



Enabling Grids for E-science

EGEE middleware

Data Services in gLite

www.eu-egee.org



- **Simple data files on grid-specific storage**
- **Middleware supporting**
 - **Replica files**
 - to be close to where you want computation
 - For resilience
 - **Logical filenames**
 - **Catalogue:** maps logical name to physical storage device/file
 - **Virtual filesystems,** POSIX-like I/O
 - Services provided: storage, transfer, catalogue that maps logical filenames to replicas.
- **Solutions include**
 - **gLite data service**
 - **Globus: Data Replication Service**
 - **Storage Resource Broker**

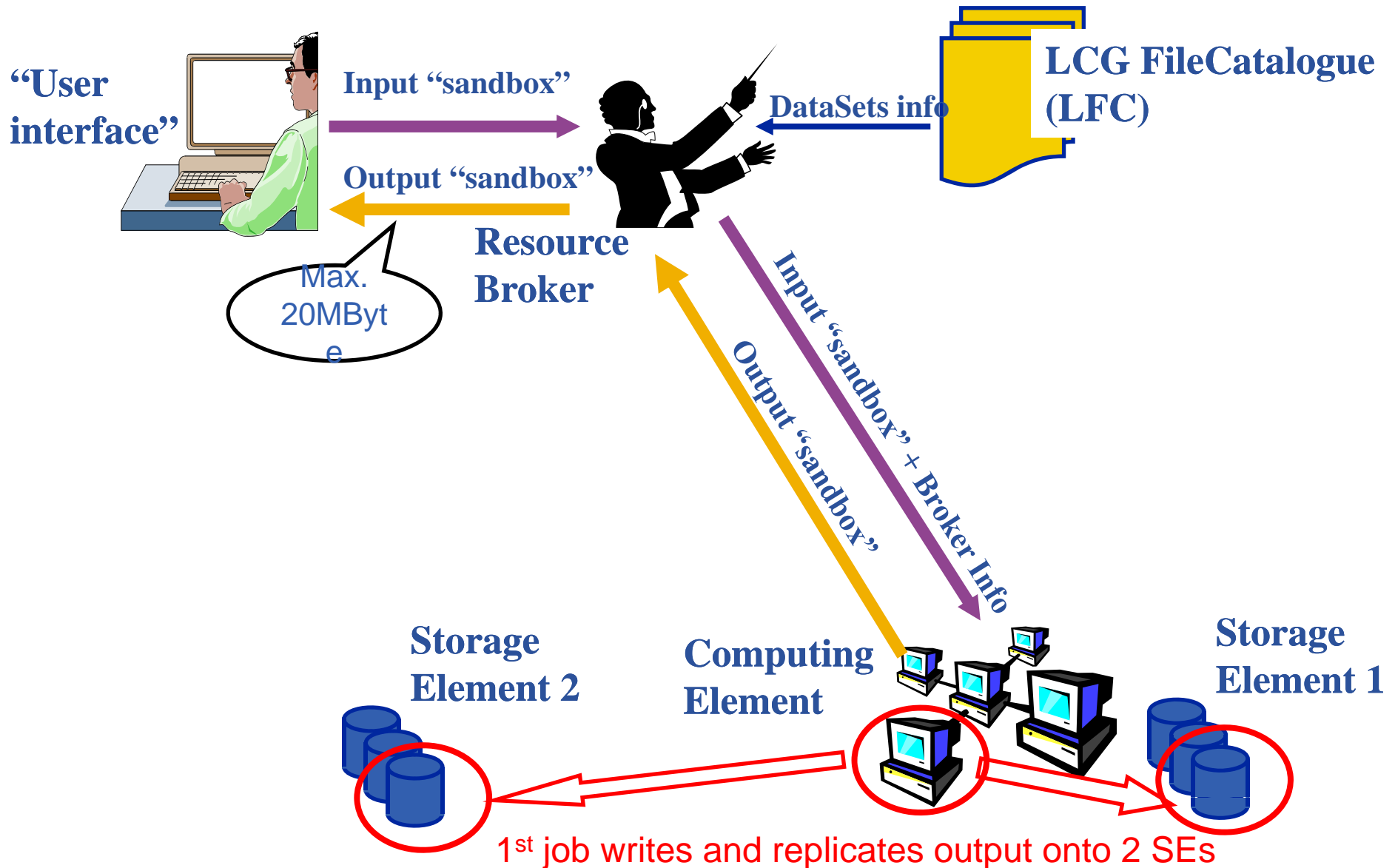
- **Other data! e.g.**
 - Structured data: RDBMS, XML databases,...
 - Files on project's filesystems
 - Data that may already have other user communities not using a Grid
- Require extendable middleware tools to support
 - Computation near to data
 - Controlled exposure of data *without replication*
- Basis for integration and federation
- **OGSA –DAI**
 - In Globus 4
 - Not (yet...) in gLite

