

LEXOR

The LCG Executor for ATLAS Production System

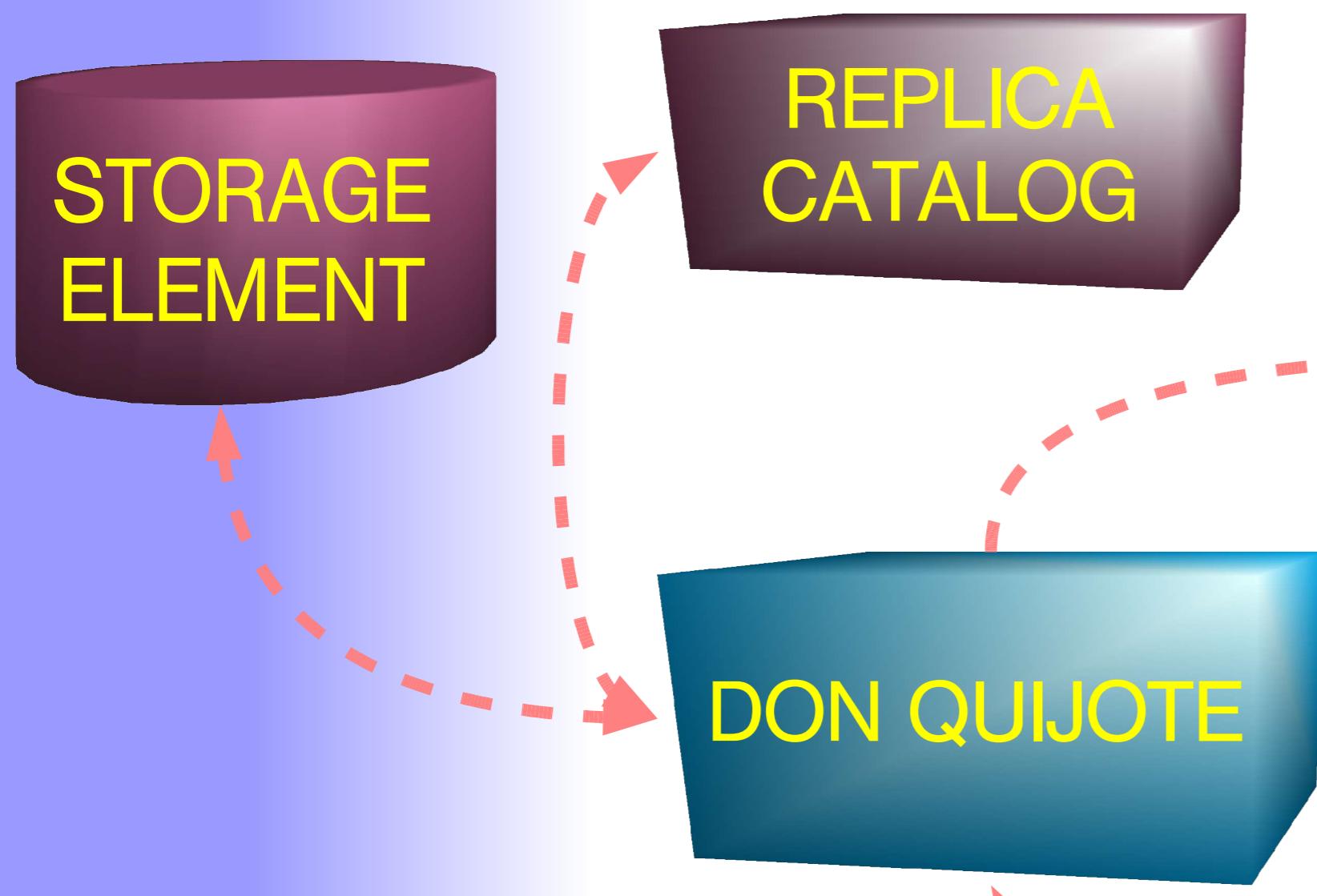
Graphic by D. Rebatto and G. Negri

LEXOR is the software component used by **ATLAS** LHC experiment during its **DataChallenge 2 – Phase One** to submit jobs to the **LCG-2 Grid**.

