

# Collaborative Environment for Tool Sharing in the Framework of Euro-NGI Network of Excellence

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## 1. Introduction

The objective of the Network of Excellence Euro-NGI is the design and engineering of the Next Generation Internet, NGI. This objective covers a large and complex set of issues, from technological aspects, as the logical and physical layer design, QoS management, traffic engineering, network security and link restoration and so on, up to social and economical issues like quality of service from the users point of view, network pricing and costing and service tariff issues.

Furthermore all the subjects previously mentioned have to be studied in a large set of heterogeneous networks, xDSL, DWDM, UMTS, WLAN, all of them based on the IP protocol.

In order to study all these issues the some of the different research labs participating in the Euro-NGI have already developed and are currently developing, a large set of software tools oriented mainly to two work lines.

- Tools for network planning and simulation
- Tools for performance measurement, statistical analysis and test beds.

A specific objective of the Network is to develop a sort of Macro – Tool which provides a homogeneous environment for the software tools developed by the research labs allowing their interrelations. The development of such a kind of environment attaches several coordination and integration problems. Therefore the optimal solution is the integration of all tools under a common user access interface, one of the best options is the web interface.

The Telematic Engineering Group, G.I.T., of the University of Cantabria is developing a web portal named *Euro-NGI Planning Tools Portal* which implements this concept. Therefore this article exposes the specification, design and current state of the implementation of the portal, explaining several innovative aspects in the field of remote software tool execution, secure access and customized interfaces and sharing environments for simultaneous execution.

## 2. Portal Specification

### 2.1. Portal Sections

The *Euro-NGI Planning Tools* web-based portal will be mainly used for information exchanges and communication between partners, mainly in the field of planning tools. Furthermore it provides the access to the corresponding tools developed or provided inside the Euro-NGI project. The access to this specific Portal is always performed from the general Euro-NGI Web site, which is already implemented. This fact assures a first control provided by this Web site.

From the contents point of view, the portal will consist in the following sections:

- General information. This will be a public section with special information about the Euro-NGI project, the specific work package that is developing the portal and the partners involved in it. Furthermore documents and related info will be placed in this section.
- Communications. This section will be accessible only for the specific work package members. It will provide the following services:
  - Documental service. Web or FTP based, for making easy exchanges of documents between project members.
  - Audio-conference or video-conference channels for direct communication between project members.
  - Instant messaging, discussion forums...
- Tools. This section will store the tools provided by project members. In a first step general info about shared tools (and other tools) and software packages will appear. A second part is accessed only by a certain group of users with such privileges. There will be a description of each tool, along with usage guide, the method used for sharing it, etc.

## 2.2. Portal Components

In the development of this Portal, several software aspects must be taken into account. The following platforms, solutions and technologies are proposed for this collaborative server:

- It is a web-based service, so a web server is required. Depending on the chosen platform and operative system, Apache or Microsoft IIS can be used.
- The portal will have a web-based interface. It will be designed using HTML and CSS (style sheets), but it can be improved adding other functionalities, such as XML content description, see [1], and PHP scripts, see [2] or Java applets, [3] for further interactivity and security issues.
- Users must be identified for accessing some sections. User accounts will be stored in the corresponding database. Open-source, multi-platform MySQL database server, [4] is proposed for this task.
- Another database will be used for storing information about partners and tools, so it can be easily queried and displayed. This information completes the general partners profiles defined by Euro-NGI .
- A secure access to contents is developed so only authenticated users from main Euro-NGI website can access to private sections in the portal. A Java applet / servlet or PHP scripts might be used for adding the security functions to the HTML code.
- Portal includes a Search utility, taking advantage of the users, partners, and tools databases.
- Finally, server implements a Management Control Panel for the portal setup: users, contents, available tools etc... can be managed (add, edit, delete) from this section.

## 2.3. Portal users

Users in the *Euro-NGI Tools Portal* can be grouped by permissions level, ranging from users only able to access public sections, to users able to manage the Portal. Depending on the permissions established in the corresponding user account the user will be allowed to access to different sections. There are three different type of users.

- Level 0 : Users that are only allowed to access the public sections
- Level 1: Users allowed to access the private section and to perform the corresponding operations with the planning tools. This level will be subdivided in different groups to allow the customized access to the planning tools.

- Level 2: This level corresponds to the portal managers with total access and control of the whole portal.

The figure 1 shows the access scheme to the *Euro-NGI Portal*.