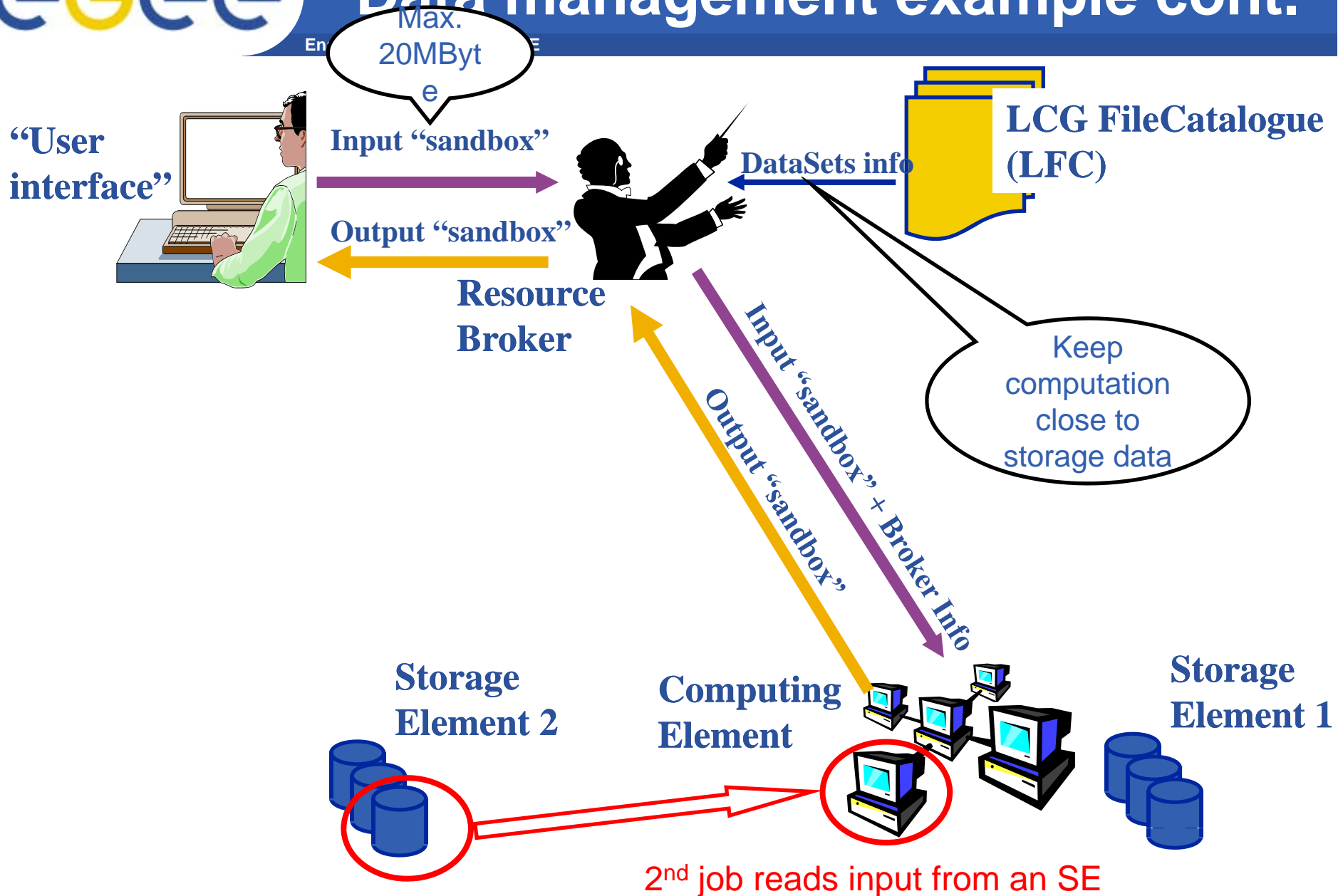
- **Files that are write-once, read-many**
 - If users edit files then
 - They manage the consequences!
 - Maybe just create a new filename!
 - No intention of providing a global file management system