LEXOR main components are:

- A Python module implementing a *LCG Job* class (which can also be used interactively as an alternative OO User Interface for LCG). By mean of this module, LEXOR is able to manage the whole life cycle of a job in LCG.
- A custom XML DOM parser, translating the XML description of jobs (used by ATLAS in its database) into JDL, the Job Description Language used by LCG.
- A Job Wrapper, performing all the needed operations before and after the actual physic job execution.

The communication with the production supervisor is performed via XML messages over XMPP.



More on LEXOR...

LEXOR homepage: <http://www.mi.infn.it/~rebatto/lexor/>
Find here more info and the code of LEXOR

Involved people

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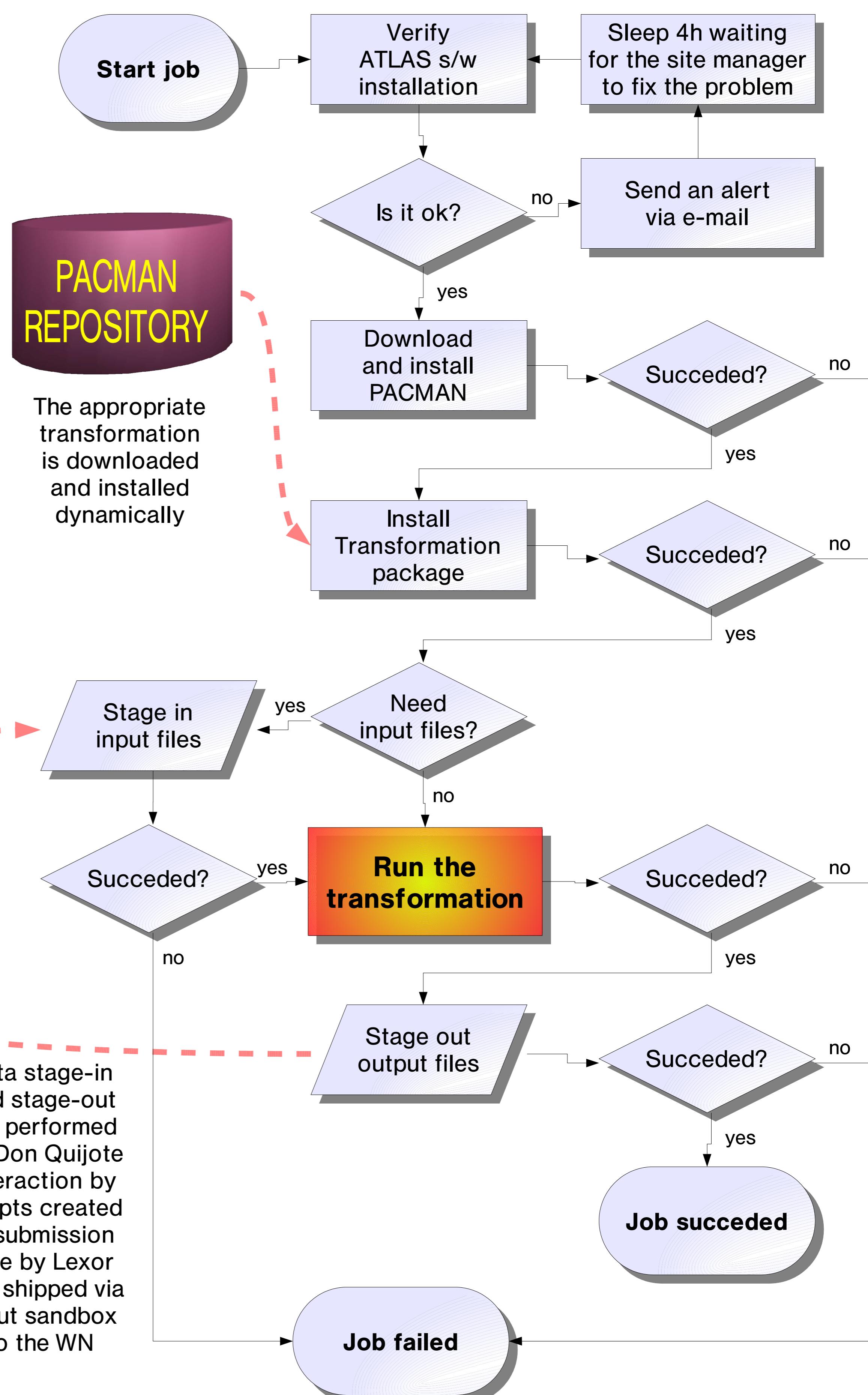
Related Projects

