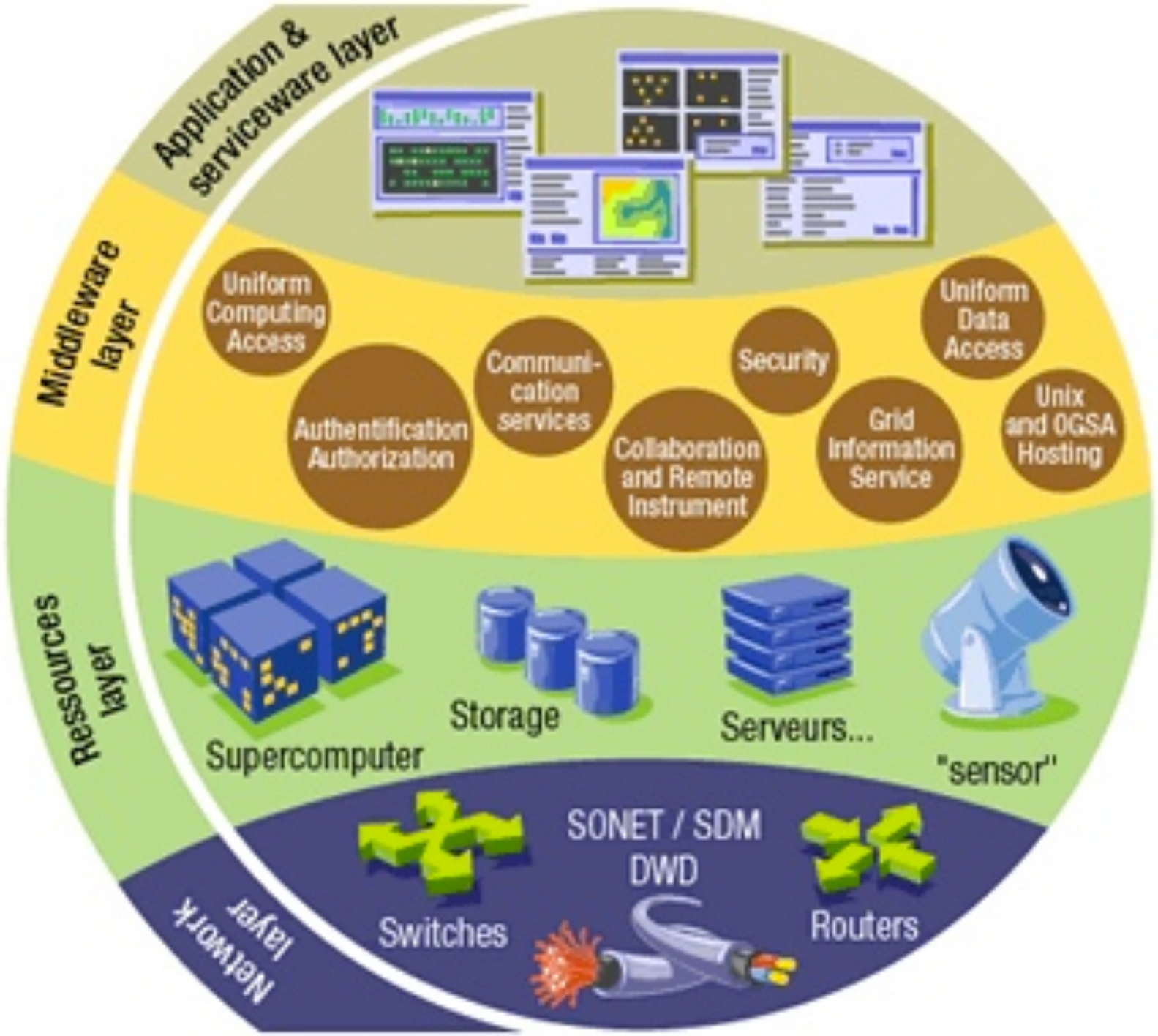
Introduction to Globus 5

GridKa Summer School 2010

Overview

- General
  - Grid, Globus Toolkit Overview
  - Authentication & Authorisation (A&A)
    - PKI, Certificates
    - GSI, Proxy Certificates, MyProxy, Short Lived Credentials
- GT5
  - Interactive Access
    - GSI-OpenSSH
    - Clients
  - Data Transfer
    - Globus GridFTP
  - Job Submission
    - GRAM5
  - Data movement service
    - Globus.org

Grid Architecture



http://www.gridcafe.org

It´s about Grid computing

- Resource sharing
  - Distributed computing
  - Computing sites

- Secure access
  - Trust between resource providers and users

Grid Computing at LRZ

- LRZ provides resources via Globus, UNICORE, gLite
- D-GRID
  - LRZ is centre of excellence for Globus in D-Grid
- DEISA and PRACE
  - LRZ coordinates Globus related activities
- EGI
  - Start support for Globus in EGI-InSpire

IGE (Initiative for Globus Europe)

- Coordination of European Globus activities
- Introduce adjustments critical for Europe into Globus code base
- Act as Globus service provider for European Grids like DEISA, PRACE, and EGI
- Measure Globus software quality
- Training, promotion, and documentation
- Organize Globus Europe conference and Globus community forum
- Bundle European input to Globus

Globus Overview

- Globus Alliance
  - International community to drive the development of Globus

- Globus Toolkit
  - Set of tools for building Grid systems and applications
  - Open source
  - Developed worldwide

Authentication and Authorisation

- Public Key Cryptography and Infrastructure (PKI)
- User and CA Certificates
- Grid Security Infrastructure (GSI)
- Proxy Certificates
- MyProxy Service
- Short lived credential service

Authentication and Authorisation (AA)

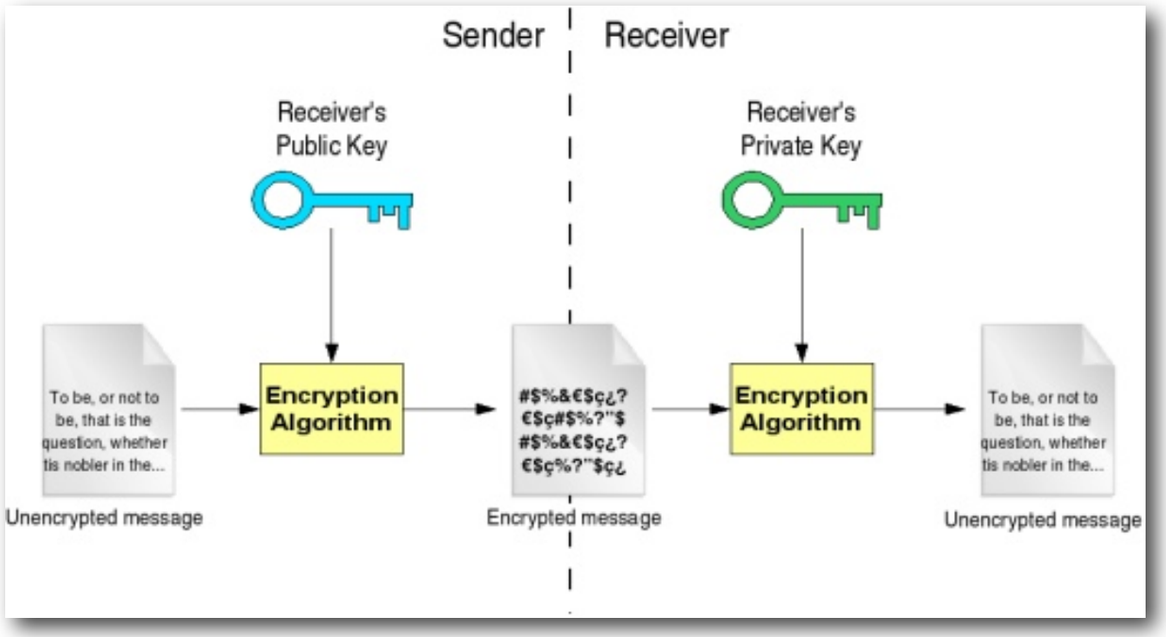
- Authentication is the process to
  - Verifying that s.b./s.th. is who he claims to be
  - Identify a user or a resource

