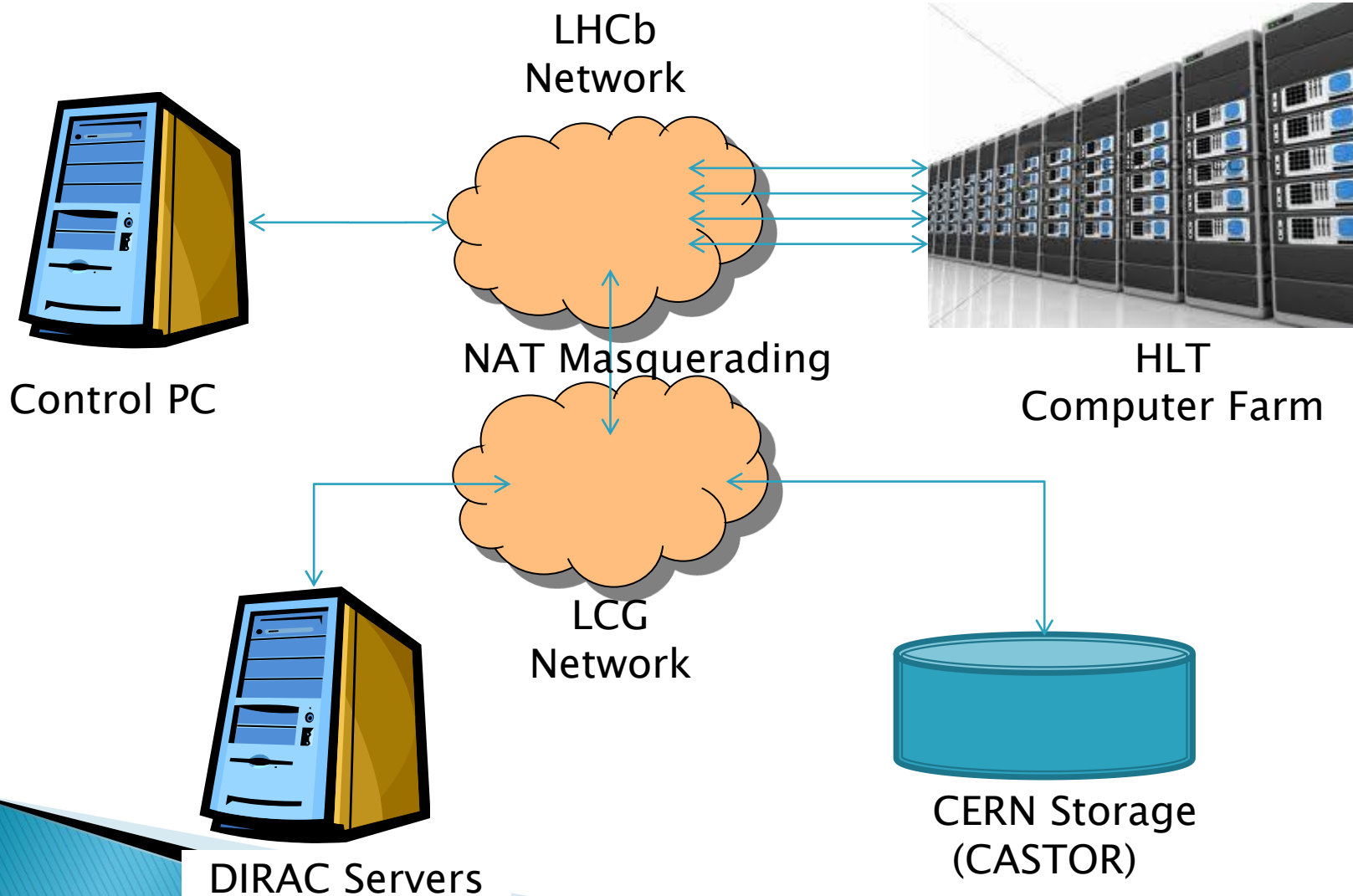


# Processing Offline Data in the LHCb HLT Farm

# Infrastructure

- ▶ Computing infrastructure
  - ~1500 Linux PCs
  - 16000+ cores
- ▶ Computing environment
  - LHCb uses the same computing environment to process both HLT data and Offline data
    - No special setup has to be done on the worker nodes
- ▶ LHCb has a private network
  - HLT Worker Nodes have private addresses
  - HLT Worker Nodes not accessible from outside LHCb
  - Masquerade NAT, deployed on 4 master nodes, which have access to the LHC Computing Grid (LCG) network
  - With masquerade NAT HLT Nodes are able to access data from DIRAC

# Network



# Control System

- ▶ Developed in PVSS using CERN standard frameworks
  - FSM toolkit
  - FMC tools
- ▶ Maintains the same Look and Feel from the DAQ control system – easier adoption
- ▶ LHCb has a unified Run Control to control the DAQ and DCS
  - DIRAC processing is interfaced with DAQ – easy coordination according to DAQ needs

# Control System

## ▶ Features

- CPU checks
  - Check what type of CPU is available on the node
    - Set max number of processes accordingly
    - Set max number of nodes independently
- Resource balancing
  - Processing is balanced according to pre-defined rules
- Information exchange with DIRAC
  - Processing state information available only on the DIRAC system
  - Job availability evaluated by agent process duration

# DIRAC on the Online Infrastructure

▶ UI

The screenshot displays the DIRAC web interface. At the top, the title bar reads "HLTE: TOP (ONLDIRAC - ONLDIRAC; #1) (on onldirac01)". The main area is divided into two sections. The upper section, titled "System", shows the overall state as "RUNNING". Below this is a table of sub-systems:

Sub-System	State
HLTE01	NOT_ALLOCATED
HLTE02	RUNNING
HLTE03	RUNNING
HLTE04	RUNNING
HLTE06	NOT_ALLOCATED
HLTE07	NOT_ALLOCATED
HLTE08	NOT_ALLOCATED
HLTE09	NOT_ALLOCATED
HLTE10	NOT_ALLOCATED
HLTE11	NOT_ALLOCATED

Below the sub-system table is a grid of 150 agent status icons, arranged in 10 rows and 15 columns. Each icon represents an agent and includes a small circular progress indicator and a date/time stamp. Some icons are highlighted in green, indicating they are running. A large black arrow points from the text "Agents running on sub-farm nodes" to these green icons.

