Introduction to gLite

Gergely Sipos *sipos@sztaki.hu*
Training and induction
Application Porting Support

MTA SZTAKI (Hungarian Academy of Sciences)
Budapest
www.lpds.sztaki.hu

www.eu-egee.org

e-infrastructure

Event webpage
Permanent storage of slides

http://indico.cern.ch/conferenceDisplay.py?confId=73509

Google – “egee na3 Training Events and Registration”
Find “An Introduction to gLite” event in the list

Outline

14:15 – 15:15

- **What is EGEE and how to get access**
  - The grid
  - The gLite middleware
  - User communities and user support services
- **gLite command line usage**
  - Executing a simple job
    - Links to hands-on exercises
  - More realistic jobs
    - Links to hands-on exercises
  - Working with large datasets
    - Links to hands-on exercises

15:15 – 15:30 Break

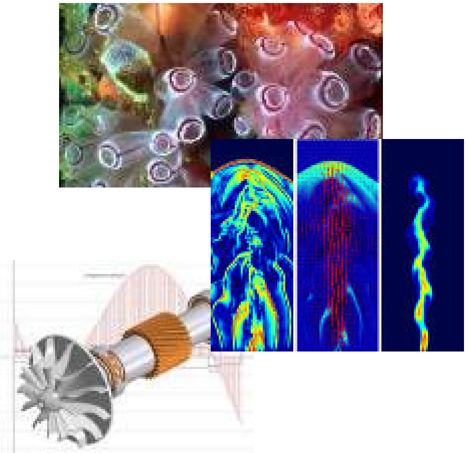
15:30 – 17:30

- **Hands-on on GILDA**
    - Access and exercises are provided

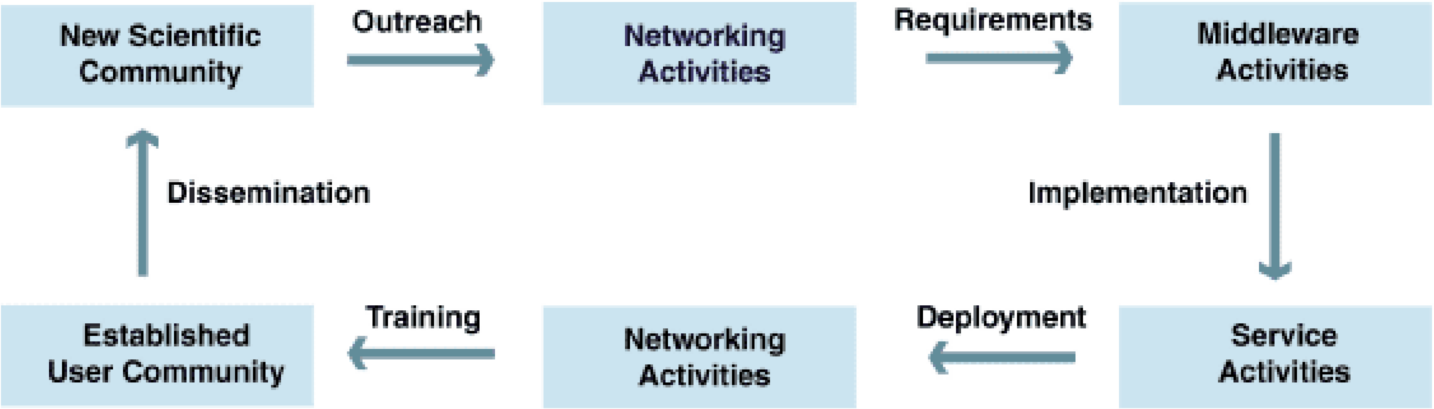
The EGEE Project

- **Aim of EGEE:**

  "to establish a seamless European Grid infrastructure for the support of the European Research Area (ERA)"



- **EGEE**
  - 1 April 2004 – 31 March 2006
  - 71 partners in 27 countries, federated in regional Grids
- **EGEE-II**
  - 1 April 2006 – 30 April 2008
  - Expanded consortium
- **EGEE-III**
  - 1 May 2008 – 30 April 2010
  - Transition to sustainable model: European Grid Initiative (EGI): www.egi.eu



New Scientific Community

Outreach

Networking Activities

Requirements

Middleware Activities

Implementation

Service Activities

Deployment

Networking Activities

Training

Established User Community

Dissemination

What is happening now?

17,000 users

~150,000 CPUs (cores)

28Pb disk

41Pb tape

12 million jobs/month

+45% in a year

260+ sites

+5% in a year

55 countries

+10% in a year

140 VOs

+29% in a year

Real Time Monitor:

http://gridportal.hep.ph.ic.ac.uk/rtm

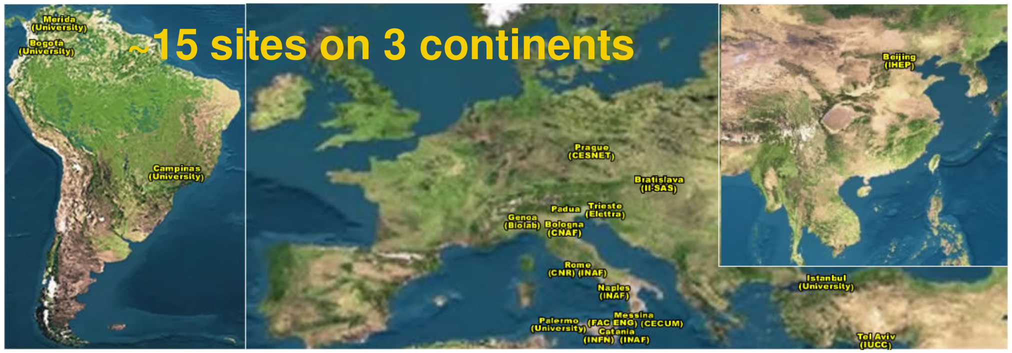
Imperial College London

GridPP

UK Computing for Particle Physics

EGEE Infrastructures

- **Production service**
  - Scaling up the infrastructure with resource centres around the globe
  - Running only well-tested and reliable middleware
  - 260 sites, 55 countries, ~150.000 CPU cores, ~69 PB storage
  - Separated into ~140 Virtual Organizations
    - T-Infrastructure (Training&Education) – GILDA Virtual Organization
      - *Complete suite of Grid elements*
      - *Everyone can register and use for training and application porting*
      - *https://gilda.ct.infn.it/*

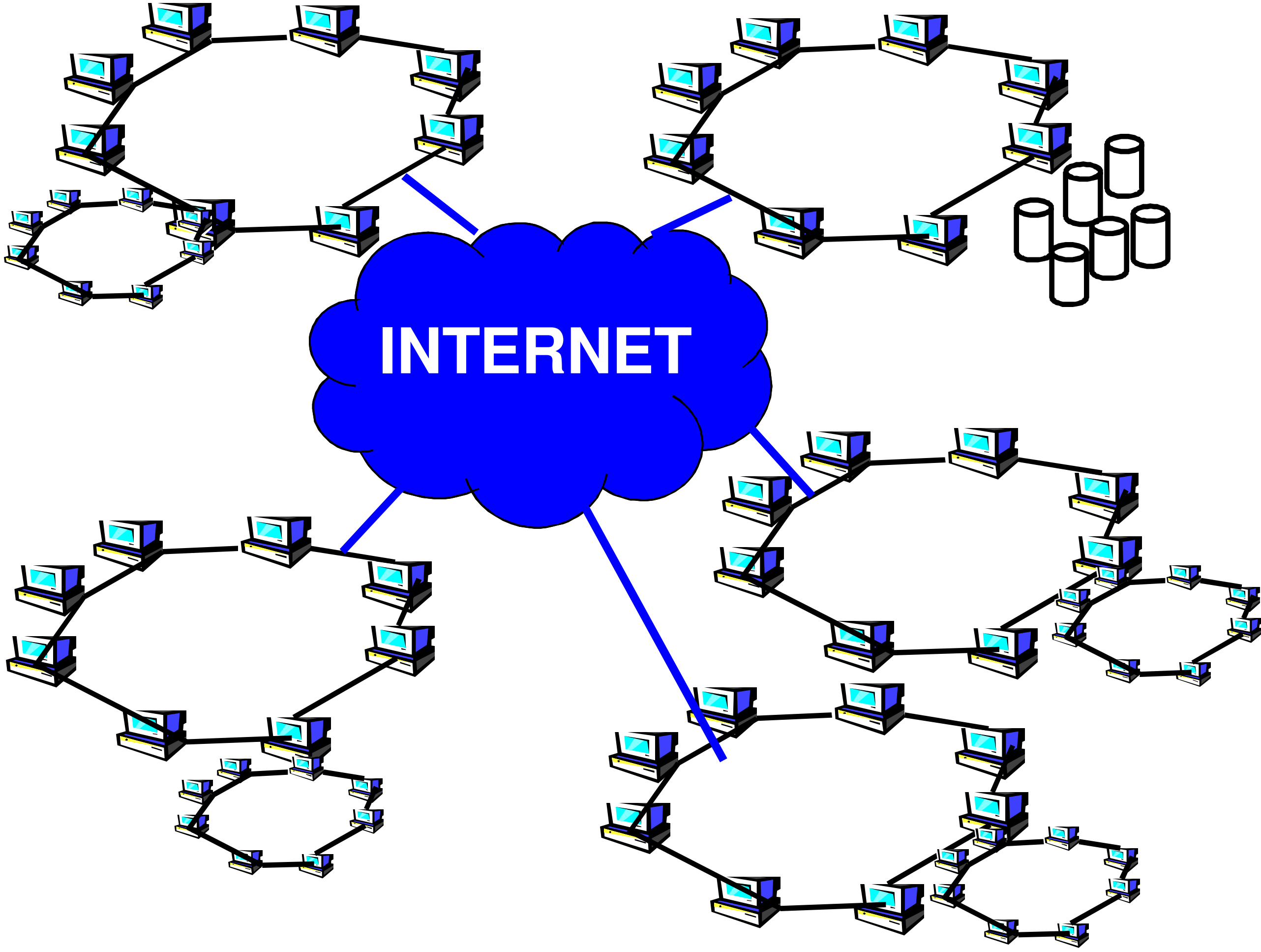


~15 sites on 3 continents

- **Pre-production service**
  - Run in parallel with the production service (restricted number of sites)
  - First deployment of new versions of the gLite middleware

EGEE, middleware and VOs

- **gLite middleware runs on each EGEE site to provide**
  - Data services
  - Computation services
  - Security service



EGEE, middleware and VOs

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  - Data services
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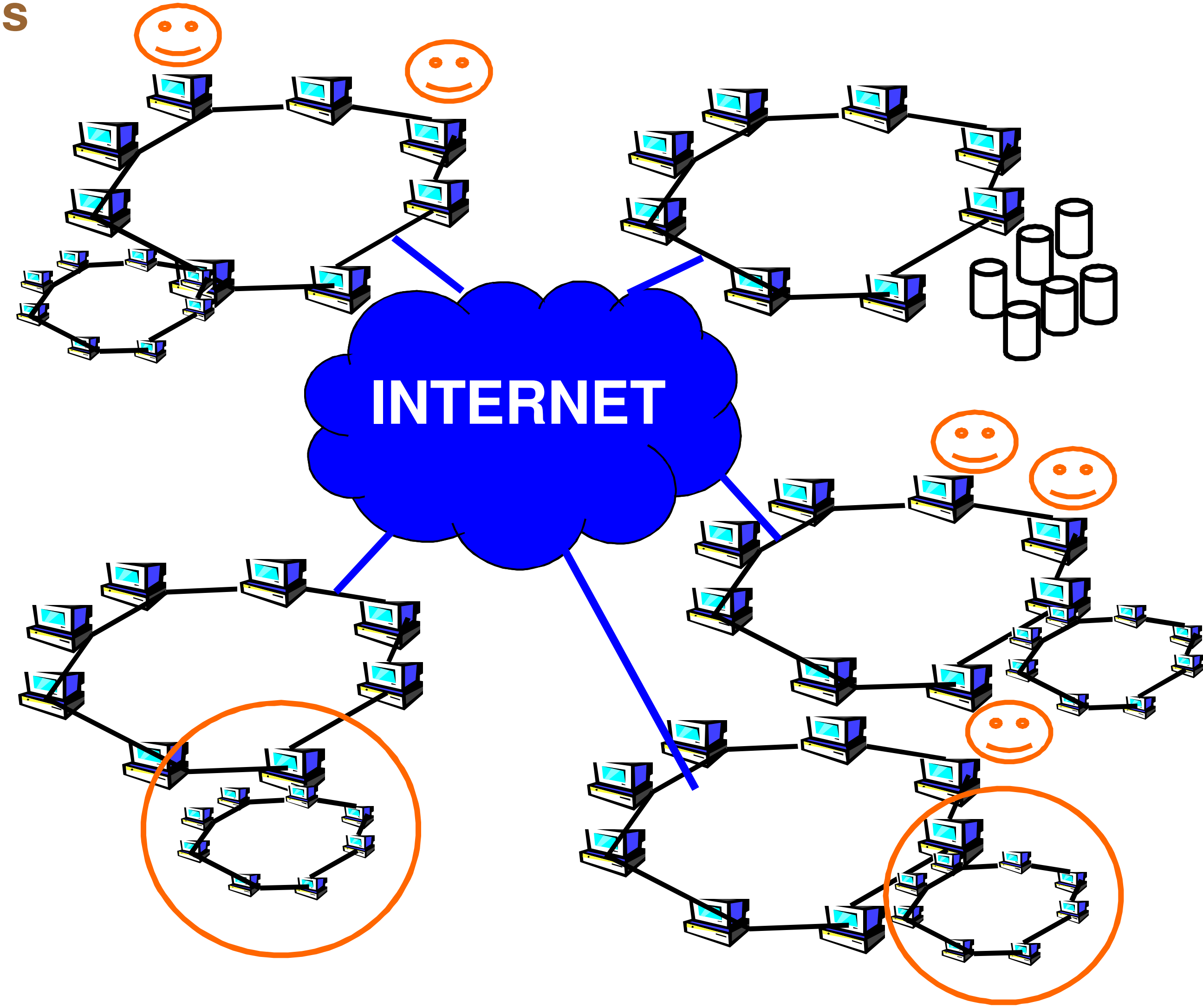
  - Security service

- EGEE resources and users form Virtual organisations (VO): basis for collaboration

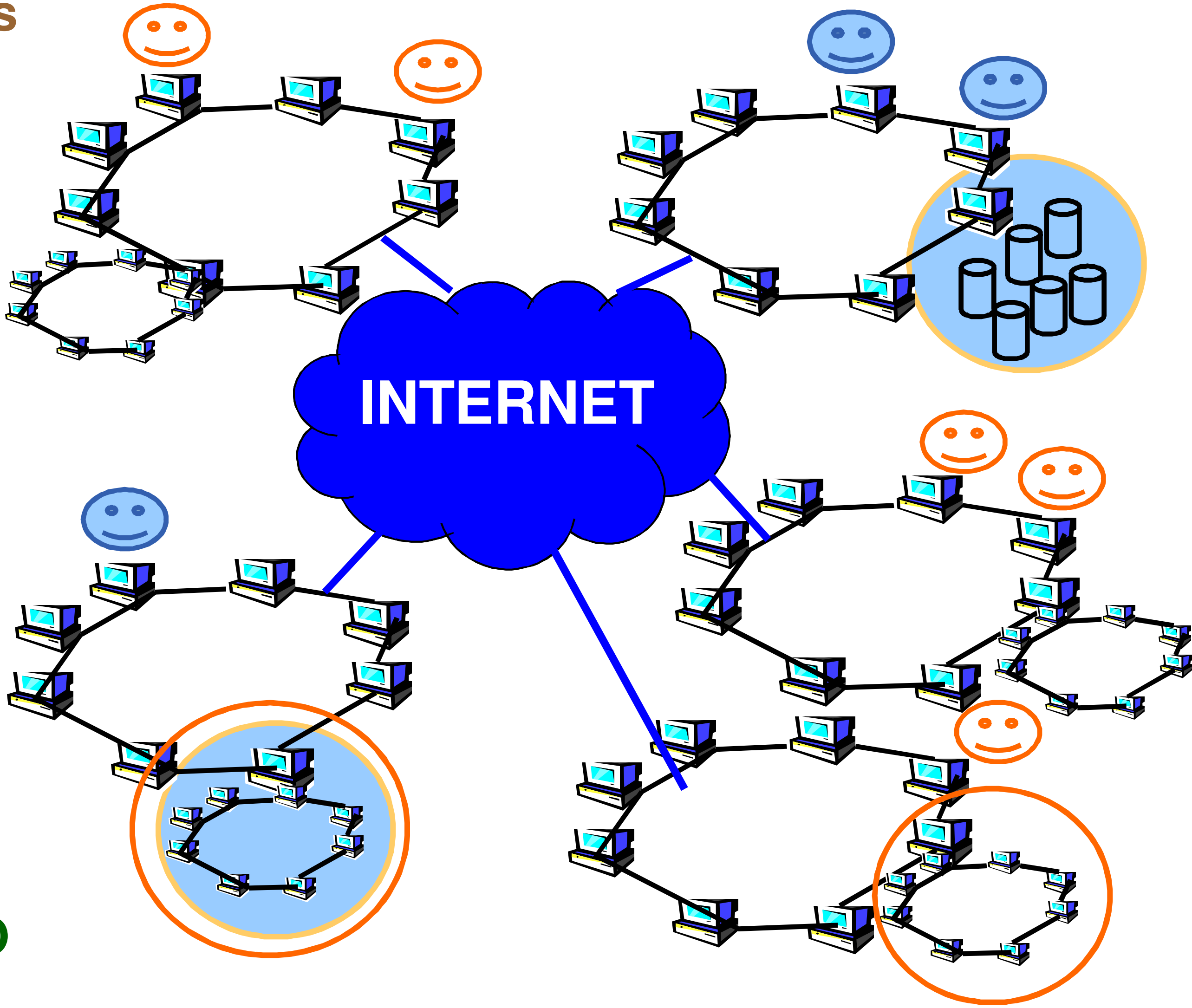


EGEE, middleware and VOs

- **gLite middleware runs on each EGEE site to provide**
  - Data services
  - Computation services
  - Security service

- **EGEE resources and users form Virtual organisations (VO): basis for collaboration**

