



# Medigrid project overview

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# Objectives

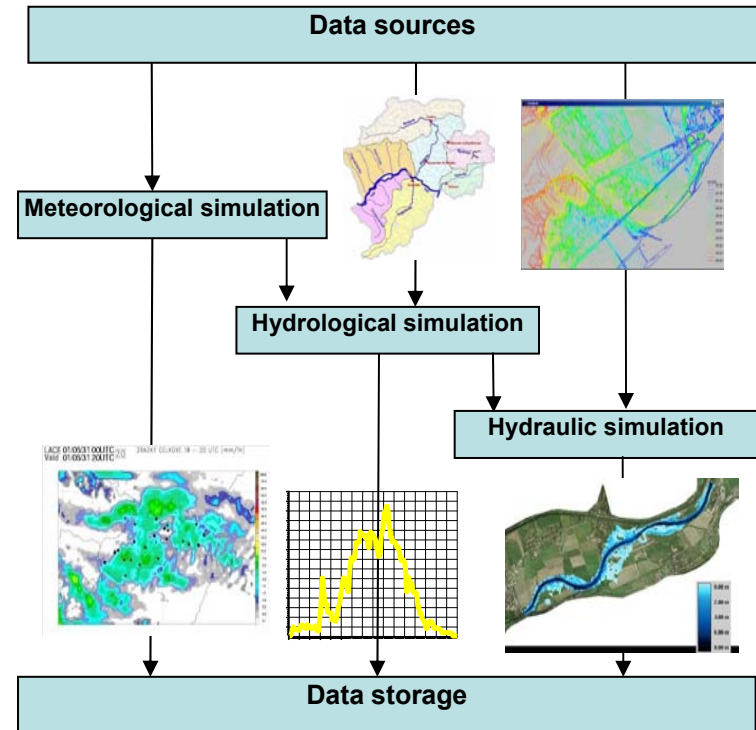
- Create a distributed framework for multi-risk assessment of natural disasters
- Make the models and data accessible via internet in a secure manner for all partners
- Models for:
  - simulation of forest fire behavior and effects
  - flood modeling and forecasting
  - landslides and soil erosion simulations
- Create a distributed repository with earth observation data, combined with field measurements

# Partners

- Algosystems SA, **Greece** - *coordinator*
- Associação para o Desenvolvimento da Aerodinâmica (ADAI), **Portugal**
- Entente Interdépartementale en vue de la Protection de la Forêt et de l'Environnement contre l'Incendie (EIPFEI/CEREN), **France**
- Tecnomia SA, **Spain**
- Institute of Informatics, Slovak Academy of Sciences (II SAS), **Slovakia**
- University of Newcastle Upon Tyne, **United Kingdom**

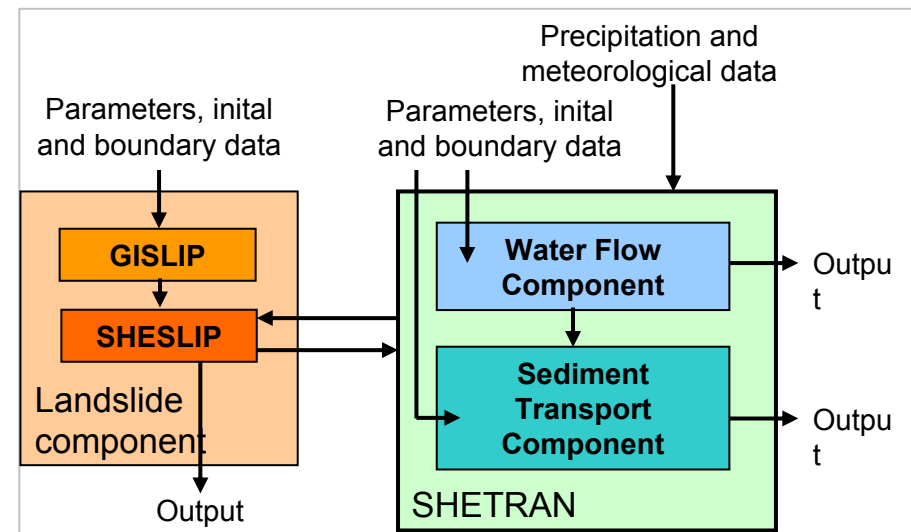
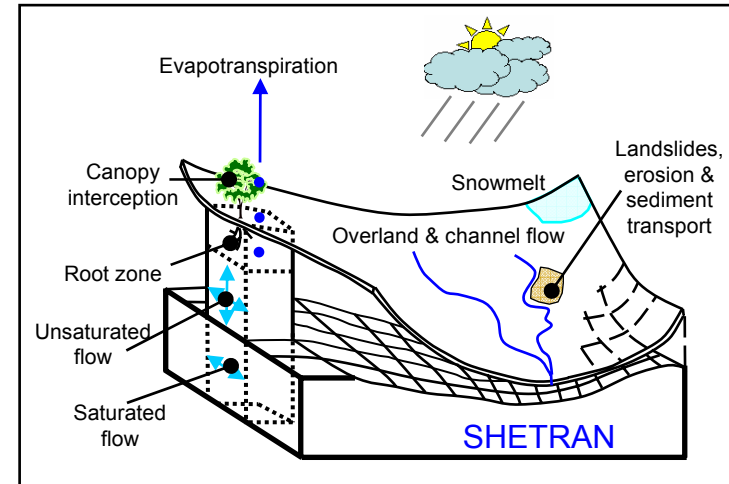
# Applications – Flood modeling

- Consists of several simulation models (meteorological, hydrological and hydraulics) and appropriate post-processing tools:
  - MM5 meteorological model forecasts precipitation
  - HSPF hydrological model computes the discharge of the river
  - DaveF hydraulics model computes the possible flood and flooded area
  - All the models generate binary output data, which are then used by post-processing tools to generate pictures visualizing the situation



# Applications – Landslides

- Using SHETRAN model
  - Physically based, spatially distributed, integrated surface/subsurface modelling system for water flow and sediment transport in river basins
  - A component is available for modelling shallow landslide erosion and sediment yield
  - can be applied to a single complete basin or to parts of a basin or to groups of contiguous basins up to an area of about 5000 km<sup>2</sup> using a grid resolution of 500 to 2000 m



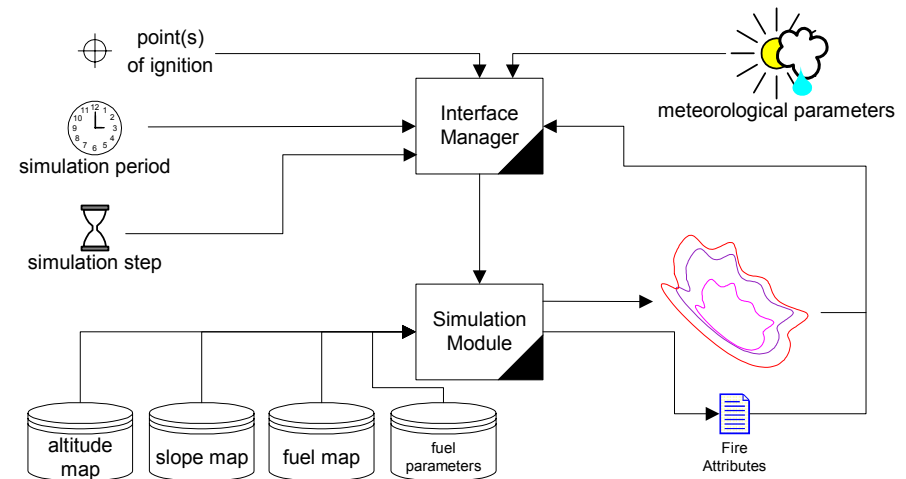
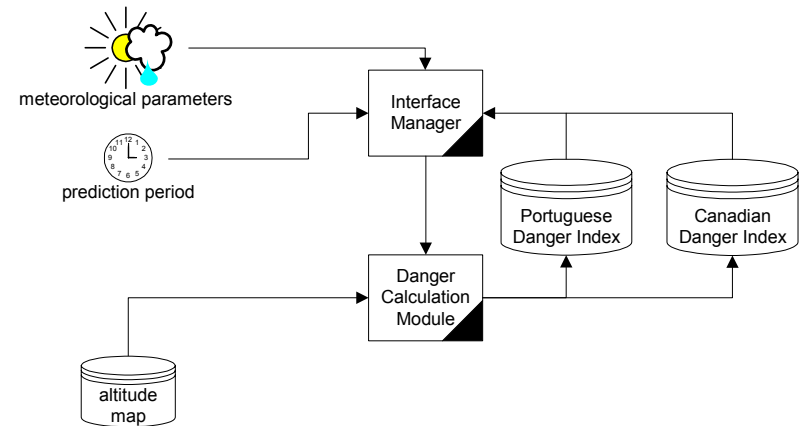
# Applications – Soil erosion

- Provides answer to the highest soil erosion risks after the passage of a forest fire in definite climate conditions



# Applications – Fire Danger and Propagation

- Calculates the danger of occurrence of a forest fire in a known geographical target area and simulates the propagation of such a fire, which is deemed to have started within this area
- Two main modules:
  - Danger Calculation Module yields the possibility of there being a fire
  - Simulation Module simulates what will happen if a fire actually occurs





# Applications – Forest fire

- Simulation of fire spread over complex topography
- Semi-empirical model for fire rate of spread, which takes as input local terrain slope, parameters describing fuel properties as well as the wind speed and direction
- Two different models are implemented for the simulation of the wind field
- Outputs: the time evolution of the fire shape, fire rate of spread, fire intensity and other related parameters
- Secondary outputs: the Fire Weather Indexes and the 3D wind field calculation



# Technology

- Because all applications except flood prediction are running on Windows PCs, it is not possible to use Unix oriented grid tools like GridFTP and Job submission and thus all other tools that depend on them.
- So far, we have implemented Data Transfer and Job Submission grid services in Java using Globus WSRF implementation.



# Job Submission Service

Branislav Šimo

II SAS

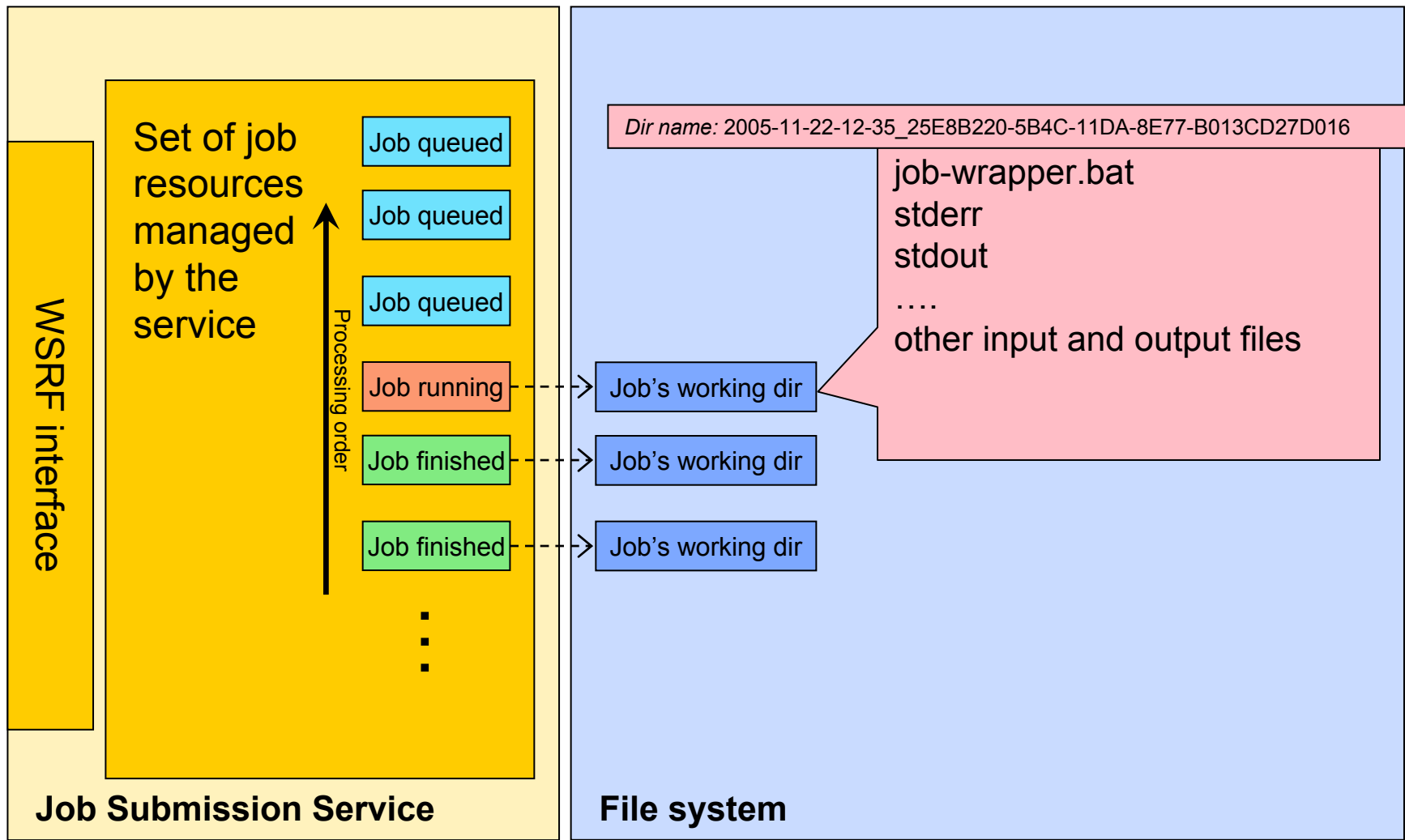
# Overview

- WSRF Web Service & client tools
- Implemented using Globus Java WSRF Core
- Provides job submission mechanism
- Acts as an interface to defined fixed executable. Does not allow to specify executable, user can just specify parameters.
- Replaces other grid job submission mechanisms, because we needed to use Windows hosts as computational servers

