DTM a lightweight computing virtualization system based on iRODS

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Overview

- Introduction
- User Operation
- Architecture
- An iRODS Based System
- Implementation and Evaluation
- Computing workload managed by data activity
- Future work

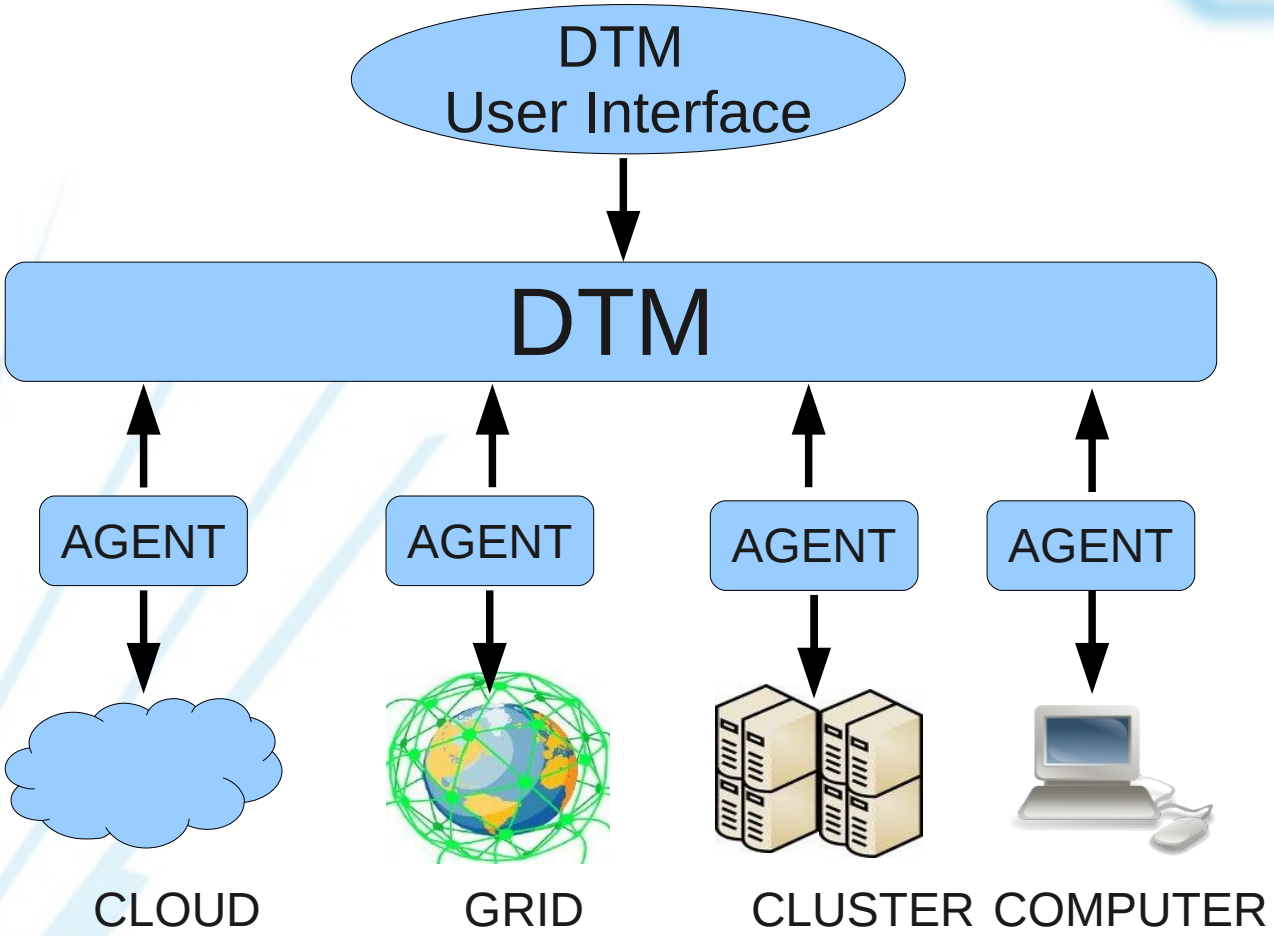
Introduction

- Users need to employ several computing infrastructures simultaneously: batch clusters, grid computing, clouds, ...
- They want automate the utilisation procedures to improve efficiency of use of the resources
- But these infrastructures use different middleware and interfaces

Introduction

- We propose the Distributed Task Manager (DTM)
- With DTM, users have the perception of using a single, simplified and powerful computing system
- DTM creates simple and uniform resource access across multiple heterogeneous computing platforms and provides location transparency
- It uses a pull scheduling approach to execute tasks in a distributed way via agents that hide the infrastructure heterogeneity

