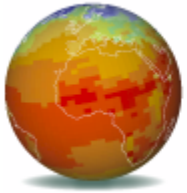
Latest developments in climate*prediction*.net

Andy Bowery

BOINC Workshop Grenoble 2013



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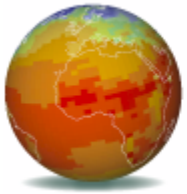
Overview of talk

- Introduction to climate*prediction*.net
- Remote workunit submission
- Ongoing work
- New website



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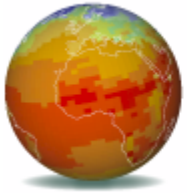
Introduction to climate*prediction*.net

- climate*prediction*.net has recently passed the 10 year milestone
- climate*prediction*.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 climate*prediction*.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



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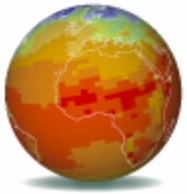
What do we study in climate*prediction*.net?

- 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



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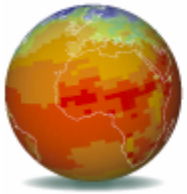
Why do we use BOINC?

- 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



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Current applications in climate*prediction*.net

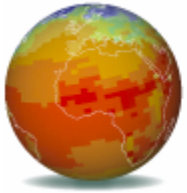
- We currently have three applications that are being used for studies, all use computational models developed at Hadley Centre in the UK Meteorological Office:

- 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



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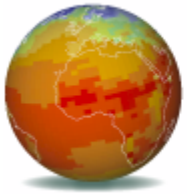
Workunit Submission

- Collaborators in the climate*prediction*.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



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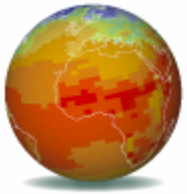
Remote Workunit Submission

