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DISCLAIMER

SoBigData (654024) is a Research and Innovation Action (RIA) funded by the European Commission under the Horizon 2020 research and innovation programme.

SoBigData proposes to create the Social Mining & Big Data Ecosystem: a research infrastructure (RI) providing an integrated ecosystem for ethic-sensitive scientific discoveries and advanced applications of social data mining on the various dimensions of social life, as recorded by "big data". Building on several established national infrastructures, SoBigData will open up new research avenues in multiple research fields, including mathematics, ICT, and human, social and economic sciences, by enabling easy comparison, re-use and integration of state-of-the-art big social data, methods, and services, into new research.

This document contains information on SoBigData core activities, findings and outcomes and it may also contain contributions from distinguished experts who contribute as SoBigData Board members. Any reference to content in this document should clearly indicate the authors, source, organisation and publication date.

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GLOSSARY

ABBREVIATION	DEFINITION
VA	Virtual Access
VRE	Virtual Research Environment

TABLE OF CONTENT

DELIVERABLE SUMMARY

This deliverable reports the experiences of partners from different infrastructures at integrating their services, methods, and applications as SoBigData resources. The first section describes the general integration patterns, while the section section reports the experiences from the individual partners, revealing the *effort required*, in terms of time and technical complexity, and *earned benefits*.

EXECUTIVE SUMMARY

In order to achieve Virtual Access SoBigData partners must undertake a process of integration of their method resources in the e-infrastructure. This deliverable reports the experiences of partners from different infrastructures at integrating their services, methods, and applications as SoBigData resources. The first section describes the general integration patterns, while the section section reports the experiences from the individual partners, revealing the *effort required*, in terms of time and technical complexity, and *earned benefits*. This feedback will be used to further simplify the process of integration and mitigate complexity when this can be done.

1 RELEVANCE TO SOBIGDATA

In order to achieve Virtual Access SoBigData partners must undertake a process of integration of their method resources in the e-infrastructure. This document reports on the actual experience of scientists involved in this process, with the aim of highlighting the challenges and the benefits. This feedback will be used to further simplify the process of integration and mitigate complexity when this can be done.

2 INTRODUCTION

This deliverable reports the experiences of partners from different infrastructures at integrating their services, methods, and applications as SoBigData resources. The first section describes the general integration patterns, while the section section reports the experiences from the individual partners, revealing the *effort required*, in terms of time and technical complexity, and *earned benefits*.

3 INTEGRATION PATTERNS

3.1 APPLICATIONS

An application in the SoBigData infrastructure is a stand-alone system running on a remote server and offering one or more social mining methods via WebUIs; in some cases it may also offer social mining datasets.

A lightweight integration is achieved by explicitly registering/publishing application information on the SoBigData catalogue. Each application is described in the catalogue by a record enabling its discovery and including a URL to the web application.

A mild integration consists in integrating the WebUIs as a portlet in the SoBigData VREs, leaving the application running on the remote server, equipped with SmartGears (see Wiki page) to account access to methods from SoBigData users. To achieve a deeper integration, the action can include the integration of the application with the VRE workspace, allowing scientists to provide input to the application directly from the local workspace and expect the results of the application to be stored in the local workspace.

A full integration consists instead in:

- Reconsidering application's architecture in order to extrapolate the methods and the datasets;
- Make methods compliant with the guidelines of the hosting platform according to the methodology described in a dedicated Wiki page. This activity might require some modification / adaptation of the method implementation, e.g. for input parameters specification. The cost of this adaptation depends on the complexity of the method;
- A SoBigData: step-by-step procedure for algorithm integration (including a couple of Java simple classes) resulting from a concrete integration exercise is available;
- Publish the algorithm through the platform. In case the method is implemented with a R script, the platform is provided with a facility supporting this publishing phase;
- Transform the datasets in publishable assets and publish them as previously described;

Once "fully integrated", the application actually becomes a set of SoBigData social mining assets that will benefit from:

- **Scalability** Will benefit from a distributed and scalable computing platform;
- **Repurposing** Can be exploited in the context of many virtual research environments and it is suitable for being repurposed / applied to datasets;
- **Standard accessibility** Will be automatically made available via a web-based GUI as well as with web-based protocols (SOAP and Rest);
- **Accounting** Are monitored and assessed by SoBigData tools, e.g. detailed statistics on usage are transparently collected.

If "mildly integrated" the application will only benefit from **repurposing** and **accounting** benefits.

3.2 METHODS

A method in the SoBigData infrastructure is a piece of code in Java, Python or R that implements a social mining algorithm / procedure.

A lightweight integration can be achieved by explicitly registering/publishing method software information via the SoBigData infrastructure resource catalogue. Each method software is described in the catalogue by a record enabling its discovery and usage (documentation, download, examples) and including a URL to the software.

A full integration can be achieved by "wrapping" (implement the relative APIs) the method as a WPS method, compatible for execution by the general-purpose gCube-based data analytics engine. To this aim, scientists should:

- Make their method compliant with the guidelines of the hosting platform according to the methodology described in a dedicated Wiki page. This activity might require some modification / adaptation of the method implementation, e.g. for input parameters specification. The cost of this adaptation depends on the complexity of the method;
- A SoBigData: step-by-step procedure for algorithm integration (including a couple of Java simple classes) resulting from a concrete integration exercise is available;
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4 RESOURCE INTEGRATION USE-CASES

This section reports on the experiences of scientists, as described by the scientists themselves, in integrating their applications, methods, and services in the infrastructure, including those cases where the integration is ongoing. Experiences are organized by typology of resources to be integrated and each of them reports on the effort required/envisaged, in terms of time and technical skills required for the integration, describing the high-level procedure that was followed and the highlighting the gaps for feedback and further improvement.

4.1 APPLICATIONS INTEGRATION EXPERIENCES

4.1.1 TAGME (MARCO CORNOLTI, DEPARTMENT OF COMPUTER SCIENCE, UNIVERSITY OF PISA)

TagMe is an entity linking annotator, namely a software that, given a textual document, links mentions of entities found in the document towards a catalogue of entities drawn from a knowledge base. This has the important effect of building, on top of the document, a non-ambiguous representation of the topics mentioned by it, with impact on NLP applications such as information extraction, question answering, document topical clustering and categorization.

