



Analysis Project - APROM

ARDA Workshop

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APROM - A Project for Analysis Coordination



□ Mandate

- Coordinate CMS computing and software activities for analysis from the perspective of end-user physicists
- Prepare work plans, with the concurrence of PRS and CCS and track identified deliverables

□ Scope

- Analysis model, policies, overall coherence (meta-data etc.)
 - Oversight of authentication, resource allocation and accounting (link with CMS-CCC),
 - Streaming policy
- User Data location and Processing Services
 - Utilities to facilitate discovery of which data exists and where, to make local copies of sub-samples, prepare catalogs, etc
- Interactive and Batch Analysis Utilities/Applications
 - Tools for analyse DST's and, for example, make mini-DST's (AOD's)
 - Interoperability of COBRA/ORCA/OSCAR and analysis tools (ROOT, JAS, HippoDraw)
 - Event visualisation, remote analysis (e.g. IGUANACMS, Clarens...)
- Liaison with LCG / EGEE / ARDA

Started on July 04

Bi-weekly meetings + CMS and CPT weeks



Analysis: High Level task decomposition



Analysis Model

- From Digi/DST to final plots (eps file) for publication

[APROM Web Page](#)

Data Request

- UI to production - service: **DataSet Request**
- UI to production-service: **Request's status Monitoring**

Data Access

- Data Location service: **RefDb, PubDb**
- Data-transfer service: **PhEDEx**

Analysis strategy (interactive, batch, distributed)

- Analysis job submission: **local, distributed**

Job Monitoring

- System monitoring, job application monitoring: **Monalisa &...**

Analysis Tools

- ROOT, JAS, HippoDraw
- Detector and Event display (**IGUANACMS**)

PhySh is the **Glue** between different components. It's based on **Clarens**
Analysis Environment Integration, Validation & deployment



Analysis Model



Analysis is the full chain from accessing event data up to producing the final plot for publication. Examples for P-TDR and first years of data taking

- Detector Monitoring and Detector Analysis Performances
 - Input: raw-data and/or reconstructed data
 - Software used: ORCA packages based on reconstructed hit, tracks.. Need to get access to the full event information.
- Physic Channel Analysis
 - Iterative process:
 - Input: reconstructed Data (basic objects like tracks, vertex, calorimeter objects, jets, P-Id, tau-jet b-jet...)
 - Software used: electron-photon, muon-identification, b tagging, tau tagging in order to improve the components relevant for the specific analysis, apply new calibration constants...
 - Output: mini/micro-DST (AOD) : Reduce data samples to more interesting subsets (selection and data reduction)
 - Compute higher level information, calculate statistical entities
 - Several steps:
 - Run analysis job on full dataset (few times)
 - Use interactive analysis tool to run several times on reduced dataset and make plots, histogramm fitting and decorate them.



Analysis Model & Data Flow



Production system and data repositories

Tier
0/1/2

Mini-DST, micro-DST extraction/conversion/transport services

ORCA analysis farm(s)
(or distributed 'farm'
using grid queues)

PIAF/Proof/..
type analysis
farm(s)

RDBMS
based data
warehouse(s)

Tier
1/2

Tool plugin
module

Data extraction
Web service(s)

Query Web
service(s)

Local analysis tool:
Iguana/ROOT/...

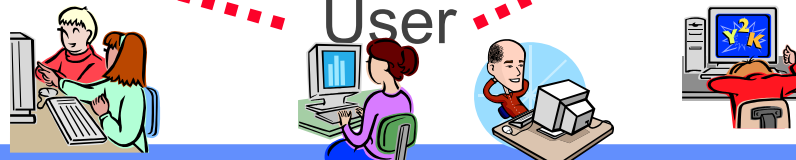
Local disk

Web browser

Tier
3/4/5

- Production data flow
- Mini-DST, micro-DST data flow
- Physics Query flow

User





CM Task Forces



Computing **M**odel task forces

Editors: Lucas Taylor, Claudio Grandi

There be three pairs of conveners for the working groups:

- **CMS Data and Analysis Model:** Paris Sphicas, Lucia Silvestris
- Computing Strategy: David Stickland, Norbert Neumeister
- Computing Specification: Werner Jank, Ian Fisk

There be an additional seven members of the Task-Force

PRS/T Members: Avi Yagil, Sasha Nikitenko, Emilio Meschi

CCS Members: Vincenzo Innocente, Dave Newbold, Nica Colino

External Members: Peter Elmer

Internal Reviewers: Harvey Newman, Gunter Quast

External Reviewers: John Harvey, Tony Cass

They will be carried by VRVS and/or conference phone and open to all members of the Task-Force and all PRS/CCS Level-2 managers.



Data Request & Physics Validation



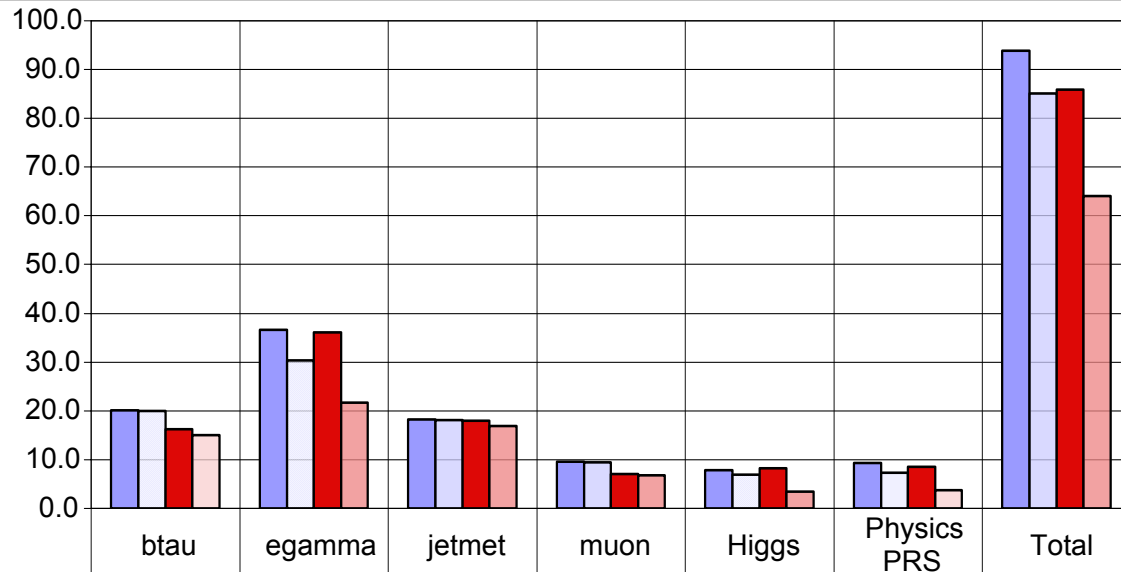
- ❑ **DataSet request: today**
 - ❑ PRS conveners request DataSets via a WEB interface
 - ❑ All physics inputs (# events request, generated, generator card, luminosity) together with Production flow (assignment, RC etc..) are stored inside RefDB (central mysql DB).
- ❑ **DataSet request and Physics Validation: plans**
 - ❑ Improvement on the web Interface for DataSet request.
 - ❑ Post-processing in order to update luminosity and additional details on physics process after generator information
 - ❑ Store generator metadata information inside POOL via COBRA as for the other components simulation/reconstruction.
 - ❑ Validation test on the physics content. This need to be done systematically with automatic procedure
 - ❑ Test unit need to be provided from the PRS requestor.
 - ❑ reduce waste of resources but..
 - ❑ physicists need to access data to different level asap in order to test the sample before full production. More validation tests.



