

The POOL File Catalog for LCG-1

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(on behalf of the POOL Team)

- Requirements from the experiments
- File Catalog functionality
- Some use cases for LCG-1



Component purpose



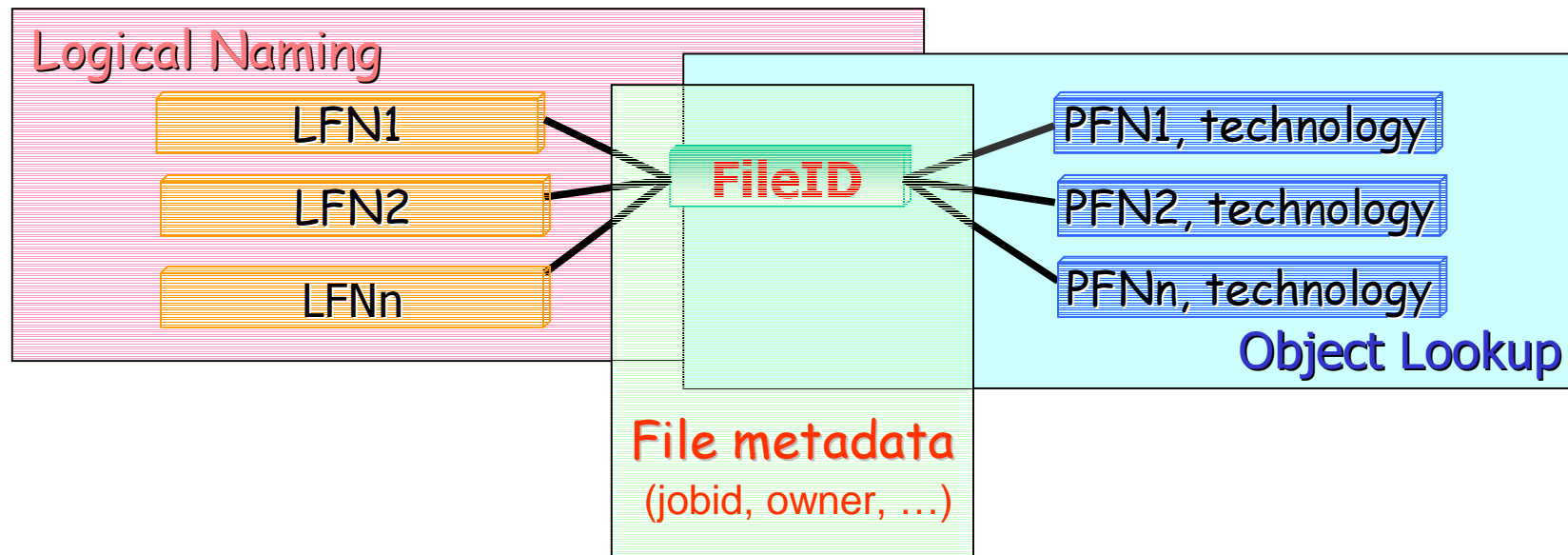
- Maintaining a consistent list of accessible files (physical and logical names) together with their unique identifiers
- GUID implementation for FileID
 - **unique** and **immutable** identifier for a file (generated at create time)
 - allows the production of a consistent sets of files with internal references without requiring a central ID allocation service
 - catalog fragments created independently can later be merged without modification to corresponding data files



File Catalog Schema



- **FileID-PFN** mapping is sufficient for object lookup
- **FileID-LFN** mapping is supported for user convenience, but not used internally by POOL
- File **technology** type is stored together with PFN (e.g. root/tree)
- Optionally, **File metadata** attributes are associated with the FileID, used for fast query based catalog manipulation. Not used internally by POOL





Component Usage



- Abstract interface insulates the user from several concrete implementations
- API clients:
 - C++ API for POOL storage components and experiment framework to register and lookup a file inside the application process
 - Command-line tools for end-users and file administrators (maybe replaced later by python scripts)
 - Python based graphic user interface for the catalog browsing



Concrete implementations



- **XML Catalog**
 - typically used as local file by a single user/process at a time
 - no need for network
 - supports r/o operations via http
 - tested up to 50K entries
- **Native MySQL Catalog**
 - handles multiple users and jobs (multi-threaded)
 - tested up to 1M entries
- **EDG-RLS Catalog**
 - grid aware applications
 - Oracle iAS or Tomcat + Oracle / MySQL backend
 - pre-production service based on Oracle (from IT/DB) , RLS TEST, already in use for POOL V1.0



Requirements from the experiments



- A questionnaire has been circulated recently to the experiments to collect their requirements for the File Catalog component
- POOL will be integrated in experiments' data challenges in
 - **Alice**: not currently planned
 - **Atlas**: second quarter of 2004 for next larger production activity DC2 (integration into ATHENA already started)
 - **CMS**: POOL proposed as baseline for PCP (starting this summer) and later for DC04
 - **LHCb**: spring 2004
- Expected number of entries in the catalog
 - ATLAS/DC2 - $O(100)$ minimum bias input files/job, $O(10^6)$ total output files
 - CMS/PCP - $O(10k)$ minimum bias input files, $O(10^6)$ total output files
 - LHCb/spring '04 - $O(100)$ input files/job, $O(10^5)$ total output files