- Authorisation is the process to
  - Give permission to perform certain operations or access specific resources

Public Key Cryptography

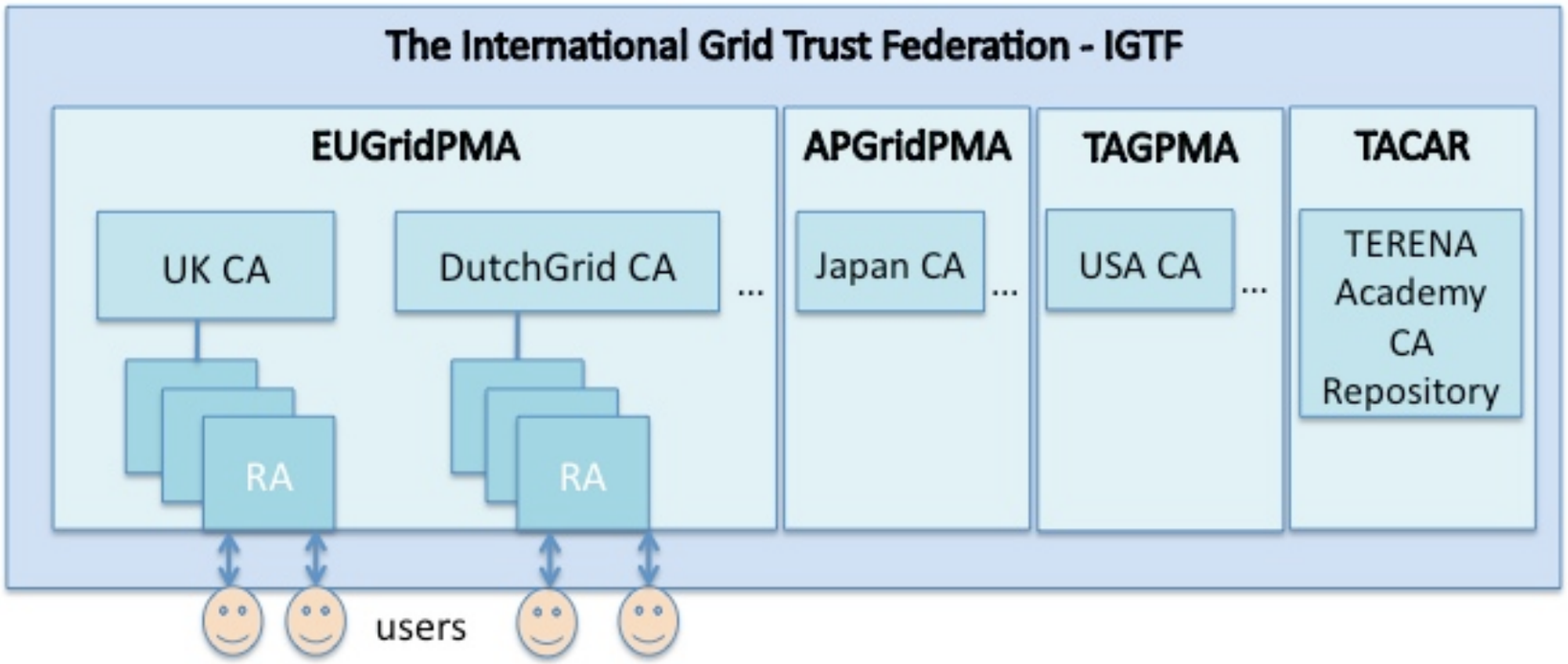
- Private Key: File - only the owner may know the content
- Public Key: File - one can/have to give it to other people
  - Sender uses his Private Key to **sign** his message.
    Then the receiver can **verify** if the message was created by the sender and not **tampered** with the sender´s public key

  - Sender uses recipient´s Public Key to **encrypt** the message.
    Then the message is only **decryptable** with the recipient´s corresponding Private Key



Grid Security Infrastructure (GSI)

- Based on Public Key Infrastructure (PKI)
- Allows to identify a person to be authorized by a resource provider without previous communication
- Certificate Authority (CA)
  - Trusted 3rd party that confirms identity and issues certificate
  - Using a CA means you trust that this CA verified person/host after common rules



Certificates

- Certificates - Central concept in GSI
  - Distinguished Name – unique Grid id for user/service
    - Example: "/C=DE/O=GridGermany/OU=Leibniz/CN=Your Name"

- Certificate proves who you are - security!
  - Keep your user certificate in a private directory
  - Revoke your certificate immediately if there are indications that your certificate is compromised

- Authentication
  - Both sides must have CA certificates that they trust
  - Certificate is used to authorise user and resource provider against each other

Certificate Formats

- PEM-format:
  - Separate files for certificate and private key (.pem)
    - Used by Globus toolkit (gsissh, gridftp, ...)

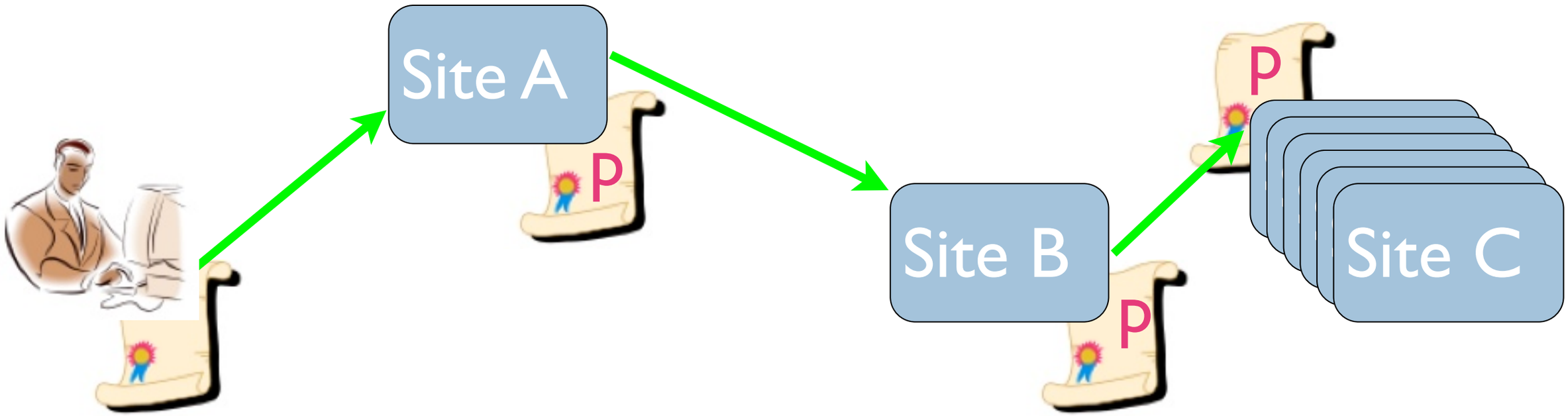
- PKCS12 (Certificate Container):
  - Can include private key, certificate and/or CA certificate
  - Used by web browsers, also by Globus
  - Transformations are possible, e.g. via openssl

Grid-mapfile

- Authorisation in GSI via grid-mapfile
- Mapping of global DN to a local system account
- Format: Textfile (“DN“ local Account)
  Example entry:
  - “/C=DE/O=GridGermany/OU=Leibniz/CN=Your Name“ lrz28230
- All GSI-Services use grid-mapfile