Data Request Service & Data Production

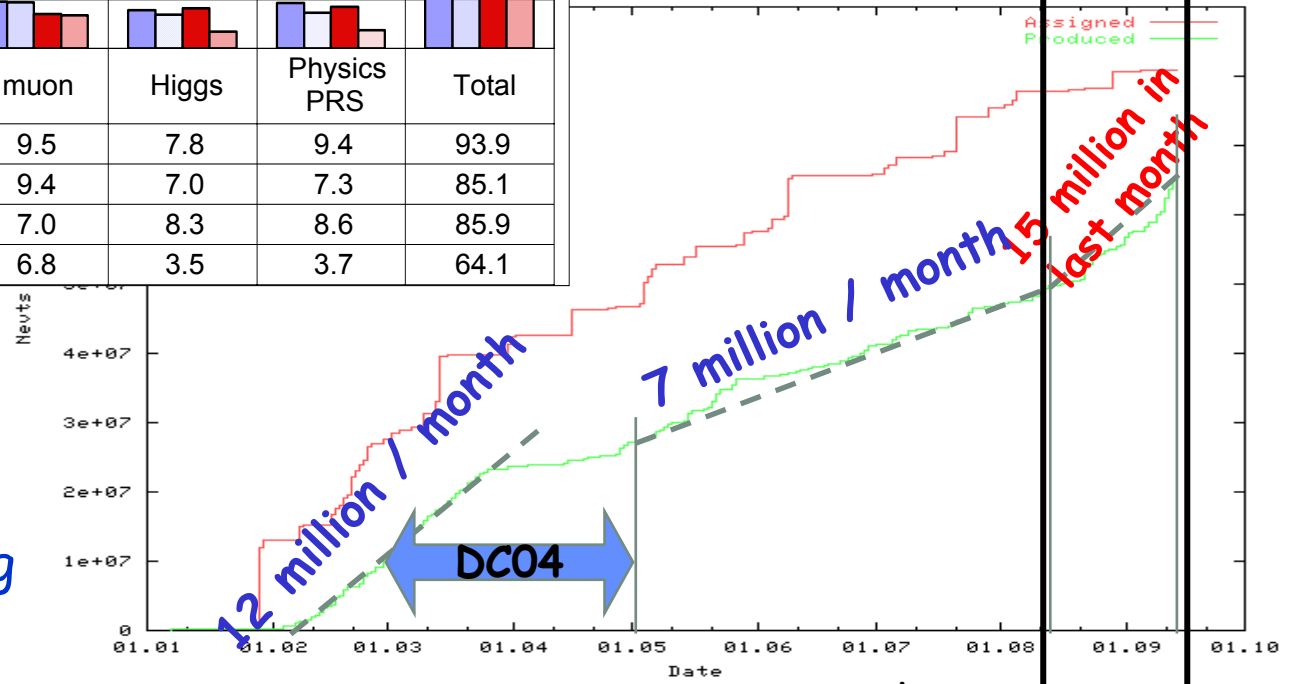


Data Production Statistics



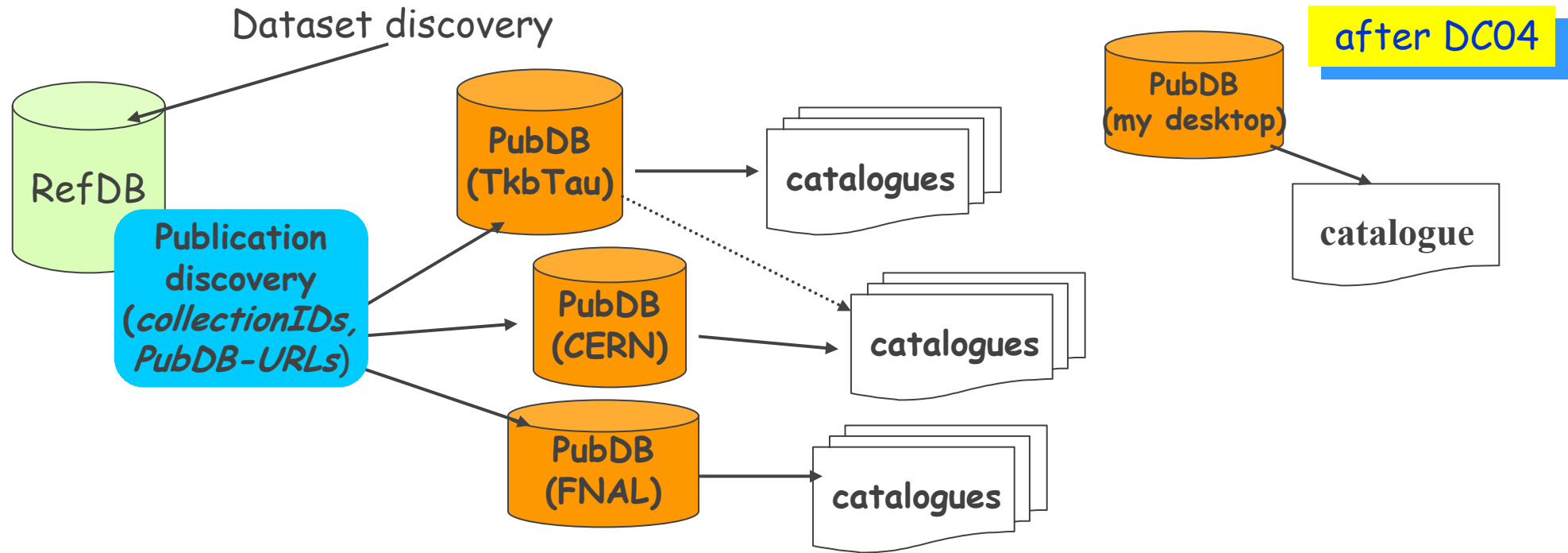
Simulation request	20.1	36.6	18.3	9.5	7.8	9.4	93.9
Simulation done	19.9	30.3	18.1	9.4	7.0	7.3	85.1
Digitisation request	16.3	36.0	18.0	7.0	8.3	8.6	85.9
Digitisation done	15.0	21.7	16.9	6.8	3.5	3.7	64.1

