Analisi In CMS

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Outline

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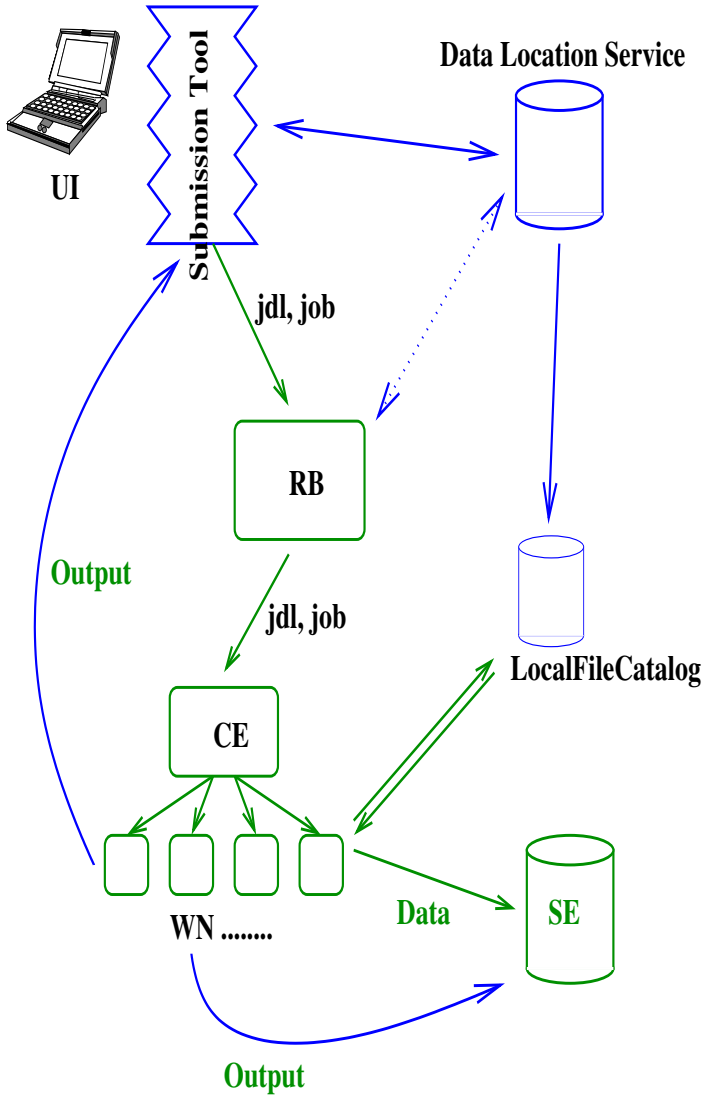
How To Do Analysis?

- CMS model foresee Distributed, Tier-based data deployment
- From computing point of view, the most complex issue when doing remote analysis is Locating and Accessing Data
- How to access Data?
  - Batch: large input data
  - Interactive: small input data (typically local)
  - Root based, interactive analysis in Luca's Talk
- Will concentrate on Batch access
- To access data first need to *locate data*
- General issue about Catalogs and Publication
- Then get access to resources
- End-user oriented tools needed for both

Access to Resources

- Batch analysis will be done near to Data
- Data will be in a Tier-1 (not necessarily the national one) where, in general, direct access will not be provided
- So access will be provide via GRID
- To access remote resources user needs an User Interface (UI)
- To allow remote access to local data
  - deploy GRID middleware wherever data is
  - In order to host data visible via Grid, mandatory to have a complete Grid enabled farm (Computing Element, Working Nodes and Storage Element)

