

## The potentialities of the GRID: some user applications

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The GRID [1] infrastructures have mainly been used for solving very complex scientific problems, in particular in the field of physics. One of the goal of the Sicilian GRID is to extend the use of this powerful infrastructure to other kinds of application either from academia and from the industrial world. In this paper, we present how two completely different applications are being usefully ported in the GRID infrastructure to offer improved services to the final users, and the problems encountered for doing so.

The first application is a software tool for developing and analyzing Petri net models, named WebSPN [8]. WebSPN was developed from a team of researchers to the University of Messina some years ago; due to the complexity of the models it is able to solve, it requires a great amount of resources in terms of either memory and time, so we realized the importance of a parallel implementation [7] before, and the use of a GRID infrastructure after.

The first step towards the final result has been to characterize the software project with all the necessary requirements for submitting the user request as a job. Since the original application was developed by using the MPICH [6] support, and it has the necessity of sharing a lot of informations among the cooperating processes, a communication layer has been added to overcome the limits of the GRID infrastructure. In fact, the GRID is a completely distributed computational infrastructure, with no possibility of memory sharing or Network File System.

Another problem to manage has been the usability of the tool from the final users. In fact, WebSPN is equipped with a Graphical User Interface (GUI) written in Java, for creating a Petri net model, defining the measures of interest and submitting the job to the solution engine (running on GRID now). The easiest way for maintaining all the features offered from the GUI has been to use the WEB services offered from the actual GRID infrastructure, through its WEB portal named GENIUS (Figure 0.1). The integration in the WEB portal required some modifications to the GUI mainly because the kind of interactions with the solution engine was changed. The submission to the GRID, in fact, require the composition of appropriate batch files describing the jobs and the resources required.

Through this work, we modified WebSPN for appropriately taking advantage of the GRID potentiality in terms of available computational resources, improving the overall performance of our software tool without losing the usability offered by the GUI.

Currently, we are performing a testing phase with the purpose of verifying the real performances of the application, in terms of completion time respect to the elaboration performed on a cluster of workstation, when used by the GENIUS web portal. In particular we want to evaluate how the delay due to the scheduling of the jobs affects the completion time in computing the solution of a complex model. With this kind of activity we want to establish the level of model complexity beyond which the use of the GRID is really useful.

Our second activity takes cue from the consideration that nowadays users can access information any time anywhere, thanks to the introduction of a wide range of multimedia wireless devices: these kind of devices are very inhomogeneous in terms of display, resolution, color depth, audio reproduction, media format and connection type. Today multimedia delivery systems are very customized for some device profiles or for wireless connection type: transcoding techniques are used in order to adapt the same high quality media sources to the multiple devices and connection profiles [4]. While client side adaptation suffers both the power saving restrictions and the unnecessary channel overload due to the transmission of high quality media, server based adaptation shows, otherwise, scalability issues due to the potential high number of devices.

We propose the use of the Grid paradigm to implement a scalable multimedia server [5]. The objective of the Grid technologies is to support the sharing and coordinated use of several resources (such as computational or storage) in dynamic, multi-institutional distributed *Virtual Organization*.

The proposed application, named GridVideo, identifies two multimedia related activities:

1. Multimedia Upload and Storage (Figure 0.2)
2. Multimedia Streaming (Figure 0.3).

In the first activity (Figure 0.2), operators in each organization (the services providers for example) make a multimedia object available to the users by uploading the file in the system [2, 3]. In this activity we can distinguish four phases. The *Uploading* phases in which the file is uploaded to the grid nodes chosen for the *Splitting* phase where the file is splitted into many pieces according to the available resources; after that the files are *Encoded* so as to store each piece of each file into a common high quality format. The last phase is the *Dissemination* in which the disseminated across the Grid.

The second activity (Figure 0.3) is the Streaming activity. In this activity when the user request a movie the system will transcode all the fragments according to a device profile and to a connection profile. After that the stream is played using *vlc* over an HTTP connection with a proxy server running an Open Source Servlet Container (Jetty) that hides the fragmentation to the user.

Using this system a user that wants to access to multimedia information doesn't need to find the right format but needs only to request the information selecting the his own device profile (Figure 0.4).