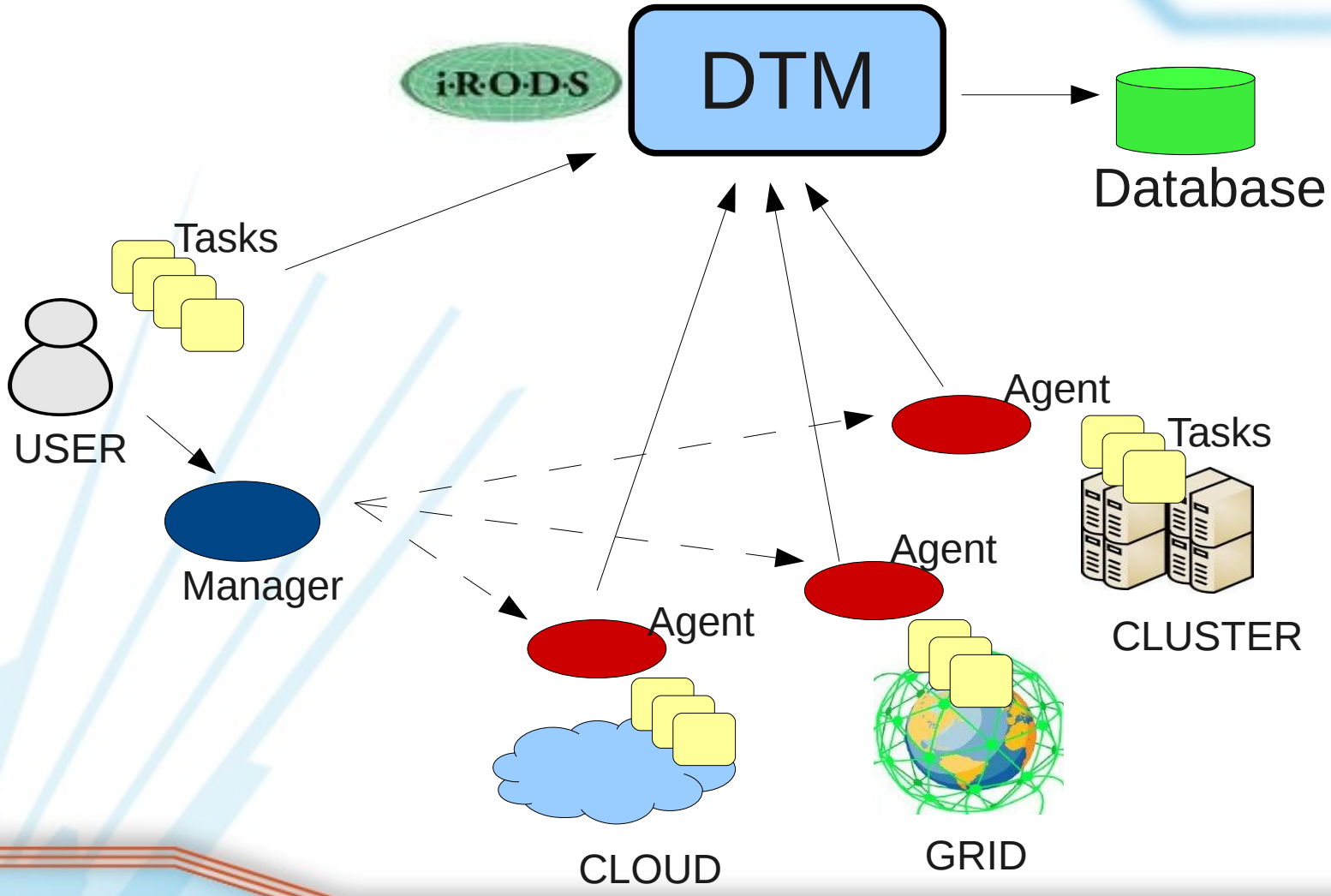
Introduction



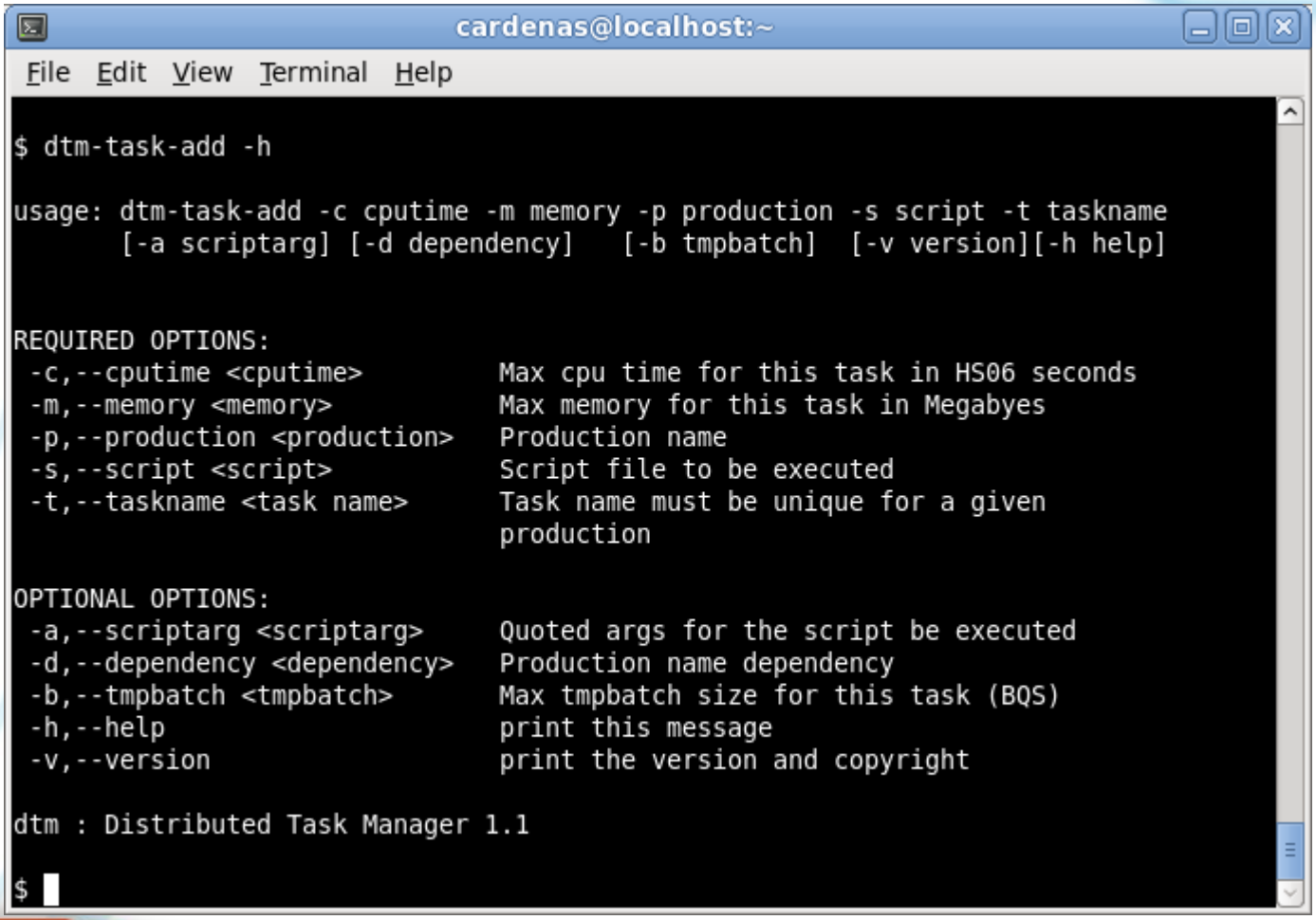
User Operation

- Register tasks and productions
  - Specify the basic task requirements (CPU, memory, ...)
  - A task must belong to a production
- Production enabling
  - Mark tasks as ready to consume
- Production performing
  - Perform a production on subset of available Infrastructures. Launches manager and agents