The lower section of the interface is titled "JobMonitoring" and contains a table of running jobs:

JobId	Status	MinorStatus	ApplicationStatus	Site	JobName	LastUpdate [UTC]	LastSignOfLife [...]	SubmissionTim...	Owner
31131997	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:28	2012-03-26 11:28	2012-03-26 10:21	rrgracian
31131993	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:28	2012-03-26 11:28	2012-03-26 10:21	rrgracian
31131981	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:28	2012-03-26 11:28	2012-03-26 10:21	rrgracian
31131980	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:28	2012-03-26 11:28	2012-03-26 10:21	rrgracian
31131975	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:28	2012-03-26 11:28	2012-03-26 10:21	rrgracian
31131968	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:28	2012-03-26 11:28	2012-03-26 10:20	rrgracian
31131966	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:28	2012-03-26 11:28	2012-03-26 10:20	rrgracian
31131963	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:29	2012-03-26 11:28	2012-03-26 10:20	rrgracian
31131956	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:27	2012-03-26 11:27	2012-03-26 10:20	rrgracian
31131955	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:27	2012-03-26 11:27	2012-03-26 10:20	rrgracian
31131954	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:28	2012-03-26 11:28	2012-03-26 10:20	rrgracian
31131953	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:27	2012-03-26 11:27	2012-03-26 10:20	rrgracian
31131951	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:27	2012-03-26 11:27	2012-03-26 10:20	rrgracian
31131947	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:27	2012-03-26 11:28	2012-03-26 10:20	rrgracian
31131944	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:27	2012-03-26 11:27	2012-03-26 10:20	rrgracian
31131934	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:27	2012-03-26 11:27	2012-03-26 10:20	rrgracian
31131927	Running	Application	Gauss v41r2 step 1	DIRAC.ONLINE...	00017281_000...	2012-03-26 10:27	2012-03-26 11:27	2012-03-26 10:20	rrgracian

