UNIVERSITÀ DEGLI STUDI DI LECCE

The Grid Resource Broker: Web access to computational grids

Giovanni Aloisio giovanni.aloisio@unile.it
Massimo Cafaro massimo.cafaro@unile.it
Italo Epicoco italo.epicoco@unile.it

Web portal

Provide users with
transparent, easy and secure
Web access to computational grids

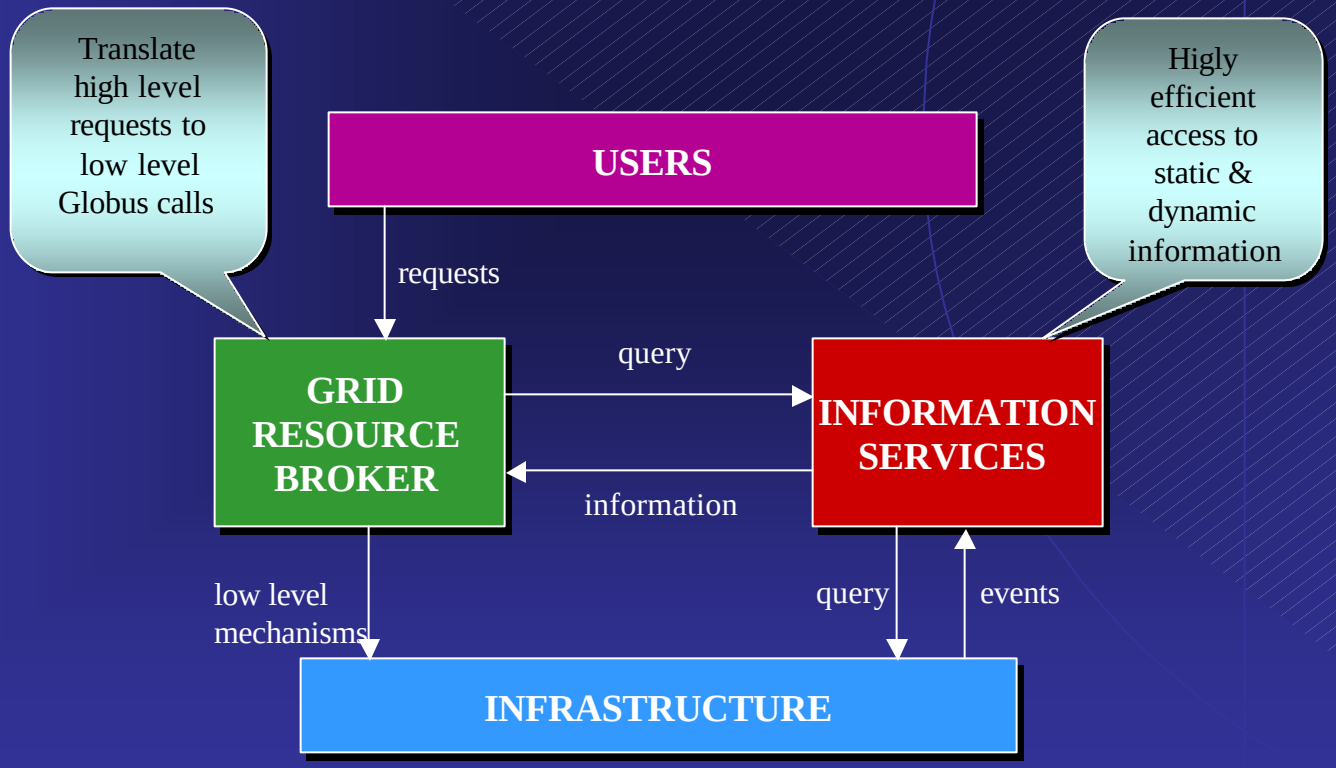
Secure: user's credentials sent using HTTPS, authentication with X.509v3 Globus certificates

Trasparent: automatic translation of high level user's request to low level Globus calls, scheduling etc.

The Grid Resource Broker

Grid Resource Broker

A portal to computational grids



GRB Services

On-line GRB Services

- Yellow Pages Lookup
- White Pages Lookup
- Interactive & batch jobs – even X windows apps
- Parameter Sweep jobs
- Brokering
- Job status monitoring
- User' Profile Management
- Thirdy-party file transfer (single file / directory)

GRB Components

Several interacting components

- Resource Finder
- Resource Matchmaker
- File Assistant
- Job Assistant
- Job Supervisor
- Parameter Sweep Agent
- Profile Manager
- Job Advisor

