Latest developments in climateprediction.net

Andy Bowery

BOINC Workshop Grenoble 2013
Overview of talk

- Introduction to climateprediction.net
- Remote workunit submission
- Ongoing work
- New website
Introduction to climateprediction.net

• climateprediction.net has recently passed the 10 year milestone

• climateprediction.net is the world's largest climate modelling facility, no other climate science group is able to run so many simulations on a study

• For example, in climateprediction.net a typical ensemble size for a study is of the range of thousands (for example: 2,000 simulations, 4 x 500 parameter sets)

• This is compared to the UK Met Office QUMP study which is looking at perturbed physics parameters, in this study 128 simulations have been run
What do we study in climateprediction.net?

• A large amount of research has been done on global mean temperature, but the greatest impacts are likely to be seen at local/regional scales (this is especially with regards to extreme events)

• We also want to investigate how the risk of extreme weather events has changed due to human influence -> so-called 'event attribution experiments'

• And how the climate might change in the future with higher levels of CO2, SO2, Ozone emissions

• Two types of studies:
  – perturbed physics (to study the uncertainty arising from how we represent physical processes in the model) -> 500 different arrangements of 12 parameters are used
  – initial conditions perturbations -> model's initial state of atmosphere is uncertain (aka 'the butterfly effect') -> can sample many possible initial states of the model given the forcings
Why do we use BOINC?

• Most climate science based on **probabilistic results** -> a distribution of scenarios is needed

-> BOINC framework **allows large number of models** (order of thousands) to be run

-> This allows experiments to be designed to be large enough so that missing results do not matter

-> We can get a better handle on uncertainties, especially with extreme events, which may occur for example, 1 in 100 years or 1 in 1000 years
Current applications in climateprediction.net

- We currently have three applications that are being used for studies, all use computational models developed at Hadley Centre in the UK Meteorological Office:

- A **Weather At Home European region** application -> a European regional model nested in a global model -> runtime of 4.5 days (average) -> each workunit produces 13 upload files

- A **Weather At Home Pacific North West region** application -> A North Western US regional model nested in a global model -> runtime of 4.5 days (average) -> each workunit produces 13 upload files

- A **HadCM3** coupled atmosphere-ocean application -> runtime of 1 month (average) -> each workunit produces 4 upload files

- Accessing these large numbers of files is time consuming for remote collaborators
Workunit Submission

- Collaborators in the climateprediction.net project are distributed across a number of countries: New Zealand, Australia, US, and India
- Currently all new workunit submissions go through myself
- In the longer term we want to decentralise the project out to collaborators to remove this dependency and to enable the collaborators better access to their data
- We need a mechanism for collaborators to be able to:
  - test work remotely
  - remotely submit work to the main site
  - receive completed results directly to their home machine organised by study
Remote Workunit Submission

- Solution -> the production of a new portal for remote submission of new workunits. Portal built with the PHP Cake framework and the BOINC api.

- A request ID given to each group of workunits submitted.

- Request ID is part of the workunit name -> enables the linking of an individual workunit to the originating request and enables the organisation of the returned uploaded files.

- Users limited to a maximum number of workunits submitted per request.

- Users upload to the portal both the workunit defining XML file and the supporting data files for the workunits -> There is one XML file per request.

- Users are organised into research groups.

- Queuing mechanism allows multiple users to submit at the same time.

climateprediction.net
the world’s largest climate forecasting experiment for the 21st century

UNIVERSITY OF OXFORD
Portal - Workflow

Administrator Login → Create Group
                  → Approve new users
                  → Assign users to groups

User Login

PORTAL

New upload
New batch
List users
New users

Upload new files
Create Batch
Send to queue

User controlled processes
Background processes

Job queue process for queuing requests for batches

Worker daemon processing batch requests and making workunits
Portal – Upload submission files
Portal – Submit group of new WUs

Create a new batch of CP

You will need to choose an XML batch definition file from the list below (when a button to allow you to do so has been provided). This system will then, as if by magic, do all the necessary checks and create the work.

Make sure you have all the necessary files uploaded already and your XML is correct, if you know what’s good for you &c.

Available XML files

<table>
<thead>
<tr>
<th>Id</th>
<th>Title</th>
<th>Description</th>
<th>Filename</th>
<th>Size</th>
<th>Filetime</th>
<th>Created</th>
<th>Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>511c90f9-51d4-4639-823b-4cc28143c37a</td>
<td>XML file</td>
<td>Update to test remote file downloading.</td>
<td>test_input.xml</td>
<td>8269</td>
<td>text/xml</td>
<td>2013-02-14</td>
<td>2013-02-14</td>
</tr>
<tr>
<td>51370fa0-ae50-48af-8730-76aa8143c37a</td>
<td>Andy’s new XML template</td>
<td>For hadam3p_eu, stash and name list local, all others remote.</td>
<td>test_input_ando_3.xml</td>
<td>2003</td>
<td>text/xml</td>
<td>2013-03-06</td>
<td>2013-03-06</td>
</tr>
<tr>
<td>51337e7-3a3c-4a78-b94e-76d28143c37a</td>
<td>Modified Andy test XML</td>
<td>Three files have been removed in the hope that this will match the templates in the cplot/*alpha $HOME.</td>
<td>test_input_ando_4.xml</td>
<td>1664</td>
<td>text/xml</td>
<td>2013-03-12</td>
<td>2013-03-12</td>
</tr>
<tr>
<td>51a8d1c1-f3cc-4846-922d-<a href="http://portal.vorvados.com/batch/add">http://portal.vorvados.com/batch/add</a></td>
<td>Andy’s workunit</td>
<td>This file sent to me with incorrect data in</td>
<td>test_input_ando_5_updated.xml</td>
<td>1686</td>
<td>text/xml</td>
<td>2013-05-31</td>
<td>2013-06-03</td>
</tr>
</tbody>
</table>
Portal – List all files uploaded