- 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



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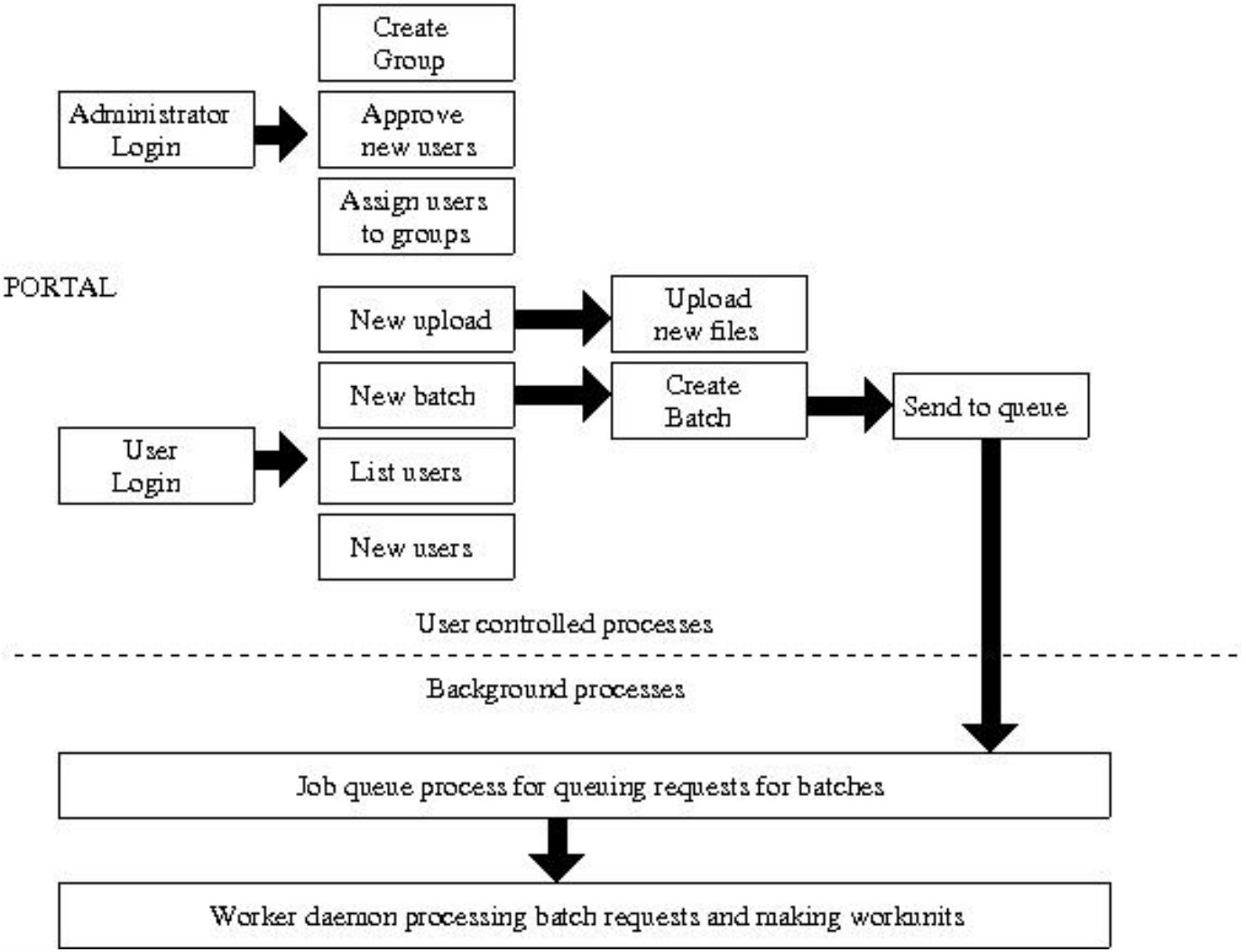
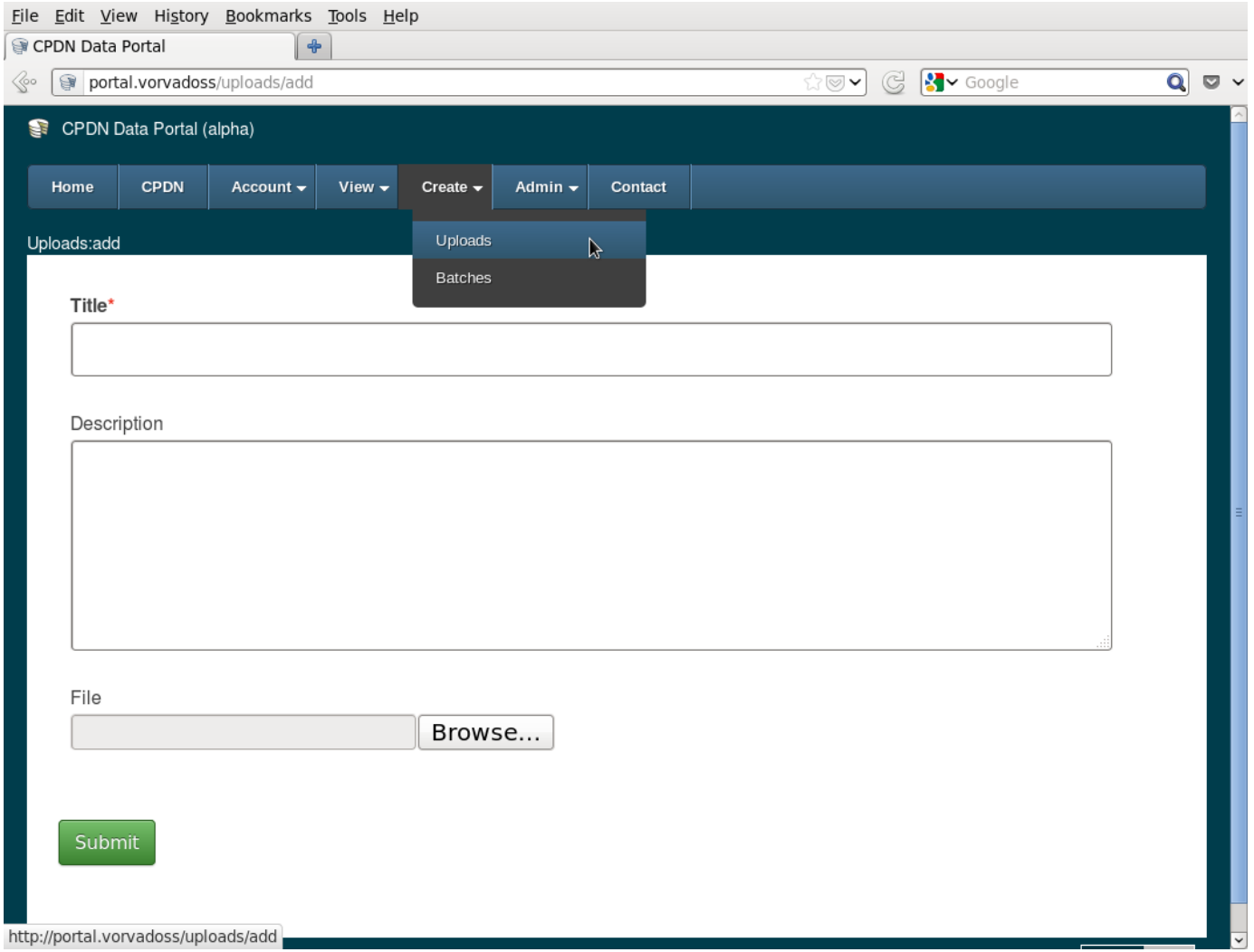
Portal - Workflow



