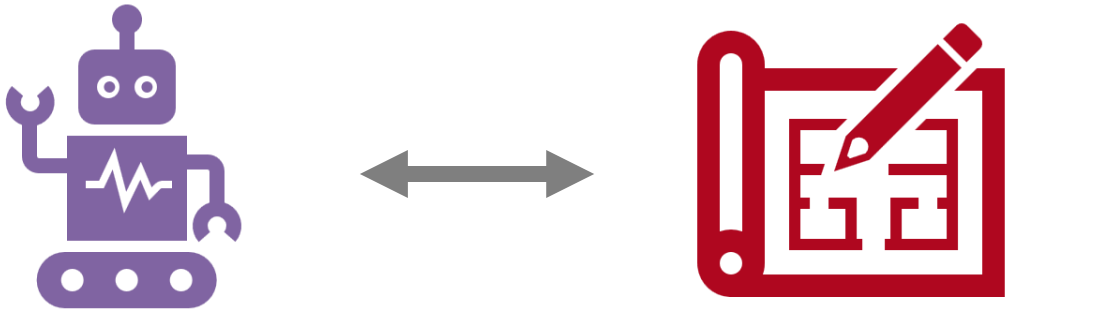
Ontologies of Cultural Heritage for Humans and Machines

The Cultural Heritage Abstract Reference Model

Cesar Gonzalez-Perez
Incipit CSIC

Ontologies?

- The semantic web
- Thesauri, controlled vocabularies, terminology
- RDF, RDFS, SKOS, OWL, etc. (W3C)



artificial intelligence

software engineering

History and Trends

Artificial Intelligence

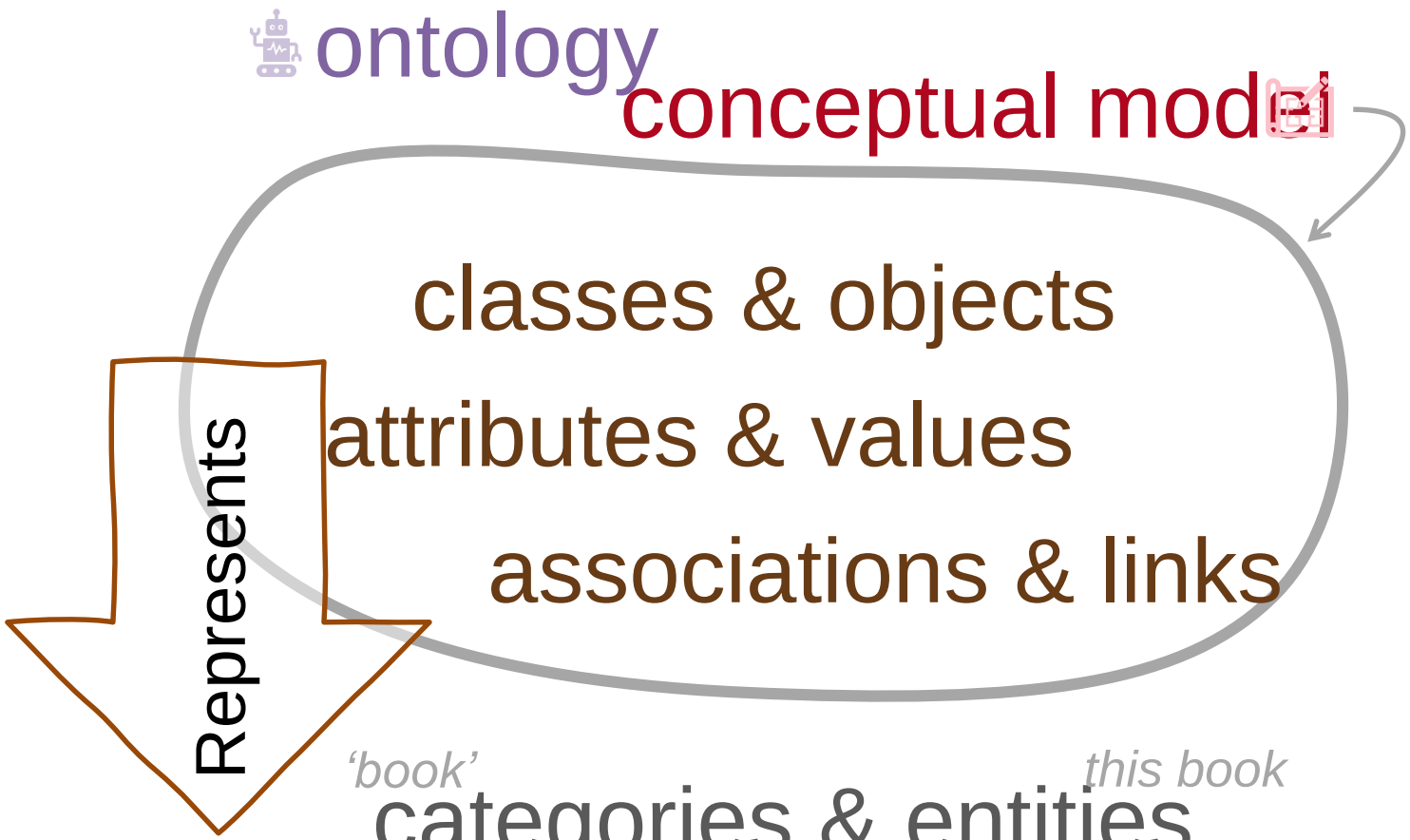
- Represent the world ✓
- How reasoning occurs ✗
- Artificial processing ✗
- For the machine ✗
- Formalist ✗
- Documentation purpose ✗
- Difficult to develop ✗

