Towards an interoperable tooling set for modelling tasks

crowd

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UNIVERSIDAD NACIONAL DEL SUR BAHIA BLANCA

KEEN Seminar - August 2021

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http://crowd.fi.uncoma.edu.ar:3335/

Outline

Before starting...

Remark

Both *conceptual models* and *ontologies* pursue a common goal: **representing knowledge about real world to be used in information systems** [Sto17]

Outline

Expectations vs Reality

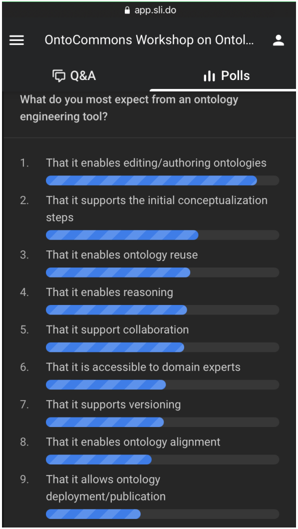


Figure: 19 March 2021

Expectations vs Reality

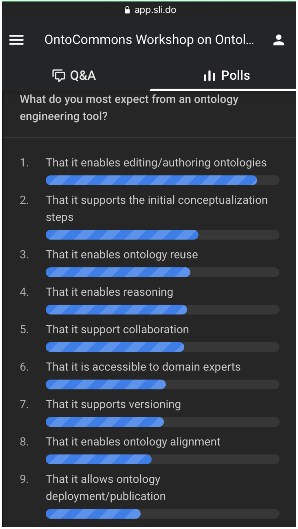
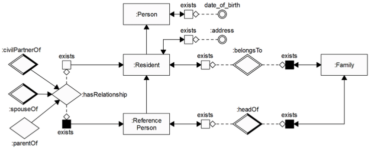
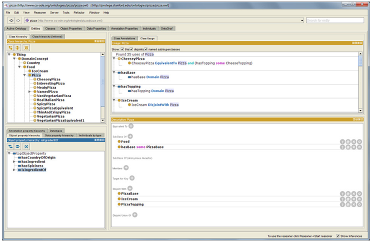


Figure: 19 March 2021

$$\mathit{Mother} \sqsubseteq \forall\, \mathit{hasChild}.(\mathit{Male} \sqcup \mathit{Female})$$





Reality (con't)

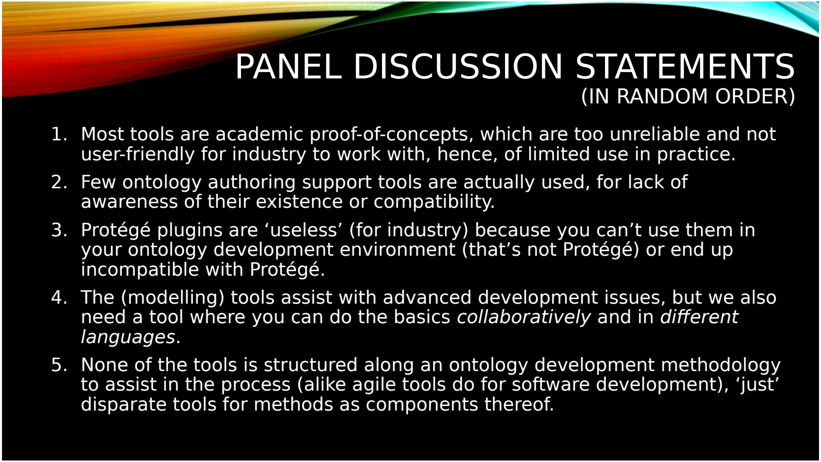


Figure: Keet's sentences (OntoCommons workshops about Tools for Ontology Engineering)

Reality (con't)

Premise

Mathieu: Can you prepare a statement about the suitability of ontology engineering tools?

Enrico: Ah!.... I had not realised there are ontology engineering tools out there....

An Ontology is an explicit specification of a conceptualization.... The idea of ontological commitment is based on the Knowledge-Level perspective... (Gruber, 1993)

Indeed, the original Knowledge Sharing initiative at ARPA focused on the use of formalisms such as Ontolingua/KIF (now evolved into CommonLogic)

Current tools neither support a specification process, nor provide a knowledge-level perspective. Typically they support OWL/RDF development, which is usually not sufficient to generate a satisfactory ontological specification.