Proxy Delegation

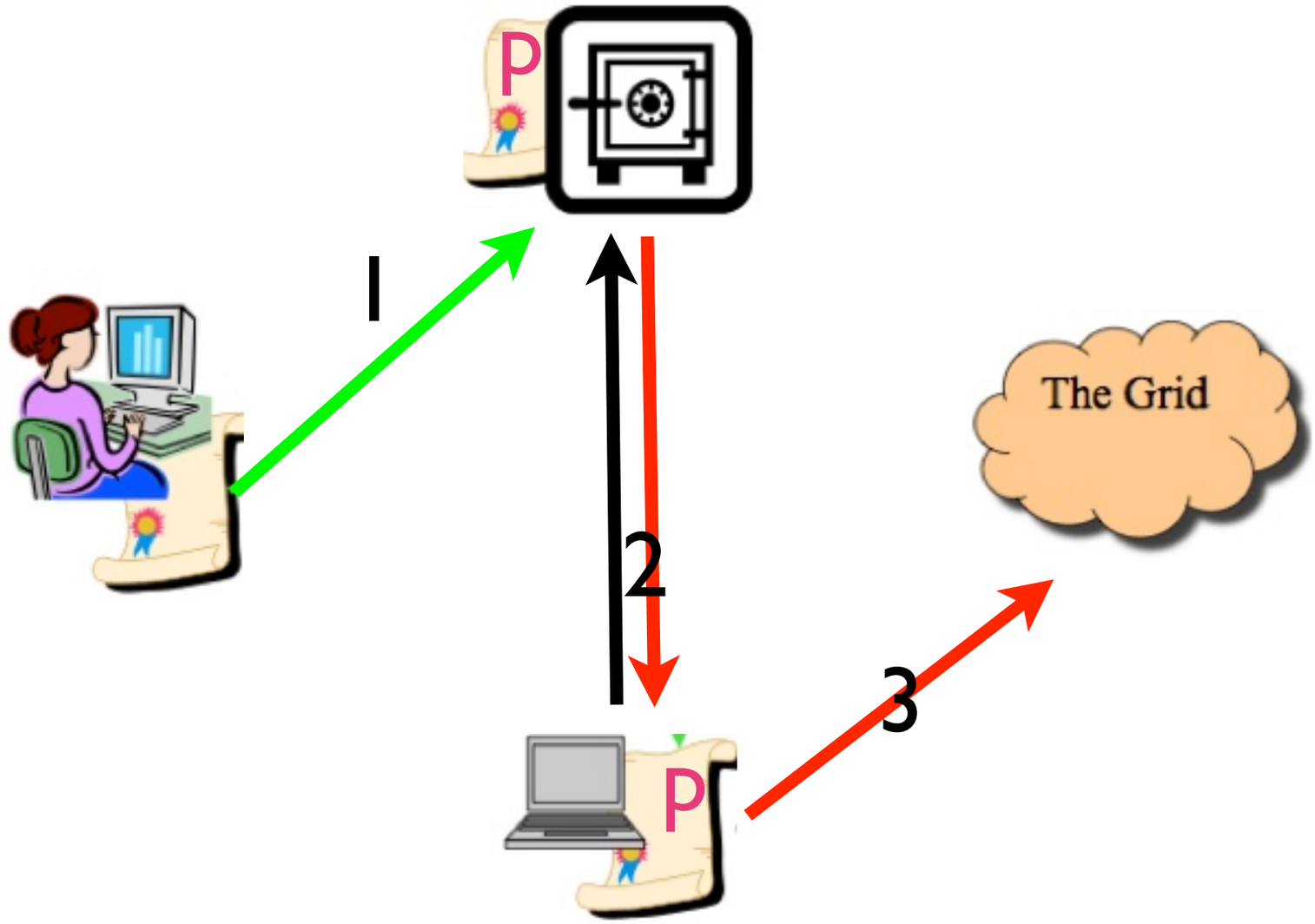
- Resource can delegate a proxy for its access to further resources (Delegation)



Proxy Certificates

- Proxy Certificates
  - Backbone of trust delegation
  - Security gain:
    - No password has to be transmitted
    - Limited life time of the proxy certificate
    - Limited capability
  - Generated from user certificate key pair
    - Signed with your normal private key
  - Proxy certificate **consists** of
    - User normal public certificate
    - Newly generated proxy private key – without password
- Single sign-on: Login only once
  - Only type your password once (for your private key)
- Used by Globus services

MyProxy - Credential Repository



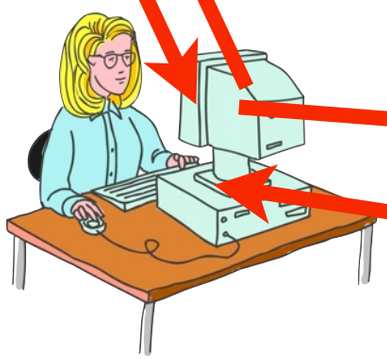
Short Lived Credential Service (SLCS) (1)

Identity Provider (RWTH)

Identity Provider (MPG)

Identity Provider (LRZ)

3



1

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Shibboleth.

5

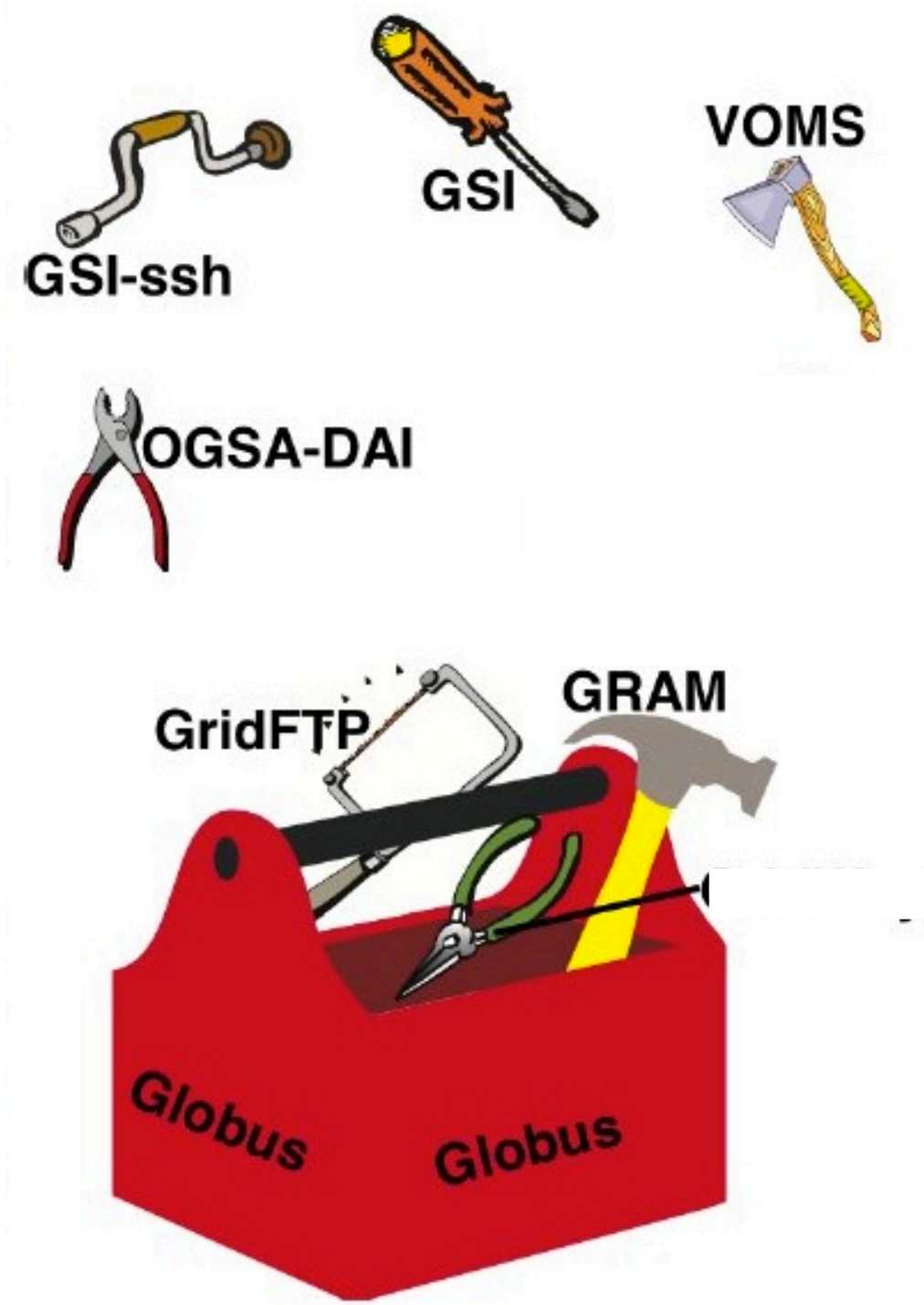
SLCS (DFN)