Software Engineering

- Represent the world
- How the world is
- Clear communication
- For the people
- Intuitionist
- Exploratory purpose
- Easier to develop

current trends ✓

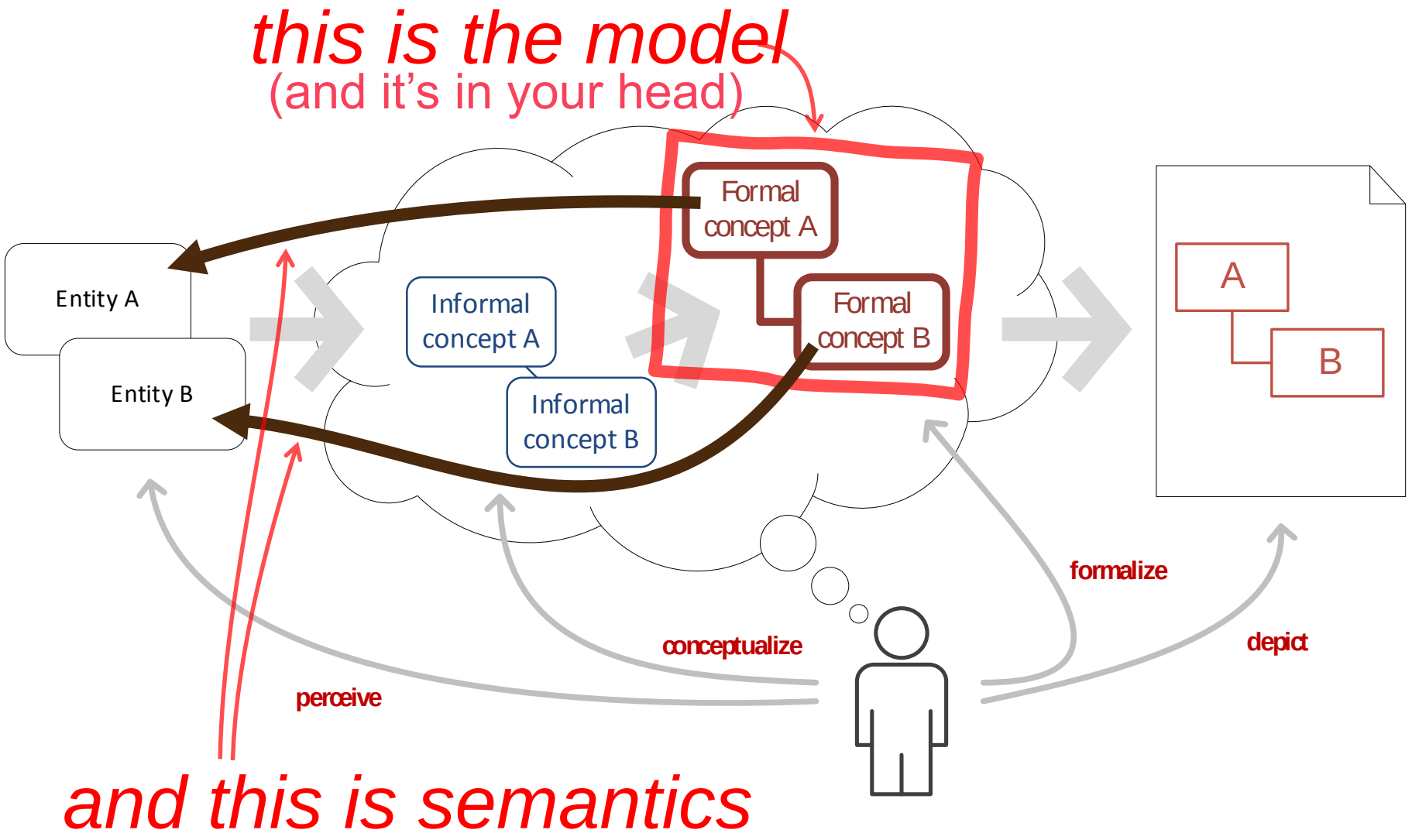
Key Concepts



Conceptual models / Ontologies

- “Made of concepts”
- Use semi-formal languages:
  - Class, Object, Attribute, Association, Link, etc.
- Represent the world:
  1. Reproduce some part of the world (scope)
  2. As they do it, they simplify it
  3. They allow us to reason on the model and apply the conclusions back to the world

The Real Semantics



Best Practices

- Express your ontology in a well-defined language (ConML)
- Modularize and layer concerns
- Deal with cross-cutting aspects properly
- Avoid implementation noise: focus on domain
- People first, machines later
- But machines too
- Properly manage instantiation levels
- Use tools

