EU Law and Publications

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Università di Roma Tor Vergata

Towards VocBench 3

Pushing Collaborative Development of Thesauri and Ontologies Further Beyond

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University of Rome, Tor Vergata

2. Publications Office of the European Union
Dissemination and Reuse Directorate, Documentary Management and Metadata Unit

3. GODAN secretariat, c/o CABI Head Office

Outline

- VocBench 1&2, (quick) history and lessons learned
- Evaluation of VB2
- Requirements for VB3
- The Platform

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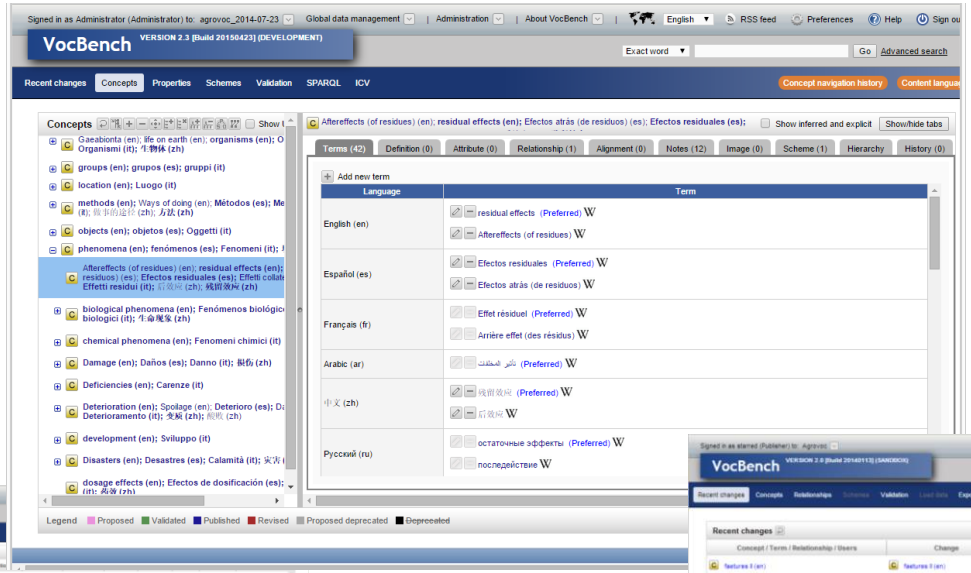
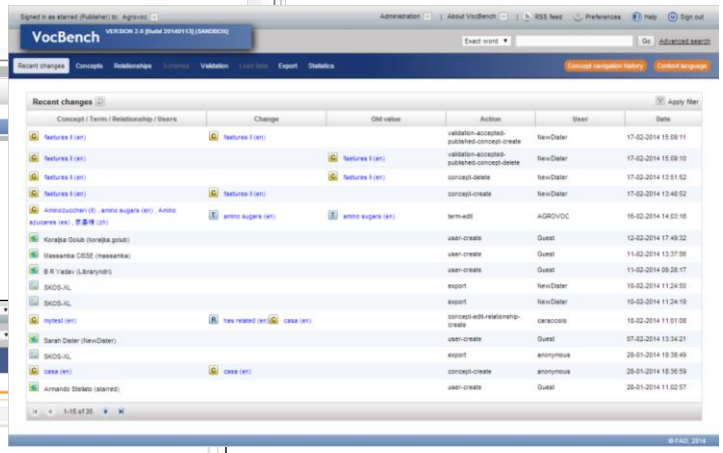
VOCBENCH (1 & 2)

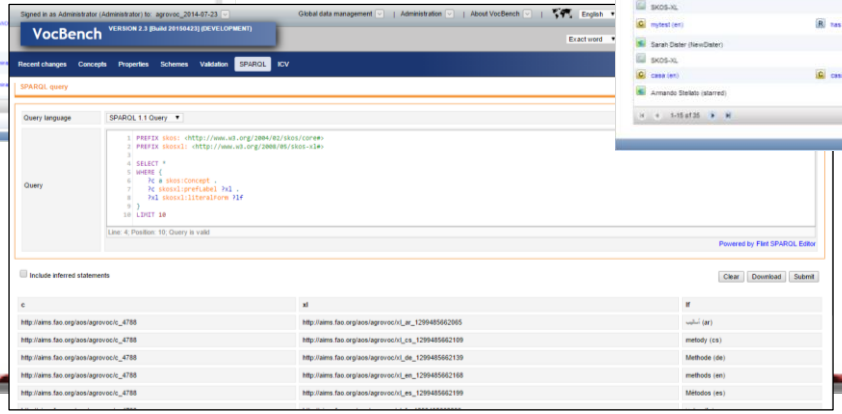
Collaborative Development of Multilingual Thesauri



VocBench is an open source web application for editing of multilingual SKOS and SKOS-XL thesauri, with a strong focus on collaboration, supported by workflow management for content validation and publication.

All editing actions inside VocBench undergo a validation and publication workflow





SPARQL Editing with syntax completion and highlight

The full history of actions per each project is stored inside VB and can be inspected by users (clients may also subscribe to its associated RSS feed)

Powered by Semantic Turkey!

Why was it built?

Maintenance of:

AGROVOC (big agriculture vocabulary developed by FAO)

- >32 000 concepts in up to 22 languages
- A global group of terminologists.
- No tool to support their work
- No existing tool that met all of FAO's needs

VocBench → VocBench 2

- VocBench was an internal FAO project (originally called Agrovoc Concept Server)

- VocBench 2 (a collaboration between FAO and Tor Vergata University) has been the first attempt at an open source collaborative platform for thesauri management

The VocBench2 Team

Armando Stellato
PhD, Researcher, Project Leader
University of Rome Tor Vergata, Italy

An insane love for insane architectures...he has two imaginary friends, sitting on each of his shoulders, fighting an eternal battle between order and chaos.

Johannes Keizer
PhD, FAO Team Leader
Food and Agriculture Organization of the United Nations

He dreamed it, he wanted it, he made it real.

Sachit Rajbhandari
PhD Student, University of Tasmania, Australia
FAO Information Management Specialist

VocBench GWT WebApp Main Developer

He created it, he was there at the beginning and even before.

Yves Jaques
FAO Information & Knowledge Management Officer
Food and Agriculture Organization of the United Nations

He raised it and drove it all the way to glory.

Andrea Turbati
PhD, Research Associate
University of Rome Tor Vergata, Italy

Semantic Turkey developer
VocBench OSGi extension for Semantic Turkey

He can carve any system bit by bit, but don't talk to him about 'frameworks'...
His motto? "if it works, it's good and if it ain't broke don't fix it!"

Caterina Caracciolo
PhD, FAO Senior Information Specialist
Food and Agriculture Organization of the United Nations

The Agrovoc Queen, she's continuously trying to make sense of all the weird people here.

Manuel Fiorelli
PhD, Research Associate
University of Rome Tor Vergata, Italy

Semantic Turkey developer

Dangerously following and amplifying Armando's architectural leaps...
his hobby is (before breakfast) refactoring 10 levels of abstraction into what Andrea just made work so well.

Sarah Dister
FAO Knowledge Management Specialist
Food and Agriculture Organization of the United Nations

A new blossom in the Agrovoc garden, but already sweet nectar for VocBench!

Tiziano Lorenzetti
Research Assistant
University of Rome Tor Vergata, Italy

Semantic Turkey developer

<A> Uh...Tiziano...if you have time could you implement...
<T>: Done.
<A> Well, then, you could move on to...
<T>: I'm already on it, done by end of today.
<A> This guy is so efficient it's frustrating!

Requirements for VB2

R1. Multilingualism

R2. Controlled Collaboration

R3. Data Interoperability and Consistency

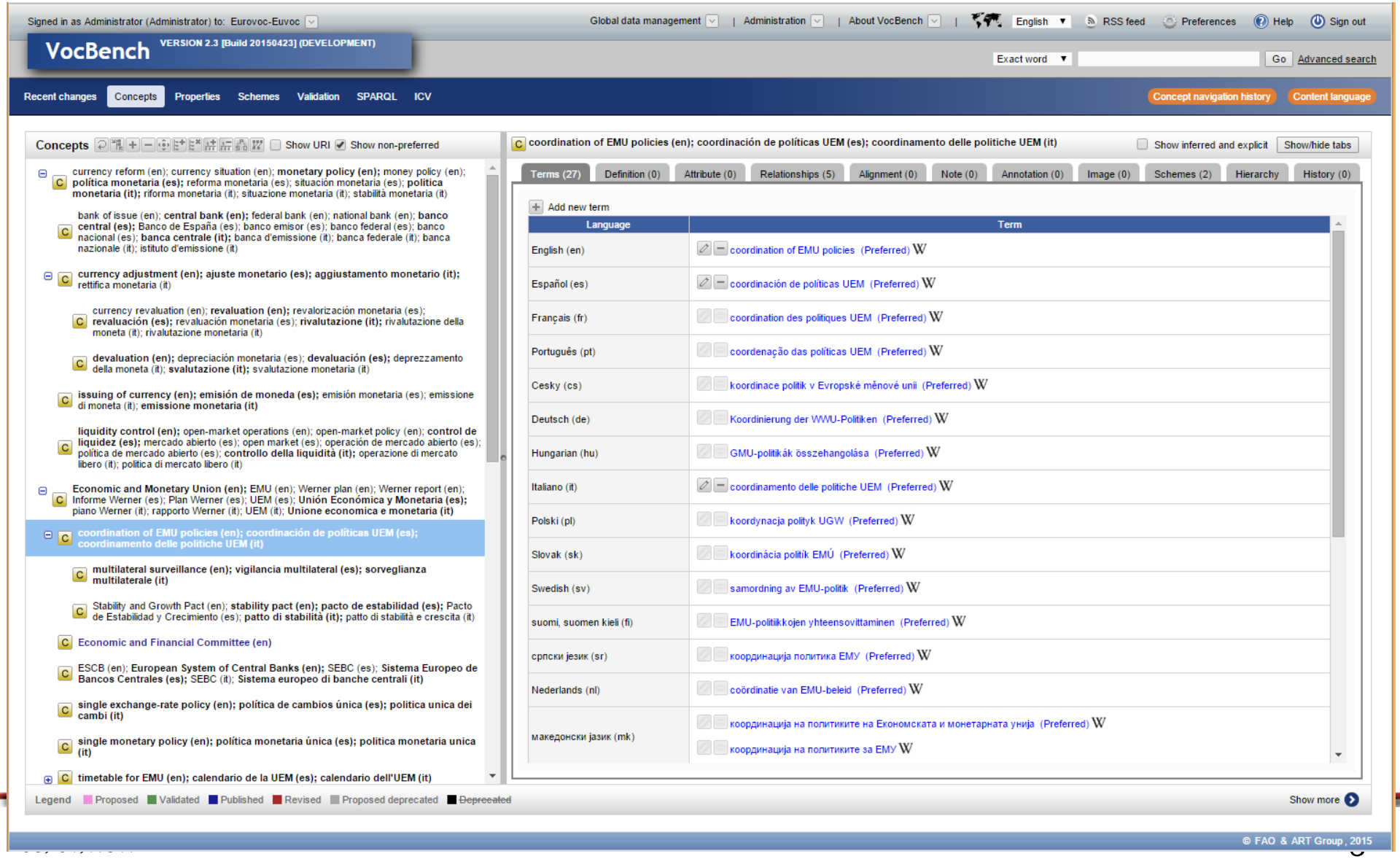
R4. Software Interoperability/Extensibility

R5. Scalability

R6. Under-the-hood data access/modification

R7. Ease-of-use for users and system admin.

…and here it was VB2



Functional Comparison (performed in 2014, for VB2)

Example 9 (non-entailment)

```
<A> skos:narrower <B> .
<A> skos:inScheme <MyScheme> .
```

does not entail

```
<B> skos:inScheme <MyScheme> .
```

Name	License	Free to use	Deployment	Data Models	Import/ Export	Scheme Management	Custom Relations	Reasoner	Data quality	Extendibility / Interoperability	ACL	Workflow Management	Collaboration, Content Validation	RDF Middleware	RDF Backend	SPARQL Querying	Semantic Integration
VocBench	GNU GPL v3 (web application), Mozilla Public License MPL (Semantic Turkey)	Yes	Web application	SKOS-XL, SKOS through offline scaling tool	SKOS(-XL), versatile spreadsheet import (through ST Firefox UI)	Yes	Creation, Import, use	Depends on triple store	Metrics	API, shared backend, pluggable	Yes	Yes	Change feed, validation	OWL ART API (connectors to others: Sesame2 bundled)	provided by Sesame2, or other connectors	Yes	assisted (browse&search) linking of resources from other projects / manual linking of LOD resources. Extensions for RDF lifting from unstructured content
PoolParty	Proprietary	No	Web application	SKOS, SKOS-XL add-on	SKOS(-XL), static spreadsheet import	Only top concepts	Creation, Import, use	Depends on triple store	Metrics Validation rules	REST API	Yes	Yes (add-on)	History, versioning, validation	Sesame SAIL API	provided by Sesame2	Yes	Linking Text Mining & Entity Extraction, Search function
WebProtégé	Mozilla Public License (MPL)	Yes	Web application	OWL 2, OBO	OWL	Not applicable	Creation, Import, use	No, external reasoning possible	Metrics	API, shared backend,pluggable	Yes	No	Discussion, watching, changes feed	OWL API	provided by Protégé 3	No	linking to BioPortal
TemaTres	GNU General Public License version 2.0 (GPLv2)	Yes	Web application	Term based thesaurus organization	MADS, SKOS-Core, Zthes, Others Import from: Skos-Core, tabulated or tagged text file	One scheme per vocabulary	Creation, use	No	Metrics, Reports	API	Yes; limited	Yes; limited	Limited validation	No RDF Middleware, SKOS RDF/XML available only as an export	Relational database (MySQL by default)	Not native, no realtime, can export data to a SPARQL endpoint through ARC2 (RDF library for PHP)	Linking between vocabularies, Entity Extraction (via addon)
SKOSEd	GNU Lesser GPL	Yes	Desktop application	SKOS	SKOS	Only top concepts	Creation, Import, use	Depends on available plugins	KB consistency	Pluggable	No	No	No	OWL API (used by Protégé 4)	provided by Protégé 4 (OWL API)	Yes (inherited from Protégé 4)	N/A

User Community and Evaluation

Online Questionnaire:
http://vocbench.uniroma2.it/purl/VocBench-User-Questionnaire_2014-10.zip

USE* questionnaire: http://hcibib.org/perlman/question.cgi?form=USE
values ranging from 1 to 7

Lund, A.M. (2001) *Measuring Usability with the USE Questionnaire.* STC Usability SIG Newsletter, 8:2.

collected 11 anonymous responses

USE Values

	Usefulness	Ease of use	Ease of learning	Satisfaction
Global	5,34	4,49	5,11	4,93
Experienced	5,58	4,66	5,18	5,02
Inexperienced	4,97	4,19	5,00	4,79

Feature Evaluation

	easy to use	effective	interesting
History	5,38	5,50	6,33
SPARQL Querying	4,00	5,40	6,29
Publication Workflow Management	5,50	5,63	6,22
Collaborative Management	5,75	5,88	6,11
Scheme Management	4,83	5,17	5,57
Role-based Access Control	5,33	5,22	5,40
Reasoning	4,29	4,43	5,38
Triple Store Connectivity	3,67	4,50	5,00

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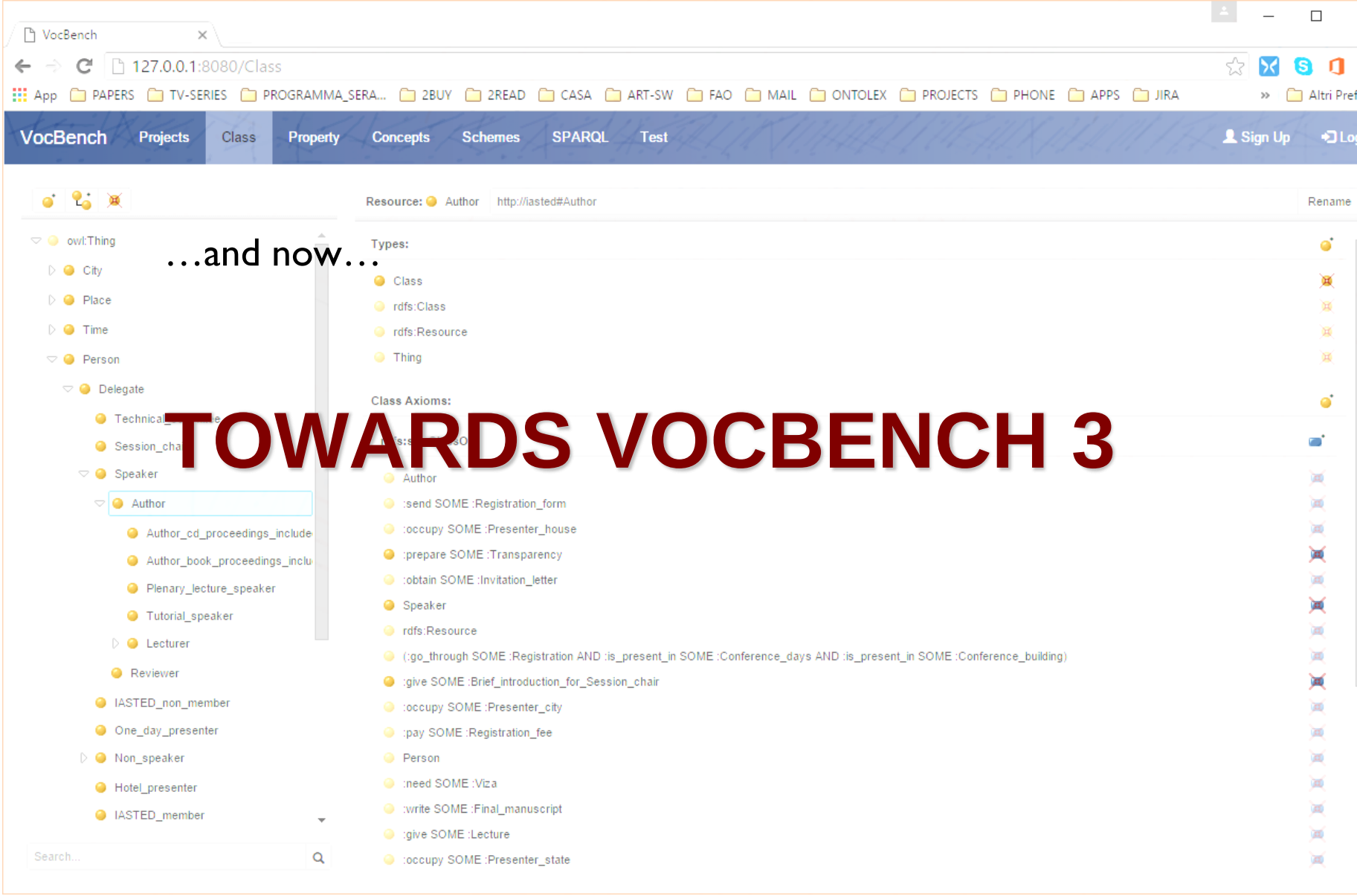

…and now…

TOWARDS VOCBENCH 3

The VocBench3 Team

The Developers

University of Rome Tor Vergata
Today, the University of tomorrow

Armando Stellato
PhD, Researcher, Project Leader
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The Users

a whole community supporting its development

funding sponsors

EU law and publications

ISA²
Interoperability solutions for public administrations, businesses and citizens

other users (just some of them, pls forgive any omission!)

