Towards VocBench 3

Pushing Collaborative Development of Thesauri and Ontologies Further Beyond

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Outline

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

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).

SPARQL Editing with syntax completion and highlight

http://vocbench.uniroma2.it
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.

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

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

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'.

Manuel Fioresi
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 Andrew just made work so well.

Tiziano Lorenzetti
Research Assistant
University of Rome Tor Vergata, Italy

Semantic Turkey developer

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!

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

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

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.

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

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

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

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

<table>
<thead>
<tr>
<th>Name</th>
<th>License/Deploymnt</th>
<th>Data Models</th>
<th>Import/Export</th>
<th>Scheme Management</th>
<th>Custom Relations</th>
<th>Reasoner</th>
<th>Data quality</th>
<th>Extendibility/Interoperability</th>
<th>ACL</th>
<th>Workflow Management</th>
<th>Collaboratin, Content Validation</th>
<th>RDF Middleware</th>
<th>RDF Backend</th>
<th>SPARQL Querying</th>
<th>Semantic Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VocBench</strong></td>
<td>GNU GPL v3 (web application)</td>
<td>Free to use</td>
<td>Web application</td>
<td>SKOS-XL, SKOS through offline tool</td>
<td>SKOS(-XL), versatile spreadsheet import (through ST Firefox UI)</td>
<td>Yes</td>
<td>Creation, Import, use</td>
<td>Depends on triple store</td>
<td>Metrics</td>
<td>API, shared backend, pluggable</td>
<td>Yes</td>
<td>Yes</td>
<td>Change feed, validation</td>
<td>OWL ART API (connector to others: Sesame2 bundled)</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>PoolParty</strong></td>
<td>Proprietary</td>
<td>No</td>
<td>Web application</td>
<td>SKOS, SKOS-XL add-on</td>
<td>SKOS(-XL), static spreadsheet import</td>
<td>Only top concepts</td>
<td>Creation, Import, use</td>
<td>Depends on triple store</td>
<td>Metrics</td>
<td>Validation rules</td>
<td>Yes</td>
<td>Yes (add-on)</td>
<td>History, versioning, validation</td>
<td>Sesame SAIL API</td>
<td>provided by Sesame2</td>
</tr>
<tr>
<td><strong>WebProtégé</strong></td>
<td>Mozilla Public License (MPL)</td>
<td>Yes</td>
<td>Web application</td>
<td>OWL 2, OBO</td>
<td>OWL</td>
<td>Not applicable</td>
<td>Creation, Import, use</td>
<td>No, external reasoning possible</td>
<td>Metrics</td>
<td>API, shared backend, pluggable</td>
<td>Yes</td>
<td>No</td>
<td>Discussion, watching, changes feed</td>
<td>OWL API</td>
<td>provided by Protégé 3</td>
</tr>
<tr>
<td><strong>TemaTres</strong></td>
<td>Gnu General Public License version 2.0 (GPLv2)</td>
<td>Yes</td>
<td>Web application</td>
<td>Term based thesaurus organizatio n</td>
<td>MADS, SKOS-Core, Zthes, Others Import from: SKOS-Core, tabulated or tagged text file</td>
<td>One scheme per vocabulary</td>
<td>Creation, use</td>
<td>No</td>
<td>Metrics, Reports</td>
<td>API</td>
<td>Yes; limited</td>
<td>Yes; limited</td>
<td>Limited validation</td>
<td>No RDF Middleware, SKOS RDF/XML available only as an export</td>
<td>Relational database (MySQL by default)</td>
</tr>
<tr>
<td><strong>SKOSeD</strong></td>
<td>GNU Lesser GPL</td>
<td>Yes</td>
<td>Desktop application</td>
<td>SKOS</td>
<td>SKOS</td>
<td>Only top concepts</td>
<td>Creation, Import, use</td>
<td>Depends on available plugins</td>
<td>KB consistency</td>
<td>Pluggable</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>OWL API (used by Protégé 4)</td>
<td>provided by Protégé 4 (OWL API)</td>
</tr>
</tbody>
</table>

### Example 9 (non-entailment)

```
<A> skos:narrower <B> .
<A> skos:inScheme <MyScheme> .
does not entail
<B> skos:inScheme <MyScheme> .
```