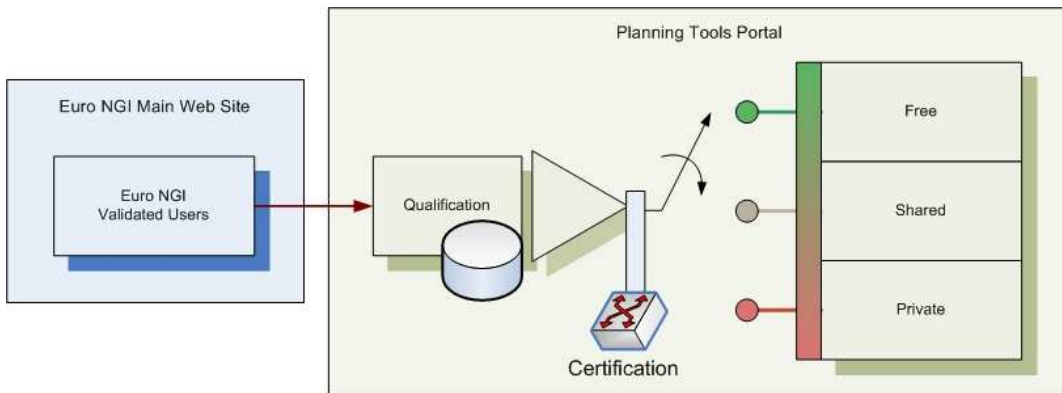


Figure 1 - Users in Euro-NGI Planning Tools Portal

More technical details about the access control are explained in section 3.3

### 3. Innovations

The *Euro-NGI Planning Tools Portal* have three main innovative lines which are enumerated below.

- Methods for tool Sharing.
- Definition and implementation of sharing environments.
- Security and Customization issues.

The underlying technology required to implement these three topics is already developed. It is commonly used, in a simplified form, for electronic commerce on Internet shops like e-bay<sup>®</sup> or Amazon<sup>®</sup>, and for electronic banking (the Bank BSCH .SA, www.gruposantander.es). However the application of this kind of shared environments in R&D activities is very limited. Therefore the Network of Excellence Euro-NGI constitutes the ideal framework to allow the exchange of knowledge through the shared use of the software tools. Next sections explain in more detail the three innovative lines previously introduced.

#### 3.1. Methods for tool sharing

The fact of sharing a specific tool can be a conflictive issue by several reasons. First, the research labs may have signed privacy and/or commercial agreements with industrial companies, so they are not allowed to provide a freely use of the software tool. Second, there might exist some kind of competition between different research labs that work on the same topic, hence, any possible misunderstanding owing to software and knowledge sharing must be avoided. Third the different labs may work under several operative system and with different program languages. Therefore it is a restrictive requirement to provide the corresponding interfaces to supply the integration of the different tools and algorithms.

Obviously, there is a broad spectrum of troubles. To overshoot them the *Euro-NGI Portal* have to provide a broad spectrum of possibilities for tool and knowledge sharing. Figure.2 shows these chances which are explained below.

- Provide a demo or Shareware version of the tool: This is the optimal solution for the research labs which works jointly with some commercial company. They can provide either a limited version of the tool, as an example, with only a unique working scenario, or a time limited version which expires after a specific number of days or executions.

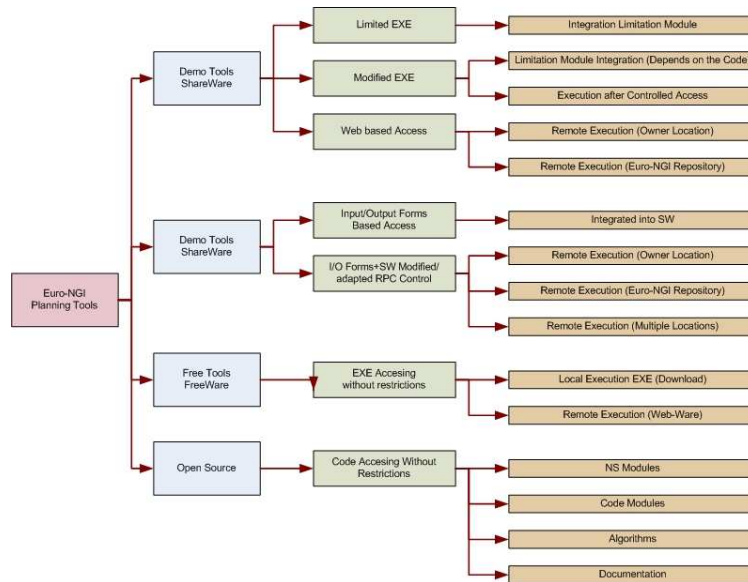


Figure 2: Classification of the sharing methods.