Windmill <<http://www-hep.uta.edu/windmill/>>
The supervisor component

Don Quijote <<http://mbranco.home.cern.ch/mbranco/cern/donquijote/>>
The ATLAS data management tool

Pacman <<http://physics.bu.edu/~youssef/pacman/>>
The package manager

The job wrapper around a typical ATLAS job



The ATLAS Production System is designed to be fully automated. Once a job is inserted into the database, the system takes care of its execution and reports the result back in the database.

Job flow through the Production System

PRODUCTION DATABASE

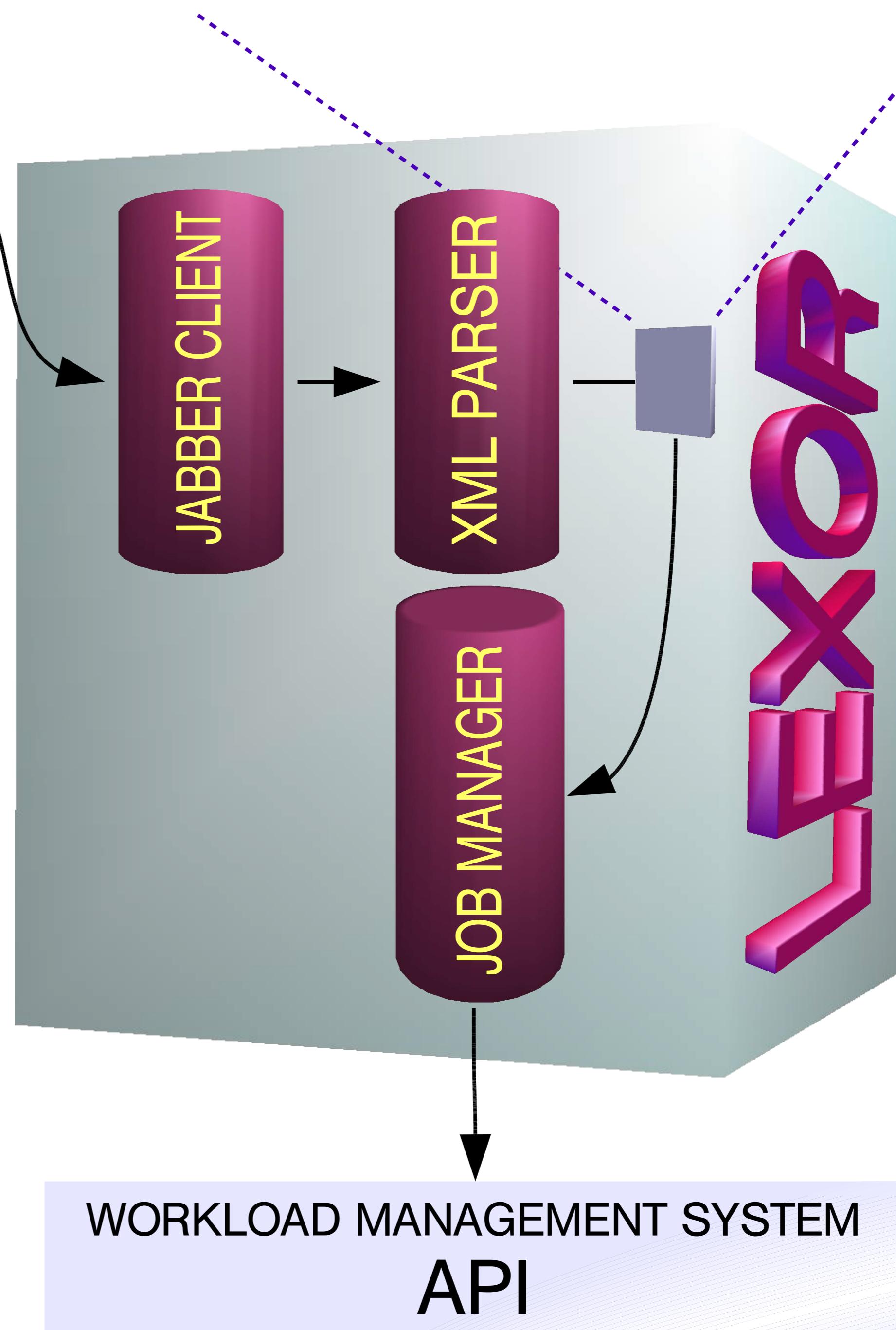
SUPERVISOR

```
<jobDef>
  <jobDefID>163334</jobDefID>
  <jobName>dc2.003026.simul.A0_top_02814.job</jobName>
  <transImplementation>share/dc2.g4sim.trf</transImplementation>
  <transHomePackage>JobTransforms-0.5.6</transHomePackage>
  <expectedCPUTime>count<25000</expectedCPUTime>
  <cpuConsumption>count<25000</cpuConsumption>
  <diskConsumption>count<500</diskConsumption>
  <ipConnectivity>min<1000</ipConnectivity>
  <minMemoryMB>count<12</minMemoryMB>
  <expectedResources>
    <jobInputs>
      <fileInfo>
        <dpn>dc2.003026.evgen.A0_top_00071.pool.root.1</dpn>
        <logCol>dc2.evtdatafiles/dc2.evgen.A0_top/<logCol>
        <useList></useList>
      </fileInfo>
    </jobInputs>
    <fileInfo>
      <dpn>dc2.003026.simul.A0_top_02814.pool.root.1</dpn>