- ➔ *Ontology specs are often created by hand (with no tool support) and only later a OWL/RDF schema is generated – e.g., see (Motta, IEEE Access 2020).*
- ➔ *It is normal to find rather basic modelling errors in published ontologies (even well-known ones)*

Figure: Motta's sentences (OntoCommons workshops about Tools for Ontology Engineering)

Expectations vs Reality (summary)

What we need:

- Visual modelling languages (UML, ER, ORM 2, ad-hoc)
- Logic-based formalisms (DL, OWL 2)
- Controlled natural languages
- Automated reasoners
- Interoperable tools
- Comprehensive workflows
- ...

Expectations vs Reality (summary)

What we need:

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What we get:

- ✗ NO widely accepted visualisation method [DLSP18]
- ✗ missing user-centred perspectives [VMJS19]
- ✗ Tools based on visualisation of axioms [DLSP18]
- ✗ Methodologies fragmented across several tools and workarounds [VBJS14]
- ...

Question: *How and to what extent can diverse representations and tools be integrated for dealing with complex system development and maintenance tasks?*

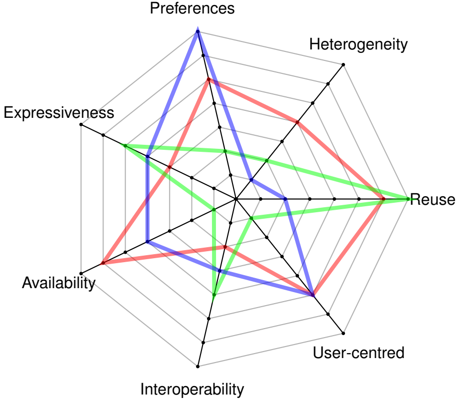

Figure: Dimensions in our question

Outline

1. Expectations vs Reality
2. The crowd Approach
3. Ongoing/Future Work

Simple (or not) Idea
requirements [BGCF20, BEF18]

(R1) Use conceptual data modelling languages UML/EER/ORM.

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- ✓ Reasoning with conceptual schemas (see R3)
- ✗ Expressiveness vs. OWL visual languages(*)

(*) "90% of class axioms (over 518 ontologies from public repositories) are expressible with simple patterns" [ESC$^+$21]

(**) We are currently working on this result, generating CDMs from simple patterns and measuring the complexity of such models.

Simple (or not) Idea (con't)

(R2) Semantic visual editing

vs. Axiomatic editing [DLSP18]

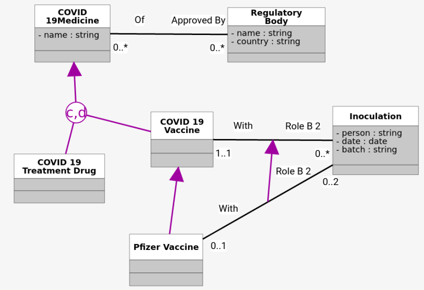
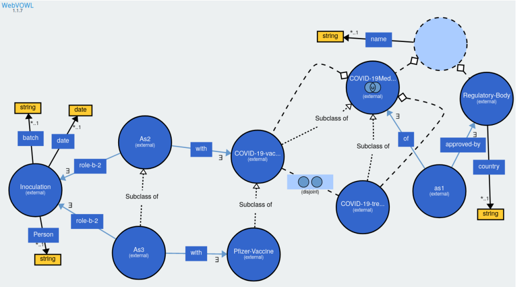


Figure: Example from Keet in crowd



Simple (or not) Idea (con't)

R3 Reason over diagrams using automated reasoners: reconstruct diagrams using well-known logic-based formalisms [BCD05, ACK^{+}07, FMS12] and off-the-shelf reasoners (Racer, Konclude, Pellet)