Globus services depended upon

The Grid Resource Broker

Builds on the Globus Toolkit middleware

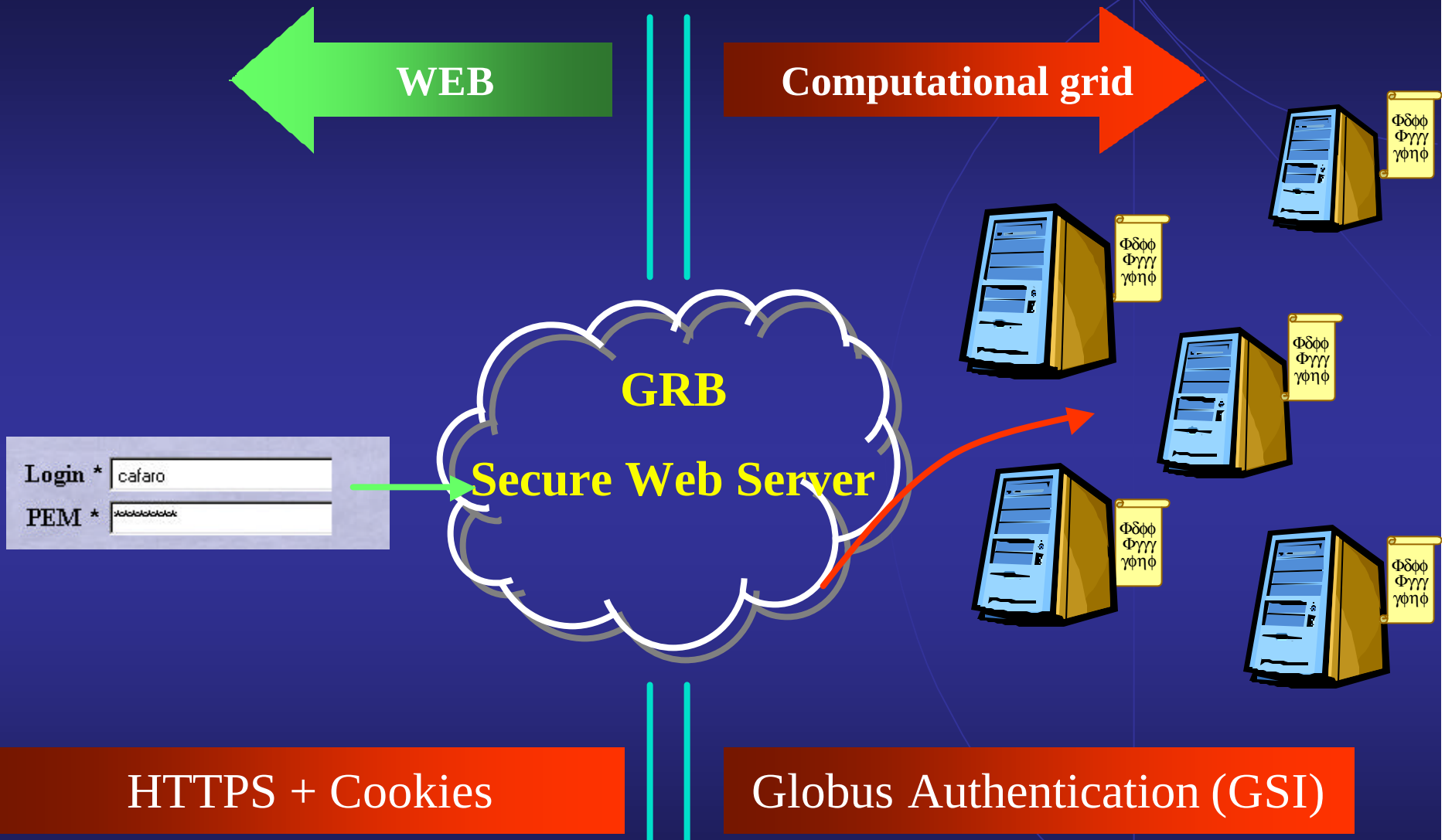
- GSI
- GIIS / GRIS
- GRAM
- GSI FTP

To do: integrate NWS

Commodity technologies and software used

- C / Unix system calls
- HTML
- CGI
- HTTPS
- COOKIES
- LDAP
- EXPECT

Authentication



GRB Architecture

File/Data Management

Job Management

Authentication

Information discovery

User's Profile Management

GSIFTP

GRAM

GIIS/GRIS

NWS

GSI

Grid

Data Services

Compute Services

Information Services

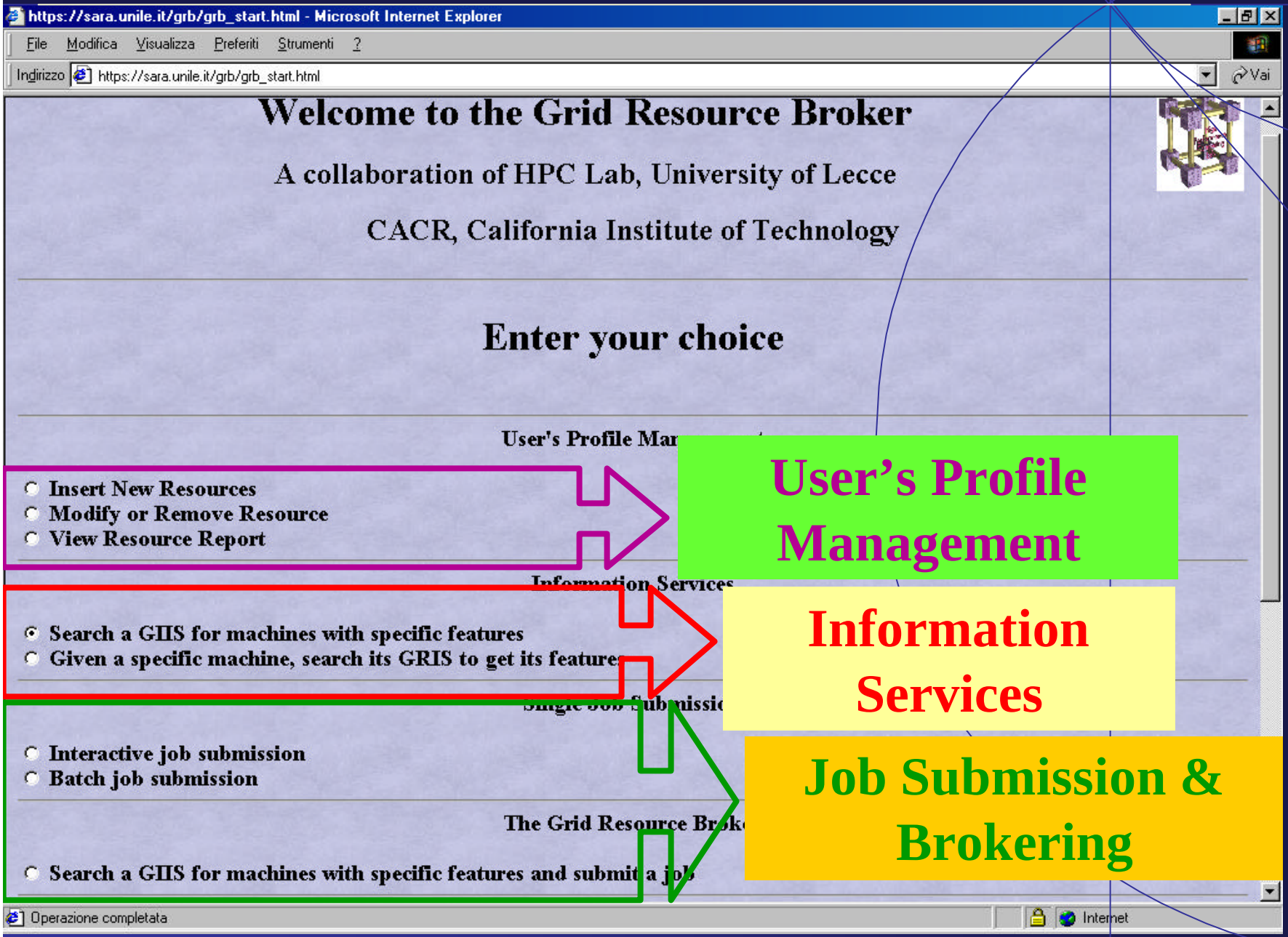
Network Services

Users

Portal

Grid

GRB Services

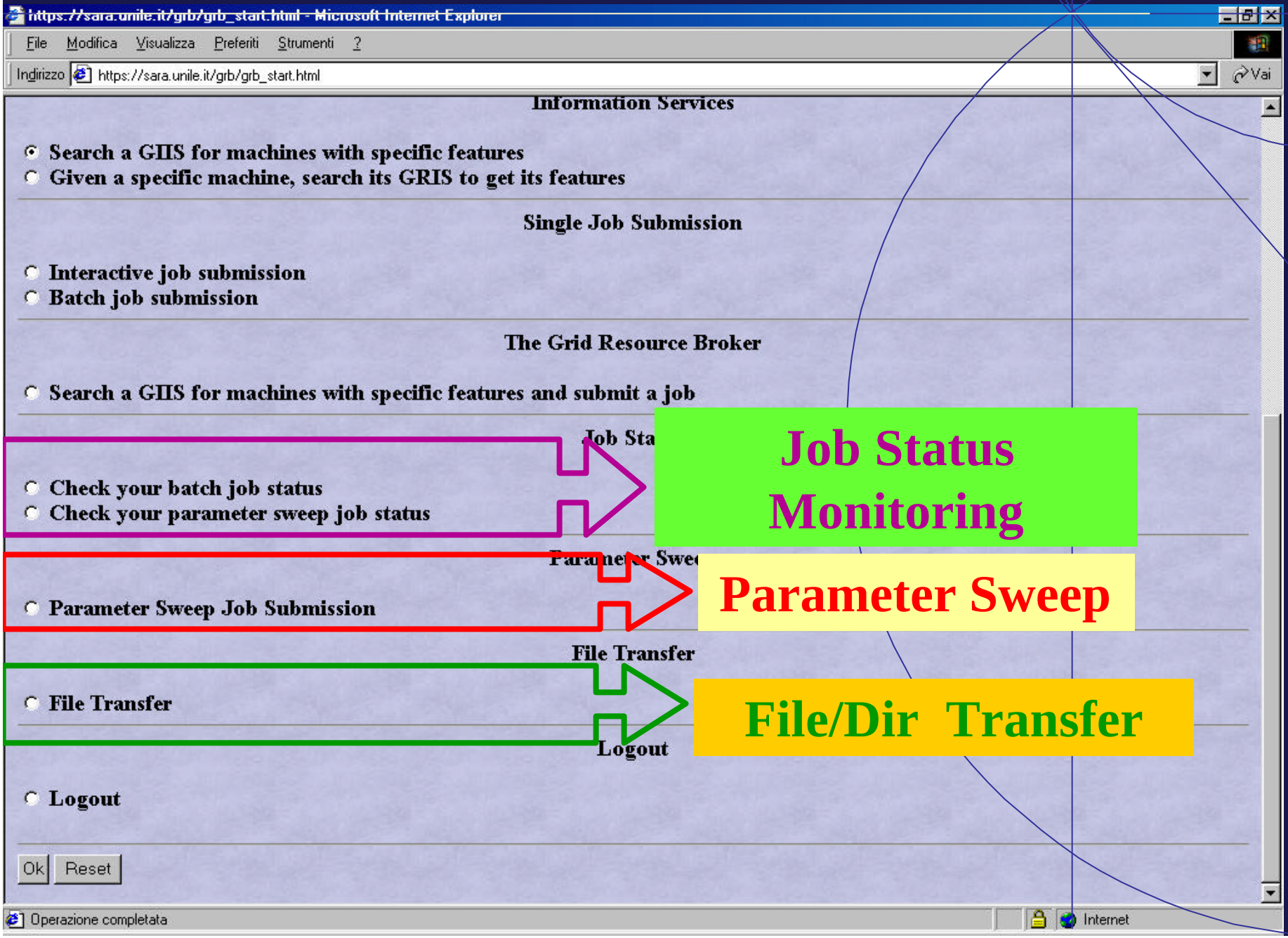


User's Profile Management

Information Services

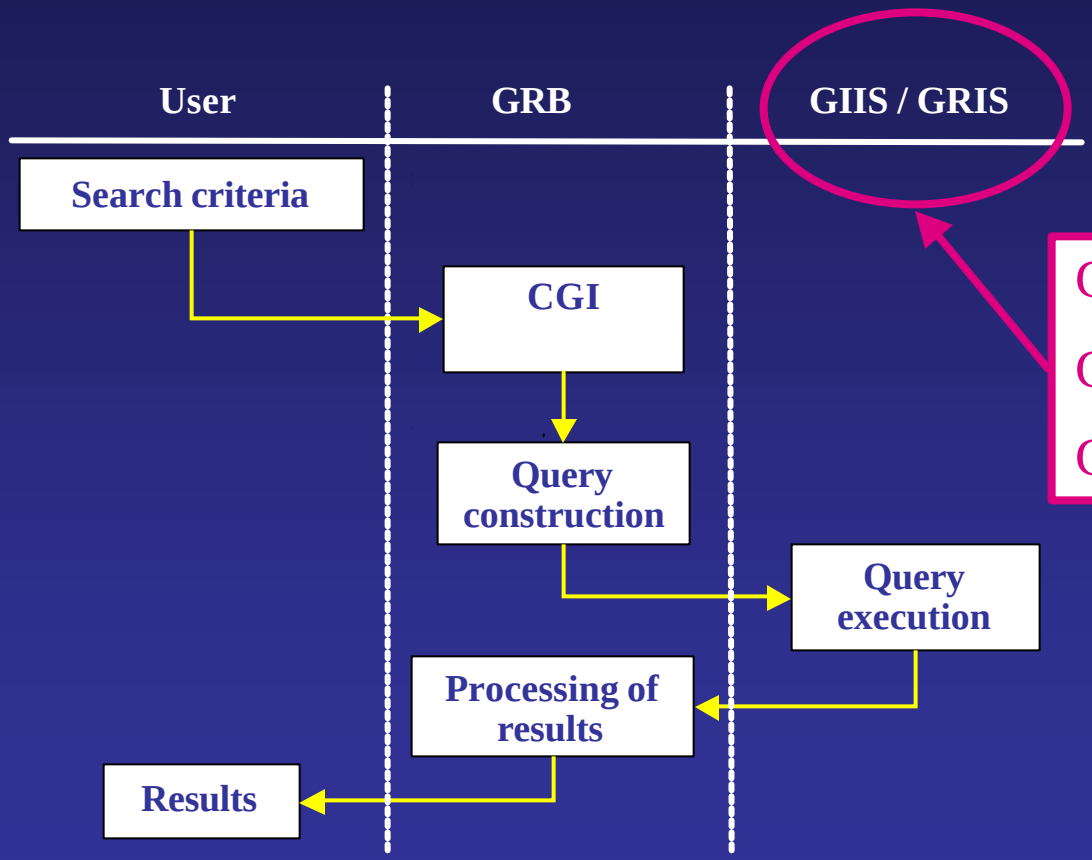
Job Submission & Brokering

GRB Services



Information Service

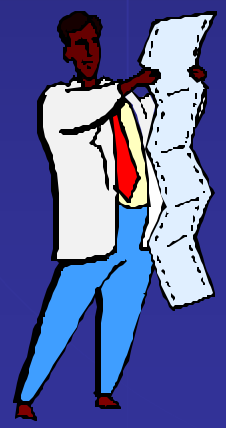
Searching for Information



GIIS e GRIS: LDAP server

GIIS: yellow pages service

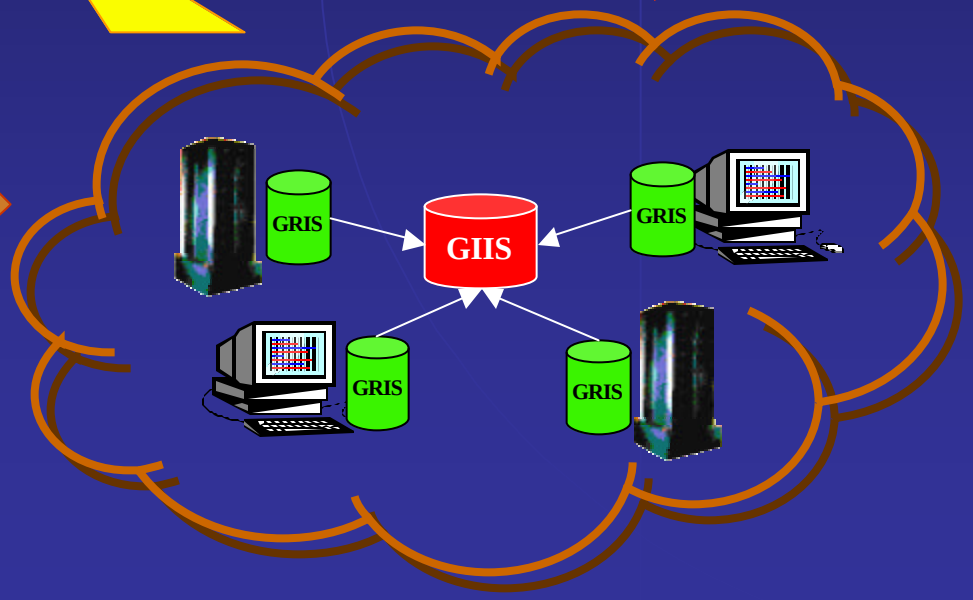
GRIS: white pages service



Information Service: GIIS

Tell me about the computing resources belonging to the HPC Lab that are uniprocessor Linux workstation, with low CPU load and available memory < 250 Mbyte

sara.unile.it



WEB

Information Service: GIIS

Search a GIIS for machines with specif featu

GIIS	sara.unile.it
Port	2130
Base DN	dc=unile, dc=it, o=Grid

The following fields can be used to do a s

OS Name	linux
OS Version	
OS Release	
Manufacturer	
Model	
Type	workstation
OSType	
CPUType	

The following fields can be used to do an exact search
Please check the fields you want to include in the search

CPUCount	=	1	☑
CPUSpeed [MHz]	<=	500	☐
CPULoad1	<=	1	☑
CPULoad5	<=	1	☑
CPULoad15	<=	1	☐
Memory (MBytes)	<=	250	☑

Allows query to arbitrary GIIS servers

Search criteria

Information Service: GIIS

Search results - Microsoft Internet Explorer

File Modifica Visualizza Preferiti Strumenti ?