      <logCol>dc2.evtdatafiles/dc2.simul.A0_top/<logCol>
      <dataset>name<dc2.003026.simul.A0_top/names</dataset>
      <useList><useList></useList>
    </fileInfo>
  </expectedResources>
  <jobOutputs>
    <fileInfo>
      <dpn>dc2.003026.simul.A0_top_02814.job.log.1</dpn>
      <logCol>dc2.evtdatafiles/dc2.simul.A0_top/<logCol>
      <dataset>name<dc2.003026.simul.A0_top/names</dataset>
      <useList><useList></useList>
    </fileInfo>
  </jobOutputs>
  <jobLogs>
    <actualPar>
      <name>inputfile</name>
      <type>string</type>
      <metaType>plain</metaType>
      <value><value></value>
    </actualPar>
    <actualPar>
      <name>retainin</name>
      <position>3</position>
      <type>string</type>
      <metaType>plain</metaType>
      <value><value>-6</value>
    </actualPar>
    <actualPar>
      <name>retainout</name>
      <position>4</position>
      <type>string</type>
      <metaType>plain</metaType>
      <value><value></value>
    </actualPar>
    <actualPar>
      <name>skip</name>
      <position>5</position>
      <type>natural</type>
      <metaType>plain</metaType>
      <value><value>100</value>
    </actualPar>
    <actualPar>
      <name>maxevents</name>
      <position>6</position>
      <type>natural</type>
      <metaType>plain</metaType>
      <value><value>2814</value>
    </actualPar>
  </jobLogs>
</jobDef>
```