Short Lived Credential Service (SLCS) (2)

- Alternative for long-lived certificate
  - Without visiting a RA
- Institutes/companies already checked your id
- User is authenticated by **home institute** via web browser with username and password and gets a short-lived certificate
  - Only valid for a short period of time (e.g. one week)
  - Proxy certificate

Globus Toolkit

- GSI
  - The backbone
- GSI-ssh
  - Secure access
- VOMS
  - VO membership service
- OGSA-DAI
  - Data integration
- GridFTP
  - Super fast data transfer
- GRAM
  - Job submission framework



What´s new in GT5?

- Job submission is now GRAM5
  - Compatible with Globus v. 2.x. NOT with v. 4.x Web Services GRAM
- There is no Web Services interface (Java container) any more
  - Crux toolkit will be released later to overcome this issue
    Keywords: "service oriented"
- No MDS information system anymore
  - Integrated Information Services (IIS) to replace in the future
- New GridFTP features
  - Resumeable file transfer
  - Compatible with older versions.
    No Reliable File Transfer (rft) anymore
- GSI-SSH and MyProxy are compatible with older versions

Interactive Access Overview

- GSI-OpenSSH
- Clients
- Login to a remote site

GSI-Enabled OpenSSH Server

- GSI-OpenSSH is a modified version of OpenSSH
- Added support for GSI authentication and credential forwarding (delegation)
- Provides a single sign-on remote login

Setup the GSI-Enabled OpenSSH Server

- Acquire a host certificate for the GSI-SSHD host.
- Authorise users you want to be able to connect with GSI SSH
  - grid-mapfile
- Configure and run the GSI-SSH daemon
  - Optional: Allowing only GSI authentication

GSI-Enabled OpenSSH Clients

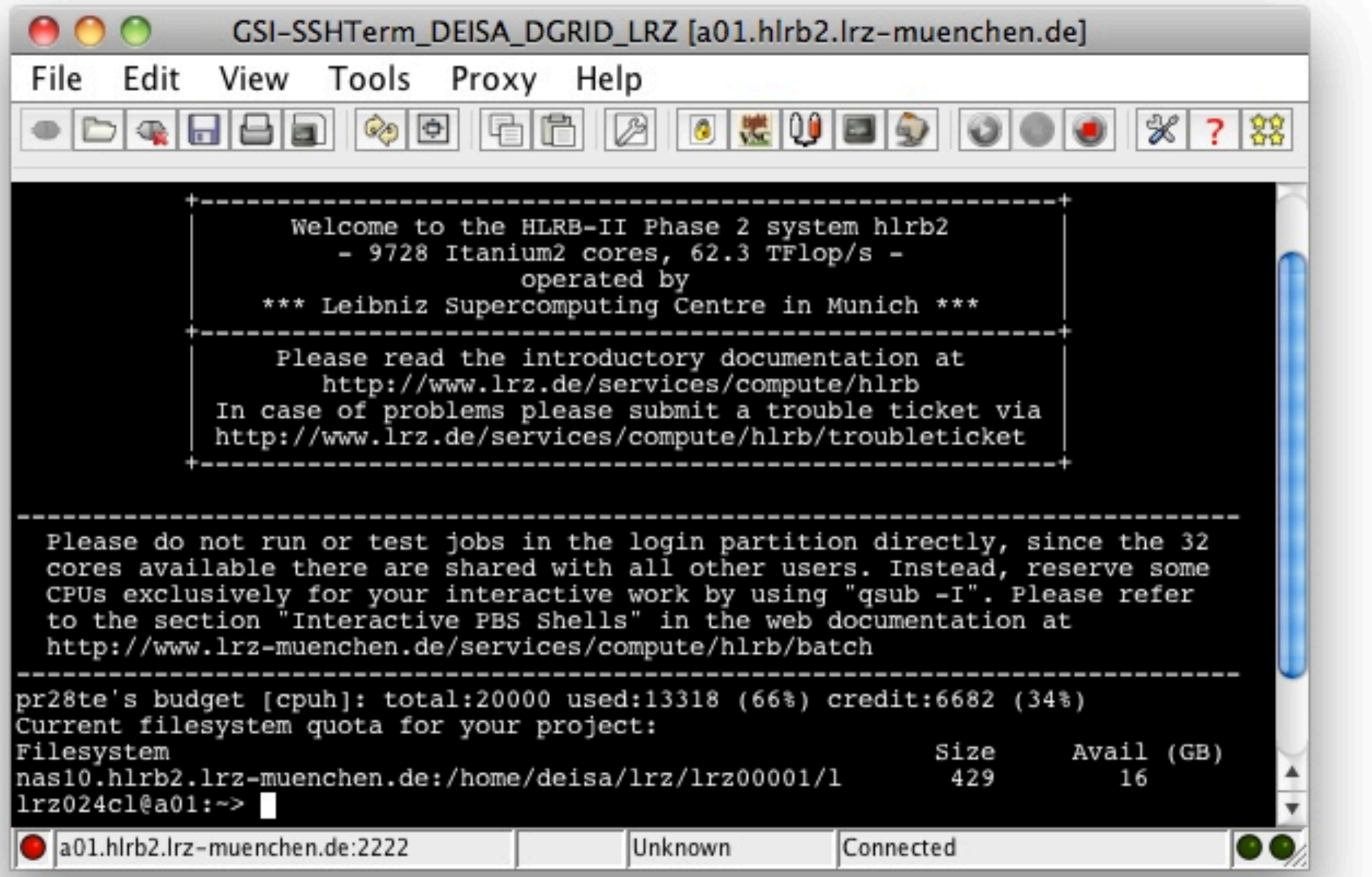
gsissh	gsissh-term
Native shell tool	Java (+ Java-Webstart)
Needs to install (a subset of) GT	Easy installation – cross platforms
As your user interface	Java look and feel

Client: GSI-Enabled OpenSSH Client

- Creating proxy credentials:
  - `grid-proxy-init`
- Information about your created proxy:
  - `grid-proxy-info`
- Login:
  - `gsissh host`
- Delete your proxy:
  - `grid-proxy-destroy`
    - highly recommended – for security reason!

Client: GSISSH-Term

- GSISSH-Term login to HLRB-II (operated at LRZ):



Data transfer with GridFTP Overview

- What is GridFTP?
- Third Party Transfers
- Performance Options
- Clients
  - GSISSH-TERM
  - globus-url-copy

What is GridFTP?