Indietro Avanti Termina Aggiorna Pagina iniziale Cerca Preferiti Cronologia Posta Stampa Discussione

Indirizzo http://sara.unile.it/cgi-bin/giis_search

Search results :

GIIS : sara.unile.it
Port Number : 2130
Base DN : dc=unile, dc=it, o=Grid

dn : hn=escher.unile.it, dc=unile, dc=it, o=Grid

manufacturer:	unknown
model:	Pentium III (Katmai)
type:	workstation
osname:	linux
osversion:	x686 unknown linux 2.2.14-15mdk
osrelease:	2.2.14-15mdk
ostype:	linux
physicalmemorysize:	124 MBytes
cputype:	GenuineIntel Pentium III (Katmai) 6 (step 3) (fpu vme de pse tsc msr pae mce cx8 sep mtrr pge mca cmov pat pse36 mmx fxsr xmm)
cpucount:	1
cpuspeed:	551 MHz
cpuload1:	0.80
cpuload5:	0.17
cpuload15:	0.05

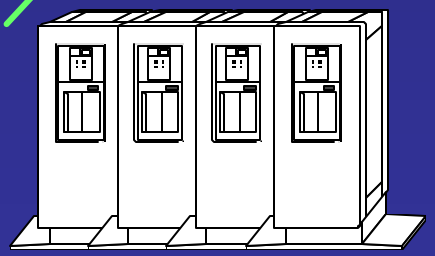
dn : hn=giotto.unile.it, dc=unile, dc=it, o=Grid

manufacturer:	unknown
model:	Pentium III (Katmai)
type:	workstation
osname:	linux
osversion:	x686 unknown linux 2.2.14-15mdk
osrelease:	2.2.14-15mdk
ostype:	linux
physicalmemorysize:	124 MBytes
cputype:	GenuineIntel Pentium III (Katmai) 6 (step 3) (fpu vme de pse tsc msr pae mce cx8 sep mtrr pge mca cmov pat pse36 mmx fxsr xmm)
cpucount:	1
cpuspeed:	551 MHz
cpuload1:	0.18
cpuload5:	0.04
cpuload15:	0.01

Information Service: GRIS

Tell me about the features of "wyglaf.unile.it"

WEB



GRIS

wyglaf.unile.it

Information about a machine

dn: sw=Globus, hn=wyglaf.unile.it, dc=unile, dc=it, o=Grid

dn: hn=wyglaf.unile.it, dc=unile, dc=it, o=Grid

rn	Host wyglaf.unile.it
canonicalsystemname	i686 unknown linux 2.2.14-15mdk
manufacturer	unknown
model	Pentium II (Deschutes)
type	workstation
osname	linux
osversion	i686 unknown linux 2.2.14-15mdk
osrelease	2.2.14-15mdk
ostype	linux
physicalmemorysize	251 MBytes
cputype	GenuineIntel Pentium II (Deschutes) 6 (step 1) (fpu vme de pse tsc msr pae mce cx8 sep mtrr pge mca cmov pat pse36 mmx fxsr)
cpucount	1
cpuspeed	350 MHz
cpuload1	1.03
cpuload5	0.28
cpuload15	0.10