Actual Workflow



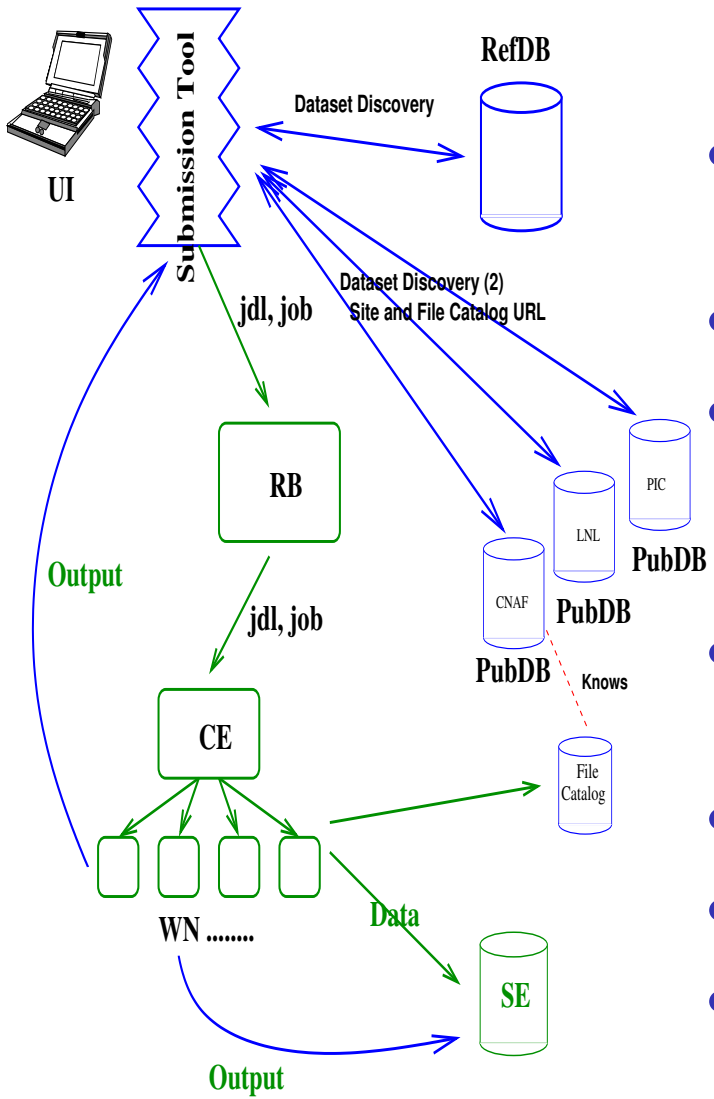
- User develops code on local UI
- Use CMS tool for Grid submission
  - Input is Data to be accessed, code
  - Job preparation (private code, splitting, submission, . . .)
  - Create wrapper job to be submitted to Grid
- RB (or tool) uses Data Location Service to find good Site
- Job arrives to Working Node and runs against local Data using a local FileCatalog
- Output is retrieved or stored on Storage Element

Outline

Data Publication: catalogs

- Data Transfer service (PhedEx) in Daniele's talk
- To access data for Analysis need to know where data is
  - Need a set of catalogs (aka DB, ...) in order to locate and access data
  - These sources of information should be few and with well define responsibilities and scopes
  - Today situation in CMS (IMO) is not very clean, lacking an overall view
  - Key issue to be defined
- Will present the current status and a proposal for future development

Present



- Dataset Discovery: RefDB (CERN) and PubDB (one per site)
- RefDB knows which PubDBs publishing data
- Each PubDBs publish site (CE, SE)
- Local PubDBs knows about Dataset details (# events, ...) and URL of local FileCatalog(s)
- Submission tool query RefDB & eligible PubDBs
- find Dataset location and tell the RB
- RB ship job to CE
- From WN, LocalFileCatalog (xml or mysql) knows file location (used by COBRA)

INFN contribution

- PhedEx (Bologna)
- Validation Tool (Bari)
  - Goal: be sure that if user job crashes is user's responsibility, not data's
  - Test data access with "standard" executable accessing all data (Hits, Digis, DST, etc ...)
  - Automatic publication on PubDB (Bari)
  - Under integration with Data Movement Tool (PhedEx)
- PubDB development (Bologna)
  - Adapt initial design (CERN) to needs of remote analysis
  - Development, test and deployment
  - Room for DB experts
- PubDB deployment and test at CNAF, BO, LNL, BA: very active!
- more activity on submission tool (later)

