

Common Infrastructure for Modeling Earth (CIME) and MOM6

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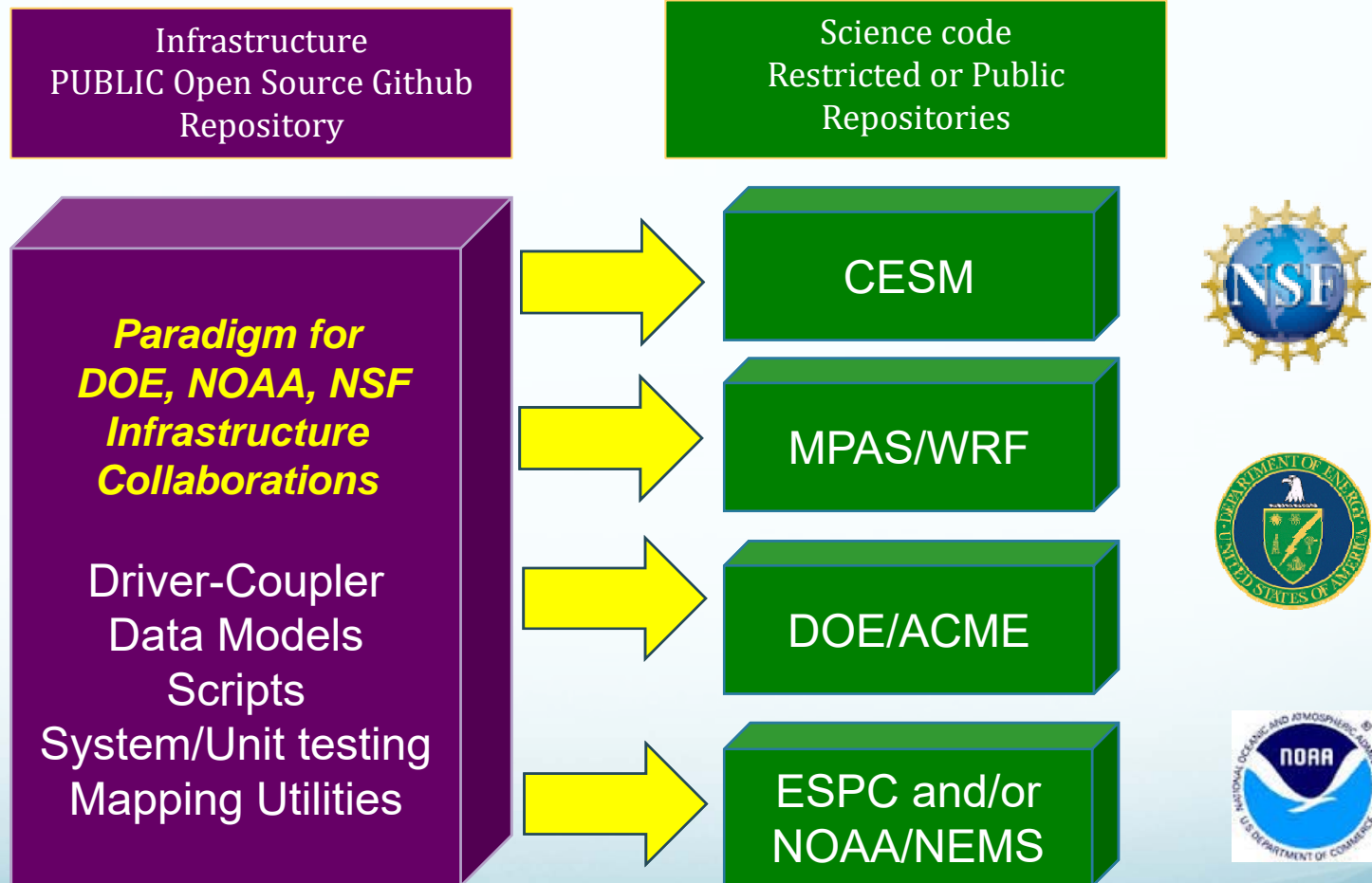