Date: Tue Sep 14 14:00:32 2004



Data Production Monitoring

Jul Aug Sep Oct



PubDB manages information about catalogue content

- Allow users to locate DataSet catalogues.
- Allow Production staff to publish data in a uniform manner
- Allow data-managers to manage their catalogues coherently

1st version deployed in several T1/T2 centers



Data Location Service: RefDb & PubDB



Additional requirements already identified -> New PubDB version available.

PubDB/RefDB Software released in **OCTOPUS** [Project CVS Repository](#), [Task tracking with Savannah](#)

[Data Discovery](#) service accessible from [APROM Web Page](#)

Dataset History

Dataset	Digitisation	ooHitFormatting	Generatio
Dat	bt_2x1033PU761_TkMu_g133_CMS	bt_Hit752_g133	genPYT120
bt03	bb1	2tau	jmu
	92000/100000	100000/100000	100000/100000

Dataset Details

Step	Owner	Application	Executa
Digitisation	bt_2x1033PU761_TkMu_g133_CMS	ORCA_7_6_1	writeAllDigis
ooHitFormatting	bt_Hit752_g133	ORCA_7_5_2	writeHits
Generation	genPYT120	CMKIN_1_2_0	kine_make_ntpl_



Data Transfer Service - PhEDEx



PhEDEx- Physics Experiment Data Export

- Transfer management database (TMDB)
- Transfer agents: movement of files between sites
- Management agents:
 - allocator agent which assigns files to destinations based on site data subscriptions
 - agents to maintains file transfer topology routing information.
- Tools to manage transfer requests: interface with CMS/RefDB/PubDB specific.
- Web monitoring tools.

Supported functionalities

- Push (automated).
 - data allocated to nodes at T1-T2 (based on a police)
- Subscription pull (low management, scalable).
 - For distribution of production data to multiple destinations
- Random pull (significant steering by client).
 - T2 getting a certain dataset, physicist pull to laptop ...

V2 deployed last week
25 TB replicates in
Different sites

PhEDEx Project organization

- Task tracking with Savannah.
- Homepage for access to docs, talks etc.



Data Transfer Service - PhEDEx Plans



Collaborate with EGEE

- first discussion during July 04 EGEE/ARDA Workshop.

Move toward peer-to-peer infrastructure.

- Avoid single points of failure.
- In stable system no need for immediate global information.
- All design currently with peer-to-peer in mind.

More discussion on DM components during the CMS Data Management workshop next week.

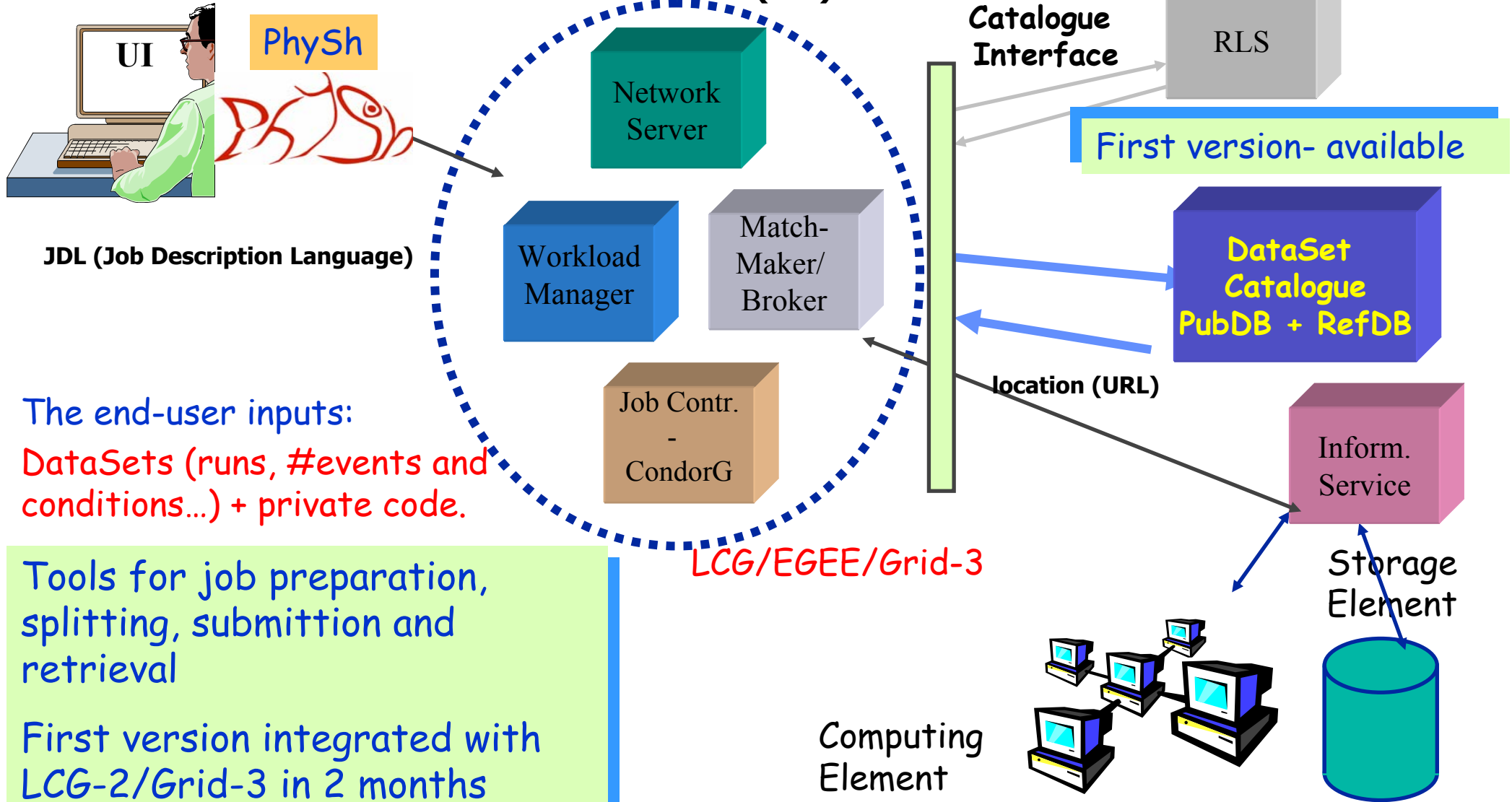
Goal: provide a working versions for end-user ... But these will change/improved in time ...