dn: service=jobmanager, hn=wyglaf.unile.it, dc=unile, dc=it, o=Grid

cputype	i686
osversion	2.2.14-15mdk
osname	linux
manufacturer	unknown

Resource Allocation

Interactive job submission

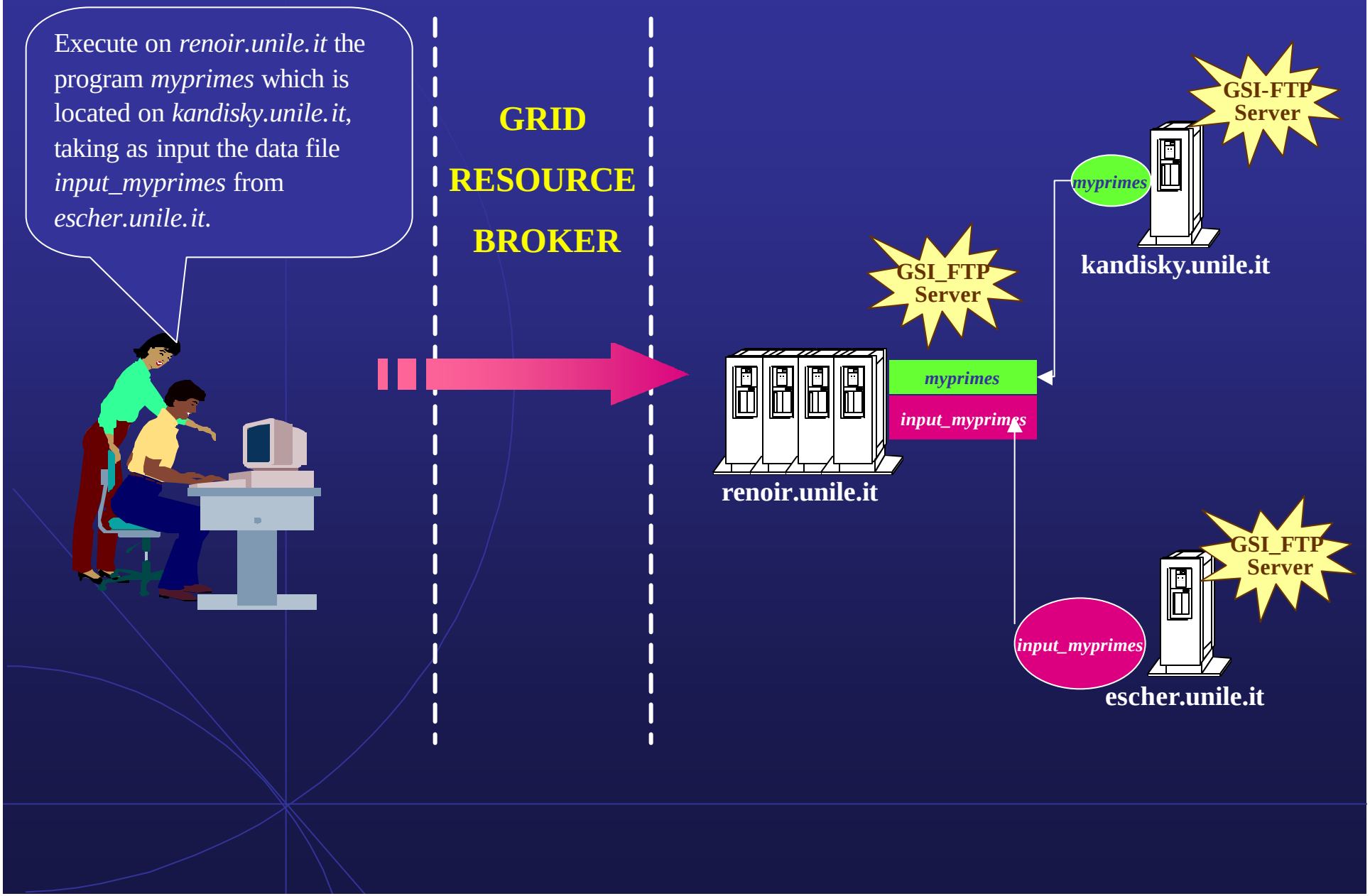
→ **Remote execution with automatic staging of executable & input files; output sent back on the client browser**

Batch job submission

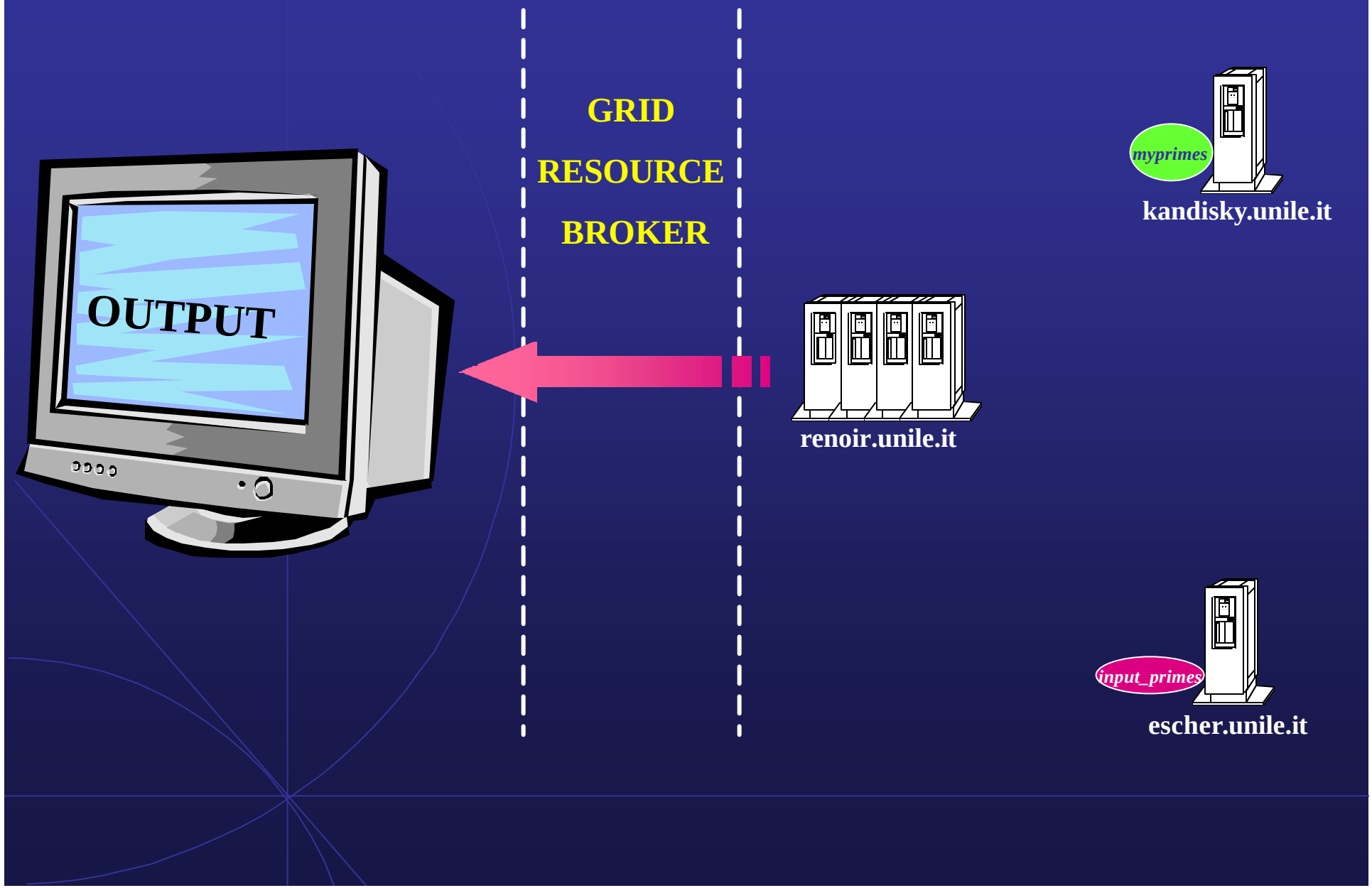
→ **Remote execution with Automatic staging of executable, Input/output files**

