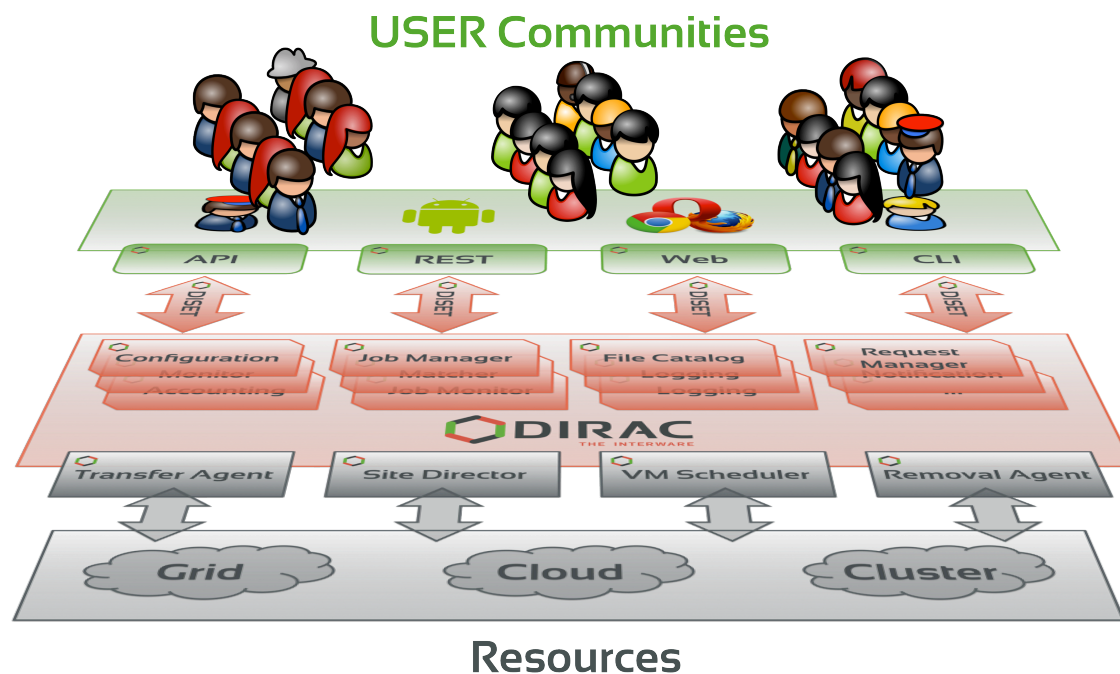


# BigData with DIRAC

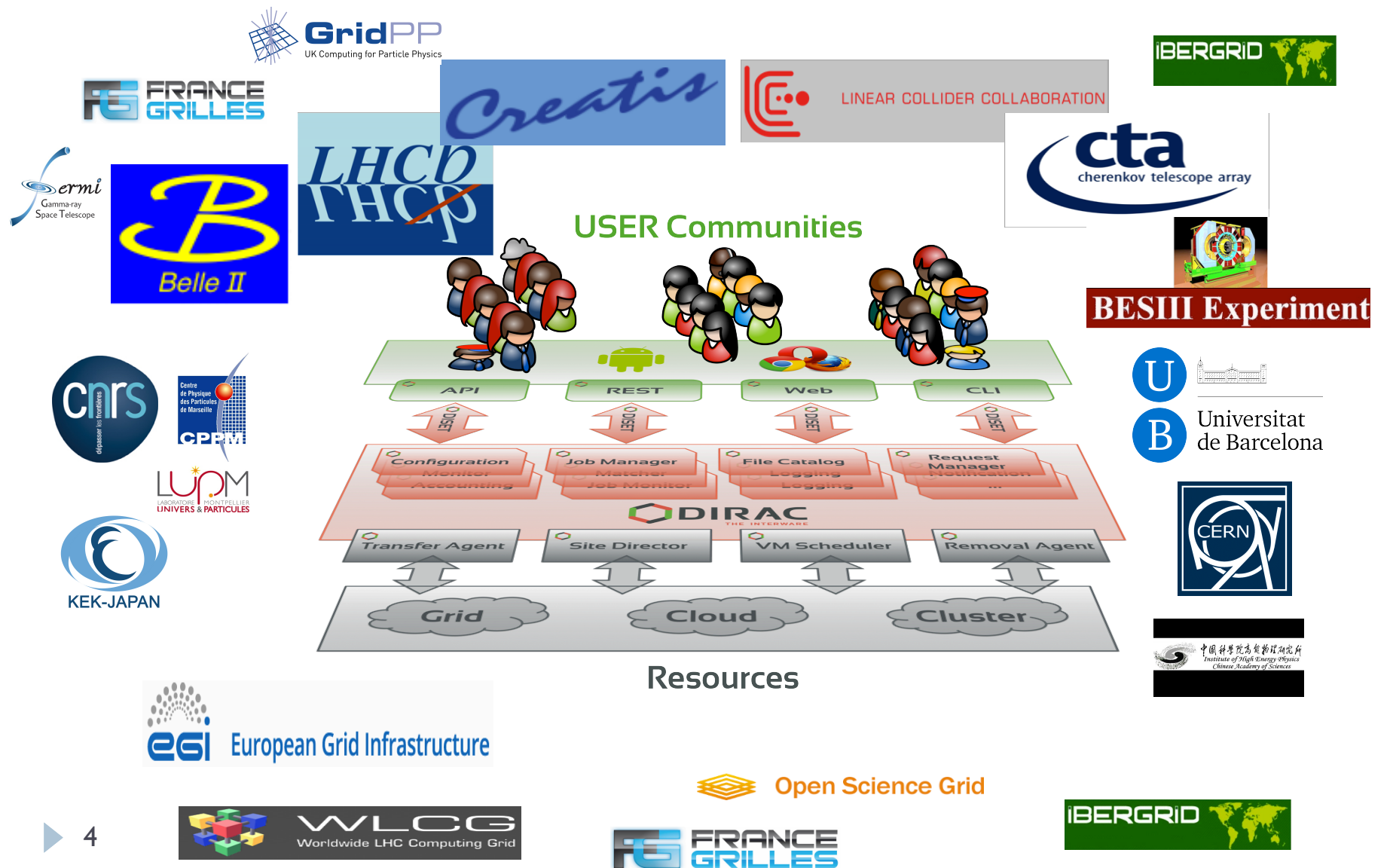
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- ▶ A software framework for **distributed computing**
- ▶ Builds a layer between **users and resources**
- ▶ Allows **interoperability** simplifying interfaces

