



Migrating Desktop and Roaming Access
Whitepaper

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1 Product overview

In this whitepaper we describe Roaming Access Server (RAS) and Migrating Desktop (MD), which is a graphical user interface that can be used to work with many different grid infrastructures. This functionality refers to two grid projects: Progress (co-founded by Sun Microsystems and the Polish State Committee for Scientific Research), continuation of work was held within EU CrossGrid project IST-2001-32243. The used term mobility: refers to the users that very often change their location. There is a need to give users remote and individual access to the resources, independently of the original location. We propose a transparent user work environment, independent on the system version and hardware. The place of user do not play a rule here, every grid user can save their private settings, application parameters, parameters of transfer protocols and session and restore them somewhere else. A flexible system structure enables defining and adaptation requirements of individual groups of users.

Nowadays grid user interfaces gives access to one grid infrastructure – specific resource broker and storage system. We look ahead to give users possibility to use resources from more than one grid at the same time. Therefore we create Migrating Desktop, which is a graphical user working environment (see Fig. 1). With Migrating Desktop users can manage remote and local files, submit and manage jobs and visualize jobs results. Migrating Desktop is just a front end to Remote Access Server (RAS), which intermediates to communication to different grid infrastructures. All user settings are stored in RAS therefore Migrating Desktop started from another workstation looks the same. One of our aims is to standardize a different approach and give one interface as a web service. Server implementing this interface is plug-in based, and plug-ins are responsible for communication with specific grid infrastructures. This architecture provides an important future direction with respect to the general acceptance of services and protocols. A grid infrastructure is being simultaneously developed in the framework of many academic and commercial projects. One of the biggest challenges for grid designers is managing the enormous complexity of Grid-based systems, making them interoperable with existing systems and other emerging technologies and standards.



Fig. 1 Migrating Desktop main window and sample configuration dialogs.

2 Architecture overview

For the purpose of this document we show only basic architecture components and interfaces between corresponding modules (see Fig. 2). The heart of the architecture is the Roaming Access Server that serves/provides grid functionality for different kinds of clients.

The Roaming Access Server is a set of web services that mainly provide grid functionality, see Fig 1. It is the integration level for interfaces of different grid projects. The number of RAS servers depends on the amount of users and their requirements; it is a fully replicated part of the system. It is recommended to have at least one server for Virtual Organisation.

At the moment we offer three types of RAS clients: Migrating Desktop CrossGrid application portal, and standalone applications (grid-based and local). In this document we focus on Migrating Desktop product as a client – the entry point to the distributed resources.

Migrating Desktop is an advanced user-friendly environment that serves as uniform grid working environment independent on specific grid infrastructure. Java based GUI is designed especially for mobile users and is independent on platform (MS Windows, Linux, Solaris) and hardware (personal computers, laptops, workstations). It is a complex environment that integrates many tools and allows working with many grids transparently and simultaneously. The main functionality concerns local and interactive grid application support, local and grid file management, security assurance, authorisation of access to resources and applications, and single sign-on technology based on X509 certificates.

