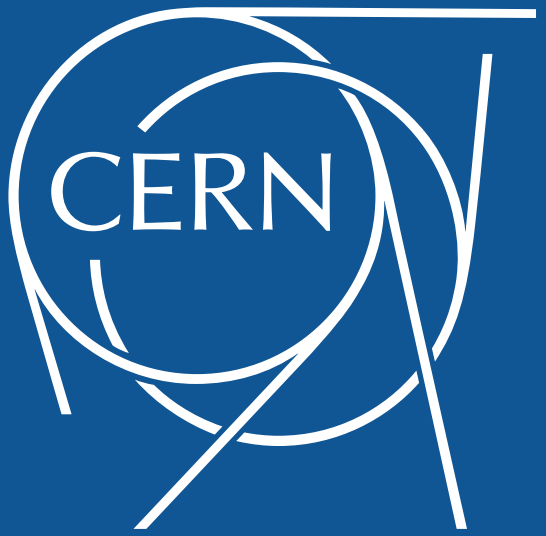

CERN

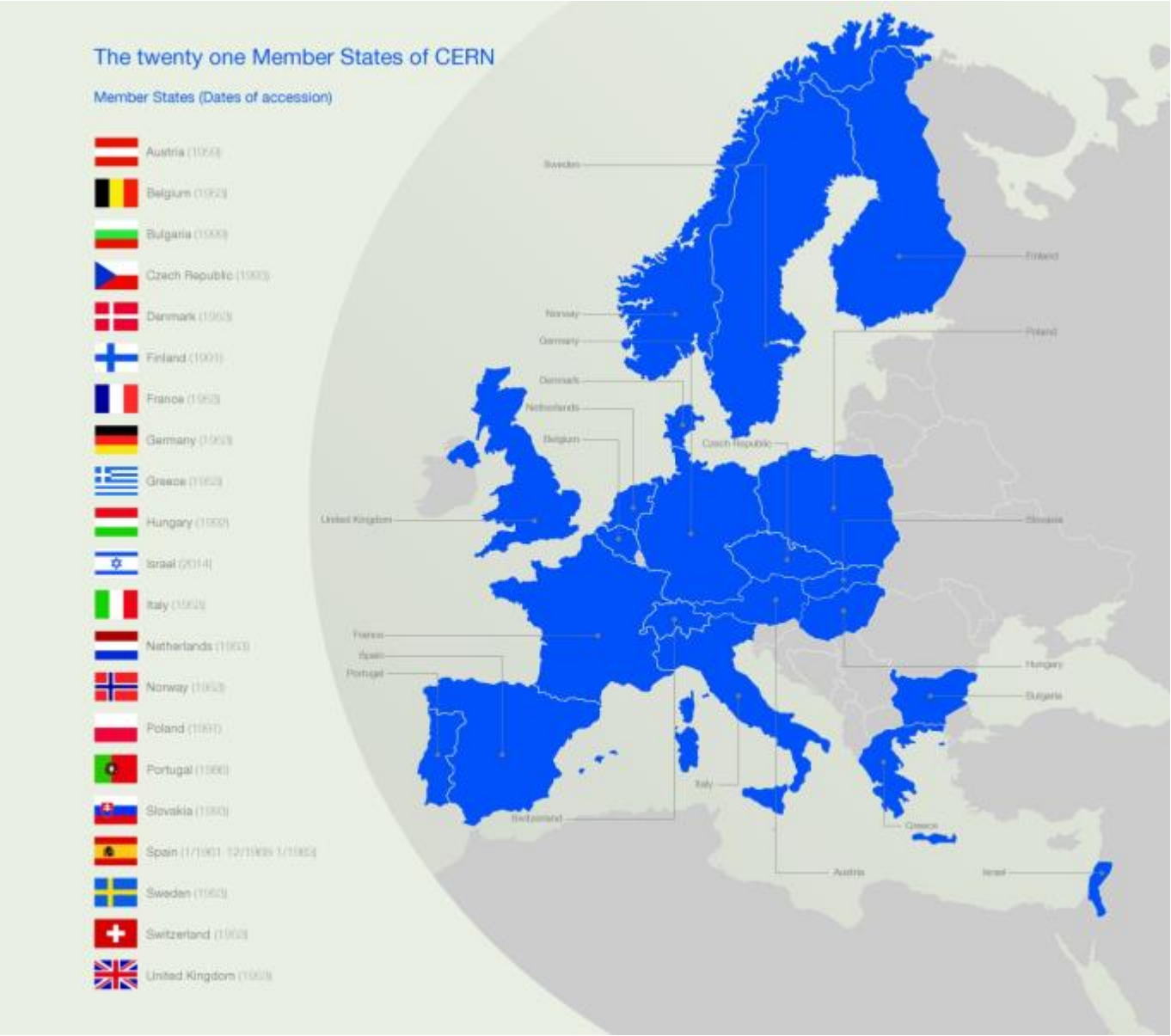
Volunteer Computing at CERN