Food and Agriculture Organization of the United Nations

HARVARD UNIVERSITY

IEDA INTERDISCIPLINARY EARTH DATA ALLIANCE

INRA SCIENCE & IMPACT

Senato della Repubblica

Scottish Government Riaghaltas na h-Alba gov.scot

www.cabi.org

UNCCD

UNEP United Nations Environment Programme

Requirements for VB2

R1. Multilingualism

R2. Controlled Collaboration

R3. Data Interoperability and Consistency

R4. Software Interoperability/Extensibility

R5. Scalability

R6. Under-the-hood data access/modification

R7. Ease-of-use for users and system admin.

Requirements for VB3

R1. Multilingualism

R2. Controlled Collaboration

R3. Data Interoperability and C

R4. Software Interoperability/Ex

R5. *Data* Scalability

R6. Under-the-hood data access/modification

R7. *Adaptive Context and Ease-of-use*

R8. RDF Languages Support

- OWL ontologies
- SKOS thesauri

nability (Architect

- Revamped Collaboration Mechanism
- Integrated application

- Different solutions for supporting alignment
- On the fly constraint-checking
- Mass integrity-checking a fixing

- An elaborated RDF service/data model as a

- All actio meta
- Meta and p

- Users with proper authorization can reach and

- Possibility to store dataset dumps
  &
- access and compare them through a time-machine

- SPARQL support (included in

- Even easier installation than in VB2
- Scale out to the scenario of use

s for users
tions

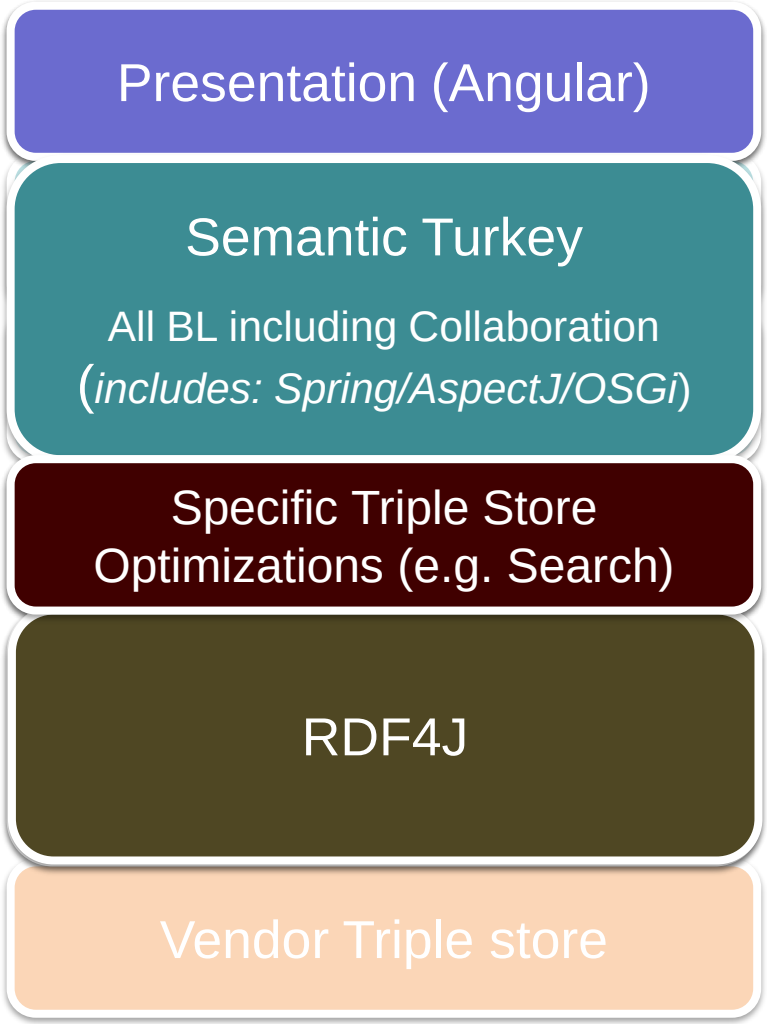
- Differently from VB2, all data, metadata, action logs etc.. has to be represented as RDF, thus facilitating consistency and acidity of actions

Technological Stack in VB3: Changes

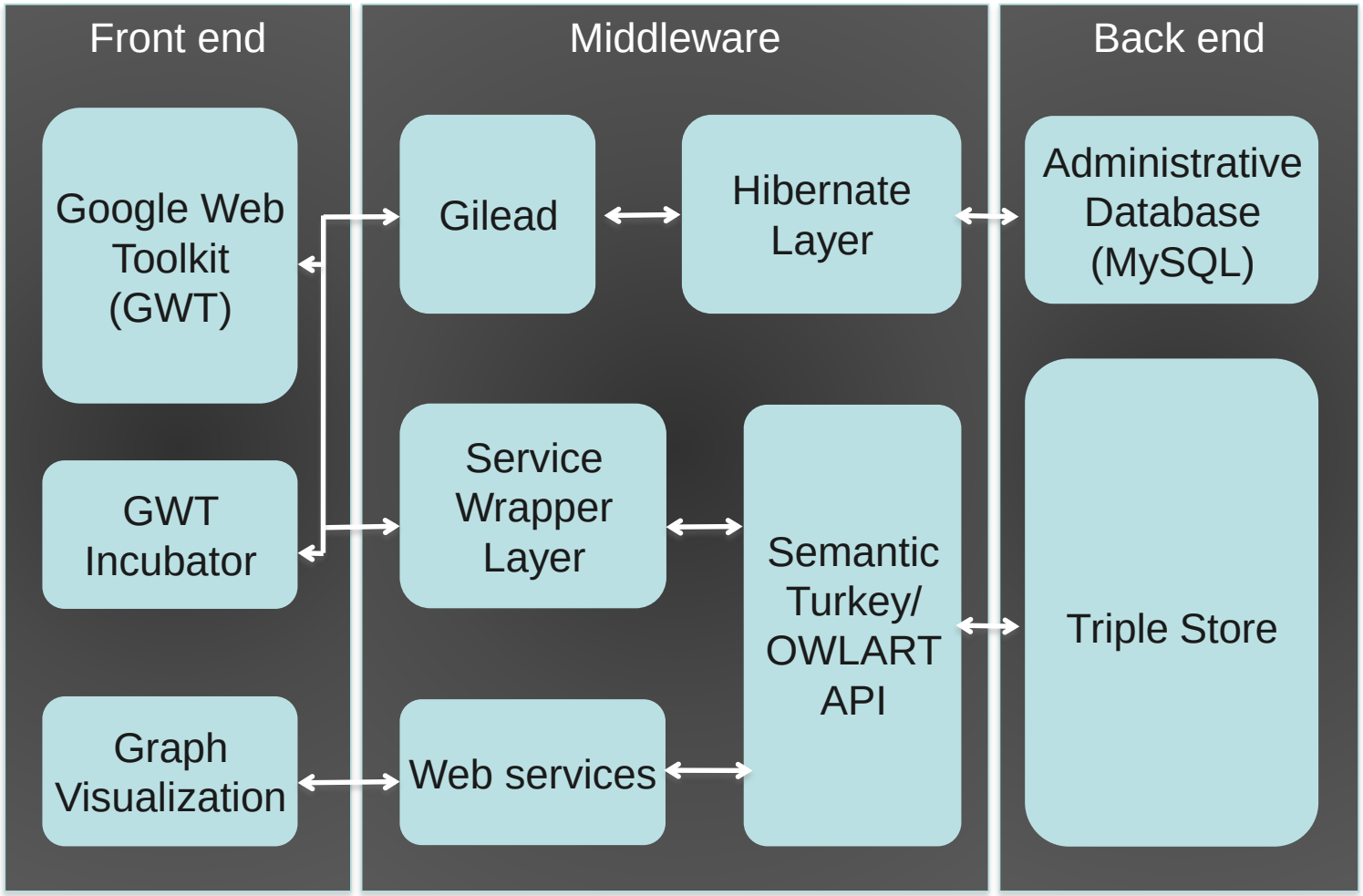
Lightweight Presentation Layer
- Angular (previously known as Angular 2)

Business Logic all in ST, including:
- User Management/Auth
- Data Validation/History

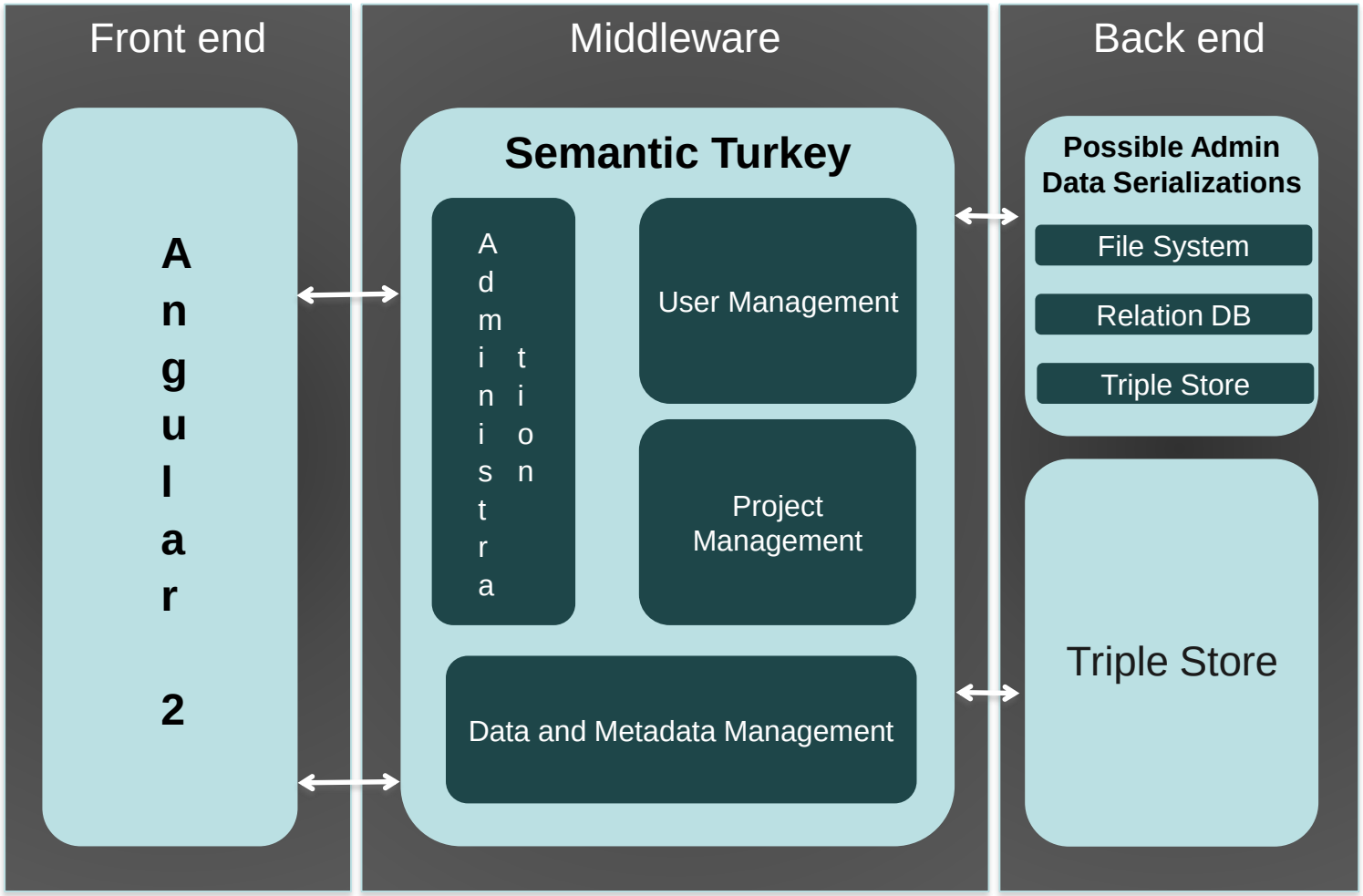
Commit to Sesame framework
- Nowadays (a) winning middleware
- No relevant triple store is uncompatible with Sesame
- Recently rebaptized as RDF4J, under the Eclipse umbrella
- Maintaining a neutral middleware such as OWLART is no more cost-effective



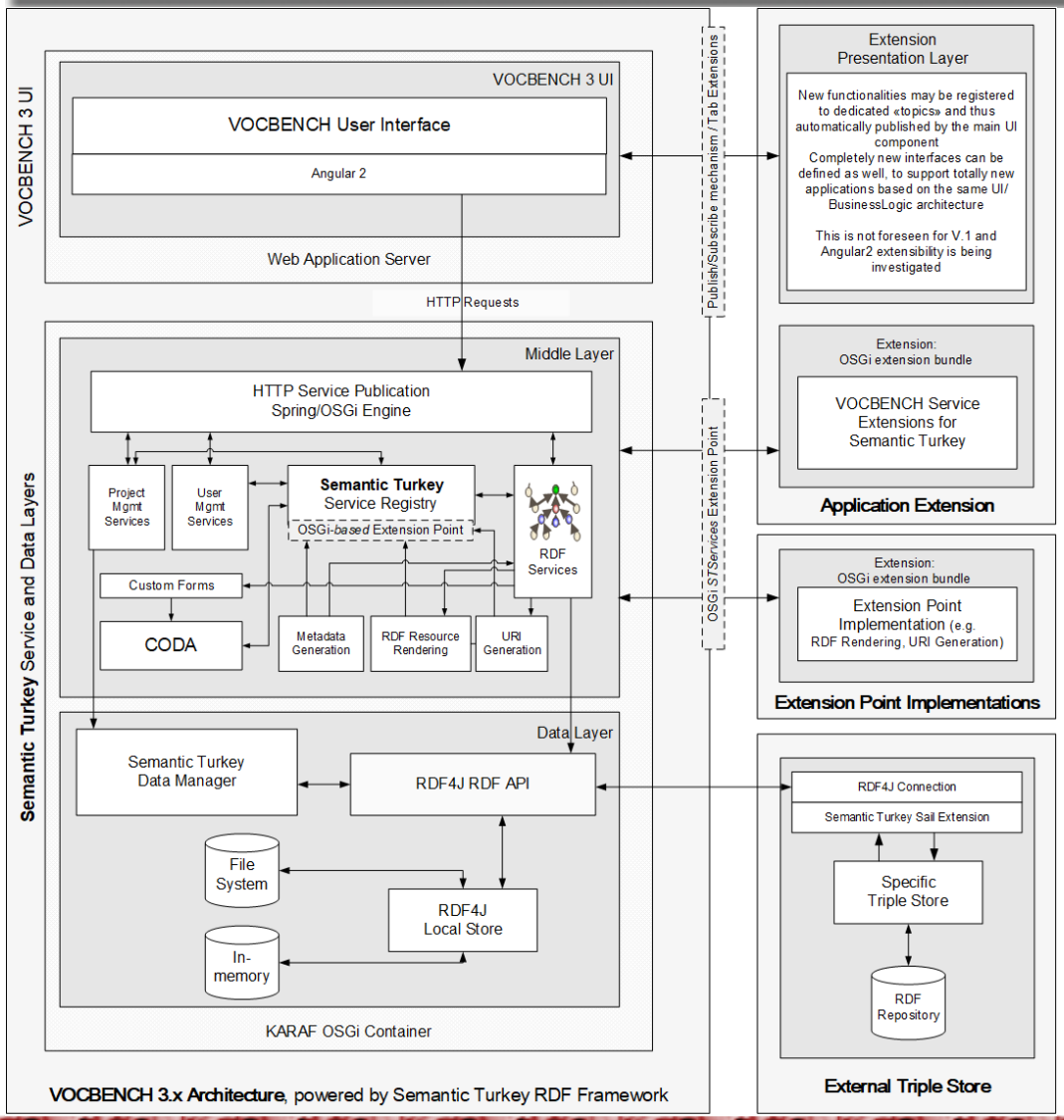
From Vocbench 2.0 Components…



…to VB 3


Front end
Angular 2
Middleware
Semantic Turkey
Administration
User Management
Project Management
Data and Metadata Management
Back end
Possible Admin Data Serializations
File System
Relation DB
Triple Store
Triple Store

Vocbench 3 (and ST) Architecture



Three layered extensible architecture

Presentation Layer

- Angular. Vocbench User Interface

Services Layer

- Enables communication between the client (Vocbench UI) and the ontology persistence layer.
- HTTP based Services accessed through the Ajax paradigm
- OSGi Extensible Servicing System

Persistence Layer

- Access to ontological knowledge.
- Based on RDF4J Framework
- Requires a dedicated RDF4J Sail expressly developed for VocBench in order to store information for projects using History & Validation