# Features

- WSRF service with jobs represented as “resources” with associated “resource properties” exposed for reading and notification
  - Job state
  - Time of submission, start, finish
  - URL to job’s working directory in Medigrid Data Transfer service format
- Currently supports local “fork” jobs on Linux and Windows. Provides queuing for job requests. Jobs are run “one at a time” (hosts in our “grid” are mostly single-processor windows machines).
- Planned support for job re-submission to a linux cluster for MPI parallel jobs and HTC computing.
- Platform dependent job launching and termination.

# Host machine



# Client Commands

- medigrid-job-
  - submit – requests execution of a job with given parameters
  - status – reads exposed job's resource properties and allows download of job's stdout and stderr outputs
  - cancel – cancels job execution and potentially removes working directory
  - monitor – monitors job's state transitions



# Command examples

- `medigrid-job-submit \`  
`https://gaia.ui.savba.sk:8443/wsrf/services/medigrid/job/MedigridJobFactory \`  
`job.params epr.xml`
  - Submit job and write its ID into epr.xml
- `medigrid-job-status -t epr.xml`
  - Check job status and print timing info
- `medigrid-job-status -d . epr.xml`
  - Download files to working dir
- `medigrid-job-cancel -c epr.xml`
  - Cancels the job (if running or queued) and cleans its directory





# Medigrid Data Transfer Service

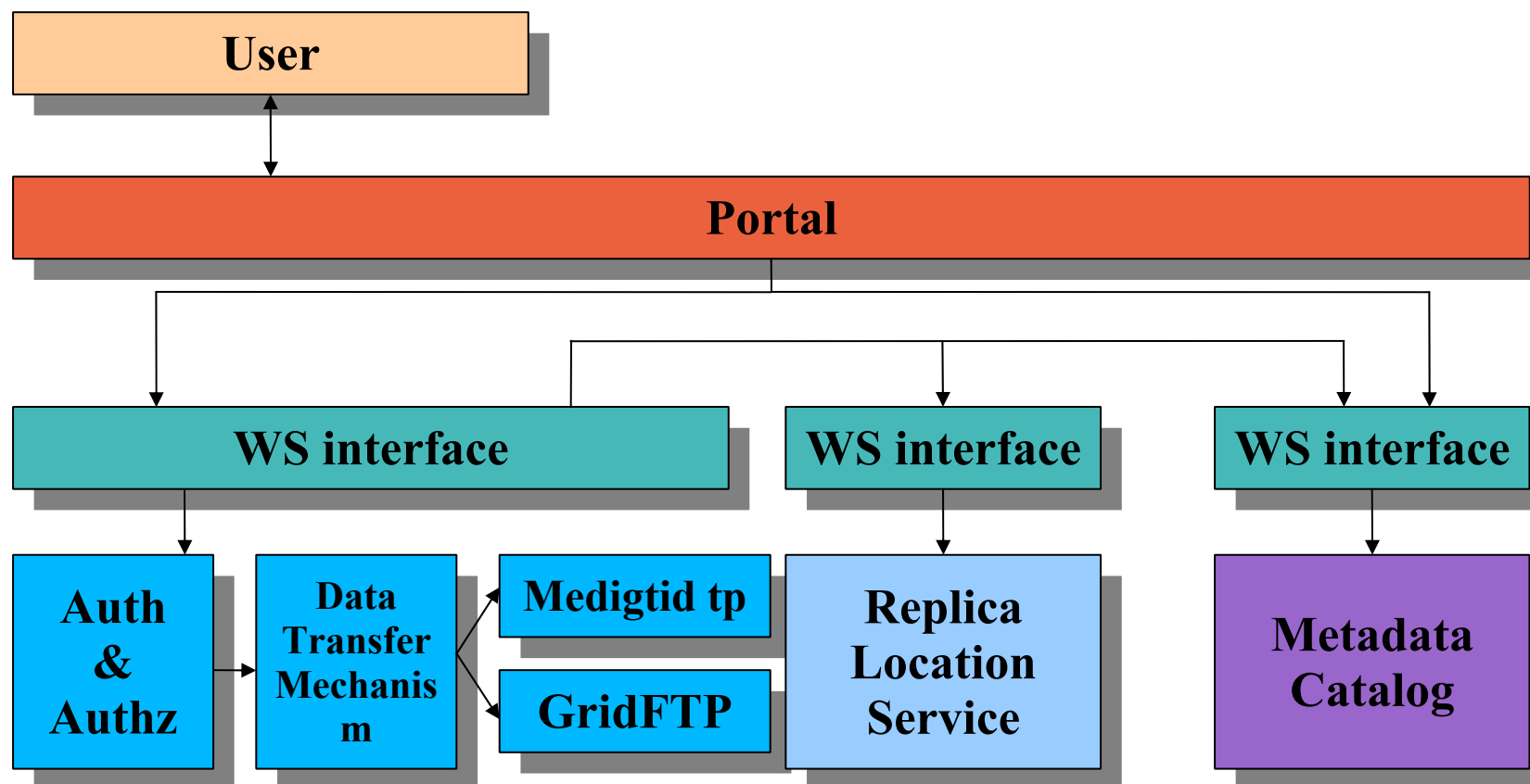
Marek Ciglan

IISAS

# Data Transfer Service Overview

- WSRF Web Service & client tools
- Provides data transfer mechanism
- Replacement for GridFTP
  - (GridFTP server doesn't run on Win platform)
- Provides data access policies definition
- Provides data access security
- Integrated with central catalog services:
  - Replica Location Service
  - Metadata Catalog Service

# High-level architecture



# Data Security

- **Requirement:** different access rights for different files in Medigrid testbed

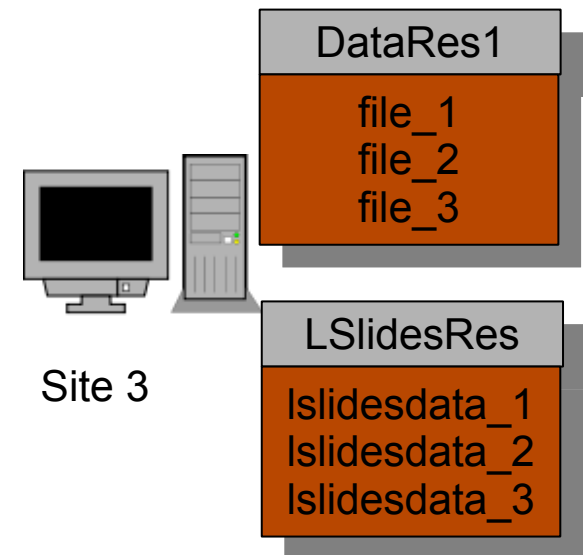
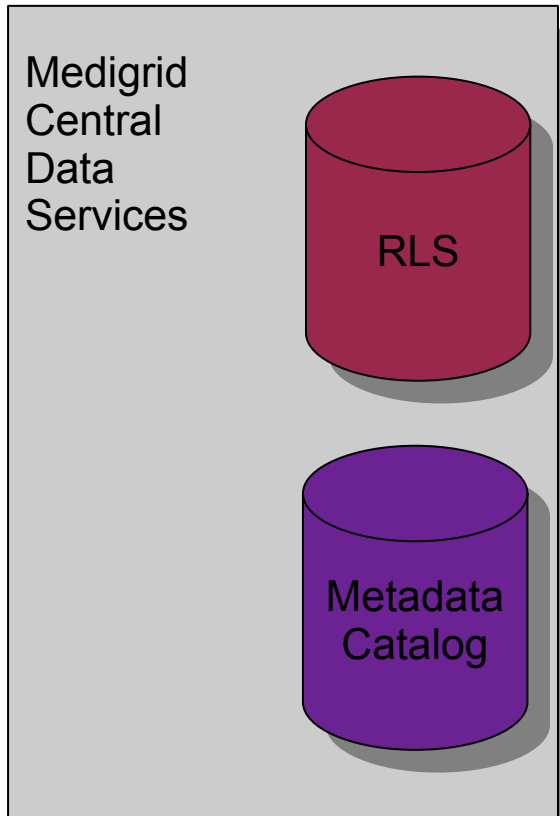
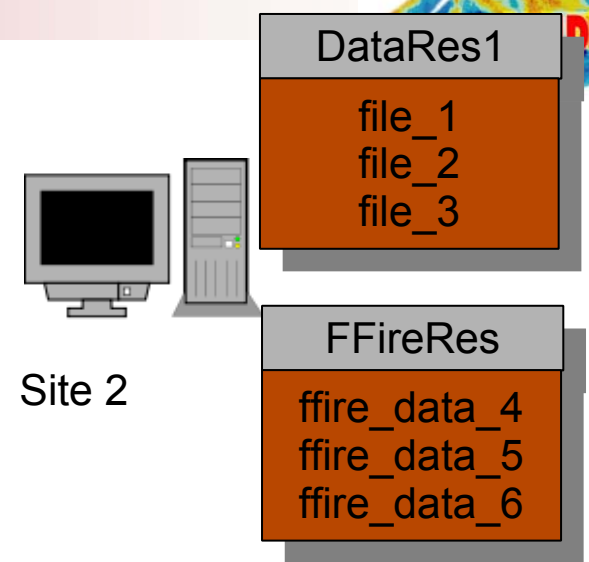
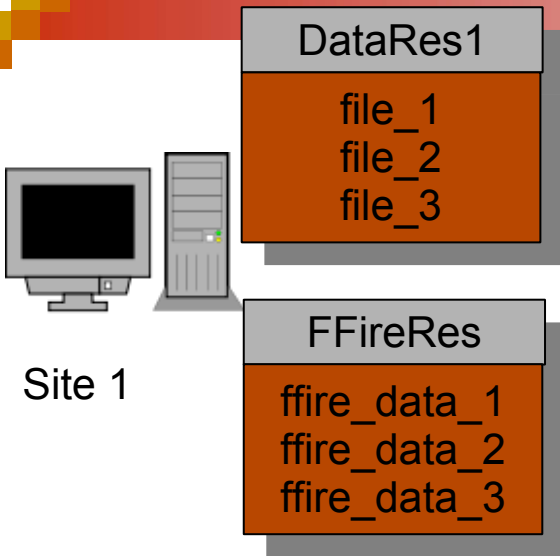
## **Authorized data resources:**