User Operation



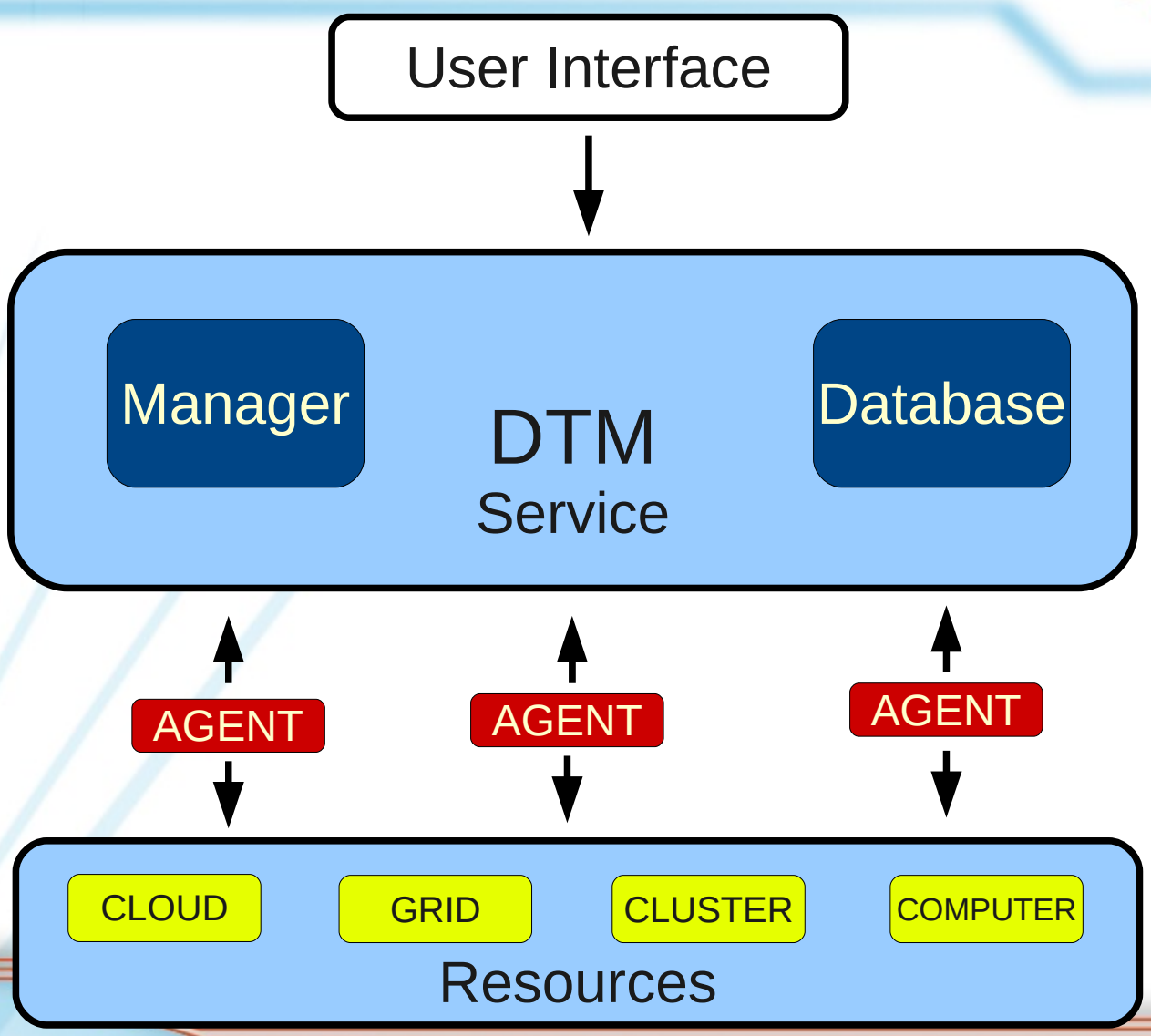
User Operation



Architecture

- Database: Information system
  - Registers state information and actions on tasks.
  - It ensures the integrity of information related with task assignment
  - Implements transactions and operations as stored procedures
- Task: Action that a user wishes to perform on a computing machine
  - An user creates a production to group a set of relatively homogeneous tasks
- Agent: Executes one or several user tasks
  - It runs as independent job or process
- Manager: Coordinates the execution of tasks and agents.