→ **Job status monitoring**

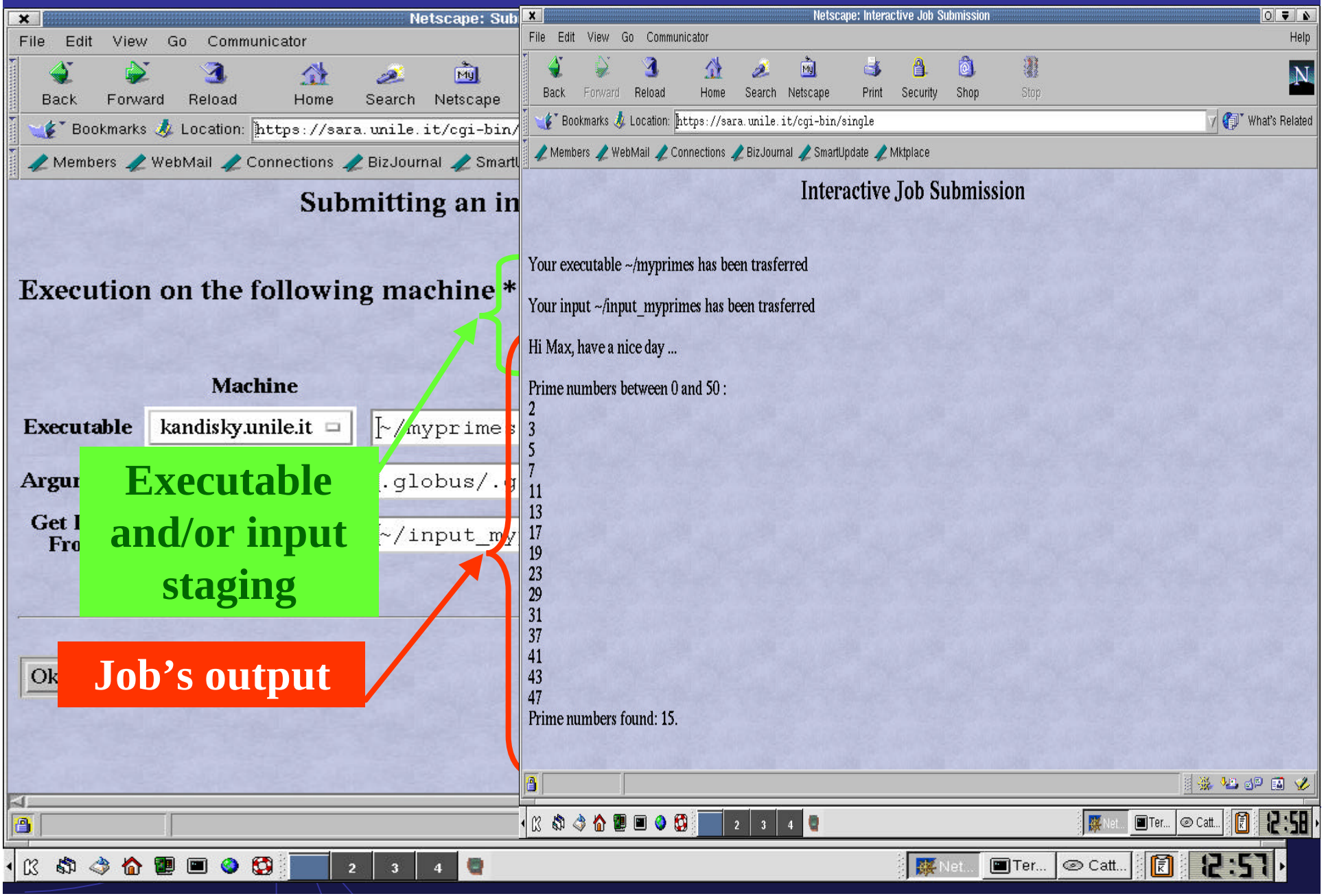
Resource Allocation: interactive job



Resource Allocation: interactive job



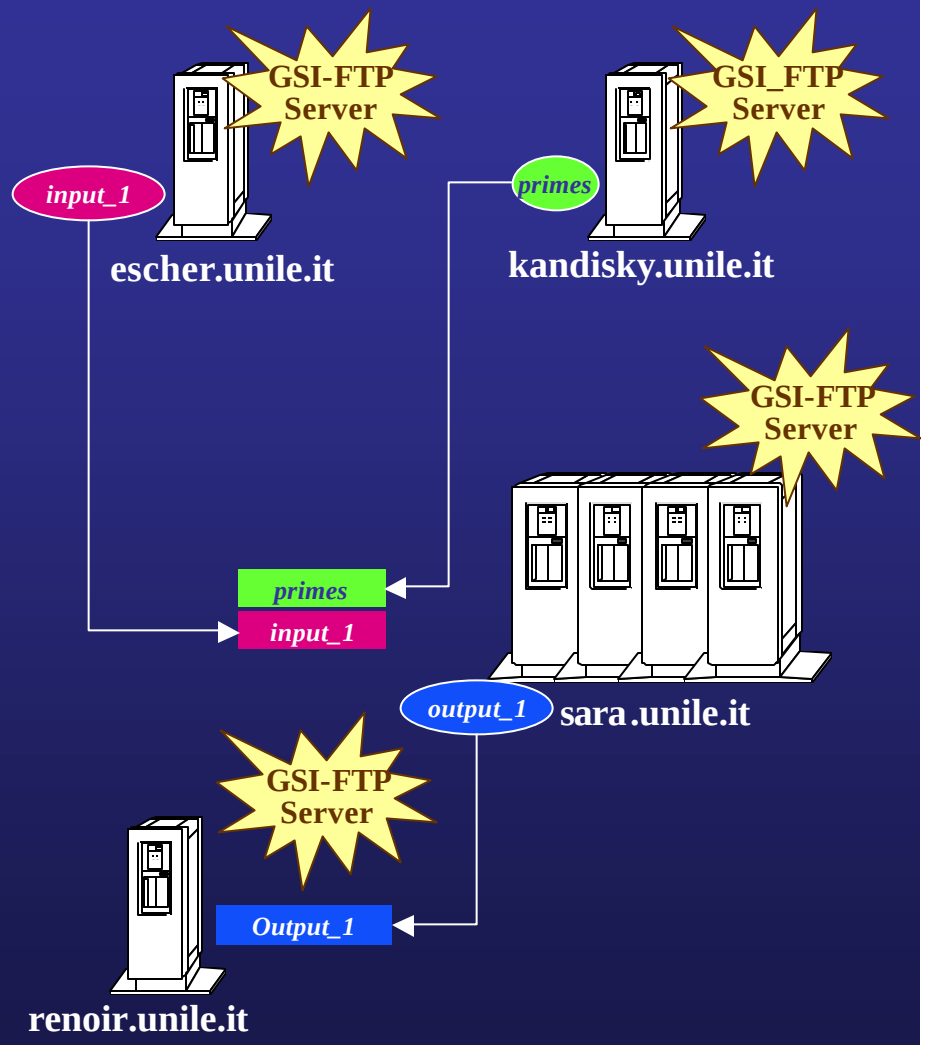
Resource Allocation: interactive job



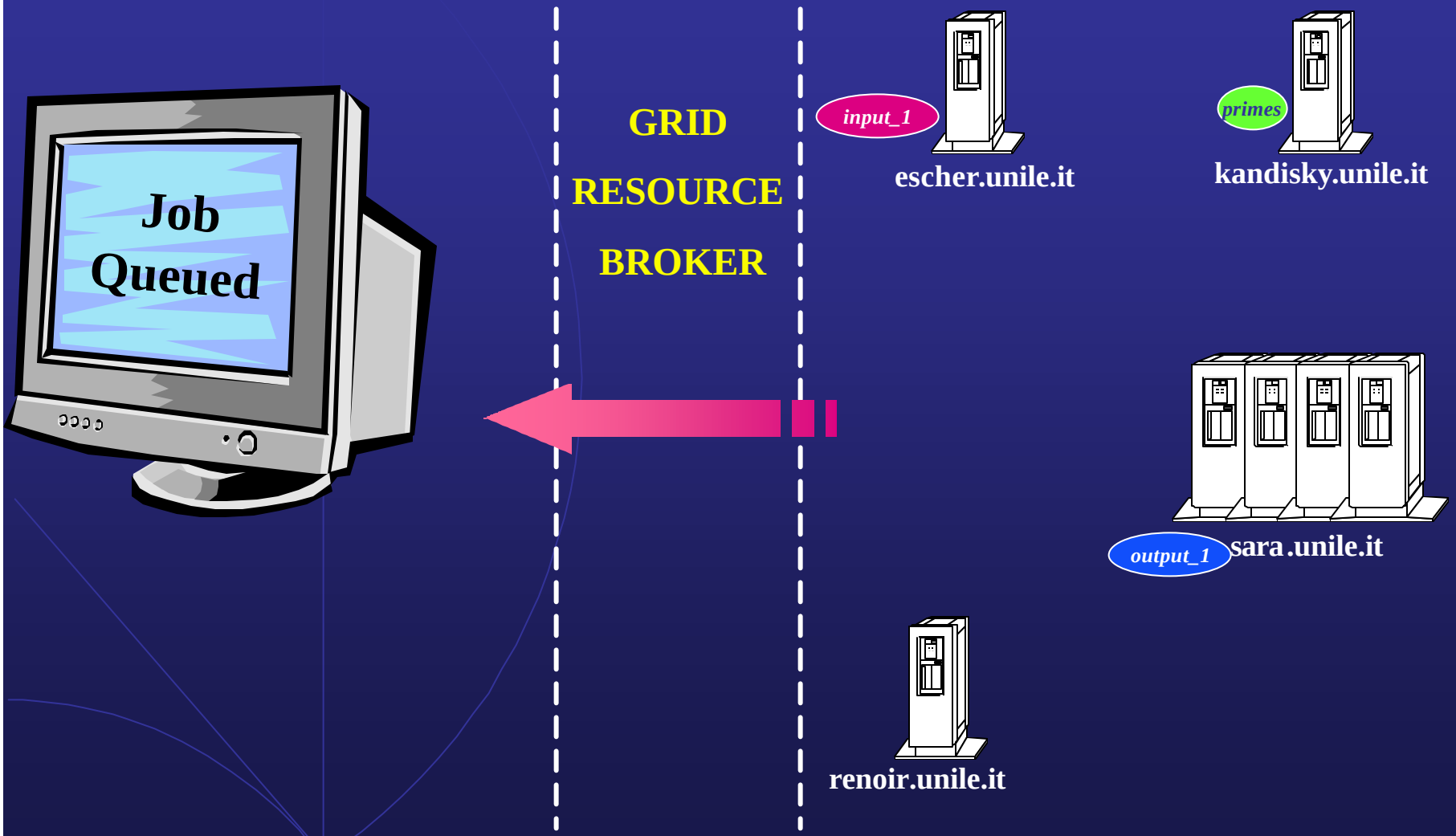
Resource Allocation: batch job

Execute on *sara.unile.it* the program *primes* which is located on *kandisky.unile.it*, taking as input the data file *input_1* located on *escher.unile.it* and send the output to the file *output_1* on *renoir.unile.it*