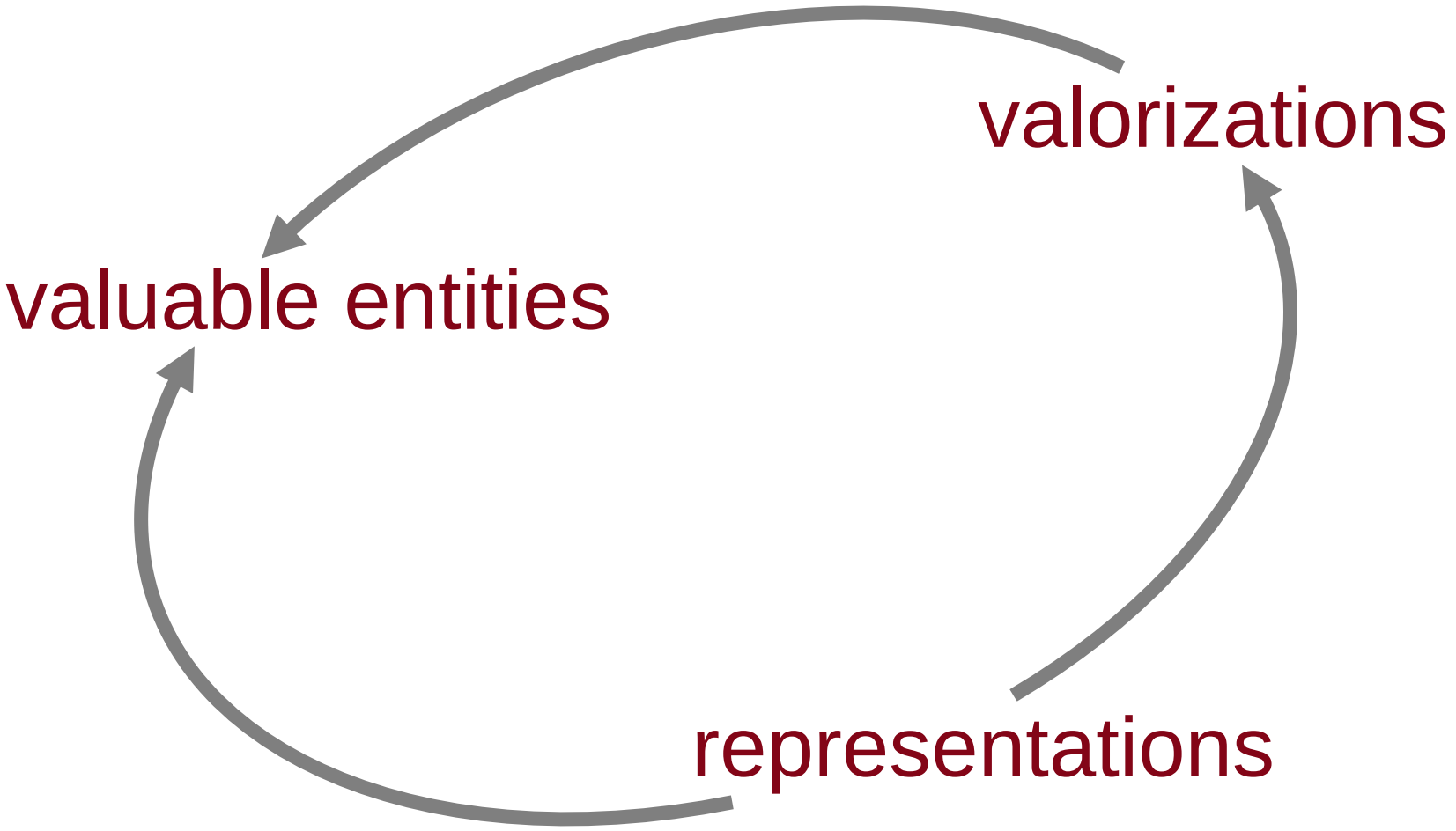
CHARM
Cultural Heritage Abstract Reference Model

- Ontology of cultural heritage
- 210 classes, 33 attributes, 95 associations
- Low data load, high connectedness
- Underpinning theory of cultural heritage
- Structures, objects, documents, agents, performative entities, places, occurrences, norms, valorizations, representations, etc.