<table>
<thead>
<tr>
<th>Id</th>
<th>Description</th>
<th>Filename</th>
<th>Filesize</th>
<th>Filenime</th>
</tr>
</thead>
<tbody>
<tr>
<td>51fcdf9-51f4-4829-b4cc281437a</td>
<td>Update to test remote file downloading.</td>
<td>test_input.xml</td>
<td>8269</td>
<td>text/xml</td>
</tr>
<tr>
<td>5137943-4894-40ae-9277-55a18143c37a</td>
<td>Test global namelist</td>
<td>xaakm.template</td>
<td>26126</td>
<td>application/octet-stream</td>
</tr>
<tr>
<td>5137959-84e8-4577-9037-55a38143c37a</td>
<td>Test regional namelist</td>
<td>xaakg.eu.template</td>
<td>25697</td>
<td>application/octet-stream</td>
</tr>
<tr>
<td>51379a4-9004-40af-bede-76b28143c37a</td>
<td>Test global stash</td>
<td>xaakm.eu.stashc</td>
<td>8177</td>
<td>application/octet-stream</td>
</tr>
<tr>
<td>51379b5-2700-48cb-a76b-76b28143c37a</td>
<td>Test regional stash</td>
<td>xaakg.eu.stashc</td>
<td>5057</td>
<td>application/octet-stream</td>
</tr>
<tr>
<td>51370a0-6e50-48af-8730-76aa8143c37a</td>
<td>Andy's new XML template</td>
<td>test_input_andb_3.xml</td>
<td>2003</td>
<td>text/xml</td>
</tr>
<tr>
<td>51337a7-2a53-4a78-b94e-76b28143c37a</td>
<td>Modified Andy test XML</td>
<td>test_input_andb_4.xml</td>
<td>1664</td>
<td>text/xml</td>
</tr>
</tbody>
</table>

http://portal.vorvosys/uploads
### Requests Index

<table>
<thead>
<tr>
<th>Id</th>
<th>User</th>
<th>File</th>
<th>Batch Name</th>
<th>Batch Description</th>
<th>Created</th>
<th>View</th>
</tr>
</thead>
<tbody>
<tr>
<td>243</td>
<td>3</td>
<td>test_input_andb_6_corrected.xml</td>
<td><a href="http://vorvadoss.oerc.ox.ac.uk/cpdmboinc_alpha/">http://vorvadoss.oerc.ox.ac.uk/cpdmboinc_alpha/</a></td>
<td>Andy's last 10: Testing Milo's portal with the corrected output template, using the same workunit that had been tested using the command line</td>
<td>2013-06-18 13:35:31</td>
<td>View</td>
</tr>
<tr>
<td>244</td>
<td>3</td>
<td>test_input_andb_4.xml</td>
<td><a href="http://vorvadoss.oerc.ox.ac.uk/cpdmboinc_alpha/">http://vorvadoss.oerc.ox.ac.uk/cpdmboinc_alpha/</a></td>
<td>Portal demo: Showing off how awesome this system is</td>
<td>2013-06-20 09:49:18</td>
<td>View</td>
</tr>
</tbody>
</table>

[Portal – View submissions](http://portal.vorvadoss/requests)
Portal – View all uploaded files
Future plans with the workunit submission portal

- Include the ability to automatically report back on progress of workunits to the submitter
- Include the ability to actively manage workunits
- Require all groups of workunits submitted to the main site to be linked to successful test groups
Ongoing and future work in CPDN

- We are currently working on **upgrading** the version of BOINC used by the project **to version 7**

- We have a number of upcoming new applications:
  
  - **Weather At Home South Asia region** application -> to study the climate over the Indian subcontinent in detail -> the development of this application is in progress
  
  - **Weather At Home Africa region** application -> to study the climate over Africa in detail looking at changes in the likelihood of extreme weather events in Africa -> development of the application is in progress
  
  - Changed backend servers -> now running 50% on VMs
New climateprediction.net website

Join the world’s largest climate experiment

Evidence of how our climate is changing is vital to encourage investment in reducing greenhouse gas emissions, as well as coping with inevitable change.

You can help discover how the climate could look by running our free software on your computer.

climateprediction.net
the world’s largest climate forecasting experiment for the 21st century
BOINC wish list

Wish list:

- Functionality to enable moderators of the forum to be identified as a distinct team, perhaps by a special user flag, this would enable them to communicate privately between each other, whilst still being able to be members of other teams
Thanks!

And lastly...

The work of climateprediction.net is not possible without the participation of volunteers, thank you to all our volunteers!