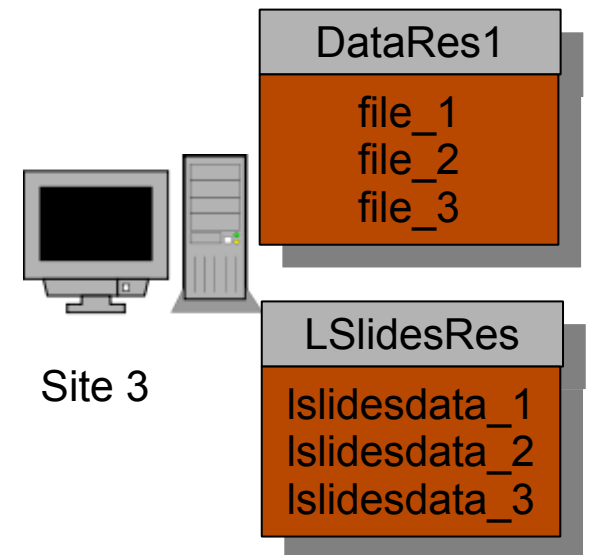
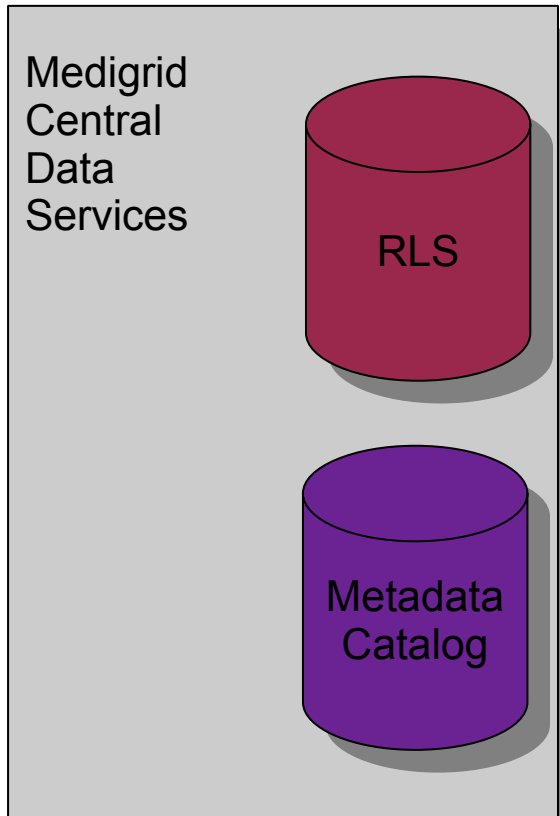
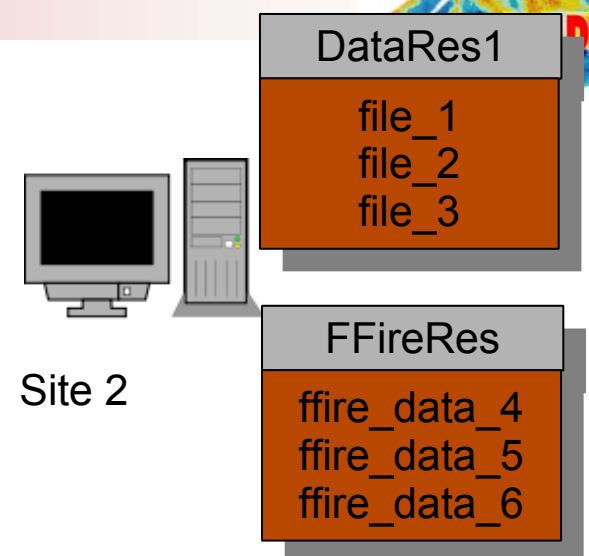
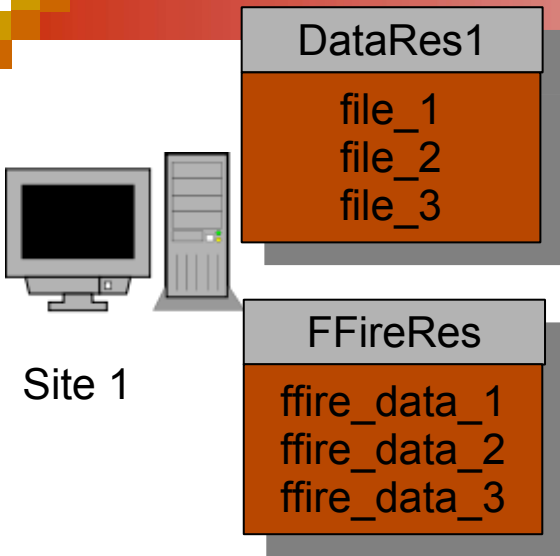
- Directory in the file system of a Medigrid site
- Can be accessible only by explicitly defined users (conf file)
- All files in the data resource can be accessed by defined users



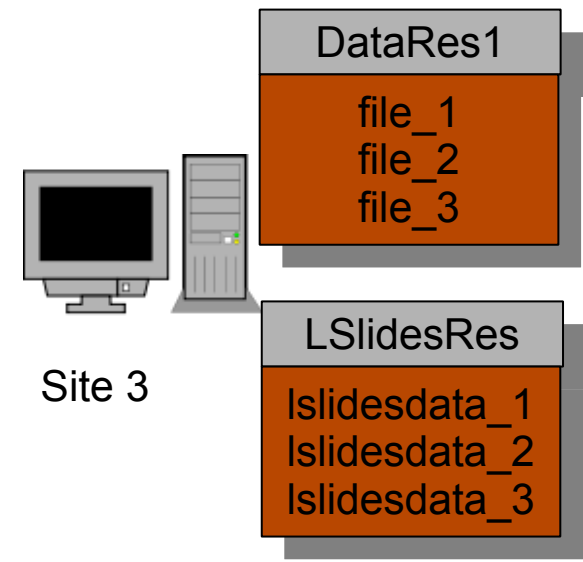
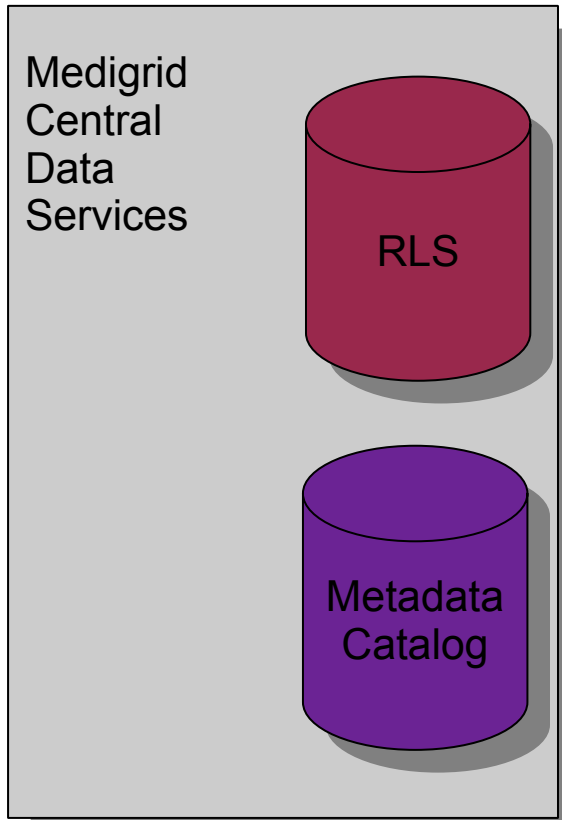
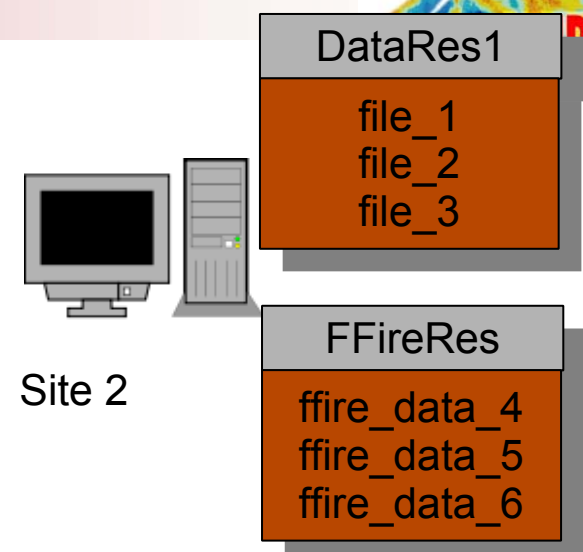
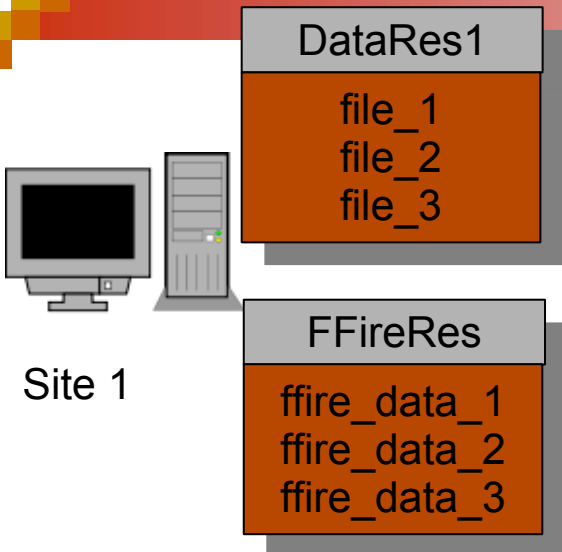
# Data resource configuration example

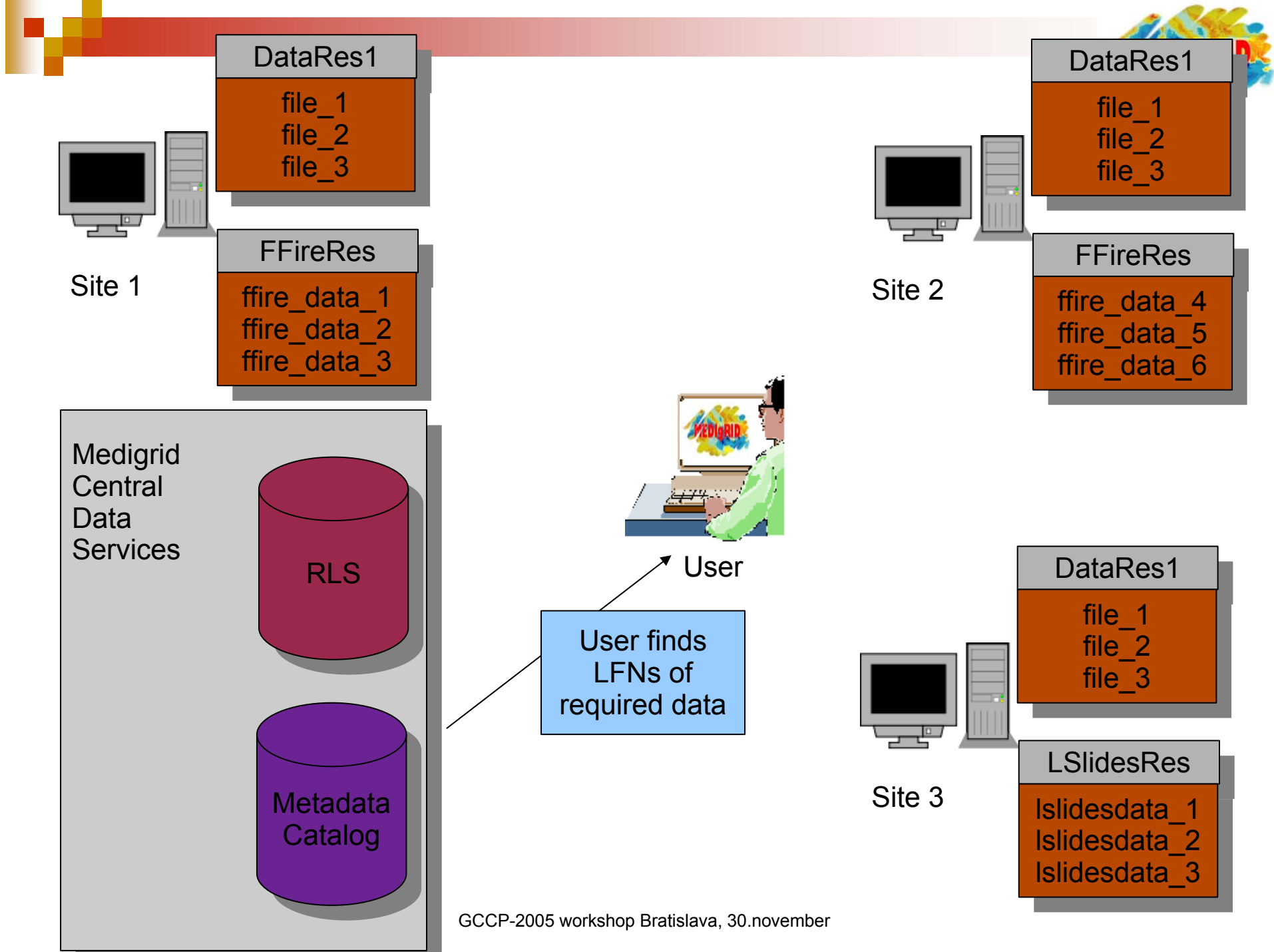
```
<?xml version="1.0" encoding="UTF-8"?>
<DataResourcesConfig>
  <LogicalResource name="dataroot" rootpath="c:/data">
    <User dn="/O=MediGrid/O=IISAS/CN=Marek Ciglan
          privileges="rw" />
    <User dn="/O=MediGrid/O=IISAS/CN=Branislav Simo"
          privileges="rw" />
  </LogicalResource>
</DataResourcesConfig>
```