XML JOB DESCRIPTION

```
[ Requirements = ( ( Member('VO-atlas-lcg-release-0.0.2*', other.GlueHostApplicationSoftwareRunTimeEnvironment) ) && \
( Member('VO-atlas-release-9.0.5*', other.GlueHostApplicationSoftwareRunTimeEnvironment) ) && \
( other.GlueCPolicyMaxCPUTime >= ( Member('DC-2.1.0*', other.GlueHostApplicationSoftwareRunTimeEnvironment) ) && \
? ( 9000000 / 60 ) : 9000000 ) / other.GlueHostBenchmarkIO0 ) ) && \
( other.GlueHostNetworkAdapterOutboundIP == true ) ) && \
( other.GlueHostMainMemoryRAMsize >= 512 );
RetryCount = 0;
Arguments = "dc2.003026.evgen.A0_top_00071.pool.root dc2.003026.simul.A0_top_02814.pool.root.1 -6 6 100 1300 2814";
Environment = [
  'LEXOR_WRAPPER_LOG=lexor_wrapper.log', 'LEXOR_STAGEOUT_MAXATTEMPT=5', 'LEXOR_STAGEOUT_INTERVAL=60',
  'LEXOR_LCG_GFAL_INFOSYS=lxh2011.cern.ch:2170', 'LEXOR_LCG_GFAL_INFOSYS_RELEASE=0.5.6/jobTransforms',
  'LEXOR_T_BASEDIR=JobTransforms-08-00-05-06', 'LEXOR_JOBTRANSFORMS=transformations/lcg_trf',
  'LEXOR_STAGEIN_LOG=dg_163334_stagein.log', 'LEXOR_STAGEOUT_LOG=dg_163334_stageout.log',
  'LEXOR_STAGEOUT_SCRIPT=dg_163334_stageout.sh'
];
MyProxyServer = "lxh0727.cern.ch";
Executable = "lexor_wrap.sh";
StdOutput = "dc2.003026.simul.A0_top_02814.job.log.1";
OutputSandbox = { "metadata.xml", "lexor_wrapper.log", "dg_163334_stagein.log", "dg_163334_stageout.log", "dc2.003026.simul.A0_top_02814.job.log" };
VirtualOrganisation = "atlas";
Rank = [ -other.GlueCESRateEstimatedResponseTime ];
StdError = "dc2.003026.simul.A0_top_02814.job.log.1";
InputSandbox = [
  "lexor/inputsandbox/lexor_wrap.sh", "lexor/inputsandbox/dqlcg.py",
  "lexor/inputsandbox/edgrmpl.sh", "lexor/inputsandbox/dgrep.pl", "lexor/inputsandbox/run_dqlcg.sh",
  "/tmp/lexor/rebatto/dg_163334_stagein.sh", "/tmp/lexor/rebatto/dg_163334_stageout.sh"
];
]
```