TagMe is implemented in Java (hence its execution requires a Java Virtual Machine) and its functionalities are offered as a web service for easy interoperability.

The integration in the D4Science infrastructure required the deployment of an ad-hoc virtual machine, running a SmartGears distribution. SmartGears came with range of additional services, including account registration, authentication and usage accounting with minimal effort. As a middleware to deploy the Tagme webapp, we employed the Tomcat web server, that had to be configured for the specific application in order to not let requests overload the server thereby rendering service unavailable. We also had to build a specific Tomcat Valve in order to have the TagMe webapp accept UTF8-encoded text as input, since the default charset did not cover the whole unicode space. We setup a web page presenting the service, the documentation, and an online demo of the service available to unauthenticated users. We took the occasion of the deployment of TagMe to rebuild its indexes according to the latest versions of Wikipedia, and fix a few minor bugs.

TagMe was previously available in a different deployment, and users had to be migrated to the new endpoint and authentication mechanism. We decided to migrate users in "waves", in order to progressively solve potential problems. The migration was concluded in September 2016, when the former deployment was shut down.

Deploying the service on a specific D4Science VRE had an important, unexpected advantage: the VRE message board became a forum for TagMe users and a mean of cooperation for research and problem solving, and an important channel of communication between users and TagMe administrators/developers. The deployment of a prototype of Tagme, with the only aim of testing, took two weeks and was ready for mid-May 2016. Until June, we fixed issues (often reported by users) with the web interface and the server configuration. The service was launched on mid-July, when the first wave of 1% of active users was migrated to the new platform, and the registration to the platform opened to the public. The service launch was finalized at the end of August, when all users were migrated to the new platform and the former service shut down. In total, the deployment of Tagme roughly took four months.

The TagMe VRE is accessible here.

4.1.2 SMAPH (MARCO CORNOLTI, DEPARTMENT OF COMPUTER SCIENCE, UNIVERSITY OF PISA)

SMAPH (paper) is an entity linking annotator built specifically for queries, a very peculiar type of textual documents, since they usually provide limited context, no grammaticality, and feature typos. SMAPH is the state of the art for entity linking in queries, and obtained the highest score in the ERD Challenge 2014. It is built on top of search engines (currently Google Search), and uses their output to annotate a query. It also makes use of statistical machine learning to make its decisions. Its impact on queries is similar to the one TagMe has on longer text, in that the semantic layer it builds on top of queries makes it possible to go deeper (with respect to syntactic text analysis) into the user need behind a query.

From the architectural point of view, Smaph is similar to TagMe in certain aspects: it is a Java software available through a web service. Similarly to TagMe, it has been deployed on an ad-hoc virtual machine running a SmartGears distribution. The main difference with respect to TagMe is that it needs access to the Google Custom Search API, hence users have to provide a Google authentication token to SMAPH when issuing a disambiguation request.

The deployment of the SMAPH web service was easier than that of TagMe, because no users had to be migrated, since this was the first time is was deployed. The deployment process started in mid-November and the service was released in mid-December, hence it took one month.

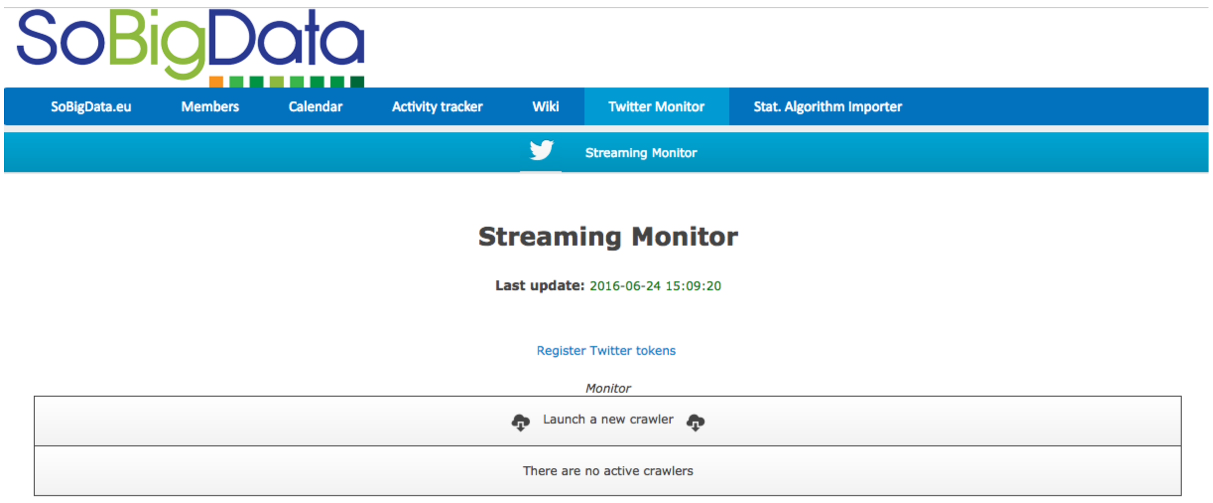
The SMAPH VRE is accessible here.

4.1.3 TWITTER MONITOR (STEFANO CRESCI AND SALVATORE MINUTOLI, IIT-CNR)

The Twitter Monitor is an interactive Web application designed to access and to collect data from the Twitter stream, by exploiting the public Twitter Streaming APIs. The application is able to manage concurrent monitors: it is possible to launch parallel listening sessions (i.e., more than one Twitter crawler at the same time) using different parameters and collecting different sets of data. In addition to offering an interactive Web interface in order to ease all the operations related to Twitter crawling, the Twitter Monitor also offers a set of functionalities aimed at minimizing the loss of data due to network or local machine problems. The Twitter Monitor is automatically capable of detecting and recovering from simple error situations, such as a closed or disconnected Twitter stream. It is also capable of detecting more serious issues, such as Twitter refusing to open new streaming connections, and automatically sends targeted alerts to system administrators.

The integration activities related to the Twitter Monitor have been twofold. On the one hand, we decided to take a course of action so as to provide a first, loosely-integrated, version of the Twitter Monitor as fast as possible. On the other hand, we also immediately started a deeper, yet longer, integration procedure.