DataRes1

file\_1  
file\_2  
file\_3

FFireRes

ffire\_data\_1  
ffire\_data\_2  
ffire\_data\_3

Site 1

DataRes1

file\_1  
file\_2  
file\_3

FFireRes

ffire\_data\_4  
ffire\_data\_5  
ffire\_data\_6

Site 2

Medigrid  
Central  
Data  
Services

RLS

Metadata  
Catalog

User

User finds  
LFNs of  
required data

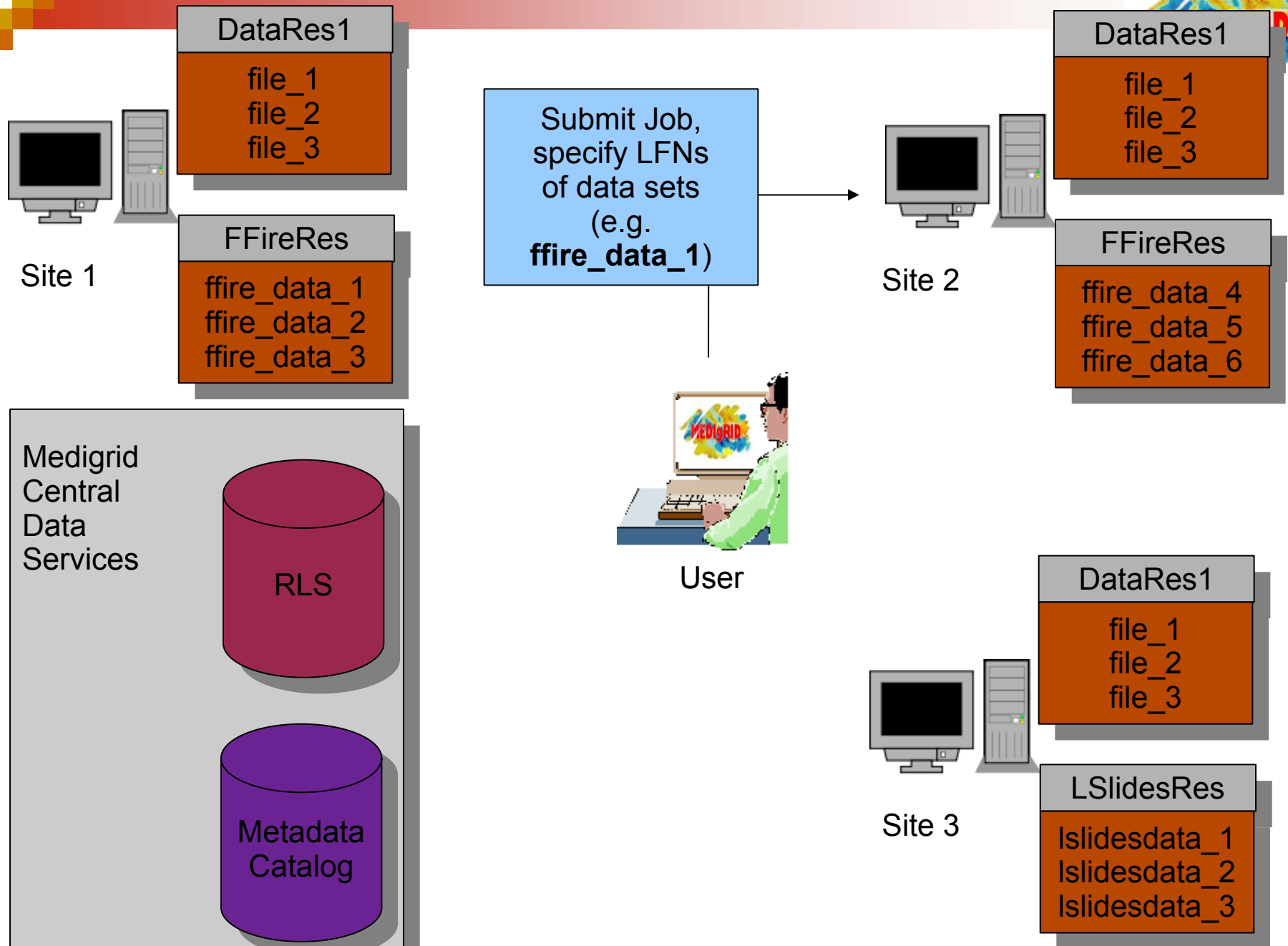
DataRes1

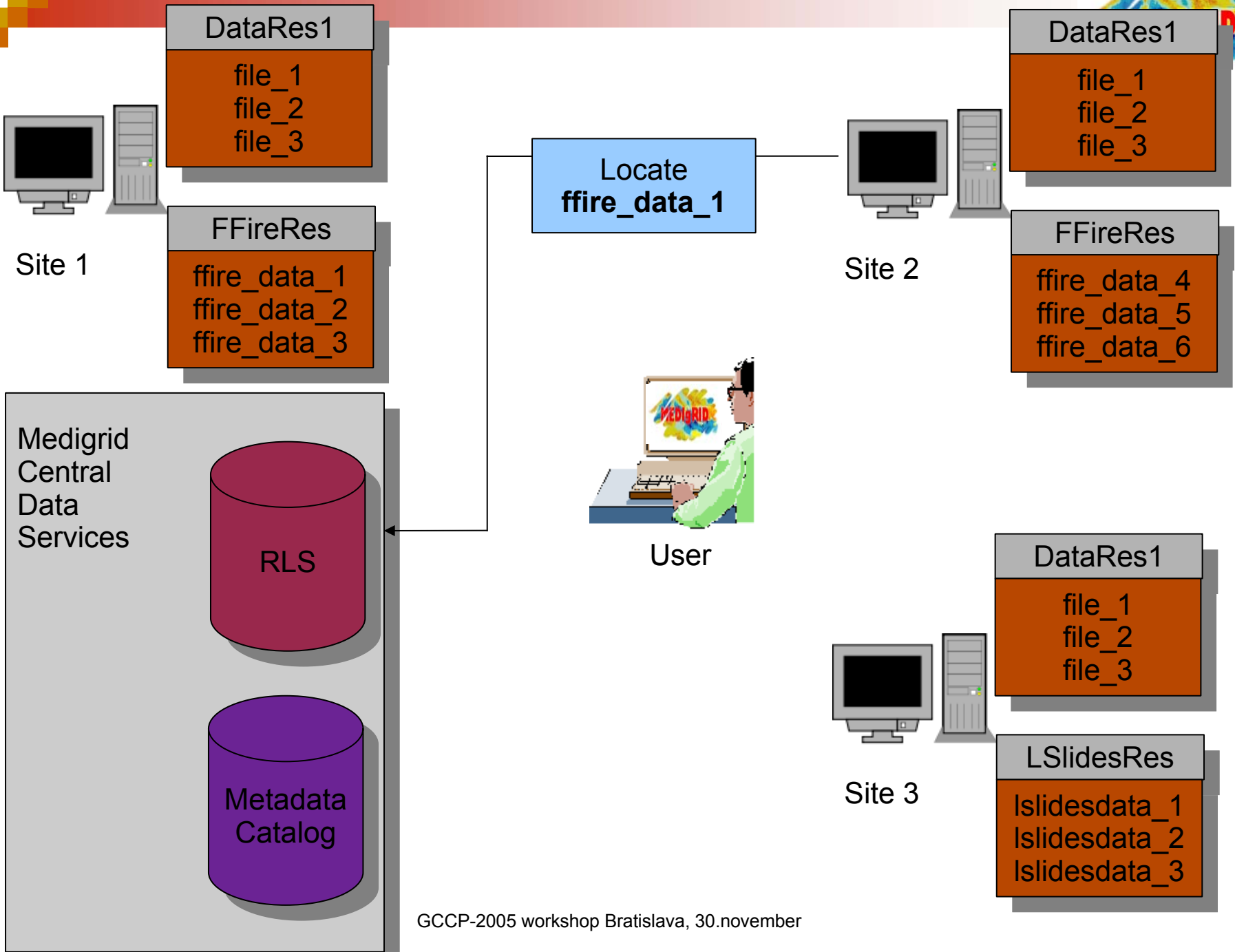
file\_1  
file\_2  
file\_3

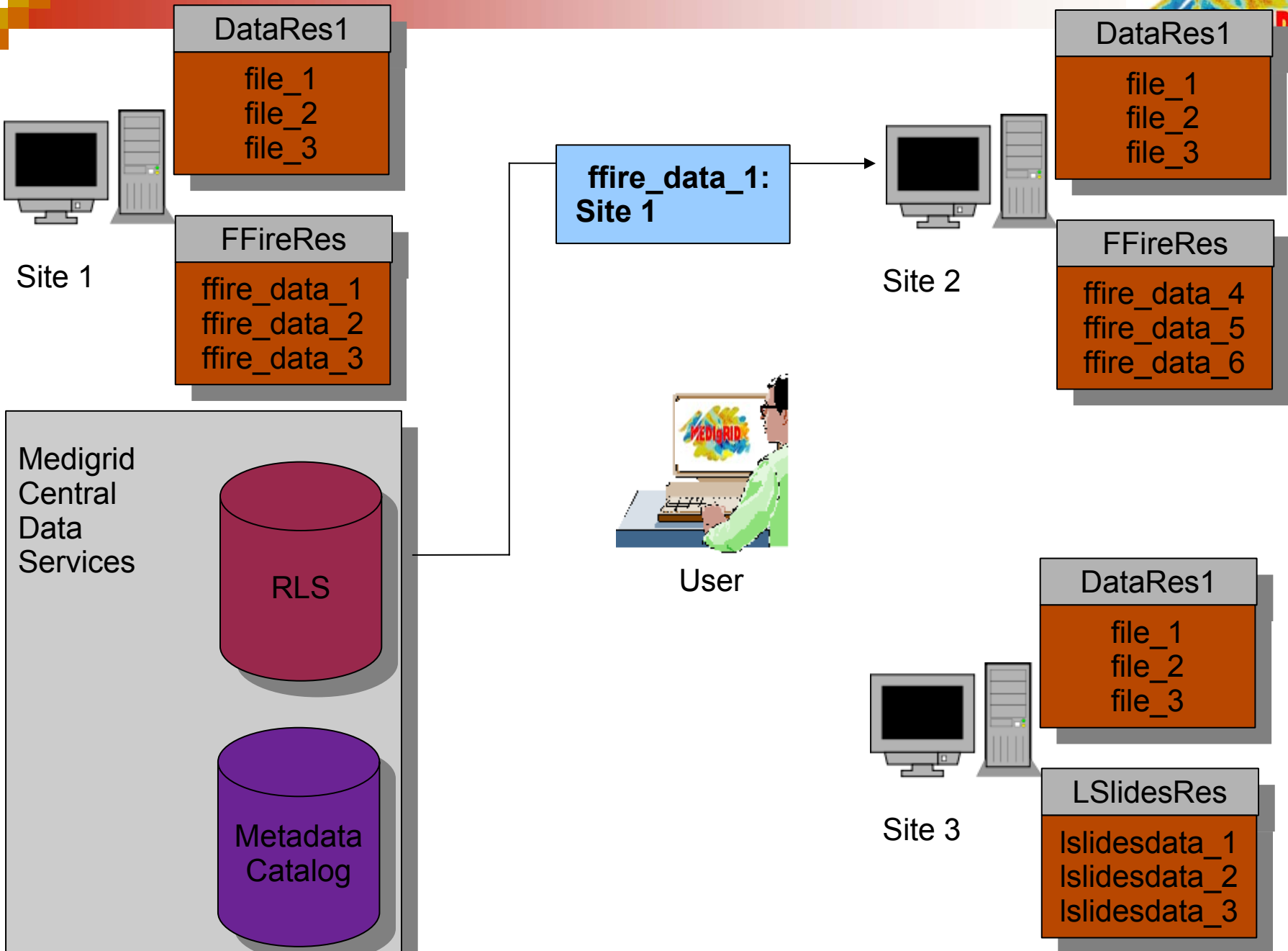
LSlidesRes

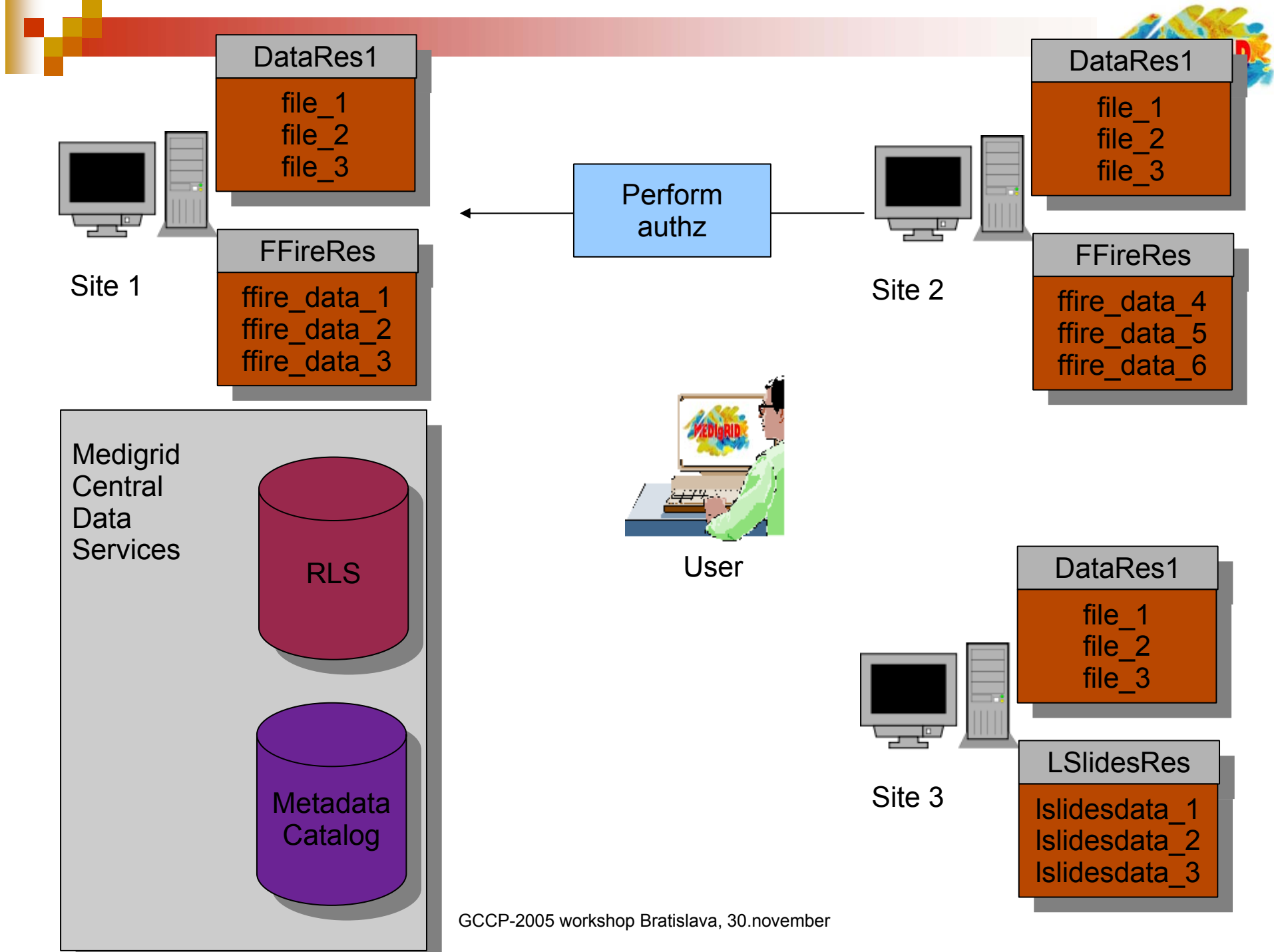
lslidesdata\_1  
lslidesdata\_2  
lslidesdata\_3