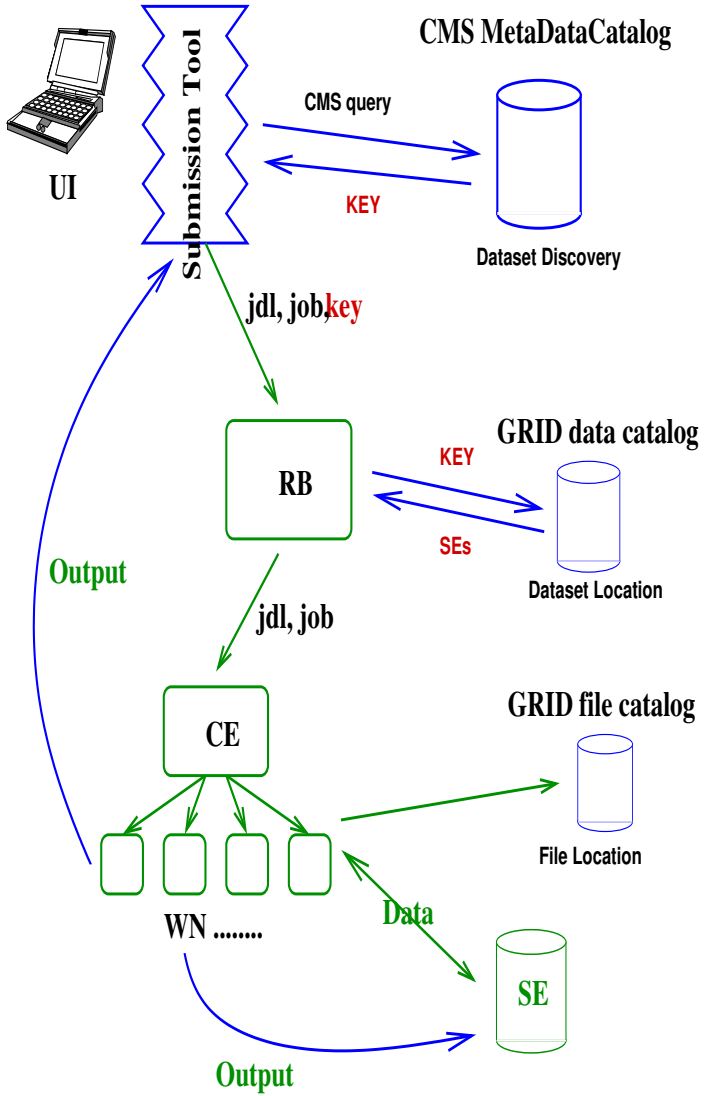
Actual problems

- Data Discovery and Data Location is handled by same service
- Not clear distinction between central service and local ones
- Need to contact several, remote PubDBs just to know that data is available
- Actual Data Discovery (SE or CE) done by CMS catalog!
- (ab)using the Grid just to get access to remote CE
- Not possible to contact local PubDB from local CE: need to do at beginning (and for all possible PubDBs)
- Need to build a complete set of catalogs according to user requirements (eg DST+MC, Digis, etc . . .): can be tricky if multiple catalogs!

With all these limitations

It works!

Data Location and Access: a proposal



- CMS specific MetaData Catalog
  - higher level, interface to physicist
  - provide query mechanism
  - output is a "key(s)", which is uniquely associated with Data chunk
  - Data Chunk is an unbreakable unit (Atom). the granularity is defined by CMS (today is Dataset . . .)
- Grid Data Catalog
  - Given key identifying DataChunk $\Rightarrow$ list of SE(s) $\Rightarrow$ RB get CE(s)
  - Use only *abstract Data*, not files!
- Grid local file catalog
  - Available at local sites
  - Files location for CMS framework **and** DataManagement system

Data Management

- Data is created by Production in a given site
  - Register new DataChunks on CMS MetaDataCatalog
  - Fill local file catalog with produced files
  - Register keys on Grid Catalogs
- Data Movement
  - Want to move DataChunk to Site B
  - Query on CMS MetaDataCatalog to get key for that DataChunk
  - Get list of SE(s) which holds DataChunks
  - (possible skip first 3 steps if push data from site A)
  - DM access local file catalog to get set of files and move them to site B
  - DM register that also Site B has DataChunk