Requirements from the experiments



- Required functionality:
 - file registration, lookup on logical and physical filenames
 - delete and clean-up on failure
 - efficient meta data and filenames query support
 - pre-registration mechanism to allocate filenames and final registration after file quality checks
- Bookkeeping is currently handled by experiment (specific) code



File Catalog Functionality



- In POOL V1.0 (some small items to be completed)
- Connection string:
 - XML
 - xmlcatalog_file:/tmp/FileCatalog.xml or file:/tmp/FileCatalog.xml
 - xmlcatalog_http://pc01.cern.ch/file001 (R/O)
 - MySQL
 - mysqlcatalog_mysql://@lxshare070d.cern.ch:3306/testFCdb
 - EDG
 - edgcatalog_http://rlstest.cern.ch:7777/edg-replication/services/edg-local-replica-catalog



File Catalog functionality



- Connection and transaction control functions
- Catalog insertion and update functions on logical and physical filenames
- Catalog lookup functions (by filename, FileID or query)
- Clean-up after an unsuccessful job
- Catalog entries iterator (caching will be fully operational in the EDG Catalog in V1.1)
- File Metadata operations (e.g. define or insert file metadata)
- Cross catalog operations (e.g. extract a XML fragment and append it to the MySQL catalog)



File metadata schema



- Uses internally the POOL AttributeList component
- User-defined attribute definition, once per catalog
 - "(jobid,string), (owner,string), (jobtype,string), (run_number,integer)"
- Only catalogs with consistent schema can be cross populated



Queries



- Queries are used to look-up or to extract a catalog fragment from the source catalog and attach it to the destination catalog
- Queries are supported at the client side for XML and EDG (EDG is working on support for server side), and at the server side for MySQL
- Some examples
 - "jobid='cmssim' ", "owner like '%wild%' "
 - "pfname like 'path' and owner = 'atlasprod' "
- Evaluation of numerical query expressions not yet fully supported (backend enhancements in progress)



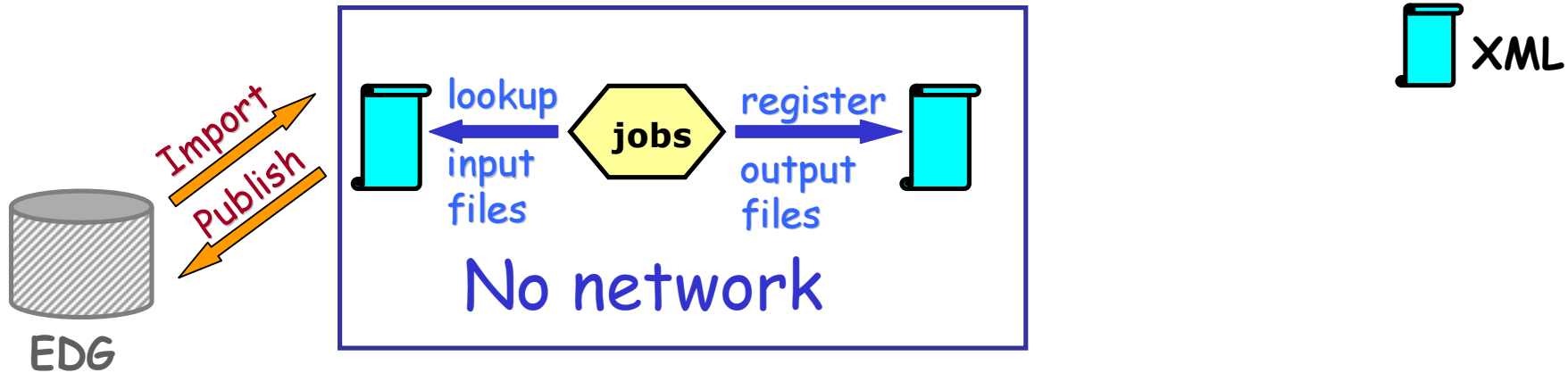
Use of command-line tools



- Definition of a schema for a given experiment catalog
(FCdefineMetaData)
- Population of a local catalog
(FCregisterLFN, FCaddMetadata)
- Eventual actions after quality checks
(FCclearUnsuccessful, FCdeleteEntry, FCrenamePFN, FCaddReplica)
- Publication of the local catalog to the general catalog
(FCpublish, also by query)
- Retrieval of file information
(FClistPFN, FClistLFN, FClistMetaData, also by query)



Use case: isolated system



Import: get schema `$set schema = `FCdescribeMetaData -u $edgcatalog ``

Import: define schema `$FCdefineMetaData -u $xmlcatalog -d $schema`

Import `$FCpublish -d $edgcatalog -u $xmlcatalog -q "pfname like %digi% and owner = lhcbprod"`