- **Distributed services (both people and software) enable a VO**



Example: *Biomed* Virtual Organization

https://twiki.cern.ch/twiki/bin/view/EGEE/LifeSciences

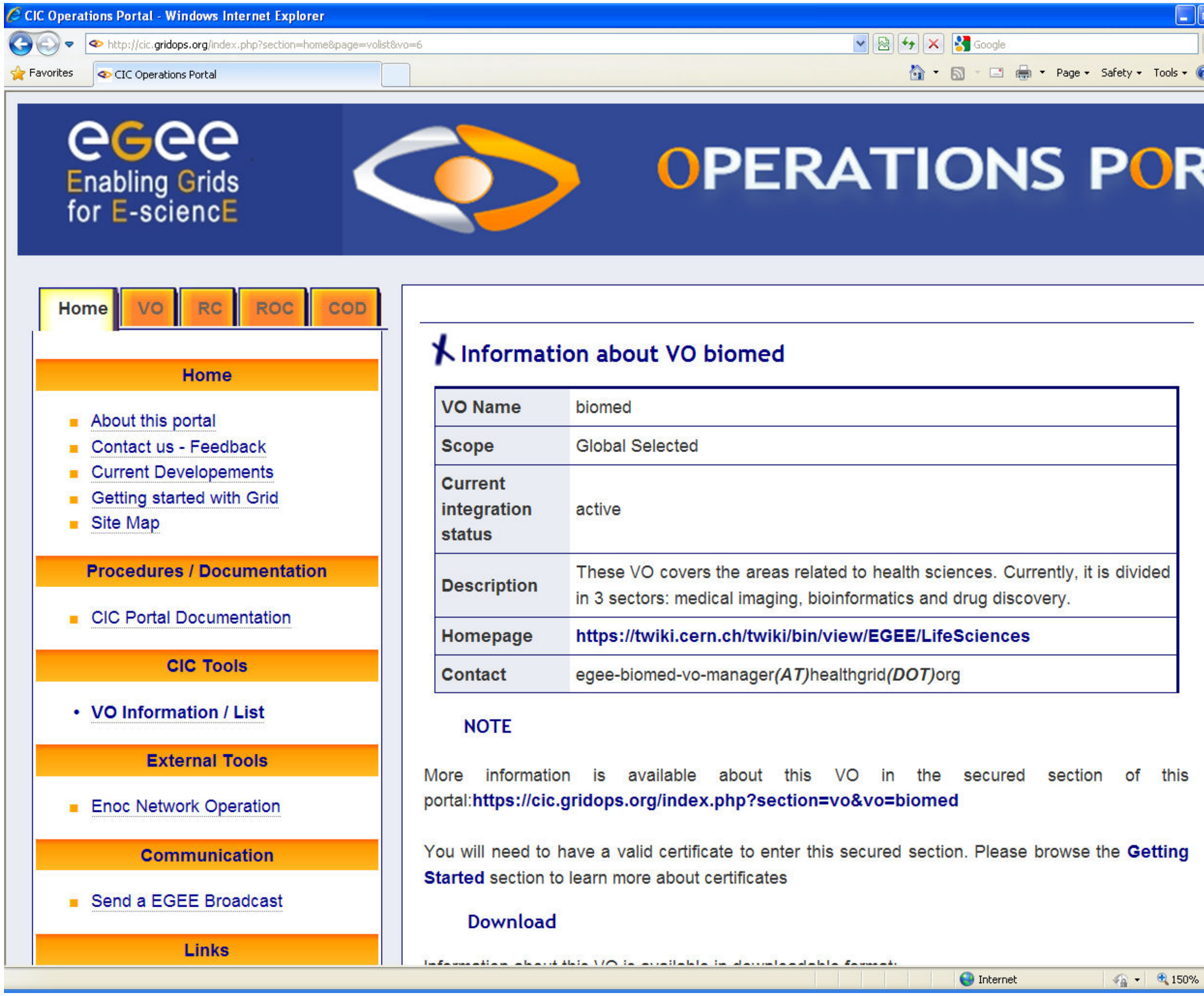
Sites:

- 36, mostly from Europe and Asia
- 65,584 CPUs
- ~741 TB storage

Portal services are also available

Members:

- Anybody working with biomedical applications
- No geographical restriction
- Currently 220-250 members


CIC Operations Portal - Windows Internet Explorer
http://cic.gridops.org/index.php?section=home&page=volist&vo=6
Google
Favorites
CIC Operations Portal
Page
Safety
Tools
egee
Enabling Grids for E-sciencE
OPERATIONS POR
Home
VO
RC
ROC
COD
Internet
150%

Home

- About this portal
- Contact us - Feedback
- Current Developements
- Getting started with Grid
- Site Map

Procedures / Documentation

- CIC Portal Documentation

CIC Tools

- VO Information / List

External Tools

- Enoc Network Operation

Communication

- Send a EGEE Broadcast

Links

Information about VO biomed

VO Name	biomed
Scope	Global Selected
Current integration status	active
Description	These VO covers the areas related to health sciences. Currently, it is divided in 3 sectors: medical imaging, bioinformatics and drug discovery.
Homepage	https://twiki.cern.ch/twiki/bin/view/EGEE/LifeSciences
Contact	egee-biomed-vo-manager*(AT)*healthgrid*(DOT)*org

NOTE

More information is available about this VO in the secured section of this portal:**https://cic.gridops.org/index.php?section=vo&vo=biomed**

You will need to have a valid certificate to enter this secured section. Please browse the **Getting Started** section to learn more about certificates

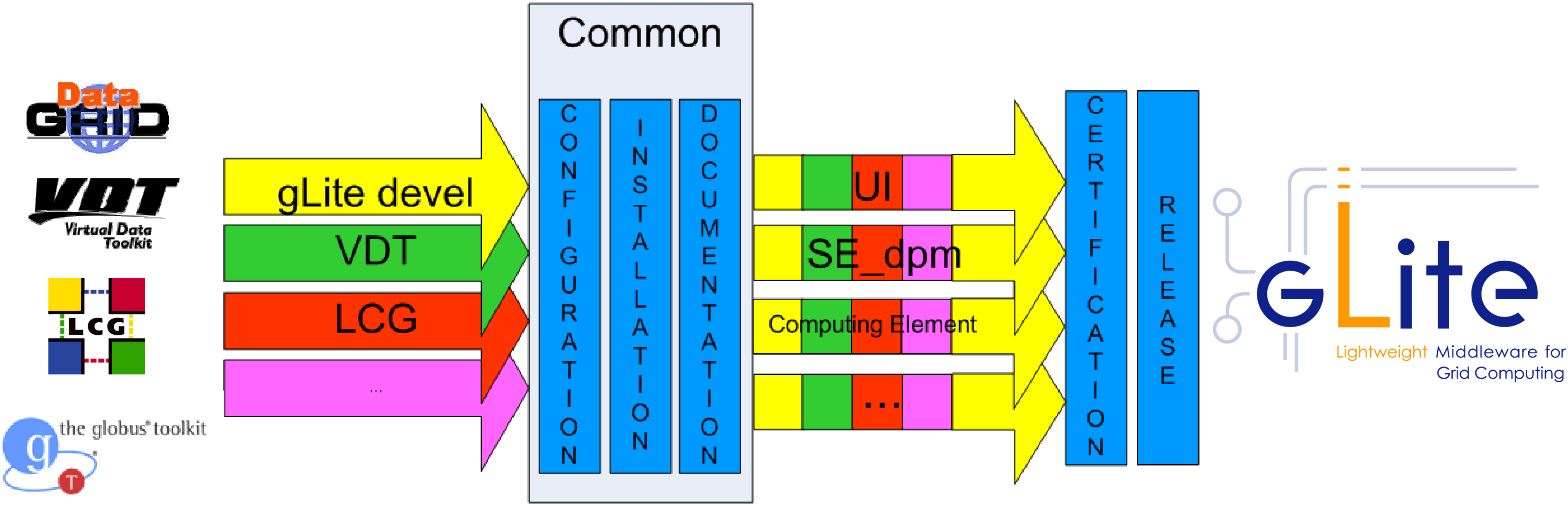
Download

Information about this VO is available in downloadable format:

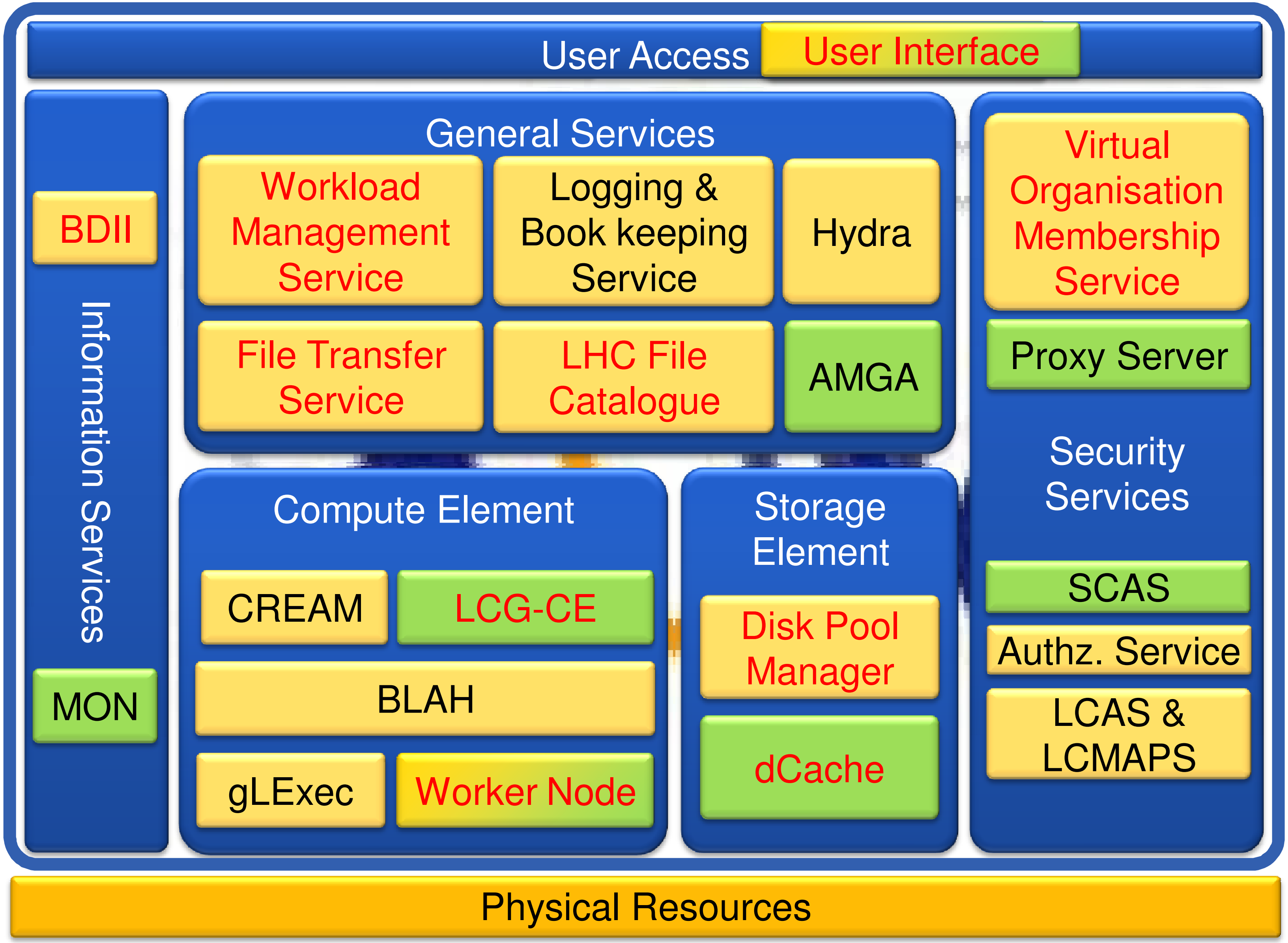
Enabling VOs: gLite - the EGEE middelware

www.glite.org

- **The current release is gLite 3.2**
- **Compatible with Scientific Linux 5**
  - Some services also work with Debian and/or older SL distributions
- **gLite is…**
  - A distribution
  - With its own large development effort
- **It is updated almost every week**



The complete gLite service stack



User Access

User Interface

Information Services

BDII

MON

General Services

Workload Management Service

Logging & Book keeping Service

Hydra

File Transfer Service

LHC File Catalogue

AMGA

Compute Element

CREAM

LCG-CE

BLAH

gLExec

Worker Node

Storage Element

Disk Pool Manager

dCache

Security Services

Virtual Organisation Membership Service

Proxy Server

SCAS

Authz. Service

LCAS & LCMAPS

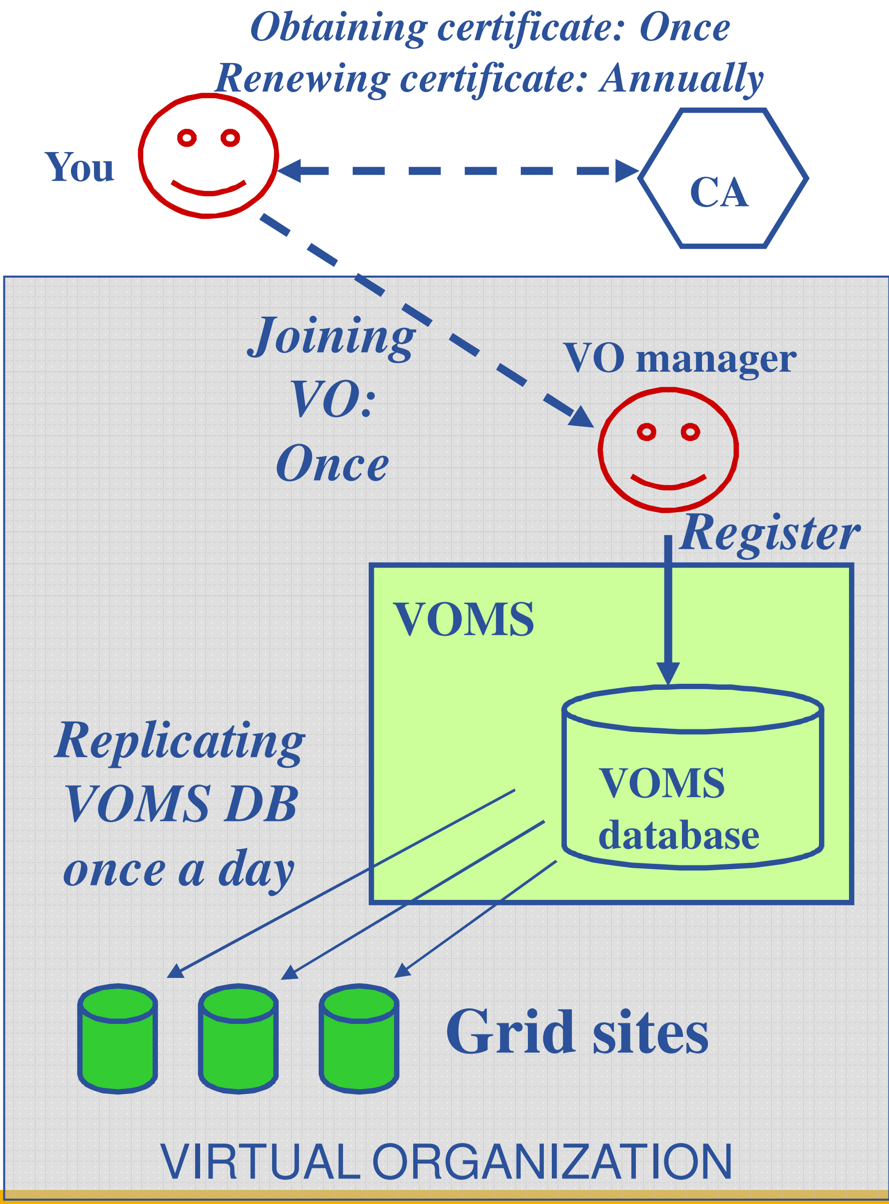
Physical Resources

Getting access to an EGEE VO

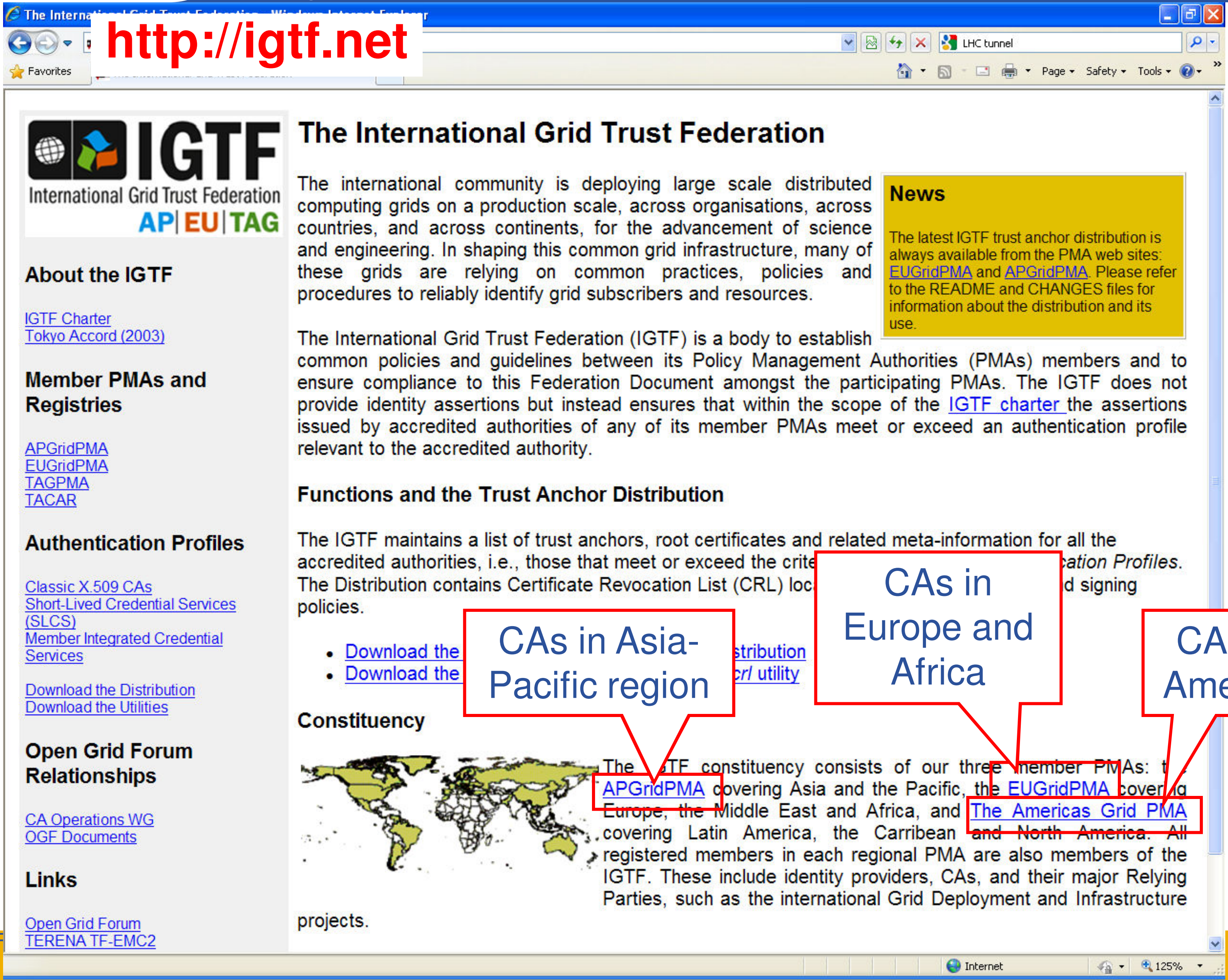
- Users (and machines) are identified by grid certificates. Certificates issued by national Certification Authorities (CA)

- VO Membership Service (VOMS) keeps list of people who are registered to a VO

- Users' steplist
  - Obtain certificate from your national CA: http://www.igtf.net
  - Register at the VO
    - List of VOs: http://cic.gridops.org/
  - VO manager authorizes You
    - VOMS DB updated
    - Your identity is replicated onto VO resource within 24 hours
  - Use the grid through command line *or* graphical interfaces


Obtaining certificate: Once
Renewing certificate: Annually
You
CA
Joining VO: Once
VO manager
Register
VOMS
VOMS database
Replicating VOMS DB once a day
Grid sites
VIRTUAL ORGANIZATION

Find your national CA!



http://igtf.net

The International Grid Trust Federation - Windows Internet Explorer
LHC tunnel
Favorites
Page
Safety
Tools
Internet
125%

IGTF
International Grid Trust Federation
AP | EU | TAG

About the IGTF

IGTF Charter
Tokyo Accord (2003)

Member PMAs and Registries

APGridPMA
EUGridPMA
TAGPMA
TACAR

Authentication Profiles

Classic X.509 CAs
Short-Lived Credential Services (SLCS)
Member Integrated Credential Services

Download the Distribution
Download the Utilities

Open Grid Forum Relationships

CA Operations WG
OGF Documents

Links

Open Grid Forum
TERENA TF-EMC2

The International Grid Trust Federation

The international community is deploying large scale distributed computing grids on a production scale, across organisations, across countries, and across continents, for the advancement of science and engineering. In shaping this common grid infrastructure, many of these grids are relying on common practices, policies and procedures to reliably identify grid subscribers and resources.