- Integration in the Web Portal, Web-ware. From the point of view of the authors this is the best option in order to interchange knowledge in the framework of the Euro-NGI. The integration of a specific tool into the web portal can be performed in two main ways.
  - Integrated software. In this option the input and output is performed using the corresponding web forms and the tool execution is performed in the machine hosting the portal.
  - Remote Execution. Again the data is introduced using the corresponding web forms. The software lies either in the Euro-NGI software tool repository<sup>1</sup>, in a server of the research lab that provides the tool, or finally in multiple locations.
- Provide a complete free software, Free-Ware: This is can be a good option if everybody is truly honest with the corresponding researcher. The freeware can be either downloaded to the user machine or executed in the web Portal.
- Open source. This means the complete access to the code of the tool or algorithm without any restriction, so everybody can use the code in their own software tools.

These four methods are strongly interrelated, and the division between them is not always clear. As an example, a shareware version of a software tool can be integrated into the portal with some restrictions about the maximum number of executions per user. It is obvious that the access to these tools have to be allowed only to the members of the project and related entities. The required security and Customization aspects are exposed in the section 3.3.

<sup>1</sup> The Euro-NGI software tool repository is a single or set of application servers. It is a different entity of the *Euro-NGI Planning Tools Portal*, although they can be in the same machine.

### 3.2. Sharing environments.

Considering the remote tool execution, up to now we have assumed that the tools are only in a single and specific location. This place can be either a server in the same research lab that have developed the tool or the Euro-NGI repository. This means that in most cases only a single user can access and execute the corresponding tool. The other possibility is to install the application in several servers. In that case some mechanism is required to distribute the request of remote execution over the different servers. The set of the distribution mechanism, the servers where the application is installed and the methods for secure and Customization access conforms the concept of a *sharing environment*.

Most part of the components of the *sharing environment* has been previously explained in the article. The new elements are the execution and communication servers. The communication server receives the connection request of the client. Then it establishes the secured and customized working environment with the client, using the information stored in the corresponding database. For this purpose it might use the *fingerprints* methodology explained in [5]. From this point the requirements about user-machine authentication and information confidentiality and integrity are fulfilled. After establishing this secure environment the client ask for the remote execution of a specific planning tool between the set of available tools. Then the execution server, using the information available on the database, establishes which one of the remote execution servers is going to provide the specific service to the client. For this purpose the database have to store information about the number, locations and specific facilities of each server. Furthermore the communication server has to feed the database with information about the usage level of each execution server to avoid possible congestions or service denials.

The other new element is the execution server. This equipment performs the service provision to the final client playing the same role that the Euro-NGI repository for the case of a single remote execution machine. However the execution server has an additional function. It has to inform about it state to the communication server, which stores this information into the database. That means that the communication server needs to know which execution servers are busy at a specific time moment to avoid a new client assignation to those servers. This type of execution server farm will allow the complete system to serve more users with higher quality of service. Note that because of the communication server drives the different client request to different execution servers, the required bandwidth in each one of them is reduced.

The complete system with the different network elements is summarized in the figure 3.

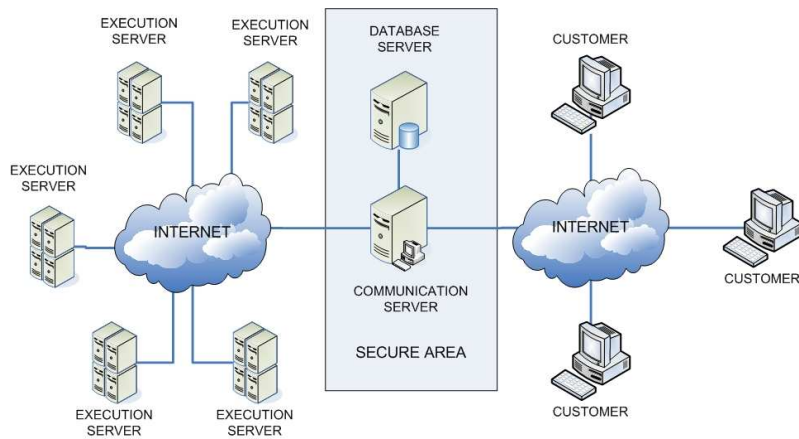


Figure 3: Representation of the sharing environments.

### 3.3. Security and Customization issues.

As it was commented before there exists three main entities (client, communication server including main Portal's database server and execution server). It is desirable to isolate the data warehouse most of the times from the rest of systems. As a consequence we consider two communication channels: client-Portal and communication server-execution server. The first channel represents the common access to the Portal. Second channel is an exclusive method for active sharing of programs and contents, including remote executions.