The fast lightweight integration allowed us to register the Twitter Monitor service in the SoBigData catalogue[1] and to include a navigation tab inside the SoBigData VRE pointing to an iframe that contains the first version of the SoBigData Twitter Monitor[2]. The SoBigData Twitter Monitor rendered inside the iframe is a slightly modified instance of the standalone monolithic Twitter Monitor that has been developed by IIT-CNR. It is a single PHP application that runs on an IIT-CNR virtual machine. Given this lightweight integration, the Twitter monitor is able to provide its services to the SoBigData users, but it cannot scale to serve a large amount of requests. The implementation effort required to modify the original Twitter Monitor so that it could be used from inside the SoBigData VRE was about 2 weeks of work. The result of this integration is visible in Figure 1 and Figure 2 and has been extensively described in Deliverable D8.2 Crowdsensing Platform.



Streaming Monitor

Last update: 2016-06-24 15:09:20

Register Twitter tokens

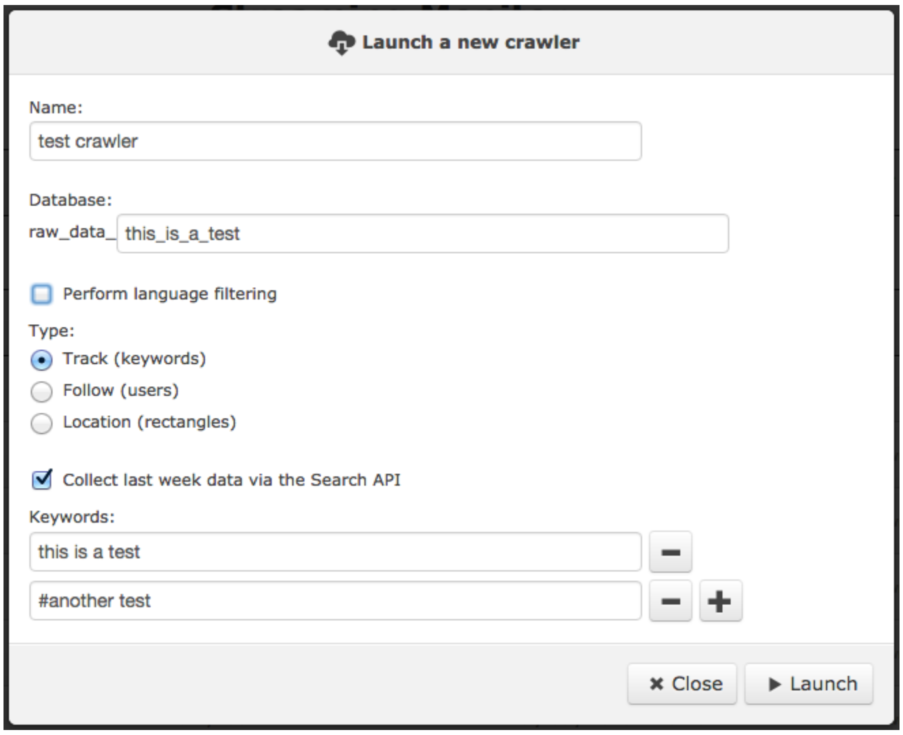
Monitor

Launch a new crawler

There are no active crawlers

Figure 1: Twitter Monitor application rendered inside a dedicated navigation tab from the SoBigData VRE.

[1] https://sobigdata.d4science.org/group/resourcecatalogue/data-catalogue
[2] https://sobigdata.d4science.org/group/sobigdata.eu/twitter-monitor


Launch a new crawler

Name: test crawler

Database: raw_data_ this_is_a_test

☐ Perform language filtering

Type:
[✓ Track (keywords)]
Follow (users)
Location (rectangles)

☑ Collect last week data via the Search API

Keywords:
this is a test
#another test

Figure 2: Twitter Monitor dialog window to allow parameter configuration of a new crawler.

While completing the lightweight integration, we also started the design and implementation of the full integration. At first, we had to reengineer and refactor the original monolithic Twitter Monitor application. Specifically, we split the whole application into 3 distinct logical modules, so as to allow a dynamic and scalable deployment of needed modules to the SoBigData eInfrastructure nodes. Then, we had to reimplement in Java the functionalities of the original PHP modules.

The new, fully-integrated, TwitterMonitor is composed of three modules: the Scheduler, the Cron and the Crawler. These modules were originally implemented in PHP. In order to integrate their functionalities inside the SoBigData infrastructure the Scheduler and the Cron have been replaced by equivalent Java modules. For the Crawler, due to its higher complexity, we decided to implement a *SmartExecutor* plugin that wraps the original PHP module by running it as a process. The Scheduler provides a GUI to let the user specify some input parameters needed to filter the Twitter events to gather. It has been implemented as a *StandardLocalExternalAlgorithm* subclass. The Cron runs at fixed intervals without user interaction and has been implemented as a *SmartExecutor* plugin. The Crawler is run/stopped by the Cron and has been implemented as a *SmartExecutor* plugin. The modules interact with each other by means of a database that contains the list of tasks to run and their status. As a first step, we decided to setup a *SmartGears* node to host the *SmartExecutor* plugins: this helped managing the plugin deploying more easily, without involving other system administrators. In the same virtual machine hosting the *SmartGears* node we deployed the postgres database, needed by the plugins, and registered it within the SoBigData infrastructure. The *SmartGears* installation simply required running a setup script. Then after few configuration steps it was ready to run. We also installed the *SmartExecutor* service to make the plugins accessible within the eInfrastructure. We implemented the modules by using some templates available in the documentation. Some support from developers helped us in speeding up the implementation.

The implementation of modules required a review of the functionalities of the infrastructure and, in particular, its interaction with the modules (i.e. the plugins). The main concerns were about discovering the reference for the database, interacting with the user, storing data in the user workspace, finding and running other plugins. During this activity, the D4Science developer team supported us by providing code snippets and quick links to the proper documentation.

4.1.4 VISUALIZATION APPS (THORSTEN MAY, IGD-FRAUNHOFER)

The application to be integrated in SoBigData is providing methods for registration and on-demand delivery of visualization code for the purpose of embedding user created content into external HTML5 applications. The idea is to integrate it in the SoBigData infrastructure a visualization test bed, which allows registered users to apply their own data to provided visualizations with the intended purpose to share their results with the public. See Figure 3 for an example.