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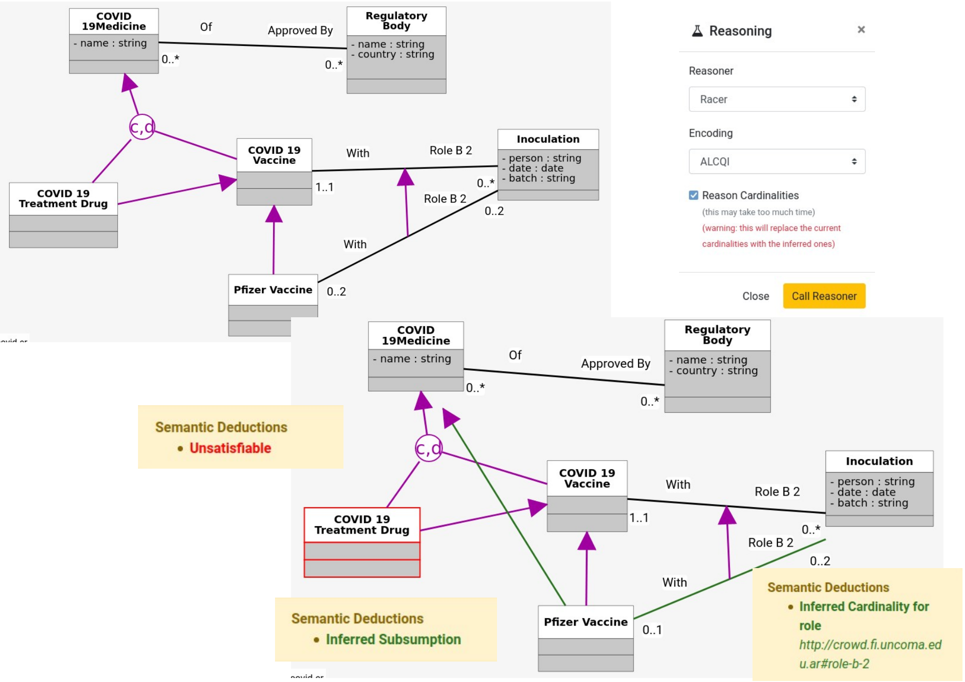
✗ Not a silver bullet!



COVID 19Medicine
- name : string
Of
Approved By
0..*
0..*
Regulatory Body
- name : string
- country : string
c,d
COVID 19 Vaccine
With
Role B 2
Inoculation
- person : string
- date : date
- batch : string
1..1
0..*
Role B 2
0..2
COVID 19 Treatment Drug
With
Pfizer Vaccine
0..2
Reasoning
Reasoner
Racer
Encoding
ALCQI
Reason Cardinalities
(this may take too much time)
(warning: this will replace the current cardinalities with the inferred ones)
Close
Call Reasoner
COVID 19Medicine
- name : string
Of
Approved By
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0..*
Regulatory Body
- name : string
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Semantic Deductions
• Unsatisfiable
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0..1
Semantic Deductions
• Inferred Subsumption
Semantic Deductions
• Inferred Cardinality for role http://crowd.fi.uncoma.edu.ar#role-b-2

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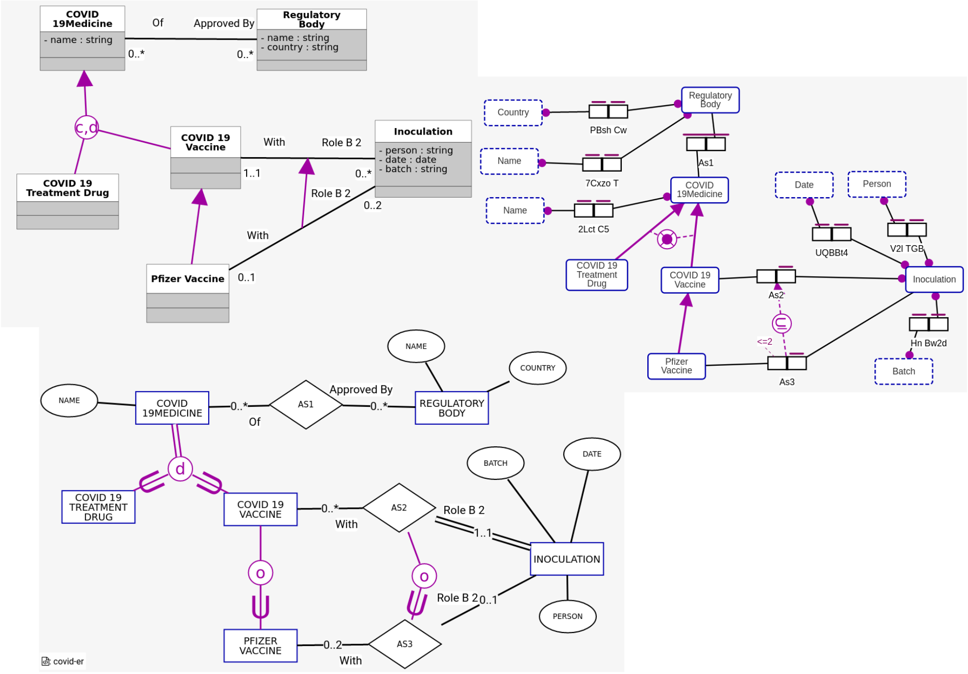
R4 Use the Keet-Fillottrani metamodel [KF15] as conceptual layer, guaranteeing interoperability.