Portal – Upload submission files



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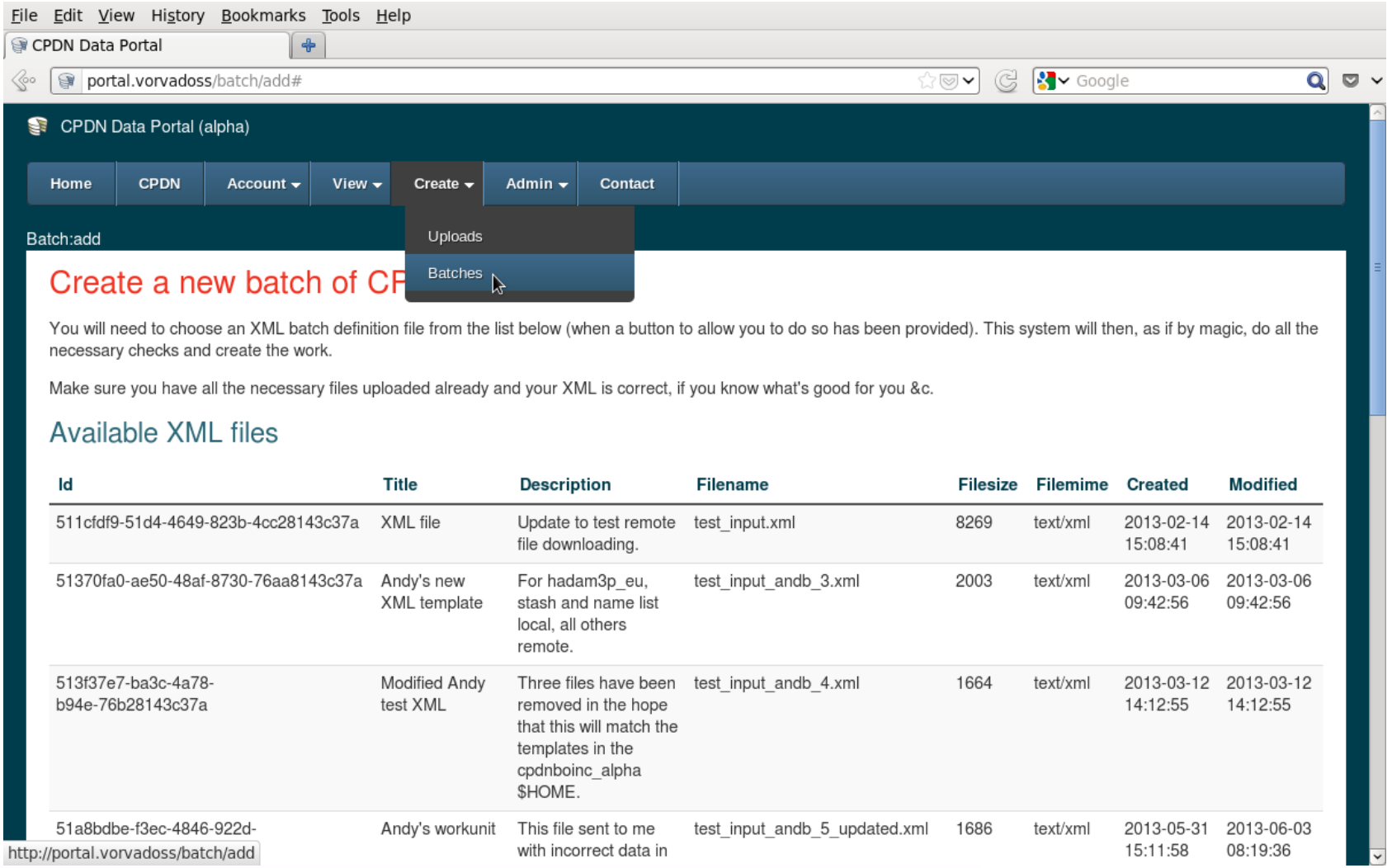
Portal – Submit group of new WUs