The starting point is a web application composed by a Java based portal service and two backend services implemented in JavaScript. These services are part of the visualization service platform with the goal to aid users to select and build interactive web visualizations

- with their own data
- without the need of actual programming
- with the ability to use these visualizations in their own visualizations.

With the SoBigData WP10 Integration, the visualization service platform becomes part of the SoBigData-Infrastructure. With the CNR-team we discussed three different levels of integration, distinguishing, for example, where the services are hosted, or how the user authentication is served.

We opted for a mild integration level, where we deploy a SmartGears hosting node containing an application that functions as a proxy to our internal services. This way, we intend to wrap calls to our internal SmartGears-unaware service APIs with authentication and accounting methods provided by the SoBigData research infrastructure.

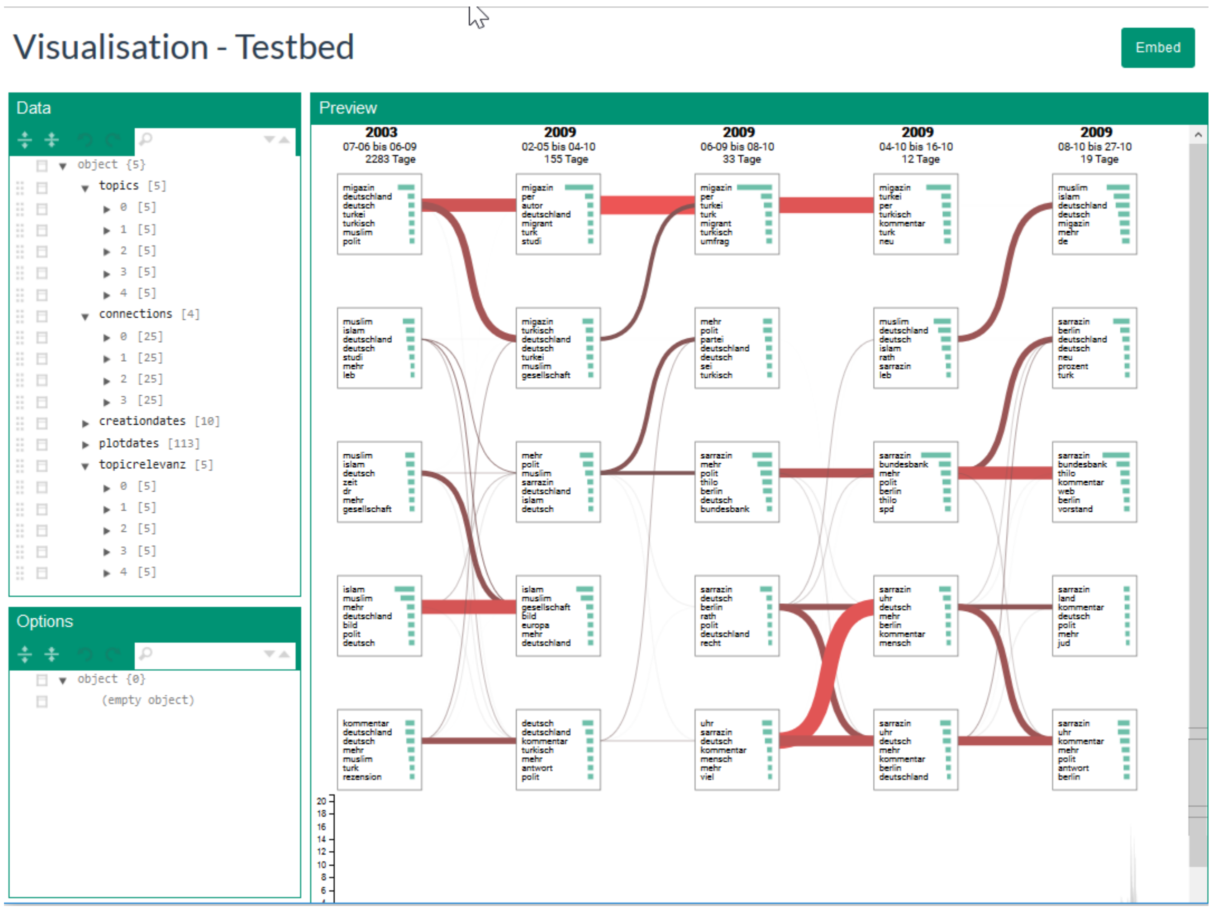


Figure 3: the current testbed contains a visualization demo, which is attached to an input data set. A user may interact with both the visualization and its input, to get an impression of what the visualization does and how it is used.

Our integration **efforts so far** were as follows:

- Setup of a SmartGears hosting node on our premises using the provided security tokens. By following the manual in the gCube-Wiki this process was straightforward and involved mostly scripting for our internal deployment platform.
- Evaluation of the SmartGears framework on how to implement our service. The documentation in the gCube-Wiki lacks some details on the admittedly special case, of integrating an interactive visualization service. This initial hurdle was resolved by a short face-to-face inquiry, after we were provided with a sample Java web-application, that implements a simple JAX-RS based REST endpoint using the functionality from the Smartgears framework.

Our **current work** are the integration basis by implementing a proxy service that routes requests with valid D4Science credentials to our services (and ignoring/returning all others). The main effort as of now is the mapping of our internal technology stack to the Jersey based Smartgears framework.

From there, **we plan** to evaluate and implement the following:

- Incorporating D4Science user profiles as users into our system. We especially look forward for OAuth2 support in gCube, since our application already uses this authentication standard.
- Actually show a Visualization as a UI-element in the D4Service portal.
- Extending our service with the function to load/receive data from the VRE in order to visualize the results of an analysis conducted with methods provided by the VRE.

4.2 METHODS INTEGRATION EXPERIENCES

4.2.1 TRAJECTORYBUILDER (ROBERTO TRASARTI, ISTI-CNR)

Trajectory Builder (https://ckan-sobigdata.d4science.org/dataset/trajectory_builder) is a basic algorithm of the M-Atlas package (http://m-atlas.eu/). It is implemented in Java and interact with a Postgres database (with Postgis extension for spatial primitives) in order to build a trajectory from raw spatio-temporal observations, i.e. points in space and time represented by a triple <latitude, longitude, timestamp>. Hence the dependencies of this algorithm are: the M-Atlas cose (matlas.jar) and the connector drivers for postgresql (postgresql-8.4-701.jdbc4.jar).