- High-performance, reliable data transfer protocol optimized for high-bandwidth wide area networks

- Based on FTP protocol - defines extensions for high-performance operation and security
  - Authenticate control and data channels with GSI

- Standardized through Open Grid Forum (OGF)

- GridFTP is the OGF recommended data movement protocol

Understanding GridFTP

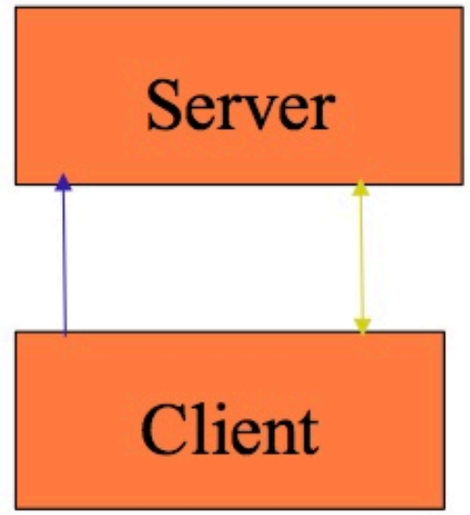
- Two channel protocol like FTP

- Control Channel
  - Command/Response
  - Used to establish data channels
  - Basic file system operations eg. mkdir, delete etc

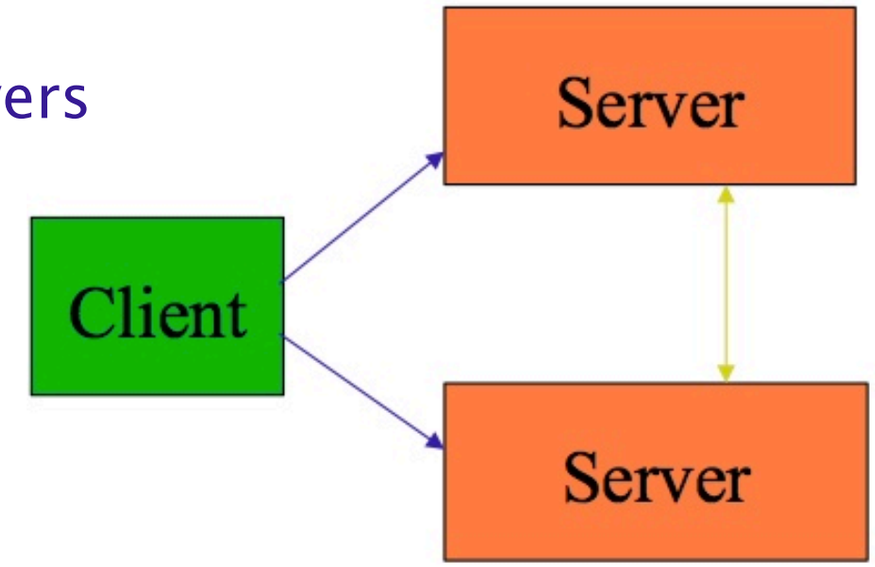
- Data channel
  - Pathway where file is transferred

GridFTP´s Third Party Transfers

- Two party transfer
  - The client connects to the server
  - Information is exchanged to establish the DC
  - A file is transferred over the DC

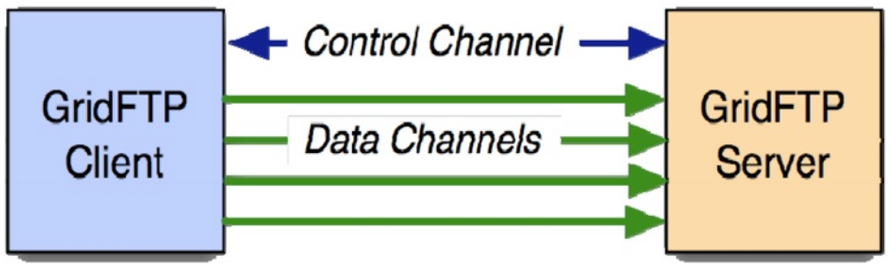


- Third party transfer
  - Client initiates data transfer between 2 servers
  - Information is routed through the client to establish DC between the two servers.
  - Data flows directly between servers
  - Client is notified by each server when the transfer is complete

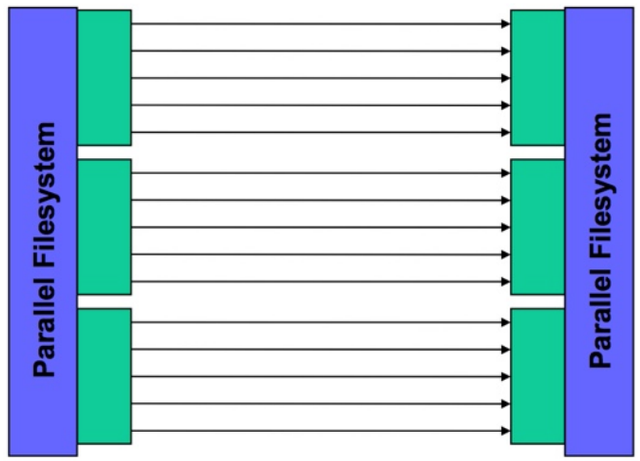


GridFTP Performance Options

- Adjustable buffer size of data channels (-tcp-bs)
- Parallel TCP streams (-p)



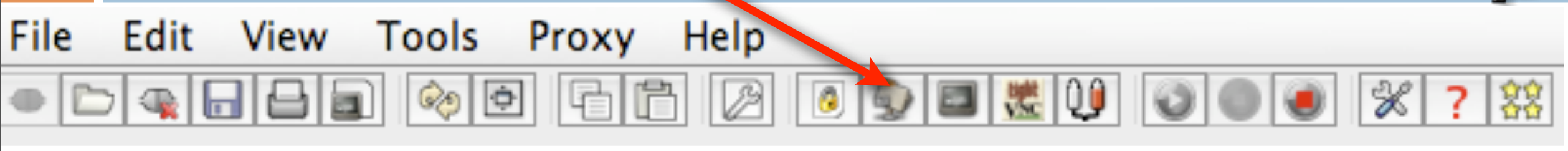
- Striped GridFTP
  - Multiple network endpoints for the transfer of the same file



Globus-url-copy

- Command line client
  - scriptable
- Commonly used client for GridFTP
- Syntax overview
  - `globus-url-copy [options] sourceURL destinationURL`
  - `globus-url-copy gsiftp://host/foo file:///tmp/bar`
- URL
  - protocol://[user@][host]/path
  - [host] can be IP address, localhost, DNS name

File transfer with GSISSH-Term



GSI-SSHTerm

File Navigate Favorites Tools Help

Back | Properties | Delete | ?

Address /scratch/shared/deisa/TrainingMaterials Go

Name	Size	Rights	Modified	Owner	Group
GridFTP_Commands.txt	985 bytes	-rw-r--r...	May 05...	690062	699999
UseOfCertificates.pdf	2.29 MB	-rwxr-xr...	May 05...	690062	699999
UseOfGlobusServices.pdf	4.55 MB	-rwxr-xr...	May 05...	690062	699999

remote browser

Select destination location

File: training

training

Name	Date Modified
Globus_Training	Tuesday, May 4, 2010 2:57 PM
Globus_Training	Tues...
hpx0tr62.p12	Thurs...
UseOfCertificates	Tues...
UseOfCertificates	Tuesday, May 4, 2010 5:49 PM
UseOfGlobusServices	Wednesday, May 5, 2010 7:18 AM
UseOfGlobusServices	Wednesday, May 5, 2010 1:18 AM
usercert.pem	Monday, May 3, 2010 2:34 PM
	...2, 2010 11:41 AM

local browser

Cancel Copy

GSI-SSHTerm

File Navigate Favorites Tools Help

New folder

Upload Files ^V

Download ^C

Rename ^R

Properties | Delete | ?