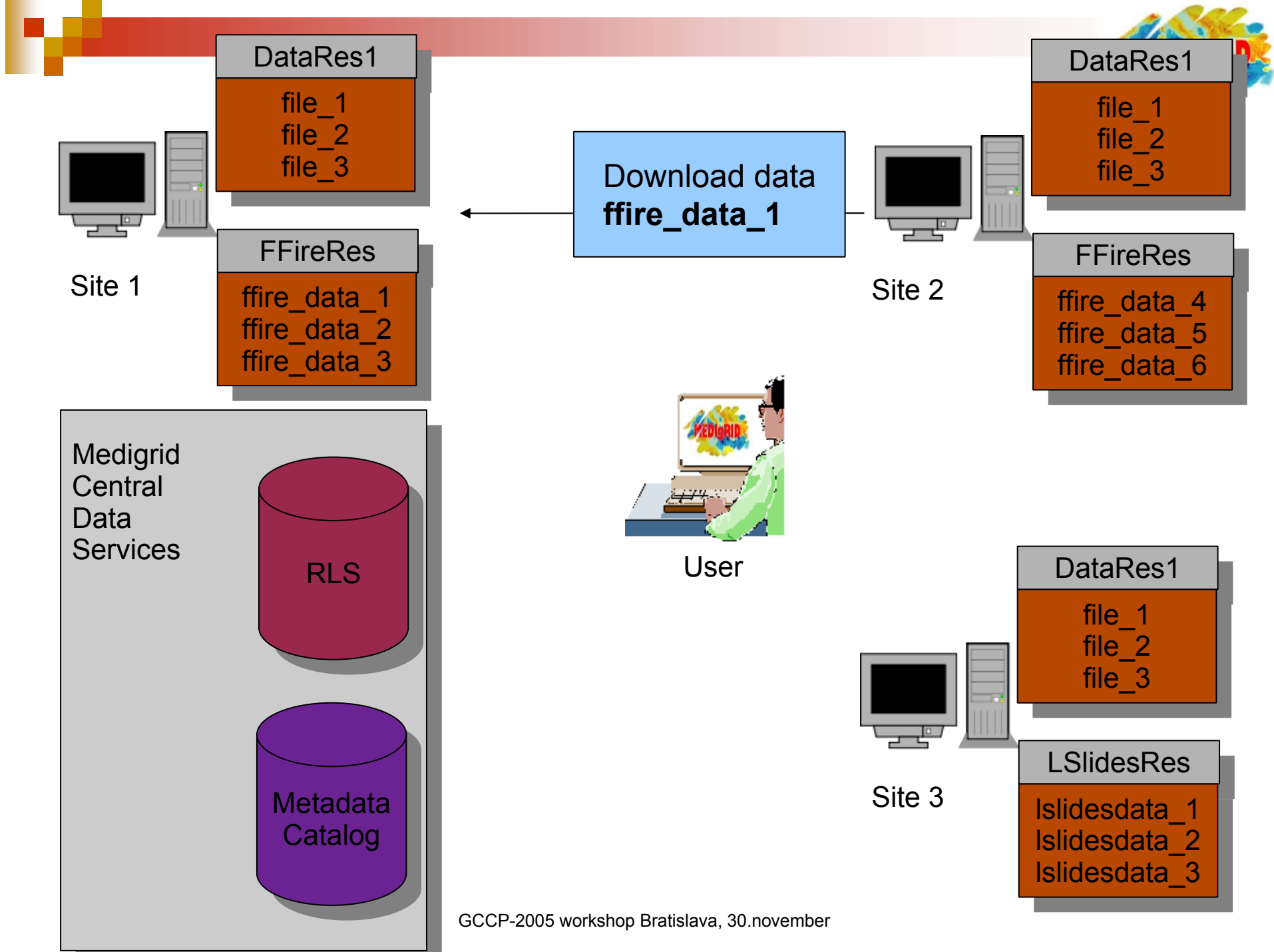
Site 3



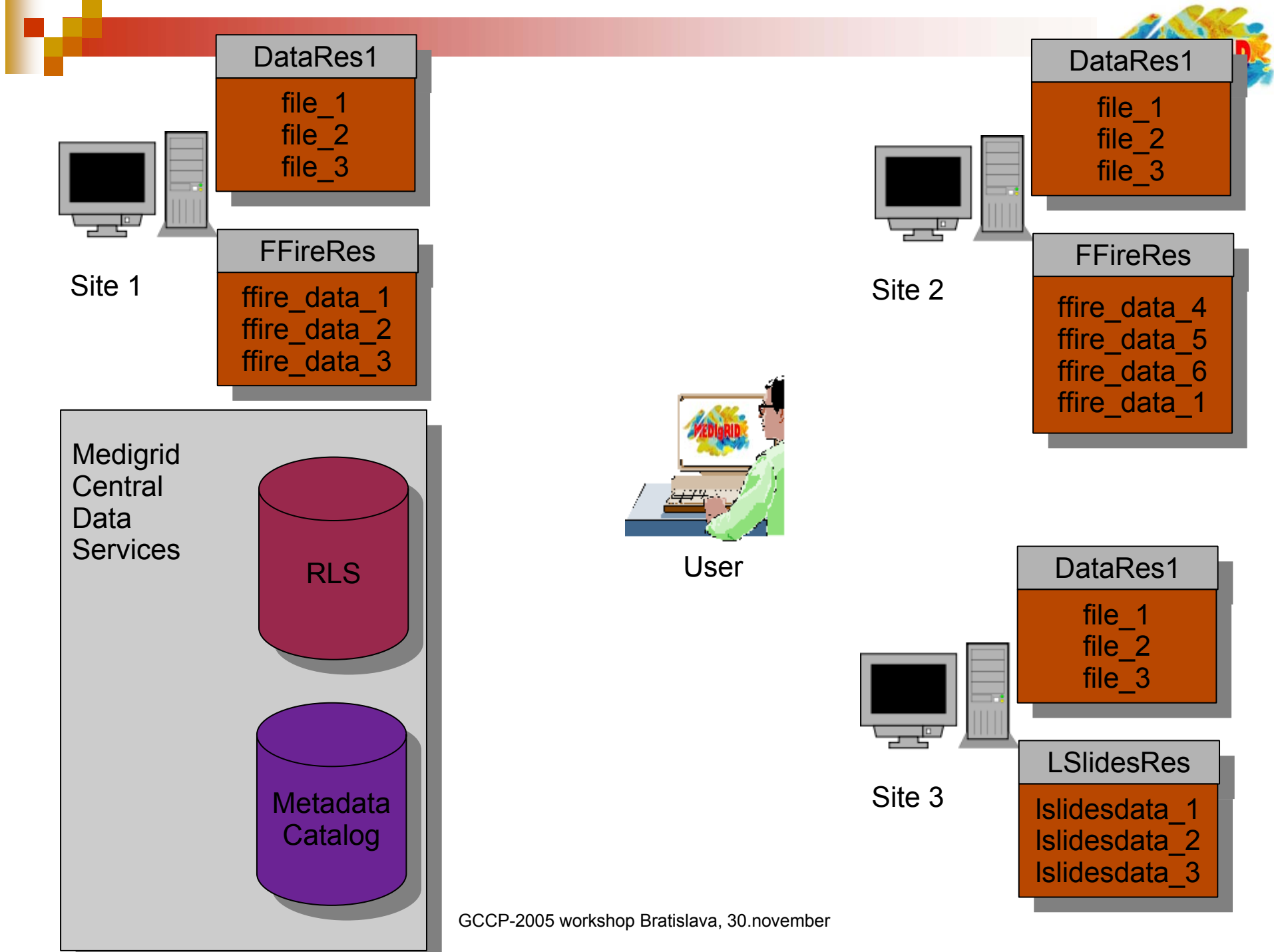


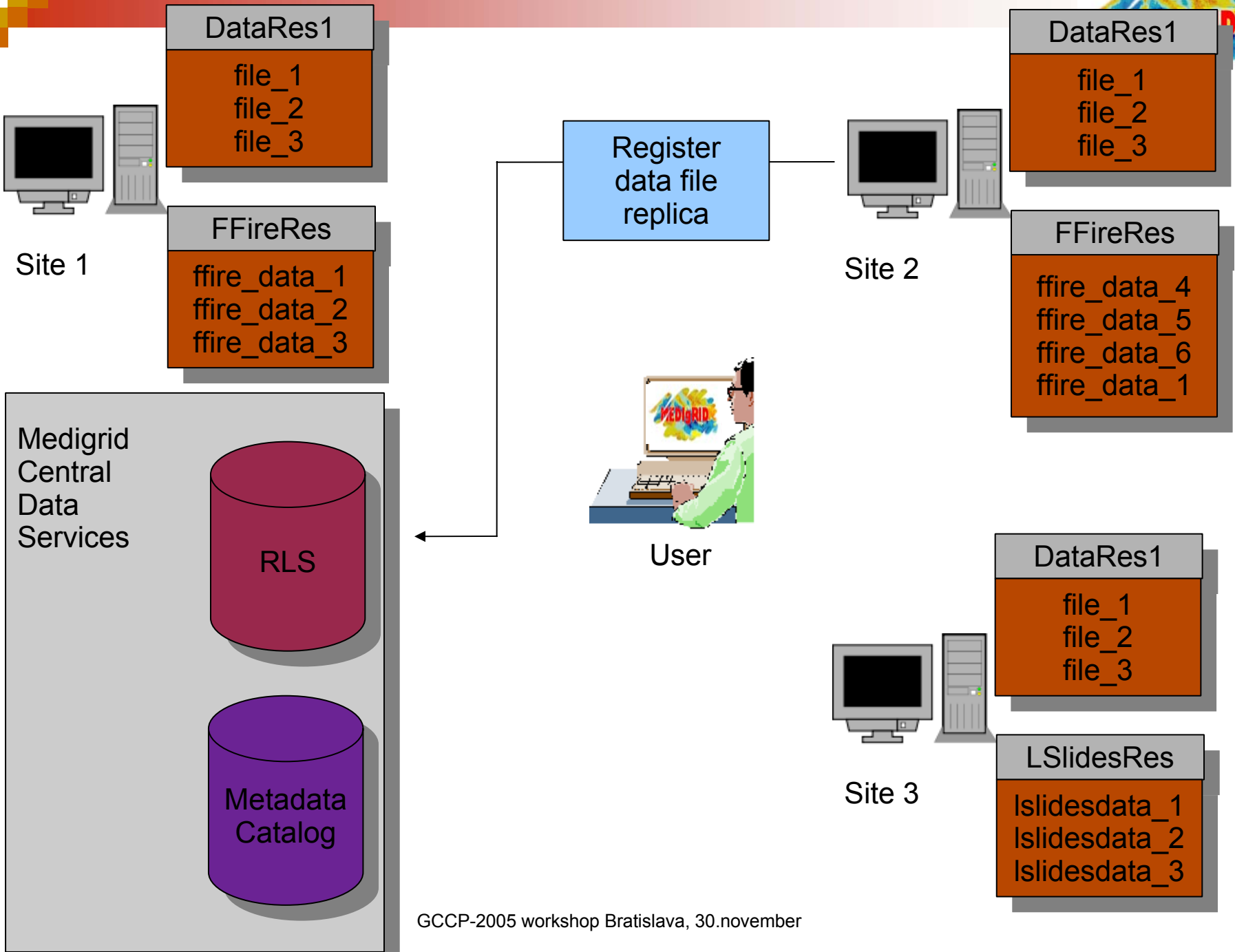


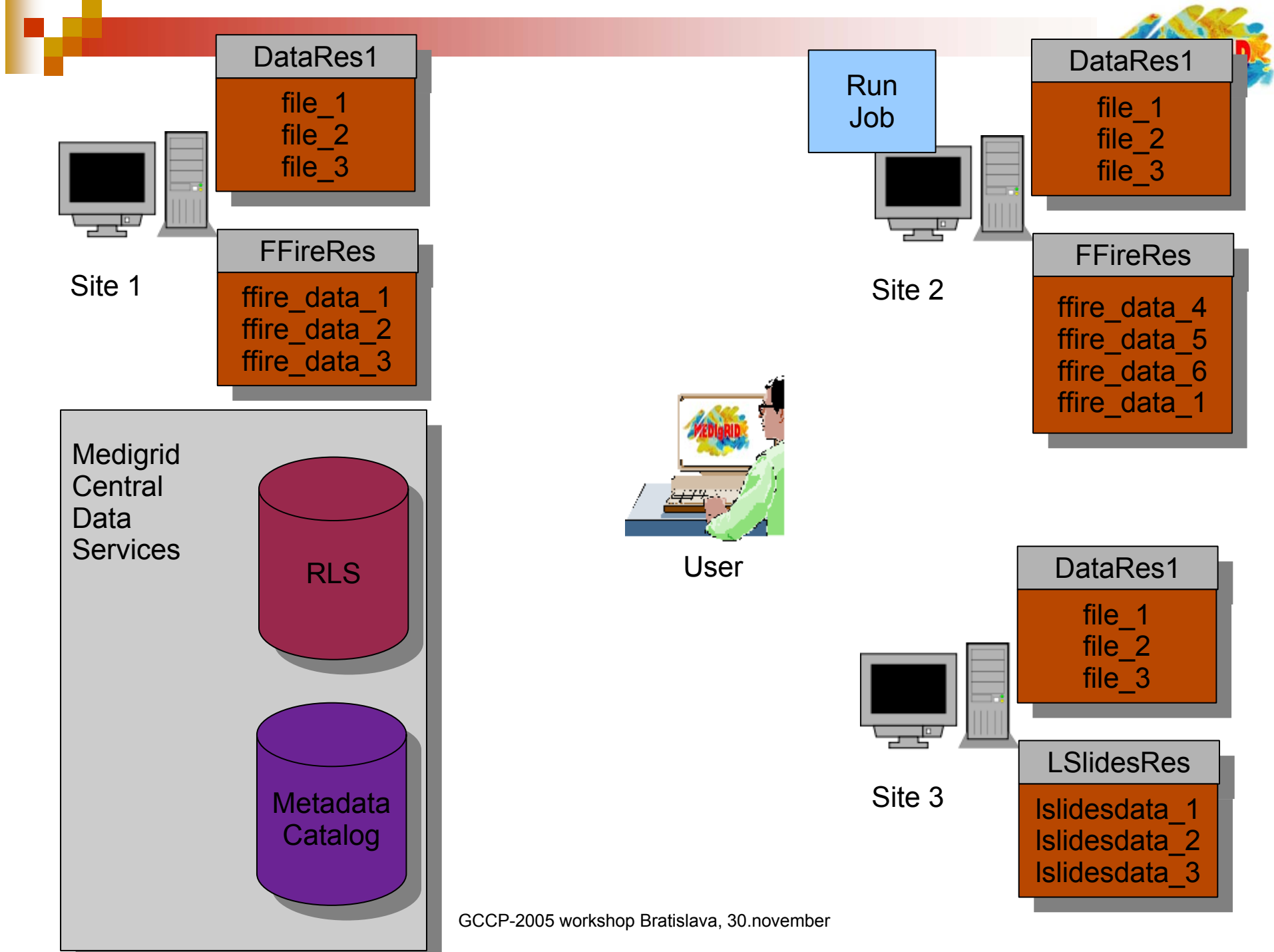


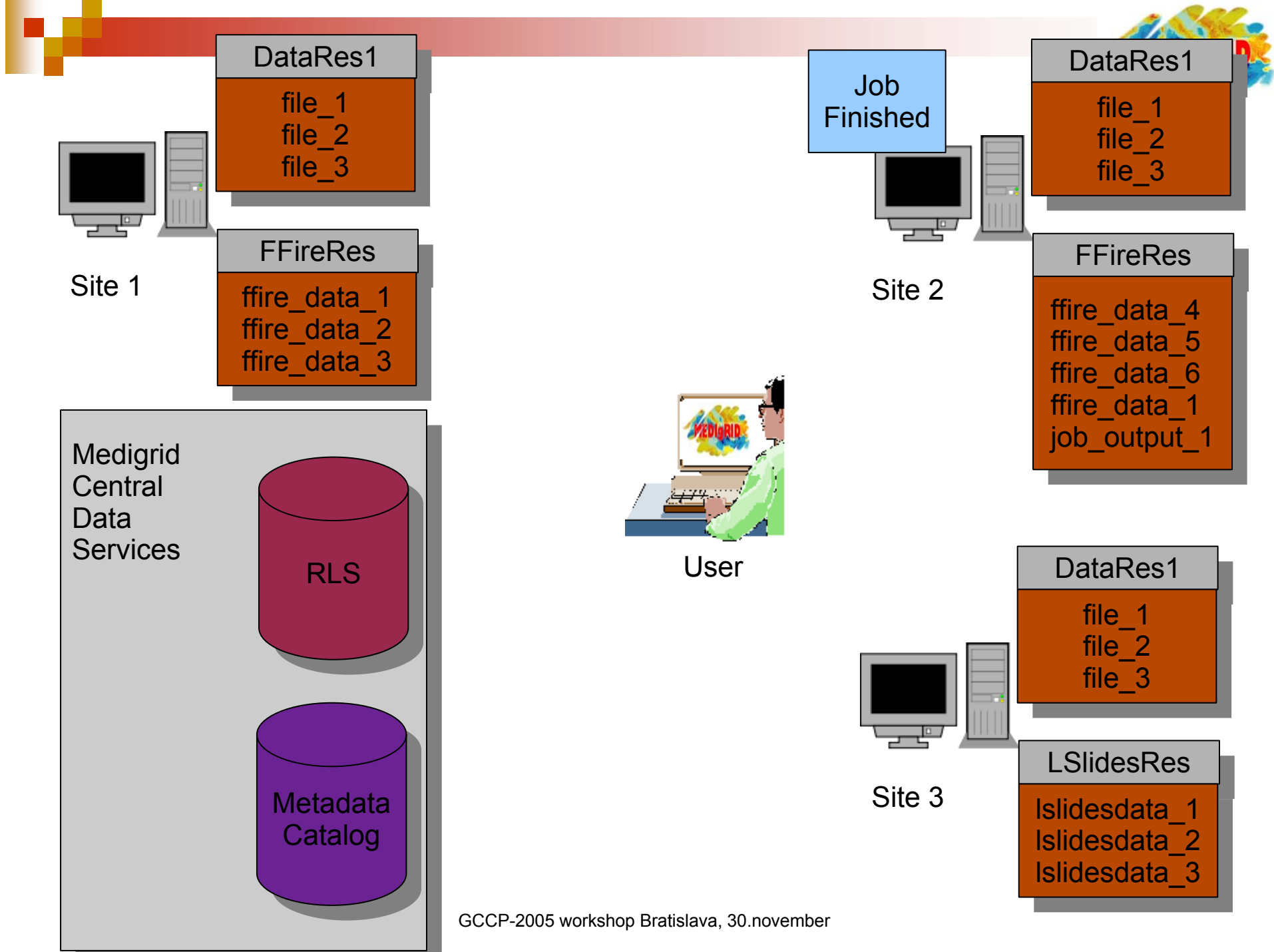