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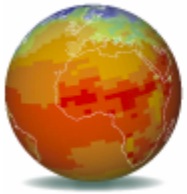
511cfdf9-51d4-4649-823b-4cc28143c37a	XML file	Update to test remote file downloading.	test_input.xml	8269	text/xml	2013-02-14 15:08:41	2013-02-14 15:08:41
51370fa0-ae50-48af-8730-76aa8143c37a	Andy's new XML template	For hadam3p_eu, stash and name list local, all others remote.	test_input_andb_3.xml	2003	text/xml	2013-03-06 09:42:56	2013-03-06 09:42:56
513f37e7-ba3c-4a78-b94e-76b28143c37a	Modified Andy test XML	Three files have been removed in the hope that this will match the templates in the cpdnboinc_alpha $HOME.	test_input_andb_4.xml	1664	text/xml	2013-03-12 14:12:55	2013-03-12 14:12:55
51a8bdbe-f3ec-4846-922d-	Andy's workunit	This file sent to me with incorrect data in	test_input_andb_5_updated.xml	1686	text/xml	2013-05-31 15:11:58	2013-06-03 08:19:36



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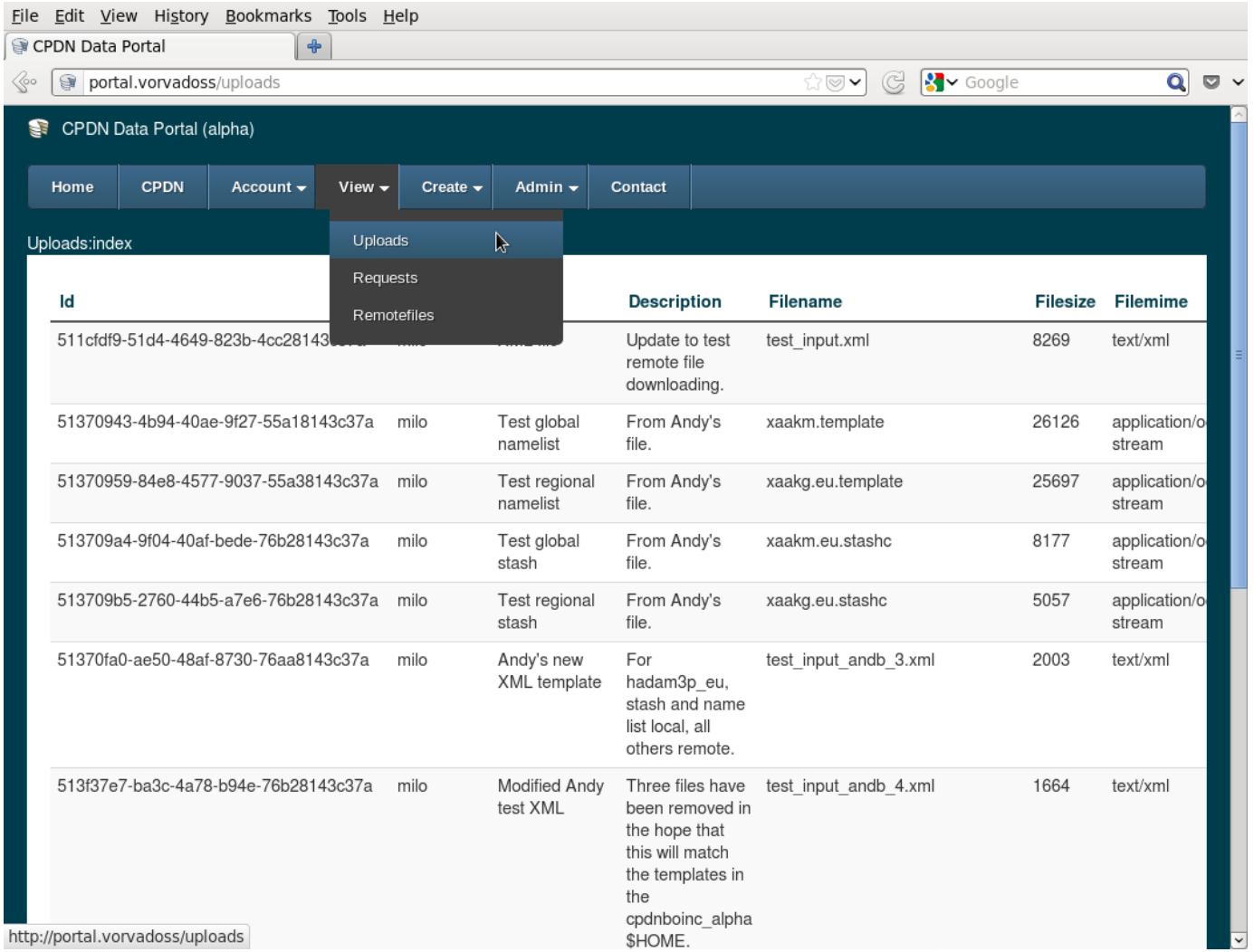
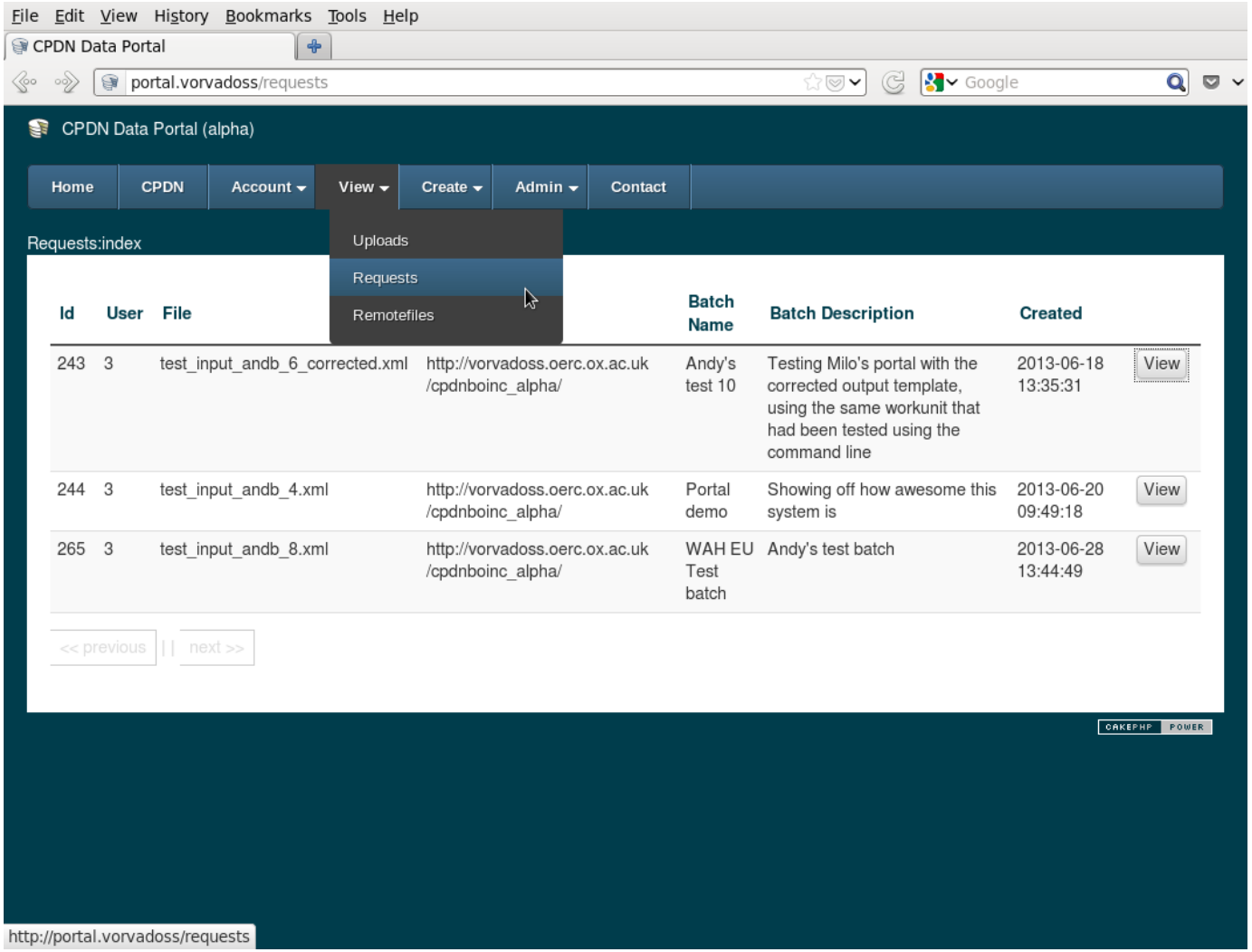
Portal – List all files uploaded