- ✓ Implement semantic interoperability (Multi-modality)
- ✓ Saving and tracking the whole semantics of this interaction, i.e. control over addition or losses of knowledge (cardinalities in Axiomatic views)
- ✓ Define "the conceptual layer": visual, encoding, storage and data access independence

Simple (or not) Idea (con't)

R5 "Simultaneous" visual models: visualise the very same model using diverse visual or serialised representations at the same time. (it depends on R4)



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1..1
0..*
COVID 19 Treatment Drug
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Pfizer Vaccine
0..1
Country
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COVID 19Medicine
Name
2Lct C5
Date
Person
UQBBt4
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COVID 19 Treatment Drug
COVID 19 Vaccine
As2
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Hn Bw2d
Pfizer Vaccine
As3
Batch
NAME
COUNTRY
NAME
COVID 19MEDICINE
0..*
AS1
Approved By
0..*
REGULATORY BODY
Of
d
COVID 19 TREATMENT DRUG
COVID 19 VACCINE
0..*
AS2
Role B 2
With
1..1
BATCH
DATE
INOCULATION
o
o
Role B 2
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PERSON
PFIZER VACCINE
0..2
AS3
With
covid-er

Simple (or not) Idea (con't)

R6 Implement clear interfaces: extensible and interoperable APIs

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- ✓ Standard interfaces/protocols: JSON/OWLlink

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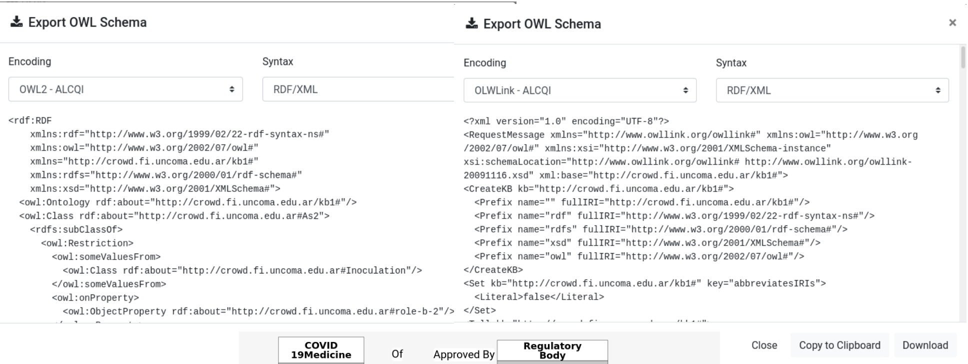
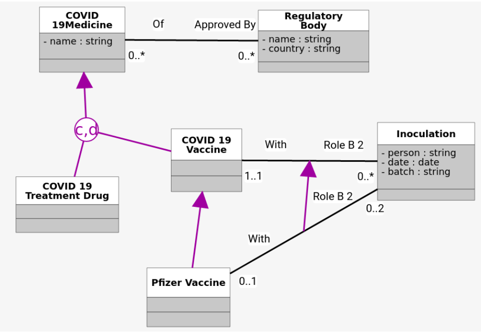
R6 Implement clear interfaces: extensible and interoperable APIs

- ✓ Non-functional requirement
- ✓ Interoperability with other tools (Protégé, reasoners, etc)
- ✓ Standard interfaces/protocols: JSON/OWLlink
- ✓ Documentation

Simple (or not) Idea (con't)

R7 Semantic Web compatibility: compliance with W3C standards.


