

Distributed computing R&D

progress report

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CPPM: Andrei TSAREGORODTSEV



8th FCPPL Workshop — Hefei (China), April 8-10, 2015

Background: project topics

- DIRAC-based heterogeneous **distributed computing** system
- **Cloud storage** technologies for physics data

DIRAC-powered platforms

BES III grid

- Significant effort in 2014 for consolidating DIRAC-powered grid platform

major hardware and software upgrade

development and extensive testing of the experiment-specific file catalog

- Platform aggregates the computing power of sites in China (5), Italy (1), Russia (1) and US (1)

IHEP plays the role of central data repository

individuals can now also use the grid platform for their particular needs, including simulation, reconstruction and analysis

observed 98% job success rate, from 90% one year earlier

accuracy of the physics results comparable to the jobs running in the conventional farms

BES III grid (cont.)

- Ongoing experimentation with **cloud platforms** in Torino, CERN, JINR and IHEP

BES III jobs transparently run in virtual machines managed by OpenStack or OpenNebula on those sites

320 CPU cores aggregated, bulk capacity in IHEP

96% job success rate in cloud sites: main failure reason is lack of disk space

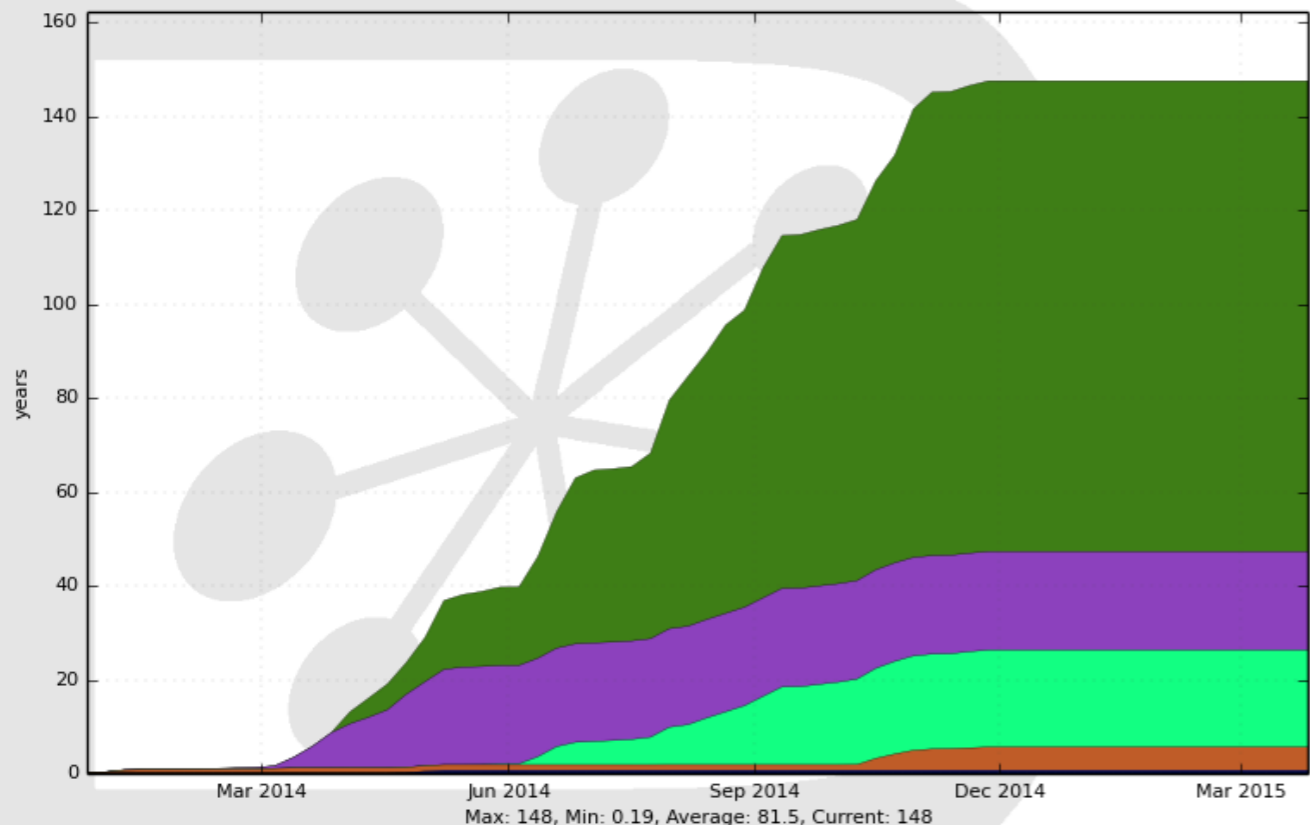
France-Asia VO

- TREND continued using opportunistically the computing resources available for France-Asia VO
DIRAC-powered, operated by CC-IN2P3 for France Grilles used for simulation studies of the GRAND prototype more than 800k jobs executed during 2014 in France (CC-IN2P3 and LPNHE), China (IHEP) and Japan (KEK)
- Significant usage for an experiment without dedicated computing resources
very good example of the benefits of this collaborative effort which provides an international computing infrastructure with low barriers to entry for fast-paced experimentation

France-Asia VO (cont.)

France-Asia Cumulative Wall Time by Execution Site

65 Weeks from Week 51 of 2013 to Week 12 of 2015



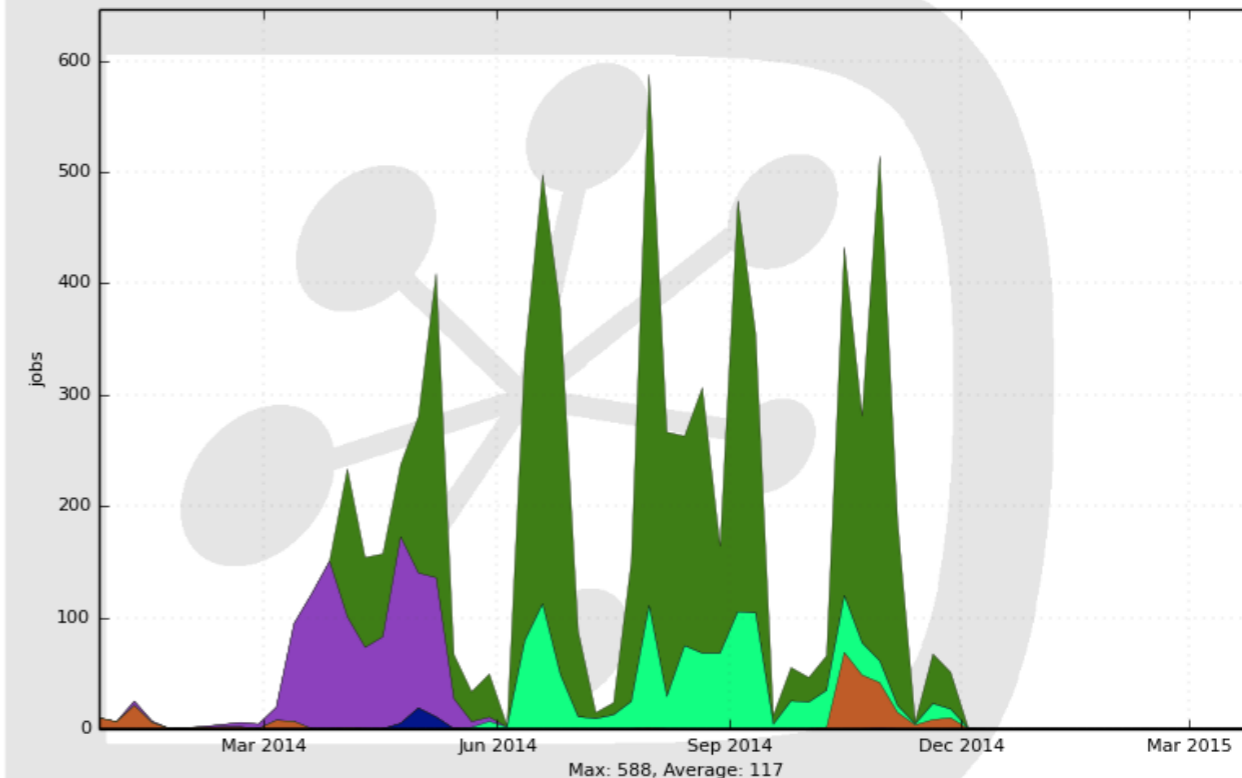
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LCG.IN2P3.fr	21.0	LCG.KEK.jp	5.0	ANY	0.0		