News

The latest IGTF trust anchor distribution is always available from the PMA web sites: EUGridPMA and APGridPMA. Please refer to the README and CHANGES files for information about the distribution and its use.

The International Grid Trust Federation (IGTF) is a body to establish common policies and guidelines between its Policy Management Authorities (PMAs) members and to ensure compliance to this Federation Document amongst the participating PMAs. The IGTF does not provide identity assertions but instead ensures that within the scope of the IGTF charter the assertions issued by accredited authorities of any of its member PMAs meet or exceed an authentication profile relevant to the accredited authority.

Functions and the Trust Anchor Distribution

The IGTF maintains a list of trust anchors, root certificates and related meta-information for all the accredited authorities, i.e., those that meet or exceed the crite *cation Profiles*. The Distribution contains Certificate Revocation List (CRL) loc d signing policies.

- Download the stribution
- Download the *crl* utility

Constituency

The IGTF constituency consists of our three member PMAs: the APGridPMA covering Asia and the Pacific, the EUGridPMA covering Europe, the Middle East and Africa, and The Americas Grid PMA covering Latin America, the Carribean and North America. All registered members in each regional PMA are also members of the IGTF. These include identity providers, CAs, and their major Relying Parties, such as the international Grid Deployment and Infrastructure projects.

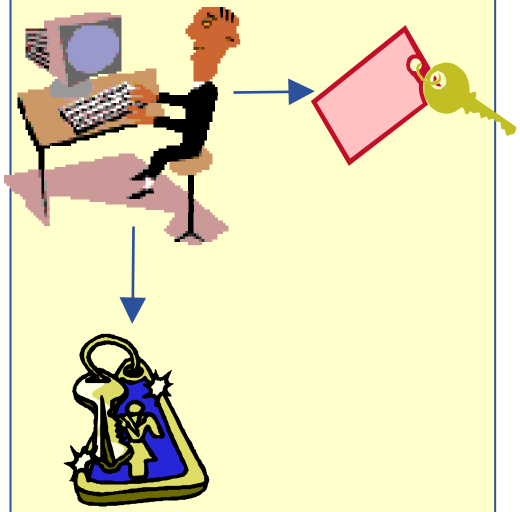
CAs in Asia-Pacific region

CAs in Europe and Africa

CAs in America

Obtaining a grid certificate

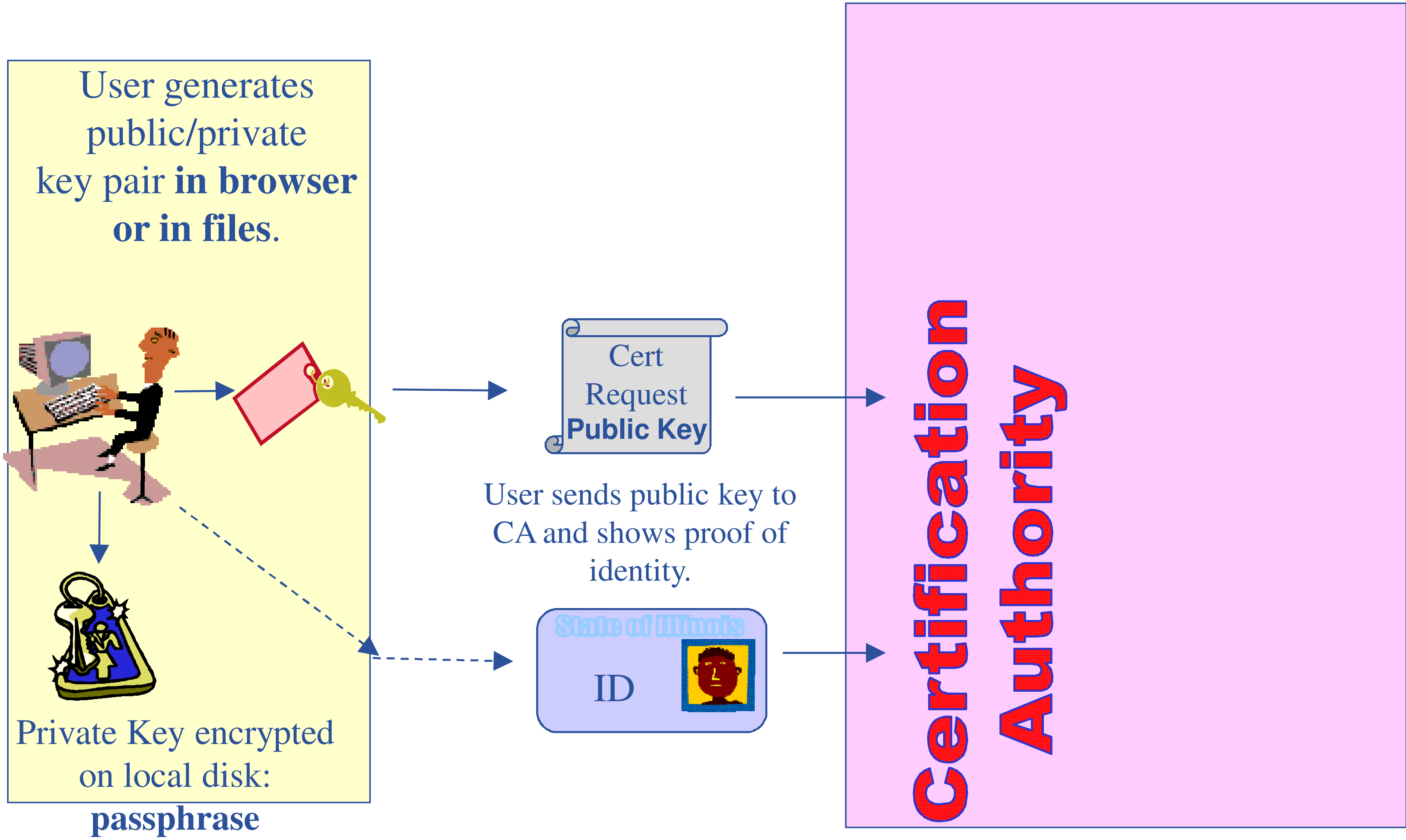
User generates public/private key pair **in browser or in files**.



Private Key encrypted on local disk: **passphrase**

Certification Authority

Obtaining a grid certificate



User generates public/private key pair **in browser or in files**.

Private Key encrypted on local disk: **passphrase**

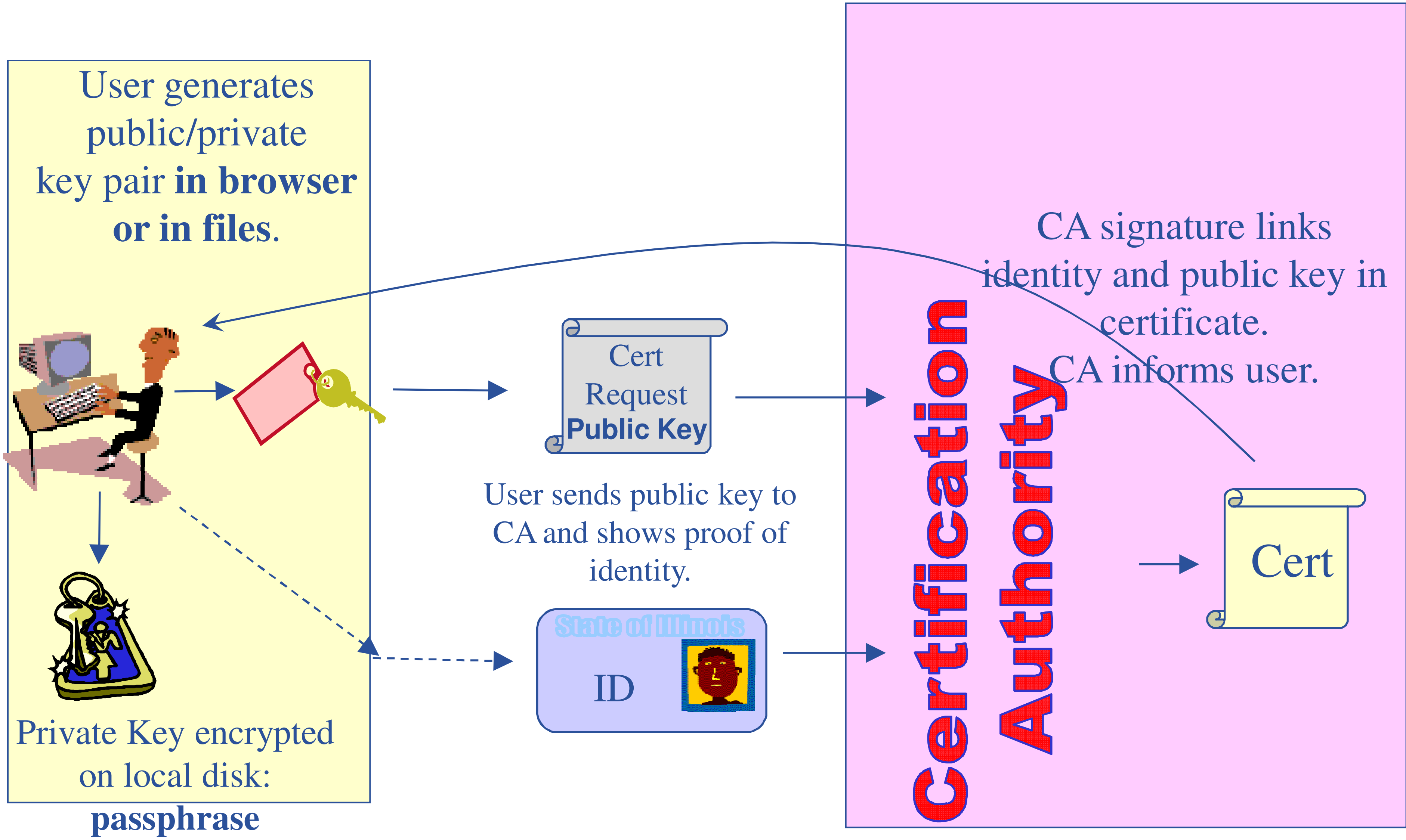
Cert Request **Public Key**

User sends public key to CA and shows proof of identity.

ID

Certification Authority

Obtaining a grid certificate



User generates public/private key pair **in browser or in files**.

Private Key encrypted on local disk: **passphrase**

Cert Request **Public Key**

User sends public key to CA and shows proof of identity.

Certification Authority

CA signature links identity and public key in certificate.
CA informs user.

Cert

User’s private key and certificate

- ***Different formats exist – transformation may be required!!!***
  - Browser format → To access user support services
  - PEM format → For grid interaction
- **Keep your private key and certificate secure**
  - *Typically kept*
    - *in Web browser*
    - *on the User Interface machine of your VO*
    - *in MyProxy server*
    - if possible *on a USB drive only*
  - Do not loan your certificate to anyone
  - Report to your CA if your certificate has been compromised

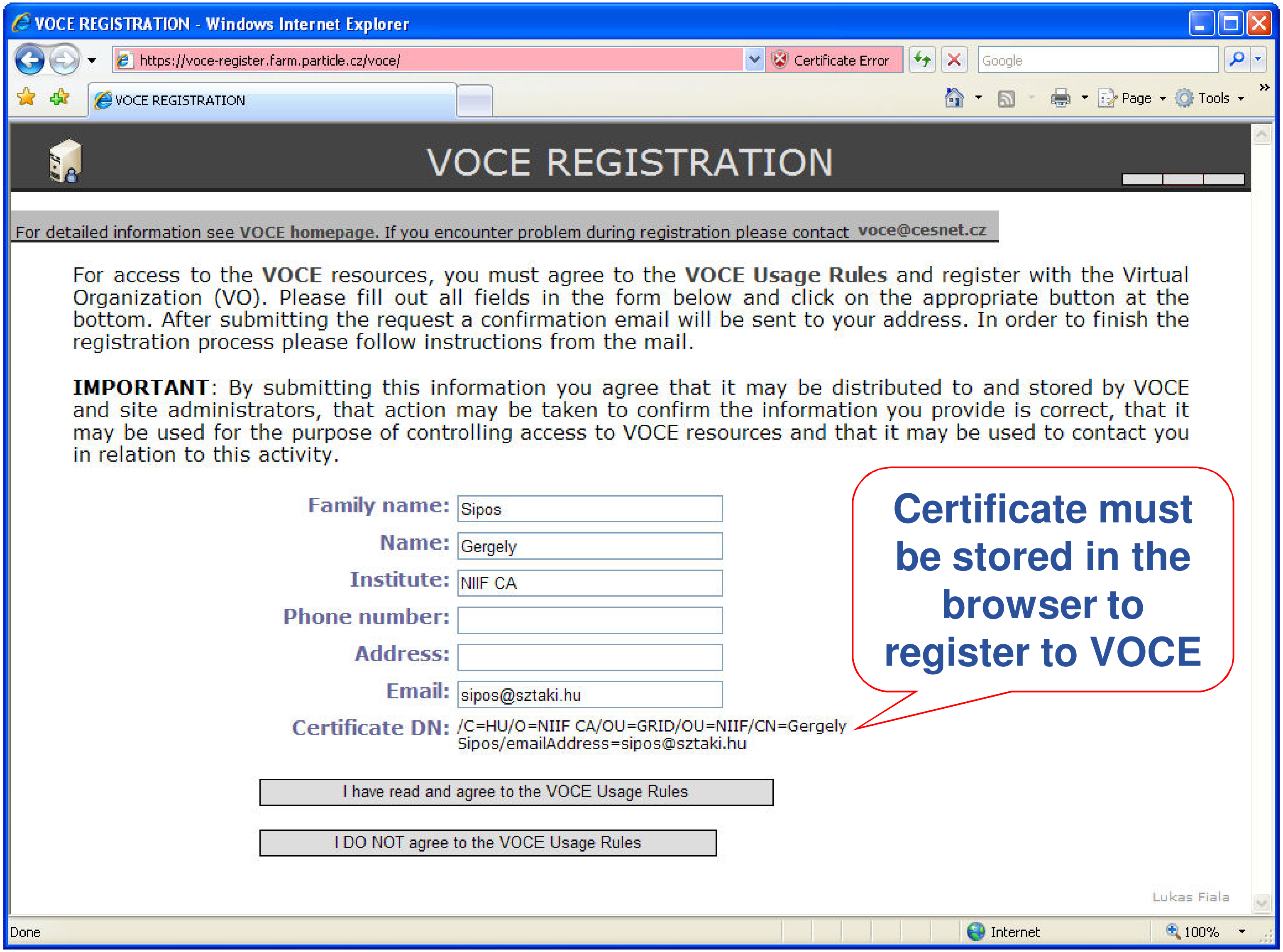
Typical situation on User Interface machine:

```
[sipos@glite-tutor sipos]$ ls -l .globus/
total 8
-rw-r--r--   1 sipos   users   1761 Nov 25  2008 usercert.pem
-r--------   1 sipos   users   951  Nov 24  2008 userkey.pem
```

Someone’s identity on an EGEE grid site = Certificate Distinguished Name:

```
[sipos@glite-tutor sipos]$ grid-cert-info -subject
/C=HU/O=NIIF CA/OU=GRID/OU=NIIF/CN=Gergely Sipos/Email=sipos@sztaki.hu
```

Joining a VO: Example: VOCE – VO of Central Europe


VOCE REGISTRATION - Windows Internet Explorer
https://voce-register.farm.particle.cz/voce/
Certificate Error
Google
VOCE REGISTRATION
Page
Tools
Done
Internet
100%

VOCE REGISTRATION

For detailed information see VOCE homepage. If you encounter problem during registration please contact voce@cesnet.cz

For access to the **VOCE** resources, you must agree to the **VOCE Usage Rules** and register with the Virtual Organization (VO). Please fill out all fields in the form below and click on the appropriate button at the bottom. After submitting the request a confirmation email will be sent to your address. In order to finish the registration process please follow instructions from the mail.

IMPORTANT: By submitting this information you agree that it may be distributed to and stored by VOCE and site administrators, that action may be taken to confirm the information you provide is correct, that it may be used for the purpose of controlling access to VOCE resources and that it may be used to contact you in relation to this activity.

