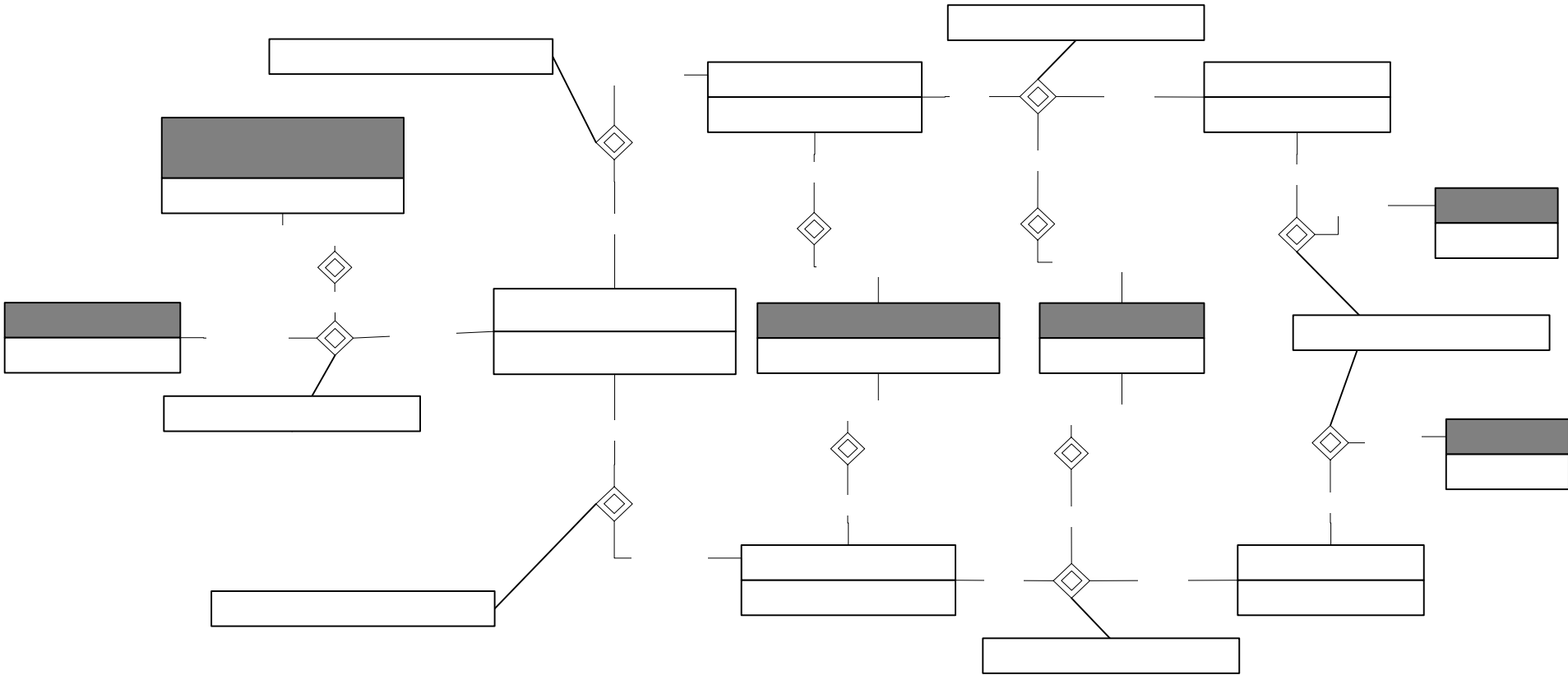Classifier

Te

Property Range Restriction

Model: Ambient Temperature Range

MANAGING RISK

3051CG ambient temperature: -40°C – 85°C

Upper Bound Of Pr

Templates for SIG ontology development

- Templates can provide a flexible and precise tool for ontology building

- Creating rich semantic structure becomes practical

- Standardization of modelling is standardizing on templates

- Let the compiler handle the assembly language

- Results can be consistency checked using automated reasoning

- Need to work with SIG's to find the statement forms that are needed