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TREND jobs running at sites in China, France and Japan

France-Asia Running Jobs by Execution Site

65 Weeks from Week 51 of 2013 to Week 12 of 2015



LCG.LPNHE.fr	68.0%	LCG.CC.fr	14.0%	LCG.BEIJING.cn	0.4%	LCG.RE.kr	0.0%
LCG.IN2P3.fr	14.2%	LCG.KEK.jp	3.4%	ANY	0.0%		

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Ongoing

- JUNO and CEPC projects are considering using DIRAC for their computing needs
testbed deployed at IHEP for evaluation purposes
- Exploring the feasibility of a multi-experiment deployment of DIRAC at IHEP
to pool effort from several experiments for operating a central infrastructure common to all of them
scheduled visit of IHEP by Andrei Tsaregorodtsev early May

Virtualization

Network virtualization

- ZENG Shan, network engineer from IHEP computing center, spent one month at CC-IN2P3 (Lyon) on summer 2014

explored Neutron, the network virtualization component for OpenStack

Neutron allows for providing tenant-specific private networks for OpenStack-managed virtual machines

necessary ingredient for creating highly customizable virtual computing environments for experiments

stay jointly funded by IHEP and CC-IN2P3

Cloud storage

- Background

developed a synthesised file system for transparent access to files stored in OpenStack Swift

no experiment software modification required

data hosted at IHEP

- First round of evaluation

BES III reconstruction jobs: randomly read fractions of binary files (random trigger data), about 2GB each

size of files make it impractical to pre-download

executed 3000 jobs on virtual machines in cloud sites in Torino, CERN, Dubna and IHEP

200 jobs in simultaneous execution

worker nodes (VMs) configured to auto-mount the file system

Cloud storage (cont.)

- Test results

97% of job success rate

remote data access completely transparent for experiment software

Swift cluster delivered 70 MB/sec: the same cluster previously shown to deliver 450 MB/sec, so hardware is not the limiting factor

low CPU efficiency as expected: high latency of transcontinental network links (~8000 km, 190 ms RTT) severely impacts each request-response cycle

- Next steps

implement caching mechanism on the client to avoid one HTTP request for each read operation

more information: <https://indico.in2p3.fr/event/11289/session/6/contribution/15/material/slides/0.pdf>

- Tests performed by YAN Tian and ZHAO Xianhu (IHEP, BES III)

People

Visit of IHEP delegation to IN2P3

- On June 2014, six young researchers from IHEP visited several IN2P3 labs on a 3 weeks-long trip

one of the two groups funded by China's CAS this year for visiting foreign research institutions

visit orchestrated by Gaëlle SHIFRIN (CC-IN2P3), visiting group led by CHEN Yaodong