Disconnected from the network, (`$setenv POOL_CATALOG $xmlcatalog`)

Browse PFN `$FClistPFN -l input_logical_filename`

Register alias `$FCregisterLFN -p out_physical_filename -l out_logical_filename`

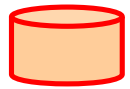
Insert metadata `$FCaddMetaData -p out_physical_filename -m "(owner,'lhcbprod'),(jobtype,'reco')"`



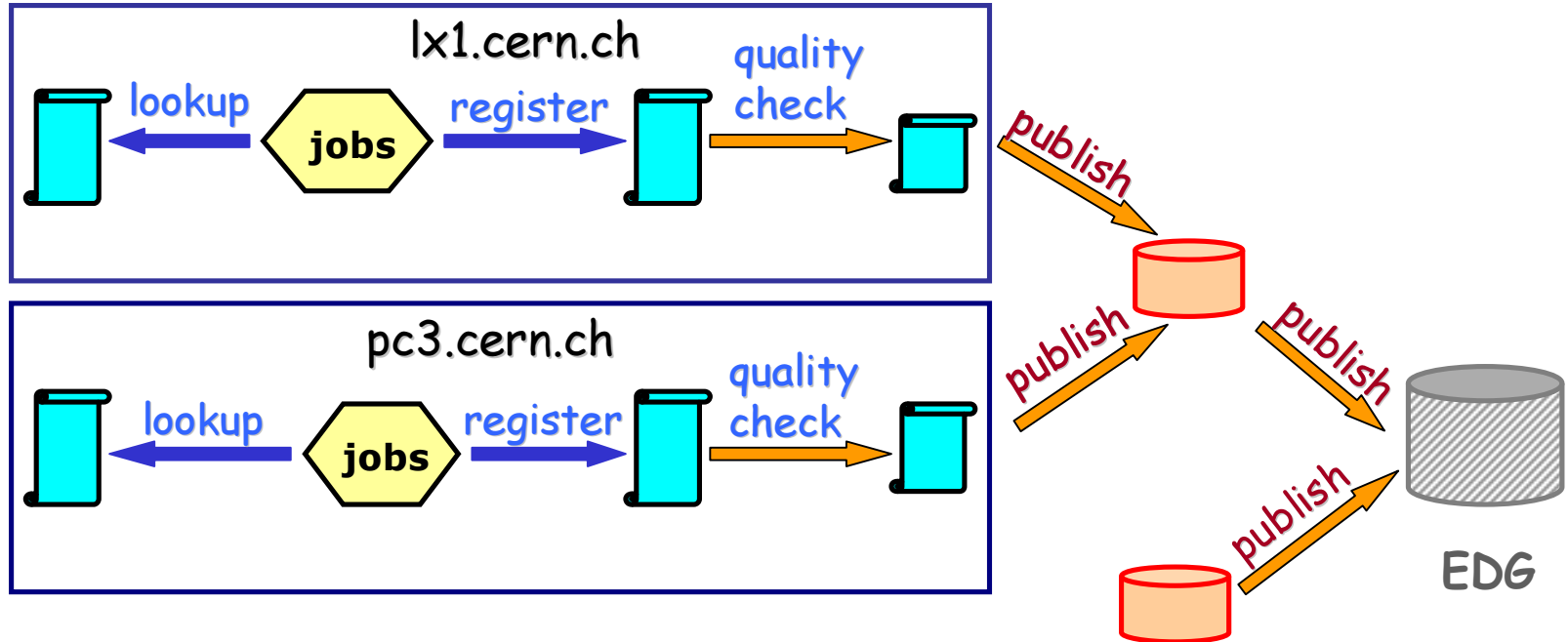
Use case: farm production



XML



MySQL



Actions after
quality check

`$FCclearUnsuccessful`

`$FCrenamePFN -p out_physical_filename -n final_physical_filename`

Publish (bulk insert in EDG-RLS) `$FCpublish -d $edgcatalog -u xmlcatalog_file:lhcbprod01.xml`



Summary and perspectives



- In POOL V1.0, the POOL file Catalog satisfies the requirements collected so far from the experiments
 - some remaining implementation constraints are being removed
- A test service, `rlstest`, is already available since POOL V1.0
- The POOL File Catalog is ready to be used in LCG-1 and needs feedback
- Experiment-specific production services for the EDG Catalog will be provided in conjunction with POOL V1.1 (e.g. `RLSATLAS.CERN.CH`, ...)

Web site: <http://pool.cern.ch/>



File Catalog performance tests



- Preliminary tests done on POOL V0.5
- XML: tested up to 50K entries
 - start time:
 - new catalog ~10ms
 - catalog with 20K entries ~6s
 - registerPFN: <0.3ms/entry
- MySQL: tested up to 1M entries
 - up to 300 concurrent clients, commit every 100 entries or less frequent
 - registerPFN: <1.5ms/entry
- EDG-RLS based catalog registerPFN: ~6ms/entry (autocommit)

Pentium III-1.2GHz
free memory-220MB
PFN-200 char; FileID-36 char