JDL JOB DESCRIPTION



LCG CLUSTERS

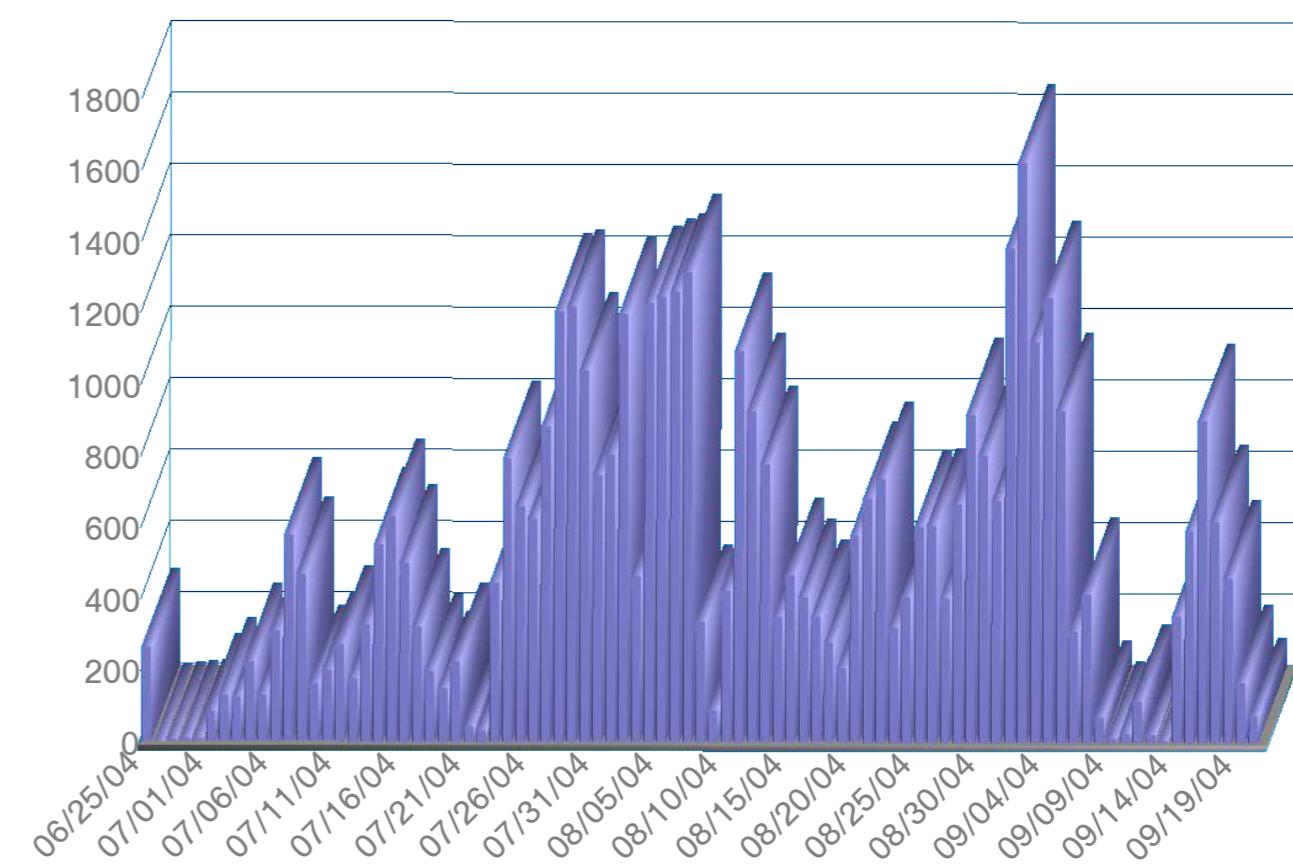
In three months of activity, **LEXOR** has managed more than 100.000 jobs, including **generation, simulation, digitization and pile-up.**

More than 30 LCG sites were involved, providing overall about 3.000 CPUs.