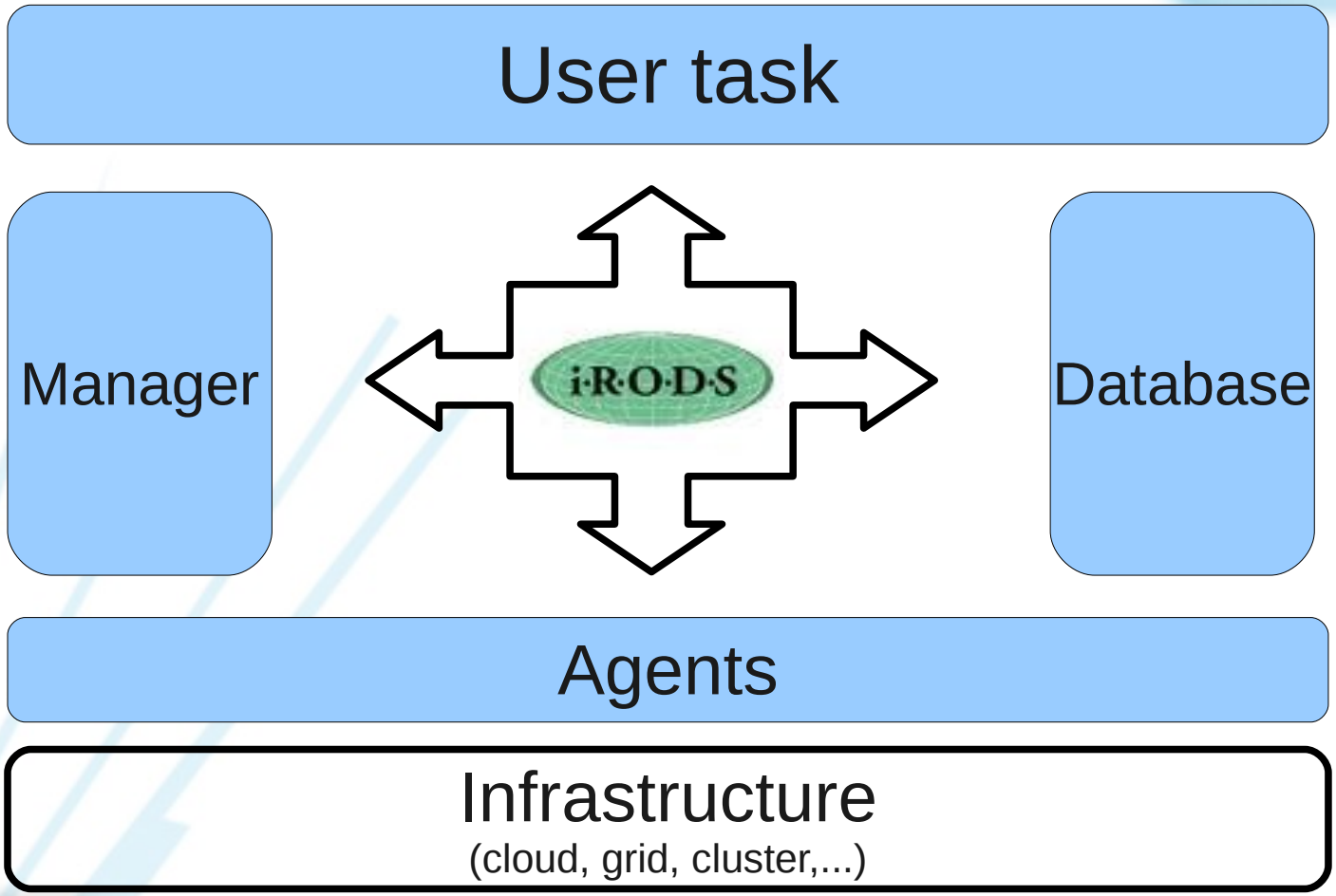
Architecture



An iRODS Based System

- Authentication
  - User authentication and across systems are hidden
  - Password and GSI (EGI)
- Rule-oriented Database Access (RDA)
  - Transparent access to the DTM database on server
  - mySQL stored procedures invoked from RDA micro-services
- Remote rule execution
  - Core business logic is implemented as rules on the server side
  - Clients and components initiate DTM actions that invoke rules on iRODS servers.