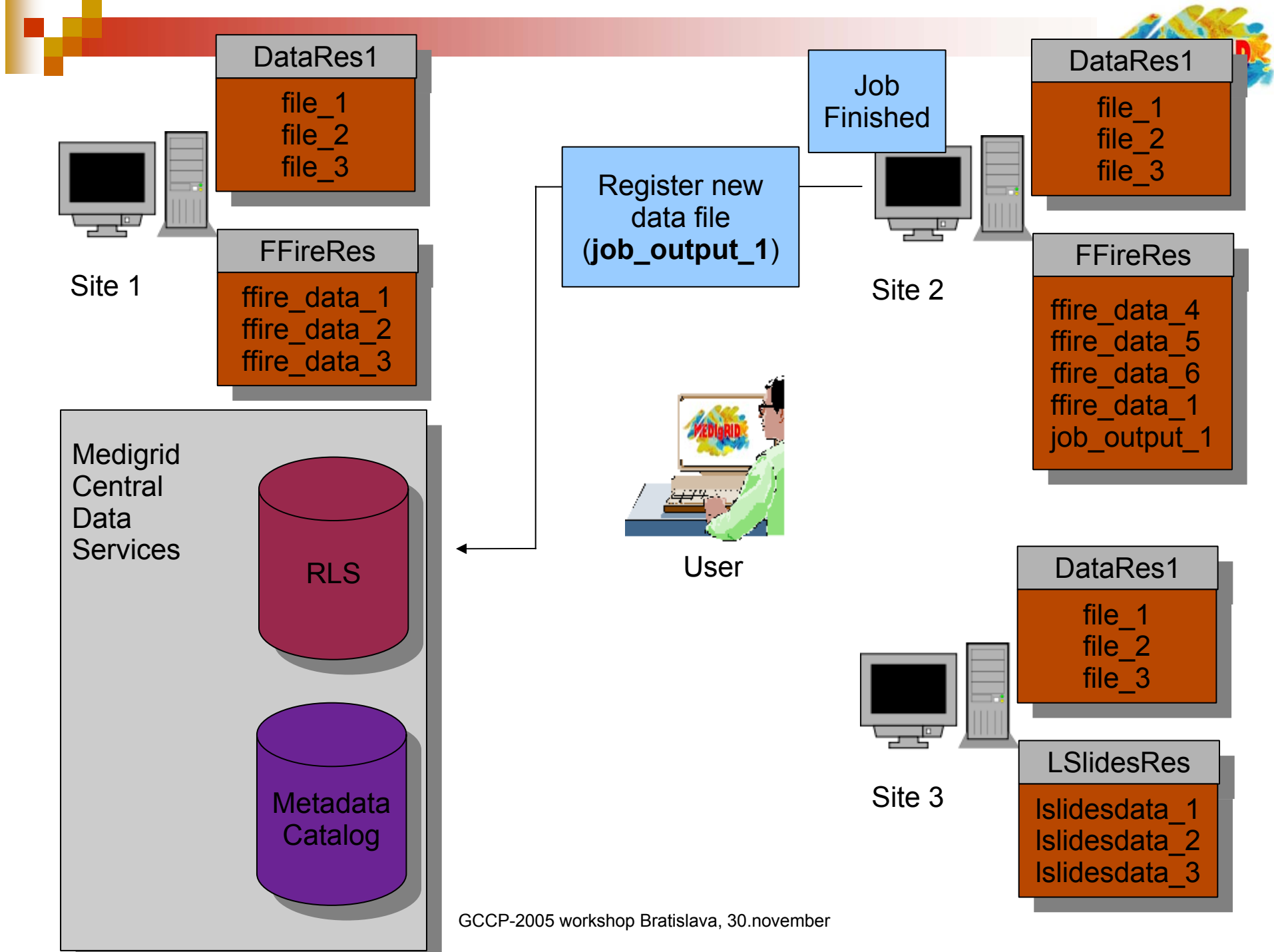


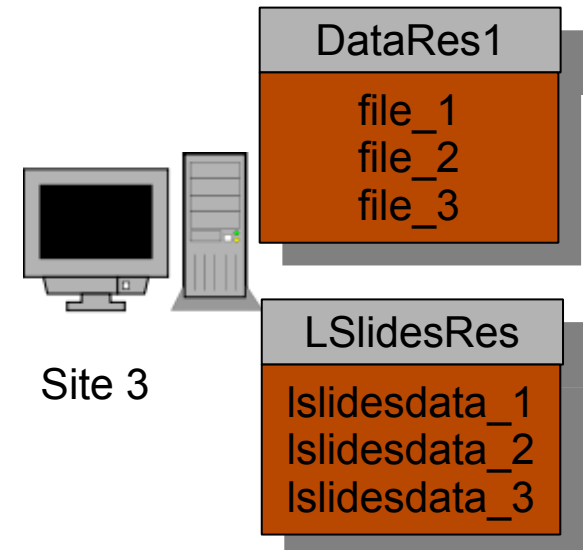
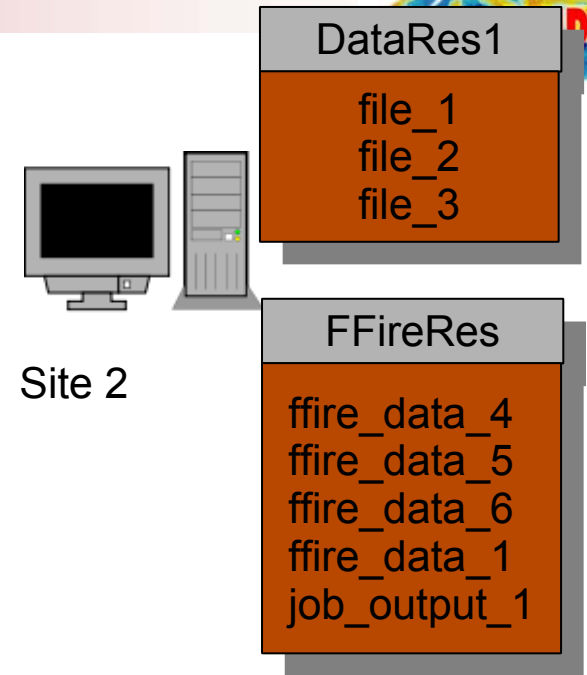
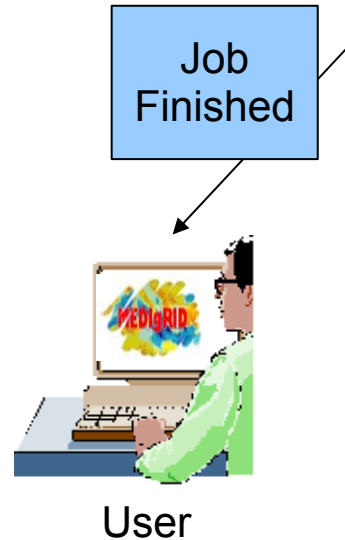
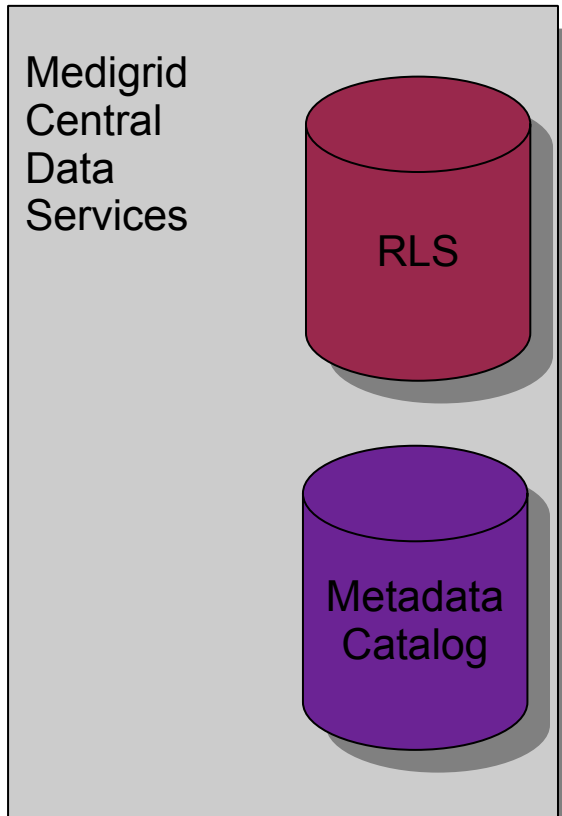
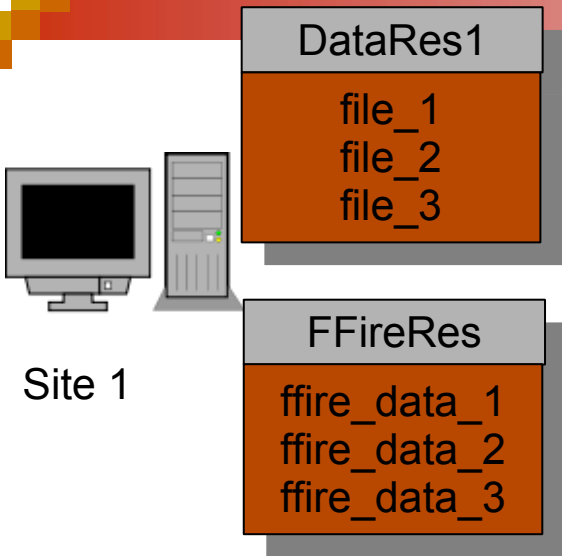