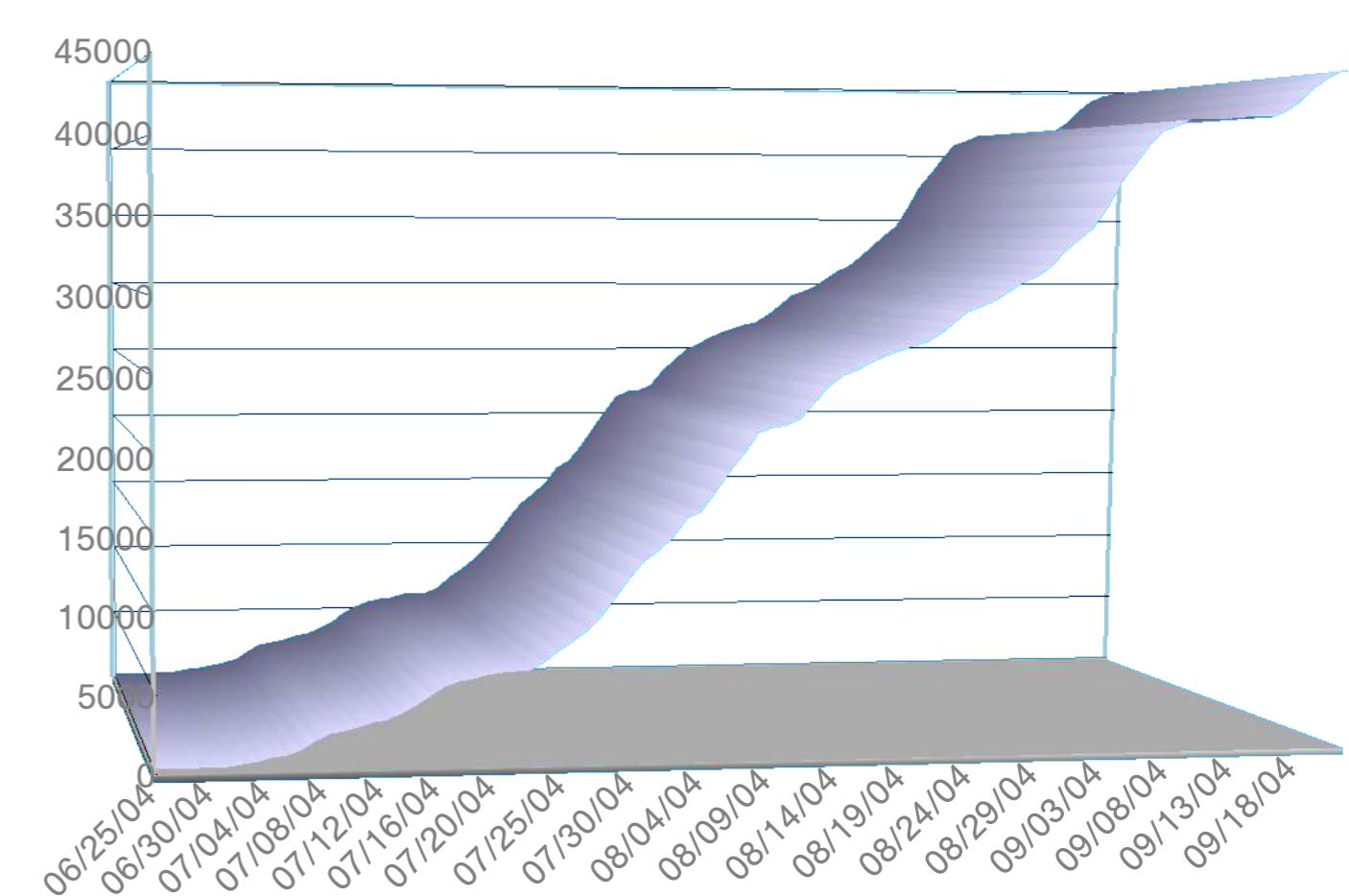
The job management was shared, on average, among six **LEXOR** instances owned by different users, every instance taking care of a maximum of about 800 jobs at a time (this threshold was decided in order to limit the size of the queries issued by supervisors to the central production database).

Troughs in the day by day production plot reflect the various issues encountered during this first phase of the Data Challenge. In fact, thanks to the heavy load we imposed on all the components, we were able to hunt undiscovered bugs in all the components of the production system and in LCG middleware.