BOINC workshop Sep 2014, Budapest

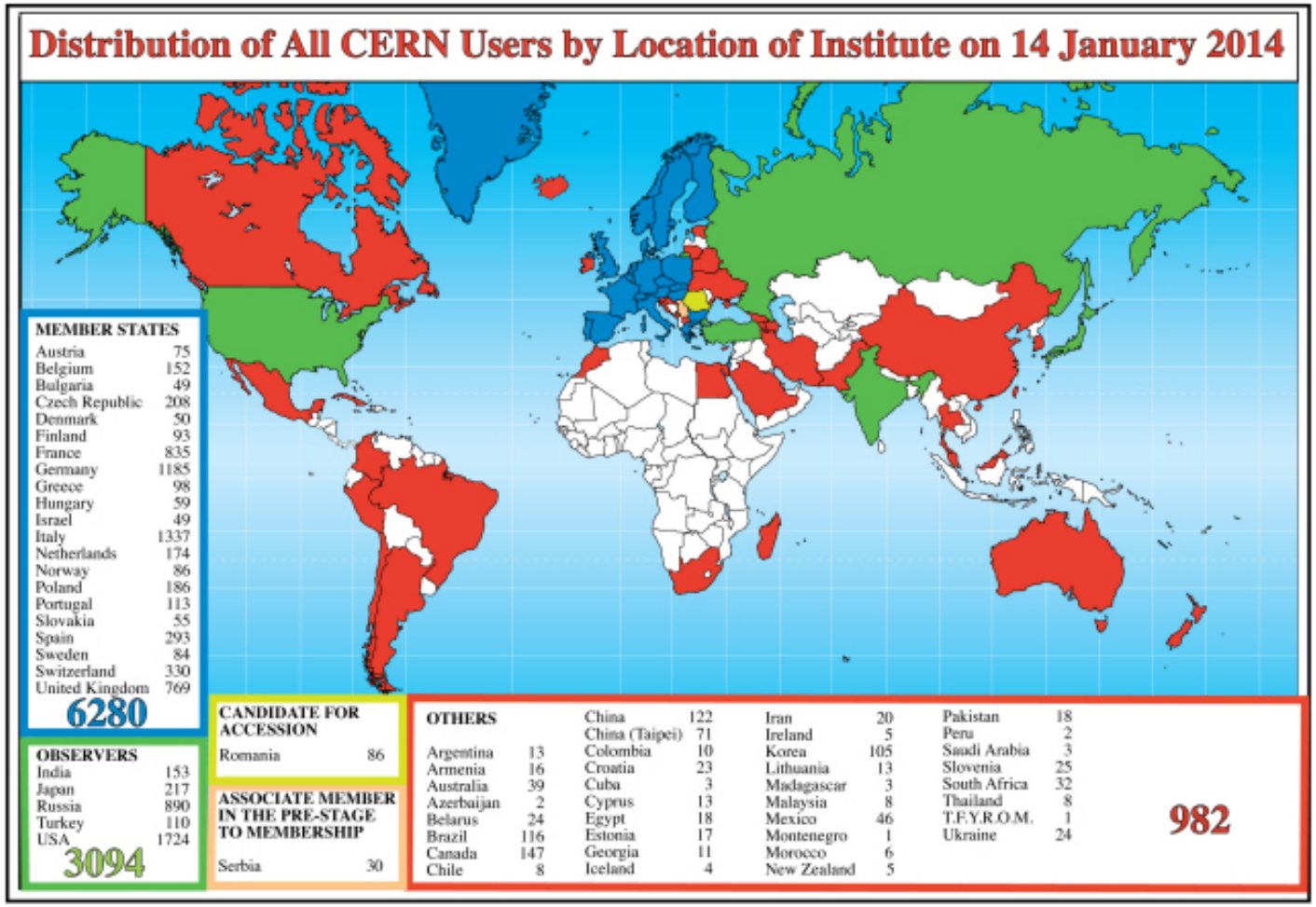
Tomi Asp & Pete Jones, on behalf the LHC@Home team