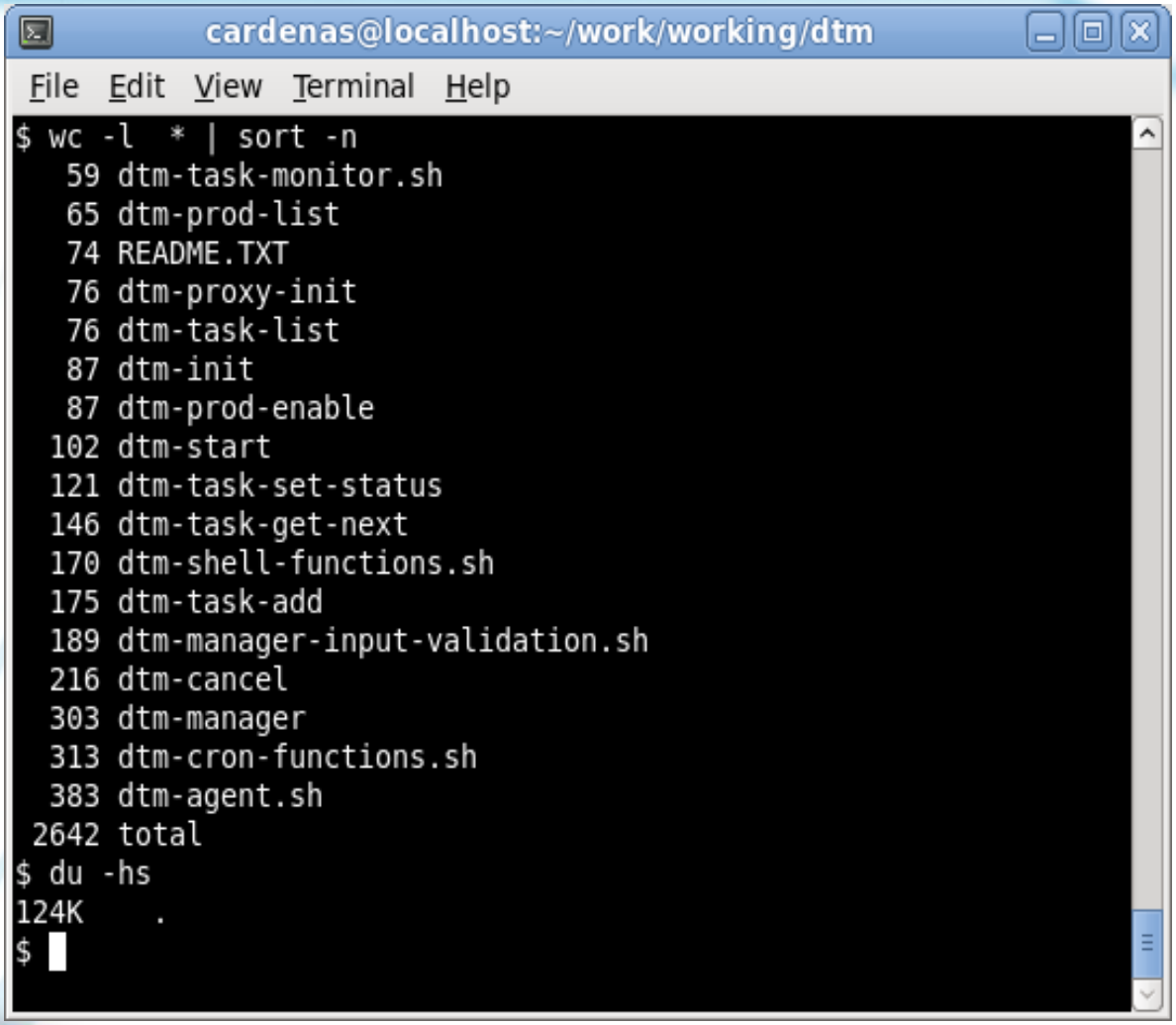
An iRODS Based System



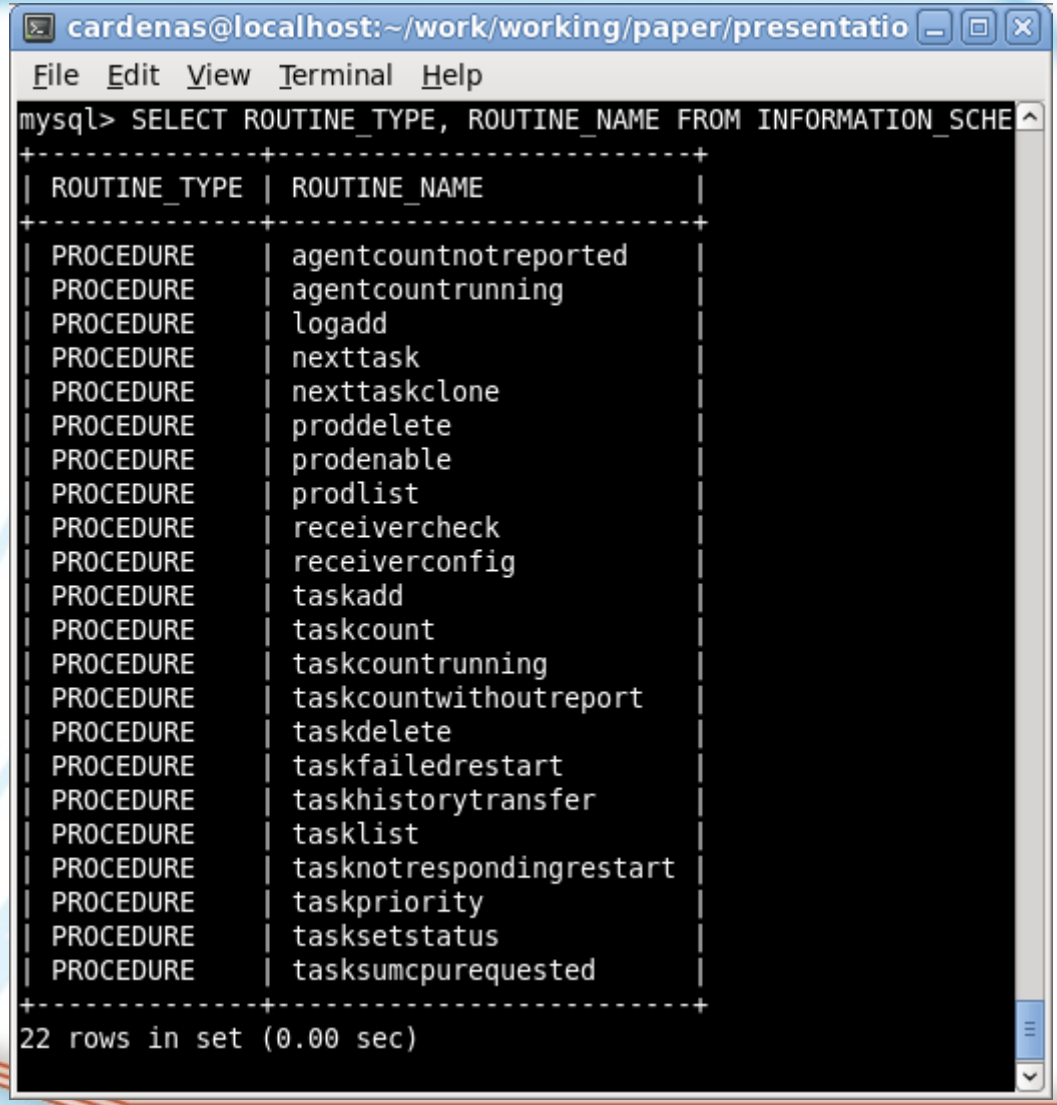
Implementation

- Support:
  - Grid: gLite (EGI)
  - batch: GE, BQS, Torque (coming)
- Database: mySQL stored procedures
  - 214 MySQL code lines
- 16 bash shell scripts
  - Manager: 303 lines (job)
  - Agent: 383 lines (job)
  - Unix/Linux user command-line utilities (eleven commands)
  - All: 2642 lines
- 15 iRODS rules
- The full implementation is 124 Kbytes of total size

