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Coupled climate models on Grids

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A climate system model consists of four loosely inter-connected sub-components for atmosphere, ocean land surface and sea-ice. The computational requirements of a climate system model is much larger than the running of an individual component. A computational grid based system offers the benefits of more number and types of parallel resources and hence more computational power than available in a local organization. Progress of an application on a grid system is not entirely dependent on the administration policies, resource loads and resource availabilities associated with a single parallel system of a single site.

We use the Community Climate System Version 3 (CCSM3). In the current practice, all the model components of CSSM are executed on a single parallel installation. The progress of a CCSM execution depends on the availability of the resources of the parallel machine in the installation for execution of all the models. Thus the current mode of usage and executions of CCSM do not entirely leverage the presence of almost disjoint and independent model components.

It is more natural and beneficial to execute coupled climate models like CCSM on a Grid system where different model components are executed on different sets of Grid resources. Load scheduling and migration of loads across the grid in case of failure of one of the sites is one of the challenging problems. The following research challenges are being currently addressed and for which initial results will be presented:

1. Modification of CCSM code such that different components of the model can execute on different sets of parallel resources on the Grid.

2. Optimal assignment of different components of the climate model to the different available resources of the Grid based on various resource and network parameters. This involves choosing the set of resources for execution of the coupler such that the resources will have maximum connectivity to the other resources on which the other

models will be executed

3. Dynamic rescheduling and migration of components as resource conditions in Grid change. This involves distributed checkpointing mechanisms, formulating eff-cient rescheduling and migrating policies/decisions, discovery and notification of new locations of migrated components to other components etc.