Agenda

- Overview
- Status of the LHC@Home projects
- Additional BOINC projects
- Service consolidation
- Planning for the future
- Questions

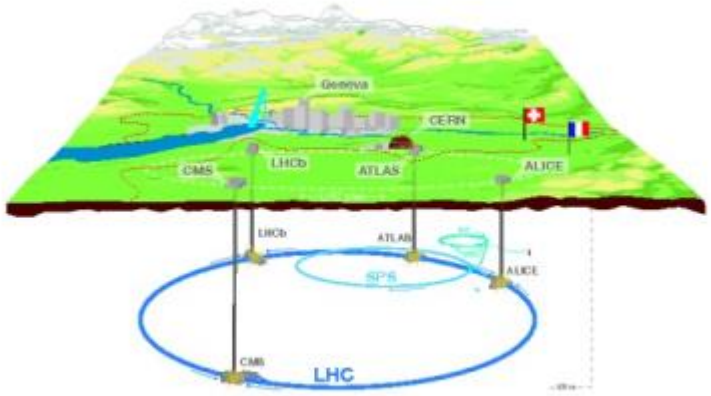


The **European Organization for Nuclear Research**

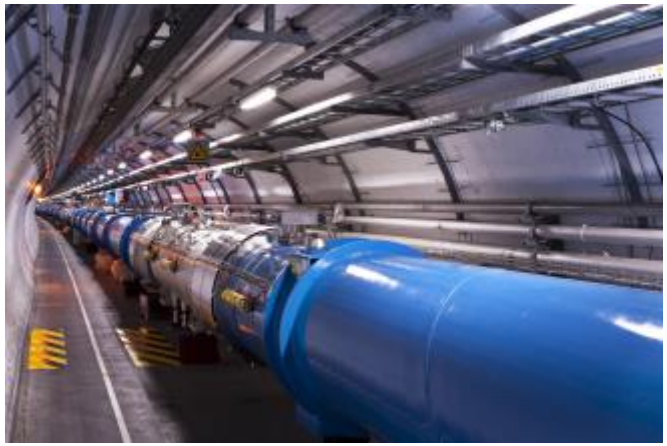

Distribution of All CERN Users by Location of Institute on 14 January 2014
MEMBER STATES
Austria 75
Belgium 152
Bulgaria 49
Czech Republic 208
Denmark 50
Finland 93
France 835
Germany 1185
Greece 98
Hungary 59
Israel 49
Italy 1337
Netherlands 174
Norway 86
Poland 186
Portugal 113
Slovakia 55
Spain 293
Sweden 84
Switzerland 330
United Kingdom 769
6280
OBSERVERS
India 153
Japan 217
Russia 890
Turkey 110
USA 1724
3094
CANDIDATE FOR ACCESSION
Romania 86
ASSOCIATE MEMBER IN THE PRE-STAGE TO MEMBERSHIP
Serbia 30
OTHERS
Argentina 13
Armenia 16
Australia 39
Azerbaijan 2
Belarus 24
Brazil 116
Canada 147
Chile 8
China 122
China (Taipei) 71
Colombia 10
Croatia 23
Cuba 3
Cyprus 13
Egypt 18
Estonia 17
Georgia 11
Iceland 4
Iran 20
Ireland 5
Korea 105
Lithuania 13
Madagascar 3
Malaysia 8
Mexico 46
Montenegro 1
Morocco 6
New Zealand 5
Pakistan 18
Peru 2
Saudi Arabia 3
Slovenia 25
South Africa 32
Thailand 8
T.F.Y.R.O.M. 1
Ukraine 24
982