Job Analysis Submission using Grid



Resource Broker (RB) node



JDL (Job Description Language)

The end-user inputs:

DataSets (runs, #events and conditions...) + private code.

Tools for job preparation, splitting, submission and retrieval

First version integrated with LCG-2/Grid-3 in 2 months

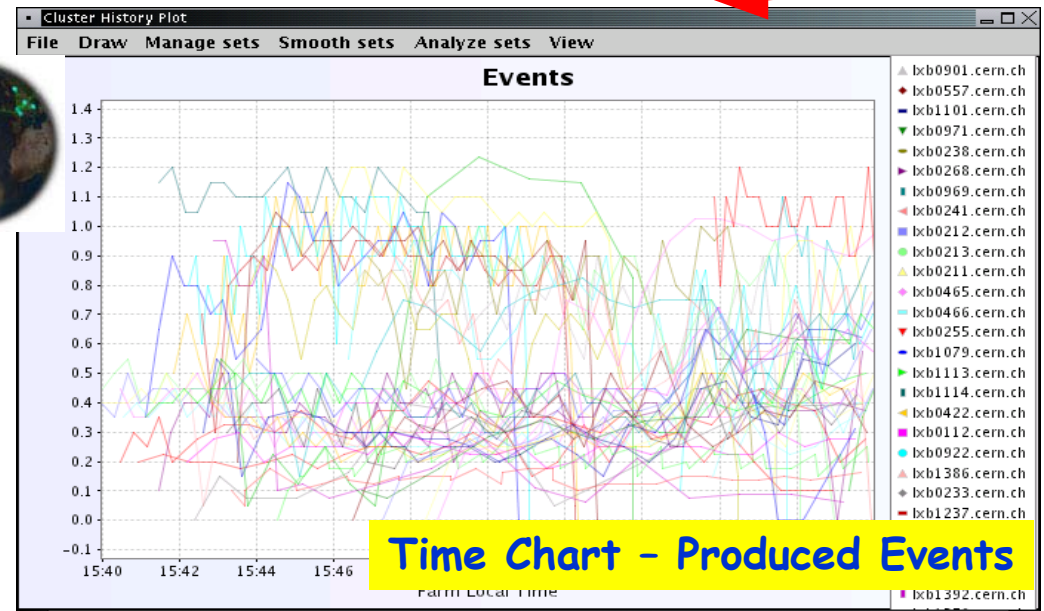
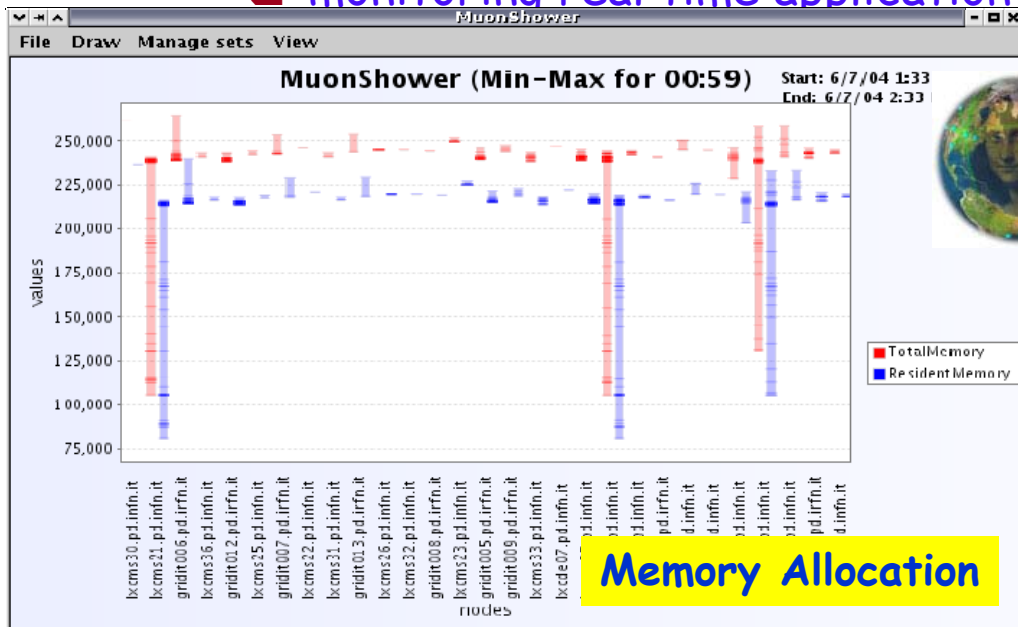


Monitoring Service



- ❑ Monitoring service are needed to monitor and track
 - ❑ site facilities
 - ❑ networking
 - ❑ jobs & applications
 - ❑ Data Management & Workload Management components
- ❑ First Prototype available for MonALISA/COBRA
 - ❑ monitor predefined quantities and produced history plots
 - ❑ monitoring real time application's status.