Family name:	Sipos
Name:	Gergely
Institute:	NIIF CA
Phone number:	
Address:	
Email:	sipos@sztaki.hu
Certificate DN:	/C=HU/O=NIIF CA/OU=GRID/OU=NIIF/CN=Gergely Sipos/emailAddress=sipos@sztaki.hu

I have read and agree to the VOCE Usage Rules

I DO NOT agree to the VOCE Usage Rules

Lukas Fiala

Certificate must be stored in the browser to register to VOCE

GILDA training Certification Authority

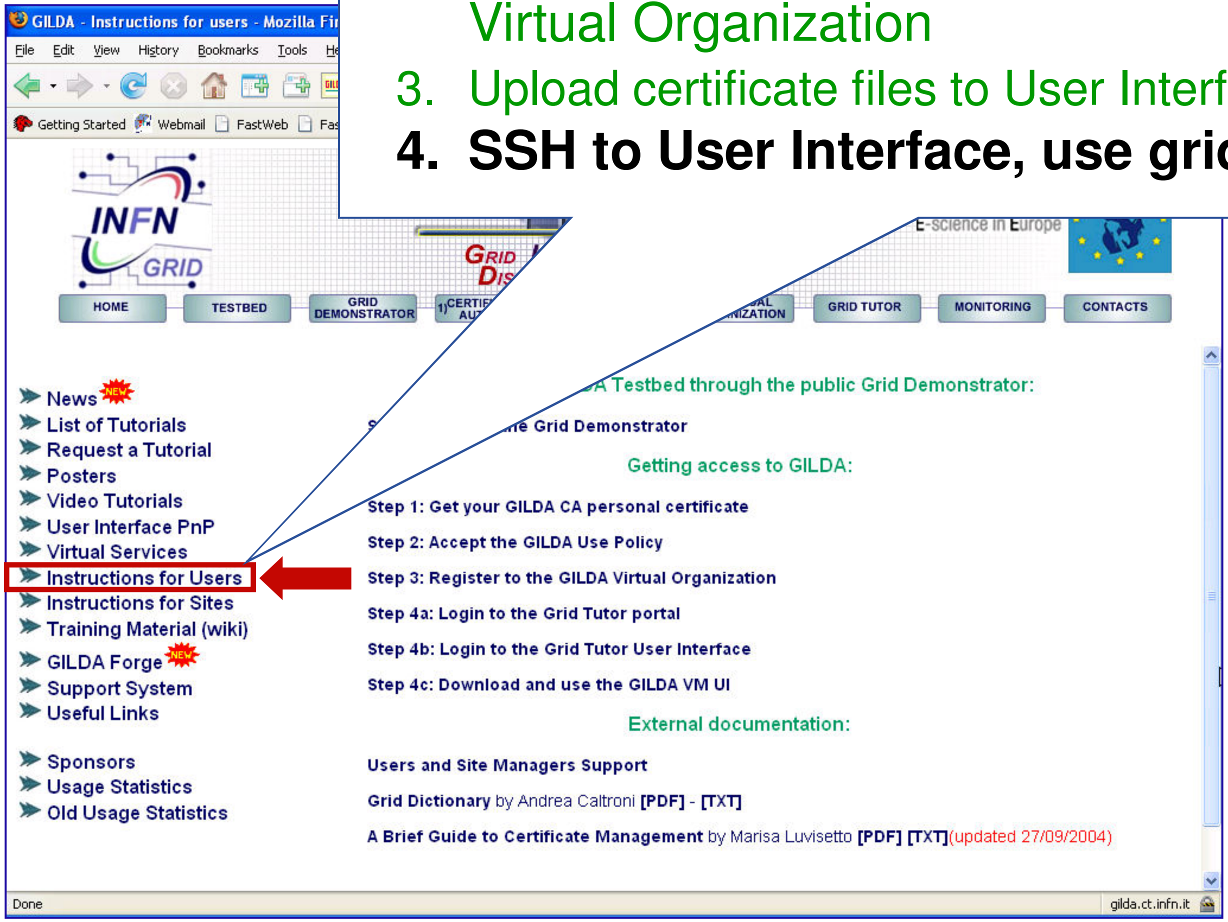
https://gilda.ct.infn.it

- **GILDA training Certification Authority is special**
  - Lightweight authentication - No need for personal visit!
    - Apply for a certificate on the Web!
  - GILDA re-newable certificates are **valid for 2 weeks** (normal certificates for 1 year, also renewable)
  - GILDA renewable certificates are valid **only in GILDA VO** (normal certificates in any VO)

- **Related resources:**
  - Apply for a GILDA certificate: https://gilda.ct.infn.it
    - Choose “Instruction for Users” menu
  - Ticketing system (GILDA-related complaints, questions):
    - http://gilda-support.ct.infn.it/

Getting access to GILDA infrastructure https://gilda.ct.infn.it

1. Obtain a grid certificate from GILDA CA
2. Accept the GILDA Use Policy, register to GILDA Virtual Organization
3. Upload certificate files to User Interface
4. **SSH to User Interface, use grid services**



A Testbed through the public Grid Demonstrator:

S he Grid Demonstrator

Getting access to GILDA:

Step 1: Get your GILDA CA personal certificate

Step 2: Accept the GILDA Use Policy

Step 3: Register to the GILDA Virtual Organization

Step 4a: Login to the Grid Tutor portal

Step 4b: Login to the Grid Tutor User Interface

Step 4c: Download and use the GILDA VM UI

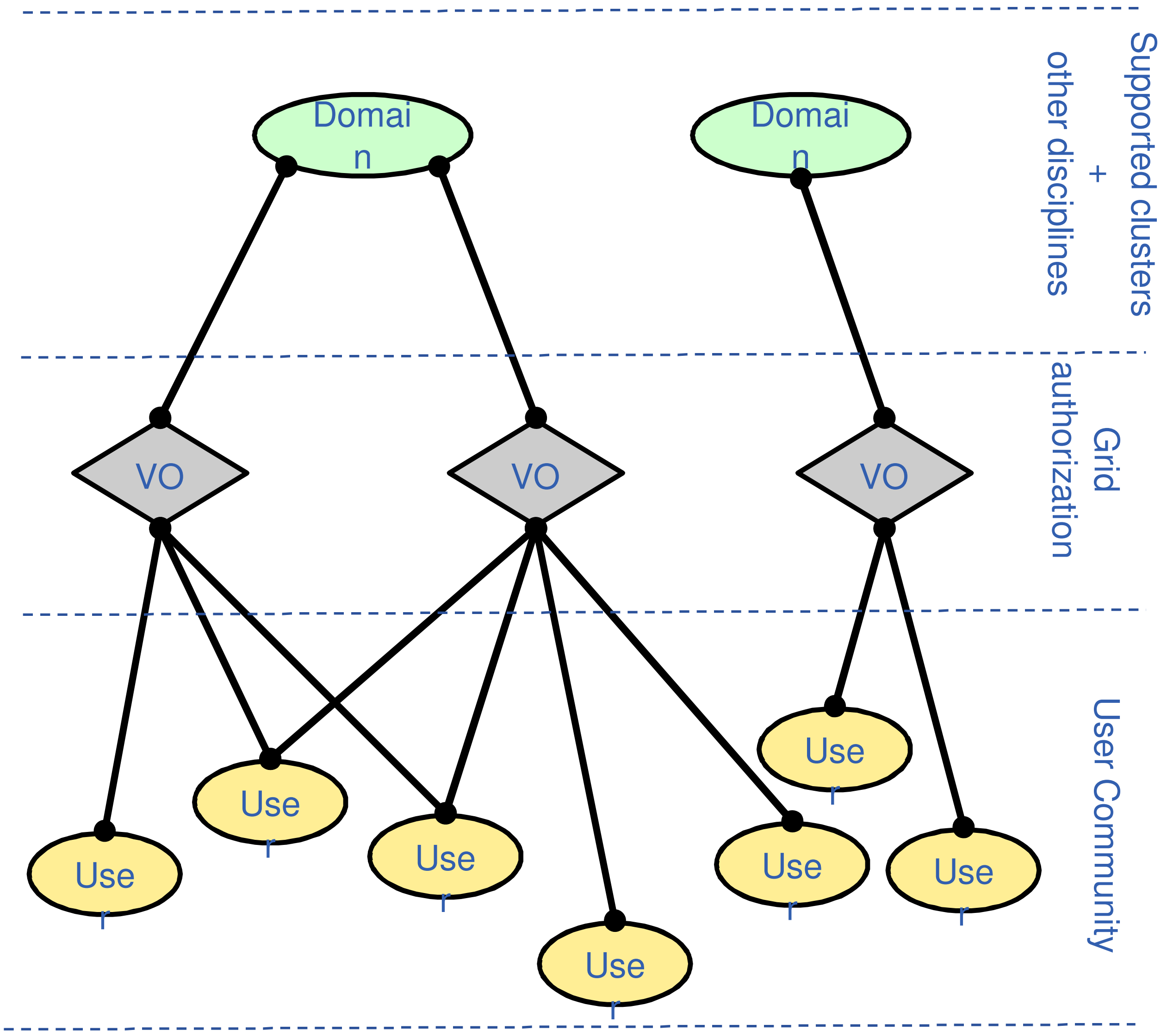
External documentation:

Users and Site Managers Support

Grid Dictionary by Andrea Caltroni [PDF] - [TXT]

A Brief Guide to Certificate Management by Marisa Luvisetto [PDF] [TXT](updated 27/09/2004)

EGEE User Community Organization



Application domains:

- High Energy Physics (HEP)
- Life Sciences (LS)
- Earth Sciences (ES)
- Grid Observatory (GO)
- Computational Chemistry (CC)
- Astronomy & Astrophysics (AA)
- Fusion (F)

23 "Core" VOs:

CPU Utilization > 10% in the domain

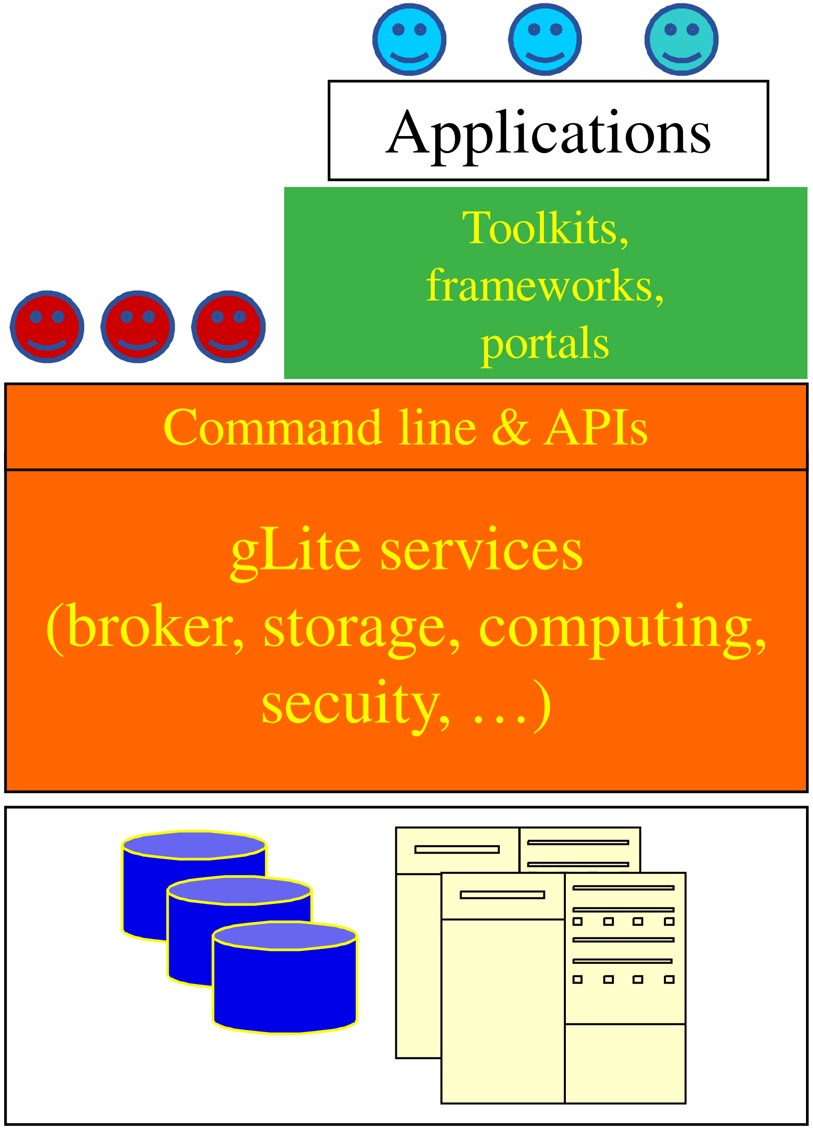
112 total Registered VOs

4167 users in "Core" VOs

13,381 users in Registered VOs

Application domains and contacts: https://twiki.cern.ch/twiki/bin/view/EGEE/NA4

Using an EGEE VO



- **Most VOs include software on top of gLite**
- **Some domain specific, some not**
- **EGEE RESPECT Programme:**
  - Recommended External Software Packages for Egee CommuniTies
  - Identify third-party software that works well with gLite
    - Expand the functionality of the grid infrastructure,
    - Reduce duplicated development
    - Speed the porting of new applications to the grid
  - http://technical.eu-egee.org/index.php?id=290

As a grid user where to get help?

Generic support services:

- **Global Grid User Support - GGUS: http://www.ggus.org/**
  - If you have problems with any of the EGEE Production VOs (e.g. CE, WMS, UI, …)
  - If you have a practical question on a gLite service
  - Your grid certificate must be in your browser (See this tutorial how to do it)
- **EGEE Application Porting Support for users: http://www.lpds.sztaki.hu/gasuc/**
  - If you don't know how to port your application to EGEE
  - Technical consultancy + programmers who can work with you!

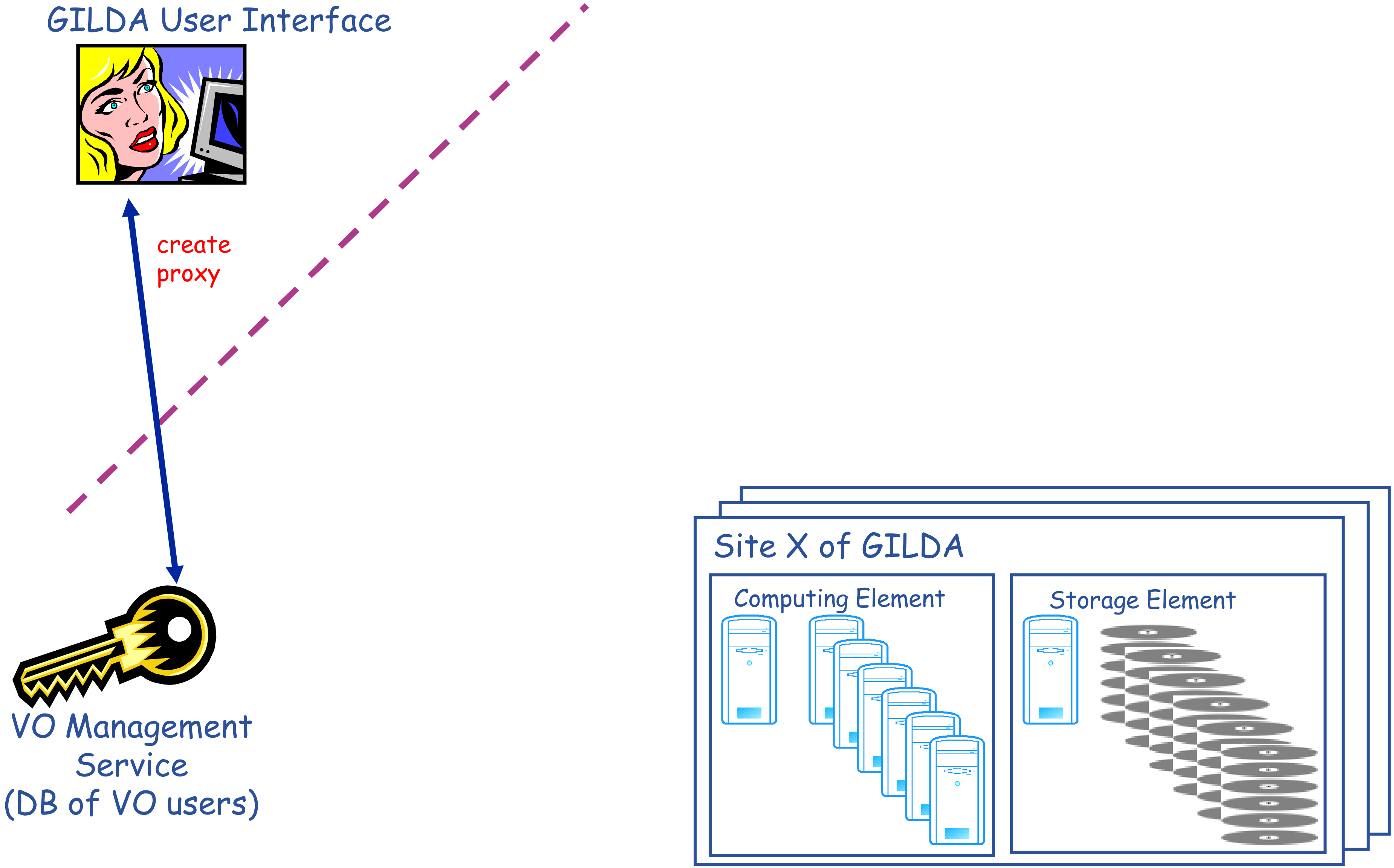
Generic support resources:

- **gLite user guide:** http://glite.web.cern.ch/glite/documentation
- **Training materials: http://egee.lib.ed.ac.uk, https://grid.ct.infn.it/twiki/bin/view/GILDA/UserTutorials**
- **Training events: http://www.egee.nesc.ac.uk**