CERN is the home of the LHC

- The CERN laboratory sits astride the Franco-Swiss border near Geneva.



- The Large Hadron Collider (LHC) is the world's largest and most powerful particle collider
- LHC data analysis requires a computing power equivalent to **~100,000 of today's fastest PC processors**



~30 Petabytes of data is annually generated by the LHC

- **CERN can only provide ~20% of the computing capacity**
- **The rest is running on the World LHC Computing Grid**
- **Volunteer computing could provide additional capacity for tasks like simulation**

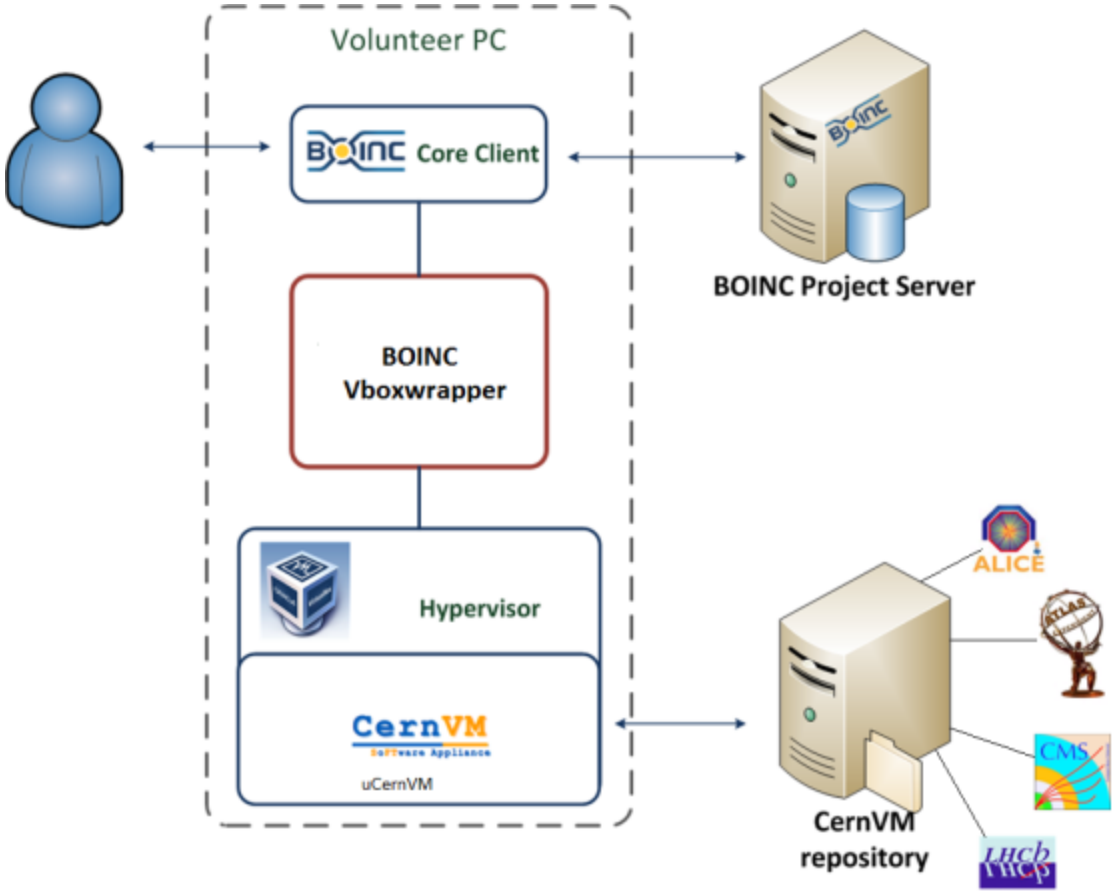
BOINC at CERN - LHC@HOME

- Sixtrack
  - Since 29-Sep 2004 to celebrate CERN's 50th birthday
  - Simulates particles accelerating through the LHC to find their orbit stability.
  - In one work-unit, 60 particles are simulated
  - 300,000 clients have signed up.
  - Peak computing power up to 40 Tflops
  - Classic BOINC architecture – Mac, Linux and Windows Clients
  - BOINC URL: http://lhcathomeclassic.cern.ch/sixtrack/
- Test4Theory
  - Since 2011 and does research about the elusive Higgs particle
  - Monte Carlo simulations of physics events at the LHC.
  - 30 ,000 volunteers
  - Computing power up to 2.5 Tflops
  - Modified architecture to traditional BOINC - uses the CERN developed CernVM and Vboxwrapper application
  - Changed name in 2014 to **Virtual LHC@home** - with the view to host more apps than Theory simulations
  - BOINC URL: http://lhcathome2.cern.ch/vLHCathome/
- Both in present form since 2011

LHC@Home – other projects in progress

- Atlas@Home
  - Lots of progress during 2014.
  - Running Atlas simulation
  - Over 5000 registered users
  - See talk later given by Wenjing Wu: Atlas@home
  - BOINC URL http://atlasathome.cern.ch/
- LHCb: Beauty
  - Since 2012 and still in test phase.
  - The LHCb experiment collaboration's cloud and grid computing management solution
  - Vboxwrapper application, with CernVM image
  - Planned to be an app on vLHC@home
- CMS
  - Started work on this during summer 2014
  - In very early stages, prototype running
  - To be added as a beta-application on vLHC@home once stable
- Adopt a Neuron
  - Pilot project with EPFL for a Human Brain project
  - For tasks in neuroscience for a volunteer computing context similar to CERN's Test4Theory
  - Slowly progressing