In order to be integrated a launcher class is implemented as a subclass of StandardLocalExternalAlgorithm (https://sobigdata.d4science.org/group/sobigdatalab/importer-documentation) . The Main problem during the integration was the configuration of the project into Maven for a deploy inside the SoBigData platform due the dependencies listed above. Thanks to the platform administrator help the problems were solved and the deploy was done. The time passed from the beginning of the integration and the publish of the algorithm in the VRE Lab is 1 month, but the actual work in implementing the tool was only few hours, the rest of the time was spent interacting (1-2 times each week) with the platform administrators and developers in order to find the right solution for the integration and how to put the dependencies in it. The difficulties of the process of integration with the SoBigData platform engine are:

- The documentation is so wide that is difficult to understand what to do and why.
- It is required know tools such as Maven and how to configure it to be compliant with the platform.
- The interaction with the platform developer sometimes was difficult trought the ticketing system, face to face meeting were fundamental to solve the problems.

Anyway several of the problems solved during this first integration will help to be more independent in the integration of next algorithm.

4.2.2 QUICKRANK (CRISTINA MUNTEAN, ISTI-CNR)

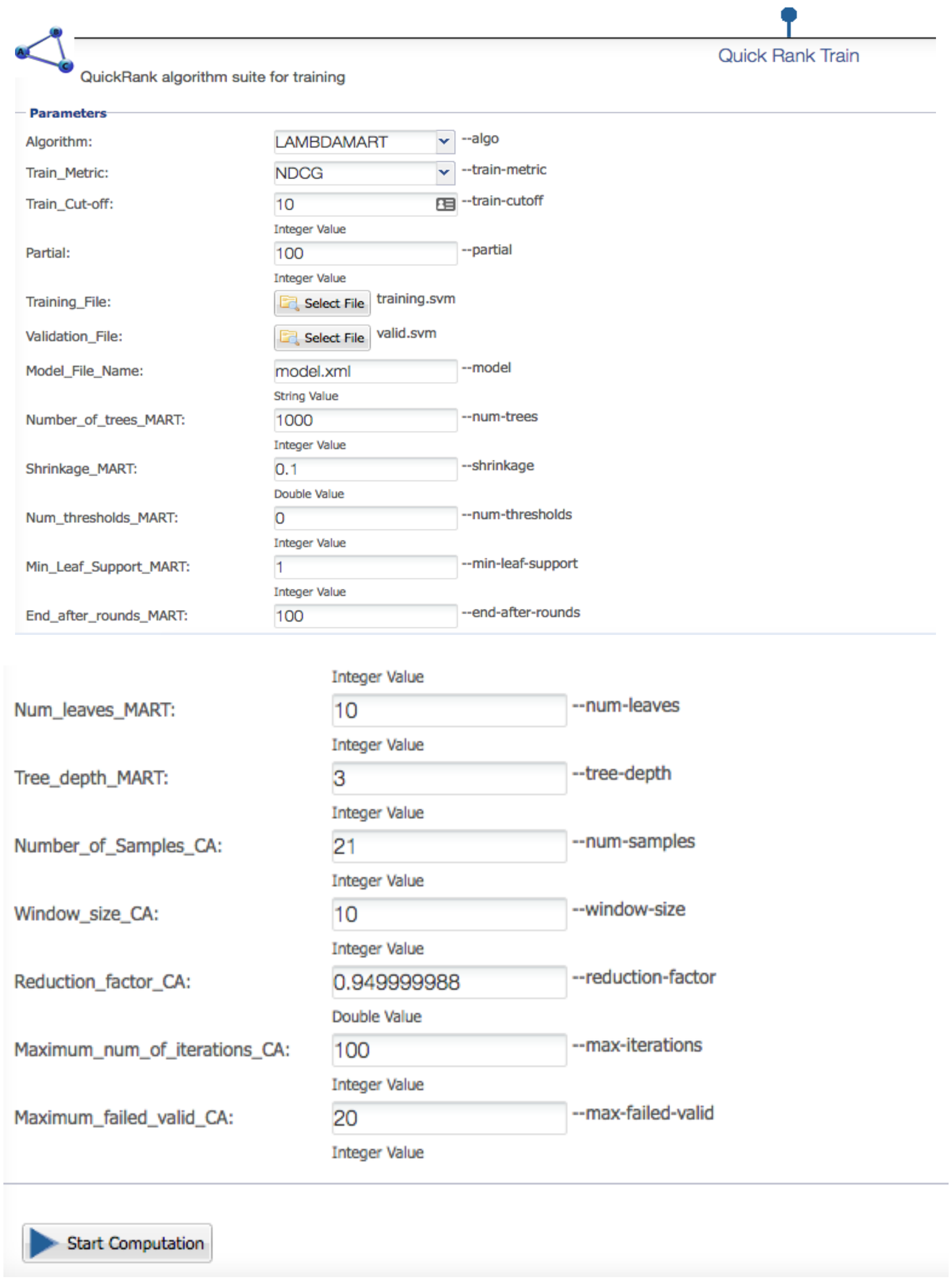
QuickRank[3] is an efficient Learning-to-Rank toolkit providing several C++ implementation of LtR algorithms. The LtR algorithms currently implemented are: GBRT, LamdaMART, Oblivious GBRT / LamdaMART, CoordinateAscent, LineSearch, RankBoost.

We made QuickRank available to SoBigData by integrating it in the SoBigData Lab VRE as a WPS method executable from VRE Method Engine[4]. The information about the integrated tool can be found in the SoBigData Catalogue at the following link: https://ckan-sobigdata.d4science.org/dataset/quickrank .

QuickRank users can train and test models with the help of a Command Line Interface (CLI). In order to integrate our tool in the SoBigData VRE we had to create a WPS wrapper around it, allowing the user to interact with it in a more user-friendly way, through the help of an User Interface (UI). He/she can insert the files and options as he invokes the training or testing capabilities on the existing LtR algorithms as he would do with a CLI. Figure 4 and Figure 5 show the interface for the training and test tools/interfaces created.