GRID RESOURCE BROKER



Resource Allocation: batch job

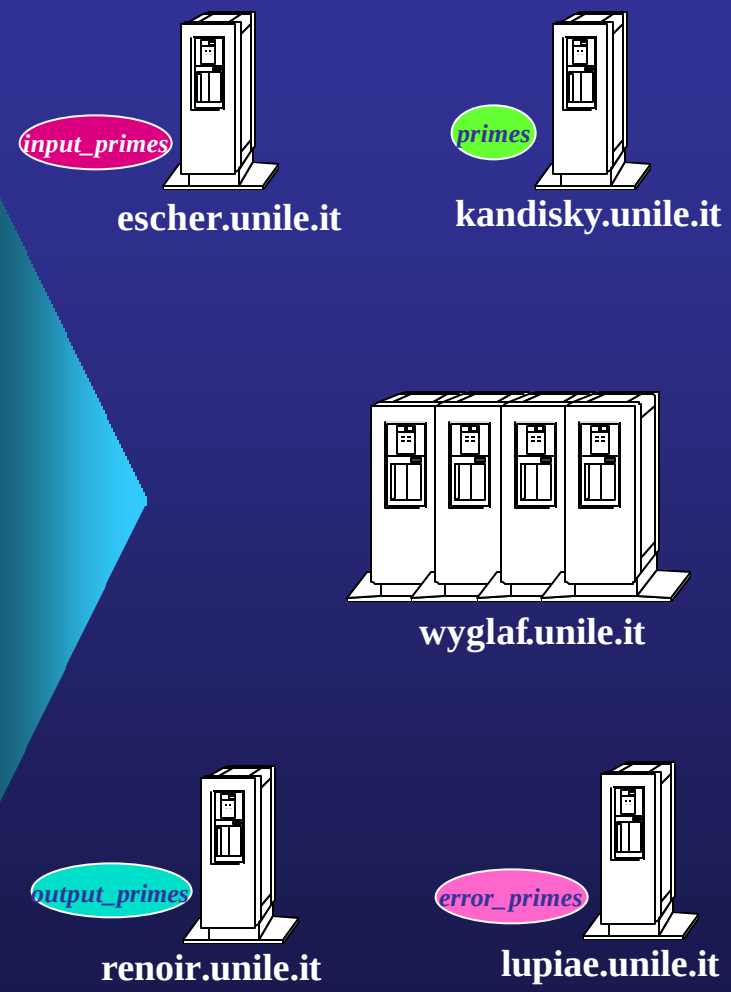


Resource Allocation: job status monitoring

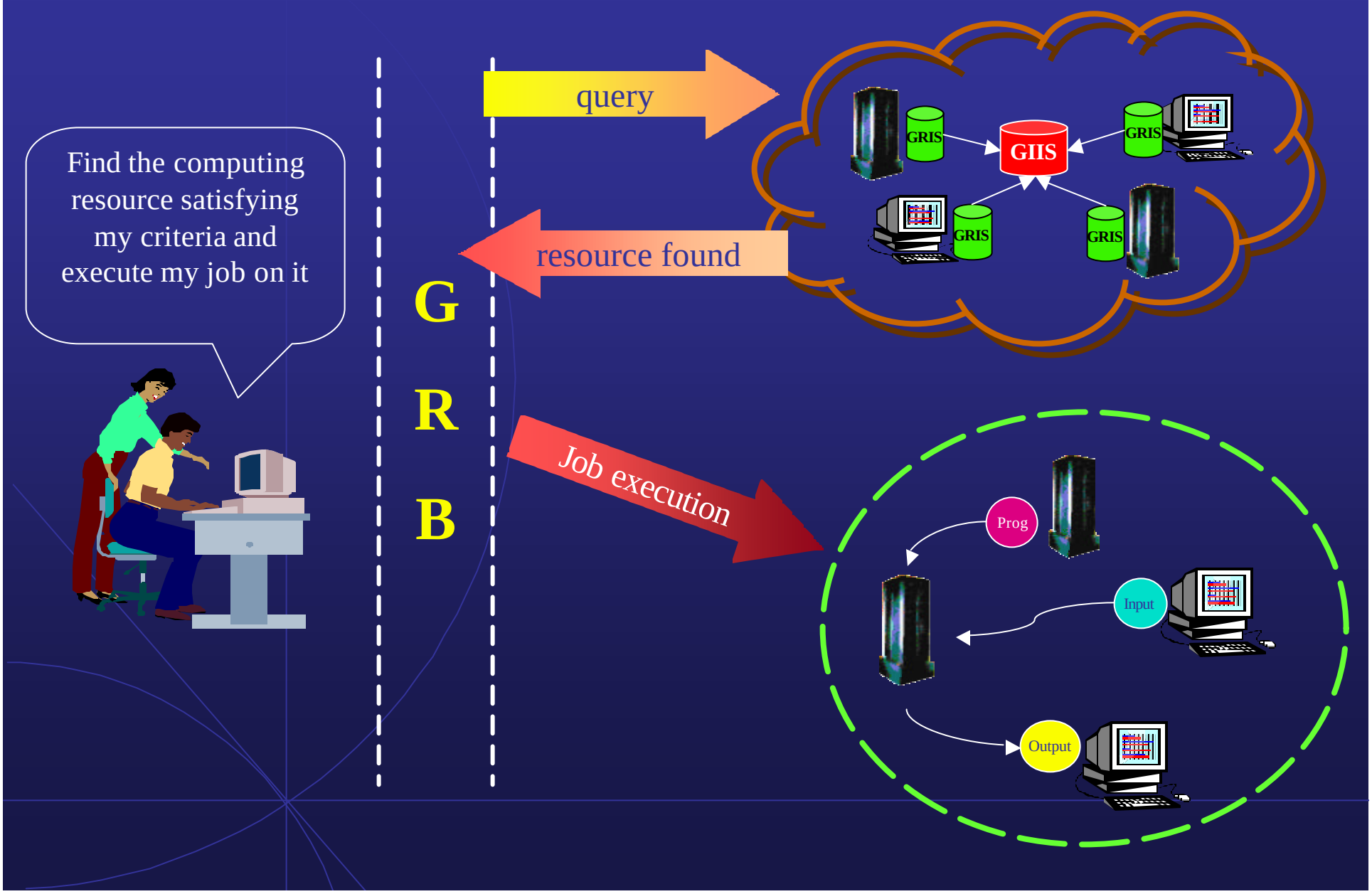
Job Status

Executable	sleep 10
Date	*Fri May 18 10:54:29 2001*
Job URL	https://datadog.unile.it:3850/10993/990175978/
Status	DONE