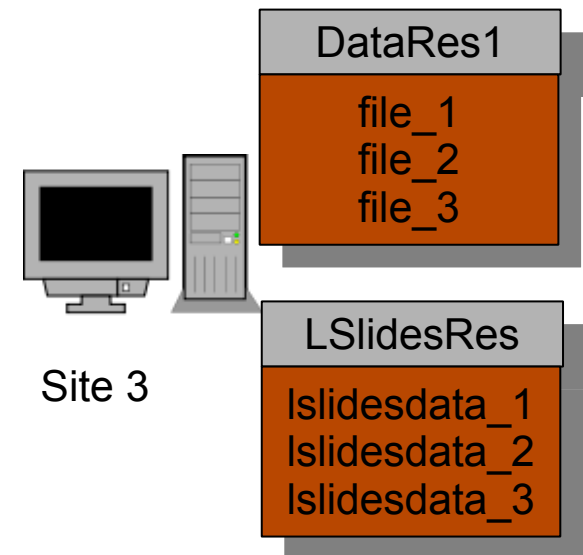
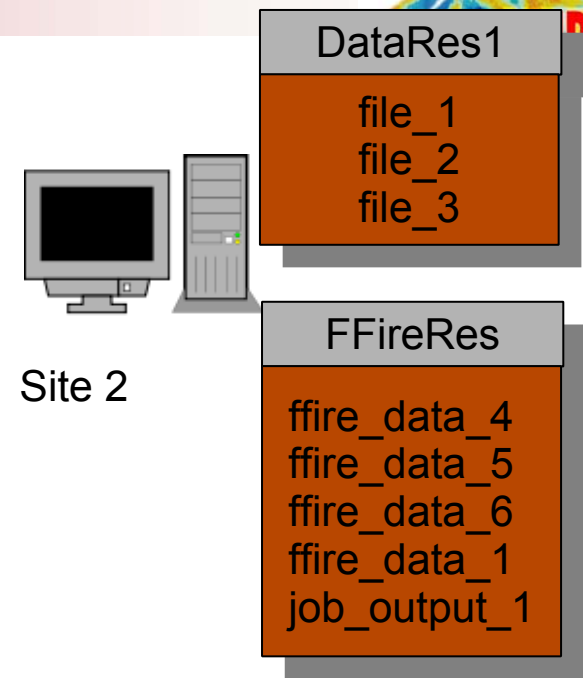
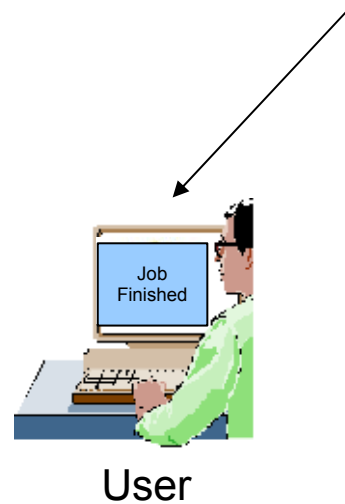
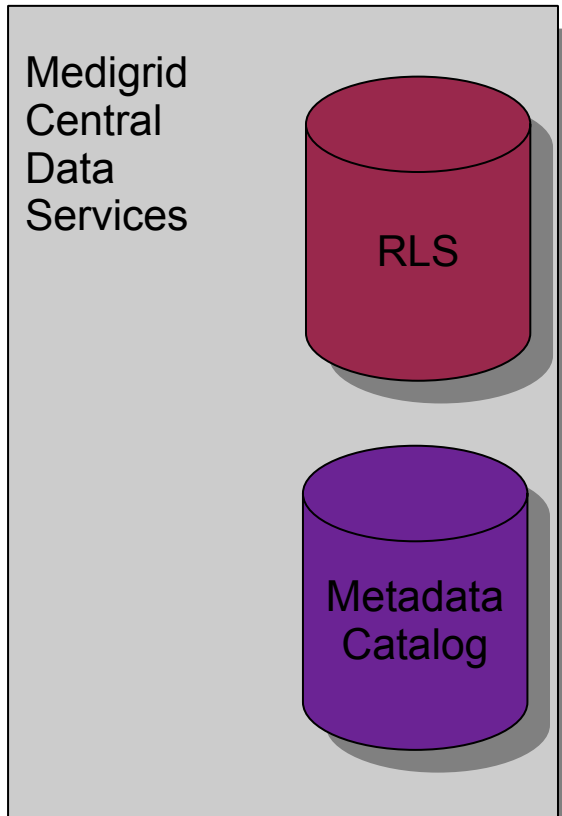
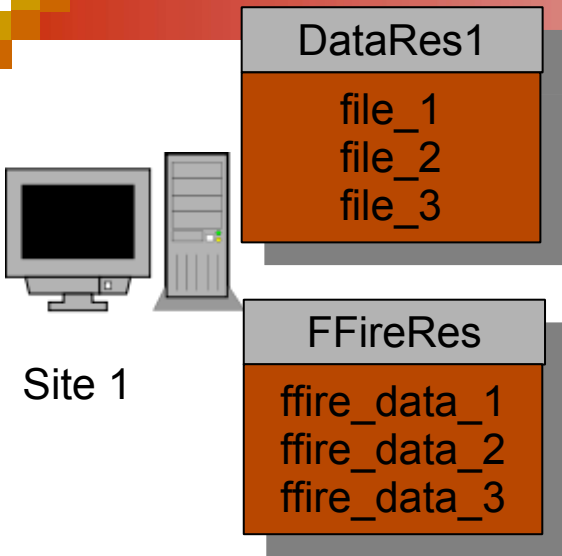