detailed program: <https://indico.in2p3.fr/event/10176>

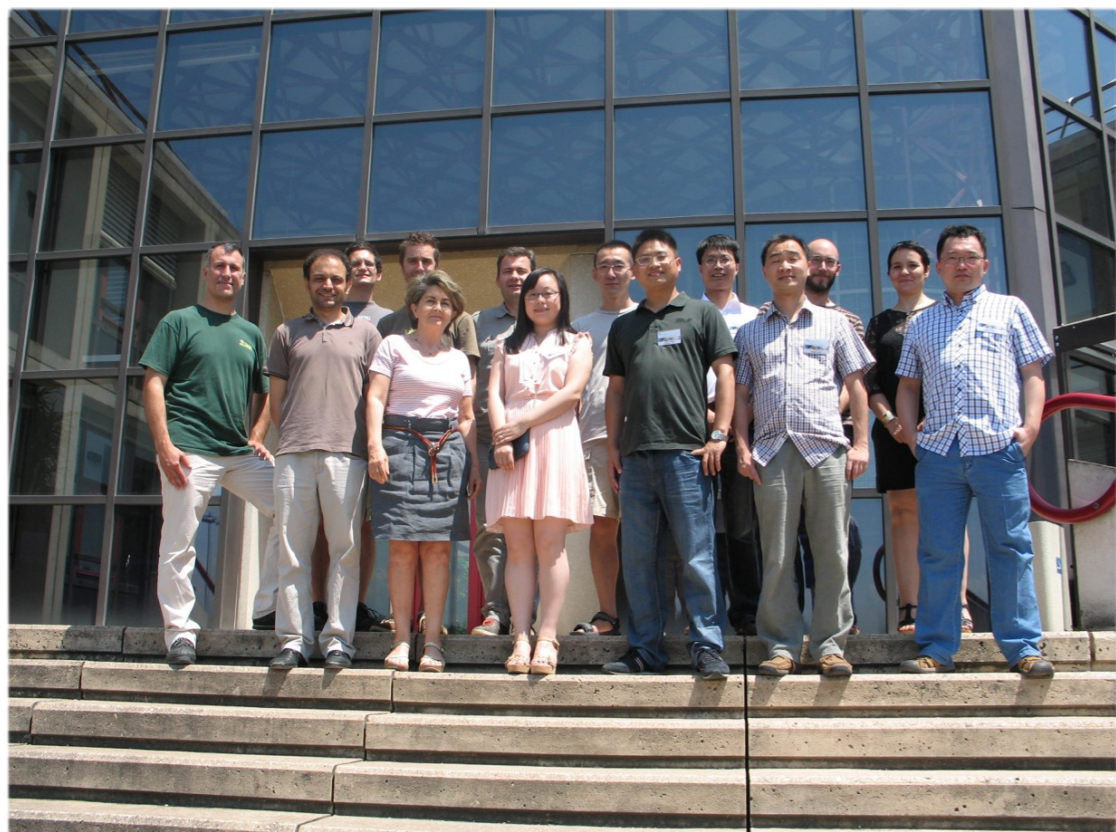
related: <http://informatique.in2p3.fr/li/spip.php?article346>

- Met experts from several IN2P3 sites

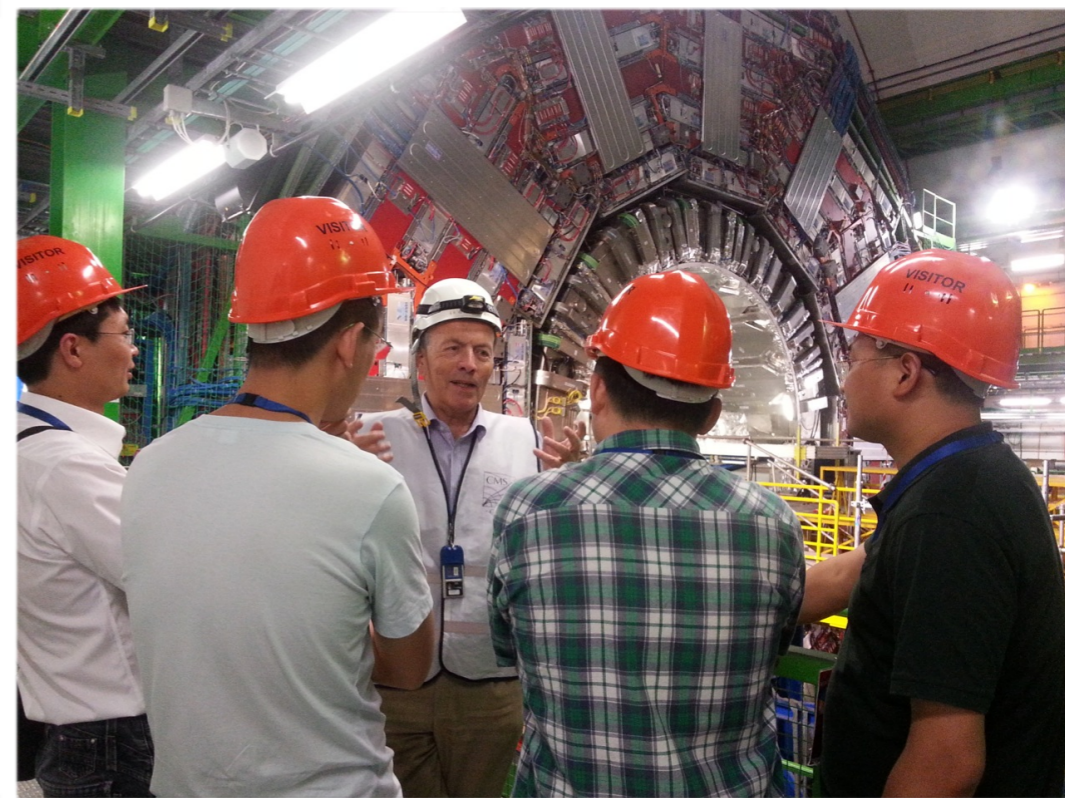
CC-IN2P3, LMA & IPNL (Lyon), CERN IT & CMS detector (CERN), CPPM (Marseille), Omega, LAL, IPNO, LLR, LPNHE & APC (Paris region)

Visit of IHEP delegation to IN2P3 (cont.)