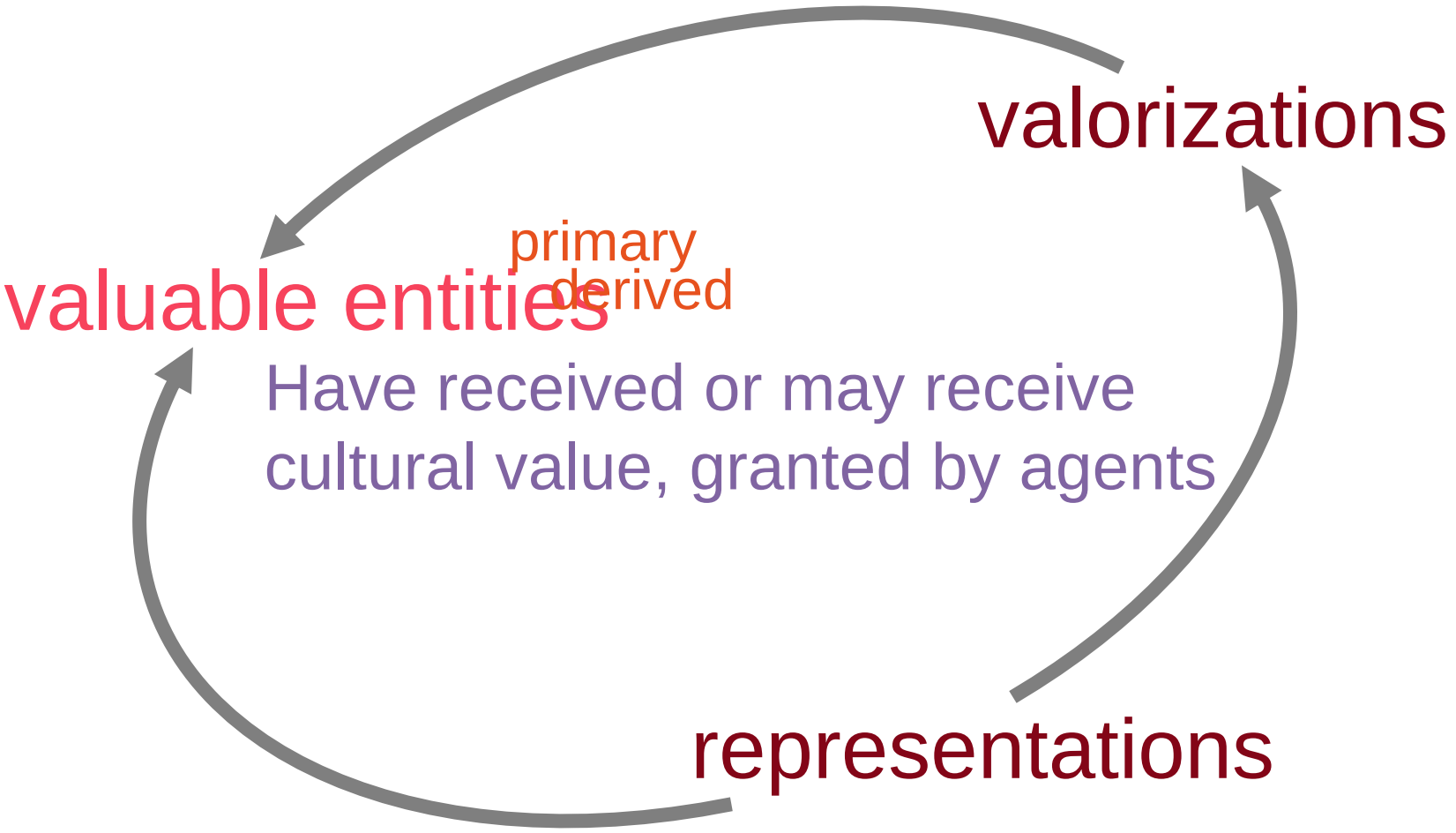
Under the Hood

- Expressed in ConML
- Bundt modelling engine and toolset
- Aspects:
  - Temporality
  - Subjectivity
  - Vagueness (ontic & epistemic)
  - Multilingualism
- Extensible, formally checked
- Gradual refinement of models