- **3 service types for data**
 - Storage
 - Catalogs
 - Transfer

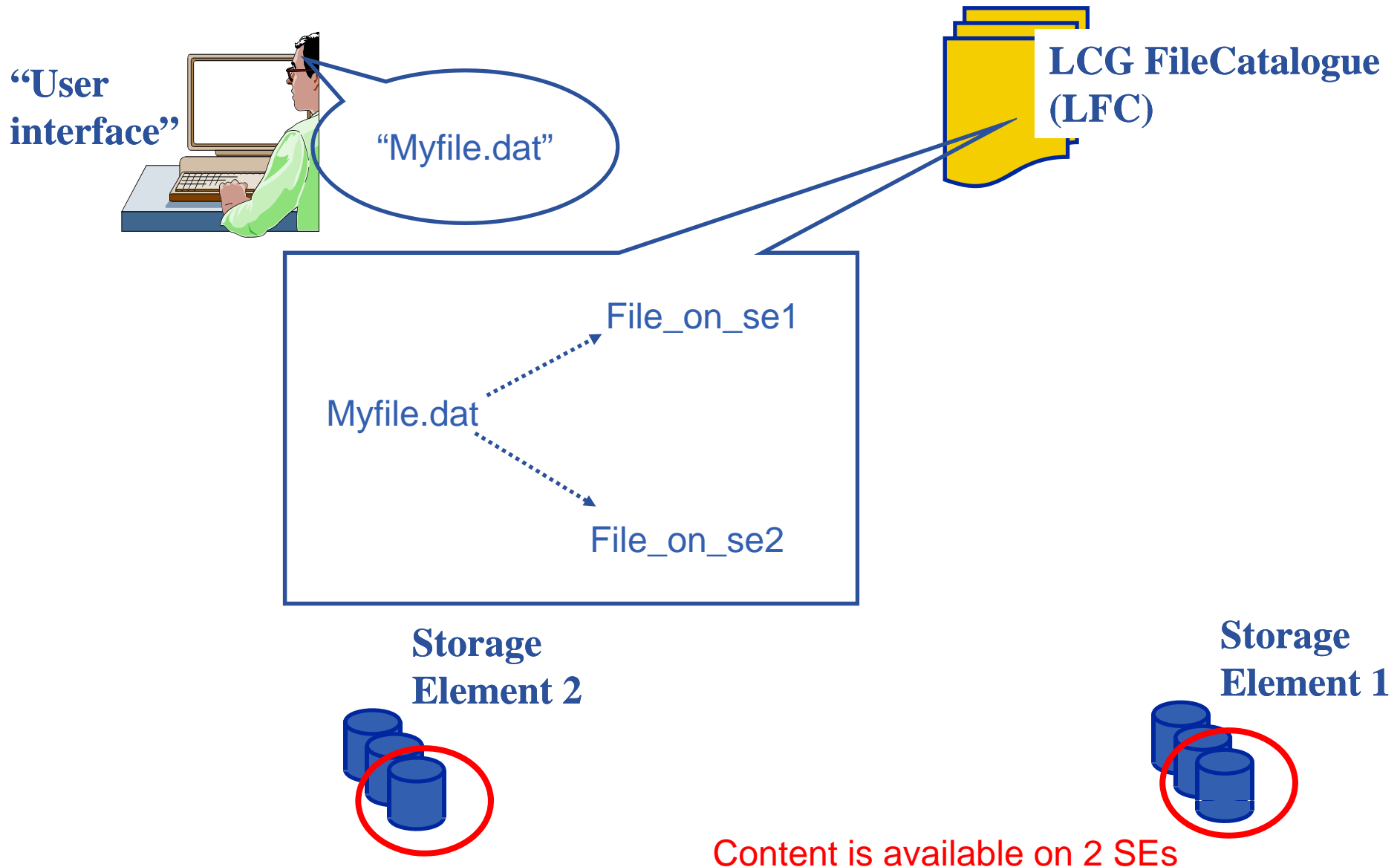
+ Metadata service : AMGA

Data management example

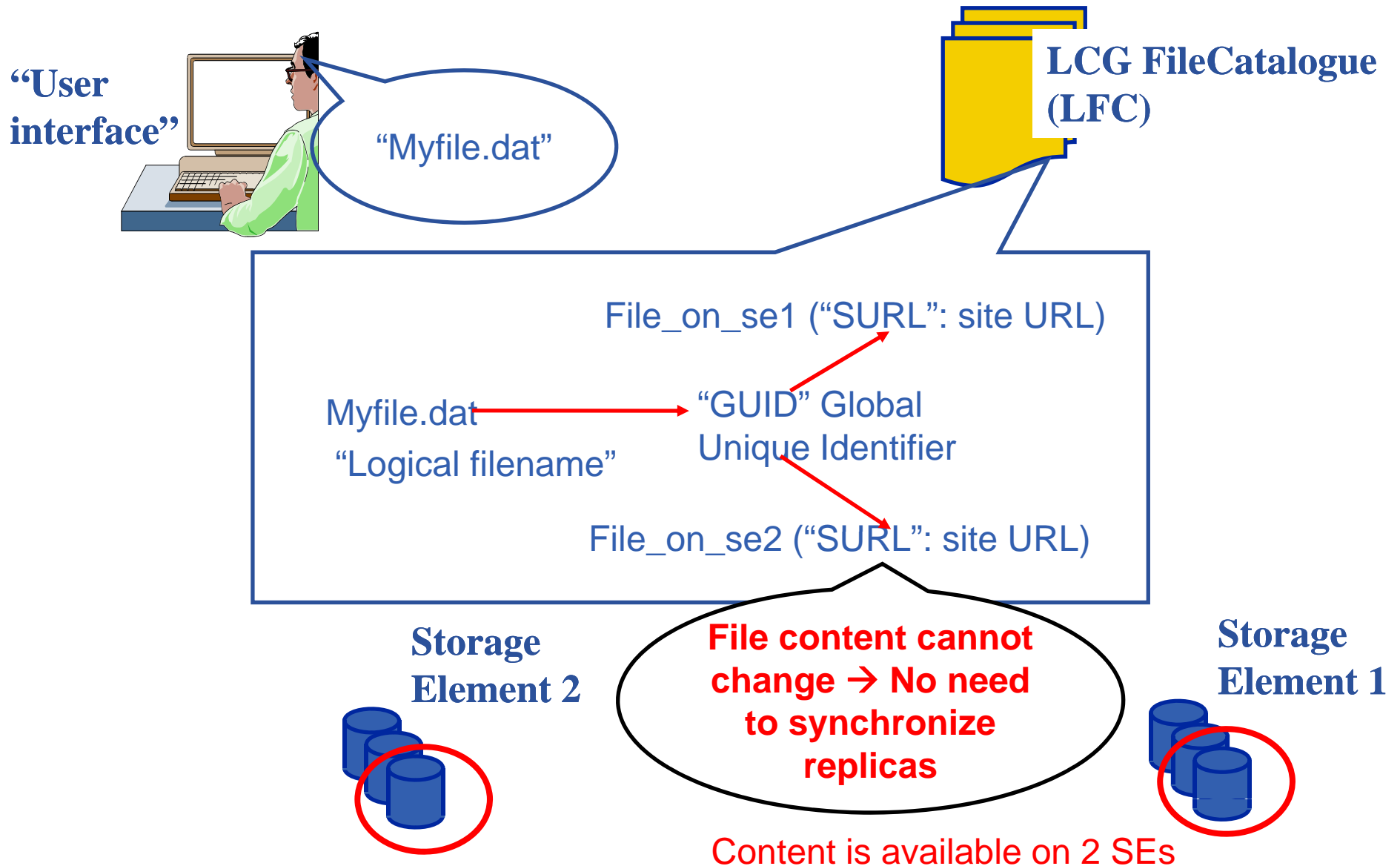




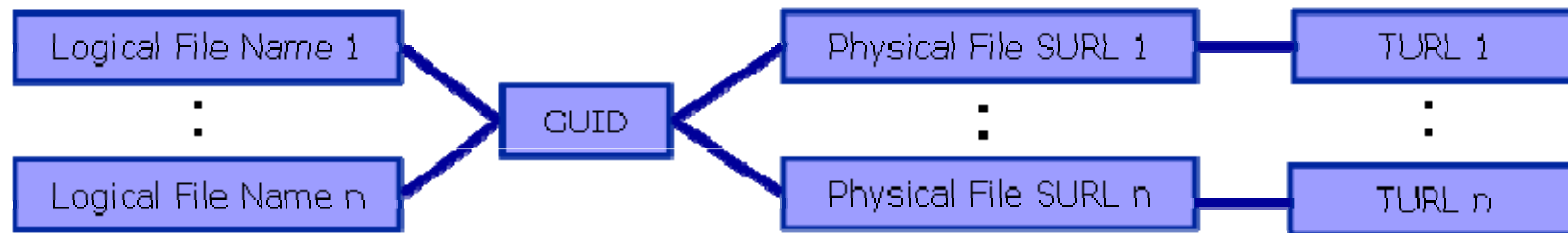
Resolving logical file name



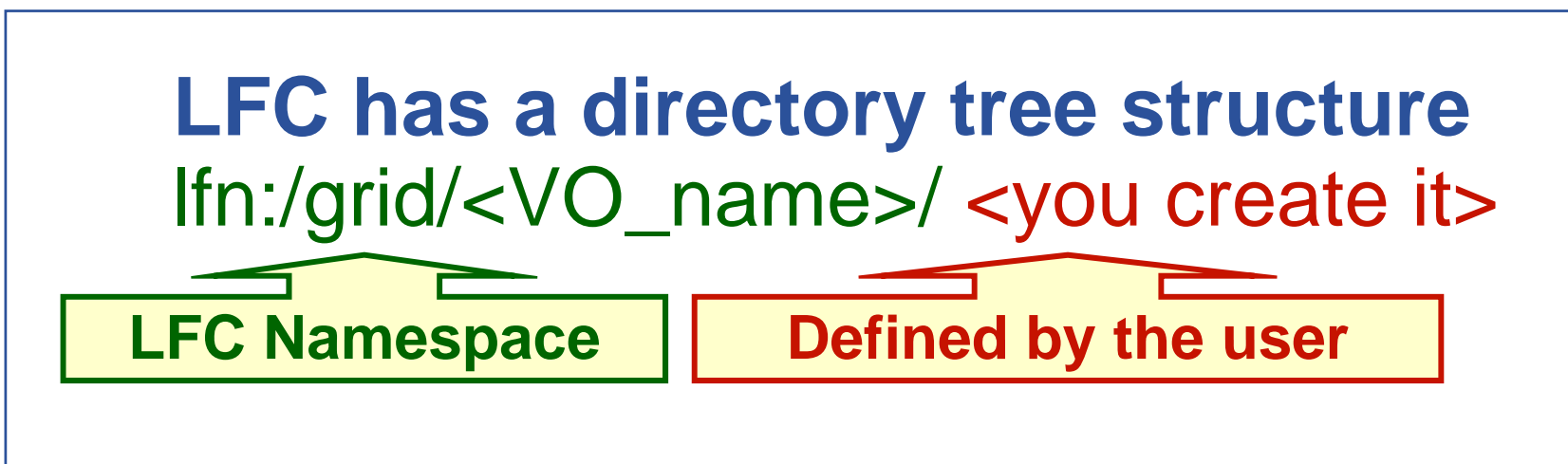
Resolving logical file name



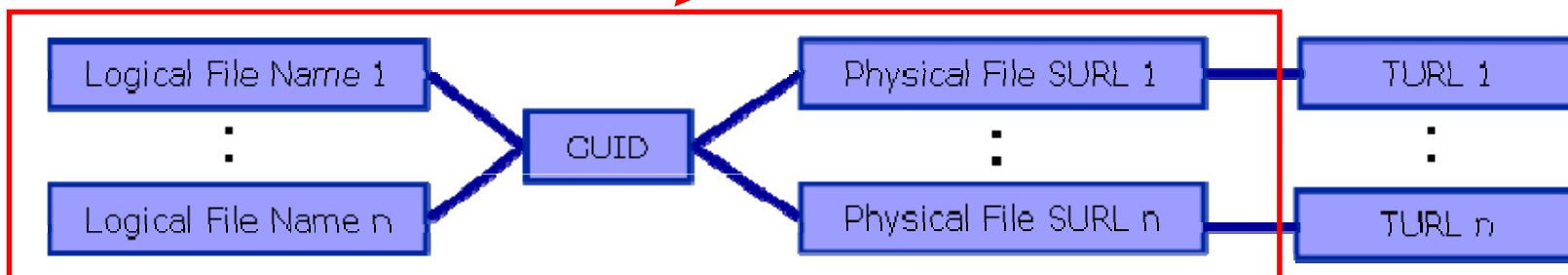
- **Logical File Name (LFN)**
 - An alias created by a user to refer to some item of data, e.g.
`lfn:/grid/gilda/budapest23/run2/track1`
- **Globally Unique Identifier (GUID)**
 - A non-human-readable unique identifier for an item of data, e.g.
`guid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6`
- **Site URL (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`