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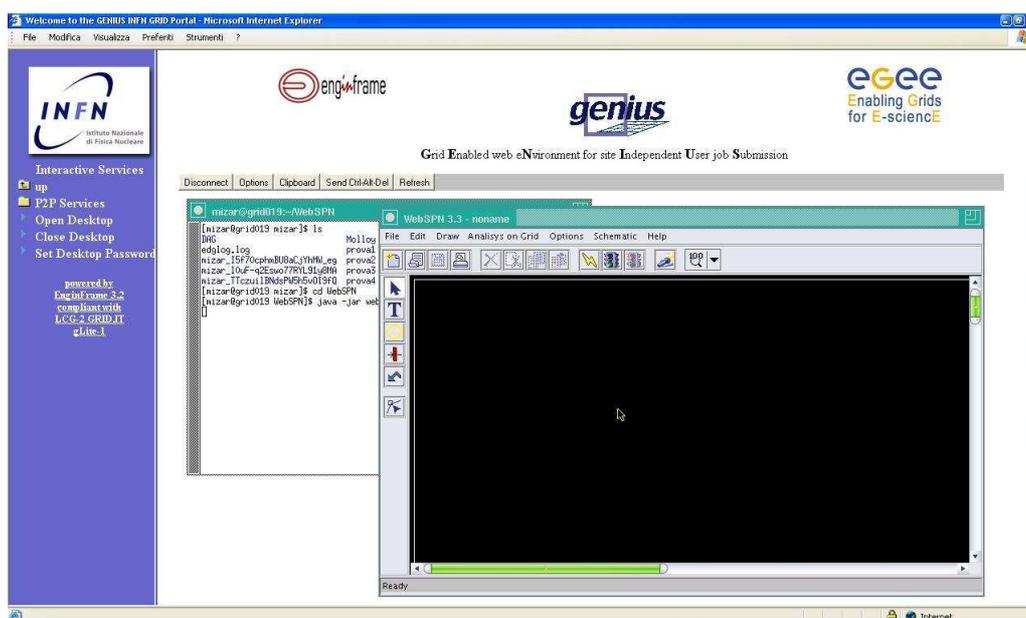


Figure 0.1: GridSPN on the GENIUS WEB portal.

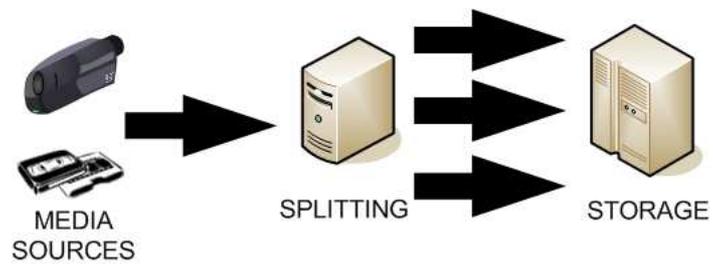


Figure 0.2: Storing of a video in the GRID resources.

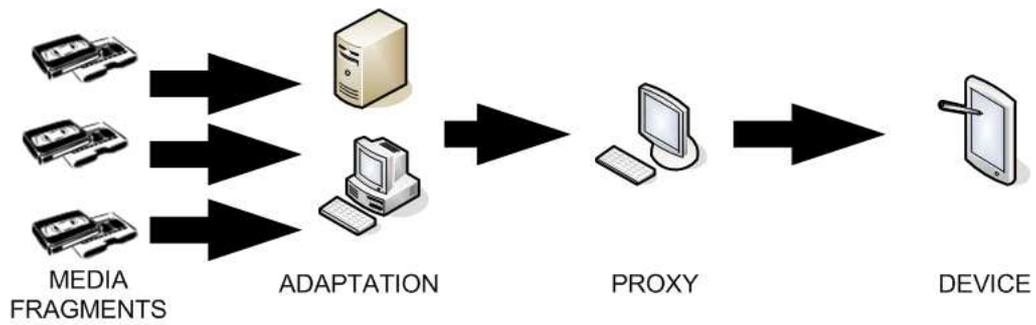


Figure 0.3: Streaming and transcoding process from the GRID.

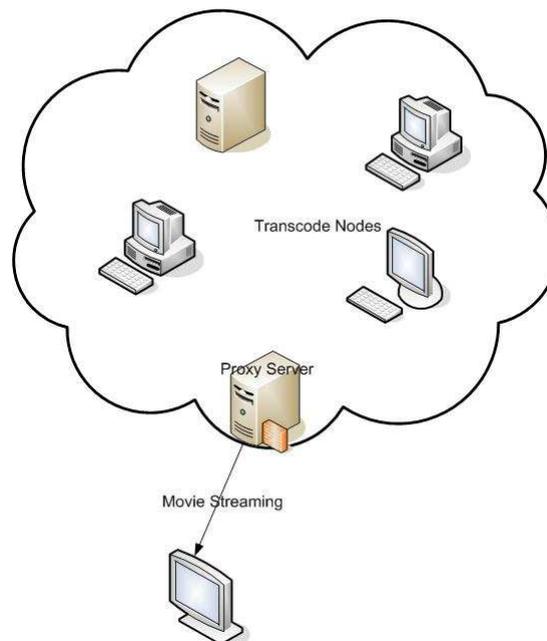


Figure 0.4: The basic architecture.