FIRST YEAR PROGRESS REPORT

EU FET OPEN PROJECT FOC

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Deliverable D3.1

"Report on Activity in WP3 - Network Visualization and Systemic Risk Forecast"

WP Leader : Stefano Battiston

WP Objectives and Progress Overview

The objective of WP3 is to provide an interactive and collaborative platform that enables users to monitor global financial networks, and to elaborate a forecast of systemic crises. In particular, we want to develop a measurement platform in which it is possible to : (a) load and share financial data about financial institutions and their relations, credit market indicators, and country level economic indicators; (b) produce topical maps of financial networks, (c) detect the propagation of financial distress (d) perform simulations, scenario analysis, and systemic risk estimation.

As foreseen in the plan, the first year activity in WP3 has been devoted to Task 3.1 (Collaborative Platform) and T3.2 (Visualize/Analyze Financial Indicators).
In both Tasks we have achieved the objectives, as described in detail below. We have also started working on T3.3 (Visualization of Financial Networks), although this Task is planned for the second year.

Task 3.1 Collaborative Platform (Planned duration Month 1-24)
The first objective of the development of the collaborative platform by month 12 is to have a working prototype of a platform that enable users to load and share data about financial institutions and their relations, as well as credit market indicators and country level economic indicators.

To this end, we have implemented an infrastructure based on a combination of technologies: the Python Web Frameworks (TurboGears, Pylons) for the web development and the Database Mappers (SqlAlchemy) for representing the data as Objects to expose them on the web. The CMS actually in use for the FOC website is Joomla (http://www.joomla.org) and it allows to share documents and to permit to the groups to interact as well as to publish new papers and related materials.

We have chosen these technologies in order to provide a modern set of tools for scientific computing (Python has a rich set of libraries for science) but also to be easy to maintain and to extend. The Joomla CMS has a vast community and it is easy to modify and expand. With these choices (language and components) the programmers can add functionalities working the new

parts as *independent* components that after can be added to the platform. In the case of Joomla the new component are called modules.

Furthermore the Python's WSGI (web server gateway interface) and the Pylons framework make easy to expose internal services to the rest of the world. It is possible to communicate and to interact with other platforms via web services protocols. In our case the web services are created with REST paradigm and we use the the JSON file format as a solution to exchange data other systems as well with the other parts of the platform.

At the moment the FOC platform is able to expose the content of several databases containing network data and time series and other materials (links, images, pages). The pages and the links can be added by the users while, for the moment, the databases need to be sent to the administrators that add them to the system. In alternative they need to be accessible via standard socket internet connections.

Once the databases are linked to the application an inner component (called Data Explorer) explores the database tables and schemes creating an interactive description of the data (for example it gives back the names and the sizes of all the candidate time series inside the pool of data) and it allows to publish links and interactive plots (realized using Javascript libraries and Java applets).

We plan also to connect a map server to the system in order to show the geographical data that for the moment are in the form of simple pictures (videos) representing financial indicators in the geography.

T.3.1.1 Description of the infrastructure

The FOC platform consists of several independent components connected by web services:

a) a **CMS** or Editing system. This is an ordinary CMS (content management system) for publishing the materials of FOC. It allows to the groups in the project to post and to share the produced contents. A more advanced functionality will be developed as an internal search engine for documents. It will be built on concepts derived from the social networks science (in this case the network of the FOC users) that can give a new classification of the documents based on communities and recommendation systems. We call this future system a Social Network Intelligence CMS.