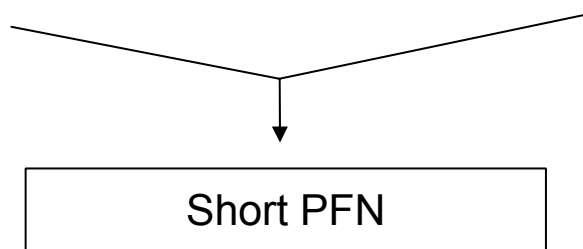






# Data files naming

- **Logical File Name:** is a unique name of the file, that identifies the data file in the grid. It is assigned by the user, when the file is published to the grid.
- **Physical File Name:** is a file name, that specify physical location of a data file in the grid testbed. It is mapped to exactly one Logical File.
- PFN in Medigrid system:
- `mgtp:<data_service_url>#<data_resource>#<path_to_file_from_resource_root>`
- `mgtp:http://gaia.ui.savba.sk:8080/wsrp/services/medigrid/dataservices/DataTransferService#dataroot#/test_20051110_2`





# Data transfer operations

- client -> MG site data upload  
(registration in RLS, MCS)
- MG site -> client data download
- third-party transfer- MG site -> MG site  
(registration in RLS, MCS)



# Medigrid Metadata service

Marek Ciglan

IISAS

# Metadata Catalog Service

- grid based metadata catalog
- developed under the GriPhyN project

## **MCS components:**

- data model that includes mechanisms for aggregation of metadata mappings
- domain-independent metadata attributes; extensibility for user-defined attributes
- set of standard service behaviours
- query mechanisms for accessing the database
- set of standard interfaces and APIs for storing and accessing metadata

# MSC logical categories

- Logical File Metadata
- Logical collection metadata
- Authorization metadata
- User metadata
- Audit metadata
- User-defined metadata attributes
- Annotation attributes
- Creation and transformation history metadata
- External catalog metadata

**Virtual Filesystem Browser**

Virtual Filesystem Browser

..	DIR	..	20051110_precip_4785
<input type="checkbox"/> hydrological_data	DIR	<input type="checkbox"/> 20051110_precip_4786	
<input type="checkbox"/> meteorological_data	DIR	<input type="checkbox"/> 20051110_precip_4787	
<input type="checkbox"/> hydraulics_data	DIR	<input type="checkbox"/> 20051110_precip_4788	
		<input type="checkbox"/> 20051110_precip_4789	
		<input type="checkbox"/> 20051110_precip_4790	
		<input type="checkbox"/> 20051110_precip_4791	
		<input type="checkbox"/> 20051110_precip_4792	
		<input type="checkbox"/> 20051110_precip_4793	
		<input type="checkbox"/> 20051110_precip_4794	
		<input type="checkbox"/> 20051110_precip_4795	
		<input type="checkbox"/> 20051110_precip_4796	
		<input type="checkbox"/> 20051110_precip_4797	
		<input type="checkbox"/> 20051110_precip_4798	
		<input type="checkbox"/> 20051110_precip_4799	

Delete Copy Move Delete Copy Move

MkDir MkDir

**Metadata Attributes**

20051110\_precip\_4785

Data_id	3
Logical_name	20051110_precip_4785
Version	1
Data_type	Precipitation data
Collection_id	0
Container_service	medigrid/dataservices/mcs
Is_Valid	1
Creator_Dn	/C=SK/O=SlovakGrid/O=IISAS/CN=Marek Ciglian
Last_Modifier_Dn	/C=SK/O=SlovakGrid/O=IISAS/CN=Marek Ciglian
Create_Time	2005-11-11 10:00:00
Last_Modify_Time	2005-11-11 10:00:00
Master_Copy	20051110_precip_4785
audit	0
xml	NO
area_code	4785
area_name	Bytca-Airoport
precipitation_min	18.06
sensor_in_area	8
clm	213.6
clv	242.7
precipitation_average	20.45
precipitation_max	23.12
wind_direction	48.3
wind_strength	5.4
precipitation_date	2005-11-10
time_period_end	10:00:00
time_period_start	08:00:00

Update

String

Add Attribute

**Metadata search**

Add search condition:

String = :

Add Condition

Search

Clear Conditions

**Conditions:**

Attribute	Type	Condition	Value
area_code	MCS_STRING	=	4785
precipitation_date	MCS_DATE	=	2005-11-10

**Results:**

[20051110\\_precip\\_4785](#)

Virtual Filesystem Browser

Virtual Filesystem Browser

..	DIR	20051110_precip_4785
<input type="checkbox"/> hydrological_data	DIR	20051110_precip_4786
<input type="checkbox"/> meteorological_data	DIR	20051110_precip_4787
<input type="checkbox"/> hydraulics_data	DIR	20051110_precip_4788
		20051110_precip_4789
		20051110_precip_4790
		20051110_precip_4791
		20051110_precip_4792
		20051110_precip_4793
		20051110_precip_4794
		20051110_precip_4795
		20051110_precip_4796
		20051110_precip_4797
		20051110_precip_4798
		20051110_precip_4799

Delete Copy Move Delete Copy Move

MkDir MkDir

Metadata Attributes

20051110\_precip\_4785

data_id	3
logical_name	20051110_precip_4785
version	1
data_type	Precipitation data
collection_id	0
container_service	medigrid/dataservices/mcs
is_Valid	1
creator_Dn	/C=SK/O=SlovakGrid/O=IISAS/CN=Marek Ciglian
last_Modifier_Dn	/C=SK/O=SlovakGrid/O=IISAS/CN=Marek Ciglian
create_Time	2005-11-11 10:00:00
last_Modify_Time	2005-11-11 10:00:00
master_Copy	20051110_precip_4785
audit	0
xml	NO
area_code	4785
area_name	Bytca-Airoport
precipitation_min	18.06
sensor_in_area	8
temp	213.6
wind	242.7
precipitation_average	20.45
precipitation_max	23.12
wind_direction	48.3
wind_strength	5.4

Metadata search

Add search condition:

String : = :

Add Condition

Search

Clear Conditions

Conditions:

Attribute	Type	Condition	Value
area_code	MCS_STRING	=	4785
precipitation_date	MCS_DATE	=	2005-11-10

Results:

20051110\_precip\_4785

Metadata collections browser  
-  
Virtual directory structures

## Virtual Filesystem Browser

Virtual Filesystem Browser

<input type="checkbox"/>	hydrological_data	DIR
<input type="checkbox"/>	meteorological_data	DIR
<input type="checkbox"/>	hydraulics_data	DIR

<input type="checkbox"/>	20051110_precip_4785	
<input type="checkbox"/>	20051110_precip_4786	
<input type="checkbox"/>	20051110_precip_4787	
<input type="checkbox"/>	20051110_precip_4788	
<input type="checkbox"/>	20051110_precip_4789	
<input type="checkbox"/>	20051110_precip_4790	
<input type="checkbox"/>	20051110_precip_4791	
<input type="checkbox"/>	20051110_precip_4792	
<input type="checkbox"/>	20051110_precip_4793	
<input type="checkbox"/>	20051110_precip_4794	
<input type="checkbox"/>	20051110_precip_4795	
<input type="checkbox"/>	20051110_precip_4796	
<input type="checkbox"/>	20051110_precip_4797	
<input type="checkbox"/>	20051110_precip_4798	
<input type="checkbox"/>	20051110_precip_4799	

Delete Copy Move Delete Copy Move

MkDir MkDir

## Metadata Attributes

20051110\_precip\_4785

data_id	3
logical_name	20051110_precip_4785
version	1
data_type	Precipitation data
collection_id	0
container_service	medigrid/dataservices/mcs
is_valid	1
creator_Dn	/C=SK/O=SlovakGrid/O=IISAS/CN=Marek Ciglan
last_modifier_Dn	/C=SK/O=SlovakGrid/O=IISAS/CN=Marek Ciglan
create_Time	2005-11-11 10:00:00
last_modify_Time	2005-11-11 10:00:00
master_Copy	20051110_precip_4785
audit	0
xml	NO
area_code	4785
area_name	Bytca-Airoport
precipitation_min	18.06
sensor_in_area	8
area_m	213.6
area_v	242.7
precipitation_average	20.45
precipitation_max	23.12
wind_direction	48.3
wind_strength	5.4

## Metadata search

Add search condition:

 : String : = : 

Add Condition

Search

Clear Conditions

Conditions:

Attribute	Type	Condition	Value
area_code	MCS_STRING	=	4785
precipitation_date	MCS_DATE	=	2005-11-10

Results:

20051110\_precip\_4785

- .View virtual directories & logical files
- .Copy virtual directories & logical files
- .Move virtual directories & logical files
- .Delete virtual directories & logical files
- .Create virtual directories

Virtual Filesystem Browser

Virtual Filesystem Browser

### Metadata attributes portlet

- View metadata attributes
- Edit metadata attributes
- Add metadata attributes

- 20051110\_precip\_4794
- 20051110\_precip\_4795
- 20051110\_precip\_4796
- 20051110\_precip\_4797
- 20051110\_precip\_4798
- 20051110\_precip\_4799

Delete Copy Move Delete Copy Move

MkDir MkDir

Metadata search

Add search condition:

String =

Add Condition

Search

Clear Conditions

Conditions:

Attribute	Type	Condition	Value
area_code	MCS_STRING	=	4785
precipitation_date	MCS_DATE	=	2005-11-10

Results: 20051110\_precip\_4785

Metadata Attributes

20051110\_precip\_4785

Data_id	3
Logical_name	20051110_precip_4785
Version	1
Data_type	Precipitation data
Collection_id	0
Container_service	medigrd/dataservices/mcs
Is_Valid	1
Creator_Dn	/C=SK/O=SlovakGrid/O=IISAS/CN=Marek Ciglan
Last_Modifier_Dn	/C=SK/O=SlovakGrid/O=IISAS/CN=Marek Ciglan
Create_Time	2005-11-11 10:00:00
Last_Modify_Time	2005-11-11 10:00:00
Master_Copy	20051110_precip_4785
audit	0
xml	NO
area_code	4785
area_name	Bytca-Airoport
precipitation_min	18.06
sensor_in_area	8
clm	213.6
clv	242.7
precipitation_average	20.45
precipitation_max	23.12
wind_direction	48.3
wind_strength	5.4
precipitation_date	2005-11-10
time_period_end	10:00:00
time_period_start	08:00:00

Update

String =

Add Attribute



Virtual Filesystem Browser

Virtual Filesystem Browser

- hydrological\_data DIR
- meteorological\_data DIR
- hydraulics\_data DIR

- 20051110\_precip\_4785
- 20051110\_precip\_4786
- 20051110\_precip\_4787
- 20051110\_precip\_4788
- 20051110\_precip\_4789
- 20051110\_precip\_4790
- 20051110\_precip\_4791
- 20051110\_precip\_4792
- 20051110\_precip\_4793
- 20051110\_precip\_4794
- 20051110\_precip\_4795
- 20051110\_precip\_4796
- 20051110\_precip\_4797
- 20051110\_precip\_4798
- 20051110\_precip\_4799

Delete Copy Move Delete Copy Move MkDir MkDir

Metadata Attributes

20051110\_precip\_4785

Data\_id 3  
Logical\_name 20051110\_precip\_4785  
Version 1  
Data\_type Precipitation data

**Metadata search portlet**

- .metadata search based on attributes values
- .specify multiple query conditions

area\_name Bytca-Alroport

precipitation\_min 18.06

sensor\_in\_area 8

clm 213.6

clv 242.7

precipitation\_average 20.45

precipitation\_max 23.12

wind\_direction 48.3

wind\_strength 5.4

precipitation\_date 2005-11-10

time\_period\_end 10:00:00

time\_period\_start 08:00:00

Update

String

Add Attribute

Metadata search

Add search condition:

String =

Add Condition

Search

Clear Conditions

Conditions:

Attribute	Type	Condition	Value
area_code	MCS_STRING	=	4785
precipitation_date	MCS_DATE	=	2005-11-10

Results:

20051110\_precip\_4785

# Work to be done

- Metadata browser portlet will be integrated with job submission portlet to ease the usage
- Refine metadata portlets according to users feedback

Thank you for your attention.