

**CCSM Coupler Project Plan**  
Version 6, the “Next Generation” Coupler

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## 1 Synopsis

The primary function of the CCSM coupler is to coordinate the execution of, and interactions between, the various component models which comprise a single configuration of the CCSM. Critical functionality in the coupler includes synchronization of the time integration of the coupled system, managing inter-model data communication, conservatively mapping data between the various model grids, and computing certain interfacial fluxes between components. The coupler must perform these functions whenever and wherever performance, software engineering, or scientific requirements dictate. The design and implementation of CCSM coupler version 6, the "next generation" coupler, will represent significant advances over previous coupler implementations, in particular, the CCSM and PCM couplers.

The primary motivations for creating a new coupler are (1) to create a single coupler that will replace the existing PCM and CCSM couplers, thus unifying the PCM and CCSM modeling efforts, and (2) to support the creation of a performance-portable CCSM, one which can execute efficiently on a range of platforms, in a variety of configurations. Thus, the coupler requirements should clearly address the goal of delivering performance portability across scalable parallel supercomputers, commodity clusters, shared memory multiprocessors, and vector supercomputers.

Continuing the naming sequence familiar to the CCSM community, this coupler is called "cpl6", or "the CCSM coupler, version six." Among developers, cpl6 is also known as the "next generation coupler" or "ngc."

## 2 Development Plan

Coupler development will proceed on two tracks. The first, which has a shorter term focus, will deliver the CCSM coupler version 5. This involves a DOE/NCAR team optimizing the existing CCSM coupler (version 4) as needed to support the performance requirements for a 2001 release of a CCSM2.0 coupled system. The desired overall throughput is 5 years/day as a minimum with 10 years/day preferred.

The second, longer term track, the DOE/NCAR team will design and implement a next generation coupler, CCSM coupler version 6. A version 6 coupler that functions sufficiently to replace the version 5 coupler will be available by the end of 2001. The DOE/NCAR team will collaborate with an Earth System Modeling Framework (ESMF) initiative as appropriate.

The version 6 CCSM coupler is intended to have the following properties:

- Support for both sequential and distributed execution, as well as hybrid configurations in which some components are stacked on the same nodes
- High-performance, scalable, parallel implementation of performance-sensitive regridding and communication operations to enable CCSM execution on greater numbers of processors

- Support for standalone execution of individual component models with the coupler being used to manage boundary condition input from files

The DOE/NCAR effort is scheduled for completion at about the same time that the ESMF team is finishing up its requirements and design phase. Ideally the DOE/NCAR effort will accelerate the design and implementation of the ESMF coupling strategy, providing an early prototype that meets many of the requirements of the ESMF. To effect this coordination, key members of the coupler team will participate in ESMF design activities.