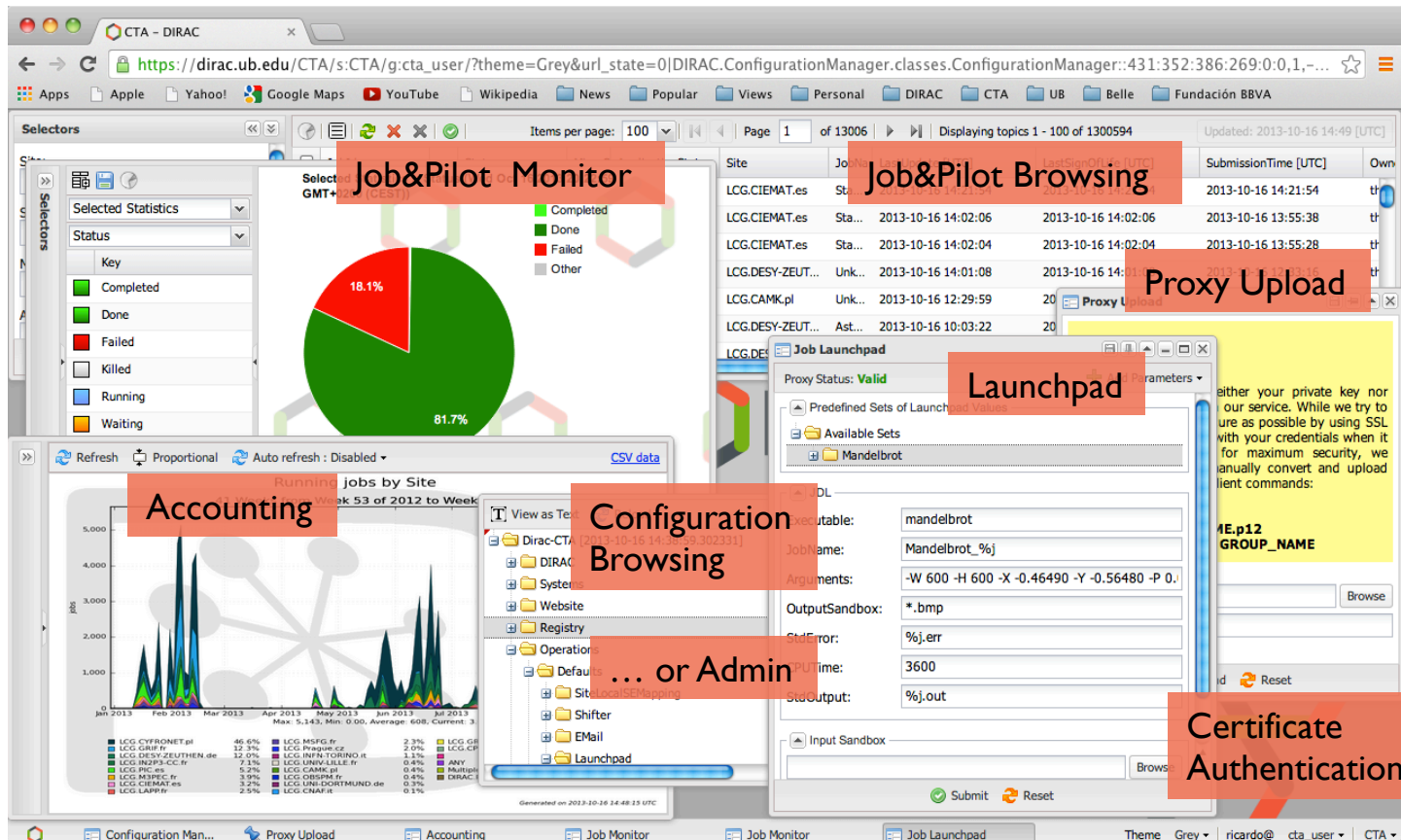


- ▶ Originally developed to support the production activities of the LHCb experiment (~10 years ago)
- ▶ Today is a general purpose software, targeting several communities in high energy physics, astrophysics, life science, ...
- ▶ Open source project developed by communities, for communities
  - ▶ <http://github.com/DIRACGrid/DIRAC>
  - ▶ Publicly documented, active assistance forum, yearly users workshops, open developers meetings
- ▶ The *DIRAC consortium* as representing body
  - ▶ CERN, University of Barcelona, KEK, IHEP, University of Montpellier as members
- ▶ In 2017 started as IN2P3 project to support further software generalization
  - ▶ CPPM, CC-IN2P3, LUPM, Creatis/CNRS, University of Bordeaux



- ▶ **Workload Management System (WMS)**