Others BOSS, GRIDICE...





Short term plan for analysis based on October 2004 DST

A COBRA/ROOT binding is unrealistic in the time frame indicated and the resources required.

- ❑ APROM Team will produce concrete examples how to produce ROOT Tree/nTuple from within ORCA including how to interact between ORCA session and ROOT session
- ❑ propose to ***not*** support wide deployment of "standard ROOT Trees/nTuples" of PRS groups
- ❑ Tree/nTuple "contents" will be the first iteration for mini-DST (AOD).

Longer term plans for next 6 months

- ❑ Review the ORCA/COBRA framework and DST object model
- ❑ Work on ORCALite and disentangle the DST object model.
 - ❑ Allow a more lightweight ORCA, ORCALite, that allows a rapid development cycle, a fast access to the data and makes ORCA callable from ROOT
- ❑ Work on a underlying event format that is compatible with accessing it from ROOT directly
- ❑ Start first prototype for mini-DST(AOD) integrated in ORCALite.



Interactive Analysis/Inspection/Debugging



Visualization applications for ORCA, OSCAR, test-beams (DAQ application);
Visualization of reconstructed and simulated objects: tracks, hits, digis, vertices,
etc.;

Full DDD detector
visualisation;

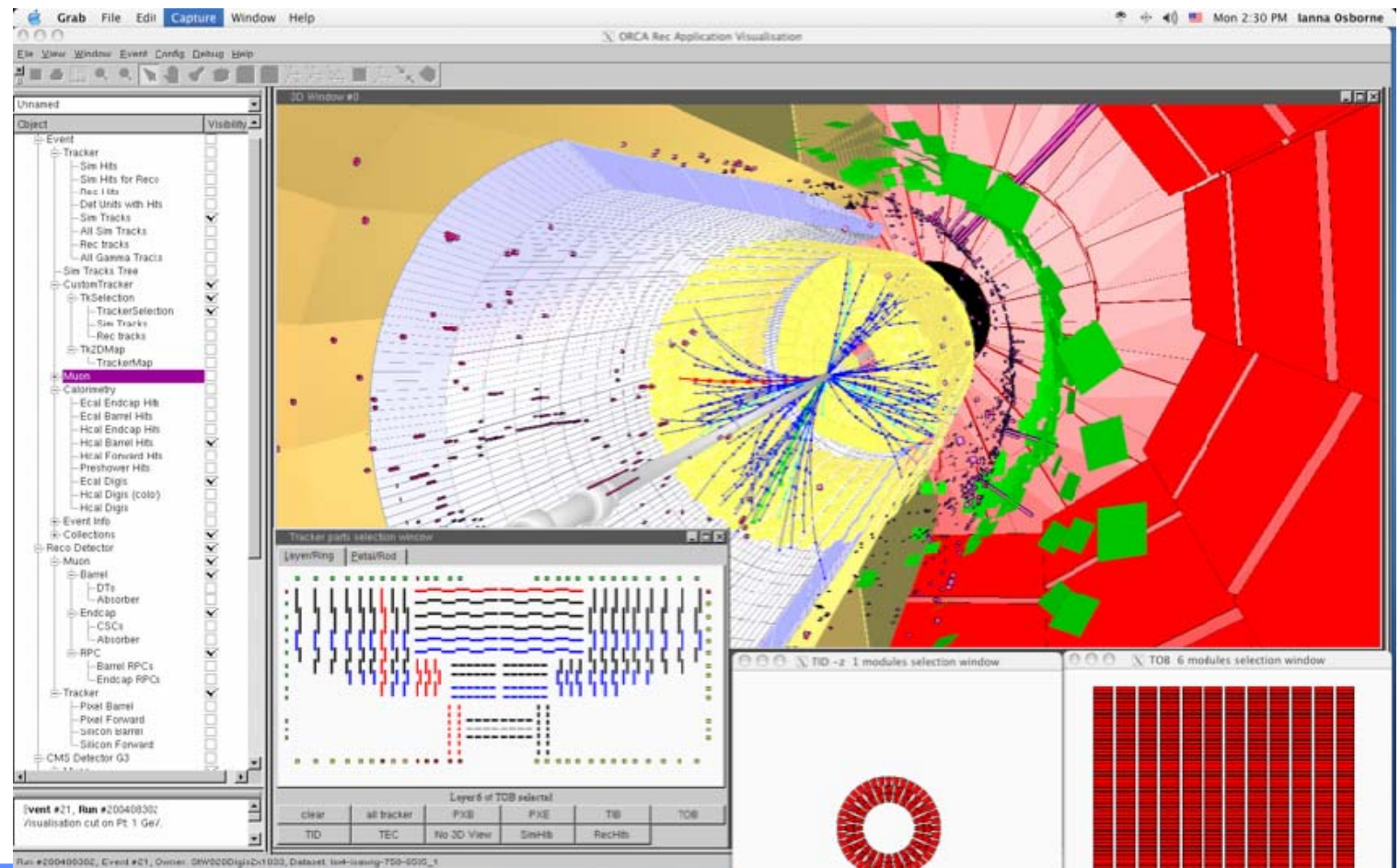
Magnetic field
visualisation;

Interactive
modification of
configurables at
run-time;

Custom tracker
selection;

Event browser;