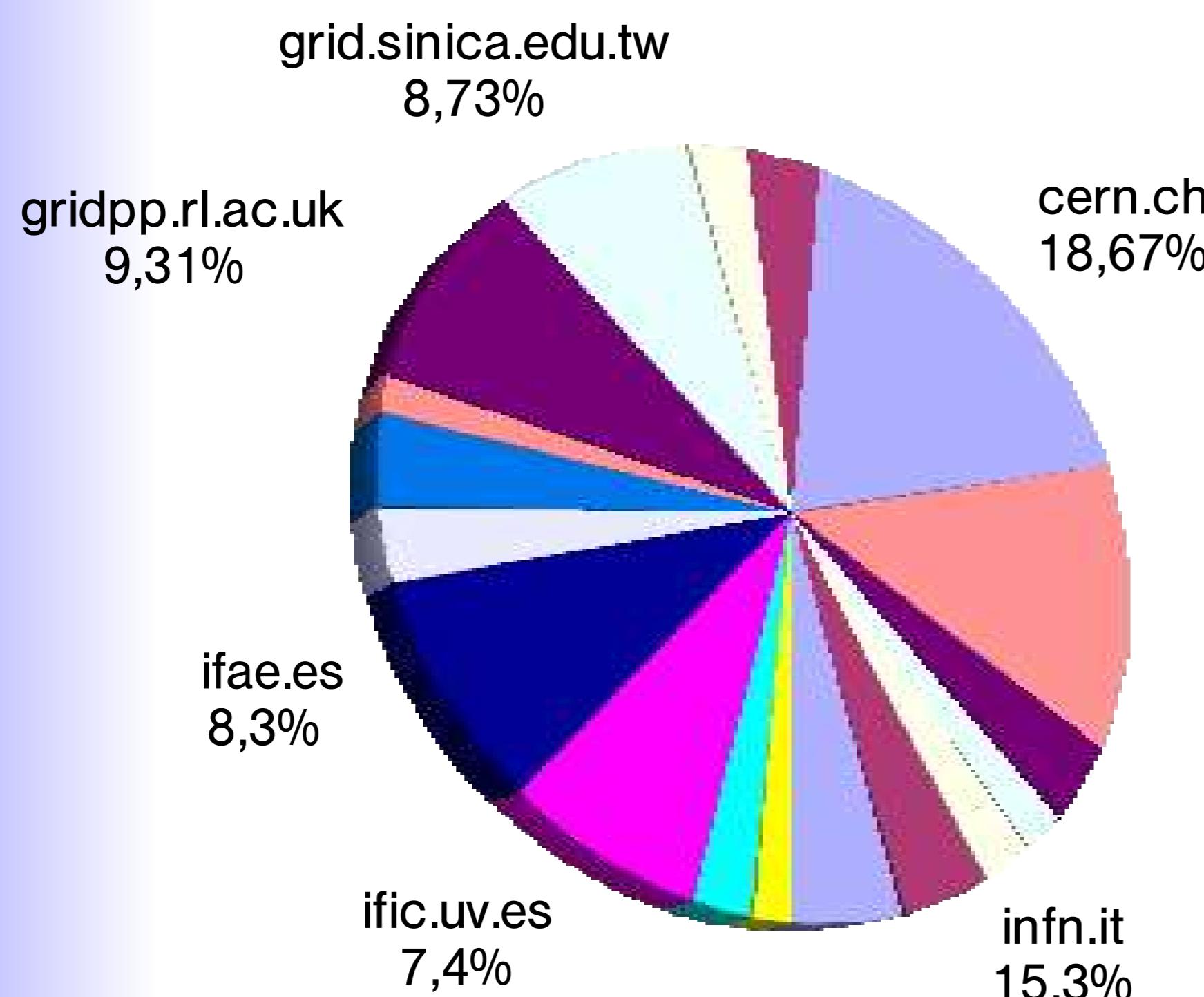
Statistics on LEXOR usage and activity



Jobs processed every day by LEXOR



Jobs processed by LEXOR during DC2



cern.ch	18,67%
farm.particle.cz	3,34%
fzk.de	2,52%
grid.sinica.edu.tw	8,73%
gridpp.rl.ac.uk	9,31%
tier2.hepmanc.ac.uk	1,59%
cccucl.ac.uk	3,51%
ftuames	2,69%
ifae.es	8,3%
ific.uv.es	7,42%
triumf.ca	2,36%
physics.utoronto.ca	
cnafinfn.it	4,54%
miinfn.it	3,77%
roma1.infn.it	2,42%
na.infn.it	2,16%
nikhefnl	3,81%
Others	

Job distribution over LCG sites