Portal – View submissions



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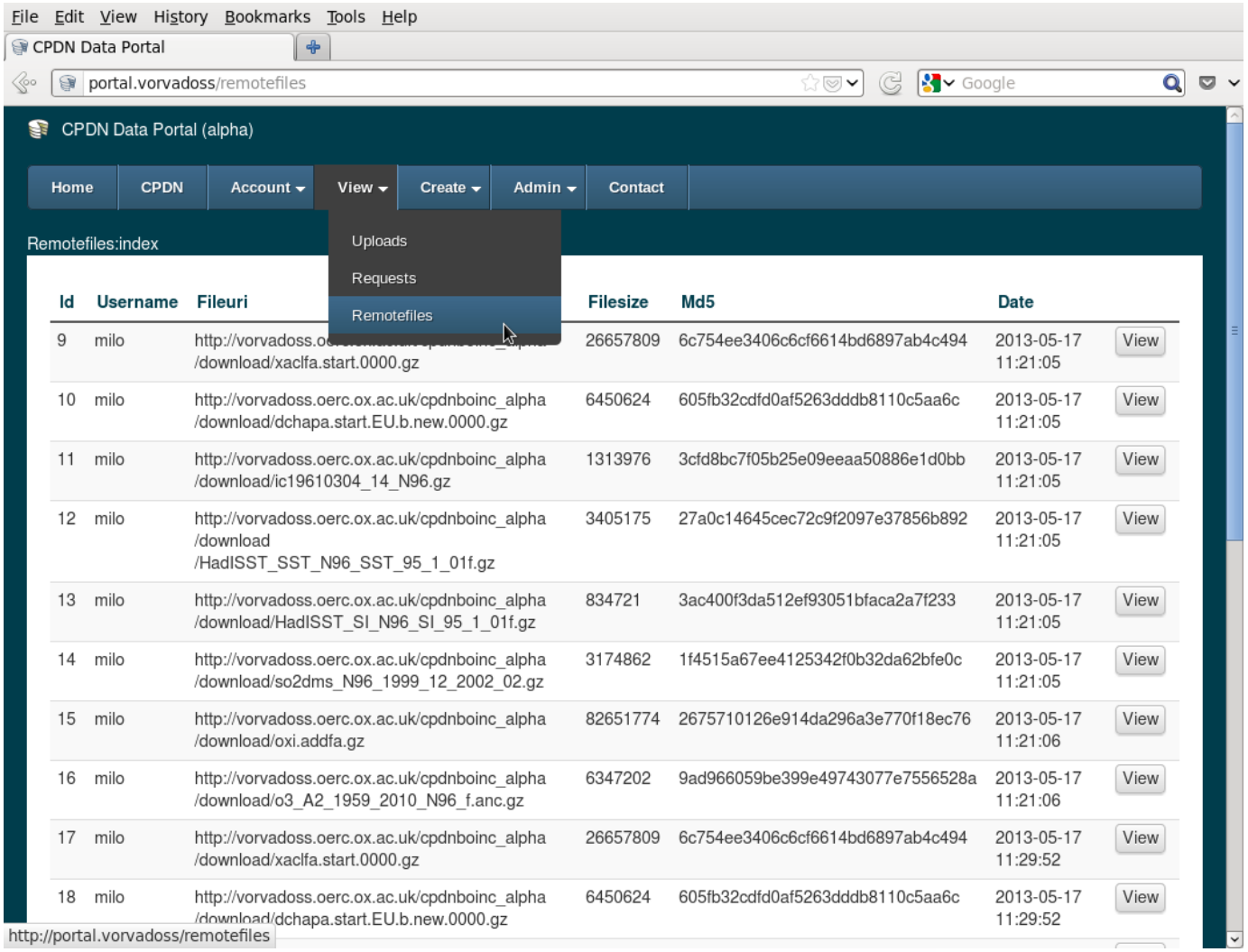
Portal – View all uploaded files



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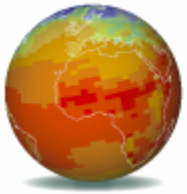
Future plans with the workunit submission portal