IGUANACMS Today





Interactive Analysis/Inspection/Debugging: First version for DST Visualization

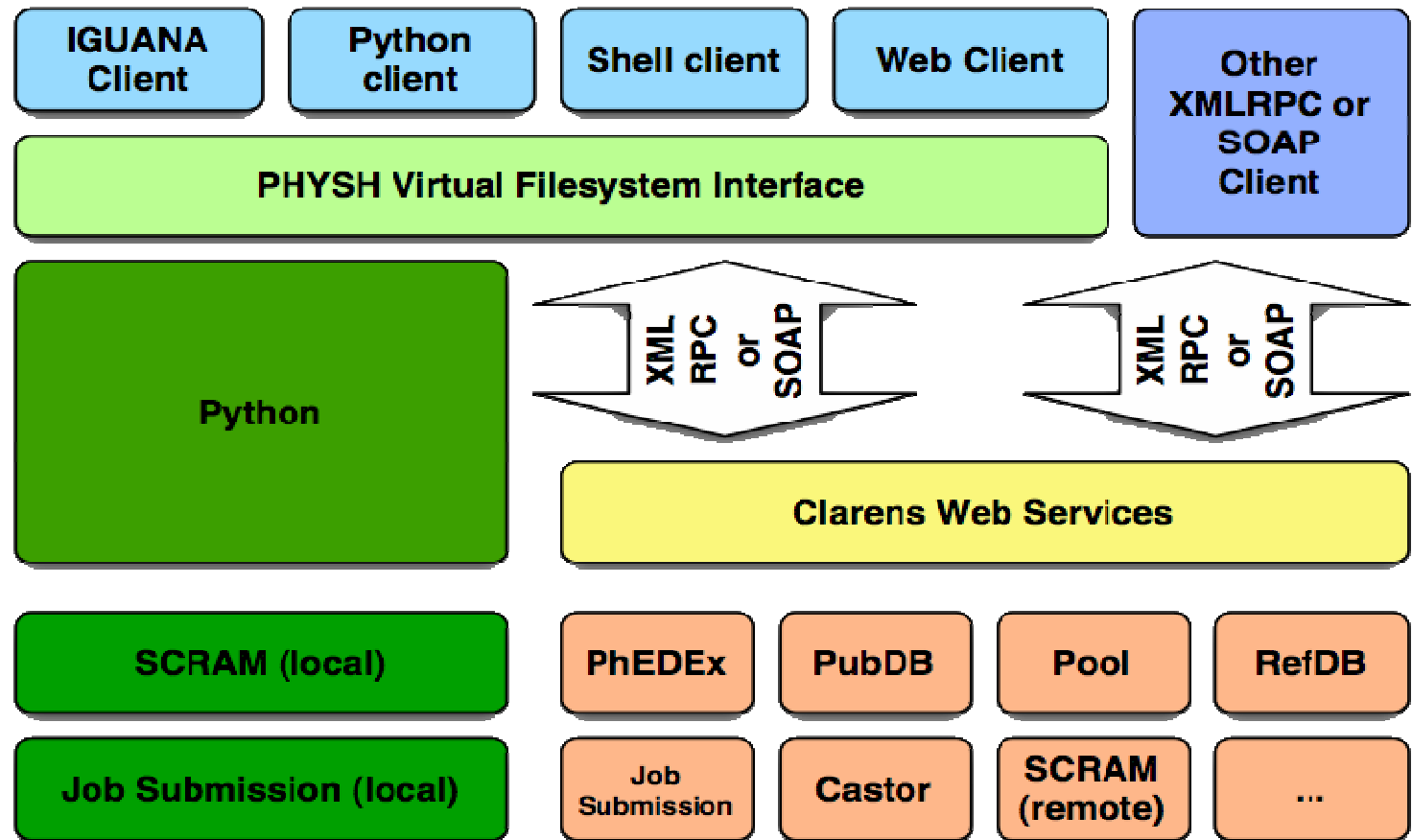


The screenshot shows the ORCA Rec Application Visualisation interface. On the left is a 'List of containers in the event' with a scrollable list of components like BTagJetWithTrajectory, CR, Collections, CombinatorialTrackFinder, etc. The main area contains three 3D windows: 'RecMuons' (top right) showing a black circular detector cross-section with a central vertex; 'TTrack' (bottom left) showing a green circular detector cross-section with tracks; and a central 'Cobra event browser' showing a graphical structure of event components. A 'Formatted text information for selected RecCollection' window is open on the right, displaying parameters for the 'CombinatorialTrackFinder'.

List of containers
in the event:
updated for each
event. Name and
version for
RecCollection

Cobra event
browser: graphical
structure of
event

Formatted text
information
for selected
RecCollection

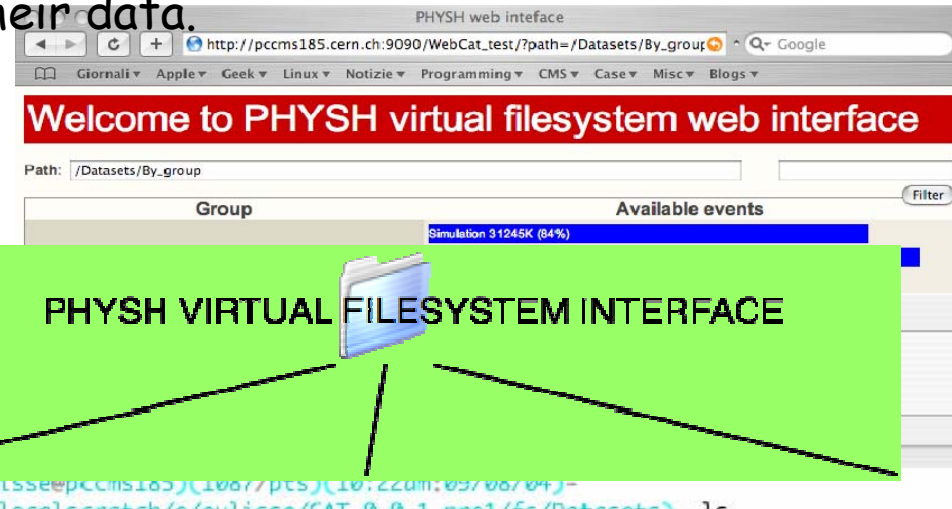


PhySh: "end user" analysis environment. **PHYSH** [Project CVS Repository](#), [Task tracking with Savannah](#) First pre-release in October 04.

The user's interface is modeled as a virtual file system.