...ratch/deisa/TrainingMaterials Go

Size	Rights	Modified	Owner	Group

Job Submission Overview

- Grid job management
- GRAM introduction
- Job execution management

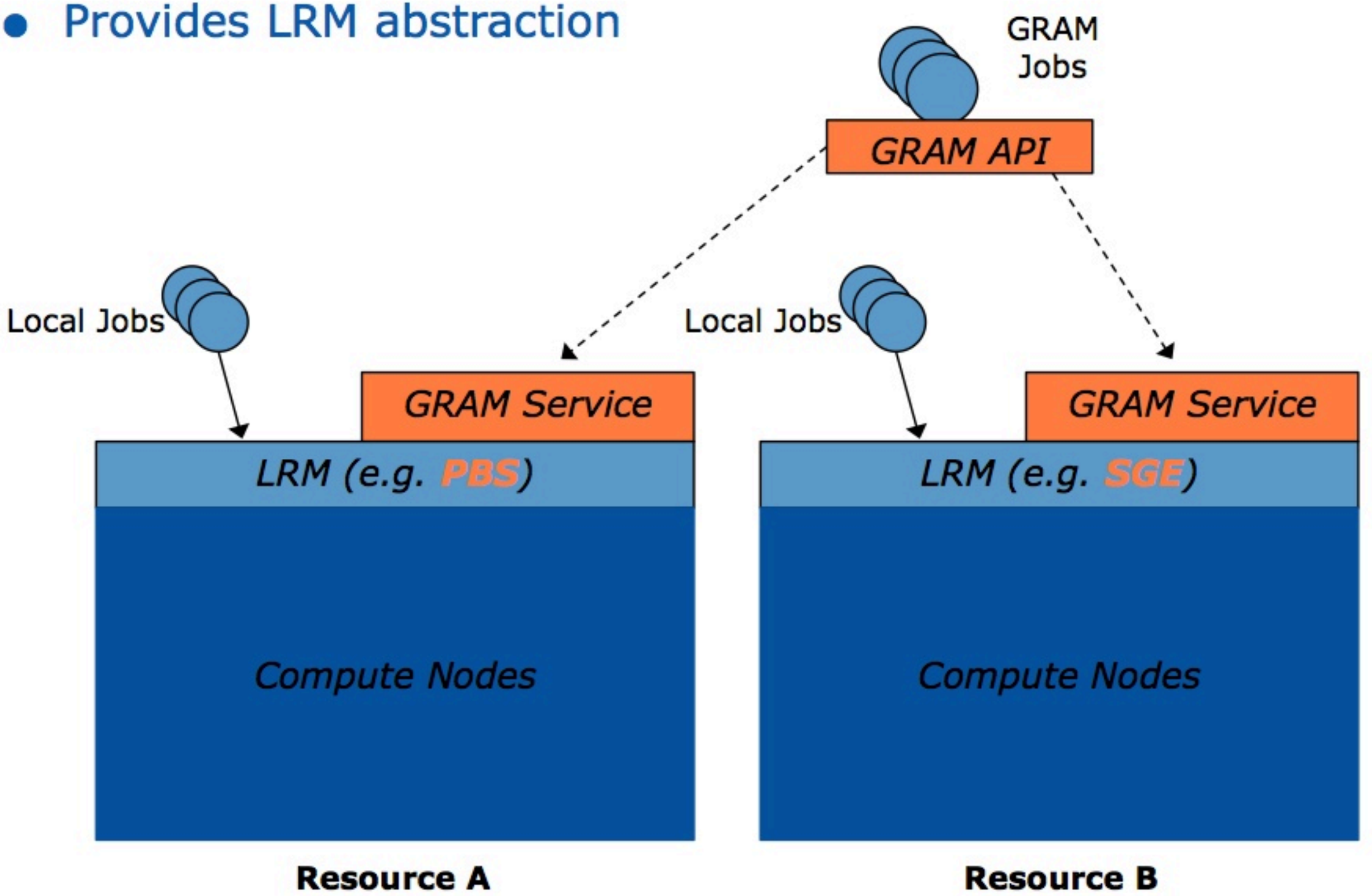
Grid Job Management Goals

- Grid Middleware provides common interface for different Local Resource Management Systems (LRMS)

- Functionality
  - Certificate based A&A
  - Stage files to/from resource
  - Initiate execution of job process(es)
  - Monitor execution
  - Signal important state changes to client

GRAM On Local Site

- Provides LRM abstraction



Job Execution Management

- Globus Resource Allocation Manager (GRAM5)
  - GRAM is a Globus Toolkit component for grid job submission
  - Interfaces to many batch systems:
    - PBS/Torque, LSF, SGE

- GRAM is a unifying remote interface to Resource Managers

- GRAM provides stateful job control
  - Asynchronous monitoring and control
  - Remote credential management
  - Remote file staging and file cleanup

GRAM5: Interfacing The System

- User submits a Globus job using
  - Globus commands
  - and optionally a job script (in Resource Specification Language (RSL))

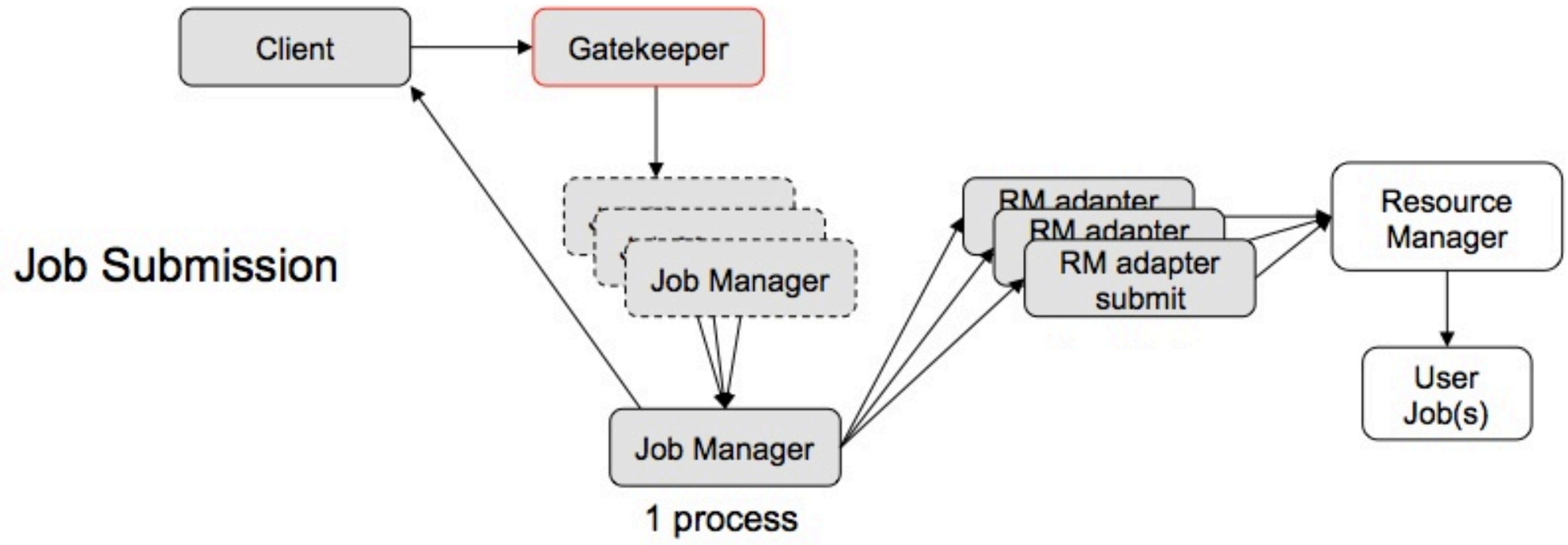
- Globus will
  - Translate your job script for the specific LRMS
  - Use native LRMS commands to submit the job

- User can monitor the job state
  - Globus will check the job state using LRMS log file

- User can cancel the job:
  - Globus will call LRMS cancellation command

GRAM5 Components

- Gatekeeper
  - Authentication
  - Starts job management service (on request)
- Job Manager
  - Processes job requests and coordinates file transfer
  - One process per user per LRSM
- Job Manager Script (RM adapter submit)
  - Interacts with LRMS and does the file transfer