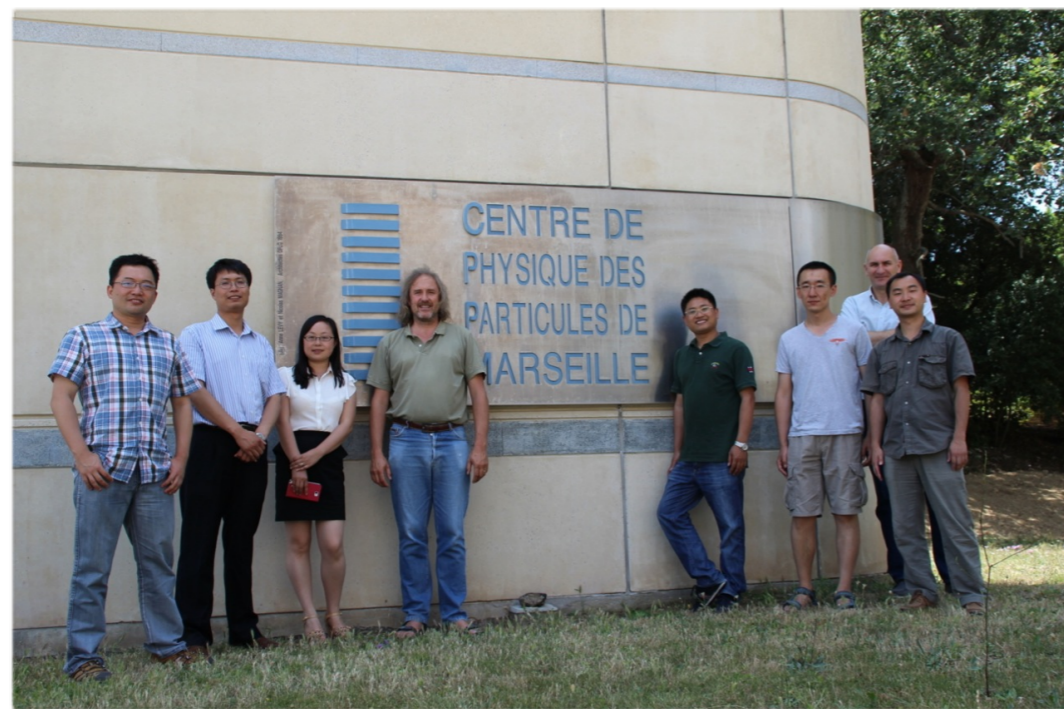
CC-IN2P3, Lyon



CMS detector, CERN



CPPM, Marseille



LPNHE, Paris



Collaboration

- WANG Cong, PhD student in computer science at IHEP, to spend one year at CC-IN2P3 from late April on
funded by the CAS-CNRS fellowship program
- WANG Lu (IHEP) and Fabio HERNANDEZ (CC-IN2P3) got their project proposal approved by the CNRS-NSFC program
CNRS' PICS (International Program for Scientific Collaboration)
storage technologies for research data
- Proposal for China's CAS President's International Fellowship Initiative submitted by Fabio HERNANDEZ and IHEP computing center was accepted
funding for short visits (one to two weeks)

Outreach

- Invited lunch talk for China's CAS National Astronomical Observatories, June 2014
- Presentation of FCPPL during a symposium at the Embassy of France in China, June 2014

<http://gcosmo.bao.ac.cn/event/lunch2014.html>

<http://www.ambafrance-cn.org/Bilan-du-premier-symposium>

<https://speakerdeck.com/airnandez/france-china-particle-physics-laboratory>

Perspectives

Project proposal

- Submitted a proposal to continue the ongoing work

partners: CC-IN2P3, CPPM, IHEP

- Topics

shared, multi-experiment DIRAC infrastructure at IHEP

storage technologies for research data

virtualization: computing and networking

Questions & Comments