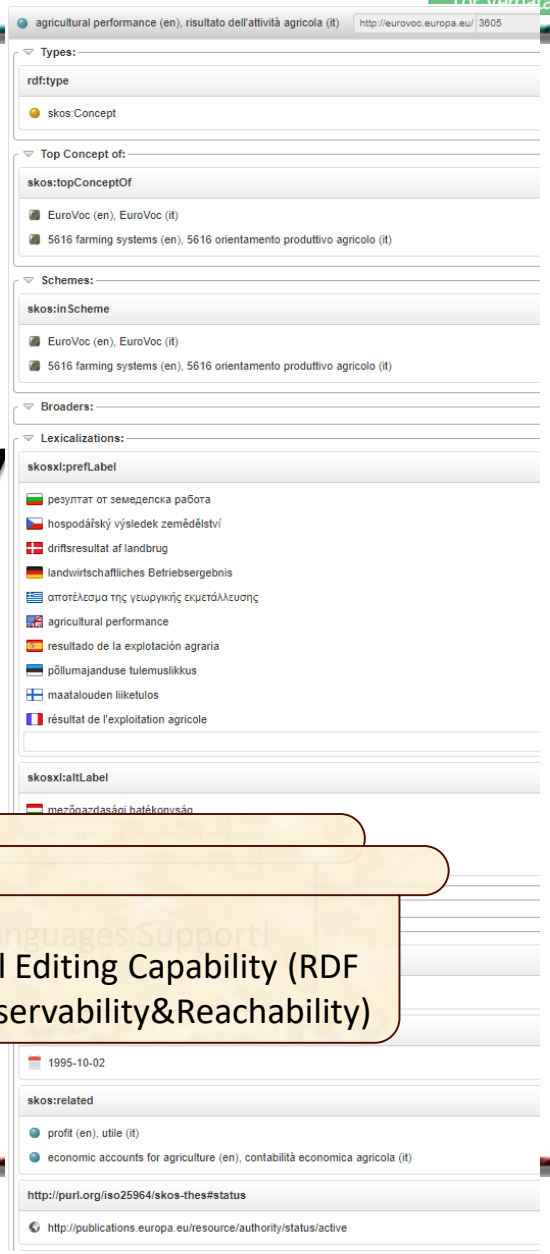
..AND FEATURES

A new User Interface

- **Technology: Angular**
- **Approach**
  - **A single *resource-view* showing every**

    vs

    VB2's several tabs
  - **Serving any kind of resource**
  - **Inspecting any detail of them**
  - **Custom Forms**

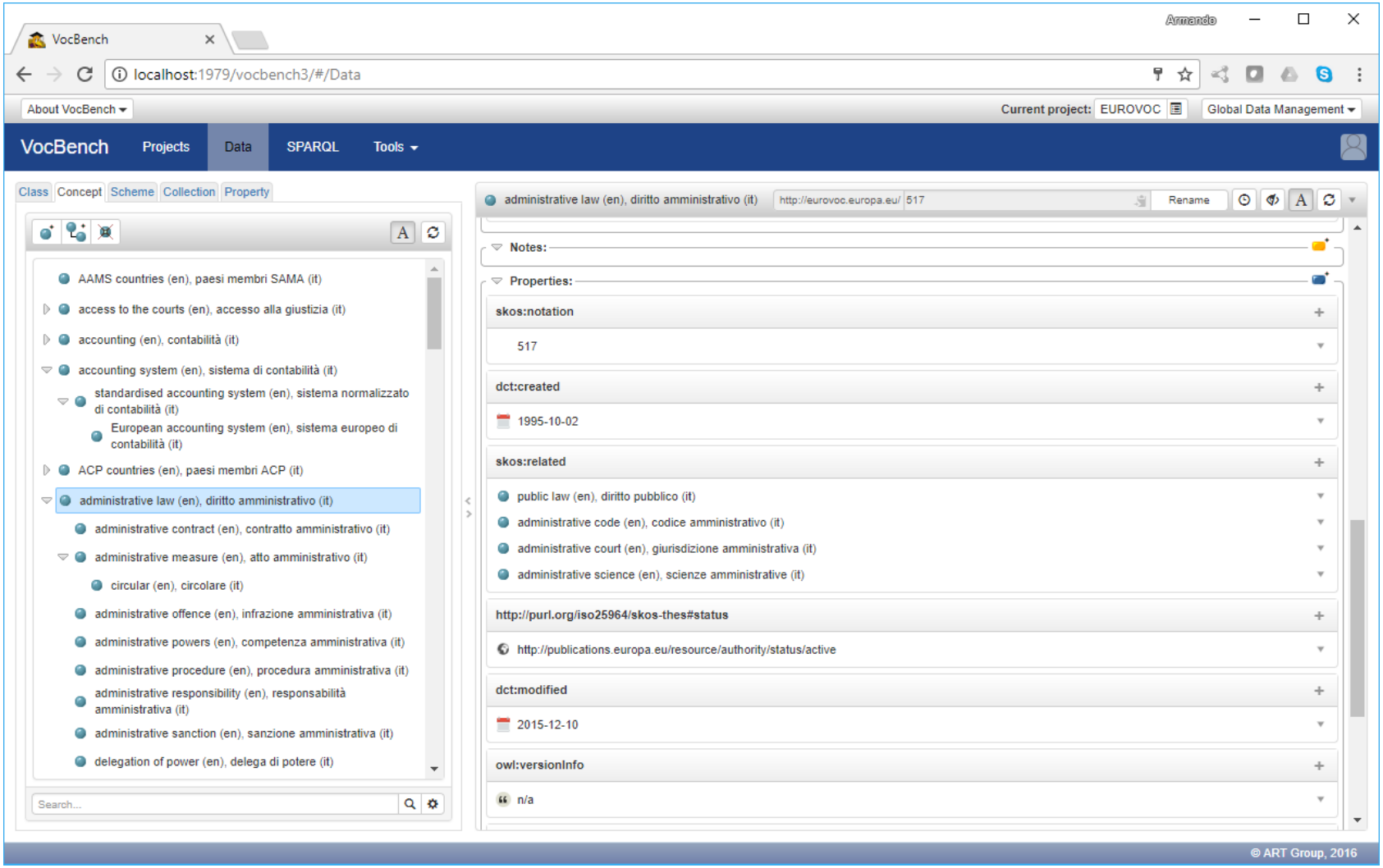


R10. Full Editing Capability (RDF ... servability&Reachability)

R14. Customizable UI

Armando Stellato stellato@uniroma2.it
http://art.uniroma2.it/stellato

A new UI


VocBench
Armando
localhost:1979/vocbench3/#/Data
About VocBench
Current project: EUROVOC
Global Data Management
VocBench
Projects
Data
SPARQL
Tools
Class
Concept
Scheme
Collection
Property
AAMS countries (en), paesi membri SAMA (it)
access to the courts (en), accesso alla giustizia (it)
accounting (en), contabilità (it)
accounting system (en), sistema di contabilità (it)
standardised accounting system (en), sistema normalizzato di contabilità (it)
European accounting system (en), sistema europeo di contabilità (it)
ACP countries (en), paesi membri ACP (it)
administrative law (en), diritto amministrativo (it)
administrative contract (en), contratto amministrativo (it)
administrative measure (en), atto amministrativo (it)
circular (en), circolare (it)
administrative offence (en), infrazione amministrativa (it)
administrative powers (en), competenza amministrativa (it)
administrative procedure (en), procedura amministrativa (it)
administrative responsibility (en), responsabilità amministrativa (it)
administrative sanction (en), sanzione amministrativa (it)
delegation of power (en), delega di potere (it)
Search...
administrative law (en), diritto amministrativo (it)
http://eurovoc.europa.eu/ 517
Rename
Notes:
Properties:
skos:notation
517
dct:created
1995-10-02
skos:related
public law (en), diritto pubblico (it)
administrative code (en), codice amministrativo (it)
administrative court (en), giurisdizione amministrativa (it)
administrative science (en), scienze amministrative (it)
http://purl.org/iso25964/skos-thes#status
http://publications.europa.eu/resource/authority/status/active
dct:modified
2015-12-10
owl:versionInfo
n/a
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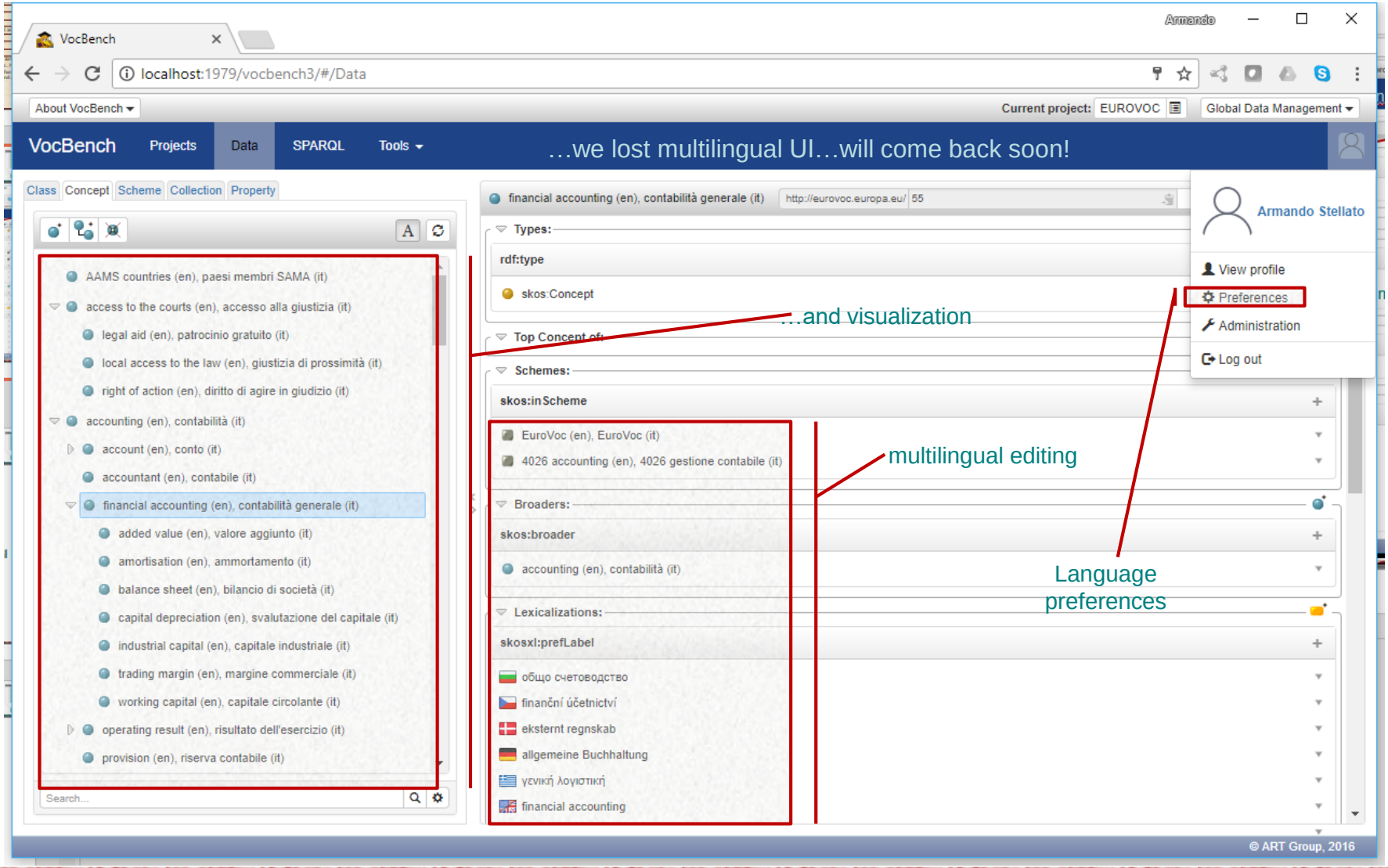
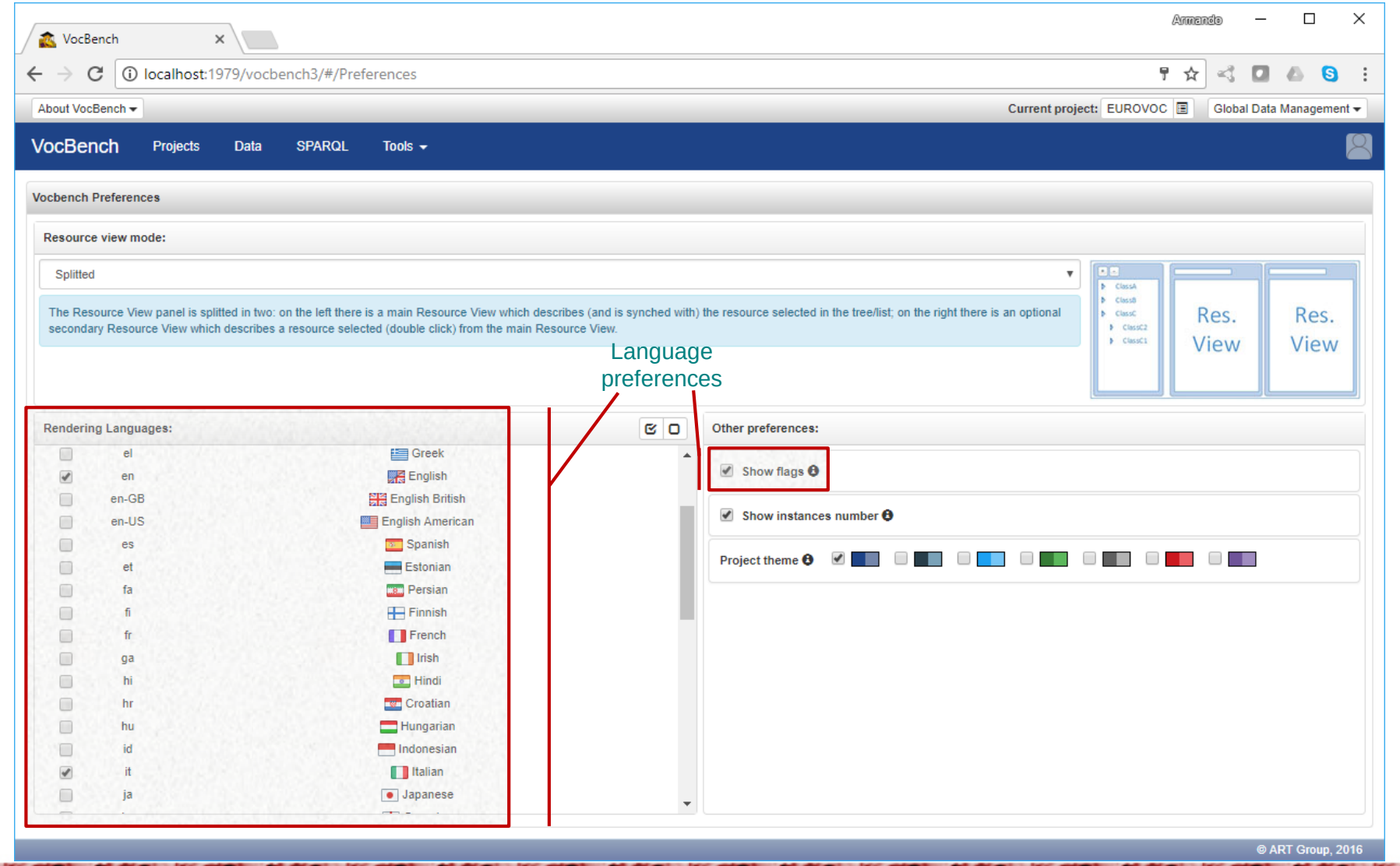
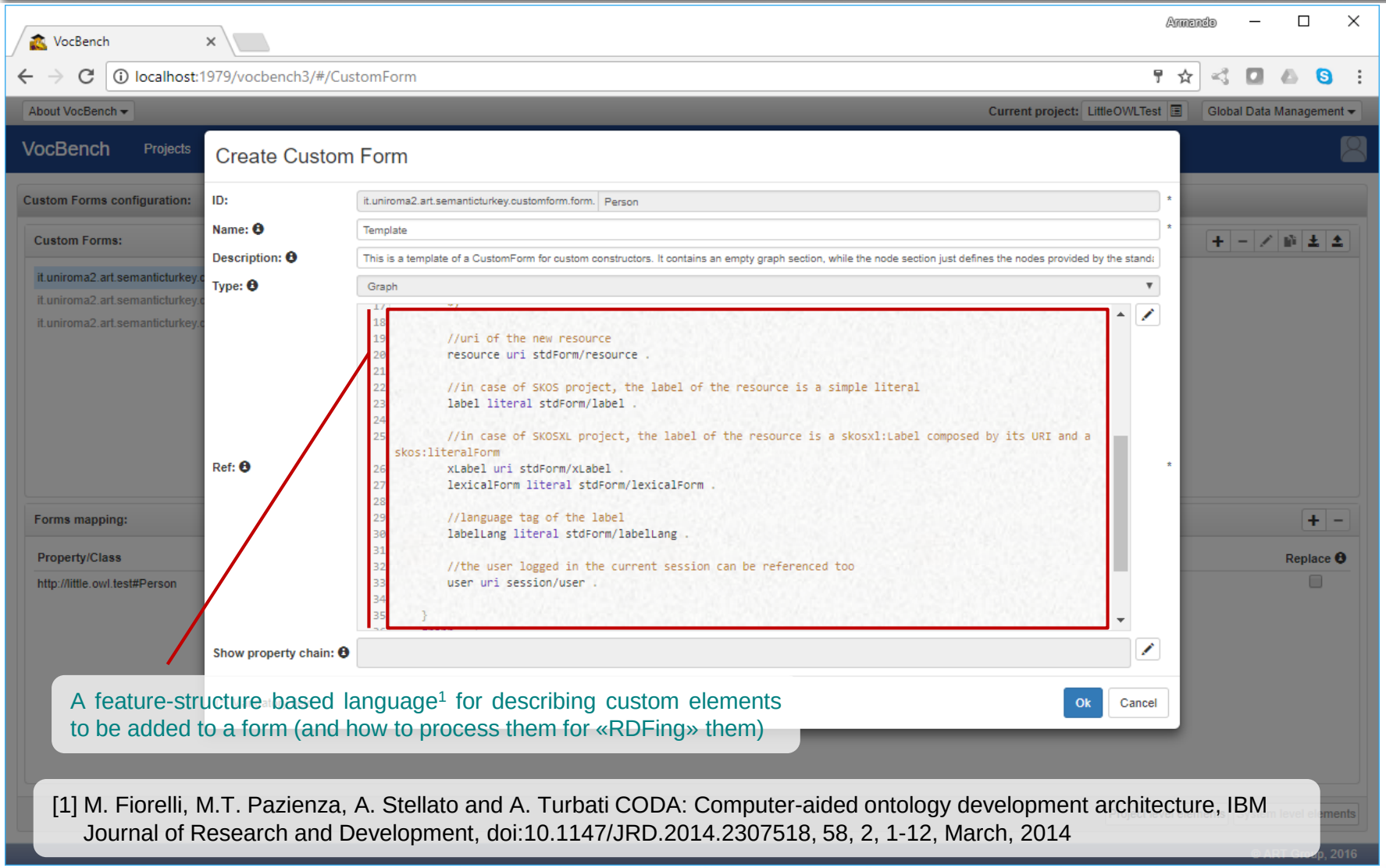
UI and Multilingualism (R1)