GRAM Client Interfaces

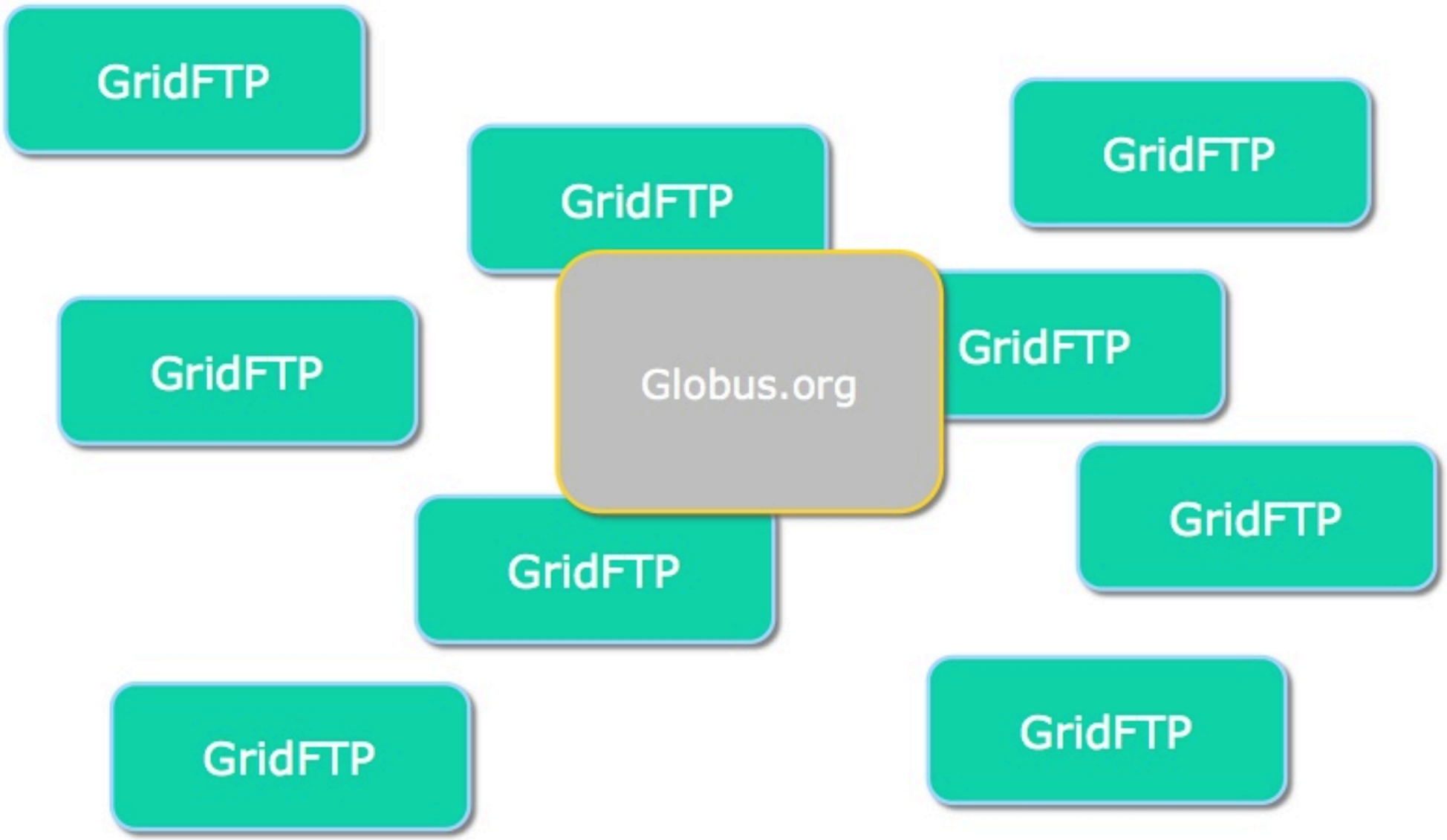
- Globus´s (job related) command line commands:
  - `globus-job-submit`
  - `globus-job-status`
  - `globus-job-get-output`
  - `globus-job-clean`