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



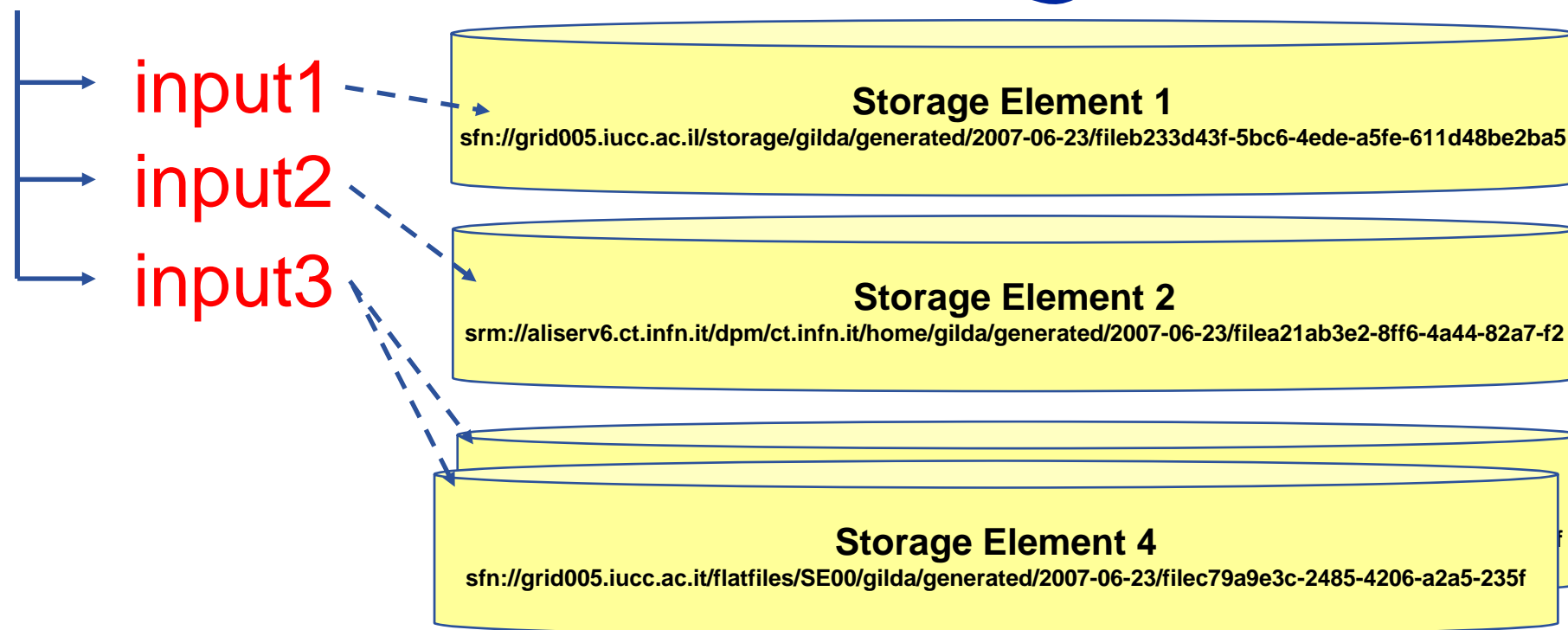
- Mapping by the “LFC” catalogue server



lfn:/grid/gilda/budapest23/run2/



LCG FileCatalogue (LFC)



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

- **lfc-***
 - LFC = LCG File Catalogue
 - LCG = LHC Compute Grid
 - LHC = Large Hadron Collider
 - Use LFC commands to interact with the catalogue only
 - To create catalogue directory
 - List files
 - Used by you, your application 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
 - Replicated