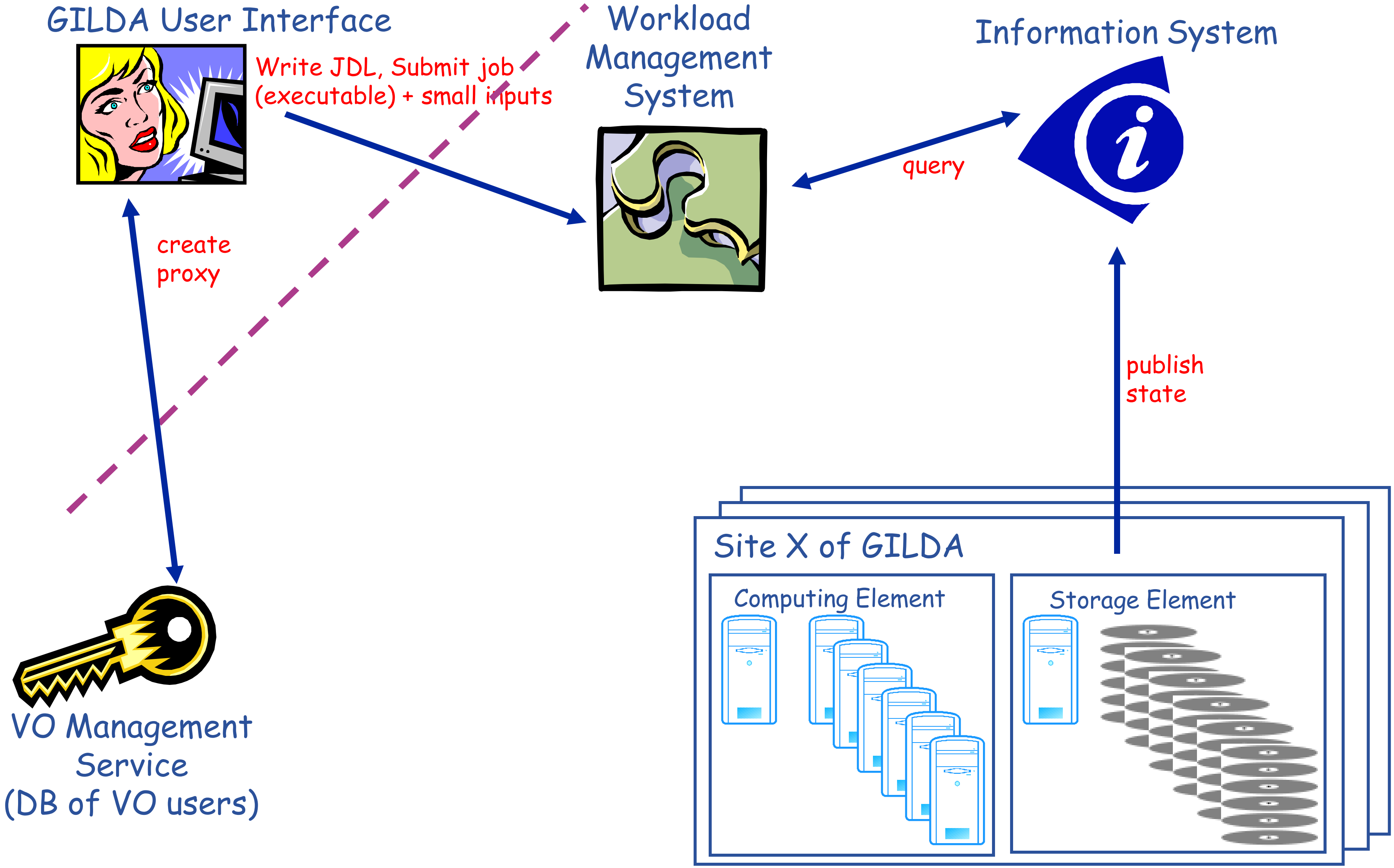
gLite command line usage

www.eu-egee.org

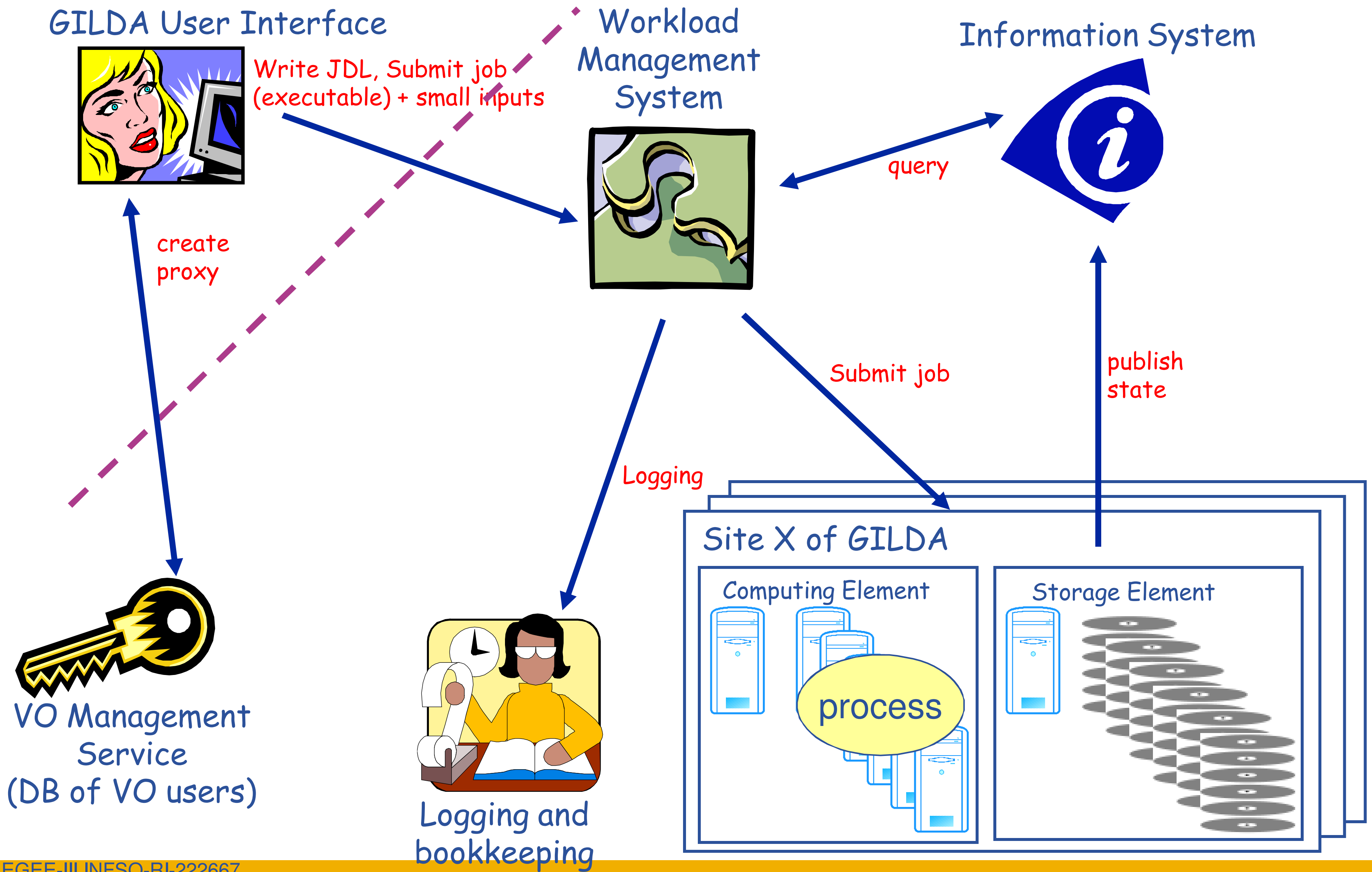
gLite use case 1: Submission of a simple job



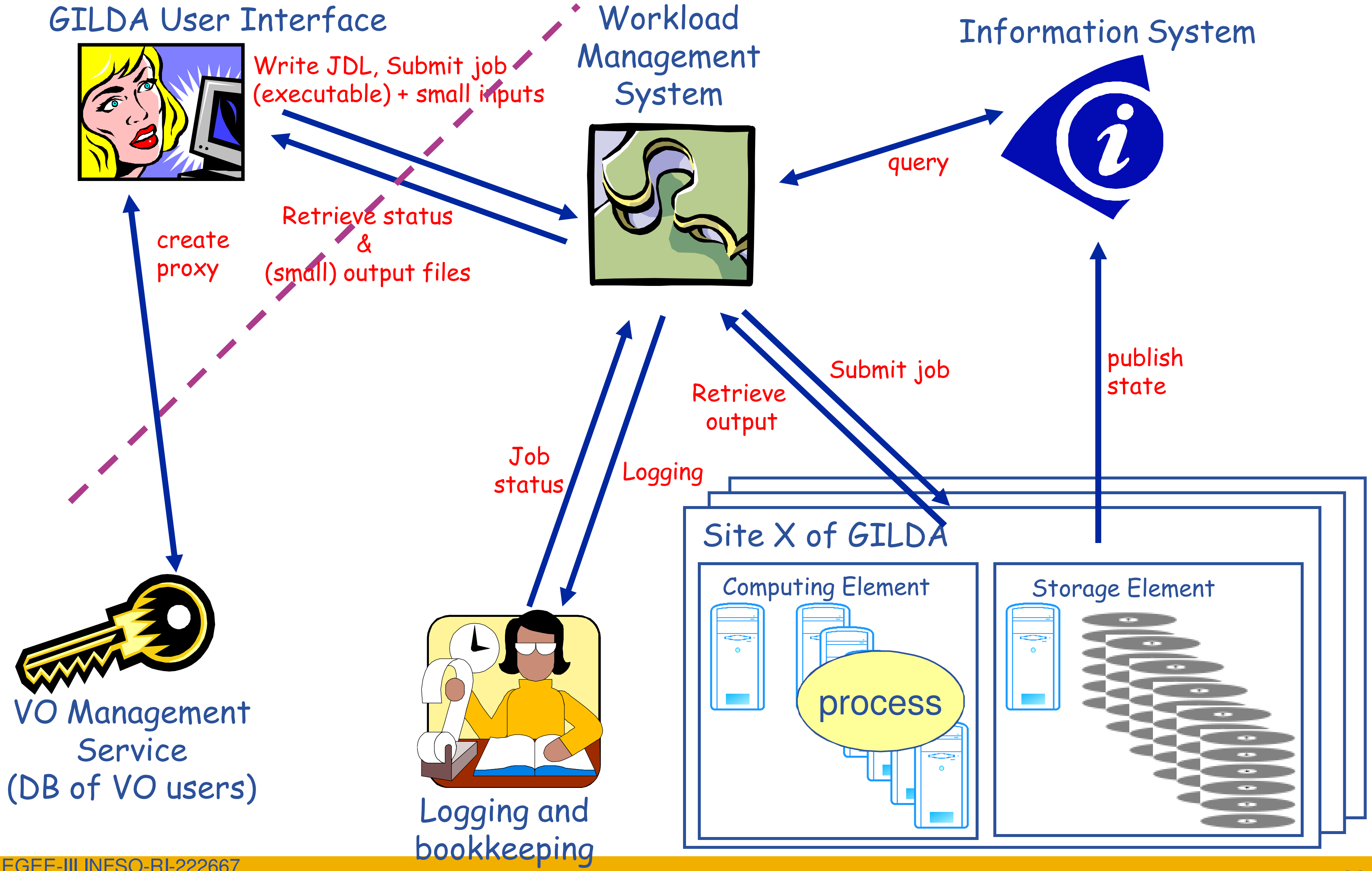
gLite use case 1: Submission of a simple job



gLite use case 1: Submission of a simple job



gLite use case 1: Submission of a simple job



Logging into the Grid: Creating a proxy

```
[sipos@glite-tutor ~]$ ls -l .globus/
-rw-r--r--  1 sipos users 1761 Dec  2  2008 usercert.pem
-r--------    1 sipos users   951 Oct 24  2006 userkey.pem

[sipos@glite-tutor sipos]$ voms-proxy-init --voms gilda
Enter GRID pass phrase: ***********
Your identity: /C=HU/O=NIIF CA/OU=GRID/OU=NIIF/CN=Gergely
Sipos/Email=sipos@sztaki.hu
Creating temporary proxy .......................................................... Done
Contacting  voms.ct.infn.it:15001 [/C=IT/O=INFN/OU=Host/L=Catania/CN=voms.ct.infn.it]
"gilda" Done
Creating proxy ................................. Done
Your proxy is valid until Sat Jun 23 04:55:19 2007
```

% voms-proxy-init → login to the Grid

Enter PEM pass phrase: ****** → private key is protected by a password

- Options for voms-proxy-init:
  - VO name
  - -hours <lifetime of new credential>
  - -help

% voms-proxy-destroy → logout from the grid

Writing a JDL file

```
[sipos@glite-tutor sipos]$ nano OR vi hostname.jdl


Type = "Job";
JobType = "Normal";
Executable = "/bin/hostname";
StdOutput = "hostname.out";
StdError = "hostname.err";
OutputSandbox = {"hostname.err","hostname.out"};
Arguments = "-f";
```

Basic JDL-file attributes

- `Executable` – sets the name of the executable file;
- `Arguments` – command line arguments of the program;
- `StdOutput, StdError` - files for storing the standard output and error messages output;
- `InputSandbox` – set of input files needed by the program, including the executable;
- `OutputSandbox` – set of output files which will be written during the execution, including standard output and standard error output; these are sent from the CE to the WMS for you to retrieve
- `ShallowRetryCount` – in case of grid error, retry job this many times (“Shallow”: before job is running)

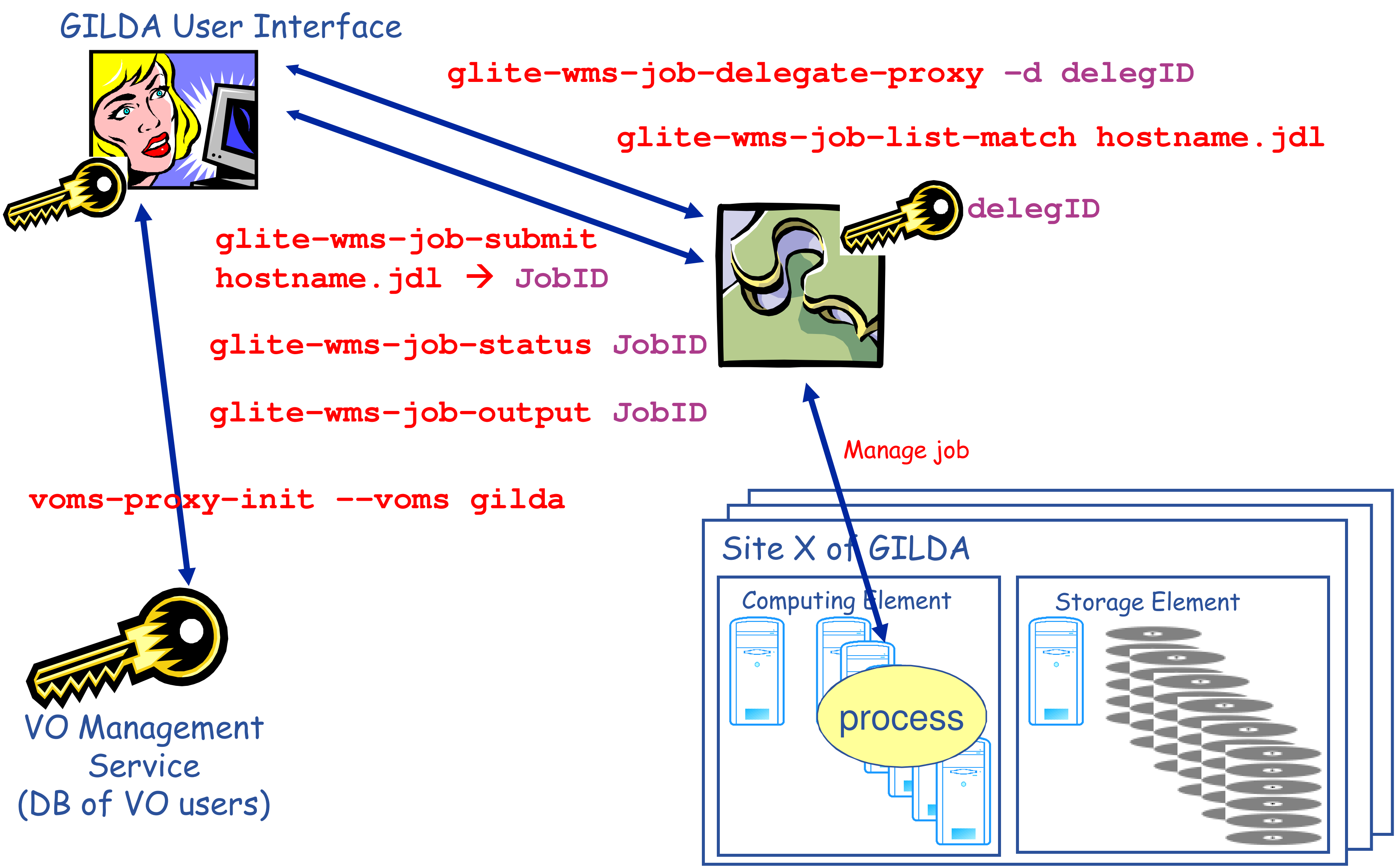
Job management commands

Recommended

DEPRECATED

WMS version	LCG-2 WMS	gLite WMS via NS gLite 3.0	gLite WMS via WMProxy gLite 3.1+
Delegate proxy			**glite-wms-job-delegate-proxy** -d delegID
Submit	**edg-job-submit** [-o joblist]jdlfile	**glite-job-submit** [-o joblist] jdlfile	**glite-wms-job-submit** [-d delegID] [-a] [-o joblist] jdlfile
Status	**edg-job-status** [-v verbosity] [-i joblist] jobIDs	**glite-job-status** [-v verbosity] [-i joblist] jobIDs	**glite-wms-job-status** [-v verbosity] [-i joblist] jobIDs
Logging	**edg-job-get-logging-info** [-v verbosity] [-i joblist] jobIDs	**glite-job-logging-info** [-v verbosity] [-i joblist] jobIDs	**glite-wms-job-logging-info** [-v verbosity] [-i joblist] jobIDs
Output	**edg-job-get-output** [-dir outdir] [-i joblist] jobIDs	**glite-job-output** [-dir outdir] [-i joblist] jobIDs	**glite-wms-job-output** [-dir outdir] [-i joblist] jobIDs
Cancel	**edg-job-cancel** [-i joblist] jobID	**glite-job-cancel** [-i joblist] jobID	**glite-wms-job-cancel** [-i joblist] jobID
Compatible resources	**edg-job-list-match** jdlfile	**glite-job-list-match** jdlfile	**glite-wms-job-list-match** [-d delegID] [-a] jdlfile

gLite use case 1 with user commands



```
glite-wms-job-delegate-proxy -d delegID
glite-wms-job-list-match hostname.jdl
glite-wms-job-submit
hostname.jdl → JobID
glite-wms-job-status JobID
glite-wms-job-output JobID
voms-proxy-init --voms gilda
```

Job states
Output of glite-wms-job-status

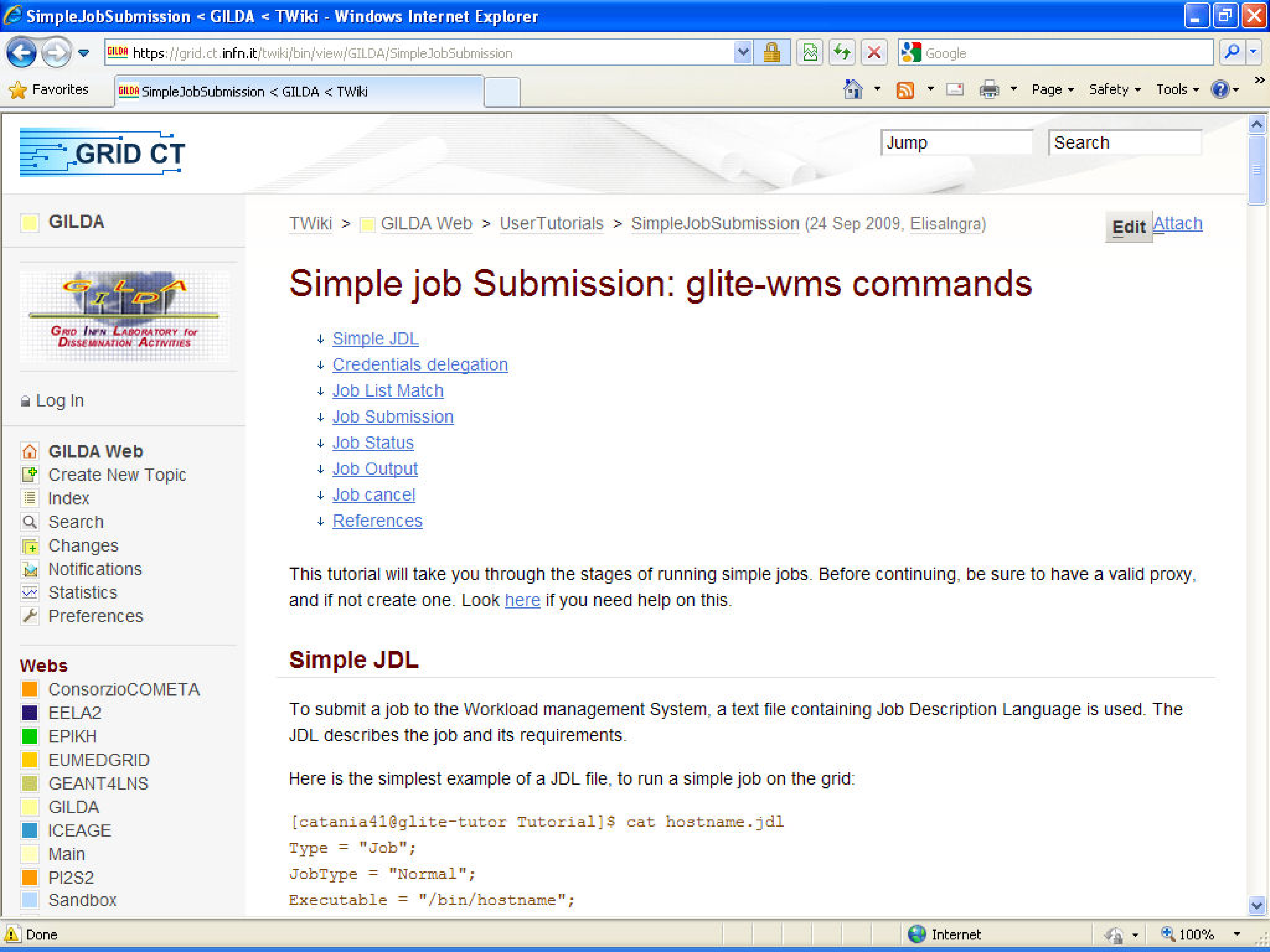
Flag	Meaning
SUBMITTED	submission logged in the Logging & Bookkeeping service
WAIT	job match making for resources
READY	job being sent to executing CE
SCHEDULED	job scheduled in the CE queue manager
RUNNING	job executing on a Worker Node of the selected CE queue
DONE	job terminated without grid errors
CLEARED	job output retrieved
ABORT	job aborted by middleware, check *reason*

Related GILDA tutorials

1. **Practical**
   https://grid.ct.infn.it/twiki/bin/view/GILDA/AuthenticationAuthorization
   - Investigate your certificate
   - Create proxy
   - Investigate your proxy
2. **Practical**
   https://grid.ct.infn.it/twiki/bin/view/GILDA/SimpleJobSubmission
   - Create a simple JDL file
     copy&paste JDL file from tutorial into a file.
   - Delegate proxy
   - List the CEs that can accept it
   - Submit job
   - Check job status until its finished
   - Retrieve output

Extra: **https://grid.ct.infn.it/twiki/bin/view/GILDA/CertificateManagement**

- How to import certificate in a web browser
- Now to convert pkcs12 to pem
- How to send signed email
- How to export a certificate from the web browser



TWiki > GILDA Web > UserTutorials > SimpleJobSubmission (24 Sep 2009, ElisaIngra)

Simple job Submission: glite-wms commands

This tutorial will take you through the stages of running simple jobs. Before continuing, be sure to have a valid proxy, and if not create one. Look here if you need help on this.