  - ▶ Job brokering with Pilot Jobs
  - ▶ Interoperability with different types of computing resources
- ▶ **Workflow Management System (Transformation System)**
  - ▶ Used by production team to handle large productions
- ▶ **Data Management System**
  - ▶ All data operations (download, upload, replication, removal, ...)
  - ▶ File Catalog as Replica and Metadata Catalog
- ▶ **Request Management System (RMS)**
  - ▶ Asynchronous handling of requests, e.g. failed transfers recovery
- ▶ **Resources abstraction**
  - ▶ Storage
  - ▶ Computing

- ▶ Command line tools, Python API, RESTful interface
- ▶ Web portal

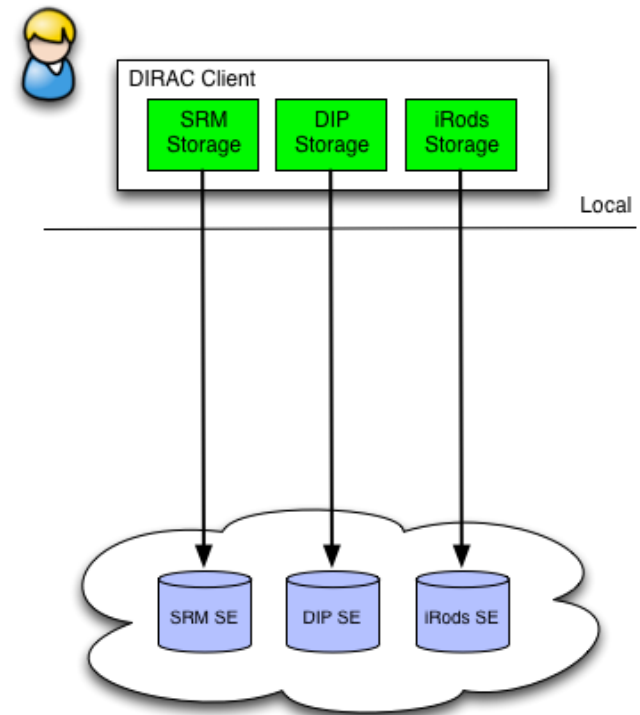


The screenshot shows the DIRAC web portal interface with several components highlighted by red callout boxes:

- Job&Pilot Monitor**: A pie chart showing job status distribution: 81.7% Completed (green), 18.1% Failed (red), and 0.2% Other (grey).
- Job&Pilot Browsing**: A table listing jobs with columns for Site, JobName, Status, LastSignOff [UTC], SubmissionTime [UTC], and Owner.
- Proxy Upload**: A section for uploading proxy certificates, showing a 'Proxy Status: Valid'.
- Launchpad**: A configuration form for job launch parameters, including fields for 'Predefined Sets of Launchpad Values', 'Mandelbrot', 'Executable', 'JobName', 'Arguments', 'OutputSandbox', 'StdError', 'PUTime', and 'StdOutput'.
- Accounting**: A bar chart titled 'Running Jobs by Site' showing job counts over time for various sites.
- Configuration Browsing**: A tree view of the system configuration, including folders like 'Dirac-CTA', 'Systems', 'Website', 'Registry', 'Operations', 'Defaults', 'SiteLocalSEMapping', 'Shifter', 'Email', and 'Launchpad'.
- ... or Admin**: A text label indicating administrative access.
- Certificate Authentication**: A section for user authentication, including a field for 'IE.p12 GROUP\_NAME' and a 'Browse' button.

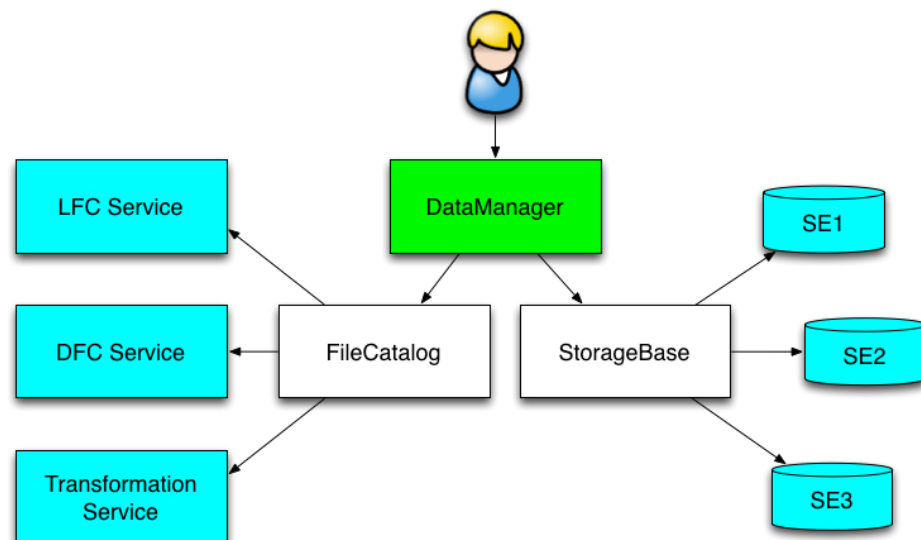
- ▶ DIRAC is striving to provide an abstraction of a single computer for massive computational and data operations from the user perspective
  - ▶ Logical Computing and Storage elements (Hardware )
  - ▶ Global logical name space ( File System )
  - ▶ Desktop-like GUI

- ▶ Storage element abstraction with a client implementation for each access protocol
  - ▶ DIPS, SRM, XROOTD, RFIO, etc
  - ▶ gfal2 based plugin gives access to all protocols supported by the library
    - ▶ HTTP, DCAP, WebDAV, S3, ...
- ▶ Each SE is seen by the clients as a logical entity
  - ▶ With some specific operational properties
  - ▶ SE's can be configured with multiple protocols