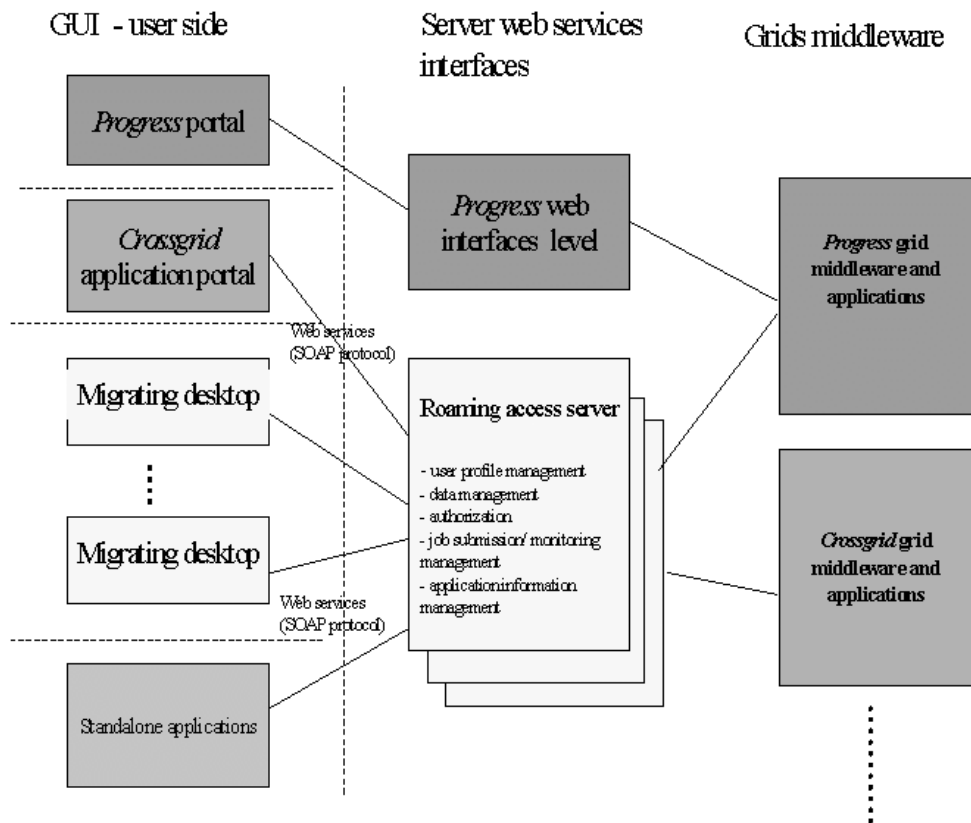


Fig. 2 RAS architecture overview.

Standalone applications can use RAS services, especially these related to job submission, monitoring and interactive protocol usage. The main aim of using RAS services inside applications is the need of accomplishing specialised requirements that cannot be fulfilled by MD or portal interfaces.

Currently RAS provides plug-ins for interoperability with two separate grids - Polish Progress and EU CrossGrid, however its infrastructure is open for expansion and attaching other infrastructures.

3 Roaming Access Server

The Roaming Access Server (RAS) offers a well-defined set of web-services that can be used as an interface for accessing HPC systems and services (based on various technologies) in a common, standardized way. All communication bases on web services technology. This way we may support wide variety of client including personal computers, laptops, and in the future PDA, and mobile phones. It is one of the infrastructure features for supporting mobile users.

The Roaming Access Server is a set of modules and plug-ins that provides interfaces to work with grids. It consists of several independent parts responsible for job submission, job monitoring, user profile management, data management, authorisation, and application information management. Provided functionality

contains a wide range of different grid services that are common for many various grid projects. The provided functionality is presented as follows (see Fig. 3):