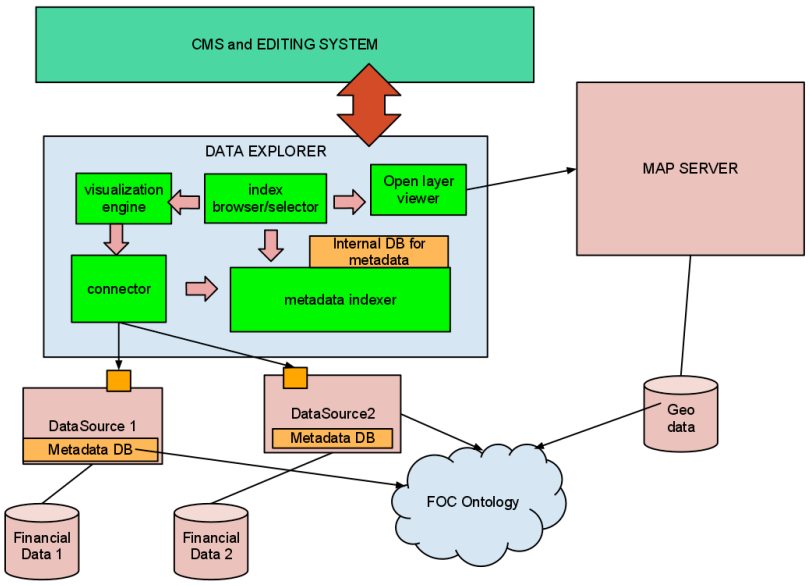
b) a **Data Explorer**. This component is based on a database mapper, that is a system able to explore databases and to map them into Objects (in the sense of OO programming). The Data Explorer performs all the necessary operations to convert the datasets of the db (time series of financial data and networks for instance) into JSON web services that can be exposed to several systems for the visualization (like Javascript tools or External Java applets).

c) a **Map Server**. This component is a standard and simple system to display geographical data about finance and economy. It is linked to the databases provided by the users with a stacked visualization technique: each layer representing an indicator.

d) an internal **document-oriented database** containing the descriptions of each datasets realized by the users. Using these data (or more precisely these metadata) it is possible to build a semantic

query engine, that is a search engine able to get relationships between different datasets (i.e. finding two databases sharing the same indicators and using them for making a new plot)

e) a set of **connectors**. These are simple web services exposing remote data to the FOC platform. They will be created and maintained by the Oxford FOC node.



In this picture a schema of the FOC platform

Illustration 1: FOC platform schema

The following picture represents the initial page where the administrators insert the link to a datasource (DSN data source name) and they choose a description for the datasource. Each datasource, as shown in the platform schema, is an external database attached to the platform via an OO connector.

Illustration 2: Adding a new Datasource to the FOC platform

A short note on the main web site of the FOC project (www.focprject.net). This site is realized using the Joomla CMS (www.joomla.org) that is a powerful platform for the content management. A Joomla module is a software component dedicated to a specific task like, for instance, the elaboration of a feed from the a market news feeder, or from the twitter platform.
The web site contents are then divided in sections dedicated to several tasks: administrative issues, announcements, people and institutions involved in the project, publications list, papers and materials to download.

T3.2 Visualize/Analyse Financial Indicators (Planned duration Month 1-24)
The objective of the second task is to provide, even if at a preliminary development version, the ability to the users to visualize time series and graphs of financial indicators.

We have implemented an infrastructure for visualizing data based on two technologies:

a) Javascript libraries (like theJit that is a library similar to the ones used by Google Analytics to print interactive plots on the web pages like in Google Trends for instance)

b) Java applets (derived from an OpenSource network visualization project of the ETH)

A set of screenshots showing the preliminary work on these tools is the following