---

**Notes:**
- **Web application** indicates a web-based application.
- **Proprietary** indicates a proprietary license.
- **Desktop application** indicates a desktop application.
- **SKOS-XL** refers to SKOS eXtended Language.
- **SKOS-Core** refers to SKOS Core.
- **Zthes** refers to a specific thesaurus.
- **OWL** refers to Ontology Web Language.
- **API** refers to Application Programming Interface.
- **RDF** refers to Resource Description Framework.
- ** sparql** refers to SPARQL (SPARQL Protocol and RDF Query Language).
- **Semantic Integration** refers to the capability of integrating and linking different semantic resources.
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

collected 11 anonymous responses

USE Values

<table>
<thead>
<tr>
<th>Usefulness</th>
<th>Ease of use</th>
<th>Ease of learning</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>5.34</td>
<td>4.49</td>
<td>5.11</td>
</tr>
<tr>
<td>Experienced</td>
<td>5.58</td>
<td>4.66</td>
<td>5.18</td>
</tr>
<tr>
<td>Inexperienced</td>
<td>4.97</td>
<td>4.19</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Feature Evaluation

<table>
<thead>
<tr>
<th>Feature</th>
<th>easy to use</th>
<th>effective</th>
<th>interesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>5.38</td>
<td>5.50</td>
<td>6.33</td>
</tr>
<tr>
<td>SPARQL Querying</td>
<td>4.00</td>
<td>5.40</td>
<td>6.29</td>
</tr>
<tr>
<td>Publication Workflow Management</td>
<td>5.50</td>
<td>5.63</td>
<td>6.22</td>
</tr>
<tr>
<td>Collaborative Management</td>
<td>5.75</td>
<td>5.88</td>
<td>6.11</td>
</tr>
<tr>
<td>Scheme Management</td>
<td>4.83</td>
<td>5.17</td>
<td>5.57</td>
</tr>
<tr>
<td>Role-based Access Control</td>
<td>5.33</td>
<td>5.22</td>
<td>5.40</td>
</tr>
<tr>
<td>Reasoning</td>
<td>4.29</td>
<td>4.43</td>
<td>5.38</td>
</tr>
<tr>
<td>Triple Store Connectivity</td>
<td>3.67</td>
<td>4.50</td>
<td>5.00</td>
</tr>
</tbody>
</table>
...and now...

TOWARDS VOCBENCH 3
The VocBench3 Team

The Developers

Armando Stellato
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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.

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Semantic Turkey developer

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!)

The Users

Funding sponsors

EU law and publications

The Developers

The Users

The Developers

The Users

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The Users
Requirements for VB2

R1. Multilingualism

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Requirements for VB3

R1. Multilingualism
R2. Controlled Collaboration
R3. Data Interoperability and Consistency
R4. Software Interoperability/Exchange
R5. Data Scalability
R6. Under-the-hood data access/modification
R7. Adaptive Context and Ease-of-use
R8. RDF Languages Support
R10. Full Editing Capability (RDF Observability & Reachability)
R11. Provenance
R12. Versioning Support
R13. Metadata Descriptions
R14. Customizable UI
R15. Everything’s RDF

05/07/2017

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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 incompatible with Sesame
- Recently rebaptized as RDF4J, under the Eclipse umbrella
- Maintaining a neutral middleware such as OWLART is no more cost-effective

Presentation (Angular)

Semantic Turkey
All BL including Collaboration (includes: Spring/AspectJ/OSGi)

Specific Triple Store Optimizations (e.g. Search)

RDF4J

Vendor Triple store
From Vocbench 2.0 Components...

Front end
- Google Web Toolkit (GWT)
- GWT Incubator
- Graph Visualization

Middleware
- Gilead
- Hibernate Layer
- Service Wrapper Layer
- Semantic Turkey/OWLART API
- Web services

Back end
- Administrative Database (MySQL)
- Triple Store
...to VB 3

Front end

Back end

Angular

Middleware

Possible Admin Data Serializations

Semantic Turkey

Angular

Angular

Data Serializations

File System

Relation DB

Triple Store

User Management

Project Management

Data and Metadata Management

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

05/07/2017

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A new UI
UI and Multilingualism (R1)

...we lost multilingual UI...will come back soon!

Language preferences

multilingual editing

...and visualization
UI and Multilingualism (R1)

Language preferences

- Greek
- English
- Finnish
- French
- Italian
- Japanese
- Portuguese
- Russian
- Spanish
- Swedish
- Chinese
- German
- Dutch
- Somali
- Romanian
- Croatian
- Hungarian
- Indonesian
- Arabic
- Persian
- Hebrew
A feature-structure based language\textsuperscript{1} for describing custom elements to be added to a form (and how to process them for «RDFing» them)

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/2016/05/ontolex/

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

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

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

R2. Controlled Collaboration!