Implementation



Implementation



Implementation

- User Invocation (bash shell):

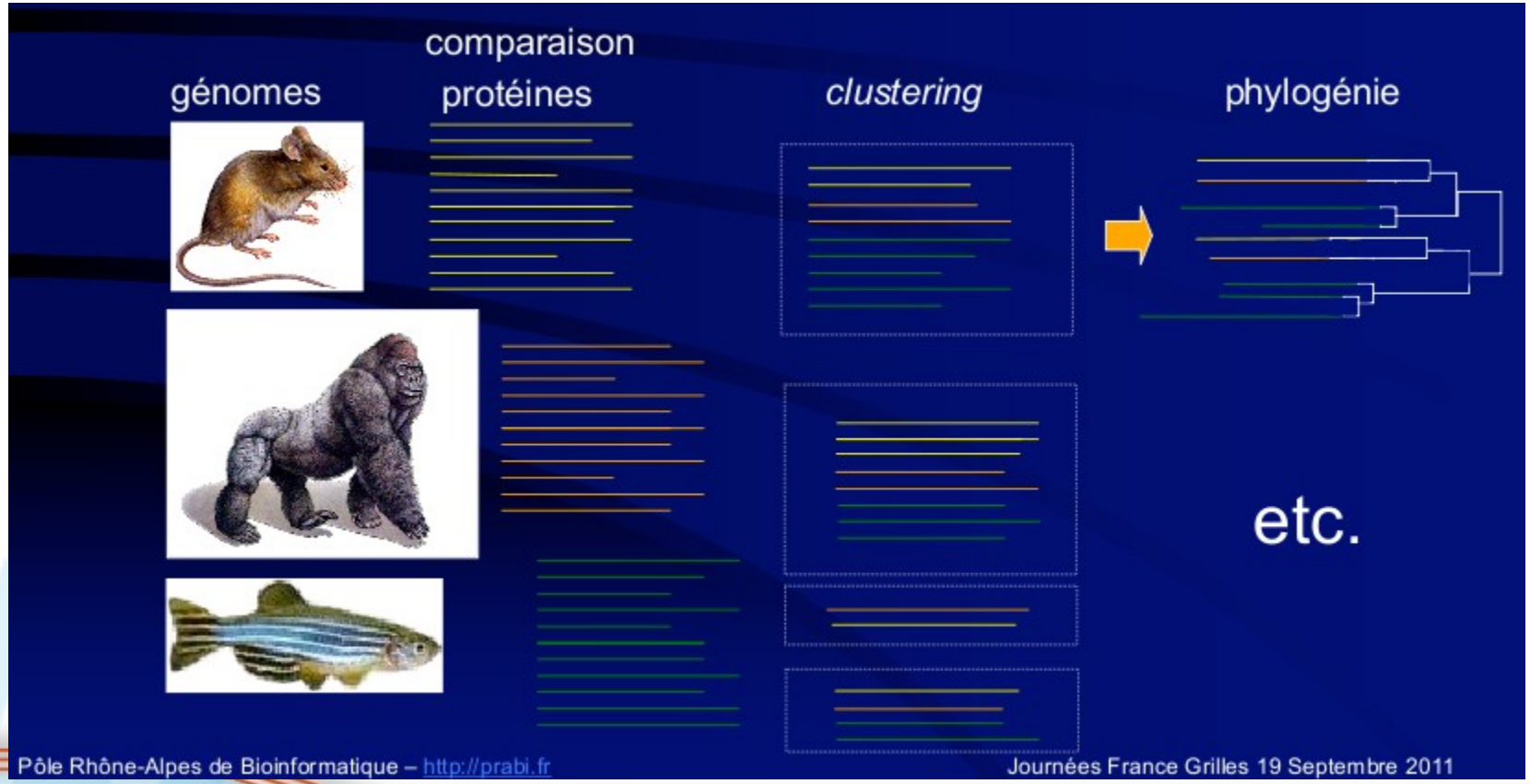
```
IRULE_NAME="acDtmTaskGetNext(*P,*C,*S,*J,*H,*A,*U,*M,*O)"

IRULE_IN="*P=$PROD_ID%*C=$CPU_TIME_LEFT%*S=$THE_SITE
    %*J=$JOB_NAME%*H='$HOSTNAME'%*A=$HOSTADRESS
    %*U='$USER'%*M='$MAXREPLY'%*O=null"

IRULE_OUT="*O"

irule -v "$IRULE_NAME" "$IRULE_IN" "$IRULE_OUT"
```

- Rule at iRODS server side:

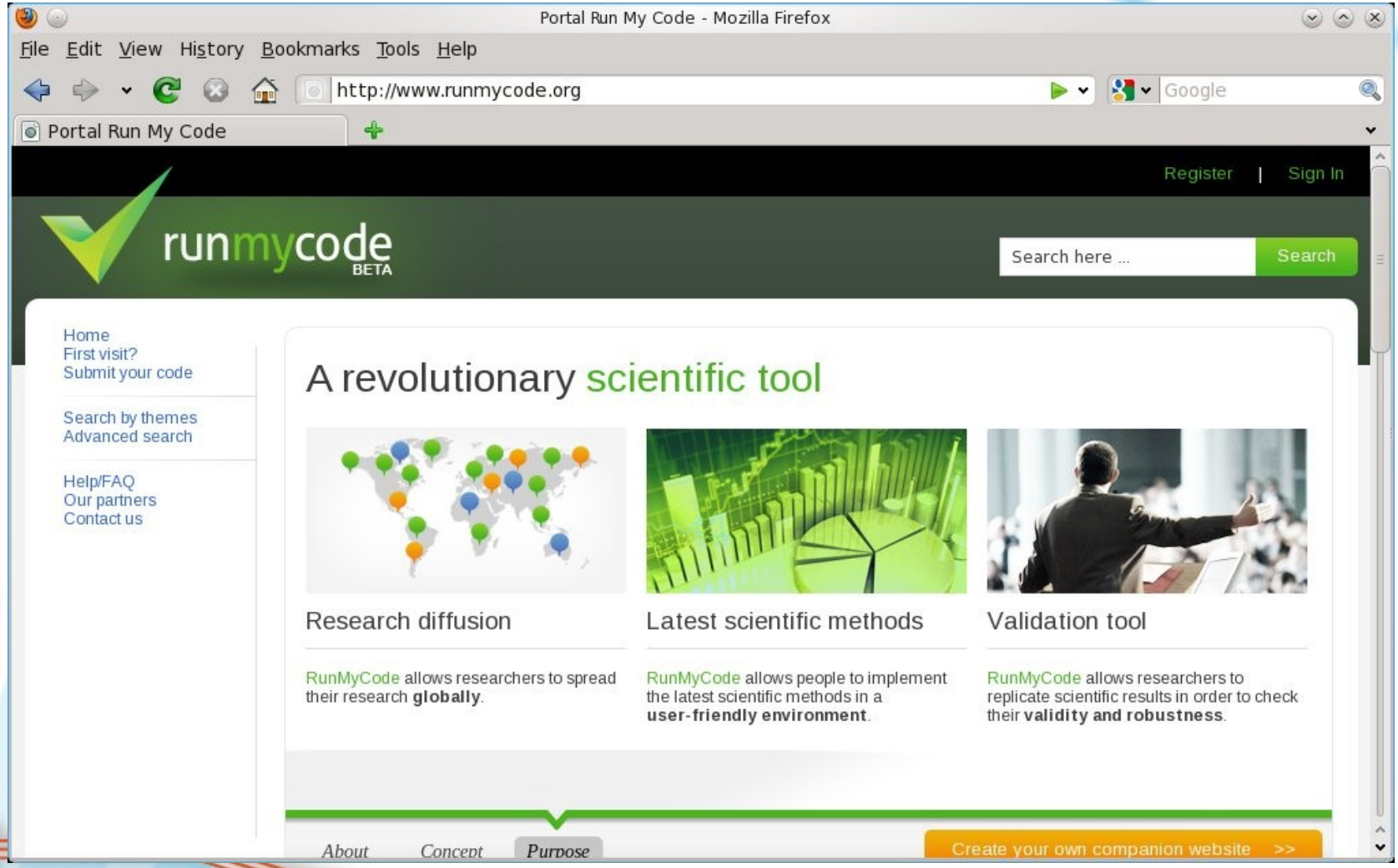
```
acDtmTaskGetNext(*P,*C,*S,*J,*H,*A,*U,*M,*O)||assign(*R,
userNameClient)##msiRdaToString(RDA,"call
nexttask('*R',*P,*C,*S,*J,*H,*A,*U,*M)",null,null,null,null,*O)|nop
```

Evaluation

- Computational genomics (phylogenetic analyses) S. Penel
- Simultaneous execution of thousands of job agents



Portal RunMyCode

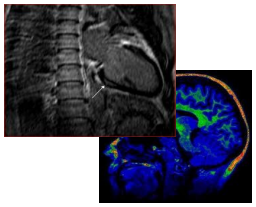


Data activity: Use Case

- Computing workload managed by data activity
- Integration between DTM and iRODS
- Triggering of a batch or grid job submission after data update
- Automatic processing of DICOM files
  - Standard format for information in medical imaging
- Analysis: Indexing of content and metadata from image files.

Data activity: Use Case

IRM



DICOM Files

DTM

i-R-O-D-S

Images Repository

Metadata

Agent

Tasks

Image Analysis

Future work

- Replace the RDA interface with the iRODS database resource
- Update to new rule syntax
- Grid job submission: Replace the gLite user interface with with JJS/JSAGA
- Support automatic submission on clouds handled by the DTM manager
- Job submission based on data management policies:
  - task execution location that integrates criteria related to data placement

Thank you

Questions ?