LFC has a directory tree structure

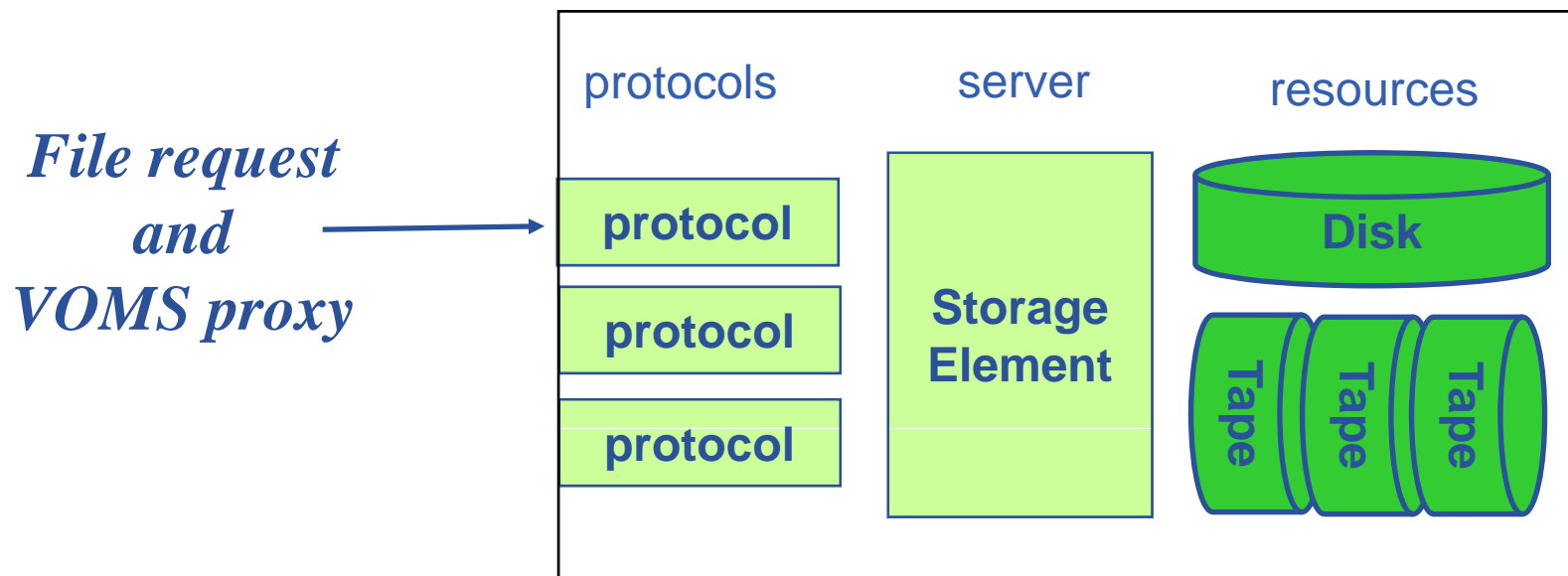
/grid/<VO_name>/ <you create it>

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)

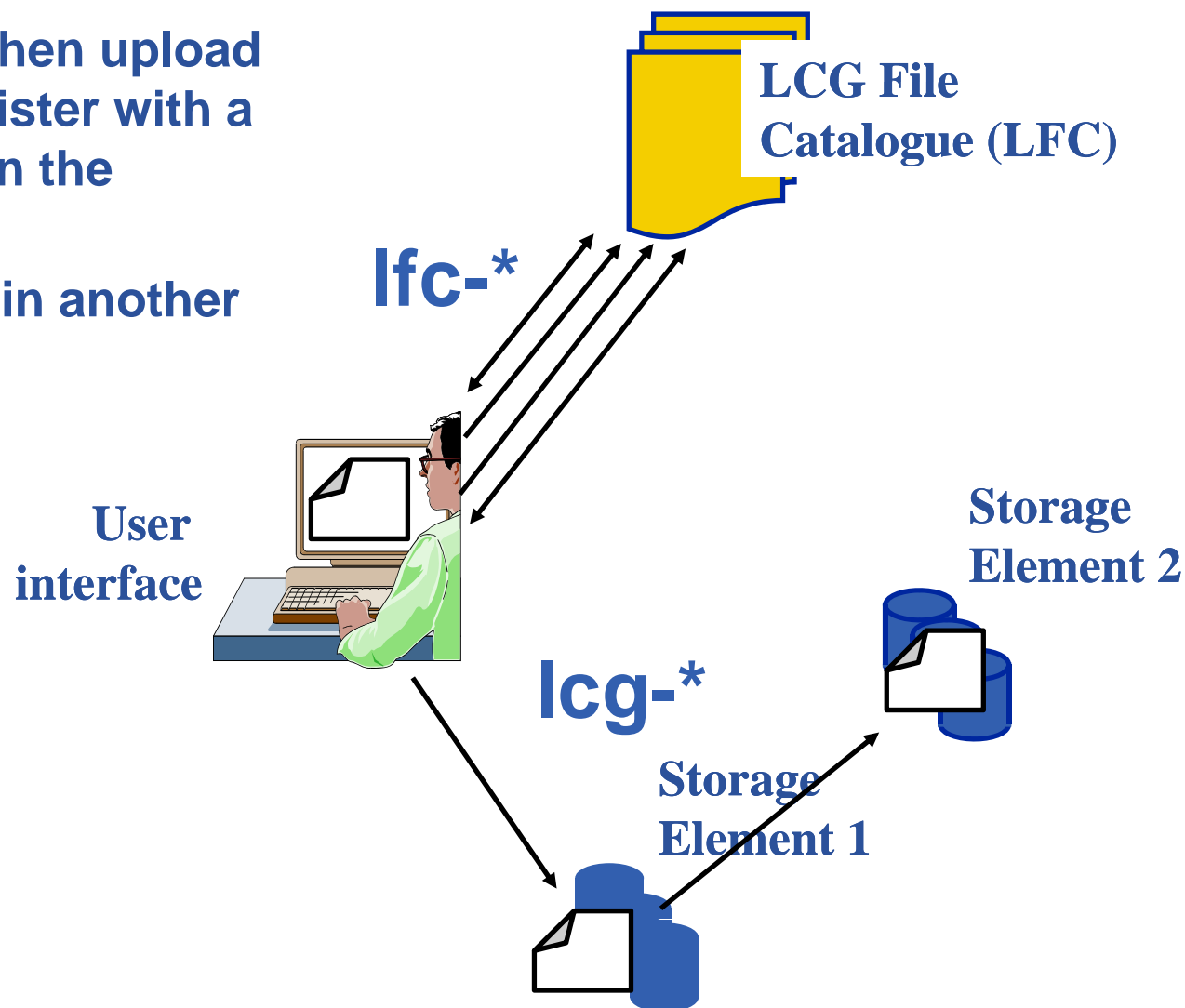
- **Provides**
 - Storage for files : massive storage system - disk or tape based
 - Transfer protocol (gsiFTP) ~ GSI based FTP server
 - Striped file transfer – cluster as back-end