Simple JDL

To submit a job to the Workload management System, a text file containing Job Description Language is used. The JDL describes the job and its requirements.

Here is the simplest example of a JDL file, to run a simple job on the grid:

```
[catania41@glite-tutor Tutorial]$ cat hostname.jdl
Type = "Job";
JobType = "Normal";
Executable = "/bin/hostname";
```

More realistic jobs

The “Executable”

```
[sipos@glite-tutor sipos]$ nano OR vi hostname.jdl
…
Executable = "/bin/hostname";
…
```

- **Installed on the CE**
    - Standard software in Linux (Scientific Linux!)
    - VO specific software: advertised in information system
        - *Use JDL expressions to navigate job to such a site*
- **Or Comes from client side**
    - Part of InputSandbox
        - Script
            - *No compilation is necessary*
            - *Can invoke binary that is statically installed on the CE*
        - Or Binary
            - *Must be compiled on the User Interface → binary compatibility with CEs*
            - *Statically linked → to avoid errors caused by different library versions*

Submitting your script

```
$ cat testsandbox.jdl
Type = "Job";
JobType = "Normal";
Executable = "/bin/sh";
Arguments = "testsandbox.sh";
StdOutput = "testsandbox.out";
StdError = "testsandbox.err";
InputSandbox = "testsandbox.sh";
OutputSandbox = {"testsandbox.err","testsandbox.out"};
ShallowRetryCount = 1;
```

```
$ cat testsandbox.sh
#!/bin/bash
ls -l
```

```
$ /bin/sh testsandbox.sh
```

Submitting your executable with a wrapper script

```
$ cat yourexe.jdl
Type = "Job";
JobType = "Normal";
Executable = "/bin/sh";
Arguments = "script.sh INSERT_YOUR_NAME";
StdOutput = "script.out";
StdError = "script.err";
InputSandbox = {"script.sh","myexecutable"};
OutputSandbox = {"script.out","script.err","exe.out"};
ShallowRetryCount = 1;
```

Compiled on UI

```
cat script.sh
#!/bin/sh
echo "setting right permissions"
chmod 755 myexecutable
echo "executing program now..."
./myexecutable $1 > exe.out
```

```
$ /bin/sh script.sh Gergely
```

Controlling WMS with JDL

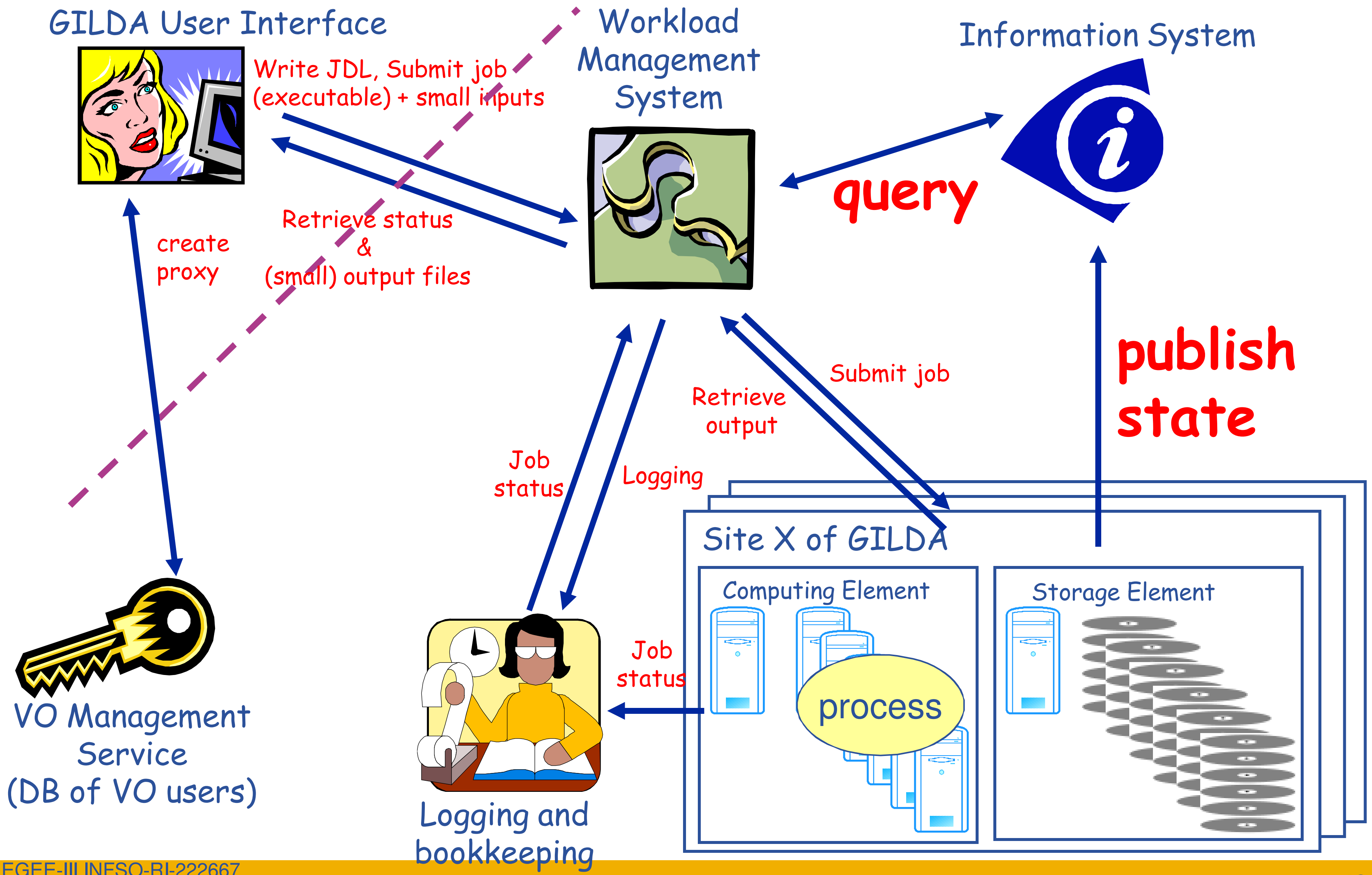
```
Executable = "gridTest";
StdError = "std
StdOutput = "st
InputSandbox =                    Test"};
OutputSandbox = {                 t.log"};


Requirements = other.Architecture=="INTEL" &&
   other.GlueCEInfoTotalCPUs > 480;
Rank = other.GlueCEStateTotalJobs;
```

WMS uses
Information System
to find CE

WMS brokering policy :

- Meet CE requirements
- Select CE with highest rank

Handling Requirements and Rank



Brokering policy

1. **Meet CE requirements**
   (defined by Requirements part of JDL)

2. **Select CE which is close to InputData**
   - “Close” relationship is defined between CEs and SEs by site administrators
   - “Close” is not necessarily physical distance – rather bandwidth
   - “Close” typically means same site
     - *CE:* iceage-ce-01.ct.infn.it:2119/jobmanager-lcgpbs-short
     - *Close SE:* iceage-se-01.ct.infn.it

3. **Select CE with highest rank**
   (rank formula is defined by Rank part of JDL)

Some relevant CE attributes

- **GlueCEUniqueID** – Identify a CE
  - Eliminating an erroneous CE:

    ```
    other.GlueCEUniqueID !=
    “grid010.ct.infn.it:2119/jobmanager-lcgpbs-long”
    ```

  - Sending the job to a given CE:

    ```
    other.GlueCEUniqueID ==
    “grid010.ct.infn.it:2119/jobmanager-lcgpbs-long”
    ```

- **GlueCEInfoTotalCPUs** – max number of CPUs at a CE

  ```
  Rank = other. GlueCEInfoTotalCPUs;
  ```

- **GlueCEStateWaitingJobs** – number of waiting jobs
- **GlueCEPolicyMaxCPUTime** – job will be killed after this number of minutes
- **GlueHostMainMemoryRAMSize** – memory size

http://glite.web.cern.ch/glite/documentation/ → **JDL specification (submission via WMS WMProxy)**

Examples

- *Rank =*
  (other.GlueCEStateWaitingJobs == 0 ? other.GlueCEStateFreeCPUs : -other.GlueCEStateWaitingJobs);

  if there are no waiting jobs,
  - then the selected CE will be the one with the most free CPUs
  - else the one with the least waiting jobs.

- *Requirements =*
  (Member(„IDL2.1”, other.GlueHostApplicationSoftwareRunTimeEnvironment)) && (other.GlueCEPolicyMaxWallClockTime > 10000);

  CE where,
  - IDL2.1 software is available
  - At least 10000s can be spent on the site (waiting + running)

Related GILDA tutorial

More complex JDLs

https://grid.ct.infn.it/twiki/bin/view/GILDA/MoreOnJDL

Using different executables

- Submit a script from client side
  - Listing work directory of the job
- Submit a binary from client side (with wrapper script)

Requirements, Ranks

- Send the job to a particular CE
- Send the job to any CE where “GEANT4-6” is available
- Send a job anywhere but a particular CE (dealing with errors)

Extra:

Query of the Information System to discover CE and SE characteristics and status:

https://grid.ct.infn.it/twiki/bin/view/GILDA/InformationSystems

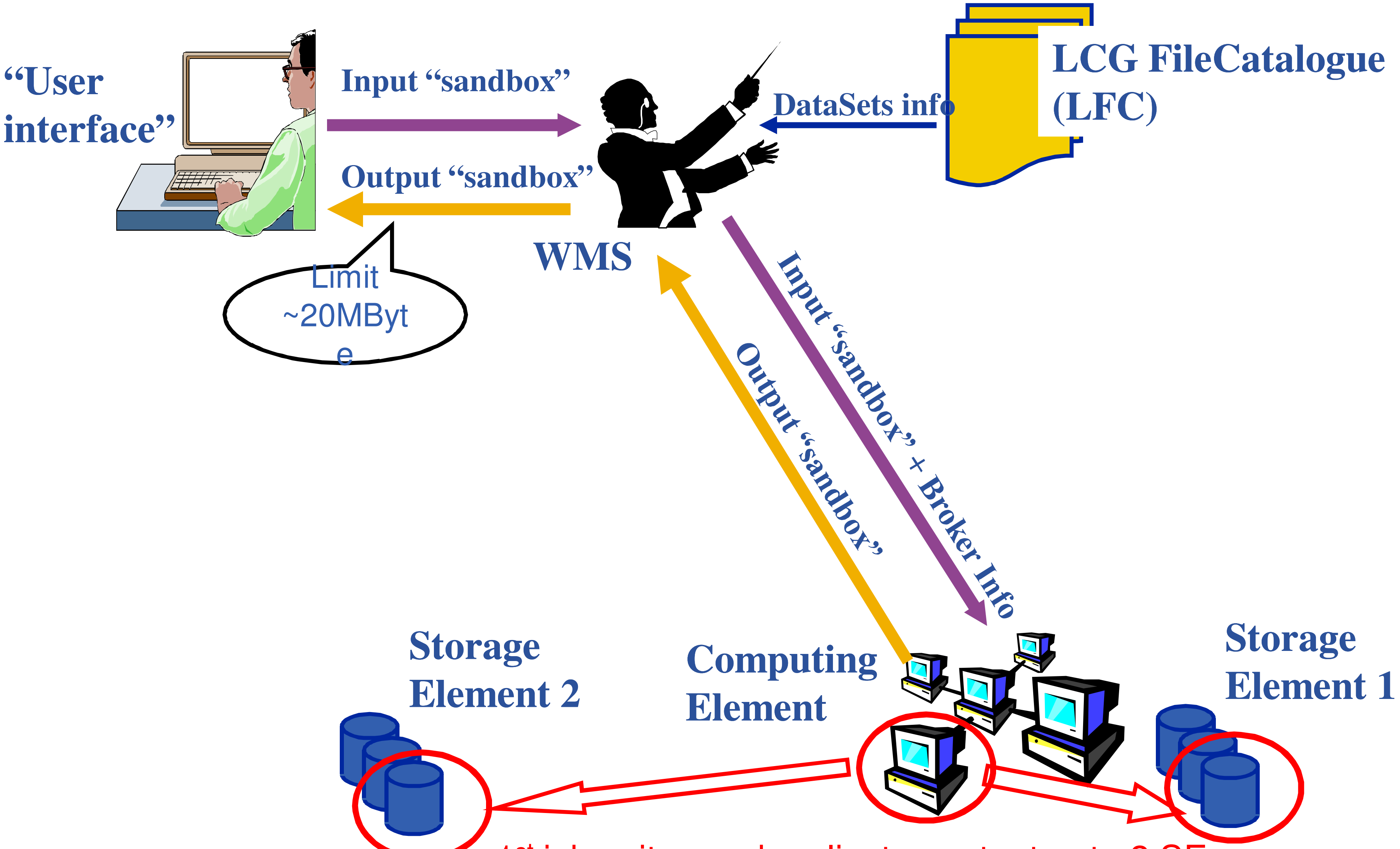
Working with large datasets

Scope of basic data services in gLite

- **Files that are write-once, read-many**
  - If users edit files then
    - They manage the consequences!
    - Maybe just create a new filename!
  - No intention of providing a global file management system

- **Services for file management**
  - Storage
  - Catalogs
  - Transfer

Data management example



"User interface"

Input "sandbox"

Output "sandbox"

Limit ~20MByte

WMS

DataSets info

LCG FileCatalogue (LFC)

Input "sandbox" + Broker Info

Output "sandbox"