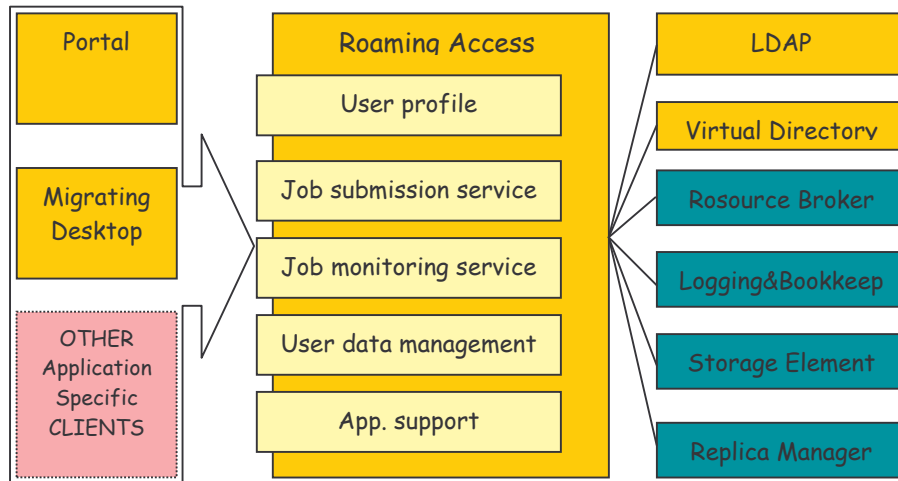


Fig. 3 Ras services

Job submission

RAS job submission interface gives a uniform access to different resource brokers. Clients can submit all jobs with this interface and then appropriate plug-ins are called to convert job description to the specific language. Currently we are using plug-in for CrossGrid/DataGrid resource broker to convert job description to JDL and Progress plug-in to convert job description to XRSL. In the future Job submission interface will support XML job description, which is under development by Job Submission Language group from Global Grid Forum.

Job monitoring

Job monitoring is an interface that allows retrieving job status information. Job monitoring module uses grid plug-ins to retrieve job status information in grid dependent way and presents uniform status information for all jobs.

User profile management

User profile management provides functionality that allows operations on user profiles. User profiles contain all information that define current user working environment including information about graphical configuration (e.g. desktop background, icon locations, and colors) and information needed to access specific grid infrastructures (e.g. user name and password). LDAP protocol is currently used for saving and retrieving stored information.

Data management

In every grid system data management is a very important and complicated part. After many analyses a common set of interfaces that allow operation on data and/or metadata was created. The designed framework allows extending RAS infrastructure easily so that many management systems could be attached.

One of the main additional functionalities is the User Virtual Directory that is an abstract file system that contains information about all user files independently of their physical location. Each branch in the Virtual Directory tree can be physically placed on different location or even can be placed on storage with different way of accessing (e.g. FTP, GridFTP or any other project native protocol). Virtual Directory was designed to standardize data access, and to create a user-friendly, uniform view of Grid and local files.

Application information management

To submit application to grid and to visualize results some information about application is needed. An interface for application information management is provided. LDAP protocol is currently used for retrieving application information.

Other services

To add support for new grid infrastructure requires RAS plug-in is necessary. RAS plug-ins provides grid specific information and are used by job submission, job monitoring and data management modules. RAS plug-in is a Java class that inherits from RASPluginBase and implements all its abstract functions:

- SubmitJob(JobDescription)
- GetAllJobs()
- GetJobStatus(Job)
- CancelJob()
- GetDirectoryStructure()
- GetUserFileLocations()
- MakeUserFileLocation()
- AddFileLogical()

We are going to extend the functionality of the Roaming Access Server not only in a field of grid services. The system is ready for supporting of functionality that will simplify the communication between users like scientists for data exchanging. In scope of our research there are also ways of noticing the user via e-mails, SMS etc. about important events connected with the status of his/her submitted jobs.

Currently RAS uses infrastructure of testbed basing on LCG1 and LCG2 provided by European Project DataGrid coordinated by CERN. Green boxes come from that project but we do not limit of usage any other components. Other Replica Manager or Resource Broker can be adapted on demand. All communication is done via modern web services technology, so every new component can be applied here under the compliance with services provided by RAS.

4 Migrating Desktop

Migrating Desktop is a common graphical user interface for application management, grid monitoring, data and metadata management, authentication and grid tools. The user front-end, desktop similar to these used in Windows or Linux

window systems, is implemented as an advanced graphical Java based application. That way we can support many operating systems with the same functionality. The software used for running MD is distributed under Public Domain licenses thus MD usage does not imply additional costs.

General concept of the Migrating Desktop was to provide the containers – frameworks for plug-ins written by application developers. Such approach allows increasing functionality in an easy way without need of architecture changes. It is possible to add various tools and applications and support visualization of different formats using that mechanism. As an example: Migrating Desktop on demand loads from network appropriate plug-in for visualization of non-standard graphics format file. That makes our product independent of specialized tools designed only for specific application.