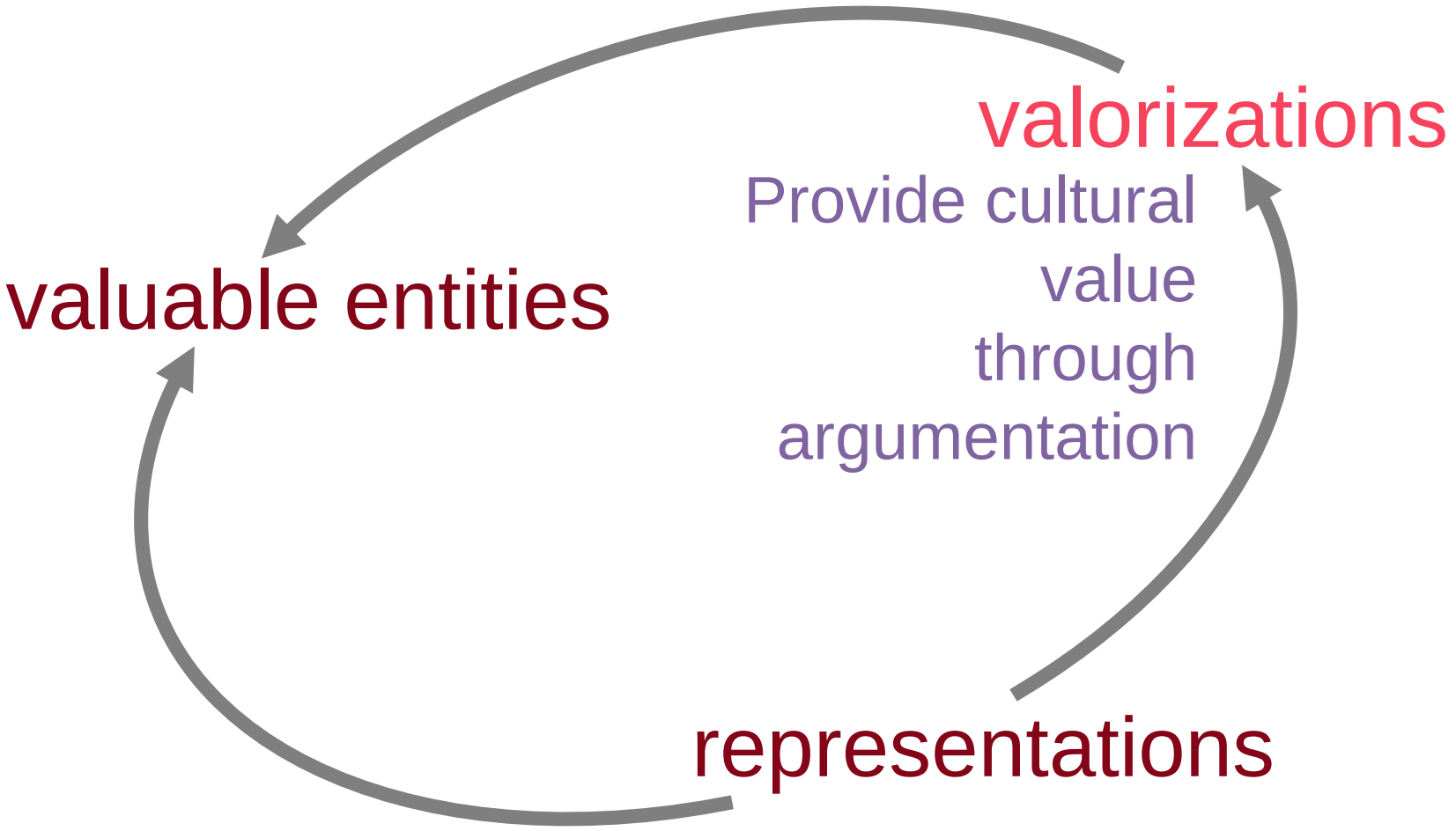
Overall Structure



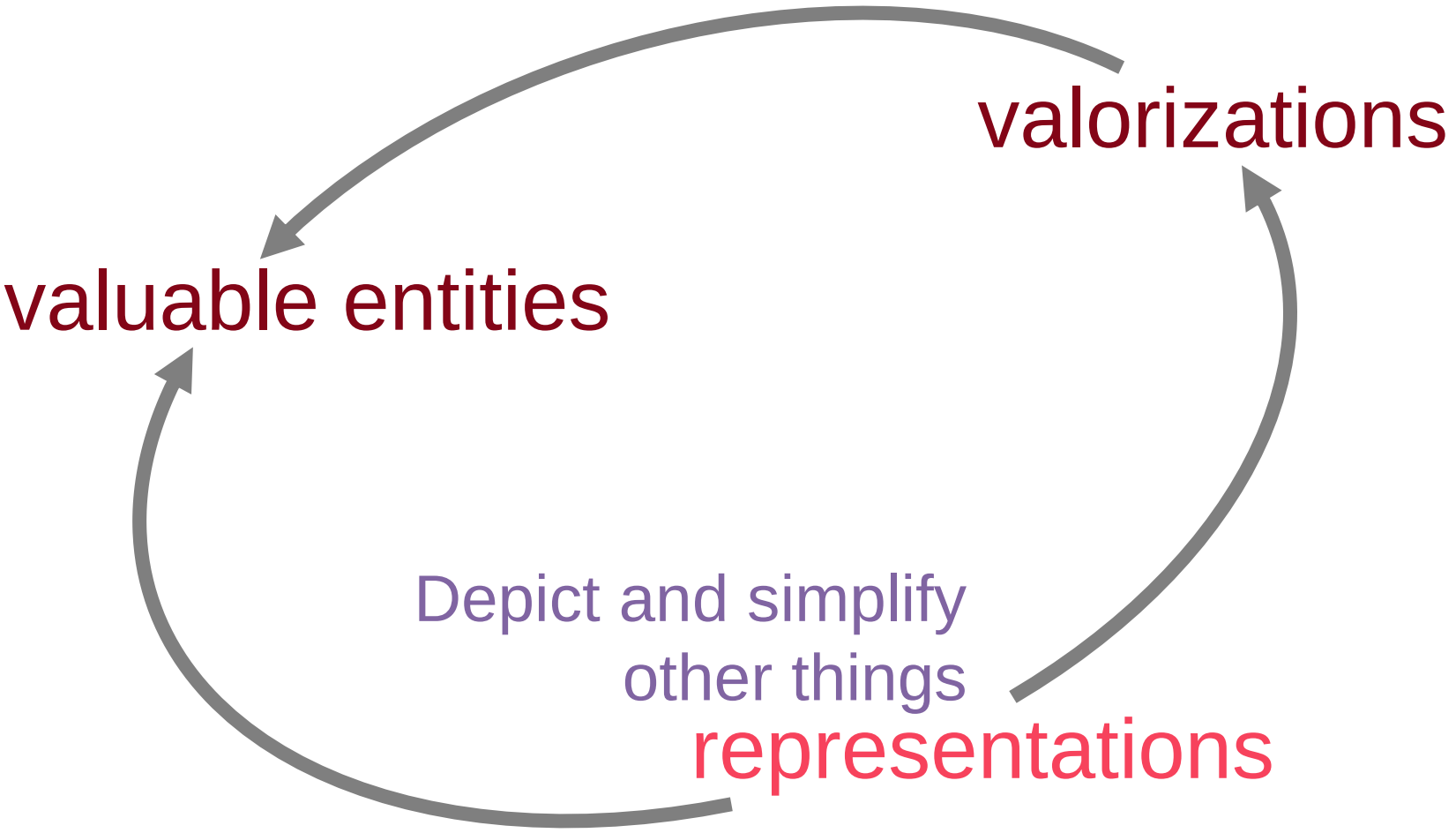
Overall Structure



Overall Structure



Overall Structure



Primary Entities

- Tangible:
  - Structures
  - Objects
  - Deposits
  - Aspects
  - Stratigraphic
  - Samples
  - Places
- Performative:
  - Social acts
  - Understandings
  - Expressive designs
    - Language
    - Sound
    - Gestural
    - Formal
- Manifestations

Primary Entities

- Abstract:
  - Category systems
  - Argumentations (incl. Valorizations)
  - Beliefs
  - Norms
- Agents:
  - People
  - Groups
  - Roles
- Occurrences:
  - Time points
  - Time spans
  - Phases
  - Changes
  - Processes
  - Actions
  - Situations