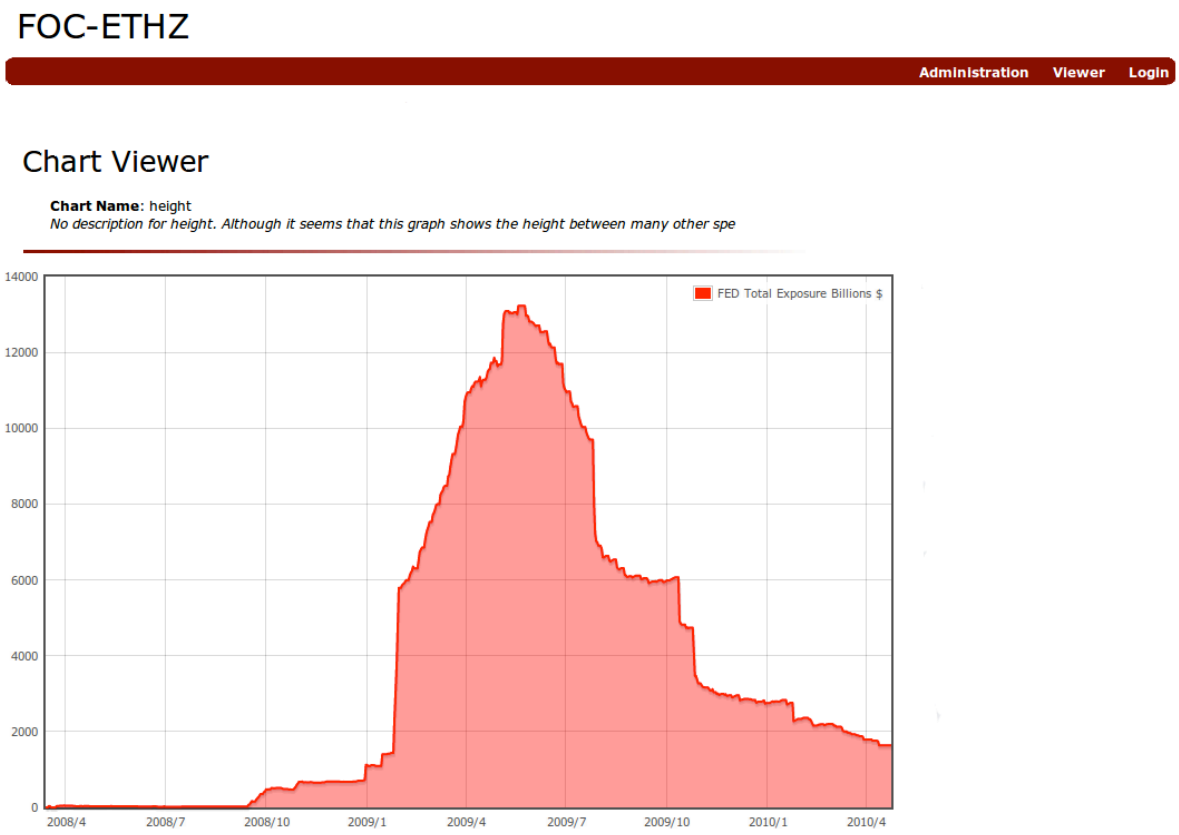


Illustration 3: Exploring time series, in this case the FED total exposure counting the maturity dates (y axis in billions of US$)

All these graphs (time series and networks) use as an internal format (JSON stream) that is an web service format, that can be attached to external web sites or applets.

T3.3 Visualization of Financial Networks and Risk Maps (Planned duration Month 24-36)

T3.3.1 Networks

Despite a bit in advance on the plan, we have started implementing a system to visualize networks based on a set of javascript libraries. This allows the user to interact with the network and to explore the nodes and the links attached to the node.