[3] http://quickrank.isti.cnr.it/

[4] https://services.d4science.org/group/sobigdatalab/method-engine



Quick Rank Train

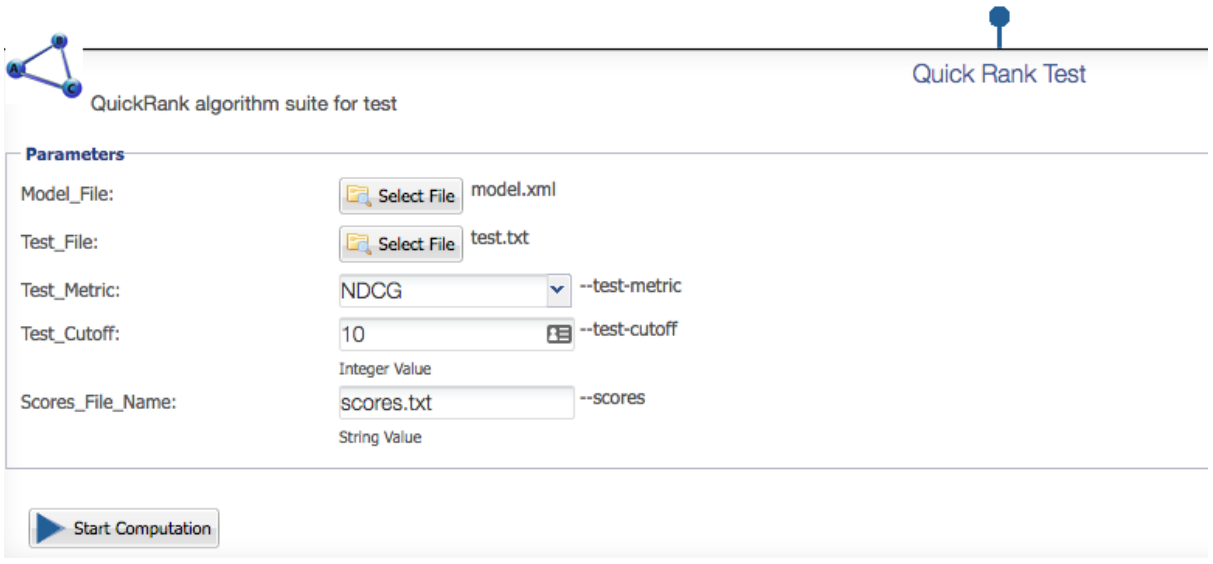
QuickRank algorithm suite for training

Parameters

Algorithm:	LAMBDAMART	--algo	
Train_Metric:	NDCG	--train-metric	
Train_Cut-off:	10	--train-cutoff	Integer Value
Partial:	100	--partial	Integer Value
Training_File:	Select File	training.svm	
Validation_File:	Select File	valid.svm	
Model_File_Name:	model.xml	--model	String Value
Number_of_trees_MART:	1000	--num-trees	Integer Value
Shrinkage_MART:	0.1	--shrinkage	Double Value
Num_thresholds_MART:	0	--num-thresholds	Integer Value
Min_Leaf_Support_MART:	1	--min-leaf-support	Integer Value
End_after_rounds_MART:	100	--end-after-rounds	Integer Value
Num_leaves_MART:	10	--num-leaves	Integer Value
Tree_depth_MART:	3	--tree-depth	Integer Value
Number_of_Samples_CA:	21	--num-samples	Integer Value
Window_size_CA:	10	--window-size	Integer Value
Reduction_factor_CA:	0.949999988	--reduction-factor	Double Value
Maximum_num_of_iterations_CA:	100	--max-iterations	Integer Value
Maximum_failed_valid_CA:	20	--max-failed-valid	Integer Value

Start Computation

Figure 4: QuickTest training user interface.



Model_File:	model.xml	
Test_File:	test.txt	
Test_Metric:	NDCG	--test-metric
Test_Cutoff:	10 (Integer Value)	--test-cutoff
Scores_File_Name:	scores.txt (String Value)	--scores

Figure 5: QuickRank test user interface.

The QuickRank WPS interfaces were implemented in Java, by extending the *StandardLocalExternalAlgorithm*[5] class, put at our disposal by the team responsible with the integration. In order for the QuickRank wrapper to work, several libraries needed to be installed on the VRE servers. QuickRank needs gcc 4.9 (or above), CMake 2.8 (or above) and git. The implementation effort required to create a wrapper around a C++ executable, with the help of the *Process Builder* class , which allows us to run the QuickRank executable from the Java class, while also passing all the necessary parameters as provided in input by the user in the UI.

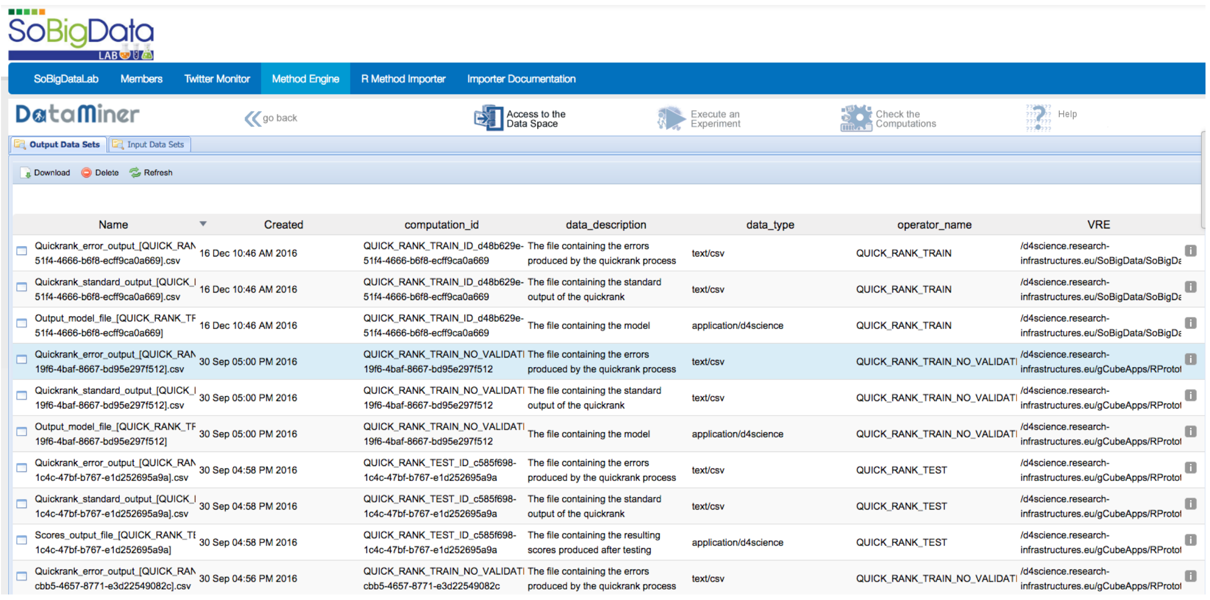
The whole integration effort lasted several months. The task was started on the 15th of February 2016, and was the first tool to be integrated in the SoBigData VRE. Initially, we developed a test wrapper on the development servers, this phase ending on the 22nd of March. Later, on the 16th of August, the second phase started, when the actual wrappers were inserted and deployed into the production environment in the SoBigData VRE. The integration effort ended onl the 30th of September.