UI and Multilingualism (R1)



Custom Forms



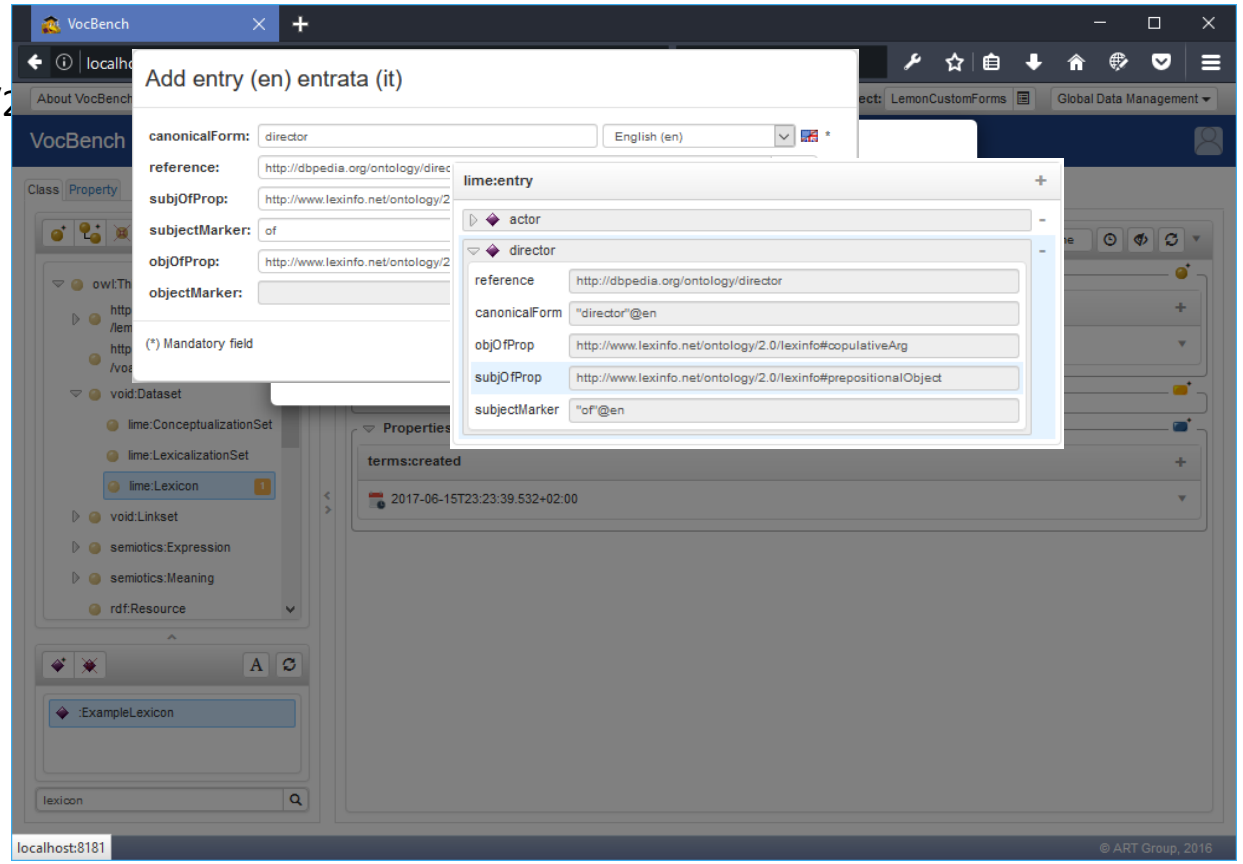
A feature-structure based language[1] for describing custom elements to be added to a form (and how to process them for «RDFing» them)

[1] M. Fiorelli, M.T. Pazienza, A. Stellato and A. Turbati CODA: Computer-aided ontology development architecture, IBM Journal of Research and Development, doi:10.1147/JRD.2014.2307518, 58, 2, 1-12, March, 2014

Custom Forms

- Custom forms have been shown to cover even complex resources
- In (Fiorelli, Pazienza, Stellato)* their expressive power was sufficient to cover the management of *Ontolex-Lemon* data

http://www.w3.org/2



* Fiorelli, M., Lorenzetti, T., Pazienza, M.T., Stellato, A.: Assessing VocBench Custom Forms in Supporting Editing of Lemon Datasets. In : Language, Data, and Knowledge (Lecture Notes in Artificial Intelligence) 10318. Springer, Cham (2017), pp.237-252

Controlled Collaborative Editing through Role-based Access Control (RBAC)

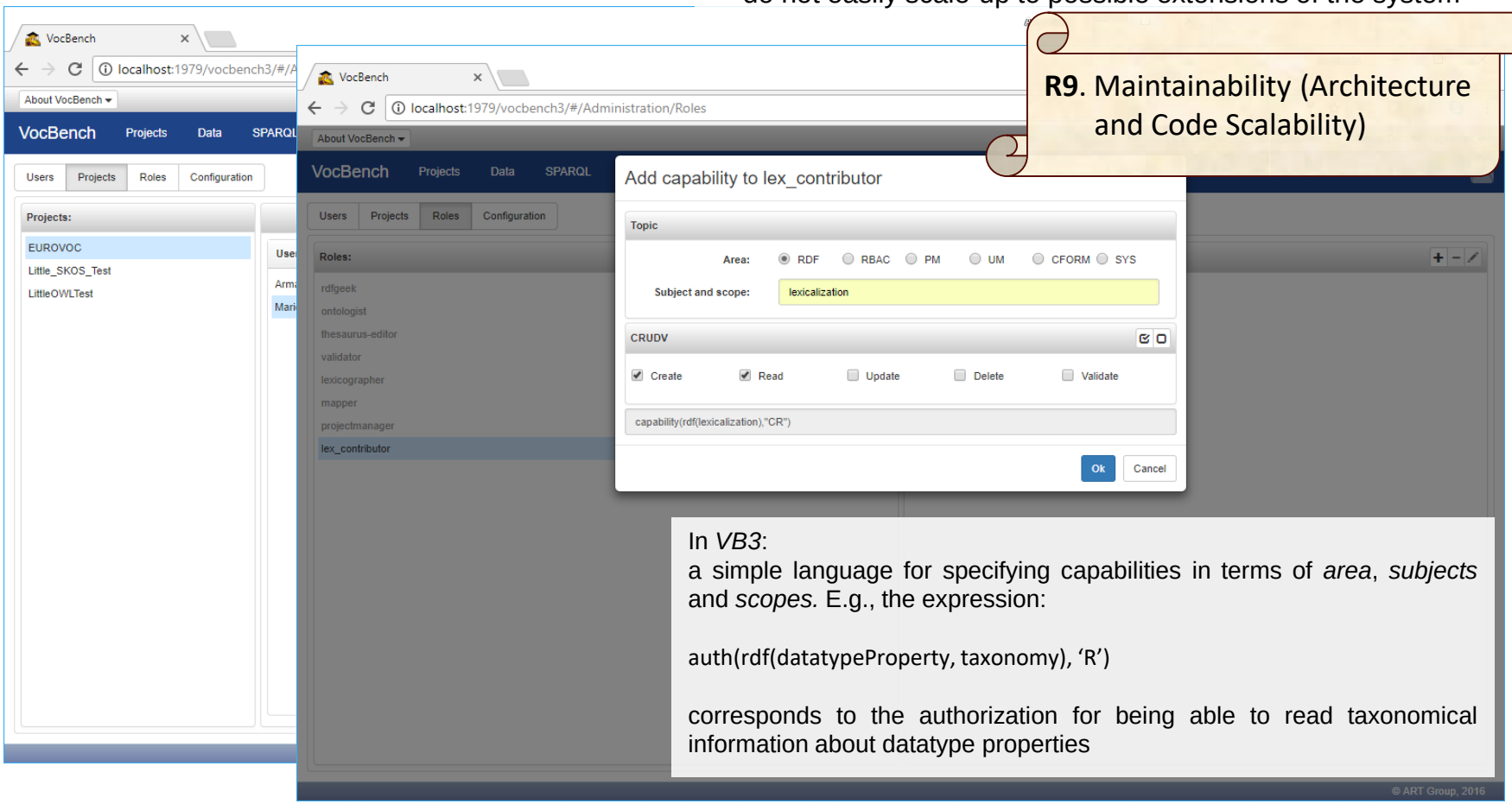
R2. Controlled Collaboration!

Role-based Access Control

In *VB2*:

- hard-wired roles with predefined and limited editing possibilities
- do not easily scale-up to possible extensions of the system

R9. Maintainability (Architecture and Code Scalability)

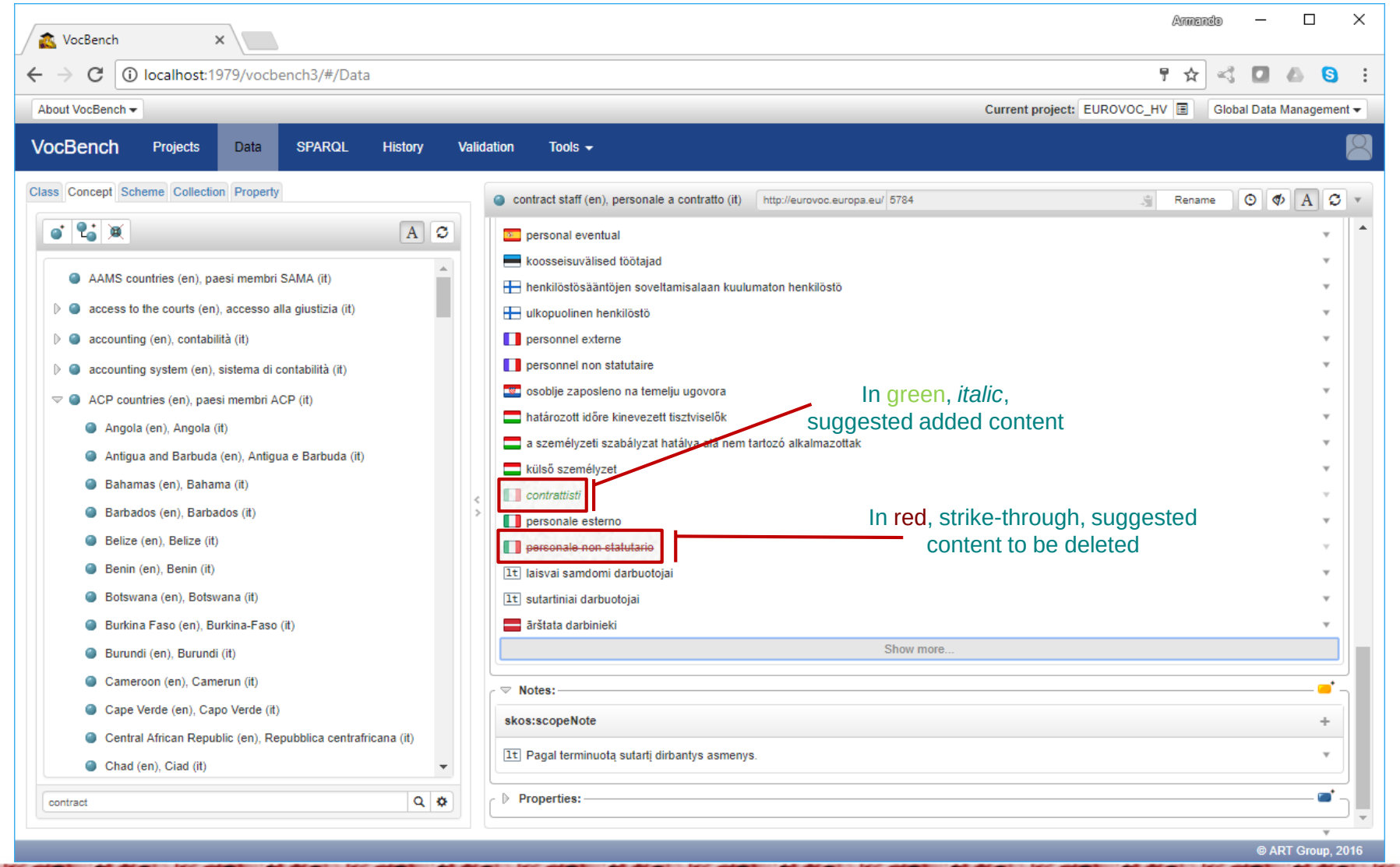


In *VB3*:
a simple language for specifying capabilities in terms of *area*, *subjects* and *scopes.* E.g., the expression:

auth(rdf(datatypeProperty, taxonomy), 'R')

corresponds to the authorization for being able to read taxonomical information about datatype properties

Advanced History and Change Tracking mechanism



Advanced History and Change Tracking mechanism

Landscape analysis for realizing H&TC

Fiorelli, M., Pazienza, M.T., Stellato, A., Turbati, A.: Version Control and Change Validation for RDF Datasets. In : Metadata and Semantics Research. 11th Research Conference, MTSR 2017, Tallinn, Estonia, November 28 - December 1, 2017, Proceedings. Springer (2017) (in press).

VB2 change-tracking mechanism:

- A strength and weakness of VB
- Appreciated by many users
- Does not scale to new services and functionalities
- Not synchroniz… with lower-level changes (e.g. loaded d… SPA
- Stored ir…

R6. Under-the-hood data access/modification

In VB3

- abandoned separated relational DB with user and history data
- track-change mechanism working at triple-level
  - A *staging-graph* local to the data repository, with triples under validation
  - A *support repository* completely in RDF with reified triples
    - reified *staged* tripled
    - reified *historied* triples
- fine-grained representation complemented with rich metad… about invoked action and the context of the invocation
- change-tracking mechanism implemente… as a sail for the RDF4J fram…ework (http://rdf4j.org/).
- The sail is embedded with the system … but can also … component inside other sail-compliant triple stores

R15. Everything's RDF

R11. Provenance

R4. Software Interoperability/Extensibility

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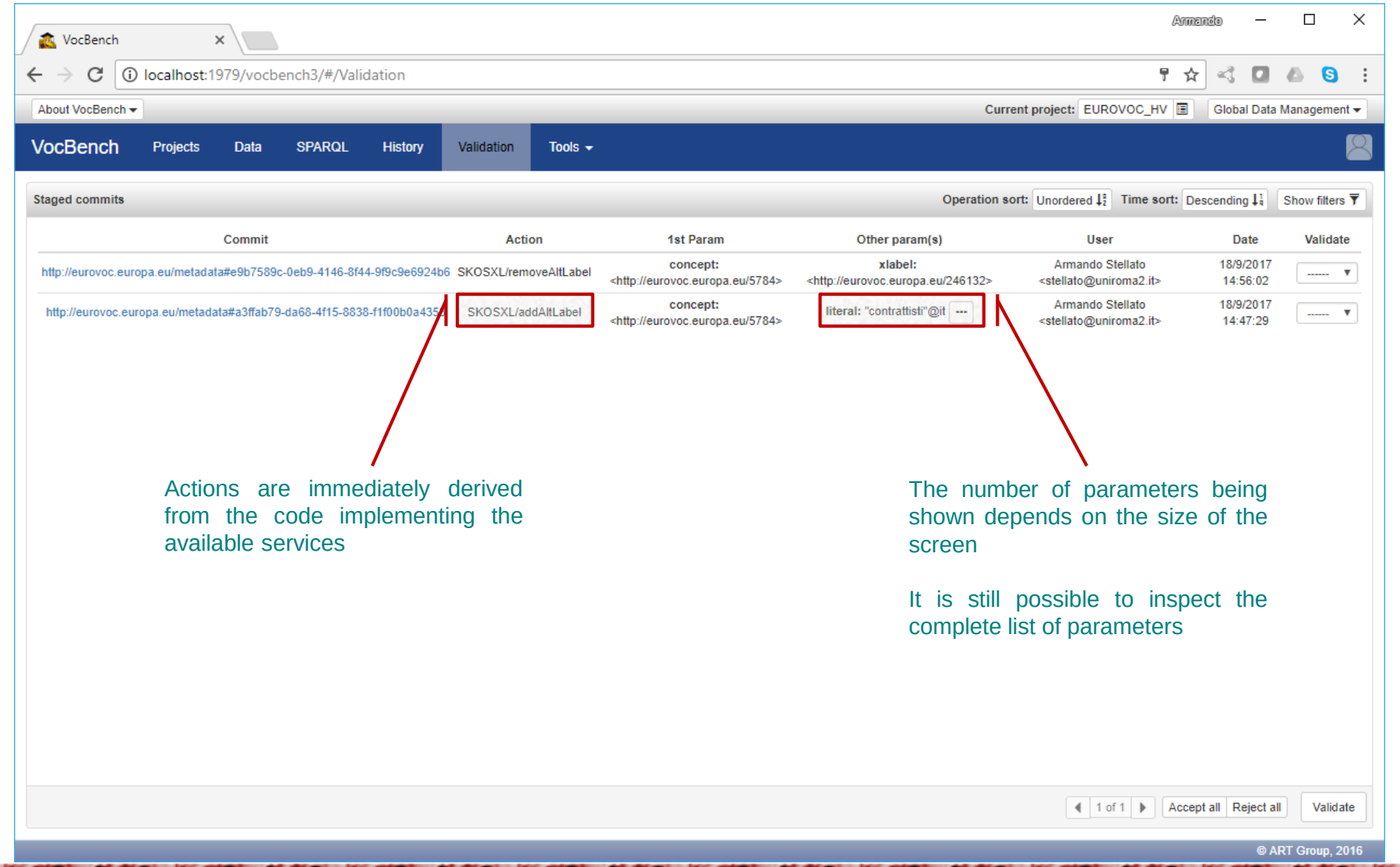
Advanced History and Change Tracking mechanism