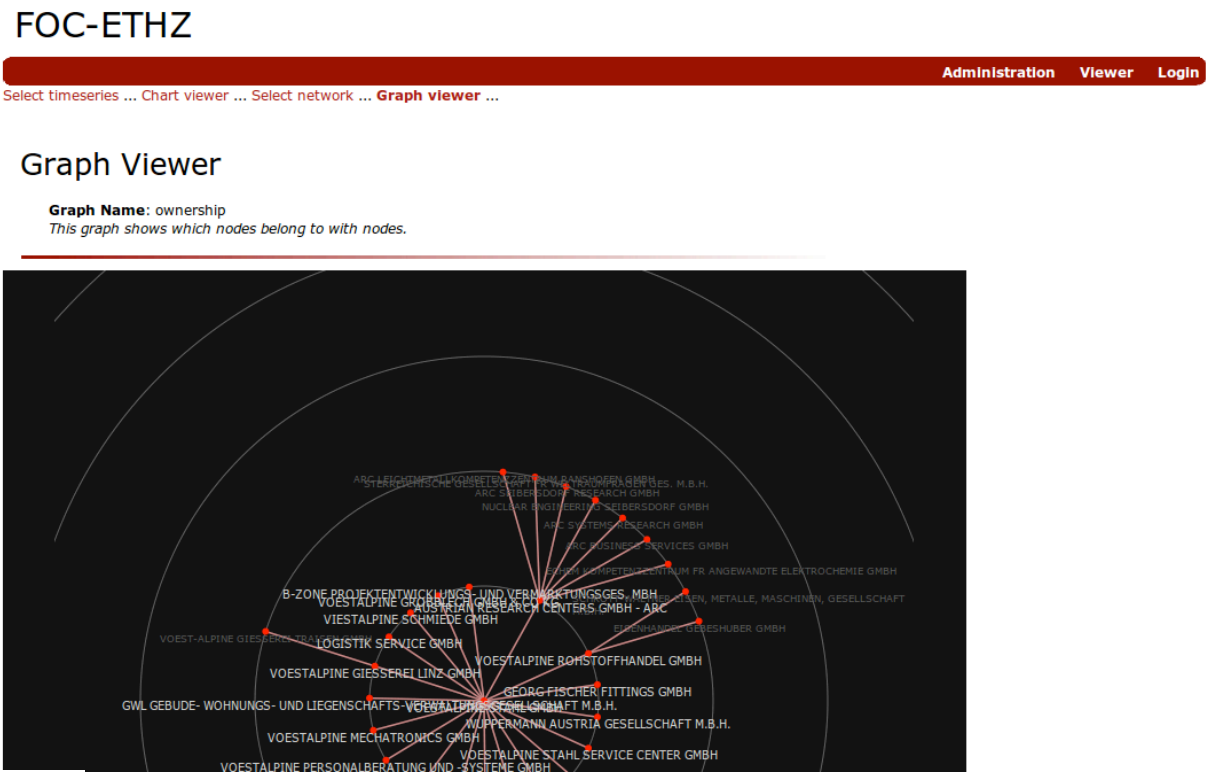


Illustration 4: Exploring Networks

Another solution is based on the reuse of the Java code written for an opensource (Cuttlefish) project of the ETHZ node. This software (a Java Applet) performs an advanced exploration of a network, allowing to pick the nodes, to transform the links and to visualize interactively a portion of the network. A snapshot of the Java Applet showing the CDS (Credit Default Swaps) network is shown below:

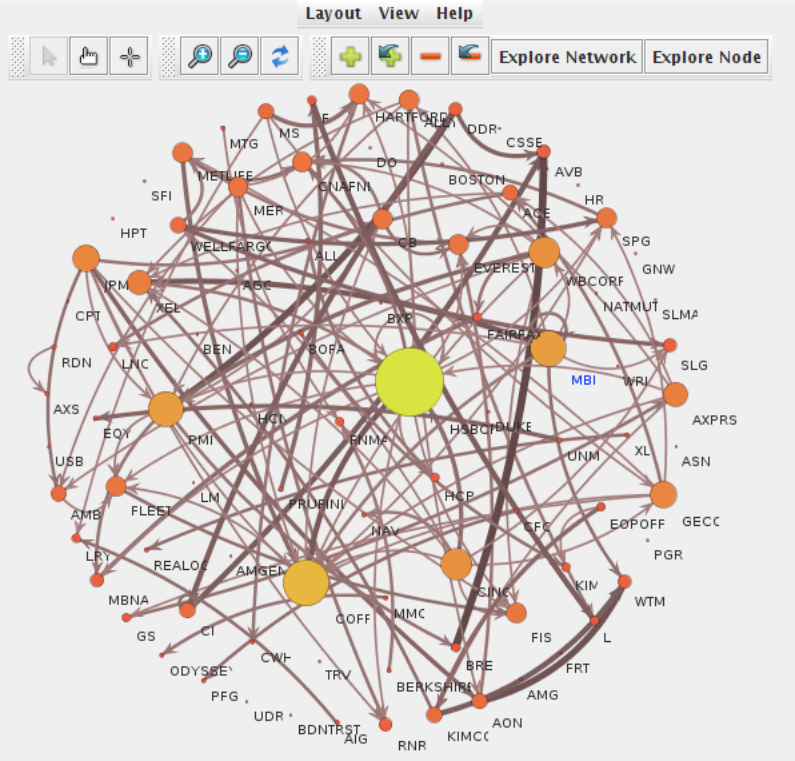


Illustration 5: the cuttlefish applet showing the CDS network

T3.3.2 Maps

Below it is reported an example of the maps that we are planning to include in the platform. This map represents the average probability of default across companies in each country, for several world countries. This map is obtained using data from the Singapore RMI database as described in the WP1 report.

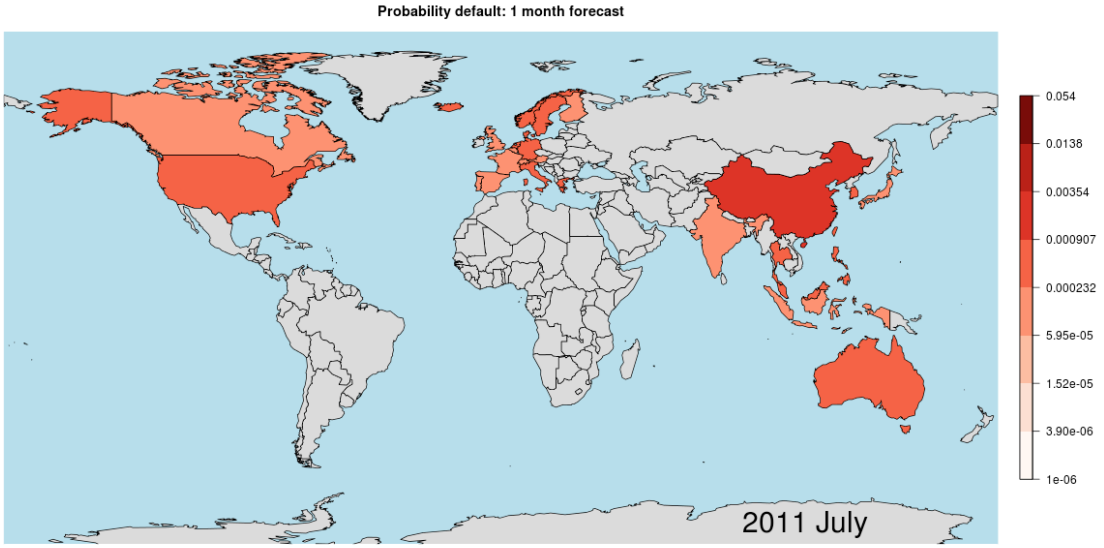


Illustration 6: the averaged probability to default computed using the RMI database (see the WP1 for further descriptions)

As a test case to the to the platform we have added the following datasets (see WP1):

a) Highlights from the FED transaction database (a database of the transactions between the financial institutions and the Federal Reserve during the recent credit crisis)

b) A network obtained by combinations of the time series of the CDS (Credit Default Swaps) that can be seen as a proxy of the cross exposure of the financial institutions during the credit crisis

References and links :
The FOC CMS is at the address http://www.focproject.net
The visualization platform is at http://ethz.focproject.net

T3.4 Forecasting and Future planning
In the second year of activity we plan to use the focproject.net website as the collector for the output of all activities. In particular it will be linked to the FOC platform and to the infrastructure for sharing all those datasets that are publicly available (or available via registration to the platform). We plan to develop a widget showing a daily live update of the evolution of the indicators of financial risk developed in WP4. This widget will be added to the website by month 18 at the ETHZ node. The main idea of this tool is to create an application exportable to other websites as a service. The application fetches the indicator data from the FOC platform and shows a map and several indexes of financial risk with the possibility to explore interactively past values of these quantities.