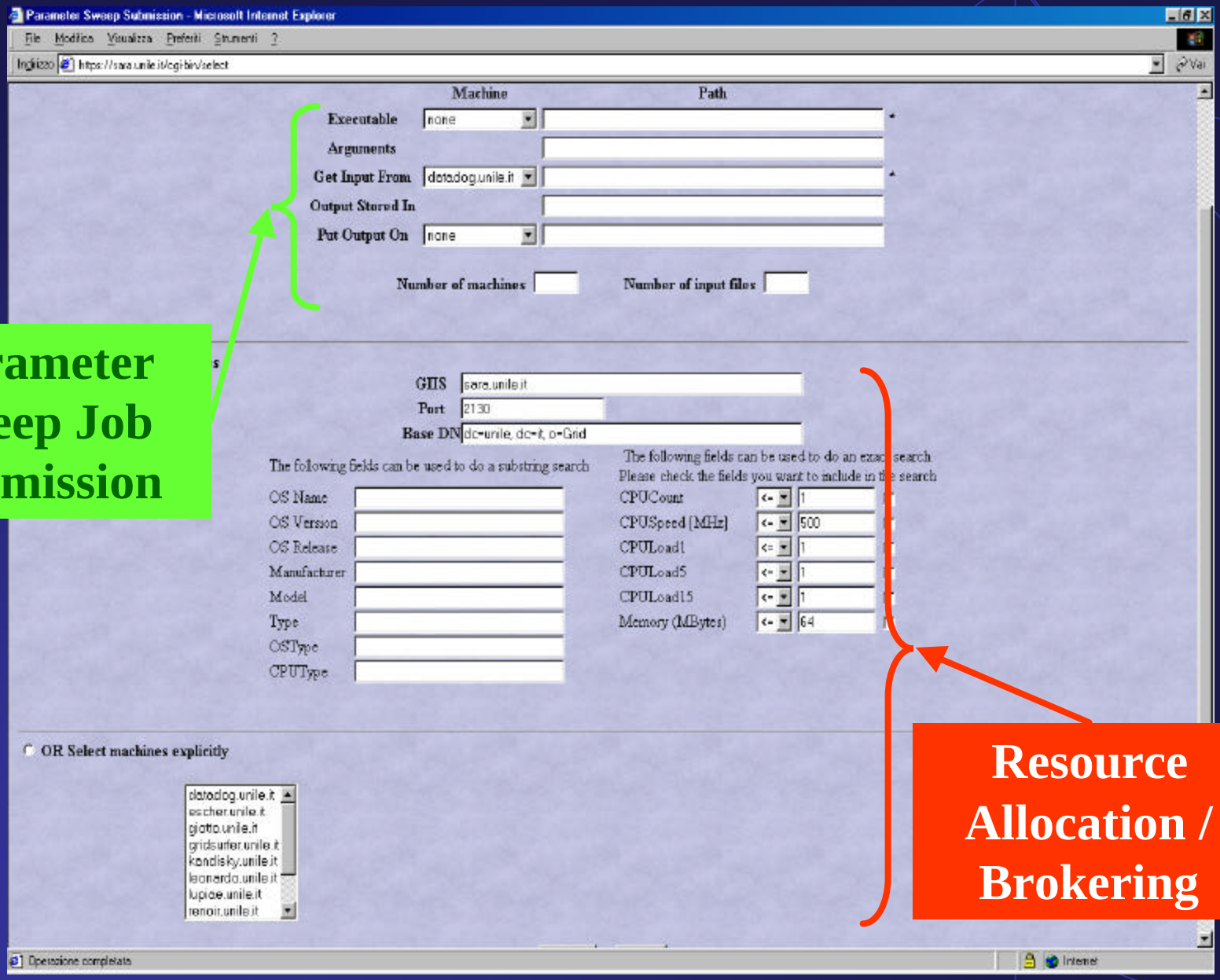
Executable	sleep 30
Date	*Fri May 18 10:54:38 2001*
Job URL	https://datadog.unile.it:3854/11034/990175988/
Status	ACTIVE



Brokering & job execution



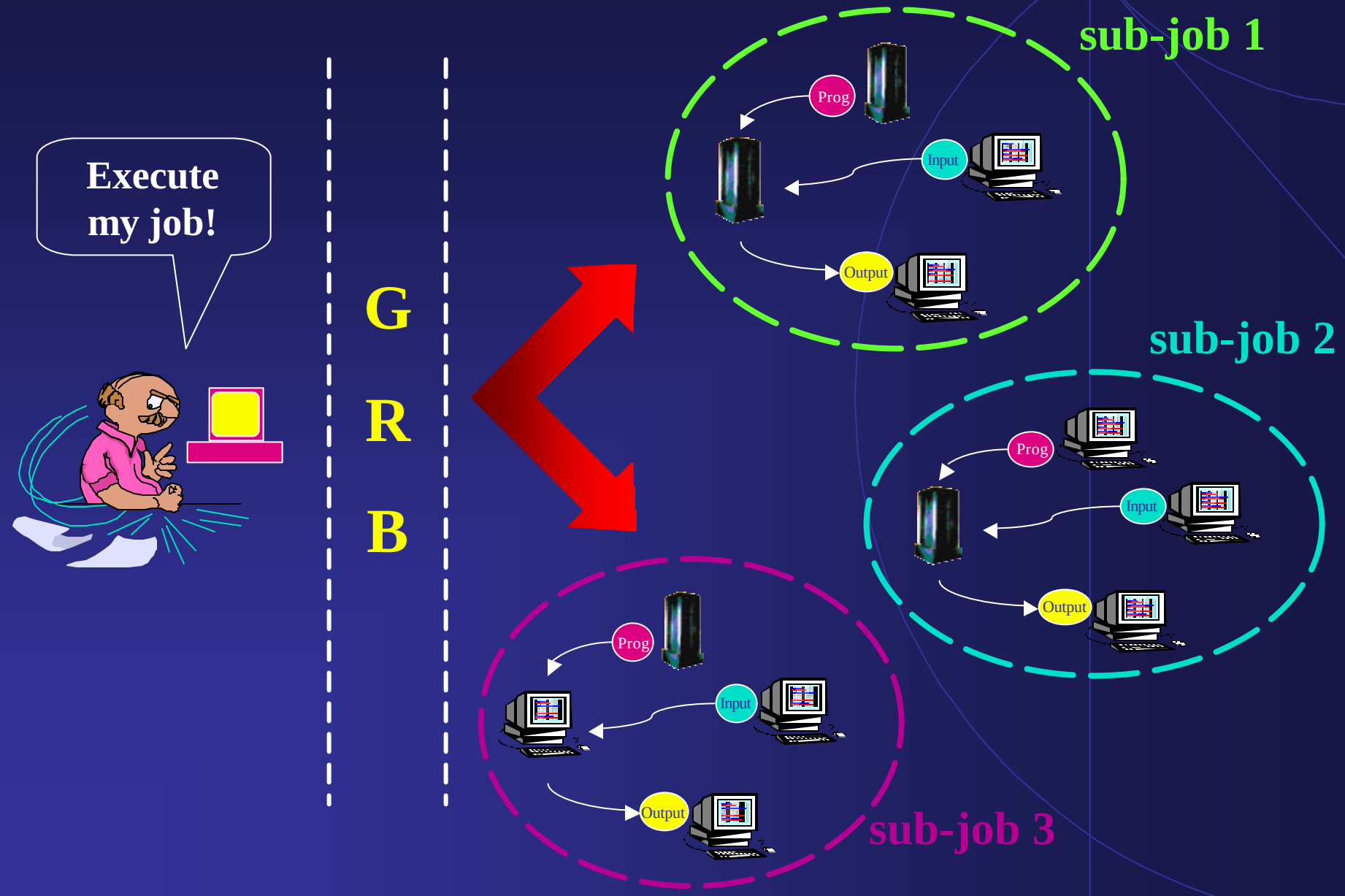
Parameter Sweep Job Submission



Parameter Sweep Job Submission

Resource Allocation / Brokering

Parameter Sweep Job Submission



GRB Library: sample functions

- Proxy management
  - Grb_generate_proxy
  - Grb_destroy_proxy
- Job submission
  - Grb_job_submit
  - Grb_job_submit_parameter
  - Grb_batch_wait
  - Grb_batch_nowait
- File transfer
  - Grb_gsiftp_copy
- Information services
  - Grb_search_giis
  - Grb_search_gris
- Job status
  - Grb_batch_job_status
  - Grb_parameter_job_status

GRB GSIFTP Library: sample functions

- Connection management
  - Grb_gsiftp_connect
  - Grb_gsiftp_quit
- Standard ftp commands
  - Grb_gsiftp_chdir
  - Grb_gsiftp_get_cwd
  - Grb_gsiftp_chmod
  - Grb_gsiftp_delete
  - Grb_gsiftp_list
  - Grb_gsiftp_mkdir
  - Grb_gsiftp_type
  - Grb_gsiftp_rename
  - Grb_gsiftp_size
- Put / get / thirdy-party transfer
  - Grb_gsiftp_parallel_put
  - Grb_gsiftp_parallel_get
  - Grb_gsiftp_parallel_copy
- Recursive put / get / thirdy-party transfer / rmdir
  - Grb_gsiftp_put_recursive
  - Grb_gsiftp_get_recursive
  - Grb_gsiftp_copy_recursive
  - Grb_gsiftp_rmdir_recursive

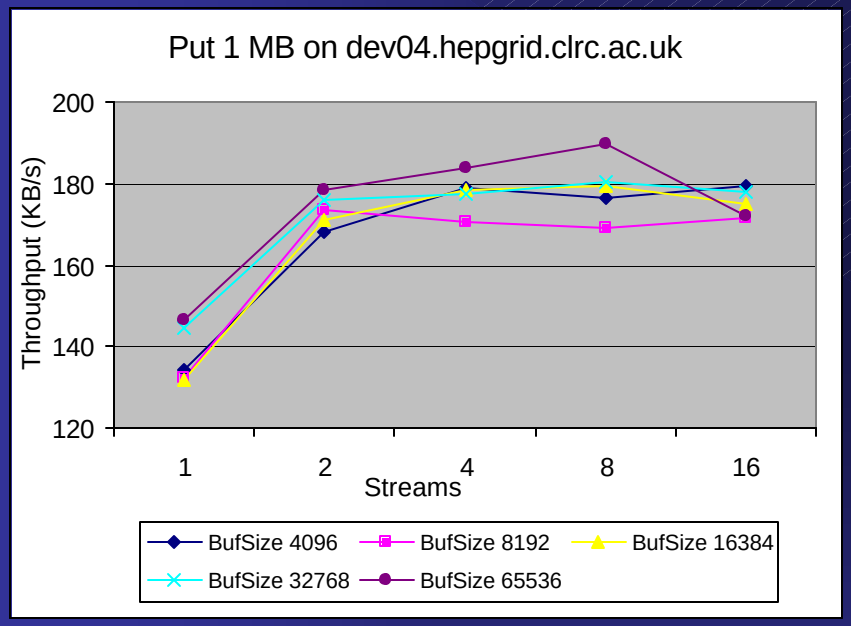
GRB GSIFTP Library: some experimental results