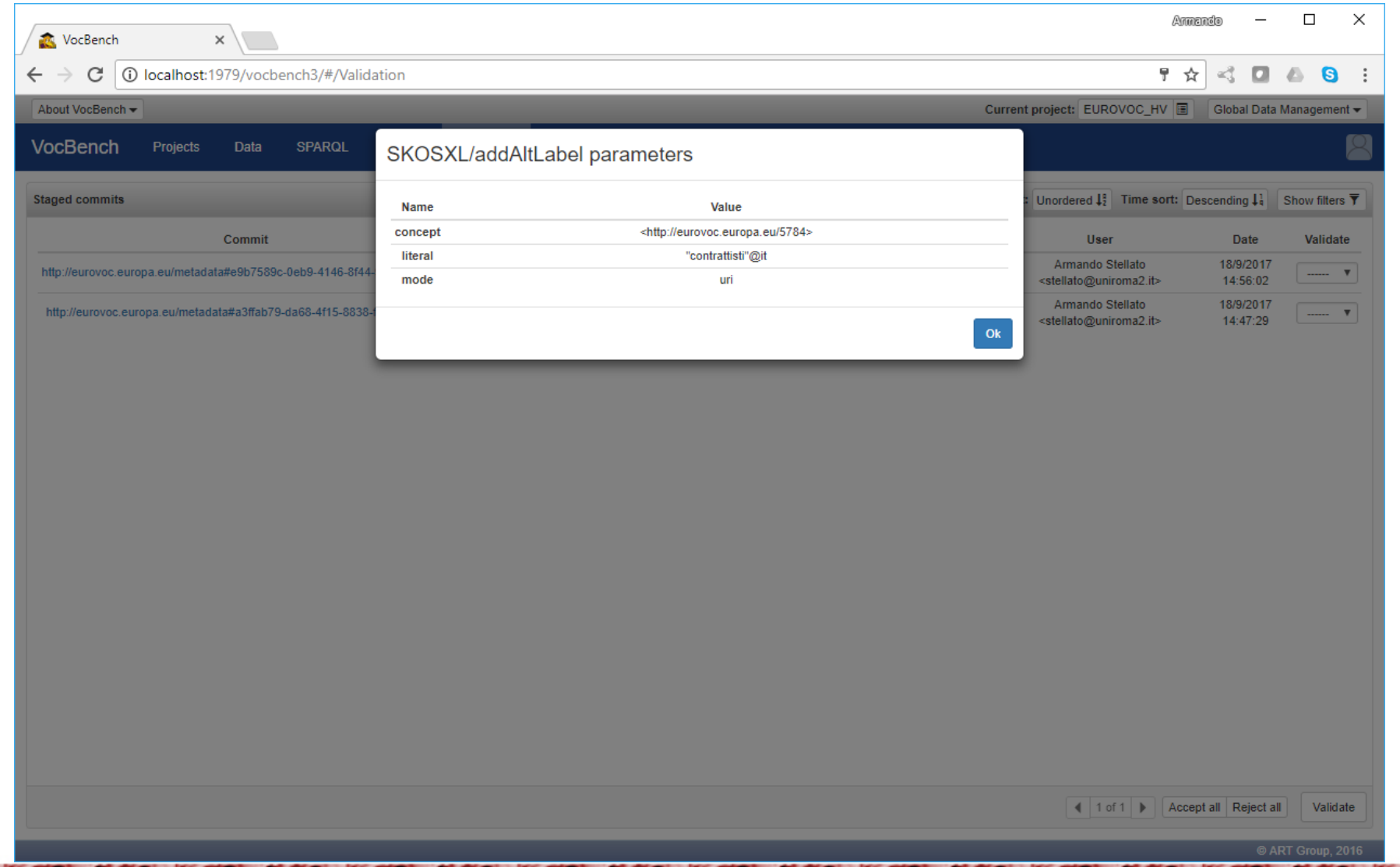


Actions are immediately derived from the code implementing the available services

The number of parameters being shown depends on the size of the screen

It is still possible to inspect the complete list of parameters

Advanced History and Change Tracking mechanism



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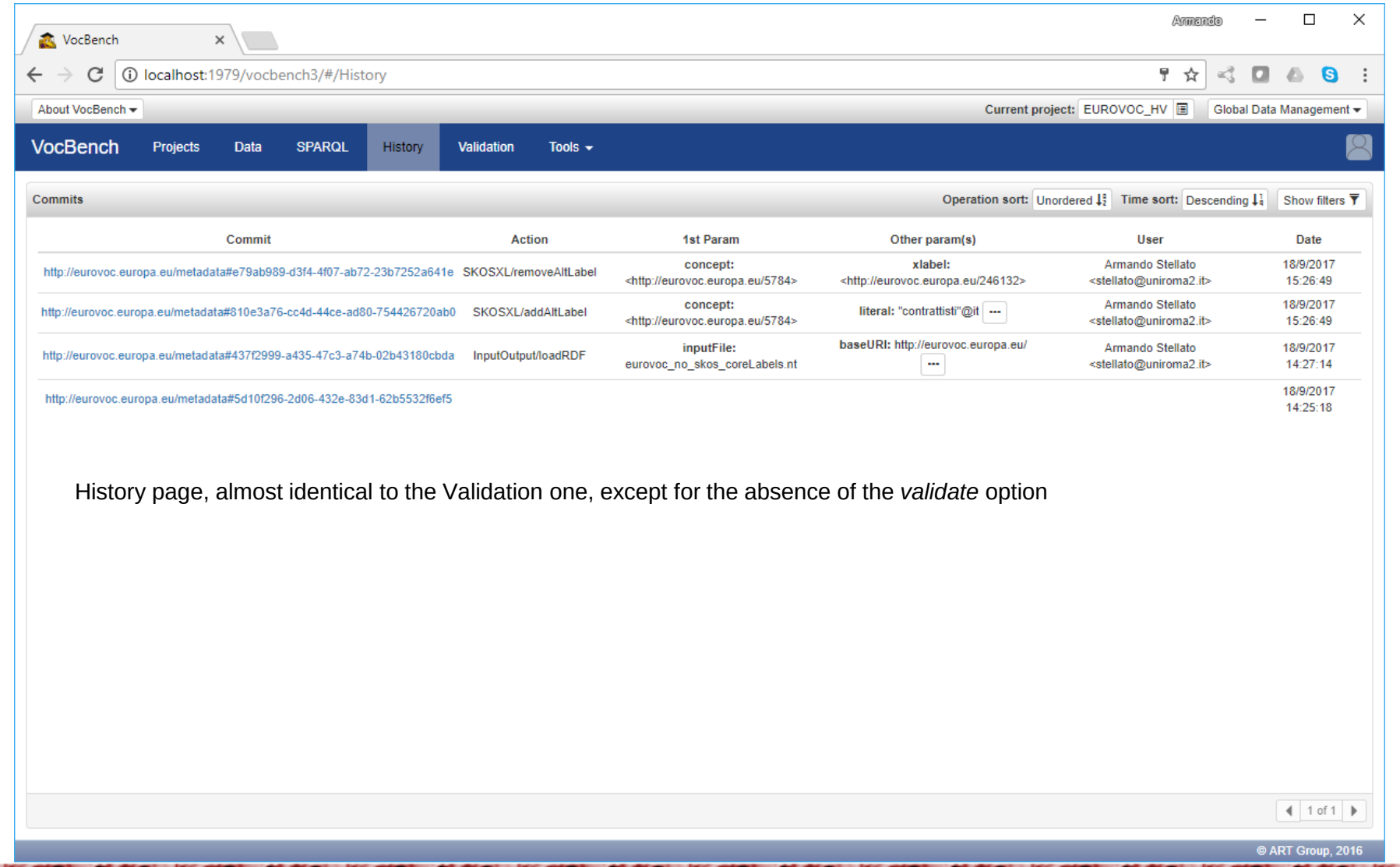
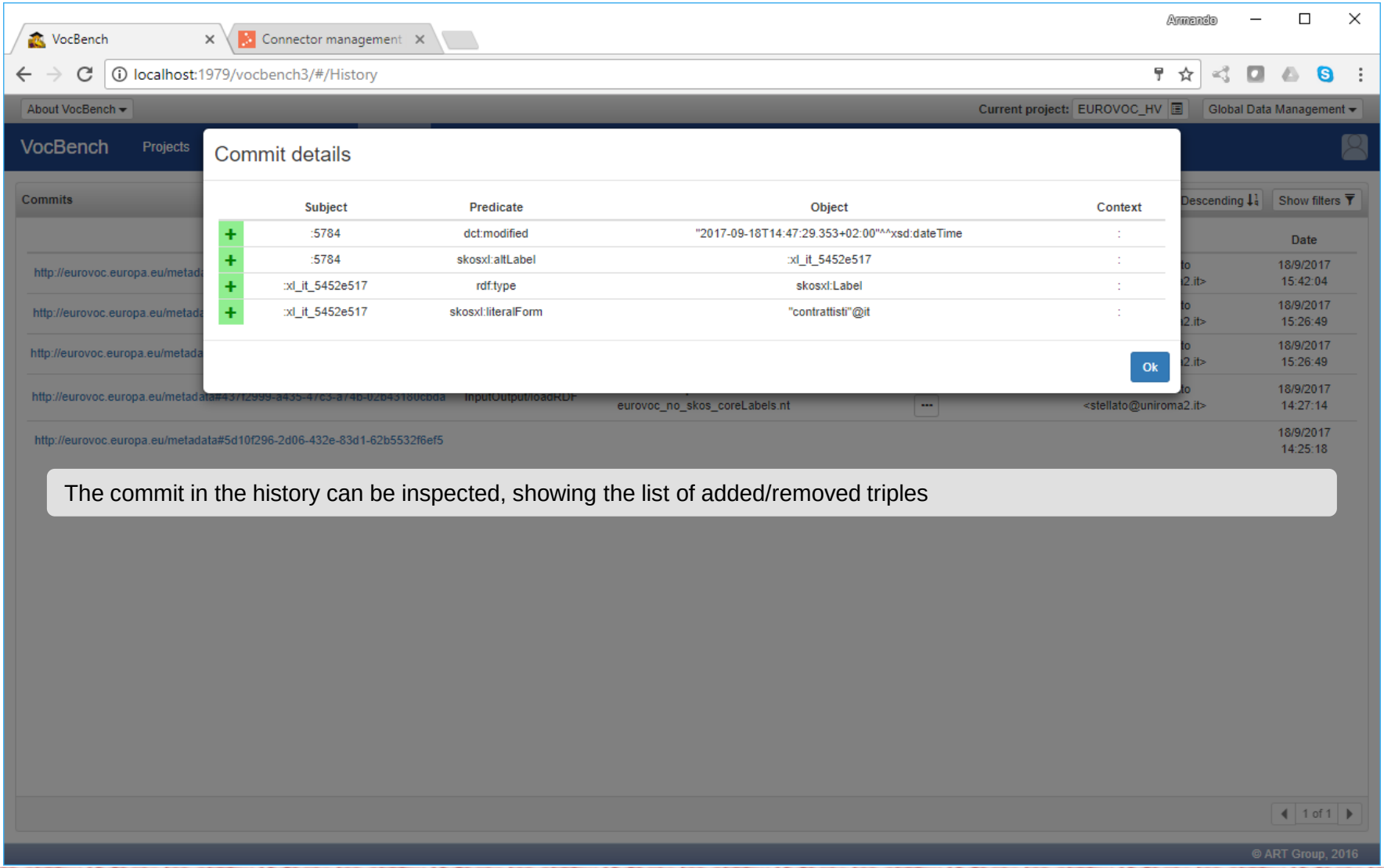


History page, almost identical to the Validation one, except for the absence of the *validate* option

Advanced History and Change Tracking mechanism



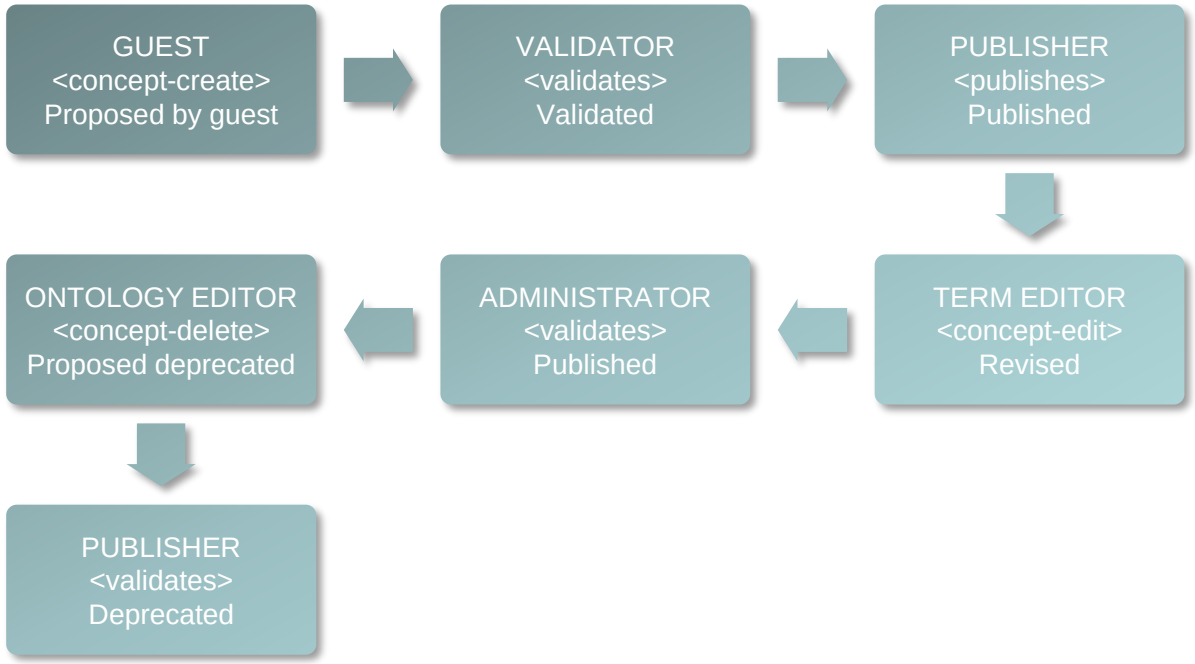
The commit in the history can be inspected, showing the list of added/removed triples

More Powerful yet Streamlined Workflow Management

Workflow Management available yet from VocBench 1

- Following the full life-cycle of concepts/terms, from proposal to deprecation
- Supported by Role-based Access Control
- Represented through a dedicated VocBench vocabulary

an example of a typical workflow:



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More Powerful yet Streamlined Workflow Management

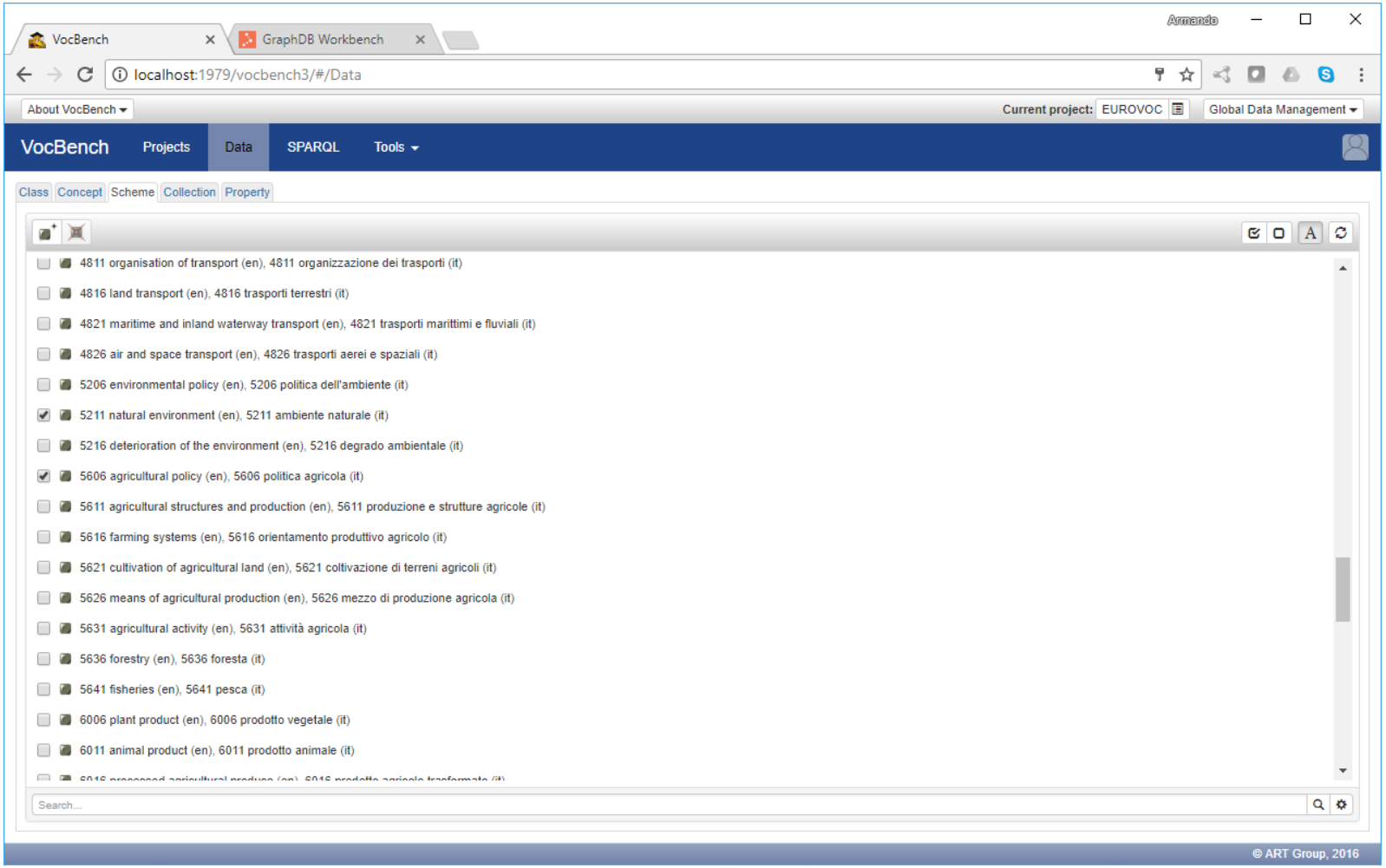
In VB3, Most of the workflow is implicit in the state transition – all in RDF – of triples from the staging repository/graphs to the core graph in the core repository