Export OWL Schema
Encoding
Syntax
OWL2 - ALCQI
RDF/XML
<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns="http://crowd.fi.uncoma.edu.ar/kb1#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:xsd="http://www.w3.org/2001/XMLSchema#">
<owl:Ontology rdf:about="http://crowd.fi.uncoma.edu.ar/kb1#"/>
<owl:Class rdf:about="http://crowd.fi.uncoma.edu.ar#As2">
<rdfs:subClassOf>
<owl:Restriction>
<owl:someValuesFrom>
<owl:Class rdf:about="http://crowd.fi.uncoma.edu.ar#Inoculation"/>
</owl:someValuesFrom>
<owl:onProperty>
<owl:ObjectProperty rdf:about="http://crowd.fi.uncoma.edu.ar#role-b-2"/>
Export OWL Schema
Encoding
Syntax
OLWLink - ALCQI
RDF/XML
<?xml version="1.0" encoding="UTF-8"?>
<RequestMessage xmlns="http://www.owllink.org/owllink#" xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.owllink.org/owllink# http://www.owllink.org/owllink-20091116.xsd" xml:base="http://crowd.fi.uncoma.edu.ar/kb1#">
<CreateKB kb="http://crowd.fi.uncoma.edu.ar/kb1#">
<Prefix name="" fullIRI="http://crowd.fi.uncoma.edu.ar/kb1#"/>
<Prefix name="rdf" fullIRI="http://www.w3.org/1999/02/22-rdf-syntax-ns#"/>
<Prefix name="rdfs" fullIRI="http://www.w3.org/2000/01/rdf-schema#"/>
<Prefix name="xsd" fullIRI="http://www.w3.org/2001/XMLSchema#"/>
<Prefix name="owl" fullIRI="http://www.w3.org/2002/07/owl#"/>
</CreateKB>
<Set kb="http://crowd.fi.uncoma.edu.ar/kb1#" key="abbreviatesIRIs">
<Literal>false</Literal>
</Set>
Close
Copy to Clipboard
Download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1..1
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0..1

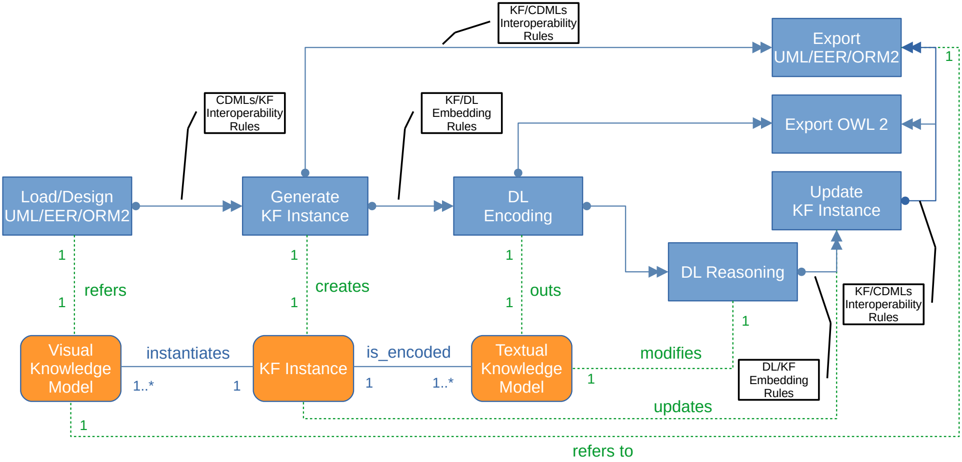
Related Tools

Table: ✓: fully supported, ✗: not supported and $\sim$: partially supported.