BOINC and Virtualisation - 1



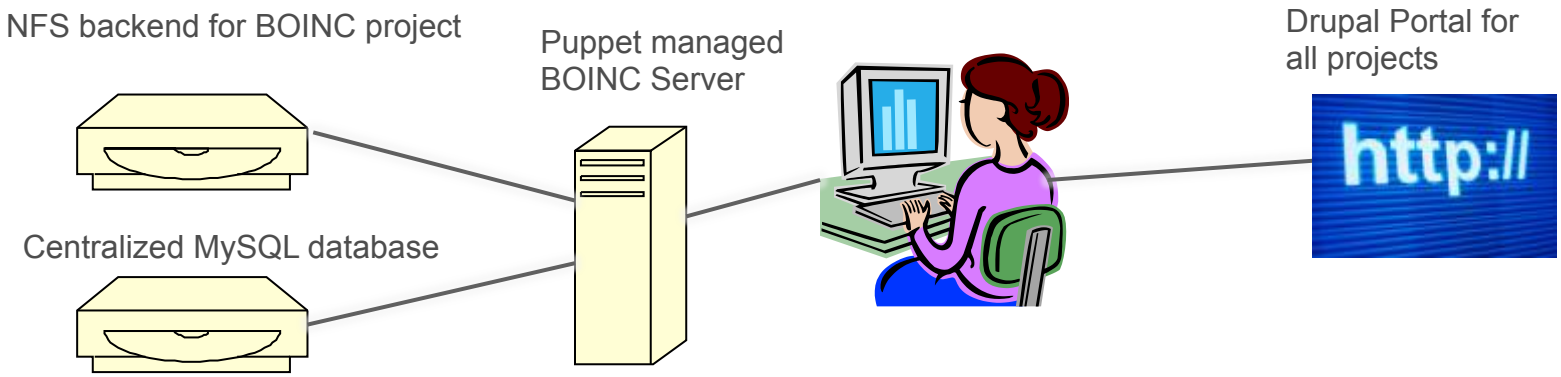
BOINC and Virtualisation - 2

- Vboxwrapper is a success
  - Thanks to Rom Walton for improvements and bug fixes
    - What about a forum for VM based projects and developments?
- Our aim is to keep the image and job size small
  - uCernVM is a small core image
    - An environment for developing and running LHC data analysis independent of OS
  - Pull applications from CernVMfs
    - A software distribution mechanism to deliver experiment software efficiently
  - Multiple tasks/cores:
    - BOINC supports multiple BOINC tasks, e.g. multiple vboxwrapper apps
      - What about multiple tasks per VM?

BOINC at CERN – recent developments

Service Consolidation

- Take advantage of CERN IT services features and support
  - OpenStack - open source cloud computing platform
  - Puppet managed VMs
  - Use of centralised Database service
    - BOINC server code modified by Tomi Asp (Graduate student at CERN for 1 year)
  - Centralised NFS disk space
  - Backup services
  - Drupal portal for lhcathome.cern.ch



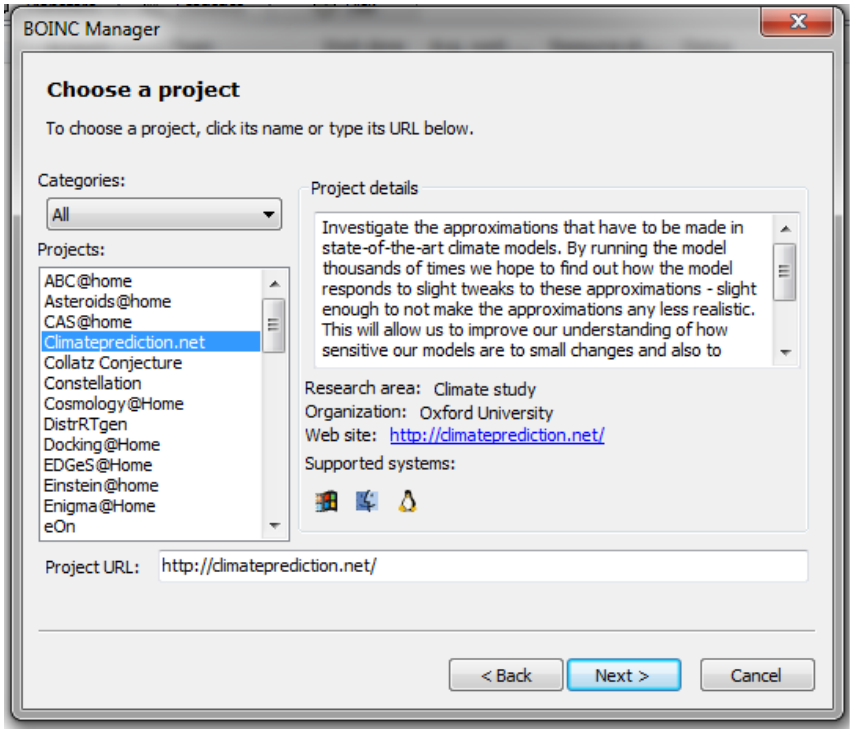
Different project approaches

- We have to consider the needs of the multiple experiments that are starting to use BOINC
- Sixtrack uses BOINC in the classic way.