- *proposed*: no need to represent as a status: if validation is enabled, the concept is still not confirmed on the working graph (it is on a staging graph/repository), and is visible on the validation table
- *validated*: we removed this, as we didn't have feedback of users distinguishing between validated and published. *Published* is just a concept available in the published version
- *published*: since all the other statuses are represented explicitly or managed through the validation system, "published" is the only status which do not require any status.
  - Simply, a resource located in the working graph (has been validated) and that *is not* deprecated is considered to be *published*
- *deprecated*: explicitly marked as **owl:Deprecated**
- *proposed deprecated*: no need here as well to create a status: when validation is activated, the request to "deprecate" needs to be validated, thus a "deprecate" action is always initially put on the validation list

Improved and More Complete Support for SKOS

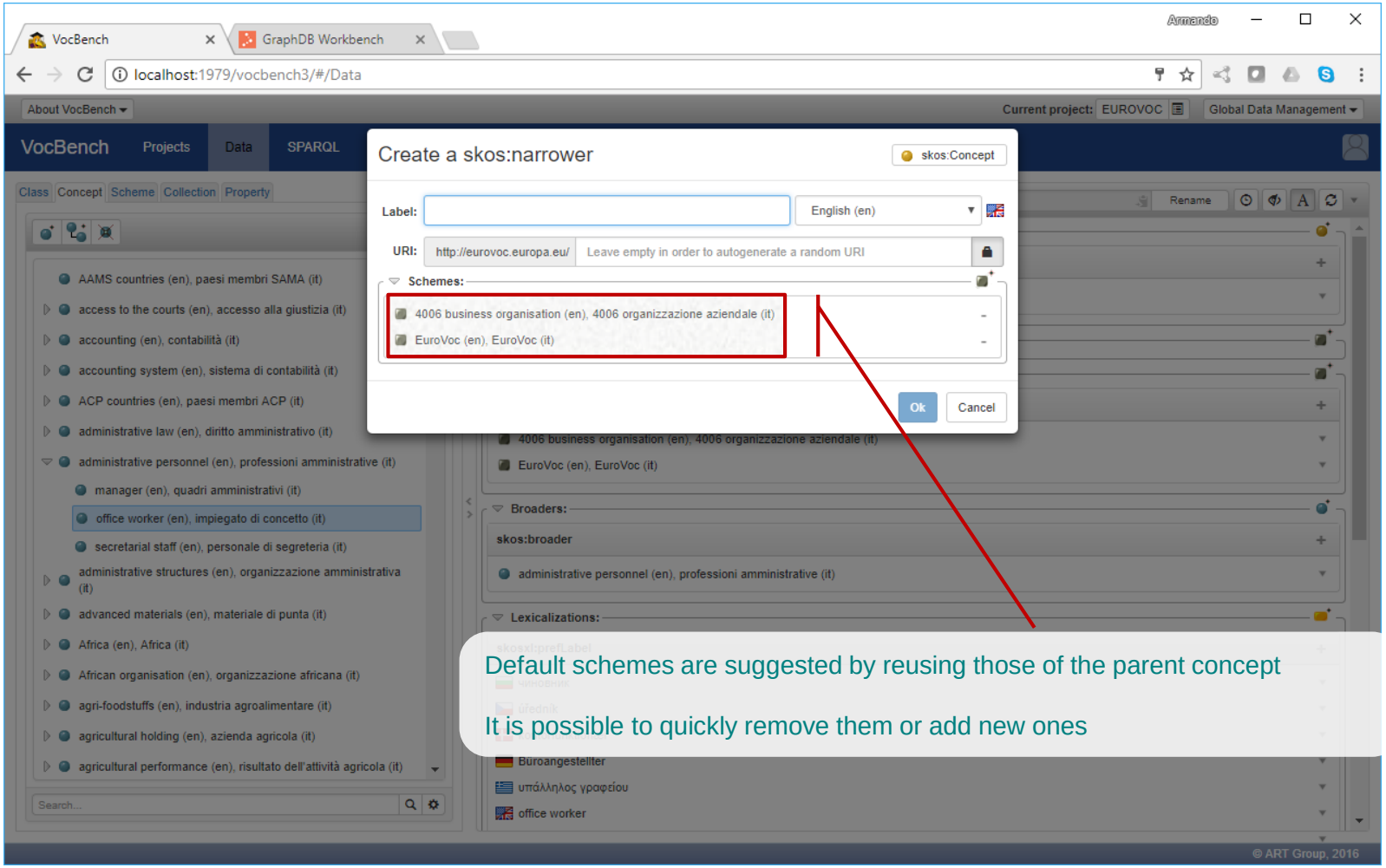
Università di Roma Tor Vergata

Support for viewing multiple schemes



Improved and More Complete Support for SKOS

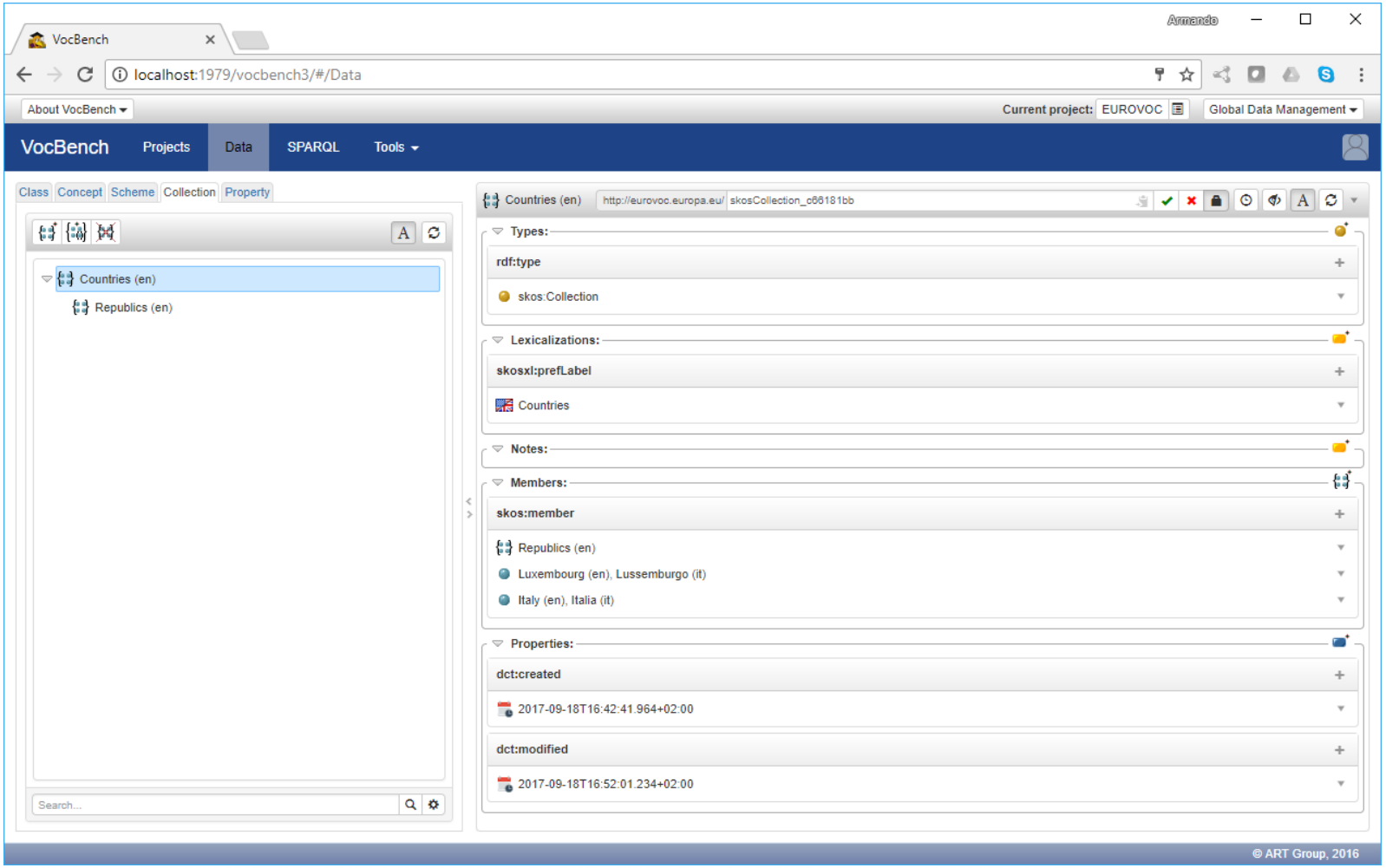
Support for viewing multiple schemes: smart & quick choices for new resources



Improved and More Complete Support for SKOS

Università di Roma Tor Vergata

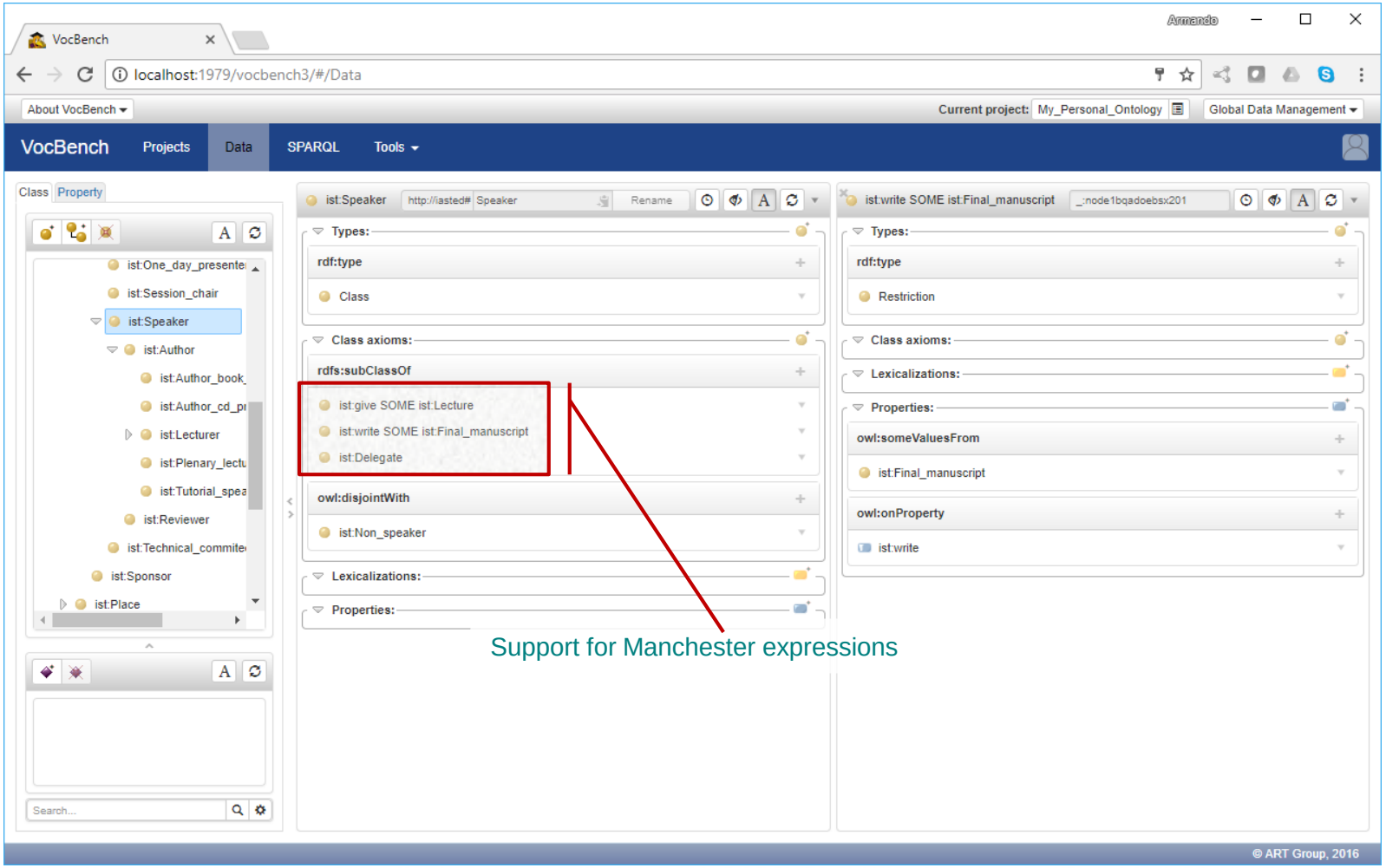
Support for Collections (Unordered and Ordered)