User environment configuration

It is one of the basic functionalities of our product. The users can configure and create their own environment, save it and restore in every place where the network access is possible. During the initialization of MD, the restore function of the RAS Profile Manager Service is invoked and the MD is presented as it had been saved before. Personal settings like configuration definitions that characterize e.g. links to the user data files, links to applications, access to portals and HPC infrastructure, as well as windows and icons settings are the same. The user can also configure multiply profiles and use them to work with different grid and local systems. That is one of the major features that support a mobile user.

Application framework

We have assumed that all grid application should be dealt with in the same way as far as possible. Migrating Desktop offers a framework for application, but application developers should prepare an application specific plug-in for job submission and result visualisation.

Applications available for users are grouped in user-friendly way in a Job Wizard. This Wizard simplifies the process of specifying parameters and limits, suggesting user defaults or last used parameters. The Wizard is responsible for proper preparation of the user's job and consists of several panels. One panel is application specific plug-in and the rest can be used to set job information, resource requirements, files and environment variables. Application plug-in asks user for application parameters and that parameters are than passed to command line. Application plug-in is just a Java class inherited from ApplicationPluginBase and must implement its abstract method. Most important method is getArguments and setArguments called when job is going to be submitted or when job is presented to the user. For application developers that do not like to prepare plug-in we created generic XML plug-in that interprets argument description given in XML to a graphical form. Example plug-ins are presented in Fig. 4.

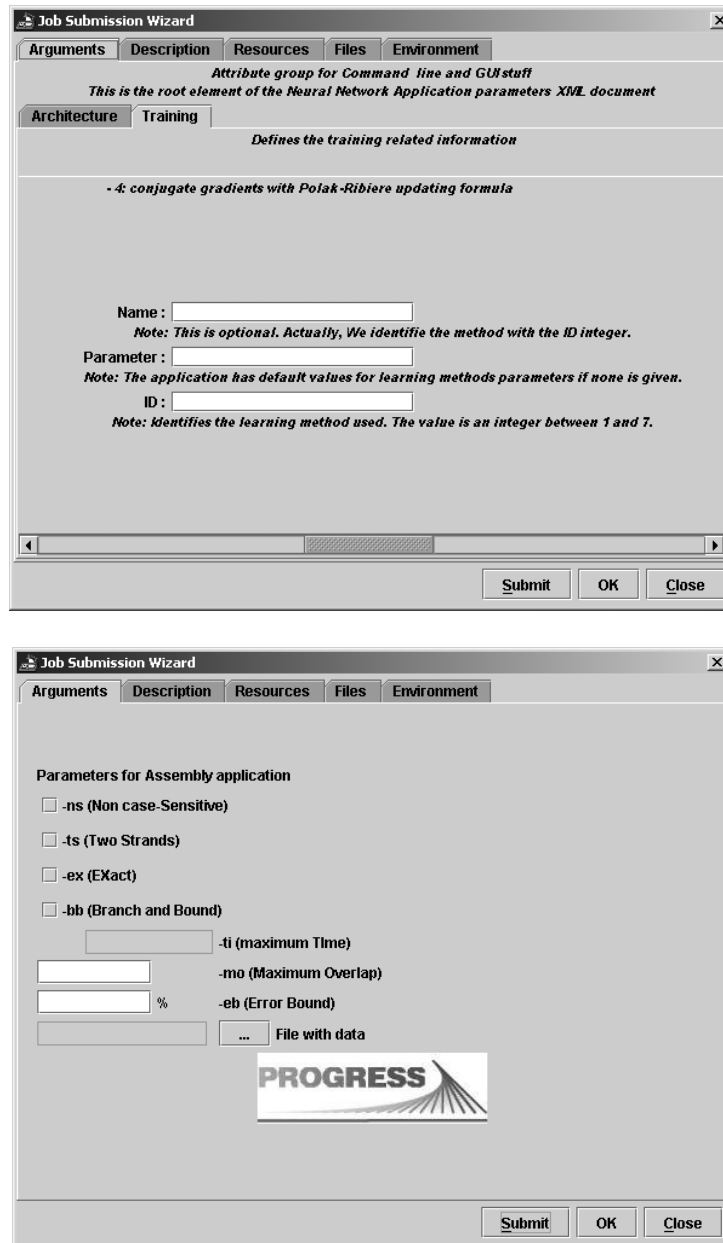


Fig. 4 Example Application plug-ins. Up – generated from XML, down – Java class.