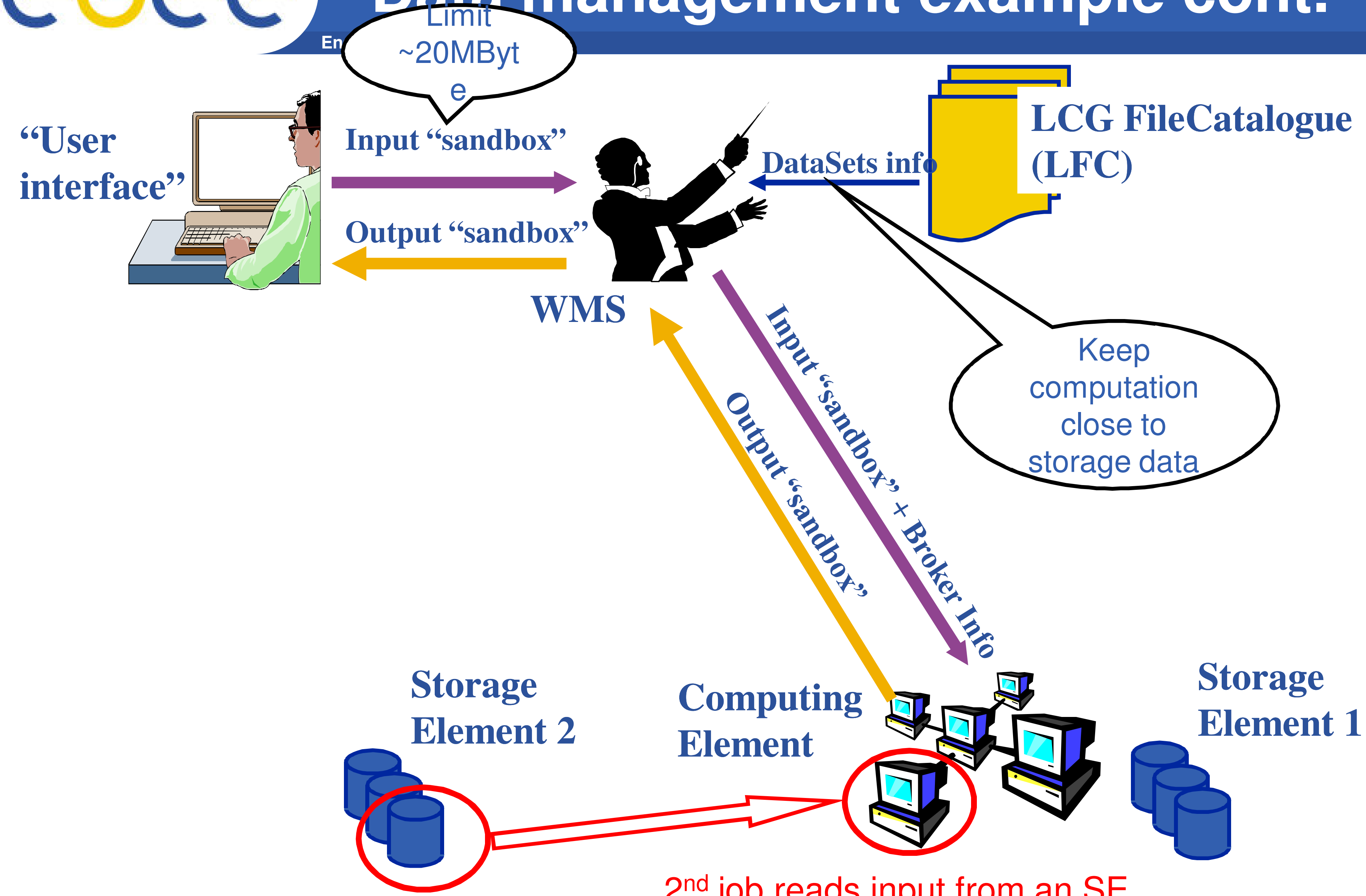
Storage Element 2

Computing Element

Storage Element 1

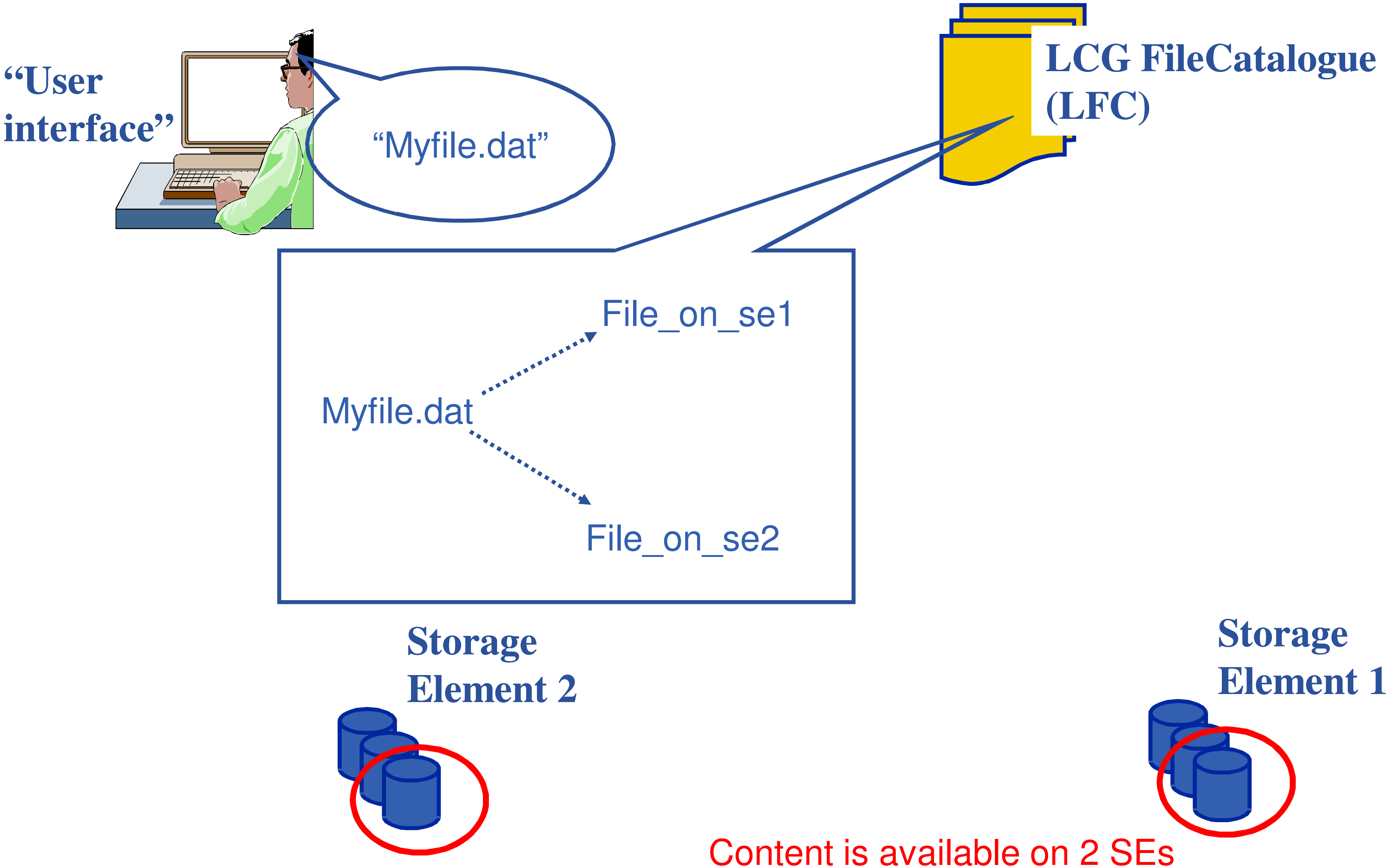
1st job writes and replicates output onto 2 SEs

Data management example cont.



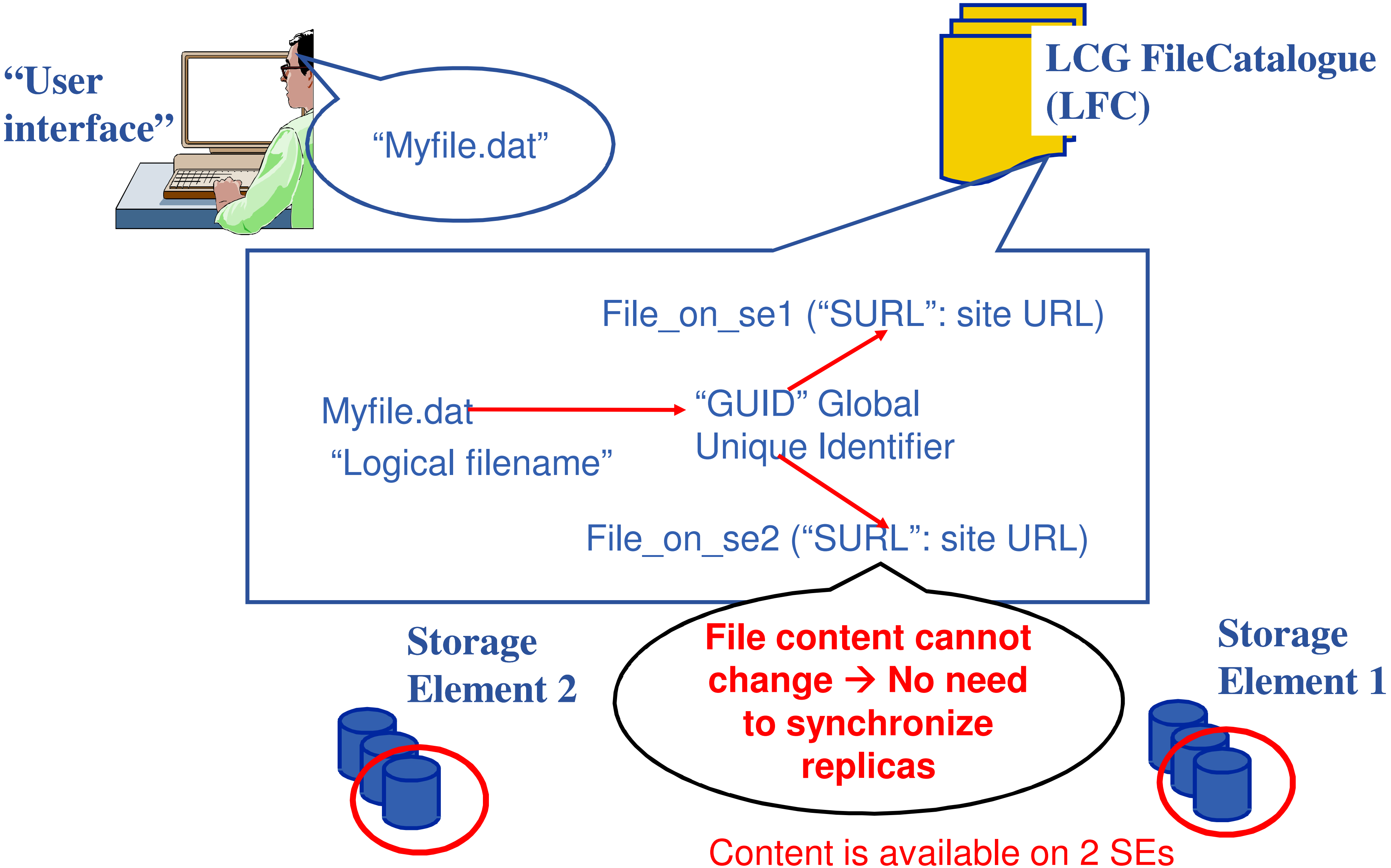
2nd job reads input from an SE

Resolving logical file name



Content is available on 2 SEs

Resolving logical file name

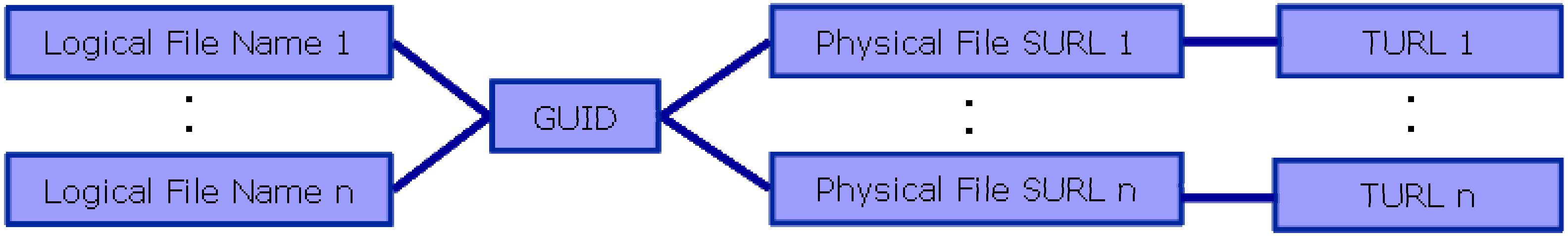


File content cannot change → No need to synchronize replicas

Content is available on 2 SEs

Name conventions

- **Logical File Name (LFN)**
  - An alias created by a user to refer to some item of data, e.g.
    `lfn:/grid/gilda/budapest23/run2/track1`
- **Globally Unique Identifier (GUID)**
  - A non-human-readable unique identifier for an item of data, e.g.
    `guid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6`
- **Site URL (SURL) (or Physical File Name (PFN) or Site FN)**
  - The location of an actual piece of data on a storage system, e.g.
    `srm://pcrd24.cern.ch/flatfiles/cms/output10_1` (SRM)
    `sfn://lxshare0209.cern.ch/data/alice/ntuples.dat` (Classic SE)
- **Transport URL (TURL)**
  - Temporary locator of a replica + access protocol: understood by a SE, e.g.
    `rfio://lxshare0209.cern.ch//data/alice/ntuples.dat`



Name conventions

- Users primarily access and manage files through “logical filenames” - LFC

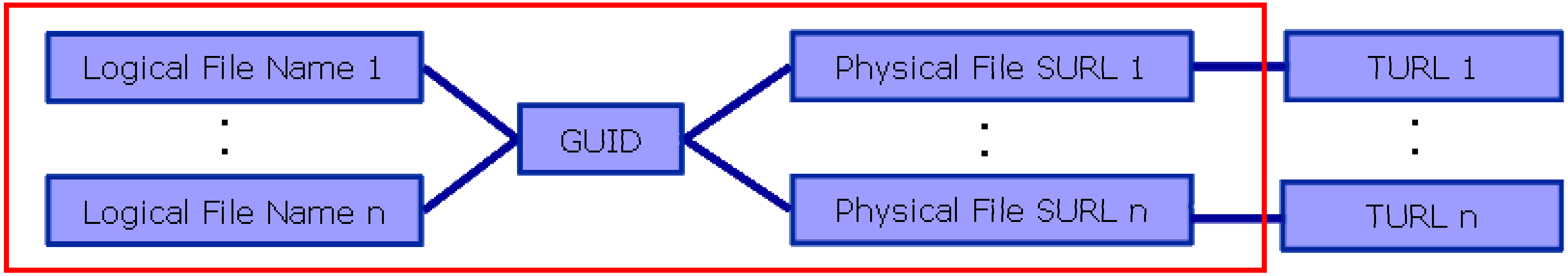
LFC has a directory tree structure

lfn:/grid/<VO_name>/ <you create it>

LFC Namespace

Defined by the user

- Mapping by the “LFC” catalogue server



Logical File Name 1

:

Logical File Name n

GUID

Physical File SURL 1

:

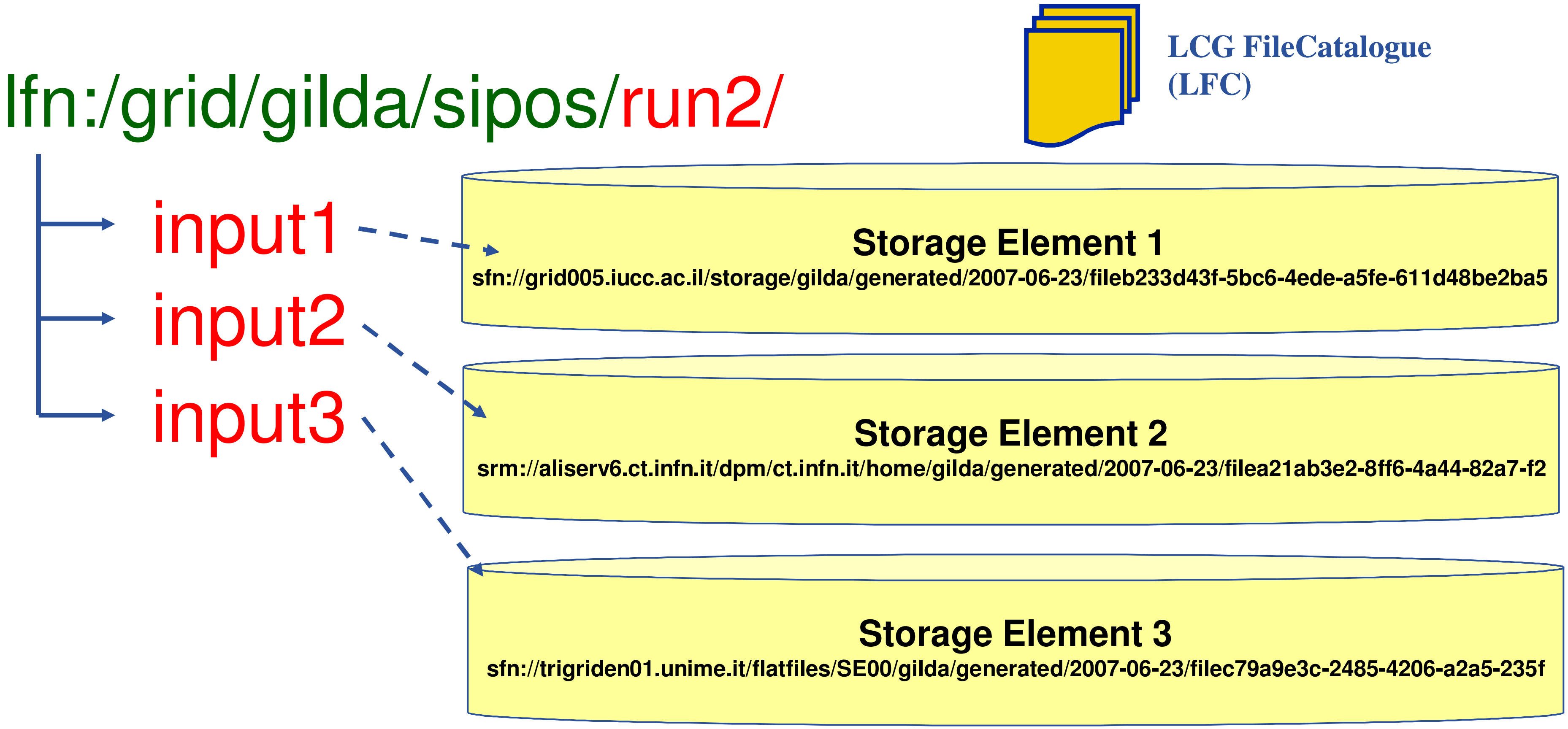
Physical File SURL n

TURL 1

:

TURL n

LFC directories



LCG FileCatalogue (LFC)

lfn:/grid/gilda/sipos/run2/

input1

input2

input3

Storage Element 1

sfn://grid005.iucc.ac.il/storage/gilda/generated/2007-06-23/fileb233d43f-5bc6-4ede-a5fe-611d48be2ba5

Storage Element 2

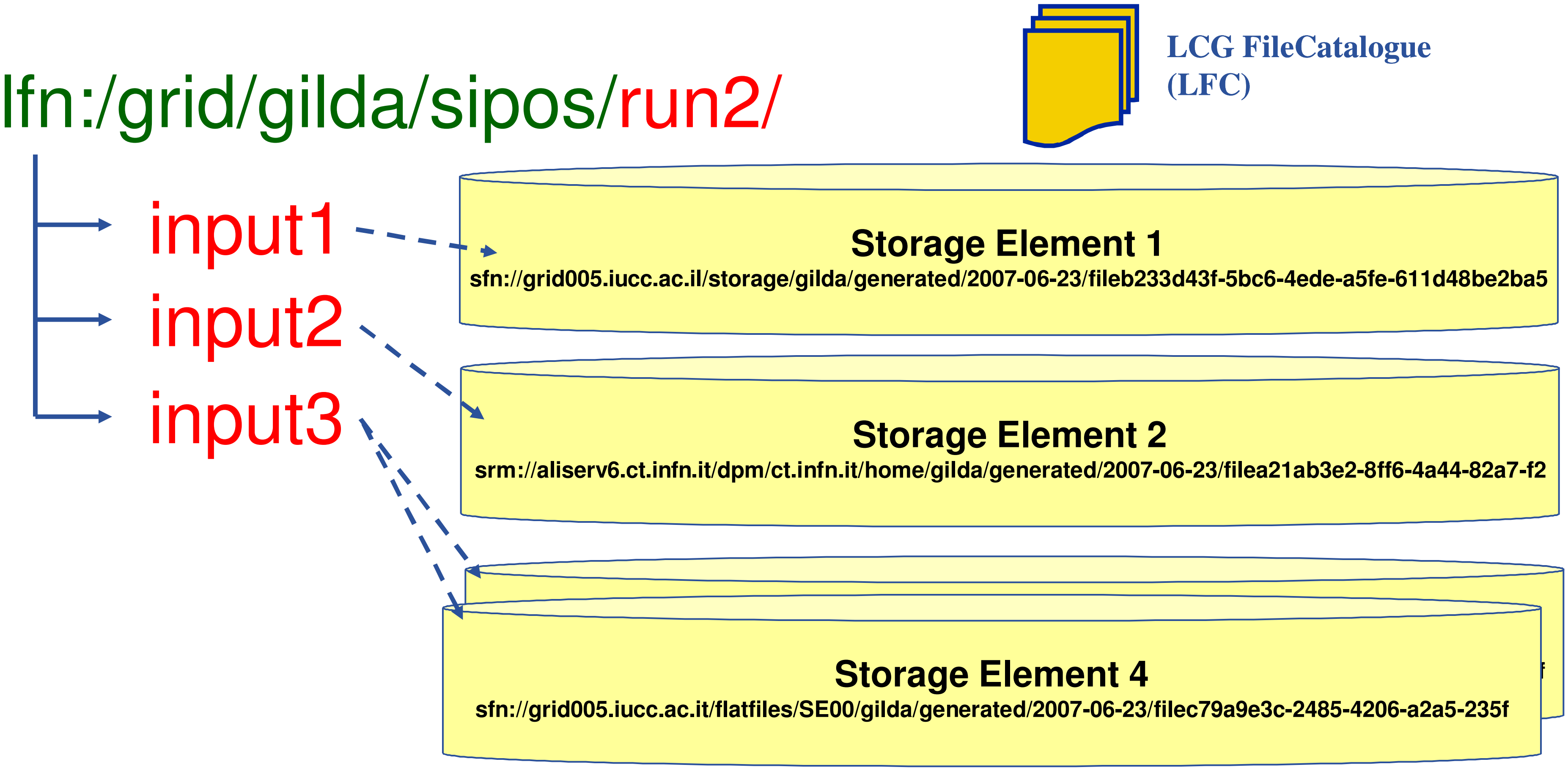
srm://aliserv6.ct.infn.it/dpm/ct.infn.it/home/gilda/generated/2007-06-23/filea21ab3e2-8ff6-4a44-82a7-f2