OWL Support

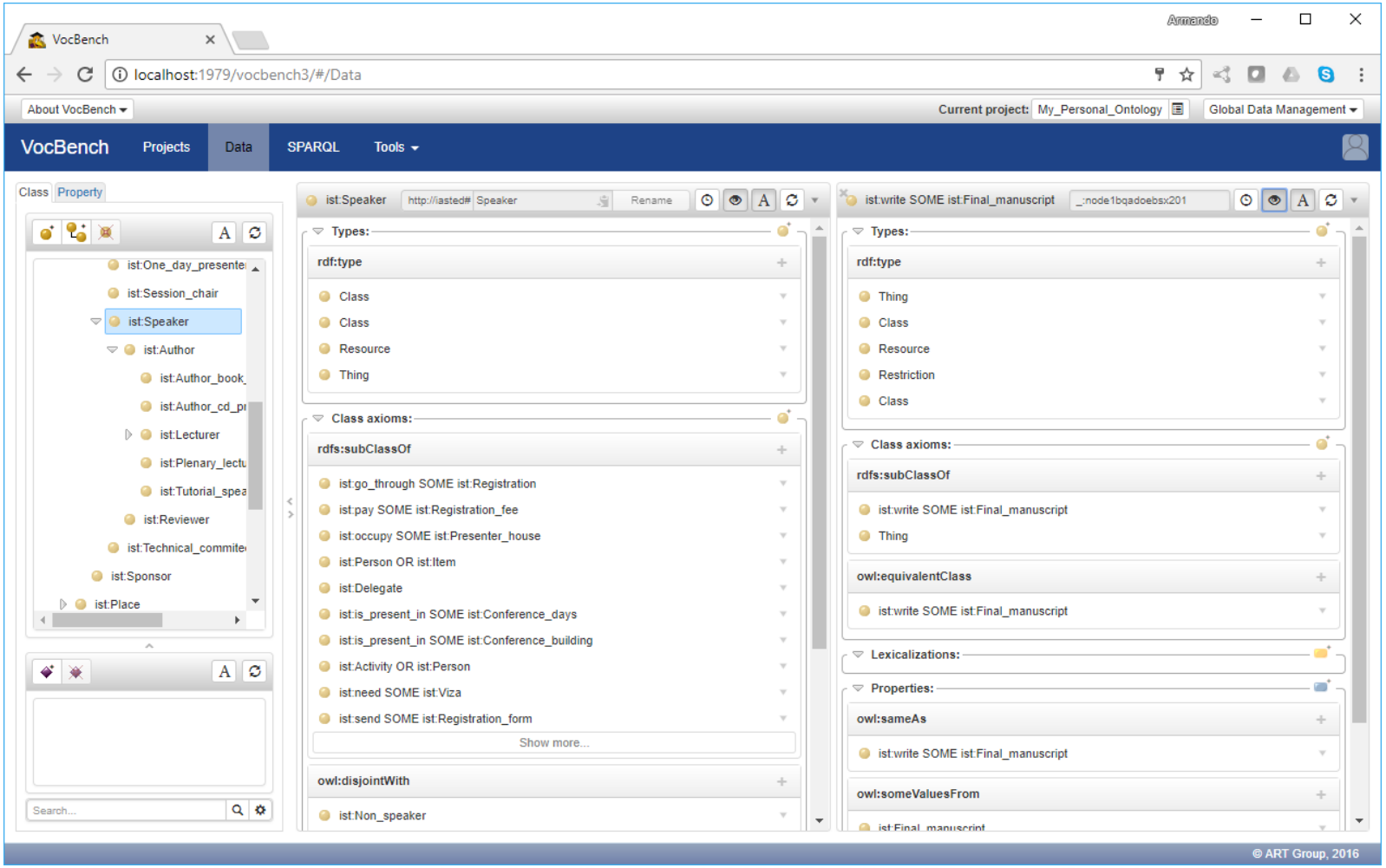
R8. RDF Languages Support

Class Tree, Instance List, OWL Editing Support

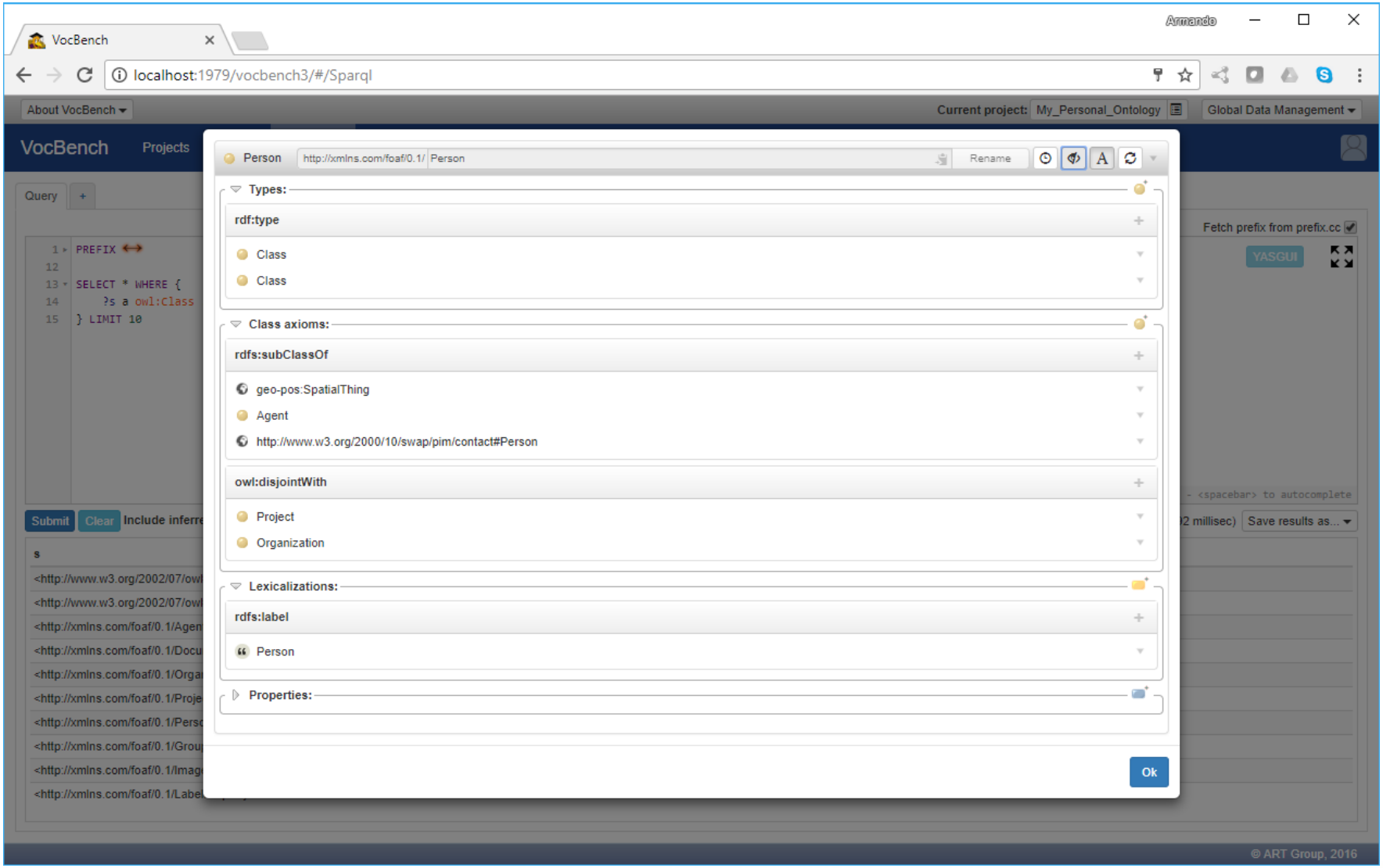


OWL Support

«Inferred» View



SPARQL Querying and Update



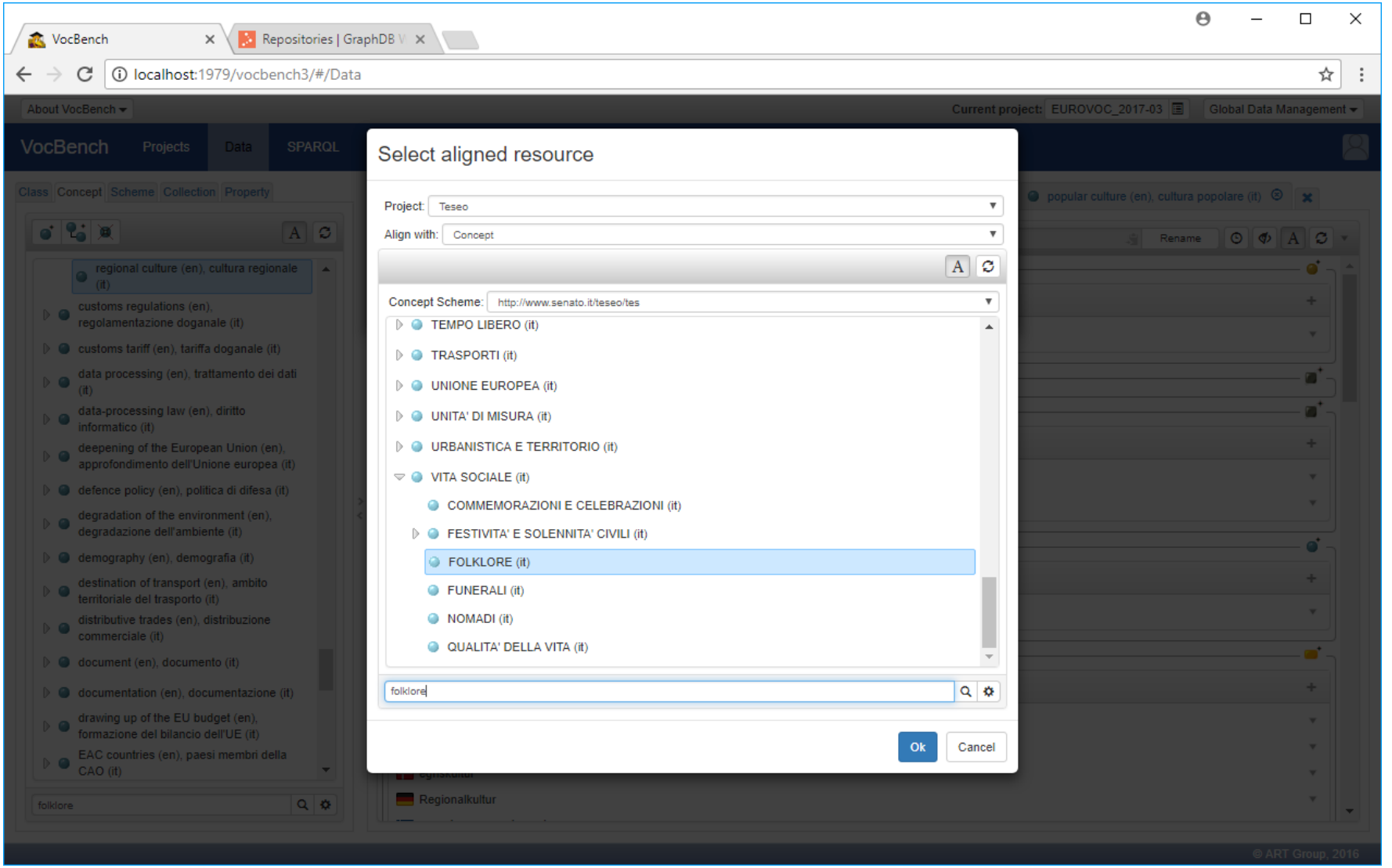
Alignment

Two kind of Alignments:

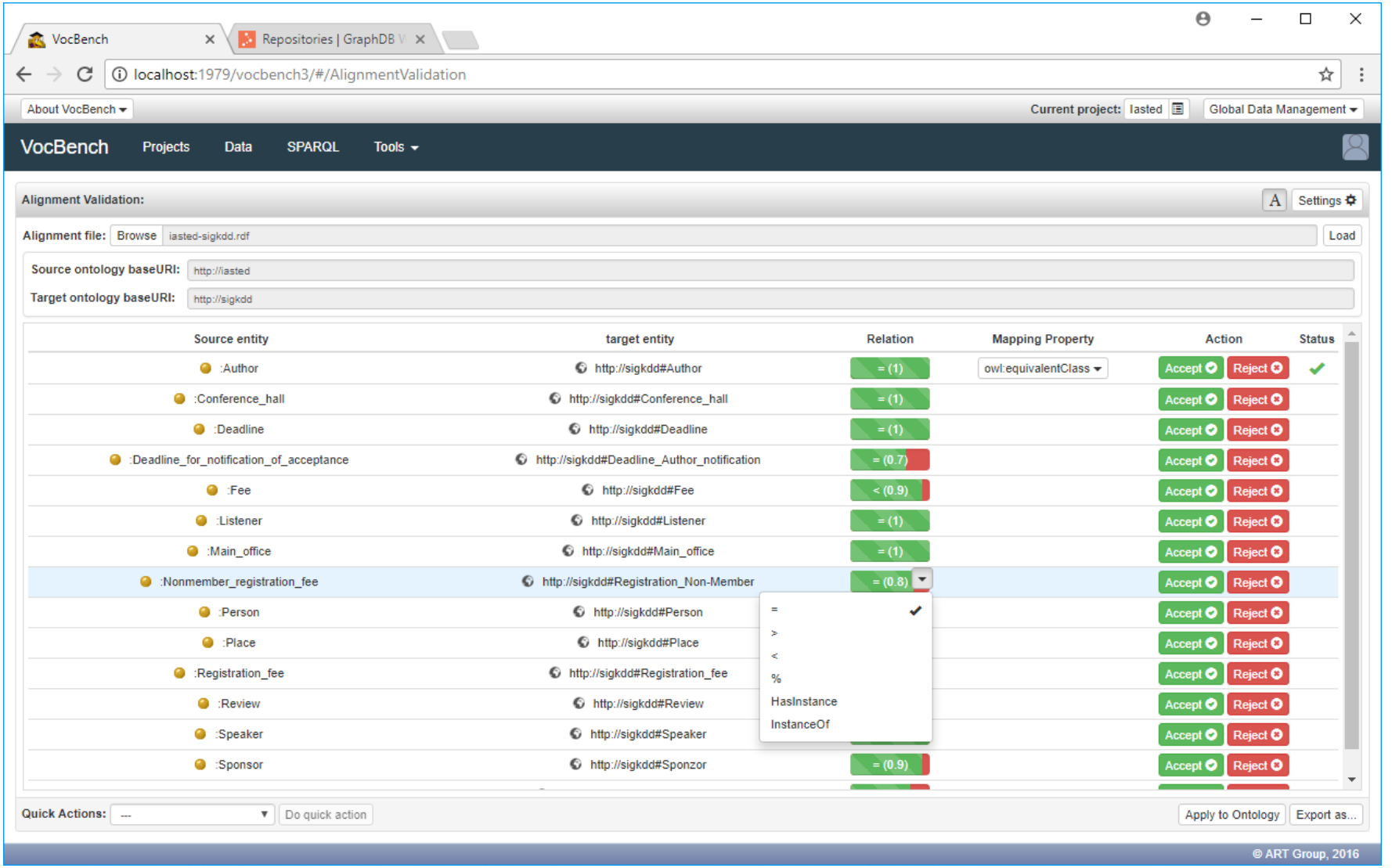
- Manual Alignment across loaded projects
  - each project, target of an alignment, must *allow* access to the inspecting project

- Alignment Validation
  - dedicated dashboard for loading, inspecting and validating imported alignments
  - alignments must be compliant with the INRIA Alignment API's vocabulary in order to be imported into the validation tool

Manual Alignment



Alignment Validation



Declarative Service Implementation

Previous service implementation

```
if (request.equals(Req.isTopConceptRequest)) {
     String skosConceptName = setHttpPar(Par.concept);
     String schemeName = setHttpPar(Par.scheme);
     checkRequestParametersAllNotNull(Par.concept, Par.scheme);
     response = isTopConcept(skosConceptName, schemeName);


public Response isTopConcept(String skosConceptName, String schemeName) {
       SKOSModel skosModel = getSKOSModel();

       try {
           ARTResource[] graphs = getUserNamedGraphs();
           ARTURIResource skosConcept = retrieveExistingResource(skosModel, skosConceptName, graphs);
           ARTURIResource skosScheme  = retrieveExistingResource(skosModel, schemeName, graphs);
           return createBooleanResponse(skosModel.isTopConcept(skosConcept, skosScheme, graphs));
       } catch (NonExistingRDFResourceException e) {
           return logAndSendException(e);
       } catch (ModelAccessException e) {
           return logAndSendException(e);
       }

   }
```

Parameter annotations may contain explicit validation checks with respect to the application's semantics

Method Annotations allow to:

- automatically publish services
- declare a-priori whether a method is allowed to read/write on the RDF data
- declare the required capabilities in otder to be authorized to use the service

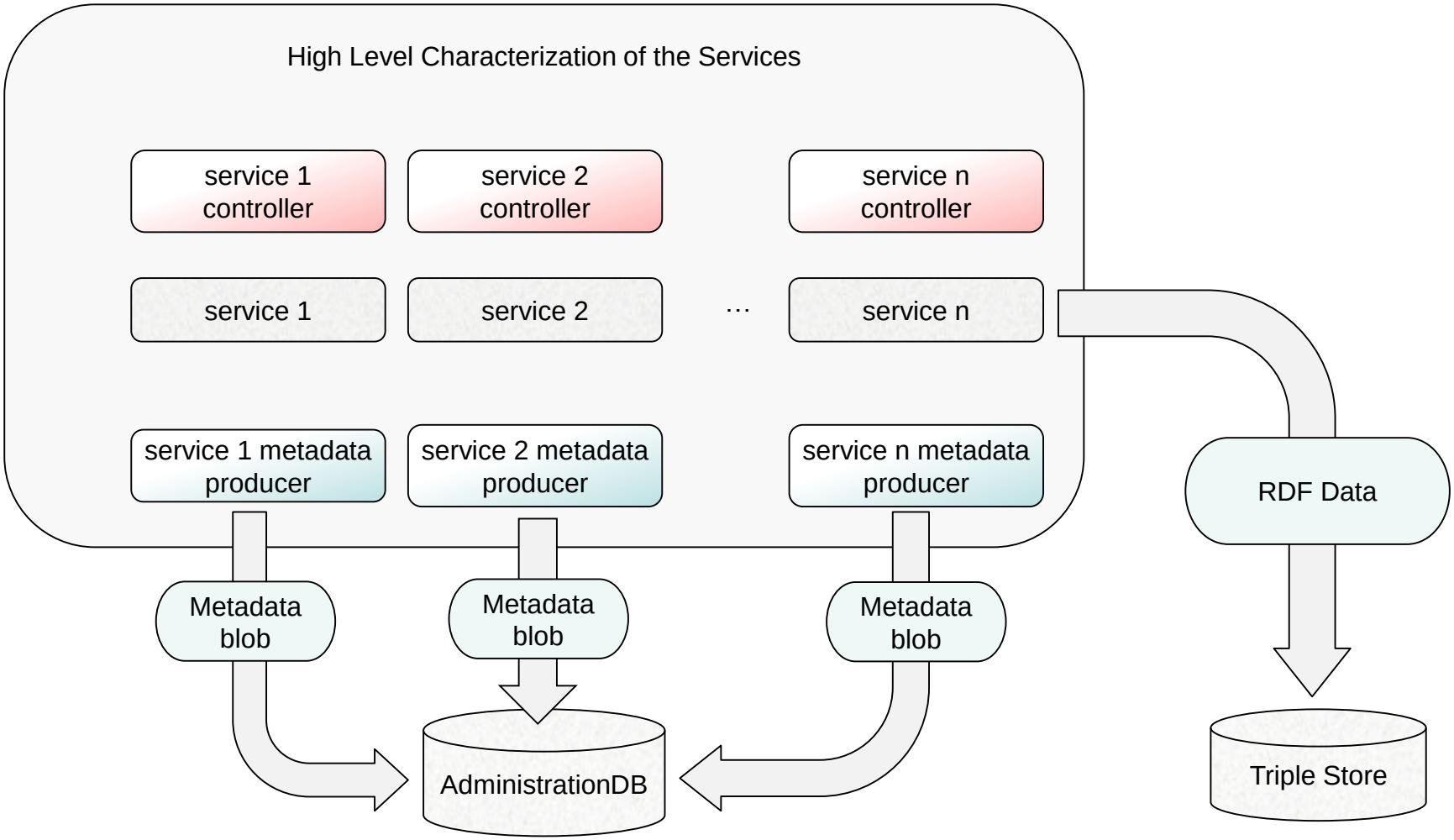
Parameters and returned values are now explicitly managed with their native types.
Marshalling/Unmarshalling to the serialization formats adopted by the service is demanded to dedicated components