Axiomatic Vis. tools	R1	R2	R3	R4	R5	R6	R7
WebProtégé [HGN+19]	✗	✗	✗	✗	✗	✓	✓
Protégé - OWLViz	✗	✗	$\sim$	✓	✗	✓	✓
Protégé - OntoGraf	✗	✗	✗	✓	✗	✓	✓
Protégé - SOVA	✗	✗	$\sim$	✓	✗	✓	✓
CoModIDE [SHH20]	✗	$\sim$	$\sim$	✗	✗	✓	✓
TopBraid [Top11]	✗	$\sim$	$\sim$	✗	✗	✓	✓
VOWL [LNHE16]	✗	✗	✗	✗	✗	✗	$\sim$
Graffo [FGP+14]	✗	$\sim$	✗	✗	✗	✗	✓
eddy - Graphol [CLSS14]	✗	$\sim$	✗	✗	✗	✗	✓
OWLGrEd [COLS12]	✗	$\sim$	$\sim$	✗	✗	✗	✓
Semantics Vis. tools							
NORMA [CH10]	✓	✓	✓	✗	✗	✗	✗
ICOM [FFT12]	✓	✓	✓	✗	✗	✗	✗
OLED [GSGA15]	✓	✓	$\sim$	✗	✗	✗	✗

Simple (or not) Idea (con't)

workflow [GBCF20]



Simple (or not) Idea

web architecture

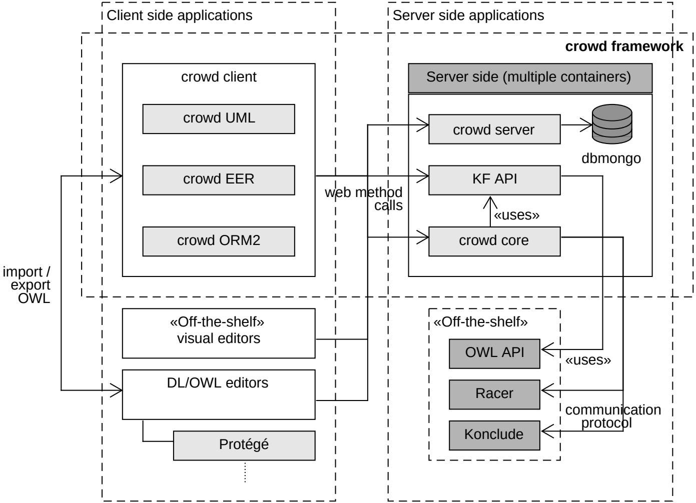


Figure: crowd architecture

Outline

Ongoing/Future Work

- ✓ Framework FaCIL (jointly with Maria and Pablo Fillottrani)
- ✓ OWL 2 import: from OWL 2 to metamodel instances (based on axiom patterns [ESC$^+$21])
- ✓ Spin-off: temporal data modelling, $\mathcal{ER}_{VT}$ tool and automated reasoning over temporal DL-Lite (jointly with Artale et.al)

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- ✓ Spin-off: temporal data modelling, $\mathcal{ER}_{VT}$ tool and automated reasoning over temporal DL-Lite (jointly with Artale et.al)
- ✓ More evaluations : Realistic scenarios, user-based
- ✓ Metamodel coverage: transformation/approximation rules
- ✓ Modularity: abstractions/semantic approach

- crowd `http://crowd.fi.uncoma.edu.ar:3335`
- crowd gui: `https://bitbucket.org/gilia/crowd-app`
- crowd reasoning API: `https://bitbucket.org/gilia/reasoning`
- metamodel API: `https://bitbucket.org/gilia/metamodelapi`
- OWL 2 import API: `https://bitbucket.org/gilia/metamodelapi-owlimport`
- crowd-$\mathcal{ER}_{VT}$ first prototype: `http://crowd.fi.uncoma.edu.ar/ervt-gui/erd_editor.php`
- crowd YouTube channel: `https://www.youtube.com/channel/UCQ_PXFdOYAKxGyvxb36EcmQ`


THANK
YOU
GRACIAS
ARIGATO
SHUKURIA
DANKSCHEEN
JUSPAXAR
GOZAIMASHITA
EFCHARISTO
TASHAKKUR ATU
YAQHANYELAY
SUKSAMA
EKHMET
GRAZIE
MEHRBANI
PALDIES
KOMAPSUMNIDA
MAAKE
BOLZÏN
MERCI
BÏYAN
SHUKRIA
TINGKI

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