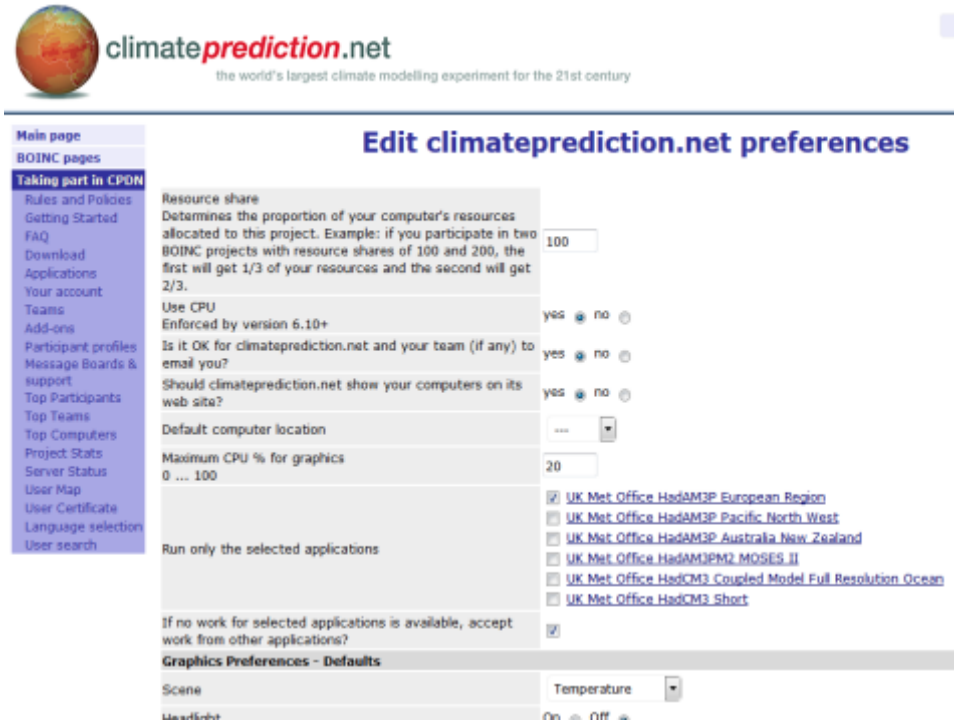
- Other projects use the Vboxwrapper application
- Common denominator for VM projects:
  - cernvm image
  - getting apps from Cernvmfs file system.
- However different job managers are used
  - (Co-Pilot, Panda+ArcCE, Crab, Dirac...)

How to organise many BOINC projects?

Individual projects



One project with many apps



We want to centralize the service and at the same time respect the needs of multiple experiments.

One project with several apps

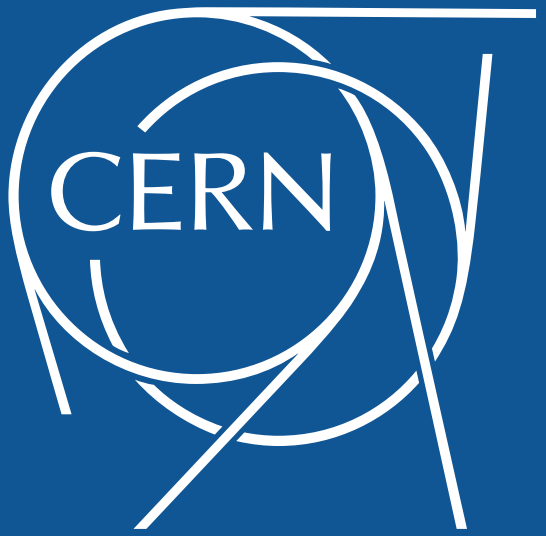
- Pros
  - One URL for the volunteer
  - One user database
  - One set of forums
  - Probably less maintenance (server and BOINC)
- Cons
  - Merging the database (e.g. users=yes, forums=no)
  - Managing different stakeholder requirements
  - The effect of many apps on the server performance
  - Handling app credit (however this seems to be fixed)

Individual BOINC projects

- Pros
  - Experiment independence
  - Easier to manage heterogeneous projects
  - Avoid merging issues
- Cons
  - Common URL – is this possible?
  - Will mean separate user registration
  - Separate forums (possible duplications)

Summary

- Increased interest in Volunteer Computing at CERN
- We provide and a centralized BOINC service
  - Integrating existing IT services
  - Accommodate the needs of all current and future projects
- Various configuration options analysed
  - All have their risks
  - Separate projects are less risky to handle
  - But the app feature seems a sensible solution
- Our setup must be able to scale
- It must be coherent for volunteers
- We welcome feedback, comments and questions


CERN