Other Classes

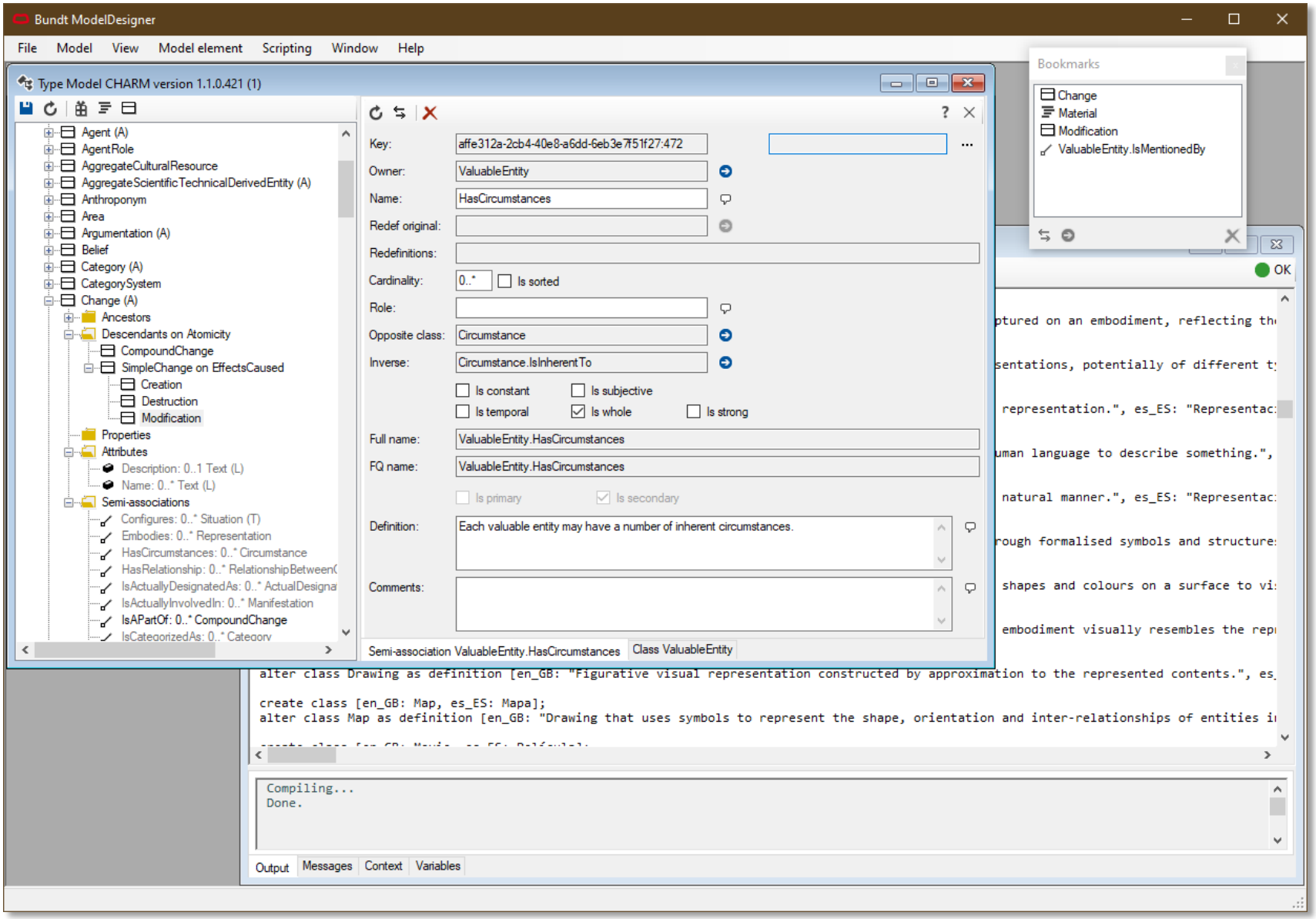
- Valorizations:
  - Administrative
  - Scientific/technical
  - Community
  - External
- Representations:
  - Linguistic
  - Visual
- Others:
  - Locations
  - Measures
  - etc.