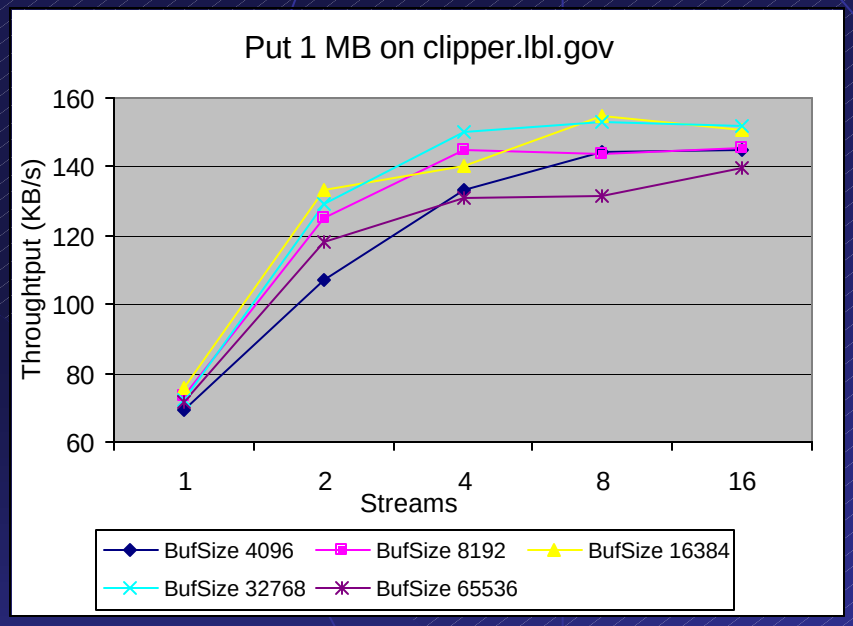
The testbed

Hostname	OS	TCP Buffer Size	GSIFP server
Gridsurfer.unile.it	Linux 2.4.3	65535	gsi-wuftpd-0.4b5
Clipper.lbl.gov	Solaris 2.7	65535	gsi-wuftpd-0.4b4
Dev04.hepgrid.clrc.ac.uk	Linux 2.2.16	65535	gsi-wuftpd-0.4b5

GRB GSIFTP Library: some experimental results

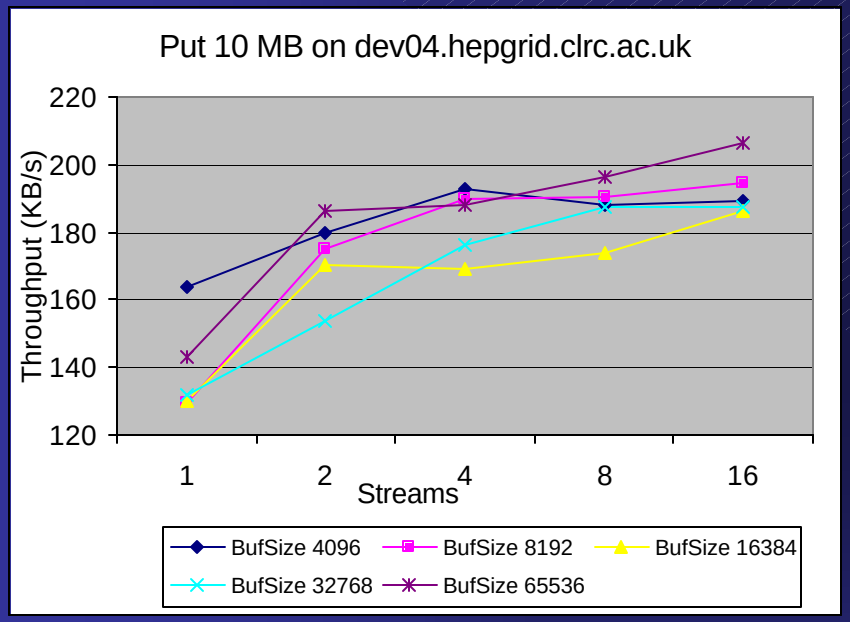
Put one Mb test

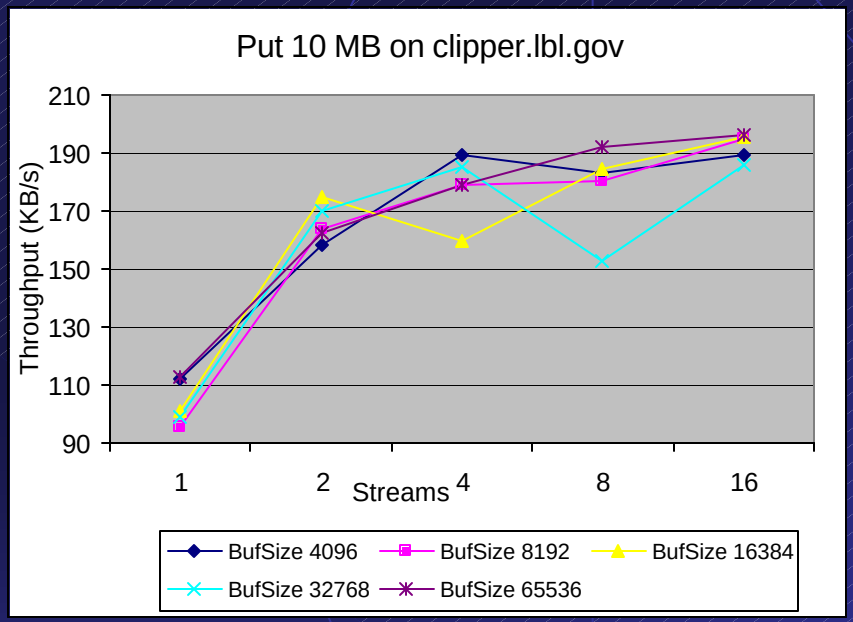




GRB GSIFTP Library: some experimental results

Put ten Mb test



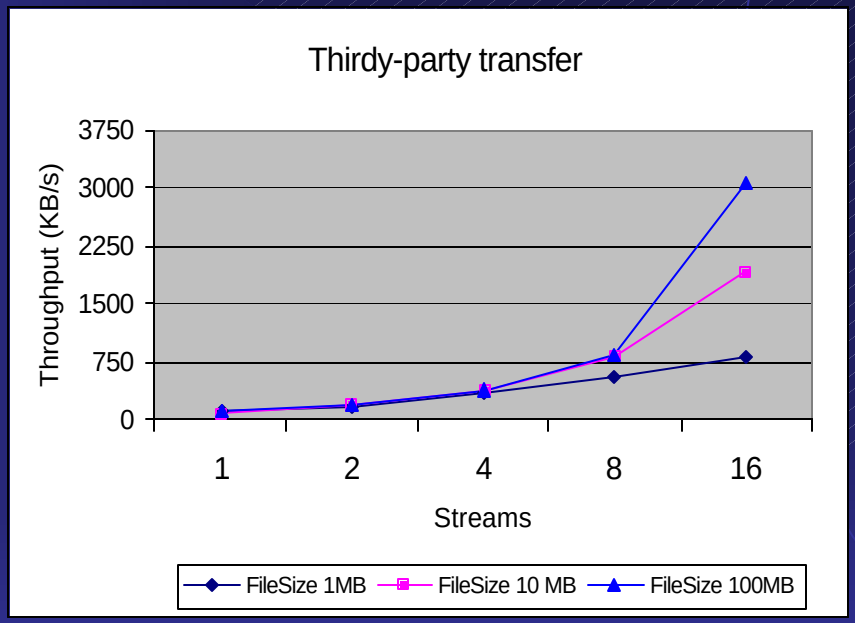


GRB GSIFTP Library: some experimental results

Thirdy-party transfer test

File size: 1, 10, 100 MB

From UK to LBL



Conclusions

Heterogeneous and geographically spread computing resources → **Computational Grid**

Low Level Middleware for Grid management → **Globus Toolkit**

Web access to the grid: secure, easy, transparent → **Grid Resource Broker**

Conclusions

GRB Features

- Fast access to Globus services
- User-friendly web gui
- Very general grid tool
- No need to write specialized code
- No need to rewrite legacy code
- C Api and libraries for developers