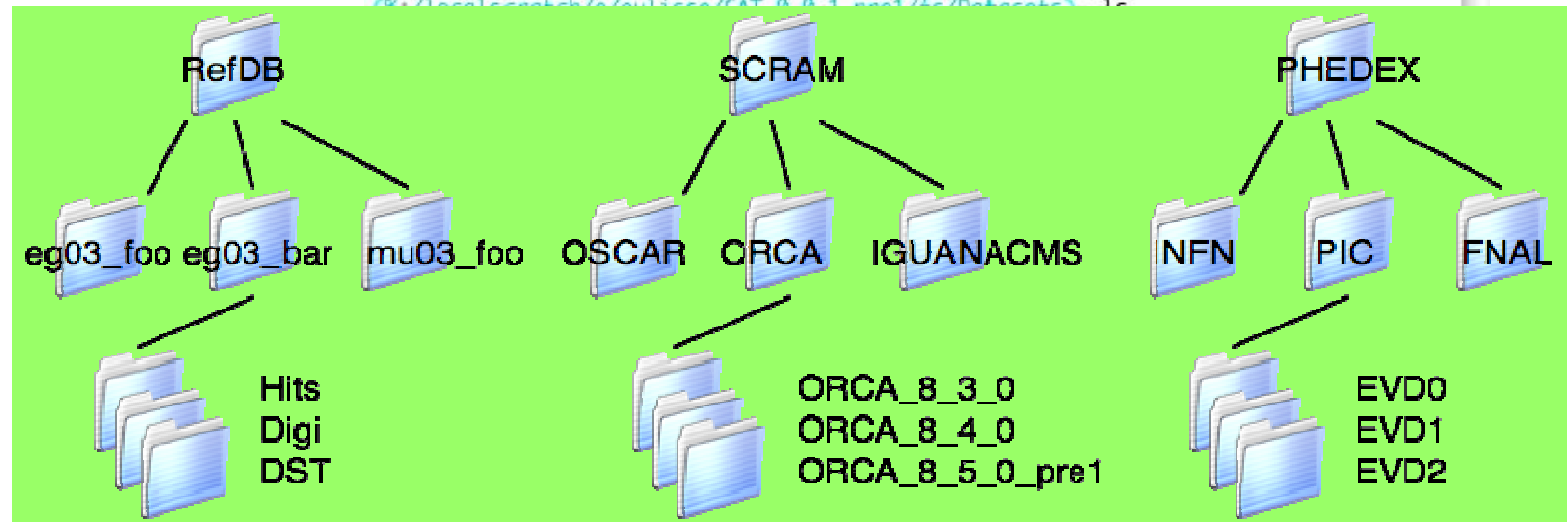
File system interfaces is what most people are common with when dealing with their data.



Data is organized as files in a directory structure.

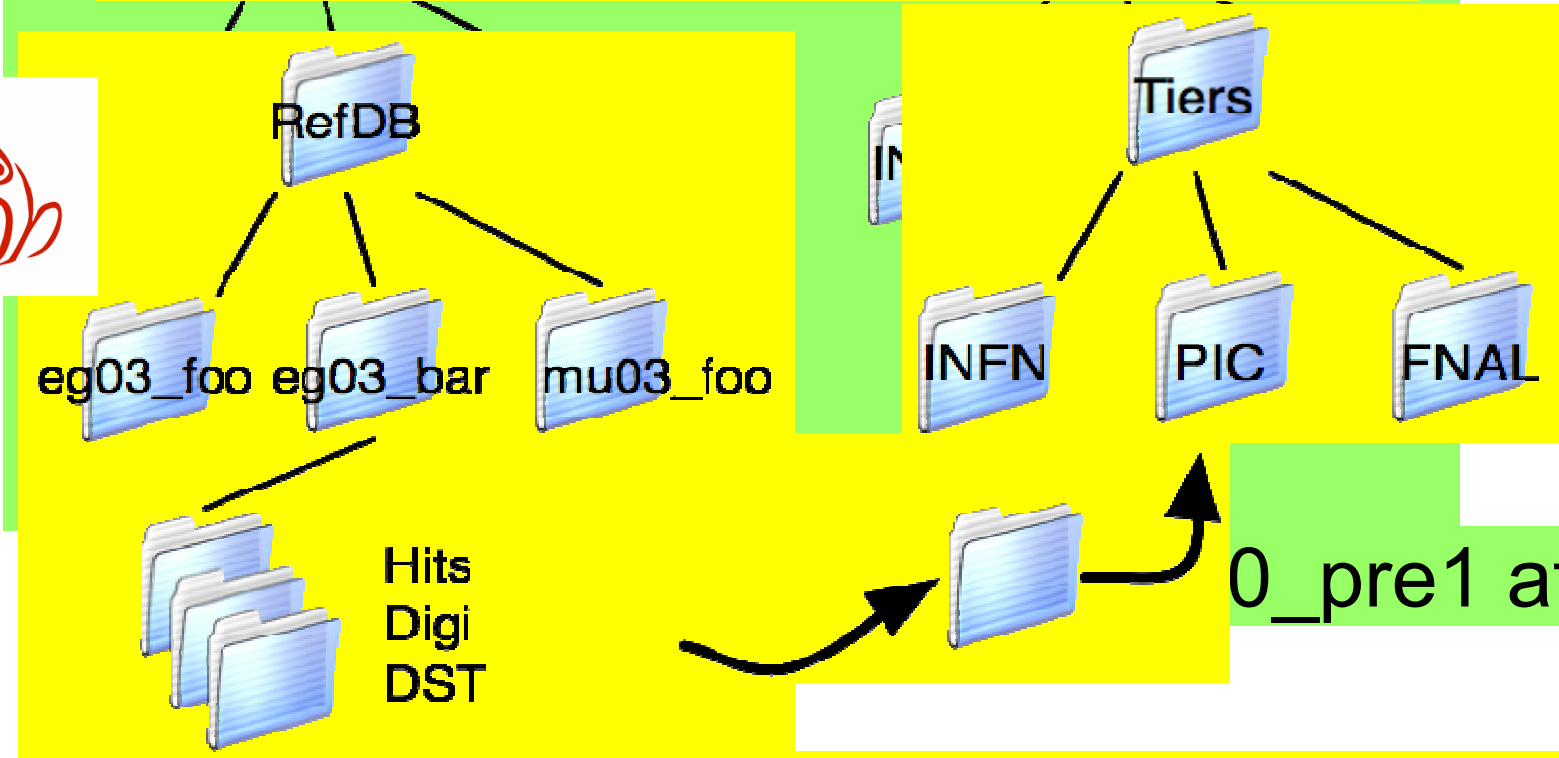
Actions are expressed in terms of copying, linking, creating files.

Multiple clients satisfy different needs.



`cp /Applications/ORCA/ORCA_8_5_0_pre1 /Tiers/FNAL/`

`cp /RefDB/eg03_foo/DST /Tiers/PIC`



`0_pre1 at FNAL`

Copies a certain collection to PIC



Liason with EGEE/ARDA



First ARDA Workshop 22-23 June 2004.