…but this is not too important

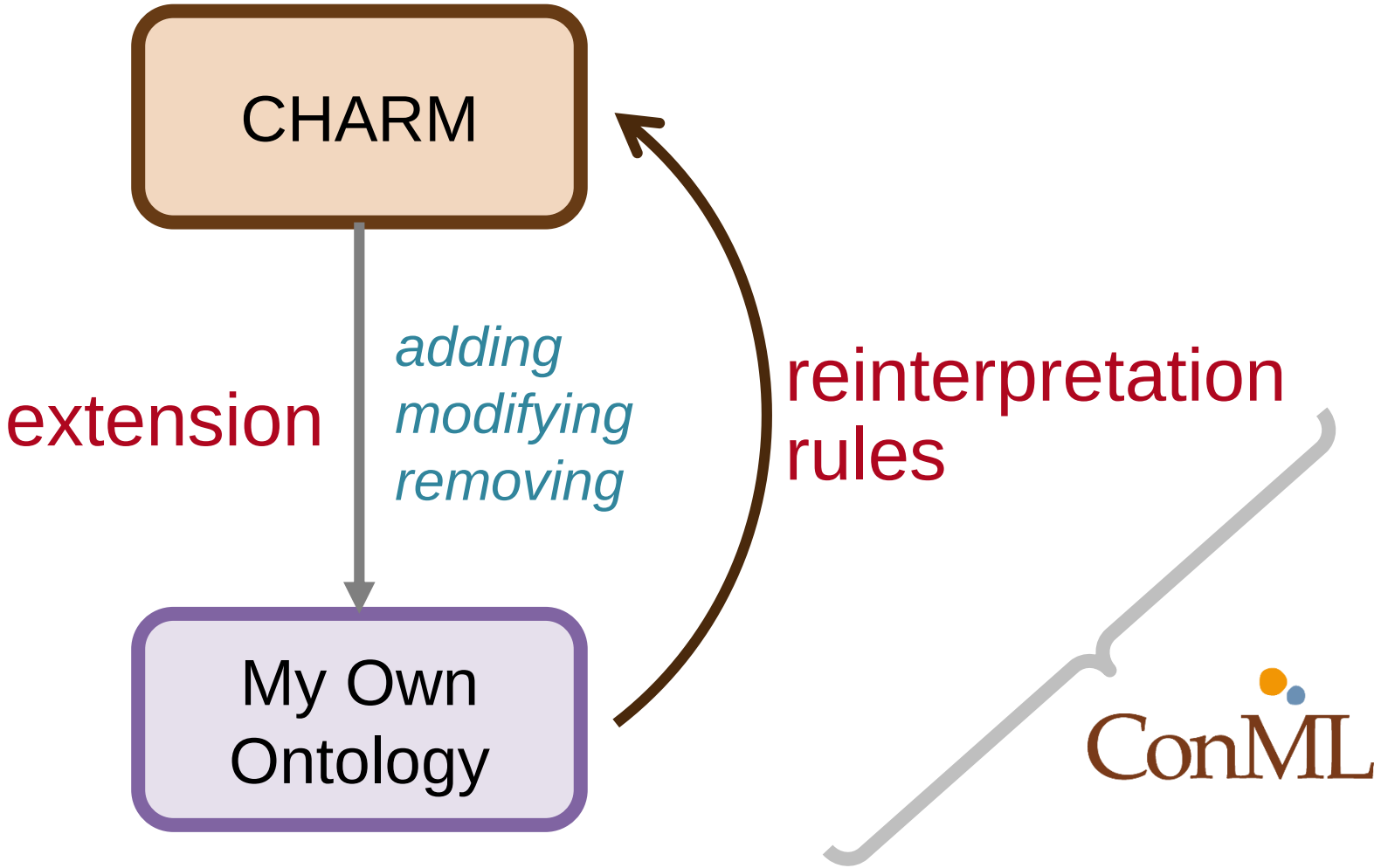
Expressivity

There is an 18th-century farm in Kojetín (Czech Republic) built of rubble and wood, which includes a cattle enclosure of stone and mortar. On 16 June 1998, a bone fragment was found in this enclosure, and given code 63.1. The fragment is 3.25 cm long and is part of a larger bone object which remains uncertain. To study the fragment, a sample was taken and given code K/63.1/1.

