

LHCb Computing Model

This poster shows the evolution of the LHCb Computing Model from an originally very rigid setup, adding flexibility over time in terms of data processing and its association to Tier levels. The changes are supported by LHCbDirac [1], the extension of DIRAC, with little additional developments efforts.

2012 Prompt Data Processing

- Standard prompt data processing at CERN + Tier 1 sites
- Extending the experience of 2011 reprocessing, with offloading new CPU intensive workflow (“Data Swimming”) [2], to one Tier 2 site attached to each storage element New

2011 Data Reprocessing

- Reprocessing of the 2011 data set in October and November, in parallel to prompt processing
- Selected number of T2 sites attached to the “closest” T0/1 storage element, forming a “regional cloud” New
- 25 % of RAW reconstruction carried out at “attached Tier 2 sites”
- Processing finished 2 weeks ahead of schedule

Data Processing Workflows

Data Reconstruction
The RAW data after processing by the high level trigger is reconstructed into physical quantities corresponding to identified particles and written into a SDST file.

Data Stripping / Merging
The reconstructed events are selected into individual physics streams during stripping. Once a threshold is reached, the files of a given stream are merged into the final analysis DST file, ready for physics analysis.

Monte Carlo Simulation
Simulation of particle interaction with the detector and their subsequent reconstruction up to a simulated analysis MC-DST

Working Group Productions
Large scale data analysis carried out by production team

Data Swimming
CPU intensive detector acceptance jobs with little data I/O New 2011

User Analysis
Unorganized physics analysis jobs by individual users New 2012

Possible Future Scenarios for Data Processing Activities

- “Free attachment” of Tier 2 sites to download input data from an available Tier 0/1 storage for data processing
 - Only for Reconstruction (CPU intensive, lower data I/O)
 - Tier 2 job needs to upload his output again to the same Tier 0/1 storage element, next input file can be taken from other storage
 - Increase of network traffic to be monitored closely
- Usage of Event Filter Farm [3] for data processing (12k CPU Cores)
 - Tested so far for Monte Carlo Simulation New

2011 Prompt Data Processing

- Prompt data processing according to initial computing model
 - Done at CERN and T1 sites
- Full processing chain from RAW to DST done at a single site
- Subsequent replication of DST file to 3 other T1 storage elements
- 1 fb⁻¹ of data collected and processed

Data Transfer and Storage Model

	DISK D1 / T0	TAPE D0 / T1
RAW	-	2 ¹
SDST	-	1 ²
DST	4	2 ³
MC-DST	3	1 ³

Data is stored only at CERN and T1 storage elements [4]

RAW: data from detector
SDST: reconstructed events (MC-)DST: physics streams

¹ one copy at CERN, one at another T1
² uploaded to site of RAW processing
³ archive copies, not accessible by users

Tier Levels and Activities (original model and now)

	Tier 0 / 1s		Tier 2s ¹	
	Original	2012	Original	2012
Data Reconstruction	Y	N	N	Y
Data Stripping	Y	N	N	Y
Data Merging	Y	N	N	N
User Analysis	Y	Y ²	N	N
Monte Carlo Simulation	Y ³	Y	Y	Y
Working Group Productions	-	Y	-	N
Data Swimming	-	Y	-	Y

¹ includes unpledged resources
² if job has no input data
³ if resources available, otherwise concentrated on Tier 2s

DIRAC
Dirac is the tool used by LHCb for all activities on distributed computing resources on behalf of the experiment. It handles data processing for reconstruction and simulation, physicists analysis activities and data management for file transfer, replication and removal.

[1] LHCbDirac: distributed computing in LHCb, F. Stagni, Poster, Tuesday
[2] “Swimming”: a data driven acceptance correction algorithm, M. Cattaneo, Parallel, Tuesday 14²⁰-14⁴⁵, Room 905/907
[3] Offline Processing in the Online Computer Farm, L. Granado, Parallel, Monday 17⁵⁰-18¹⁵, E & L Auditorium
[4] The LHCb Data Management System, P. Charpentier, Parallel, Monday 14⁴⁵-15¹⁰, E & L Auditorium