CMS Presentations:

- DC04 experience and plans (L. S.) & Data Management - PhEDEx (Lassi Tuura)

First version of the Glite Architectural and design documents available by end of August
CMS discussion done during a dedicated CCS Technical. Comments reported in EGEE PTF meeting.

CMS/ARDA Team started to work on gLite test-bed and to develop a prototype for CMS distributed analysis on the new middleware in order to test the main gLite components.

Example of the CMS analysis job with a set of scripts to submit a job to a gLite job-queue, query it's status and retrieve output files is available at

http://lcg.web.cern.ch/lcg/PEB/arda/glite/test_case.htm

First end-to-end prototype supporting CMS distributed analysis on the EGEE middleware
Will be available in November??



Analysis Environment Integration, Validation & deployment Strategies



Based on

- Observation of other large projects that (early) **integration is CRUCIAL**
- A dedicated hardware setup to serve as the deployment playground

Software Infrastructure

- Deploy the various components as they become available
 - gLite, LCG-2, Grid-3
 - dBases etc.,
 - CMS Software installation and validation Grid-wide
- Perform early integration tests
 - Given the plethora of the components required, a major challenge is posed to ensure that individual pieces of the puzzle fit well together
 - And all this has to start already with the first component being available

Hardware Infrastructure: A flexible testbed setup is required

- to deploy the software infrastructure
- it will help to uncover weakly or not at all covered areas
- it provides the necessary tooling to convert components into services
- it offers the possibility of early access to the physicist's desktop

Only after first Validation step the service will be exposed to the final end-user.

An End to End Analysis system need involvement of CCS & PRS people.



Summary/Conclusions



APROM Project started on July 2004. Short Term proposed work-plans strongly pragmatic and focused on providing an E2E analysis system for P-TDR.

Main goal provide an End-to End Analysis system

- A consistent interface to the physicist
- A flexible application framework
- A set of back-end services

This will be achieved in several iterations (next 6 months, next year....)

Physic Shell - virtual file system is the "glue" among the different services.

This project includes components from several projects like OCTOPUS/PubDB, PhEDEx, COBRA, ORCA, IGUANACMS, PhySH, LCG, Glite, GRID-3

Monitor tasks for Data & Workload Management components, applications, jobs are essential .

Integration, Validation & Deployment is CRUCIAL.



Few questions



Which is the deployment schema for Glite?

Which components are included?

Which functionality?

Where the SW is installed?

CERN, Winsconsin, and few others..

Is this a version for Glite developer or users?

How to involve outside center?

.....



Back-up slides



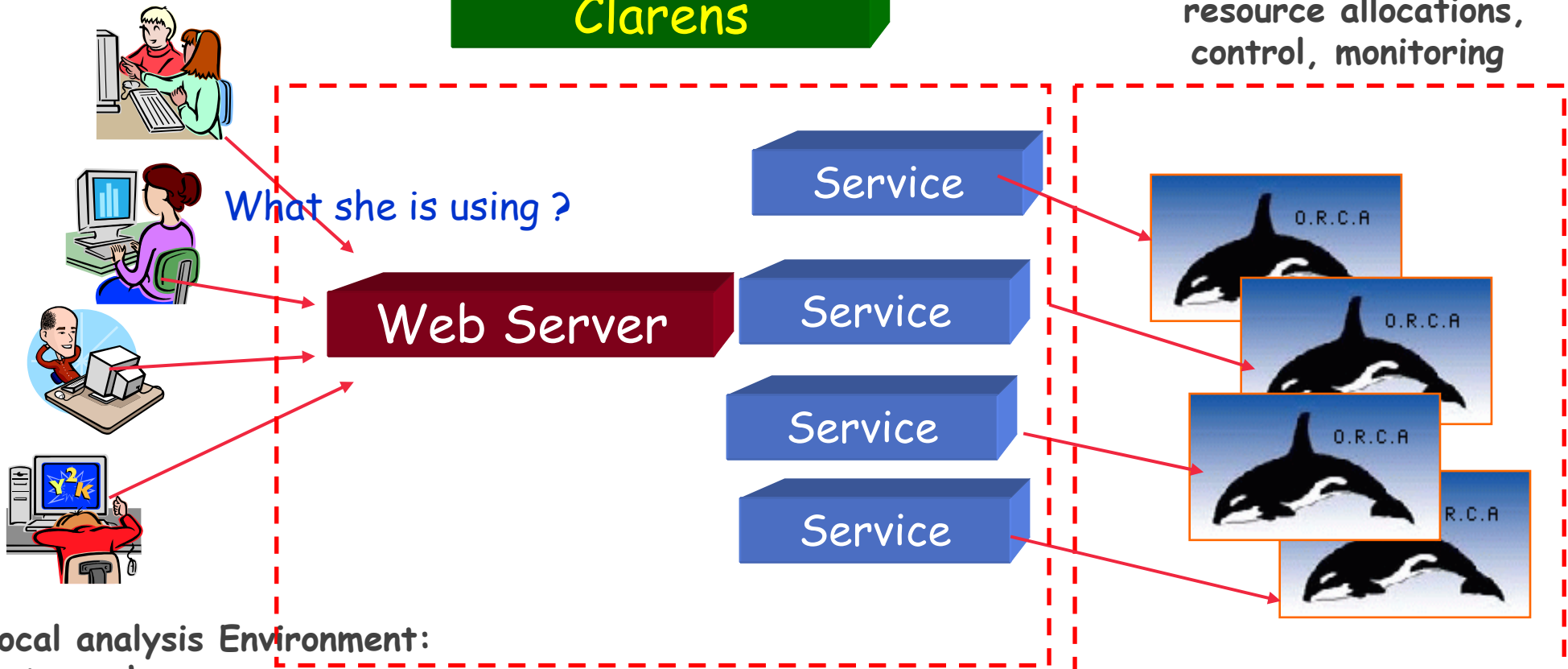


Analysis on a distributed Environment



Clarens

Remote batch service:
resource allocations,
control, monitoring



Local analysis Environment:

Data cache
browser, presenter
Resource broker?

Remote web service:
act as gateway between
users and remote
facility