- 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



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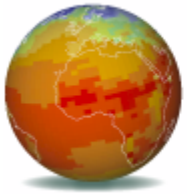
Ongoing and future work in CPDN

- 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



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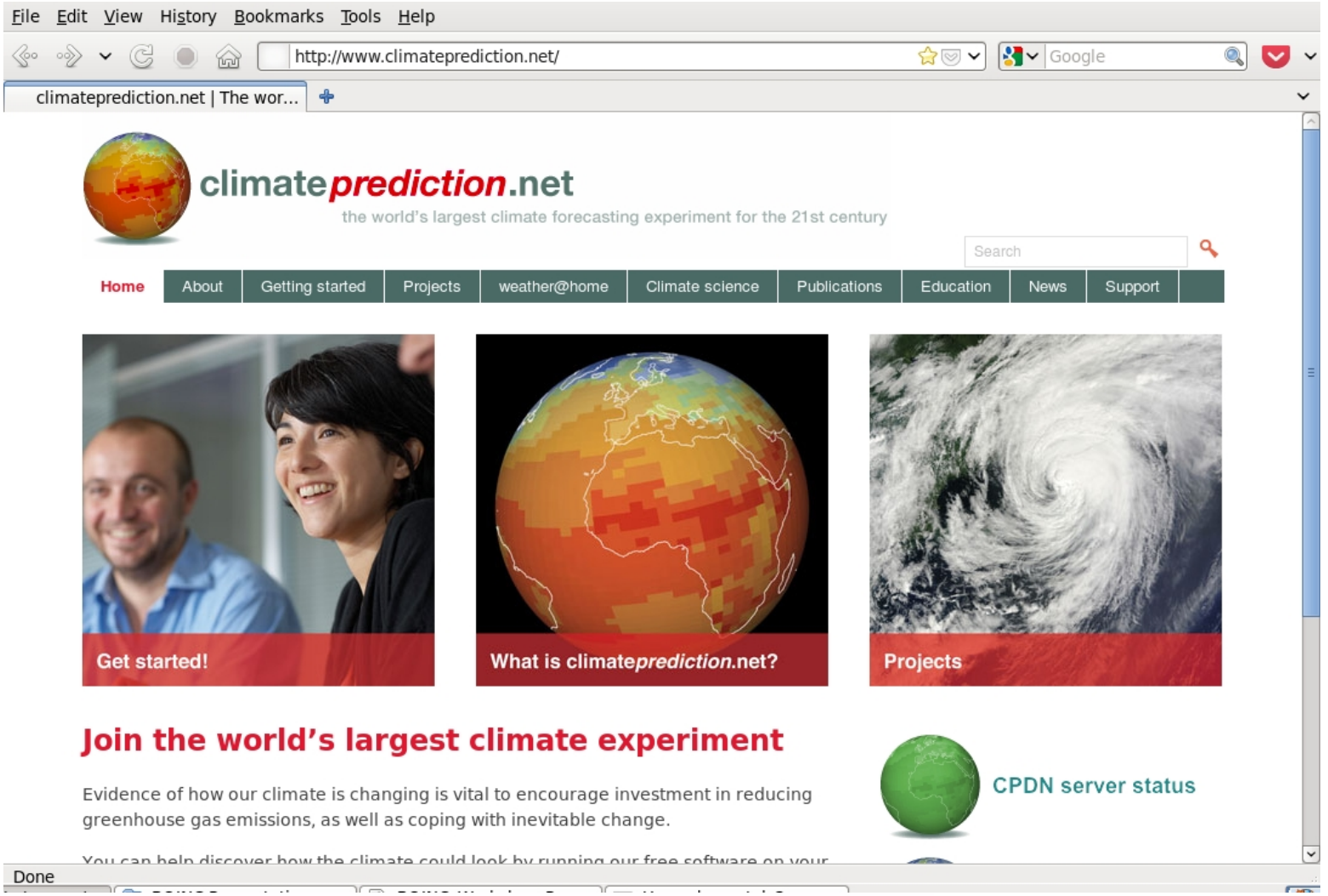
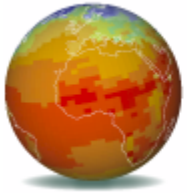
New climate*prediction*.net website



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**



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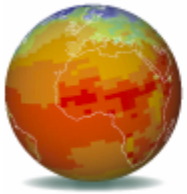
Thanks!

And lastly...

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



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