ToDo's

- Replace multiple xml FileCatalog with unique, mysql-based
- Already possible and tested (Bari)
- Some complication from Cobra MetaData handling (must be improved in future)
- PhedEx V2.1 is going to use the same local mysql File Catalog for Data Movement
- Dataset is today an *atom*: too big, but a starting point
- First prototype for high level interface for Dataset discovery
  - Work extended on RB interfaced to RefDB-PubDBs via web service Clarence-based (PD-CERN)
  - Can be extended to use *any* DB
- Activity within "italian–APROM" to reach consensus about overall architecture
- Some services are GRID responsibility
- Need to provide clean and agreed requirements in order to drive GRID people work

Outline

Site Responsibilities

- Data related
- At present
  - PhedEx agents for data import/export (Data Management)
  - PubDB installation and maintenance
  - Publication of locally produced or imported data on local PubDB
  - Local File Catalogs (either xml or mysql)
  - Automatization of most of these process (mostly publication) underway
- Site responsibility will decrease when full integration with Grid will be achieved

CMS software installation

- To allow local development and test
- To guarantee usage by Grid user
  - Grid user must find on grid Working Node exactly the same environment she find interactively: *i.e.* `scram`-based
  - Tool (`xcmsi`) for installation of CMS software
  - Usage within Grid: remote installation via Grid job by *privileged user* on all Grid sites (Padova)
  - SW installation on Grid resources not a site responsibility
- Issues
  - Different tool (`DAR`) used by Production
  - Looking for automatic procedure for deploying
  - Not only stable release, but also developing code (*e.g.* night building . . .)

Outline

Remote Access Tool Functionalities

- User friendly interface for CMS user to grid services
- Should hide as much as possible of GRID technicalities to end user
- Running on Grid should be transparent to user
- Interact with Grid and non-Grid services
  - DataDiscovery
  - Job preparation
  - Job splitting
  - Monitoring and bookkeeping
  - Output Retrieval
  - ...

Status

- Many parallel projects started
- Obviously based on current catalogs infrastructure (need to perform a set of dirty tricks in order to run!)
- INFN (Padova) CMS Remote Analysis Builder
  - Initial test by Bari, Bologna
  - Working Prototype with all needed functionalities (Beta-Tester wanted!)
- UK GROSS (based on BOSS (Bologna))
- Other project focused on US-Grid
  - GAE: based on Clarence
  - RunJob: from McRunJob used by production

CRAB Functionalities

- What the user is supposed to do and know
- She is able to run interactively on local data
- Develop/test her code on a local machine (UI)
- Provide to CRAB (via configuration file):
  - Dataset/Owner she want to access
  - Type of data she needs (DST, Digis, ...)
  - Job splitting directives (# event per jobs)
  - Name of Executable
  - `.orcarc` cards: the one she used locally!
- CRAB provide
  - Dataset discovery
  - Changes of `.orcarc` to run on remote site (including catalogs, splitting, etc ...)
  - Job submission, tracking
  - Simple monitoring
  - Automatic output retrieval at the end
- Grid details are hidden to user

CRAB Future

- Integration CRAB and GROSS/BOSS
  - General agreement, need detailed workplan
  - Use CRAB for job preparation, splitting, data discovery, etc
  - Extend BOSS with GROSS functionalities and use it for submission, monitoring, tracking, logging, output retrieval, etc ...
  - Better handling of jobs (using Boss DB), including *task i.e.* multiple jobs seen as a whole
  - Use Boss for interaction with Grid scheduler
  - Much better logging and bookkeeping
- Other issues
  - Job splitting: today event-based, discussion for future (Run-based or *atom*-based)
  - Real-Time monitoring
    - Foreseen with extended BOSS
    - Using JAM (Job Application Monitoring) (Bari): already tested
  - Give to user, get feedback and use cases

Summary

- Data Location and Access is critical for Distributed Analysis
- Short term solution is under test, proven to work
- For longer term, need to agree on a more general architecture, involving Data and Workload Management
- Possible architecture, including integration with GRID service presented
- First set of automatic remote submission tool being developed and tested
- Users are starting to use them
- Plan for longer term

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