We integrated the two main modes (3 wrappers in total) in which QuickRank can be used:

- Training with validation set
- Training without validation set
- Test

The results/outputs of the QR computation can be seen in the Output Datasets section (Figure 6)

[5] As described in: https://wiki.gcube-system.org/gcube/How-to_Implement_Algorithms_for_the_Statistical_Manager



Name	Created	computation_id	data_description	data_type	operator_name	VRE
Quickrank_error_output_[QUICK_RAN 51f4-4666-b6f8-ecff9ca0a669].csv	16 Dec 10:46 AM 2016	QUICK_RANK_TRAIN_ID_d48b629e-51f4-4666-b6f8-ecff9ca0a669	The file containing the errors produced by the quickrank process	text/csv	QUICK_RANK_TRAIN	/d4science.research-infrastructures.eu/SoBigData/SoBigDa
Quickrank_standard_output_[QUICK_I 51f4-4666-b6f8-ecff9ca0a669].csv	16 Dec 10:46 AM 2016	QUICK_RANK_TRAIN_ID_d48b629e-51f4-4666-b6f8-ecff9ca0a669	The file containing the standard output of the quickrank	text/csv	QUICK_RANK_TRAIN	/d4science.research-infrastructures.eu/SoBigData/SoBigDa
Output_model_file_[QUICK_RANK_TF 51f4-4666-b6f8-ecff9ca0a669]	16 Dec 10:46 AM 2016	QUICK_RANK_TRAIN_ID_d48b629e-51f4-4666-b6f8-ecff9ca0a669	The file containing the model	application/d4science	QUICK_RANK_TRAIN	/d4science.research-infrastructures.eu/SoBigData/SoBigDa
Quickrank_error_output_[QUICK_RAN 19f6-4baf-8667-bd95e297f512].csv	30 Sep 05:00 PM 2016	QUICK_RANK_TRAIN_NO_VALIDATI 19f6-4baf-8667-bd95e297f512	The file containing the errors produced by the quickrank process	text/csv	QUICK_RANK_TRAIN_NO_VALIDATI	/d4science.research-infrastructures.eu/gCubeApps/RProtot
Quickrank_standard_output_[QUICK_I 19f6-4baf-8667-bd95e297f512].csv	30 Sep 05:00 PM 2016	QUICK_RANK_TRAIN_NO_VALIDATI 19f6-4baf-8667-bd95e297f512	The file containing the standard output of the quickrank	text/csv	QUICK_RANK_TRAIN_NO_VALIDATI	/d4science.research-infrastructures.eu/gCubeApps/RProtot
Output_model_file_[QUICK_RANK_TF 19f6-4baf-8667-bd95e297f512]	30 Sep 05:00 PM 2016	QUICK_RANK_TRAIN_NO_VALIDATI 19f6-4baf-8667-bd95e297f512	The file containing the model	application/d4science	QUICK_RANK_TRAIN_NO_VALIDATI	/d4science.research-infrastructures.eu/gCubeApps/RProtot
Quickrank_error_output_[QUICK_RAN 1c4c-47bf-b767-e1d252695a9a].csv	30 Sep 04:58 PM 2016	QUICK_RANK_TEST_ID_c585f698-1c4c-47bf-b767-e1d252695a9a	The file containing the errors produced by the quickrank process	text/csv	QUICK_RANK_TEST	/d4science.research-infrastructures.eu/gCubeApps/RProtot
Quickrank_standard_output_[QUICK_I 1c4c-47bf-b767-e1d252695a9a].csv	30 Sep 04:58 PM 2016	QUICK_RANK_TEST_ID_c585f698-1c4c-47bf-b767-e1d252695a9a	The file containing the standard output of the quickrank	text/csv	QUICK_RANK_TEST	/d4science.research-infrastructures.eu/gCubeApps/RProtot
Scores_output_file_[QUICK_RANK_TI 1c4c-47bf-b767-e1d252695a9a]	30 Sep 04:58 PM 2016	QUICK_RANK_TEST_ID_c585f698-1c4c-47bf-b767-e1d252695a9a	The file containing the resulting scores produced after testing	application/d4science	QUICK_RANK_TEST	/d4science.research-infrastructures.eu/gCubeApps/RProtot
Quickrank_error_output_[QUICK_RAN cbb5-4657-8771-e3d22549082c].csv	30 Sep 04:56 PM 2016	QUICK_RANK_TRAIN_NO_VALIDATI cbb5-4657-8771-e3d22549082c	The file containing the errors produced by the quickrank process	text/csv	QUICK_RANK_TRAIN_NO_VALIDATI	/d4science.research-infrastructures.eu/gCubeApps/RProtot

Figure 6: QuickRank Output file.