Storage Element 3

sfn://trigriden01.unime.it/flatfiles/SE00/gilda/generated/2007-06-23/filec79a9e3c-2485-4206-a2a5-235f

- **LFC directories = virtual directories**
  - Each entry in the directory may be stored on different SEs

LFC directories



LCG FileCatalogue (LFC)

lfn:/grid/gilda/sipos/run2/

- input1
- input2
- input3

Storage Element 1

sfn://grid005.iucc.ac.il/storage/gilda/generated/2007-06-23/fileb233d43f-5bc6-4ede-a5fe-611d48be2ba5

Storage Element 2

srm://aliserv6.ct.infn.it/dpm/ct.infn.it/home/gilda/generated/2007-06-23/filea21ab3e2-8ff6-4a44-82a7-f2

Storage Element 4

sfn://grid005.iucc.ac.it/flatfiles/SE00/gilda/generated/2007-06-23/filec79a9e3c-2485-4206-a2a5-235f

- **LFC directories = virtual directories**
  - Each entry in the directory may be stored on different SEs

Two sets of commands

- **lfc-***

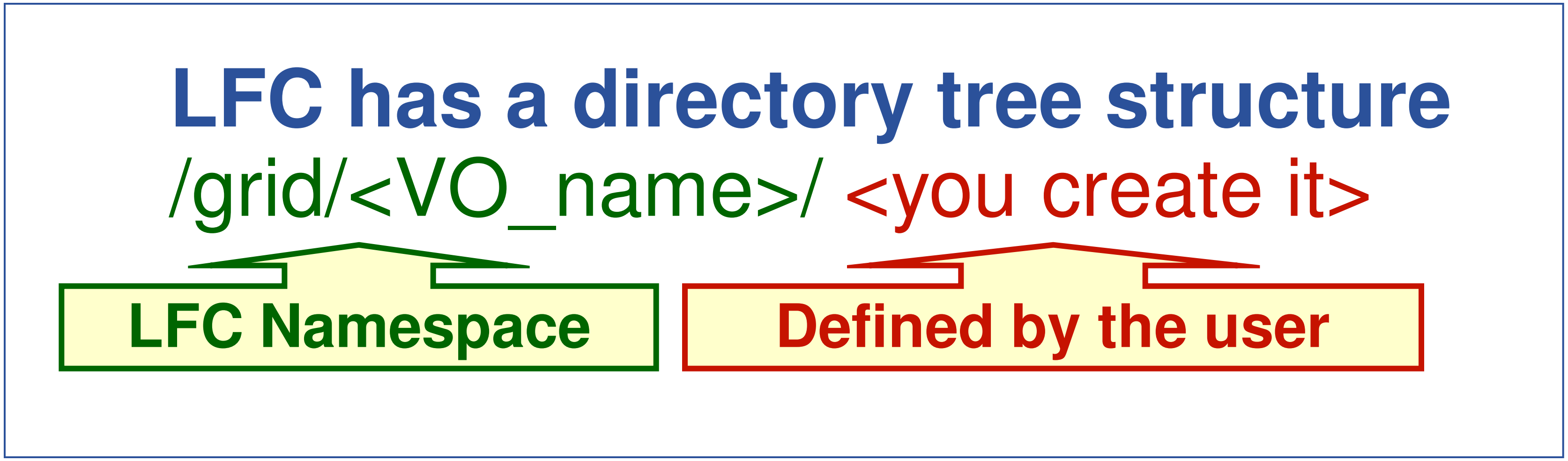
  LFC = LCG File Catalogue

  - LCG = LHC Compute Grid
  - LHC = Large Hadron Collider

  - **Use LFC commands to interact with the directiry catalogue only**
    - **To create catalogue directory**
    - **List files**
  - Used by you, your scripts and by lcg-utils (see below)

- **lcg-***
  - Couples catalogue operations with file management
    - Keeps SEs and catalogue in step!
  - **Copy files to/from/between SEs**
  - Replicate files

LFC basics



LFC has a directory tree structure

/grid/<VO_name>/ <you create it>

LFC Namespace

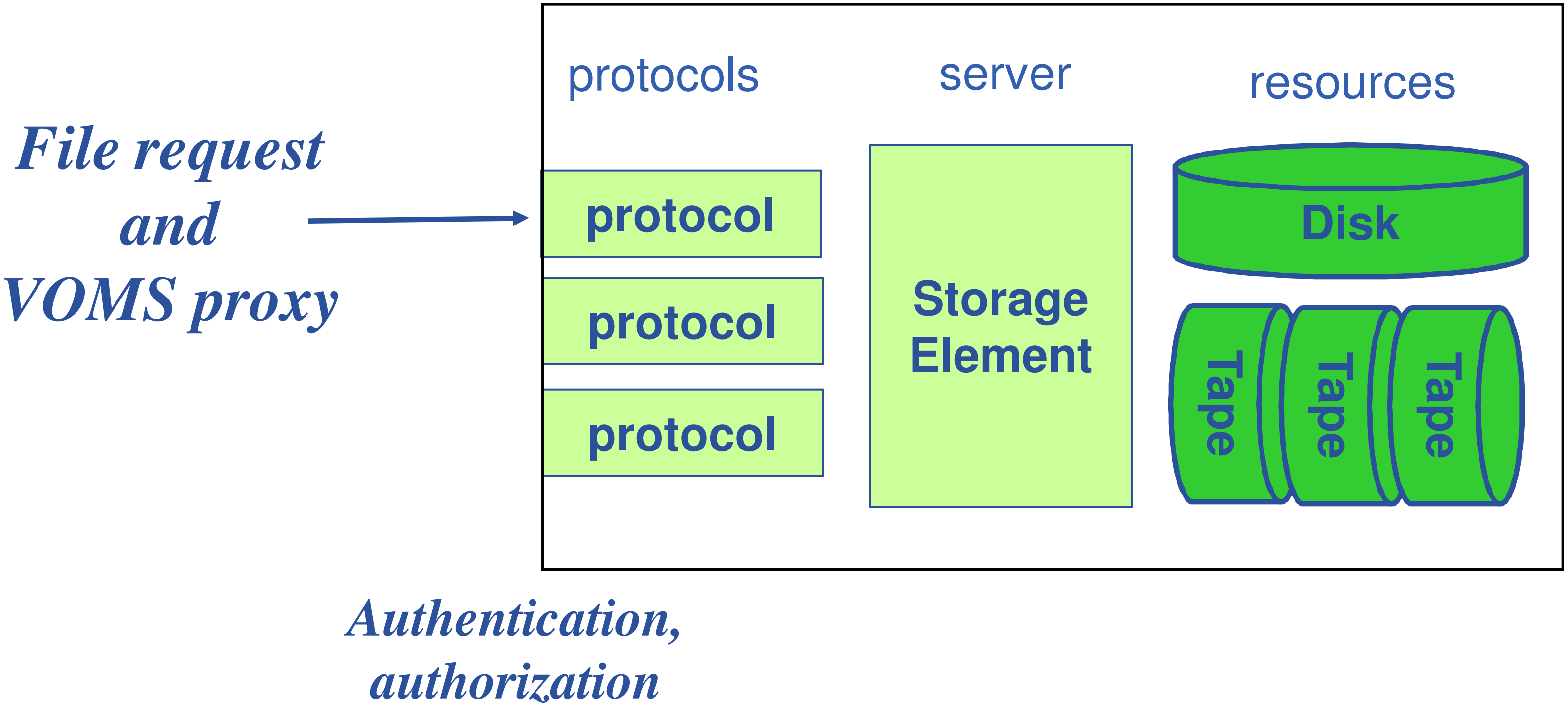
Defined by the user

- All members of a given VO have read-write permissions in their directory

- Commands look like UNIX with “lfc-” in front (often)

Storage Element

- **Provides**
  - Storage for files : massive storage system - disk or tape based
  - Transfer protocol (gsiFTP) ~ GSI based FTP server
    - Striped file transfer – cluster as back-end

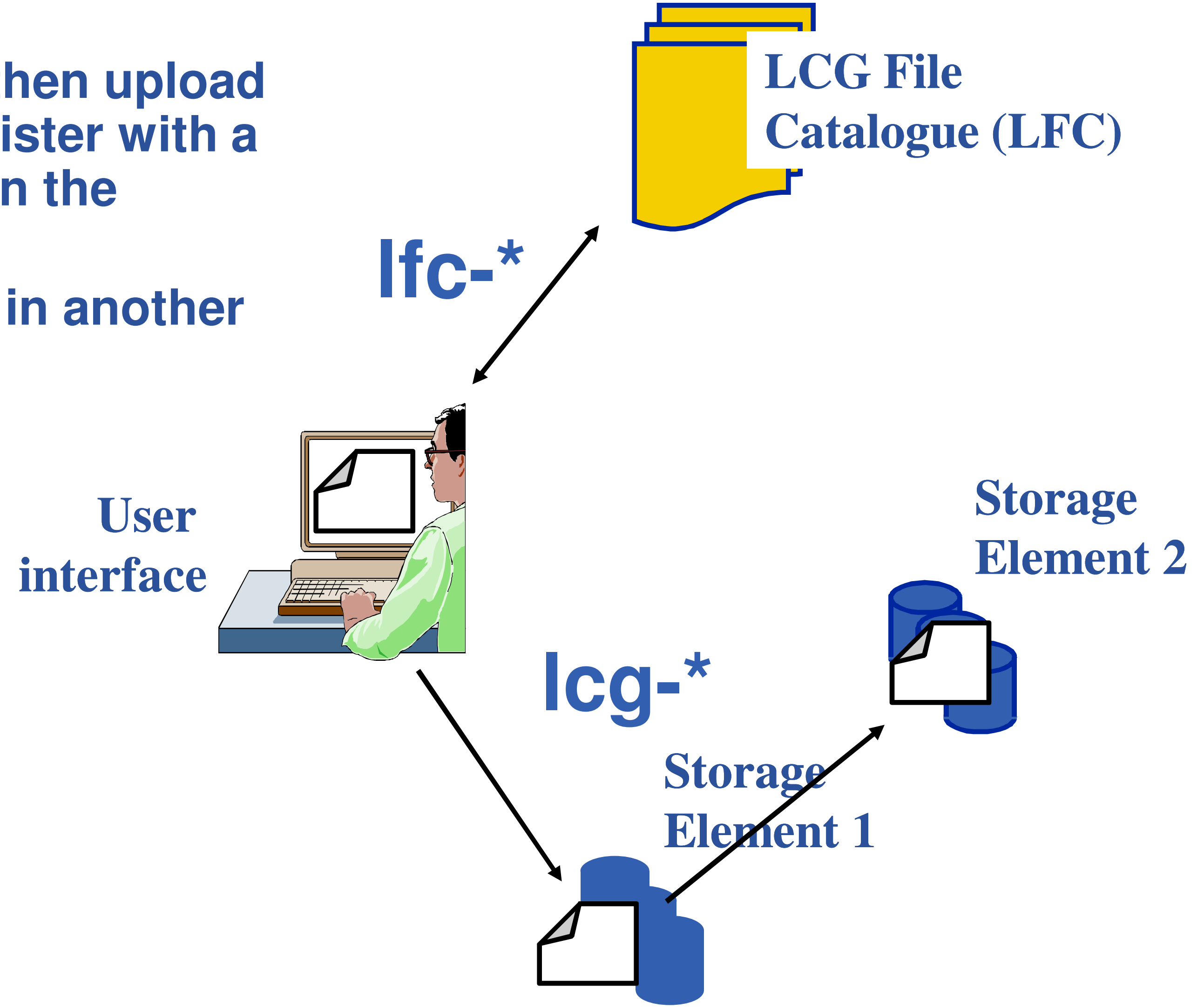


Type	Resources	File transfer	File I/O	SRM
Classic SE	Disk server	GSIFTP	insecure RFIO	No
DPM	Disk pool	GSIFTP	secure RFIO	Yes
dCache	Disk pool/MSS	GSIFTP	gsidcap	Yes
CASTOR	MSS	GSIFTP	insecure RFIO	Yes

Related practical: LFC and LCG utils

http://www.lpds.sztaki.hu/~sipos/egee/tutorials/File_Management-lfc_and_lcg_commands.htm

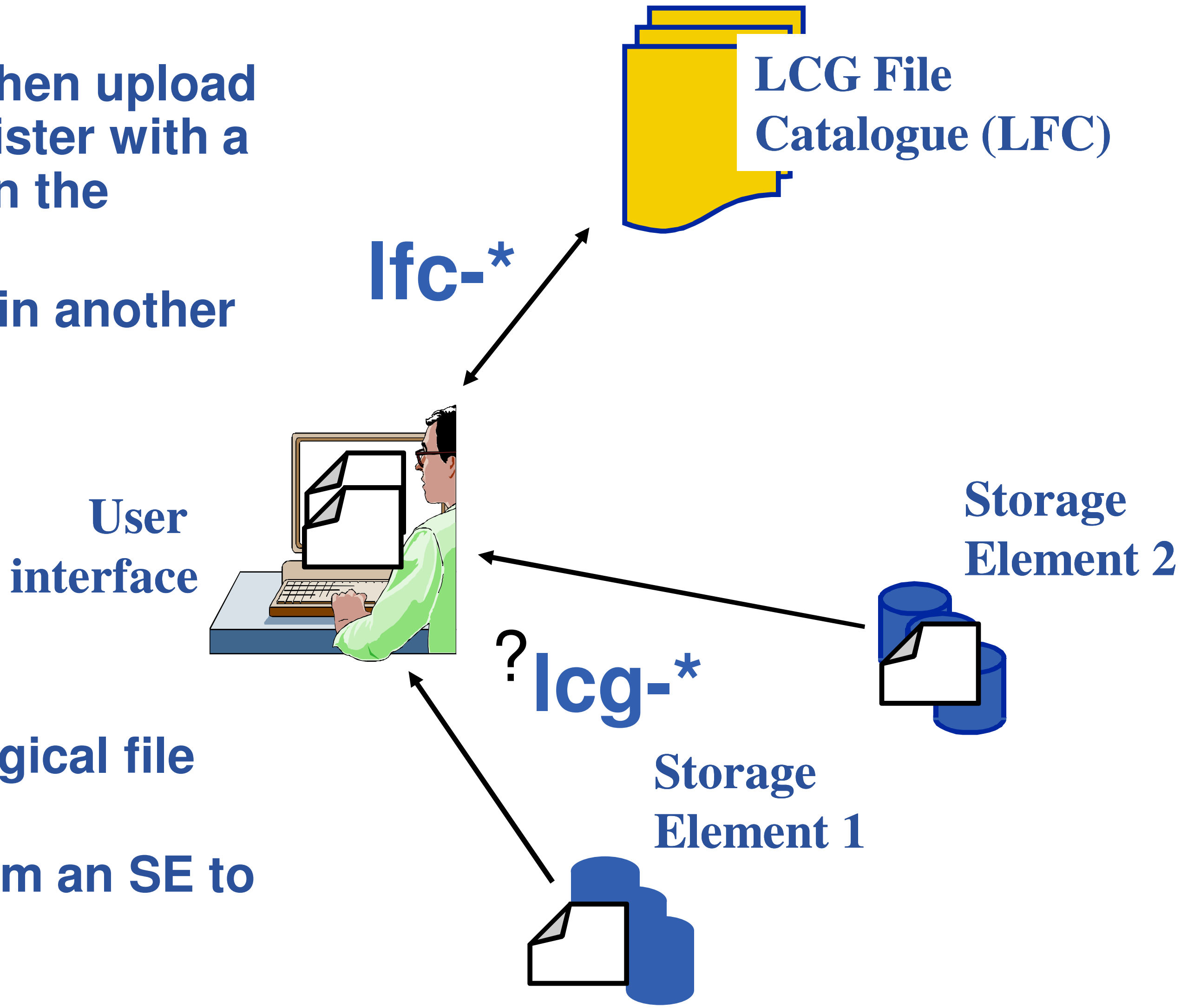
- List directory
- Create a local file then upload it to an SE and register with a logical name (lfn) in the catalogue
- Create a duplicate in another SE
- List the replicas



Related practical: LFC and LCG utils

http://www.lpds.sztaki.hu/~sipos/egee/tutorials/File_Management-lfc_and_lcg_commands.htm

- List directory
- Create a local file then upload it to an SE and register with a logical name (lfn) in the catalogue
- Create a duplicate in another SE
- List the replicas



- Create a second logical file name for a file
- Download a file from an SE to the UI

Integrating practical: Do job and file management together!

Find exercises here:

https://grid.ct.infn.it/twiki/bin/view/GILDA/JobDataWMS

Exercise one:

1. Upload a file to SE, register it in LFC
2. Send wrapper script to CE as job
3. Send real executable in sand-box
4. Script starts executable on CE
5. Executable downloads file from CE
6. Executable processes file, produces result on STDOUT

Exercise two:

1. Send wrapper script to CE as job
2. Send real executable in sand-box
3. Script starts executable on CE
4. Executable produces result in a local file
5. Wrapper uploads file to CE, registers in LFC
6. Result file is available for download with lcg-cp

Typical EGEE application approaches

- **Parallel/distributed programming:**
  - Functional Decomposition (Functional Parallelism)
    - Decomposing the problem (code) into several jobs, run on CEs
  - Domain Decomposition (Data Parallelism)
    - Partitioning the problem's data domain, give them to jobs that run on CEs simultaneously

  High level tools that help:
    - P-GRADE Portal, GANGA, GridWay, …
    - WMS scripting

- **Distributed/collaborative storage:**
    - Distribute files to SEs, create multiple replicas if needed
    - Distribute relational data to AMGA metadata catalog
    - Provide access through the Web

  Example application:
    - gLibrary – Preserve Federico De Roberto’s Cultural Heritage

Questions?

www.eu-egee.org

e-infrastructure

GILDA access for hands-on

- **Hands-on exercises**
  - See links in the slides
  - Getting access to GILDA:
    - *Open SSH client and connect to*
      - *glite-tutor.ct.infn.it*
        - *backup: glite-tutor2.ct.infn.it*
      - *User name: ***************
      - *Password: ****************
    - *Private key passphrase: *****************
  - GILDA Support System: http://gilda-support.ct.infn.it/
- **Questions, comments:**
  - Email to sipos@sztaki.hu

Exercises

1. Certificate management: https://grid.ct.infn.it/twiki/bin/view/GILDA/AuthenticationAuthorization
2. Simple job submission: https://grid.ct.infn.it/twiki/bin/view/GILDA/SimpleJobSubmission
3. More complex jobs: https://grid.ct.infn.it/twiki/bin/view/GILDA/MoreOnJDL
4. Grid catalog and file management: http://www.lpds.sztaki.hu/~sipos/egee/tutorials/File_Management-lfc_and_lcg_commands.htm
5. Integrating practical: https://grid.ct.infn.it/twiki/bin/view/GILDA/JobDataWMS

Thank you

www.eu-egee.org