- Application Programming Interface (API) for C and JAVA

Globus.org Overview

- Data movement service
- Usage with gsissh
- Globus.org webservice

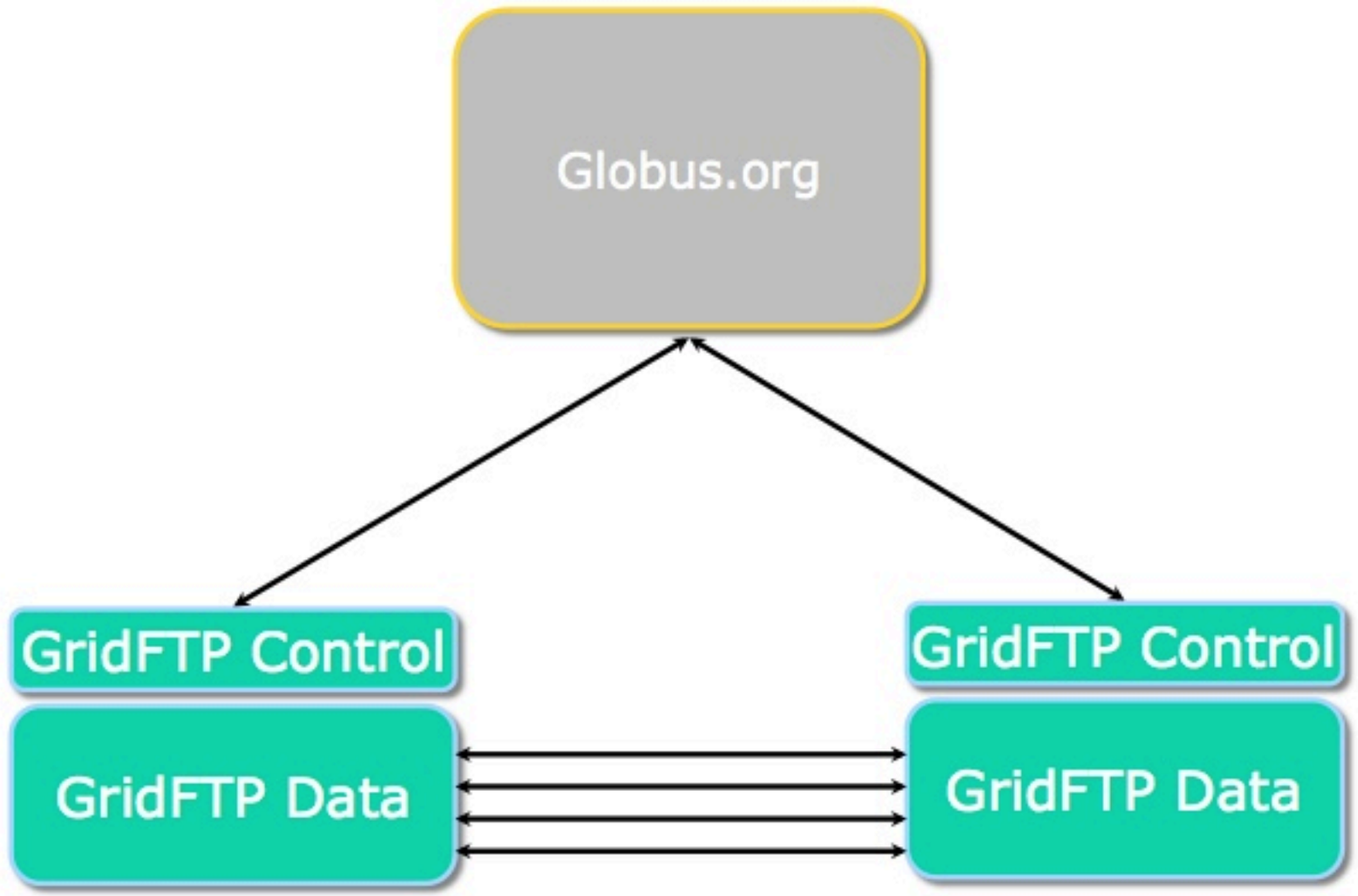
Globus.org Service



- http://www.mcs.anl.gov/~childers/GlobusWorld2010/

Globus.org Service

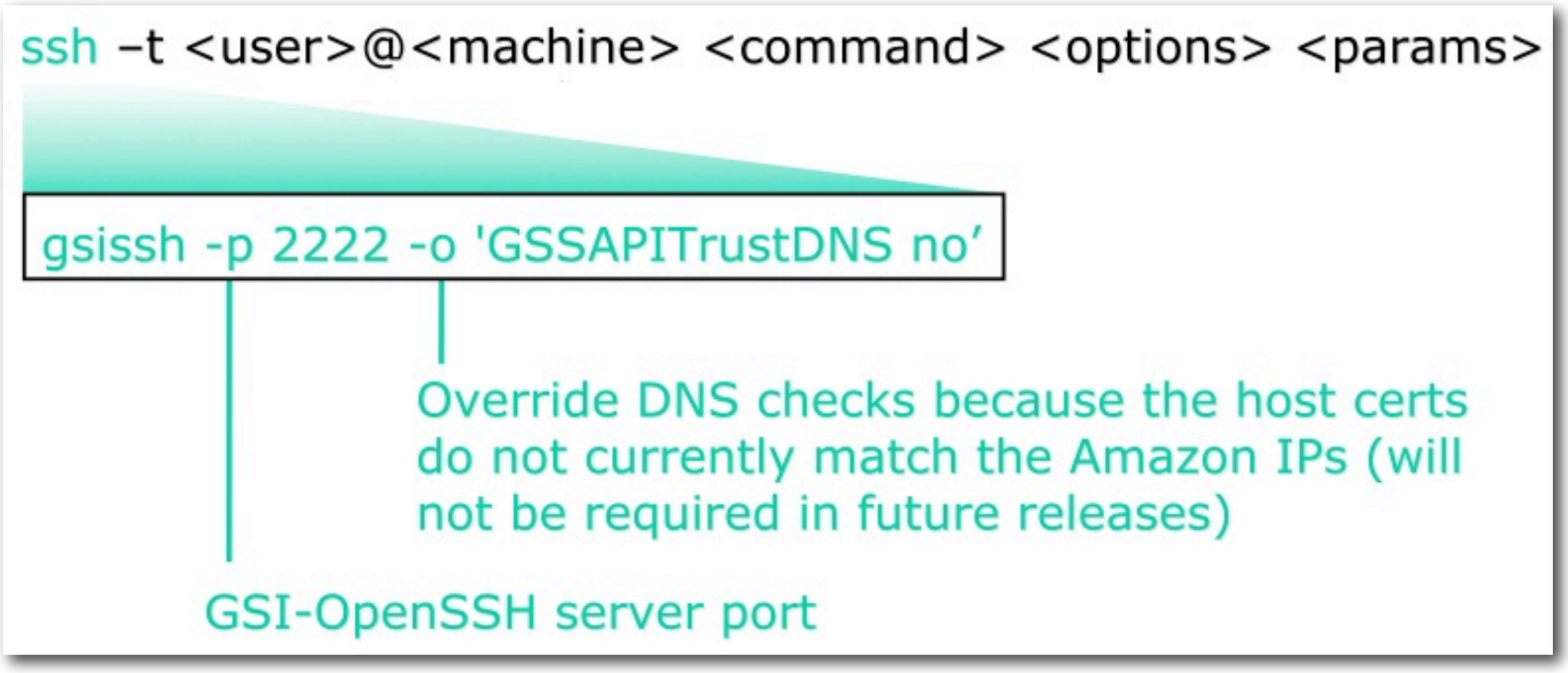
- Globus.org manages third party transfers



Globus.org Service

- Every user gets its private resource (Amazon EC2 instance)
- Access via gsissh
  - On login you don´t get a shell but
  - Text interface
- Functions
  - Manage end-points
  - Delegate your proxy
    - Direct via gsi-ssh
    - Indirect via myproxy
  - Initiate, observe, stop your transfers
  - Notifications
- API
  - REST interface

Anatomy Of Globus.org CLI Call

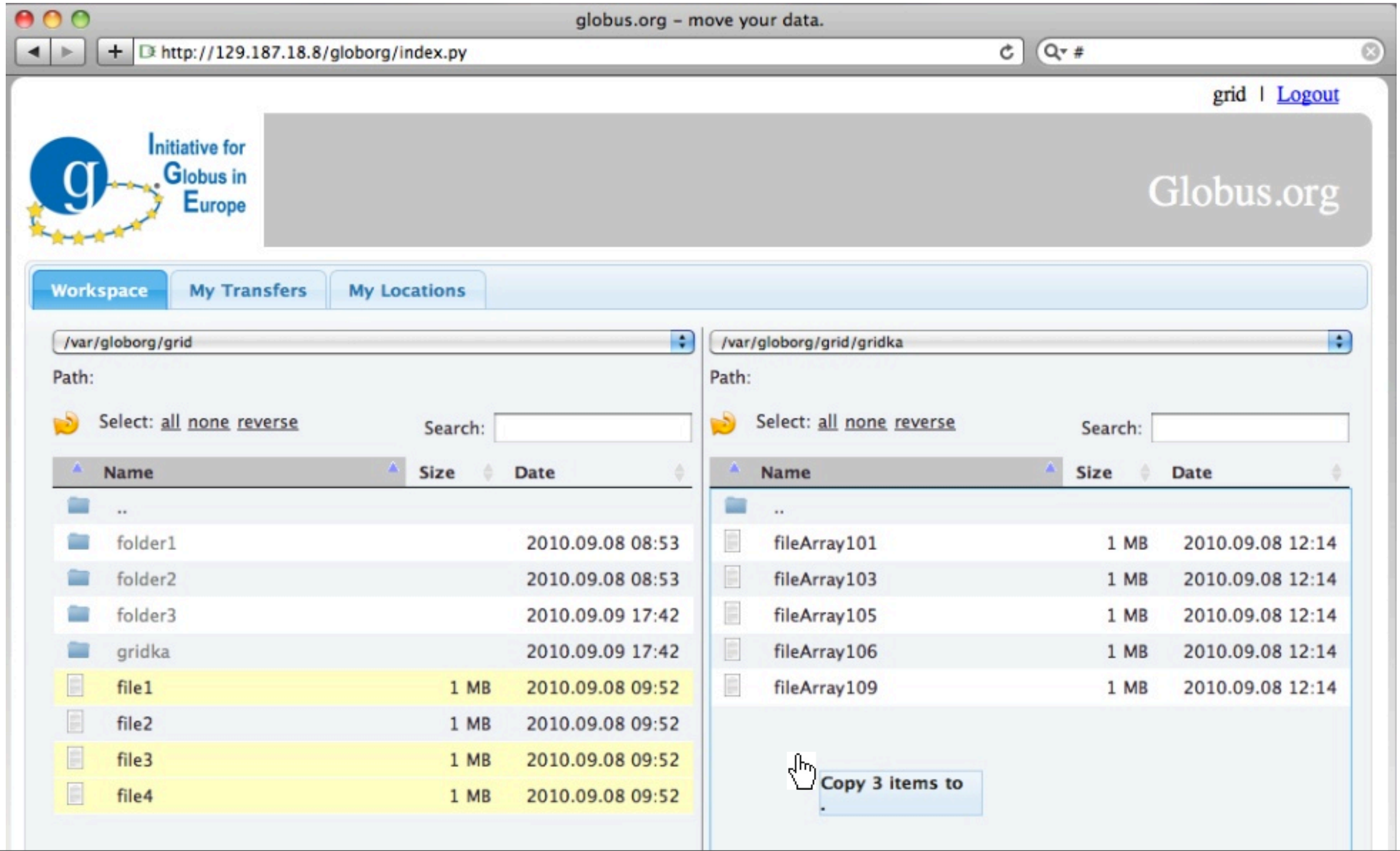


Globus.org Webservice

- Functionality of globus.org service in the web browser
  - Graphical user interface
  - Access from every computer
  - Easy to use – you don´t need globus toolkit

- Mock-up Live Demo

Globus.org Webservice



Where To Find Help

- http://www.ige-project.eu/
- LRZ globus contact: grid-support@lrz.de
- http://www.grid.lrz.de/