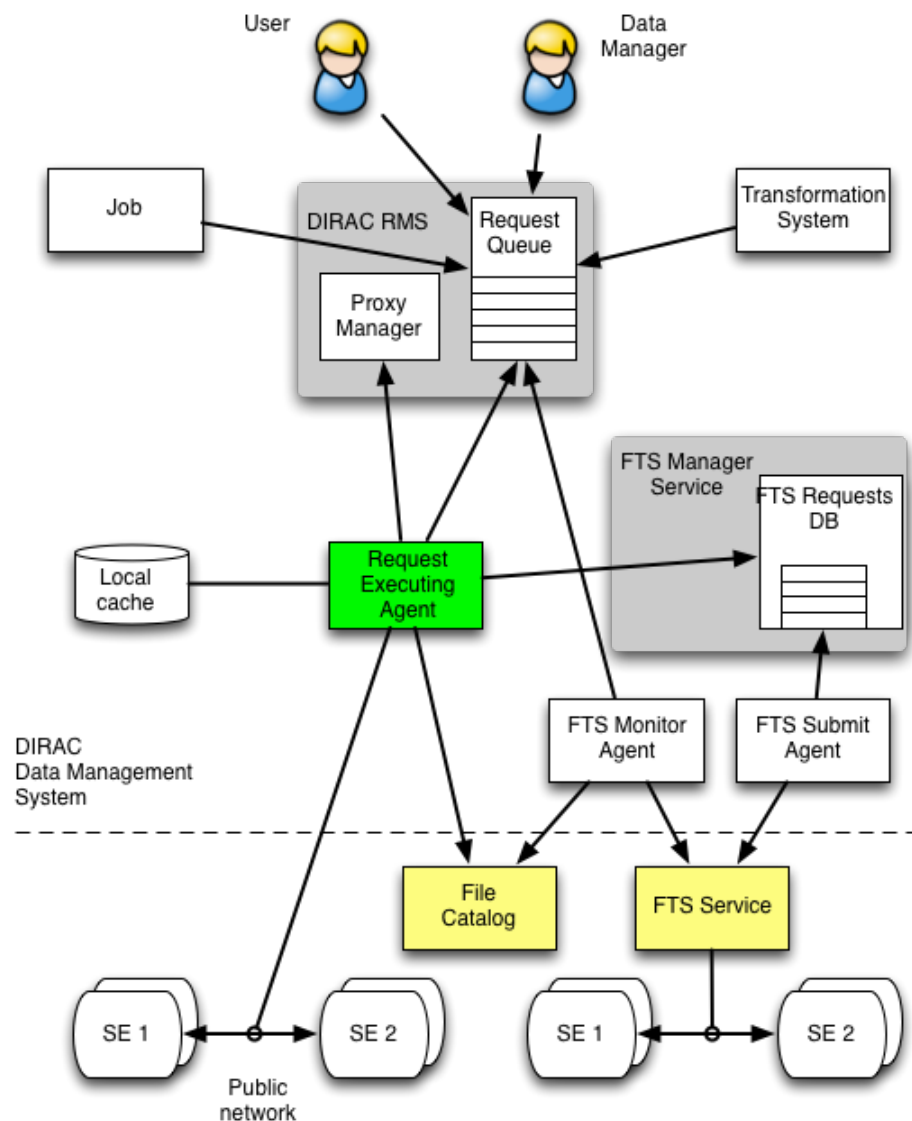


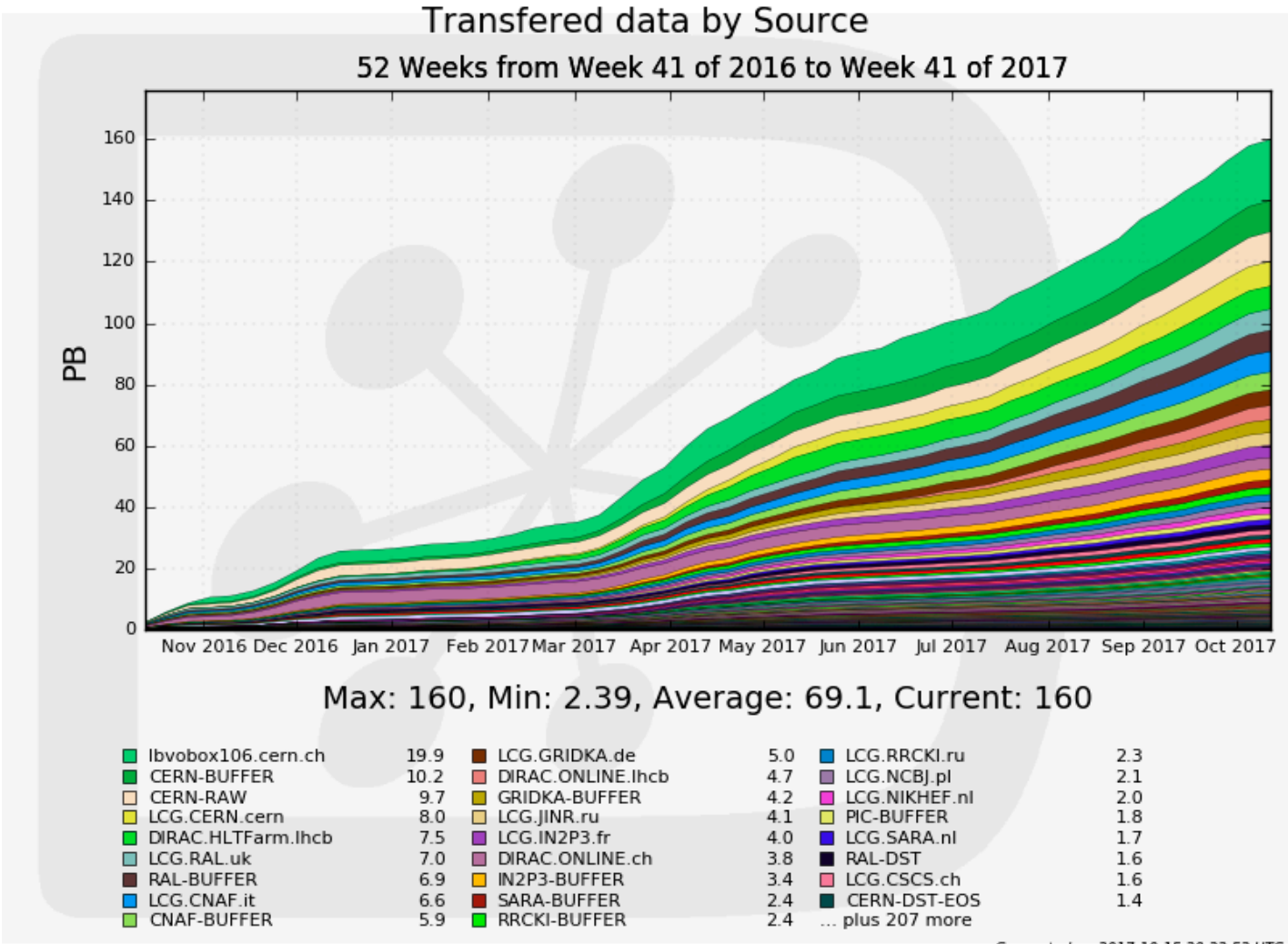


- ▶ Central File Catalog ( DFC, LFC, ... ) is maintaining a single global logical name space
- ▶ Several catalogs can be used together
  - ▶ The mechanism is used to send messages to “pseudocatalog” services, e.g.
    - ▶ Transformation service (see later)
    - ▶ Bookkeeping service of LHCb
  - ▶ A user sees it as a single catalog with additional features
- ▶ DataManager is a single client interface for logical data operations



- ▶ Replication/Removal Requests with multiple files are stored in the RMS
  - ▶ By users, data managers, Transformation System
- ▶ The Replication Operation executor
  - ▶ Performs the replication itself or
  - ▶ Delegates replication to an external service
    - ▶ E.g. FTS
  - ▶ A dedicated FTSManger service keeps track of the submitted FTS requests
  - ▶ FTSMonitor Agent monitors the request progress, updates the FileCatalog with the new replicas





- ▶ Multiple HPC centers are available for large scientific communities
  - ▶ E.g., HEP experiments started to have access to a number of HPC centers
    - ▶ Using traditional HTC applications
    - ▶ Filling in the gaps of empty slots
    - ▶ Including HPC into their data production systems
- ▶ Advantages of federating HPC centers
  - ▶ More users and applications for each center - better efficiency of usage
  - ▶ Elastic usage: users can have more resources for a limited time period
- ▶ Collaboration with HPC centers to integrate them into a common framework under the DIRAC WMS control
  - ▶ AMU Meso-center
  - ▶ HPC centers in Russia (Dubna, NNGU, others)
  - ▶ IHEP HPC center, Beijing
- ▶ Several centers already connected

- ▶ DIRAC is not a Big Data application itself
- ▶ It provides a framework for managing processing of big volumes of data in distributed computing systems
- ▶ As such it can be used to support running “Big Data” applications on a variety of resources