Separation of service method-controller / automatic generation of controller

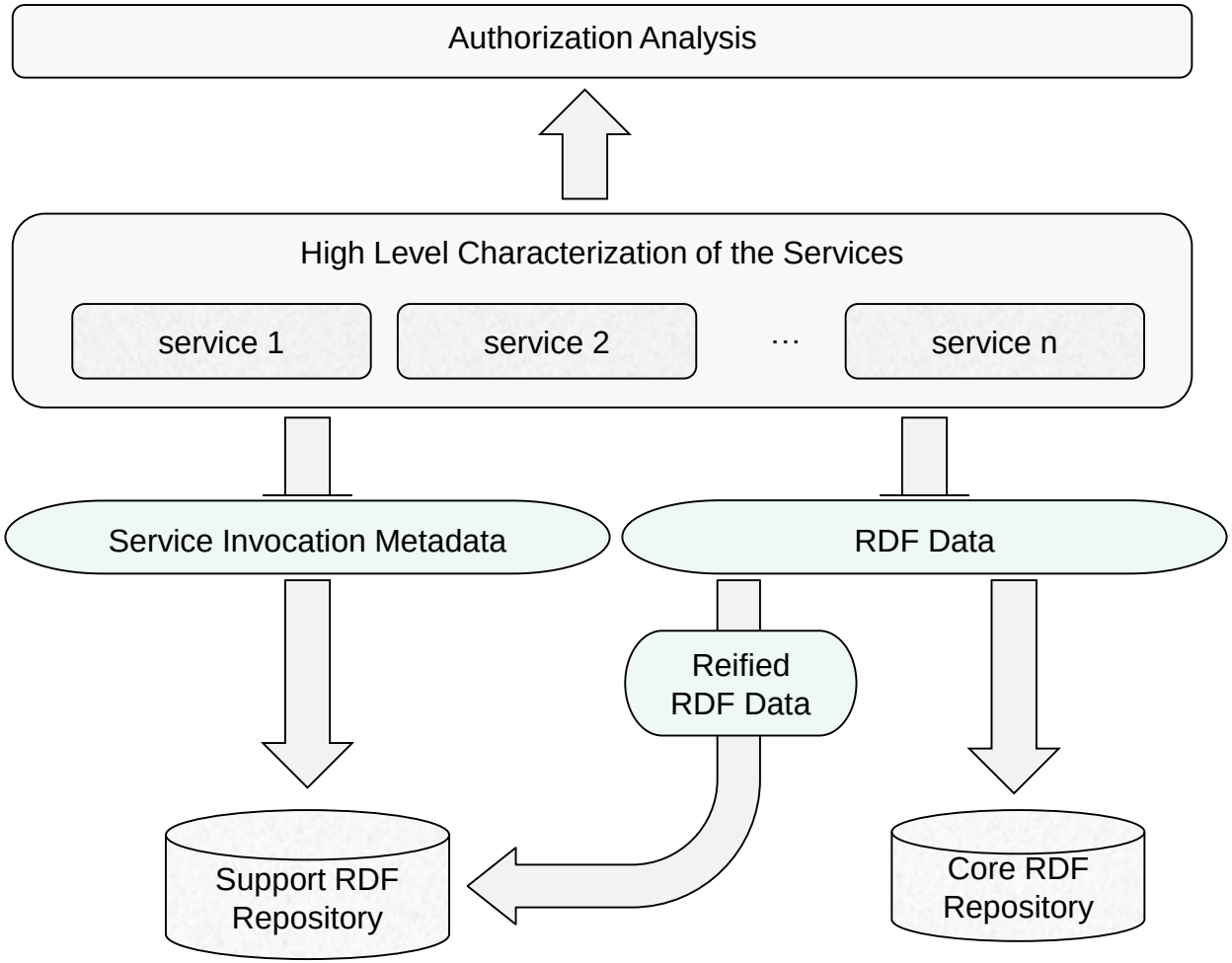
```
@STServiceOperation
@Read
@PreAuthorize("@auth.isAuthorized('rdf(concept, taxonomy)', 'R')")
public Collection<AnnotatedValue<Resource>> getTopConcepts(@Optional @LocallyDefinedResources List<IRI> schemes) {
```

The method signature then drives the generation of the controller, which is the direct frontend for the service. Exceptions are serialized in the response (the content of which codes both data and application-level error codes) and data validation annotations are managed by Spring data validation methods

Declarative Service Implementation

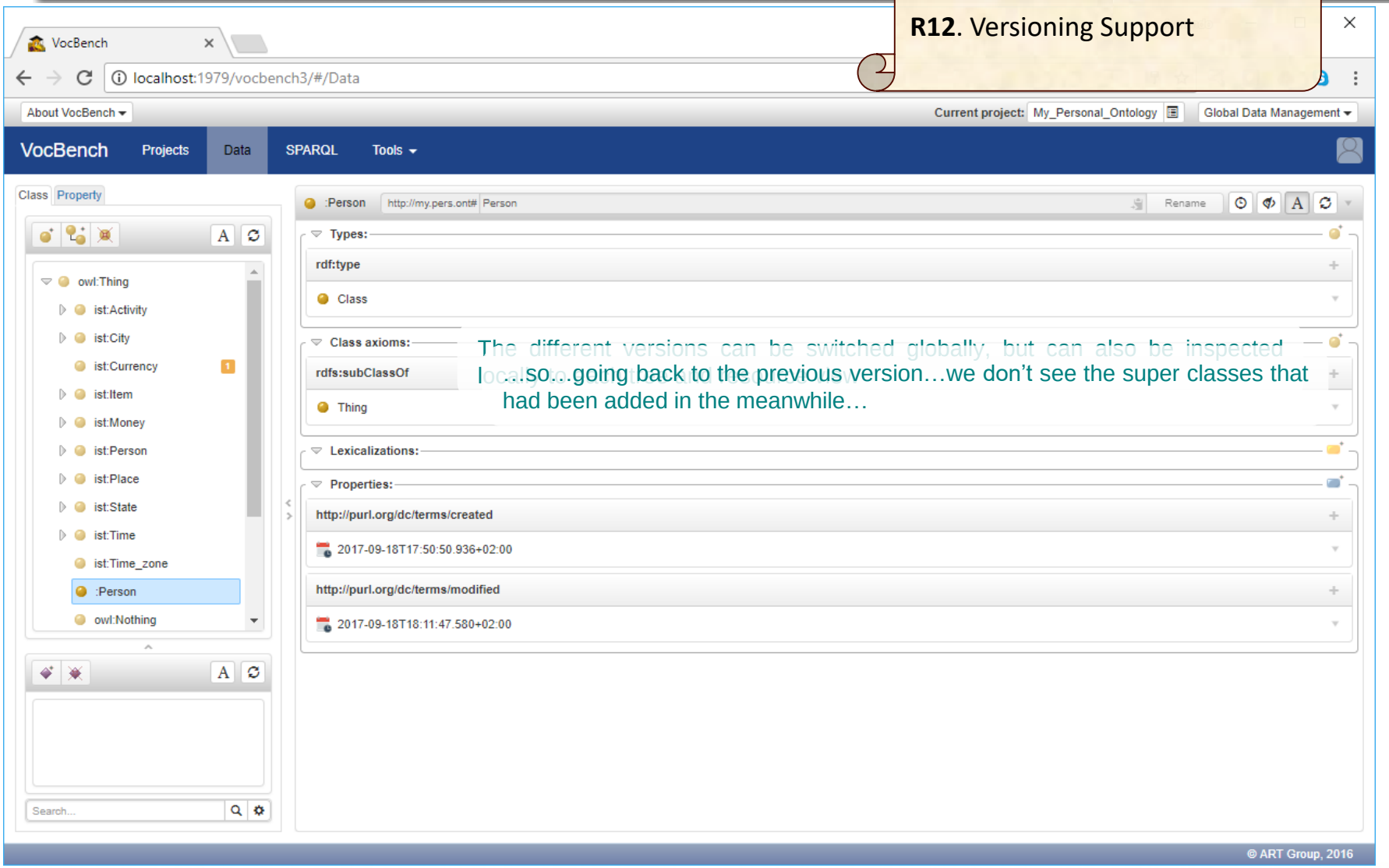


Declarative Service Implementation



Versioned datasets and metadata

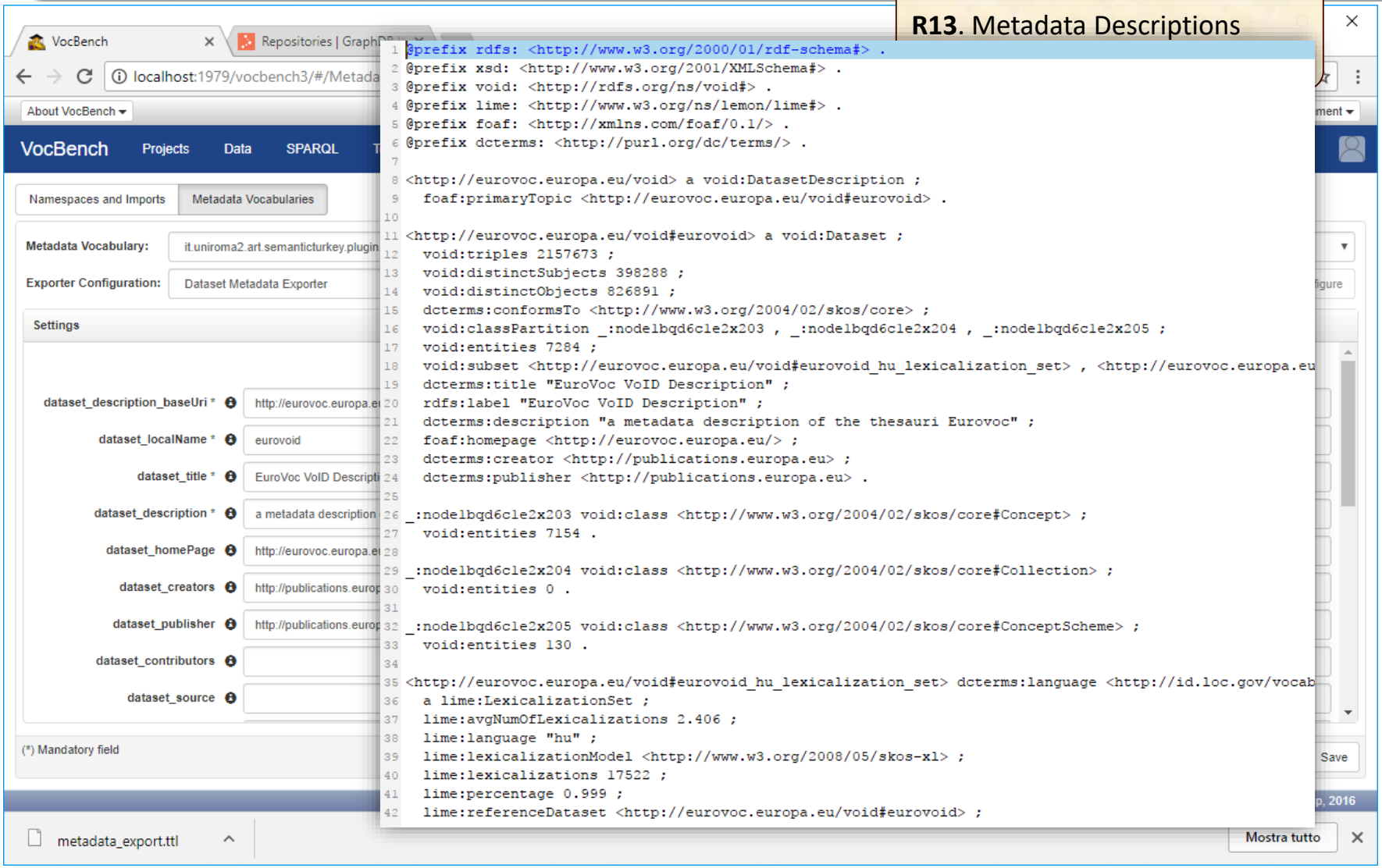
R12. Versioning Support



The different versions can be switched globally, but can also be inspected locally…so…going back to the previous version…we don't see the super classes that had been added in the meanwhile…

Dataset Metadata Export

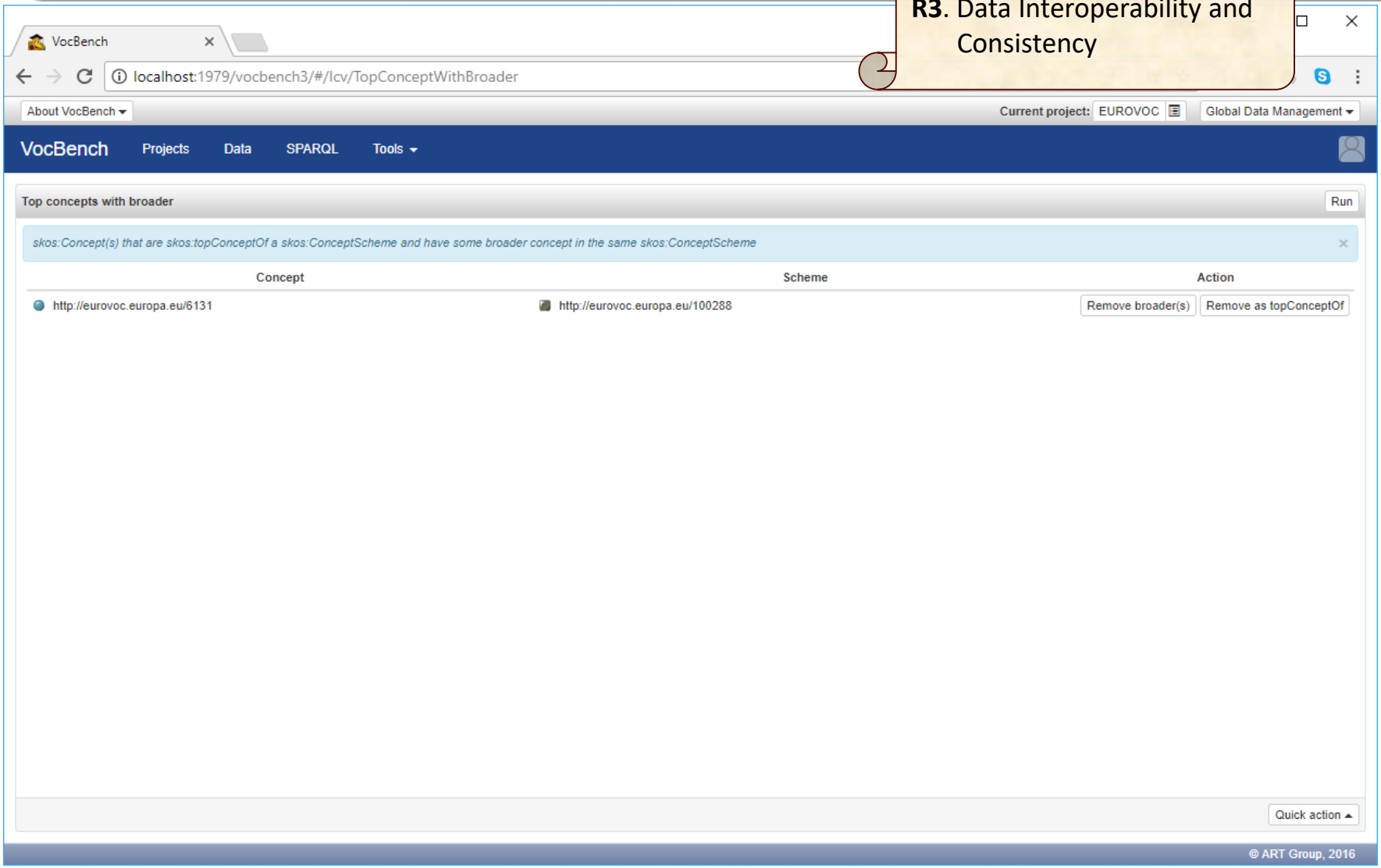
R13. Metadata Descriptions




```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix void: <http://rdfs.org/ns/void#> .
@prefix lime: <http://www.w3.org/ns/lemon/lime#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix dcterms: <http://purl.org/dc/terms/> .

<http://eurovoc.europa.eu/void> a void:DatasetDescription ;
  foaf:primaryTopic <http://eurovoc.europa.eu/void#eurovoid> .

<http://eurovoc.europa.eu/void#eurovoid> a void:Dataset ;
  void:triples 2157673 ;
  void:distinctSubjects 398288 ;
  void:distinctObjects 826891 ;
  dcterms:conformsTo <http://www.w3.org/2004/02/skos/core> ;
  void:classPartition _:nodelbqd6cle2x203 , _:nodelbqd6cle2x204 , _:nodelbqd6cle2x205 ;
  void:entities 7284 ;
  void:subset <http://eurovoc.europa.eu/void#eurovoid_hu_lexicalization_set> , <http://eurovoc.europa.eu
  dcterms:title "EuroVoc VoID Description" ;
  rdfs:label "EuroVoc VoID Description" ;
  dcterms:description "a metadata description of the thesauri Eurovoc" ;
  foaf:homepage <http://eurovoc.europa.eu/> ;
  dcterms:creator <http://publications.europa.eu> ;
  dcterms:publisher <http://publications.europa.eu> .

_:nodelbqd6cle2x203 void:class <http://www.w3.org/2004/02/skos/core#Concept> ;
  void:entities 7154 .

_:nodelbqd6cle2x204 void:class <http://www.w3.org/2004/02/skos/core#Collection> ;
  void:entities 0 .

_:nodelbqd6cle2x205 void:class <http://www.w3.org/2004/02/skos/core#ConceptScheme> ;
  void:entities 130 .

<http://eurovoc.europa.eu/void#eurovoid_hu_lexicalization_set> dcterms:language <http://id.loc.gov/vocab
  a lime:LexicalizationSet ;
  lime:avgNumOfLexicalizations 2.406 ;
  lime:language "hu" ;
  lime:lexicalizationModel <http://www.w3.org/2008/05/skos-xl> ;
  lime:lexicalizations 17522 ;
  lime:percentage 0.999 ;
  lime:referenceDataset <http://eurovoc.europa.eu/void#eurovoid> ;
```

Integrated Constraint Validation (ICV)

R3. Data Interoperability and Consistency



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Desktop Tool and Collaborative Web Platform

- system offers a very lightweight installation (i.e. unzip and click-to-run)
- default configuration options for both system and project creation → simple and easy-to-use as a desktop tool.
- Other more complex settings are still possible, satisfying different needs for distributed installation (separation of data servers, UI servers), better performance, etc...

Conclusions

VB2 has been out for 3 years, seeing a community arise and gather around this open source project, providing feedback and ideas

VB3 starts exactly from the VB2 legacy:

- learned lessons
- observed limits
- gathered feedback

Key Achievement

- not the (though many) new features!
- it is the ultimate version of its core platform (Semantic Turkey) which, in our view, provides a solid foundation for the realization of a new range of services spacing from knowledge acquisition, evolution and management in the European and worldwide scenario

"That's all Folks!"

Contacts

VocBench site: http://vocbench.uniroma2.it/

VocBench pages@FAO: http://aims.fao.org/vest-registry/tools/vocbench

You can also follow VB by registering to:

- VocBench Mailing Lists:
  - User: http://groups.google.com/group/vocbench-user
  - Developer: http://groups.google.com/group/vocbench-developer
- Semantic Turkey Mailing Lists (only for backend related aspects) :
  - User: http://groups.google.com/group/semanticturkey-user
  - Developer: http://groups.google.com/group/semanticturkey-developer