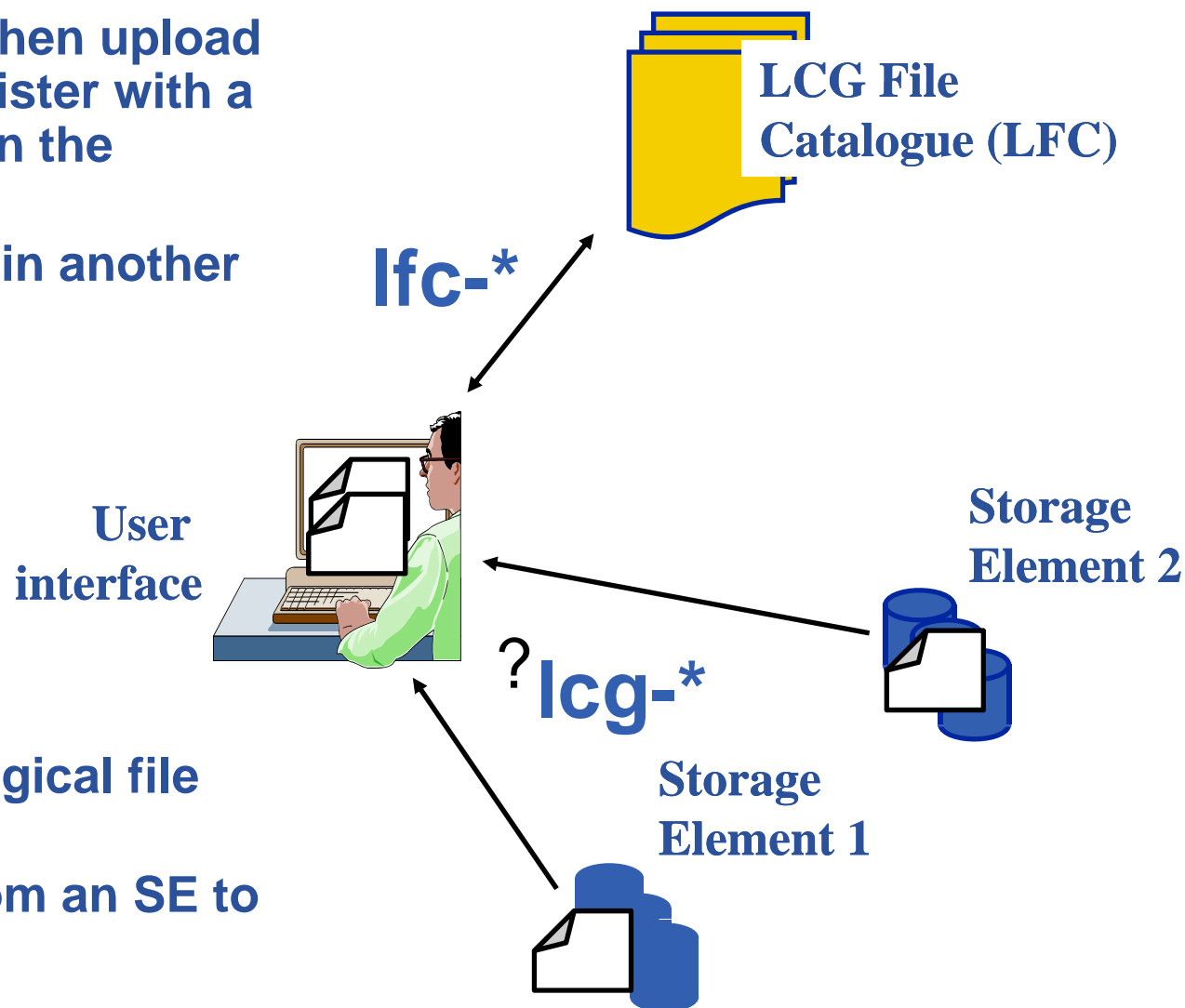
*Authentication,
authorization*

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

- 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



- List directory
 - Create a local file then upload it to an SE and register with a logical name (lfn) in the catalogue
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-
- Create a second logical file name for a file
 - Download a file from an SE to the UI



- **GFAL (Grid File Access Library) is a POSIX interface for operation on file on Storage Element**
- **Enable remote handling of files**
 - When the file is large to transfer and only part of it is needed
 - When you generate so many files that they would fill the CE
- **Libraries are in C and can be included in C/C++ sources**
- **GFAL Java API – wrapper around the C code**
- **The most common of I/O operations are available, just prefix `gfal_` to the function name (`open()`, `read()`...)**
- **`man gfal` for further details**
- **The destination SE must provide secure rfio (*classic SEs don't*)**
- **GFAL API Description**
 - http://grid-deployment.web.cern.ch/grid-deployment/documentation/LFC_DPM/gfal/html