Migrating Desktop allows also running some tools. In contrast to grid application that are submitted to resource broker, tools are Java applets that run locally. Tools should inherit from ToolPluginBase and can use some methods provided by Migrating Desktop (e.g. file transfer, Virtual Directory browsing).

Some applications require graphical visualization of job results. In our approach visualisators are just tools and can also base on Tool Plug-in. Tool Plug-ins can visualize single file or single job. All available file and jobs visualizations are registered in Migrating Desktop database, and appropriate Tool Plug-in is chosen depending on the file extension or type of job.

We also provide framework for interactive application as the VNC plug-in. Interactive applications can be started and managed using edg2.0 middleware. This

middleware is developed in DataGrid project and is still under enhancement in CrossGrid. That is why interactive application framework can be change.

Job monitoring

The user can check the state of submitted jobs, suspend or delete selected job using the Job Monitoring tool. The Job Monitoring dialog presented in Fig. 5 is a useful tool for tracing the status of the previously submitted jobs. This dialog contains all the information about the submitted job including extended job status and job log. Some information like extended status can have different format, because they are returned by different grid information systems. RAS plug-ins read information from a specific grid information system and presents them to users in text or XML format.

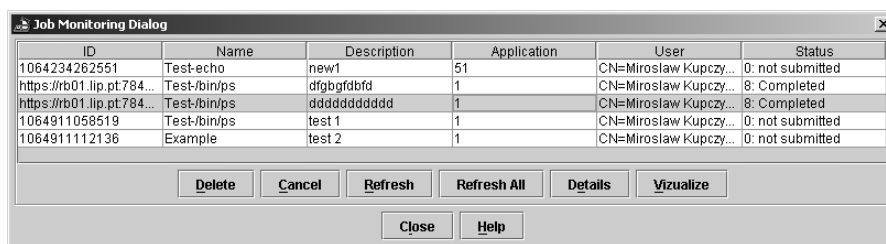


Fig. 5 Job Monitoring Dialog

Data management

The main file Management tool in Migrating Desktop is called GridCommander (see Fig. 6). It allows managing files in Virtual Directory as well as files on local disk. Copying files to Virtual Directory employs appropriate RAS plug-in, which physically does copying of the data to its physical location with suitable protocol. Grid Commander is a two-panel application similar to Commander family tools. A single panel can be a local directory, Virtual Directory branch, GridFTP or ftp directory or other storage native location. Progress project uses its own implementation of storage system with unique protocol and its storage can be also accessed by GridCommander. Virtual Directory branches can be defined for a specific user or specific Virtual Organisation.