Advanced History and Change Tracking mechanism
Advanced History and Change Tracking mechanism

Landscape analysis for realizing H&TC


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 triples
    • reified historied triples
• fine-grained representation complemented with rich metadata about invoked action and the context of the invocation
• change-tracking mechanism implemented as a sail for the RDF4J framework (http://rdf4j.org/).
• The sail is embedded with the system, but can also be deployed as a pluggable component inside other sail-compliant triple stores.

VB2 change-tracking mechanism:

• A strength and weakness of VB
• Appreciated by many users
• Does not scale to new services and functionalities
• Not synchronized with lower-level changes (e.g., loaded data, SPARQL)
• Stored in a separated database

R4. Software Interoperability/Extensibility
R5. Under-the-hood data access/modification
R6. Under-the-hood data access/modification
R11. Provenance
R15. Everything’s RDF
**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.

Actions: SKOSXL/addLabel

Parameters:

- Concept: http://eurovoc.europa.eu/5764
- Label: "Constituency"
Advanced History and Change Tracking mechanism

SKOSXL/addAltLabel parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>concept</td>
<td><a href="http://eurovoc.europa.eu/5754">http://eurovoc.europa.eu/5754</a></td>
</tr>
<tr>
<td>literal</td>
<td>&quot;controlled@it&quot;</td>
</tr>
<tr>
<td>mode</td>
<td>un</td>
</tr>
</tbody>
</table>

05/07/2017

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Advanced History and Change Tracking mechanism

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:

- Guest <concept-create> Proposed by guest
- Validator <validates> Validated
- Publisher <publishes> Published
- Ontology Editor <concept-delete> Proposed deprecated
- Term Editor <concept-edit> Revised
- Publisher <validates> Deprecated
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

Support for viewing multiple schemes
Improved and More Complete Support for SKOS

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

Default schemes are suggested by reusing those of the parent concept.

It is possible to quickly remove them or add new ones.
Improved and More Complete Support for SKOS

Support for Collections (Unordered and Ordered)
OWL Support

Class Tree, Instance List, OWL Editing Support

Support for Manchester expressions

R8. RDF Languages Support
OWL Support

«Inferred» View
SPARQL Querying and Update

Syntax

direct fetching from prefix.

Inspectable Results
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

Select aligned resource

Project: Tosco
Align with: Concept

Concept Scheme: http://www.uniroma2.it/stellato

- TEMPO LIBERO (it)
- TRASPORTI (it)
- UNIONE EUROPEA (it)
- UNITÀ DI MISURA (it)
- URBANISTICA E TERRITORIO (it)
- VITA SOCIALE (it)
  - COMMEMORAZIONI E CELEBRAZIONI (it)
  - FESTIVITÀ E SOLENNIZITÀ CIVILI (it)
- FOLKLORE (it)
- FUNERALI (it)
- NOMADI (it)
- QUALITÀ DELLA VITA (it)
Alignment Validation

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Declarative Service Implementation

Previous service implementation

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

```java
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);
    }
}
```

Separation of service method-controller / automatic generation of controller

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

High Level Characterization of the Services

- Service 1 controller
- Service 2 controller
- Service n controller
- Service 1 metadata producer
- Service 2 metadata producer
- Service n metadata producer

Metadata blob

AdministrationDB

RDF Data

Triple Store
Declarative Service Implementation

High Level Characterization of the Services

Authorization Analysis

Service Invocation Metadata

RDF Data

Reified RDF Data

Support RDF Repository

Core RDF Repository

service 1  service 2  ...  service n
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

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

<http://eurovoc.europa.eu/void> a void:DatasetDescription ;

<http://eurovoc.europa.eu/void#eurovoid> a void:Dataset ;
void:triples 2157673 ;
void:distinctSubjects 398288 ;
void:distinctObjects 826891 ;
dotterms:conformsTo <http://www.w3.org/2004/02/skos/core> ;
void:classPartition _modelo1bd6cd1e2x203 , _modelo1bd6cd1e2x204 , _modelo1bd6cd1e2x205 ;
void:entities 7284 ;
dotterms:title "EuroVoc VoID Description" ;
dotterms:description "A metadata description of the thesauri Eurovoc" ;
foaf:homepage <http://eurovoc.europa.eu/> ;
dotterms:creator <http://publications.europa.eu/> ;

a limes:LexicalizationSet ;
limes:avgNumOfLexicalizations 2.406 ;
limes:Language "hu" ;
limes:LexicalizationModel <http://www.w3.org/2005/skos-xl1> ;
limes:lexicalizations 17522 ;
limes:percentage 0.866 ;
```

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Integrated Constraint Validation (ICV)

R3. Data Interoperability and Consistency
• 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