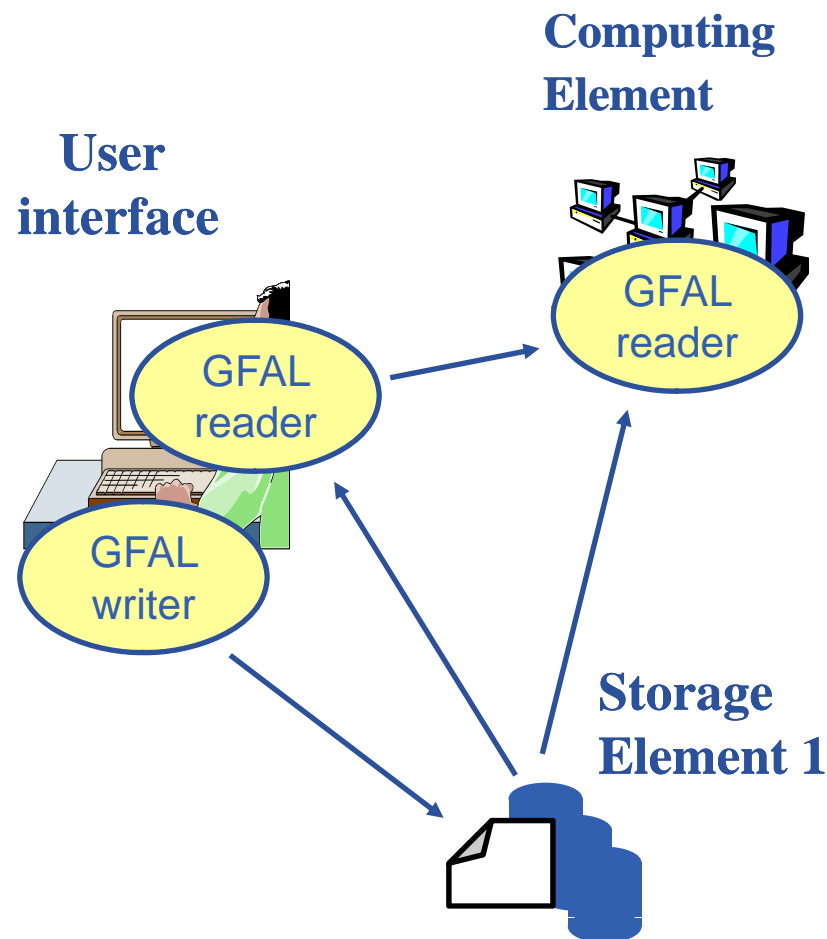
Examples in gLite3 User Guide (Appendix F)

– <https://edms.cern.ch/file/722398//gLite-3-UserGuide.pdf>

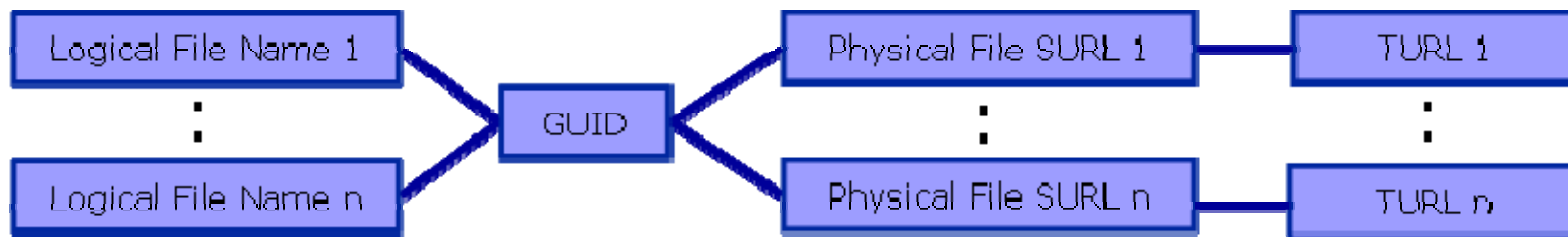
```
int fd;
struct stat remote_file_stat;

fd = gfal_open(file_ref, O_RDONLY, 0644);
cod_ex = gfal_stat(file_ref, &file_stat)
...
cod_ex = gfal_read(fd, buffer, file_stat.st_size);
...
cod_ex = gfal_close(fd);
```

- Write a file to an SE
- Read a file from an SE
- Submit the reader code as a job into the GILDA, read the file remotely



Open the practical from the agenda



- **Spare slides follow – could be used after the practical**

Summary of the LFC Catalog commands

lfc-chmod	Change access mode of the LFC file/directory
lfc-chown	Change owner and group of the LFC file-directory
lfc-delcomment	Delete the comment associated with the file/directory
lfc-getacl	Get file/directory access control lists
lfc-ln	Make a symbolic link to a file/directory
lfc-ls	List file/directory entries in a directory
lfc-mkdir	Create a directory
lfc-rename	Rename a file/directory
lfc-rm	Remove a file/directory
lfc-setacl	Set file/directory access control lists
lfc-setcomment	Add/replace a comment

Replica Management

lcg-cp	Copies a grid file to a local destination
lcg-cr	Copies a file to a SE and registers the file in the catalog
lcg-del	Delete one file
lcg-rep	Replication between SEs and registration of the replica
lcg-gt	Gets the TURL for a given SURL and transfer protocol
lcg-sd	Sets file status to “Done” for a given SURL in a SRM request

FTS client

glite-transfer-submit	Submit a transfer job : needs at least source and destination SURL
glite-transfer-status	Given one or more job ID, query about their status
glite-transfer-cancel	Delete the transfer with the give Job ID
glite-transfer-list	Query about status of all user's jobs; support options for query restrictions
glite-transfer-channel-list	Show all available channel; detailed info only if user has admin privileges

If a site acts as a central catalog for several VOs, it can either have:

- One LFC server, with one DB account containing the entries of all the supported VOs. You should then create one directory per VO.
- Several LFC servers, having each a DB account containing the entries for a given VO.

Both scenarios have consequences on the handling of database backups

- Minimum requirements (First scenario)
 - 2Ghz processor with 1GB of memory (not a hard requirement)
 - Dual power supply
 - Mirrored system disk