Arrows from the text "Agents monitoring on DIRAC" point to the "JobMonitoring" table. The top-left corner of the interface features the LHCb logo and a "System" dropdown menu set to "HLTE". A "State" dropdown menu is set to "RUNNING". The top-right corner shows the date "Mon 26-Mar-2012" and time "13:25:06". A search bar with "root" is visible. The bottom-left corner has a "Message" box.

FSM Control

Agents running on sub-farm nodes

Agents monitoring on DIRAC

# Status and Plans

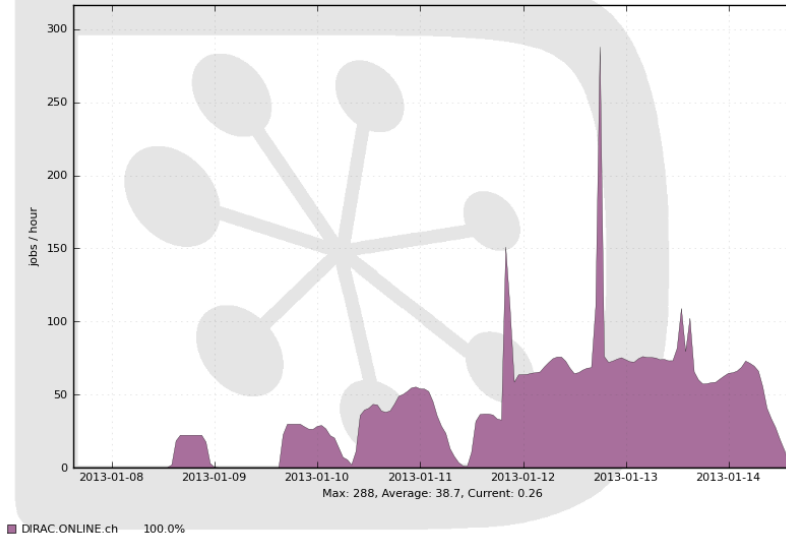
- ▶ We have been running tests for quite some time with success
- ▶ Used the system to process data over the Christmas shutdown
  - Unfortunately a bug in the Control System made it stop after 4 days (fixed)
- ▶ Being currently used as DAQ needs are reduced
  - Processed ~6500 jobs during the weekend
  - Will continue to process during the Heavy Ion Run
- ▶ About VMs
  - At this point we're not thinking about it due to the increased complexity
  - We intend to run some tests on virtualizing the HLT using openstack in 2013