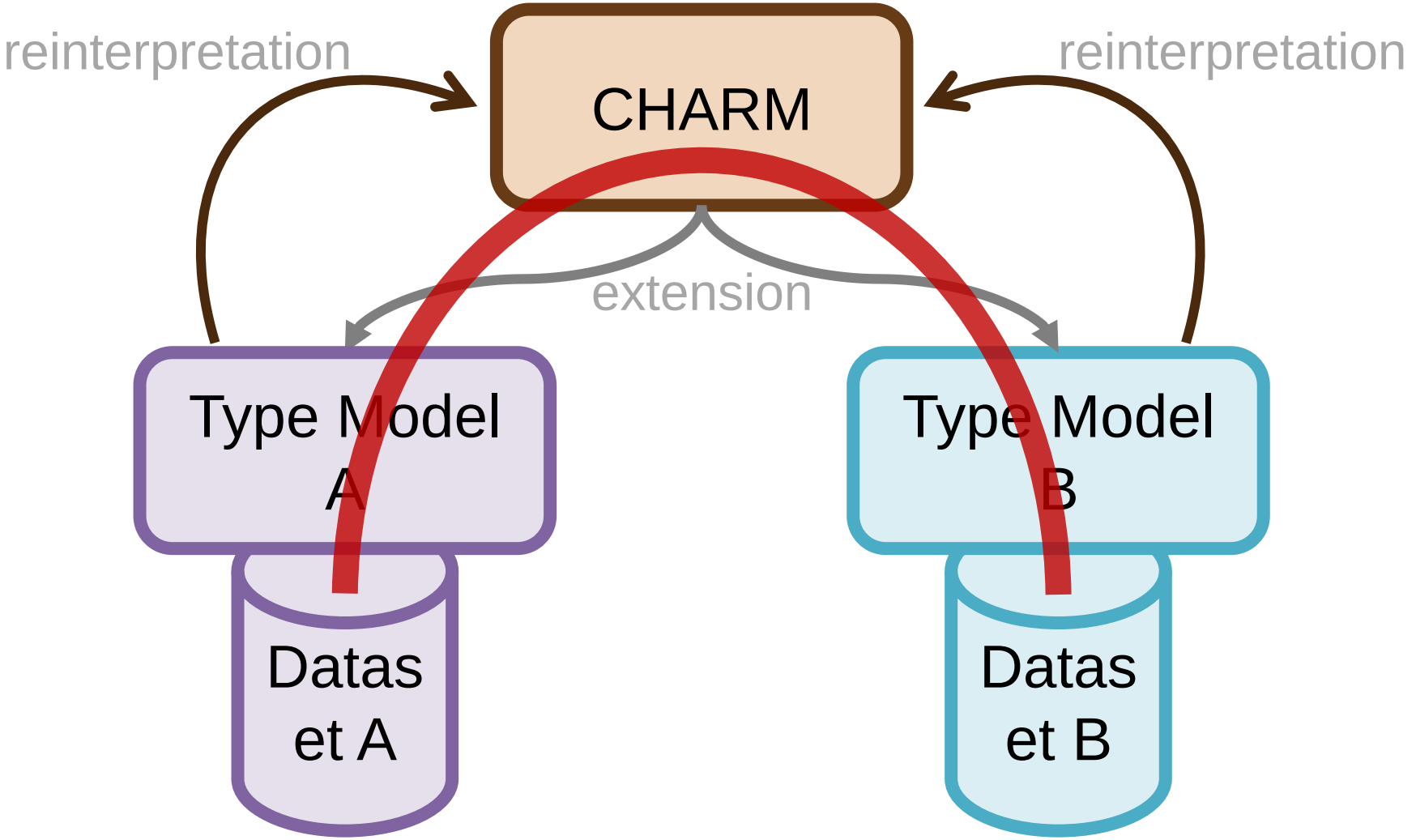
Tools


Bundt ModelDesigner
File
Model
View
Model element
Scripting
Window
Help
Type Model CHARM version 1.1.0.421 (1)
Agent (A)
AgentRole
AggregateCulturalResource
AggregateScientificTechnicalDerivedEntity (A)
Anthroponym
Area
Argumentation (A)
Belief
Category (A)
CategorySystem
Change (A)
Ancestors
Descendants on Atomicity
CompoundChange
SimpleChange on EffectsCaused
Creation
Destruction
Modification
Properties
Attributes
Description: 0..1 Text (L)
Name: 0..* Text (L)
Semi-associations
Configures: 0..* Situation (T)
Embodies: 0..* Representation
HasCircumstances: 0..* Circumstance
HasRelationship: 0..* RelationshipBetween(
IsActuallyDesignatedAs: 0..* ActualDesigna
IsActuallyInvolvedIn: 0..* Manifestation
IsAPartOf: 0..* CompoundChange
Key:
affe312a-2cb4-40e8-a6dd-6eb3e7f51f27:472
Owner:
ValuableEntity
Name:
HasCircumstances
Redef original:
Redefinitions:
Cardinality:
0..*
Is sorted
Role:
Opposite class:
Circumstance
Inverse:
Circumstance.IsInherentTo
Is constant
Is subjective
Is temporal
Is whole
Is strong
Full name:
ValuableEntity.HasCircumstances
FQ name:
ValuableEntity.HasCircumstances
Is primary
Is secondary
Definition:
Each valuable entity may have a number of inherent circumstances.
Comments:
Semi-association ValuableEntity.HasCircumstances
Class ValuableEntity
Bookmarks
Change
Material
Modification
ValuableEntity.IsMentionedBy
OK
alter class Drawing as definition [en_GB: "Figurative visual representation constructed by approximation to the represented contents.", es_
create class [en_GB: Map, es_ES: Mapa];
alter class Map as definition [en_GB: "Drawing that uses symbols to represent the shape, orientation and inter-relationships of entities i
Compiling...
Done.
Output
Messages
Context
Variables

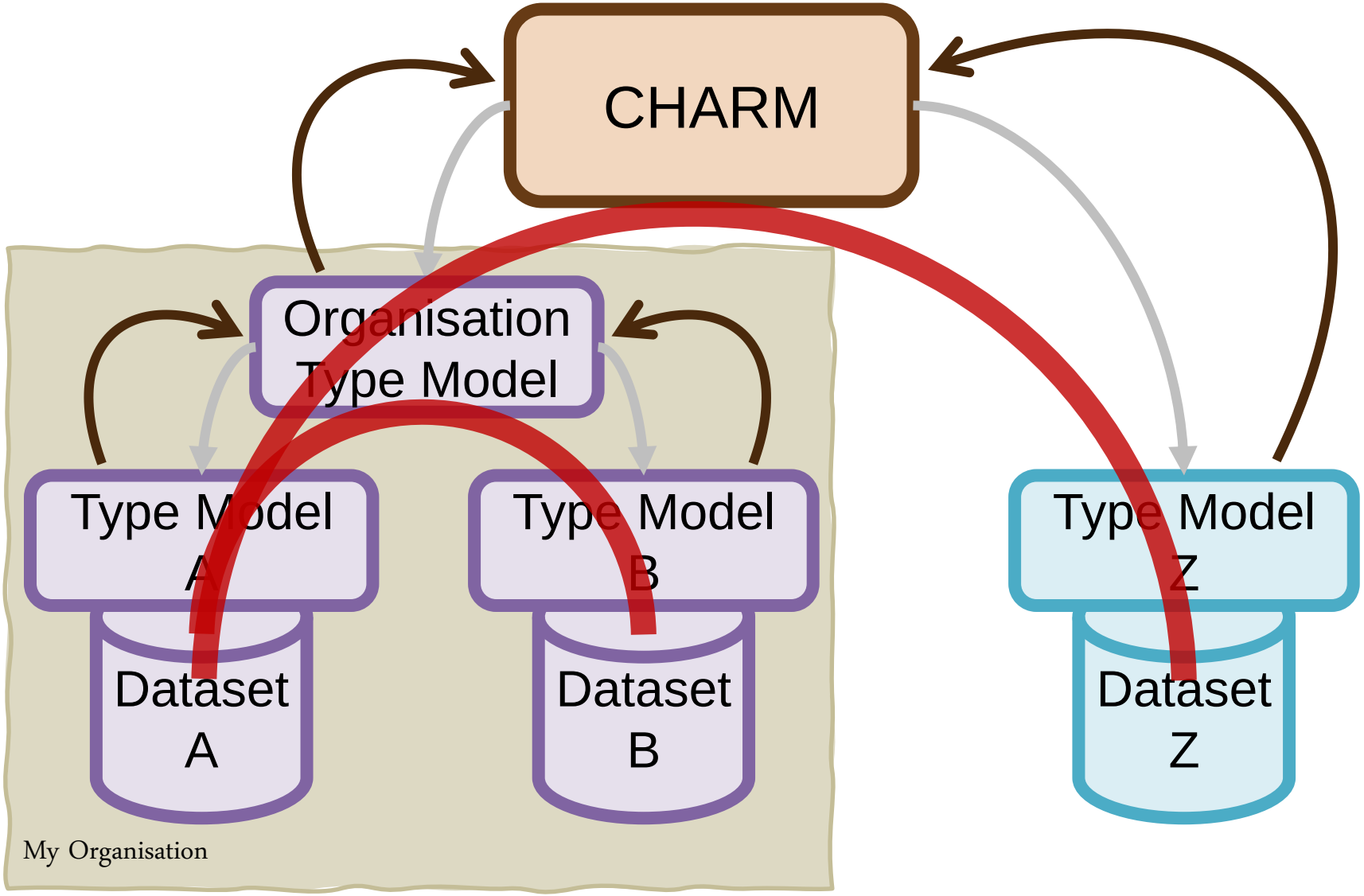
Extending CHARM



Dataset Interoperability



Gradual Refinement of Models



Conclusions

- Ontologies have a dual heritage: AI and SE
- Let’s think about people and machines
- A well-defined language with formal support allows you to bridge that gap
- Tools must support that language
- Focus on domain; remove implementation noise
- Use aspects to capture cross-cutting concerns
- Manage model ecosystems

Thank you

Cesar Gonzalez-Perez
cesar.gonzalez-perez@incipit.csic.es

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