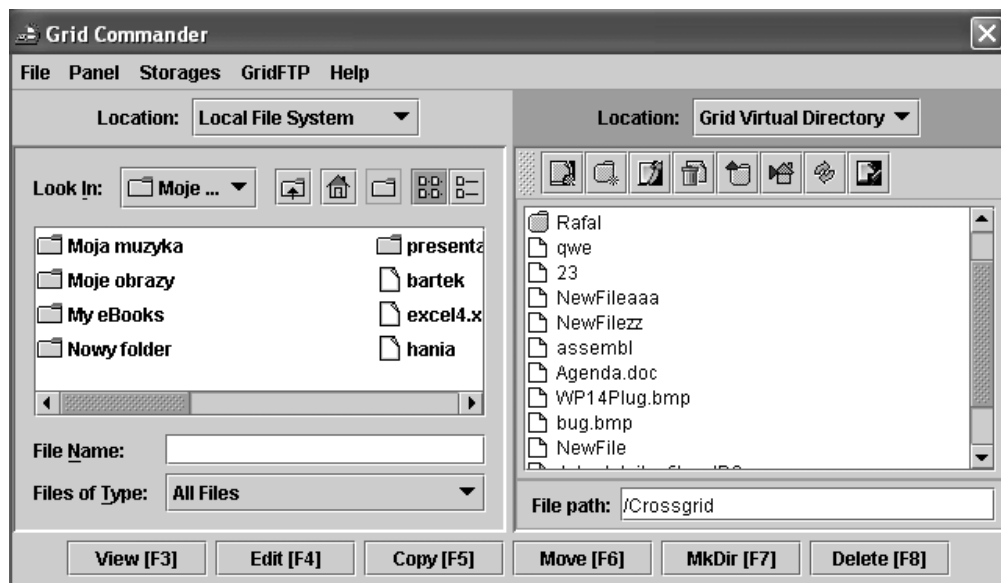


Fig. 6 Grid Commander Dialog.

Authentication issues

We try to keep authentication as simple for the user as possible. Authentication to Migrating Desktop is done with users X509 certificates that have to reside on local disk, removable disk. X509 proxy is passed to each RAS interface and is used to access grid resources. For resources that require other method of authentication (e.g. username and password) Migrating Desktop can ask about necessary information and then store it in user profile. Any subsequent authentication can be done automatically. In our current implementation we store username and password for authentication to Progress grid infrastructure, which bases on IPlanet Portal Server.

5 Short guide

The user should do the following simple steps in order to start his work with the Migrating Desktop application:

Currently, there are two ways of launching MD: web browser and Java Web Start.

- Java-enabled web browser (for example Netscape Navigator, Internet Explorer etc. with the Java plugin version 1.4.2 or newer). Under web browser use the proper address of the Migrating Desktop web page (currently: <http://ras.man.poznan.pl/crossgrid>). Be aware of keeping the Java Plugin cache (JAR cache) disabled!
- Java Web Start (JWS 1.4.2 or newer). This method is slightly faster. Run MD from this location:
<http://ras.man.poznan.pl/crossgrid/JWS/MigratingDesktop.jnlp>

Open the firewalls for 8080 port. For file transfers you should keep open the pool: 13000-17000, 2811 in both directions between your local workstation and remote SE(s). For interactivity: the VNC server contains a small Web server. It uses HTTP connections on ports: listening: 5800 and communication: 5802, 5901, 5801 too.



Valid credentials. Creating of user's certificate from the local CrossGrid enable machine

>globus-cert-request

and follow the instructions.

To sign certificates for users contact your country CA: [Certification Authorities used for CrossGrid Testbed Sites](#). Please ensure the proper CA for your country.

There is no need to pass additional passwords, it is a single sign-on architecture.

6 Future plans

Under Crossgrid project we plan to enhance the stability of the product. We are aware that the environment should be reliable as much as possible. Especially we put an effort with multi-instantiation of RAS. The replication of RAS allows better utilisation and performance of mechanisms for file transferring. In this case the Open Source products will be used. As a distributed, replicated DBMS, Postgress will be used.

Nowadays, heavy Java applications are not optimised for speed, so this is another issue that will be taken into consideration by the end of project duration. We also work on removing the limitation of MD usage across firewalls. Now, the client opens standard ports and also not well-known port pools for GridFTP, SOAP services, VNC etc, It will be tunnelled using standard secure mechanisms.

By the end of the project (by 02.2005) we also provide well-defined interactive support for grid-based applications. It will accomplish the possibility of launching VNC application on the grid and launching grid applications with active standard I/O streams (in, out, err) too. All applications, especially with the GUI part developed using our java interfaces, which implement that kind of communication, can be invoked and used via Migrating Desktop.

Licenses

The usage of the Migrating Desktop and Roaming Access Server is based on GPL (open source). The source codes are available through CVS at <http://gridportal.fzk.de>, which is the official MD and RAS repository. We put an effort to keep the testbed without commercialised packages (underlying middleware).

The official testbed installation is available at <http://ras.man.poznan.pl/crossgrid>. For test credential send a request to: plgrid-ca@man.poznan.pl.

The official Crossgrid webpage is www.eu-crossgrid.org. This is also starting point for software documentation.