The first communication channel represents the interaction in the web browser between the customer and the Portal contents. The main Euro-NGI Web server grants the access to the Tools Portal remotely.

The *Tools Portal* is a dedicated server integrated into the Euro-NGI main server. The unique entrance gate is the main server of Euro-NGI, [www.eurongi.org](http://www.eurongi.org), where the user is authenticated obtaining an active session. The session and the session identifier, ID, is maintained at [www.eurongi.org](http://www.eurongi.org), providing links to the dedicated server. When a user moves towards the dedicated server, the main server handover the user to the dedicated server. This process is performed using the following procedure. The main server sends a HTTP Post message with the Euro-NGI user ID, the main server session ID, and unique hash for security to the dedicated server. The dedicated server handles the user and it creates a new local session. Then this local session is defined by two dedicated Java Applet and Java Server entities (client program and server program) establishing a private dialogue based on encrypted mechanisms (DES), see [6]. The main server hash is used as encryption key.

In the second channel the communication take place between Communication Server and execution servers. Starting from this point the communication between both servers is encrypted and the channel is secure. Although the validation key is transmitted by a non secure channel, the complete authentication is only obtained through the establishment of the encrypted communication. This channel uses SSH to guarantee a secure channel taking advantage of the facilities provided by Java. Note that it is totally transparent to the user.

The application of these two methods assures a complete confidentiality of the communicated data because the couple of safe channels are relatively immune to possible external attacks. Figure 4 shows the complexity of the procedure for the creation of secure channels.

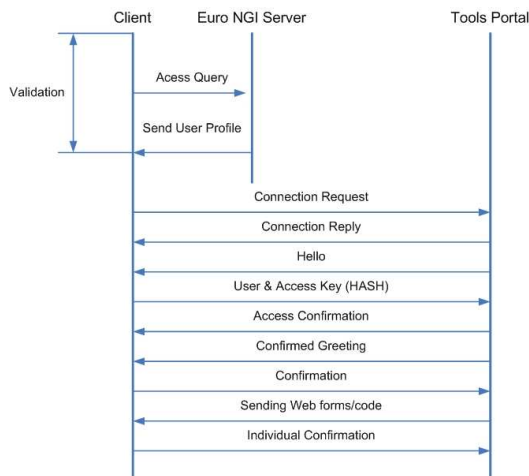


Figure 4: Secure Channels establishment

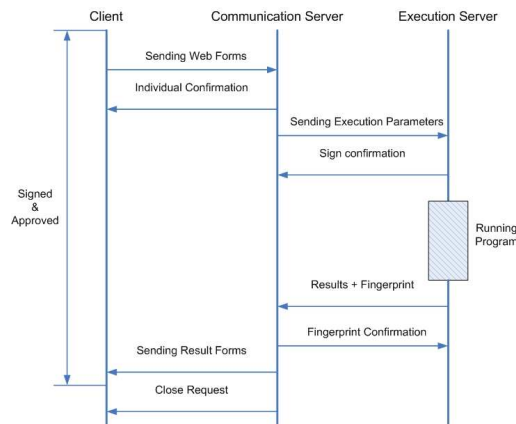


Figure 5: Secure execution

Once time the user is validated, he proceeds to send an encrypted greeting using the encryption key which is known by both server and client (session hash). If the greeting is decrypted correctly, authentication of the client is completed. Other case the user is expelled and the communication concludes. From this point the communication between the client and the server is encrypted and the channel is secure. In the following step, Input /Output web forms, programs or software are encrypted and sent, and the server confirms each one of them, as Figure. 5 shows.

While the user performs the execution or downloading, client and server don't exchange information. When the execution server concludes it sends the results. Each reception is confirmed and finally the *fingerprint* of the complete results is sent. By means of the exchange of keys the server checks the integrity and authenticity. If the confirmation is successful, the communication server proceeds to generate corresponding web pages with results of program execution.

#### 4. Conclusions and future work lines

The article exposes the specification and first implementation of the web portal named Euro-NGI Planning Tool Portal. The objective of this research is to provide a homogeneous environment for the knowledge sharing between the different partners of the project. For this purpose multiple innovative techniques, in the field of Internet applications, have been used. The application of this methods to a cooperative research & development environment is also a very relevant issue.

At the present time the first version of the portal is already implemented with the basic functionalities. Advance features like *fingerprints* with customized environments are currently under development and implementation.

#### 5. Acknowledgements

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