# Some Plots

Jobs by Site

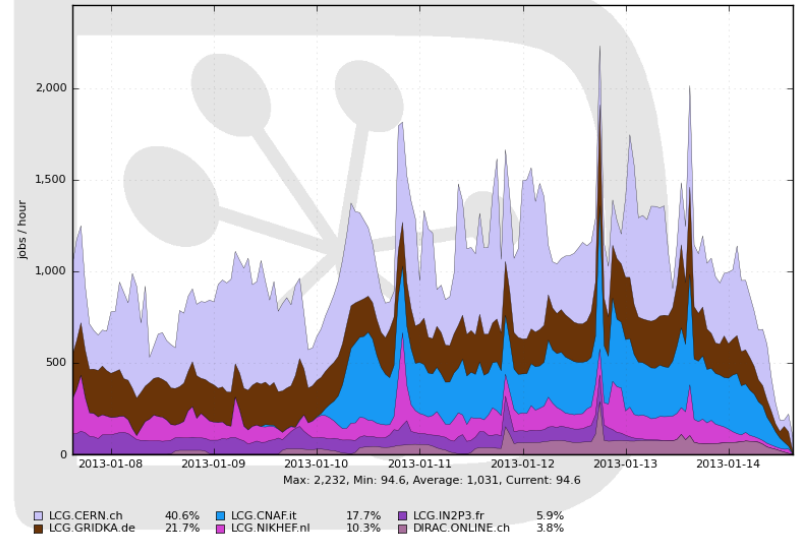
7 Days from 2013-01-07 to 2013-01-14



Generated on 2013-01-14 15:21:31 UTC

Jobs by Site

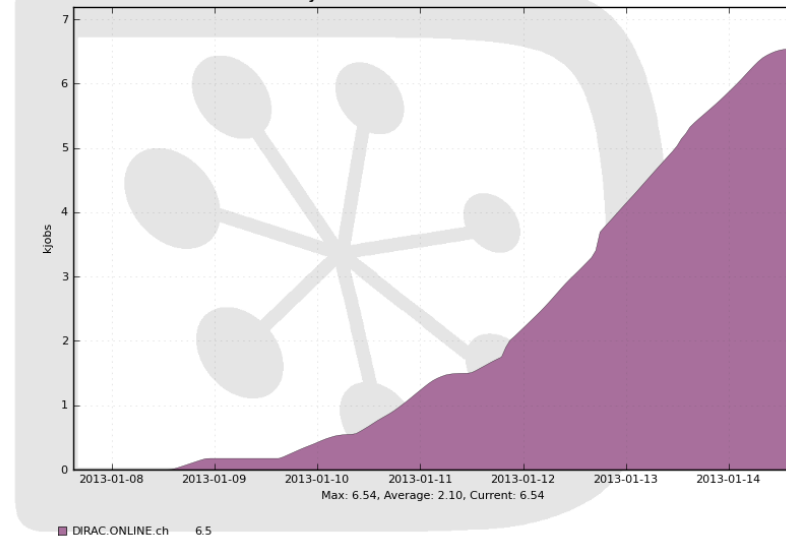
7 Days from 2013-01-07 to 2013-01-14



Generated on 2013-01-14 15:20:26 UTC

Cumulative Jobs by Site

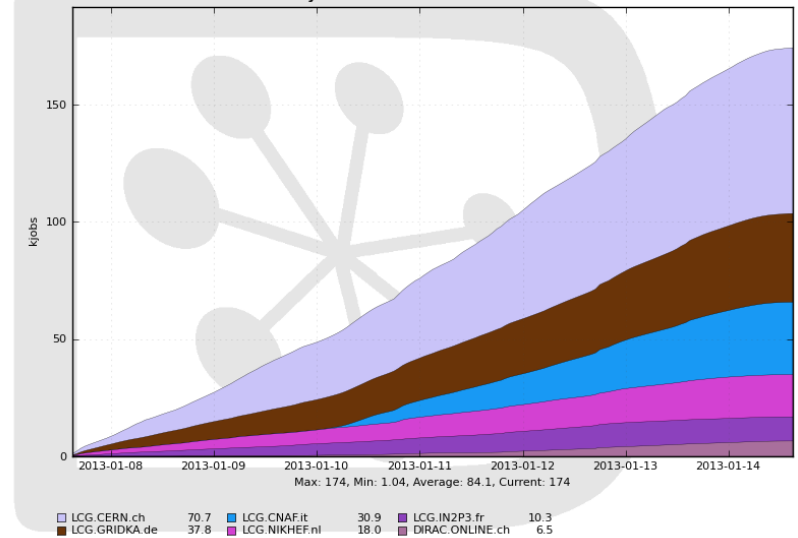
7 Days from 2013-01-07 to 2013-01-14



Generated on 2013-01-14 15:14:28 UTC

Cumulative Jobs by Site

7 Days from 2013-01-07 to 2013-01-14



Generated on 2013-01-14 15:17:07 UTC