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WRF4SG: A Scientific Gateway for climate experiment workflows

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The Weather Research and Forecasting model (WRF) is a community-driven and public domain model widely used by the weather and climate communities. As opposite to other application-oriented models, WRF provides a flexible and computationally-efficient framework which allows solving a variety of problems for different time-scales, from weather forecast to climate change projection. Furthermore, WRF is also widely used as a research tool in modeling physics, dynamics, and data assimilation by the research community.

Climate experiment workflows based on Weather Research and Forecasting (WRF) are nowadays among the one of the most cutting-edge applications. These workflows are complex due to both large storage and the huge number of simulations executed. In order to manage that, we have developed a scientific gateway (SG) called WRF for Scientific Gateway (WRF4SG) based on WS-PGRADE/gUSE and WRF4G frameworks to ease achieve WRF users needs (see [1] and [2]).

WRF4SG provides services for different use cases that describe the different interactions between WRF users and the WRF4SG interface in order to show how to run a climate experiment. As WS-PGRADE/gUSE uses portlets (see [1]) to interact with users, its portlets will support these use cases. A typical experiment to be carried on by a WRF user will consist on a high-resolution regional re-forecast. These re-forecasts are common experiments used as input data form wind power energy and natural hazards (wind and precipitation fields). In the cases below, the user is able to access to different resources such as Grid due to the fact that WRF needs a huge amount of computing resources in order to generate useful simulations:

* Resource configuration and user authentication: The first step is to authenticate on users' Grid resources by virtual organizations. After login, the user is able to select which virtual organization is going to be used by the experiment.

* Data assimilation: In order to assimilate the data sources, the user has to select them browsing through LFC Portlet.
* Design Experiment workflow: In order to configure the experiment, the user will define the type of experiment (i.e. re-forecast), and its attributes to simulate. In this case the main attributes are: the field of interest (wind, precipitation, ...), the start and end date simulation and the requirements of the experiment.
* Monitor workflow: In order to monitor the experiment the user will receive notification messages based on events and also the gateway will display the progress of the experiment.
* Data storage: Like Data assimilation case, the user is able to browse and view the output data simulations using LFC Portlet.

The objectives of WRF4SG can be described by considering two goals. The first goal is to show how WRF4SG facilitates to execute, monitor and manage climate workflows based on the WRF4G framework. And the second goal of WRF4SG is to help WRF users to execute their experiment workflows concurrently using heterogeneous computing resources such as HPC and Grid.

[1] Kacsuk, P.: P-GRADE portal family for grid infrastructures. Concurrency and Computation: Practice and Experience. 23, 235-245 (2011).

[2] http://www.meteo.unican.es/software/wrf4g