The easiest part was writing the wrapper in Java, namely extending the *StandardLocalExternalAlgorithm* class. With the help of the integration team we were able to overcome some of the issues (e.g. identify the proper data types in the gCube wiki) create the proper interfaces, fix all the problematic issues and deploy the project locally. In order to be put in production QuickRank need to have the dependencies installed and the source compiled. For this we opened a ticket, which took around 2 weeks to be resolved. Soon after that we succeeded in finalizing the integration and test the algorithms also on the production server.

4.2.3 GATECLOUD (KALINA BONTCHEVA, UNIVERSITY OF SHEFFIELD)

SoBigData users will access the GATE Cloud service indirectly through the D4Science platform. GATE Cloud is today deployed at Sheffield and exposes calls to methods as REST services. Such methods will be integrated as WPS method calls from the e-infrastructure environments. More specifically, SoBigData will mediate end-user requests (invocations of a service) to GATE Cloud by using a special API key, which will bypass the accounting inherent in GATE Cloud and use that provided by the VRE uniformly instead.

Around 23 methods available as GateCloud REST services will be exposed through the SoBigData VRE, each with their own endpoint. The API for each will be identical, accepting as input documents in XML, JSON, plain text or HTML format, producing output as JSON, HTML, XML.

These methods will be listed in VRE catalogue and be made accessible via a Method Engine application. Eventually, the VRE catalogue and the GATE Cloud catalogue will be synchronised, so that VRE users can discover methods from GATE Cloud directly. This will be supported by the HTTP API currently part of the GATE Cloud service. These services may be grouped into a single Data Miner instance for ease of discovery.

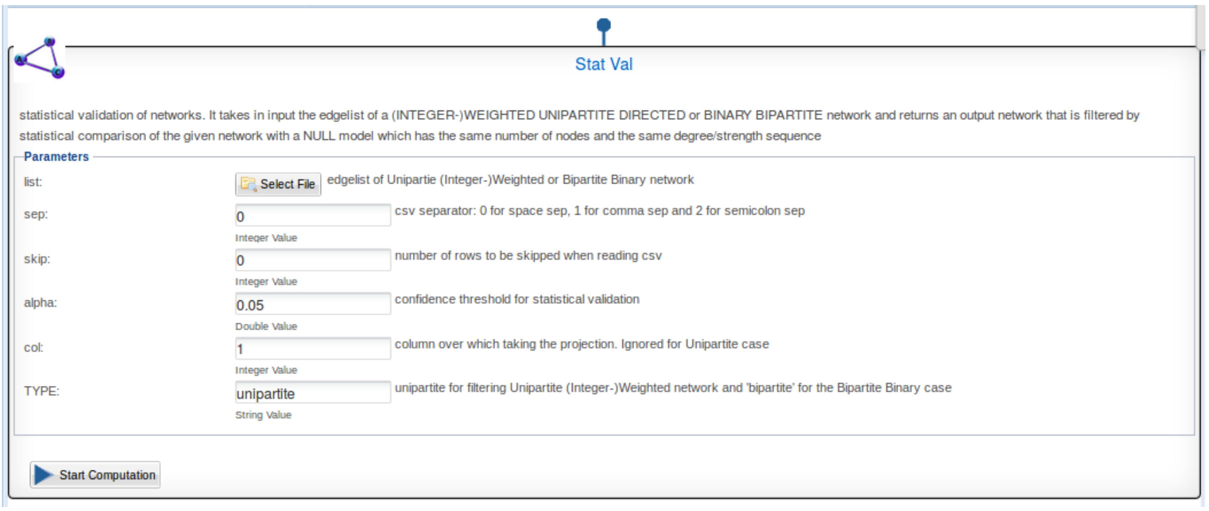
In the long term, GATE Cloud will be adapted for deployment on the SoBigData hardware premises, allowing cost-free access to GATE Cloud services by researchers within the scope of VREs.

4.2.4 STATVAL (DANIELE REGOLI, SNS)

StatVal is an algorithm performing a statistical validation filter for complex networks.

The purpose of StatVal is taking a (possibly large and dense) complex network and find the links that are not explainable by simple random wiring of the nodes given the degree/strength of nodes (namely, given how many links each node has attached). The result is a new network with only the links that are unexpected with respect to the said random model. Thus, you come up with an output network much sparser than the original, that can be considered a statistically sound representation of the network backbone structure.

StatVal is essentialy a collection of R scripts. The integration has been performed through the *Statistical Algorithm Importer* (SAI) available in the D4Science platform, which supports tools for the easy integration of R script methods inside a VRE. StatVal is now available for use in the *SoBigDataLab* environment via a Method Engine application (see Figure 7). You can find it on the resource catalogue.



statistical validation of networks. It takes in input the edgelist of a (INTEGER-)WEIGHTED UNIPARTITE DIRECTED or BINARY BIPARTITE network and returns an output network that is filtered by statistical comparison of the given network with a NULL model which has the same number of nodes and the same degree/strength sequence

Parameters

list:	Select File	edgelist of Unipartie (Integer-)Weighted or Bipartite Binary network
sep:	0 Integer Value	csv separator: 0 for space sep, 1 for comma sep and 2 for semicolon sep
skip:	0 Integer Value	number of rows to be skipped when reading csv
alpha:	0.05 Double Value	confidence threshold for statistical validation
col:	1 Integer Value	column over which taking the projection. Ignored for Unipartite case
TYPE:	unipartite String Value	unipartite for filtering Unipartite (Integer-)Weighted network and 'bipartite' for the Bipartite Binary case

Figure 7: web interface of the StatVal method.

The user has simply to load a network in the form of a csv edgelist and tune some parameters either related to the input network or to the confidence level of the statistical tests and run the method. Output is a compressed archive containing edgelists of (different) filtered networks.

Usage of SAI for R scripts integration is quite straightforward. First we needed to create a project folder, then we simply had to load in the folder the necessary R scripts. A main R script, which is going to manage the workflow of the algorithm, is to be given to the SAI. Finally, we declared the inputs and outputs of the algorithm and what R packages the algorithm requires.

Some more effort was needed in the testing part, namely when checking whether the method was working properly, and in the maintenance, namely in doing changes and modifications to the algorithms, mainly due to some misunderstandings and some problems in using test data stored inside the same folder of the software project. But with the help of D4Science administrators all problems were solved.

Total effort, counting both the first integration and successive modifications, was roughly around a week full time.