Outline

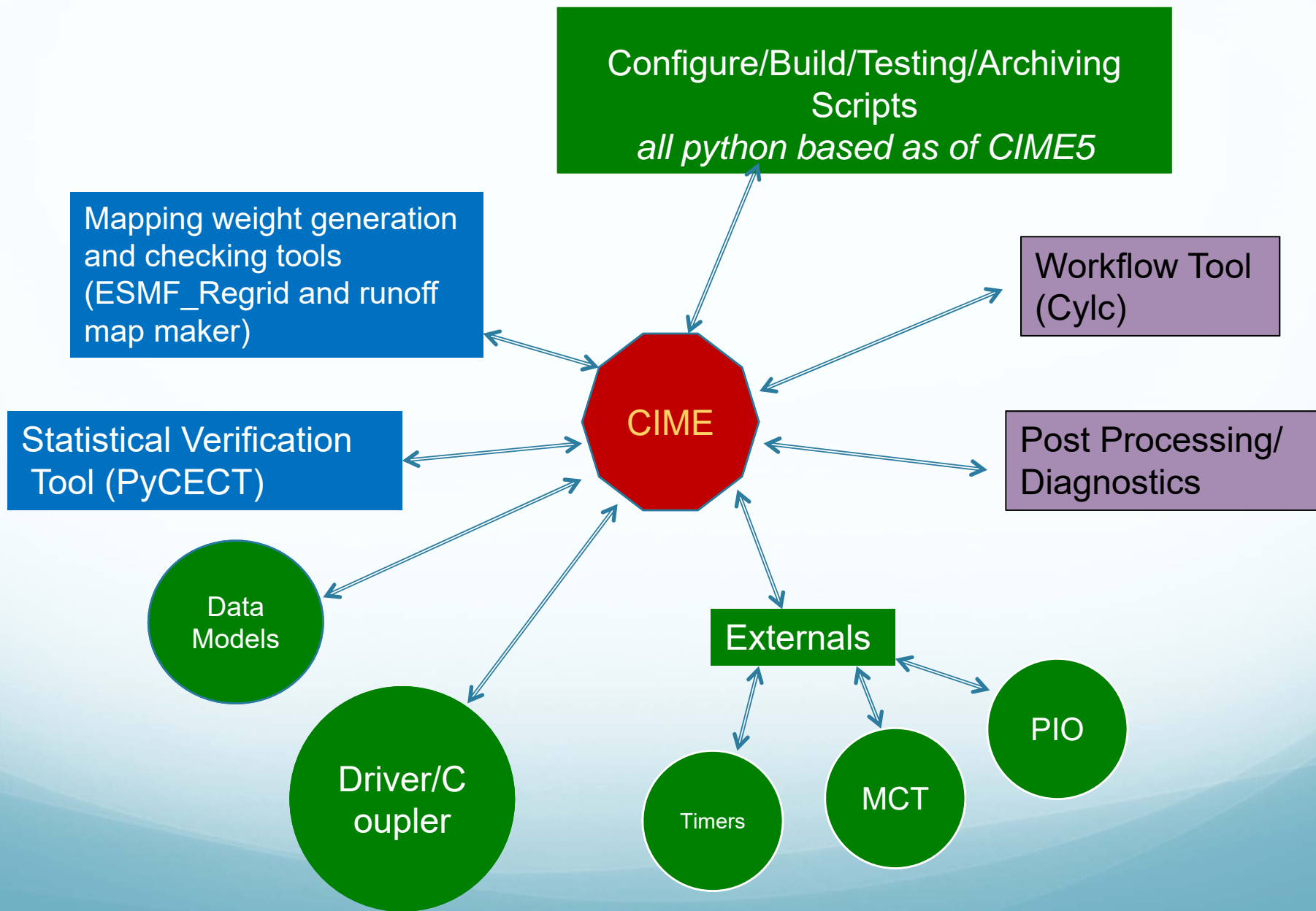
- What is CIME?
- New CIME coupling infrastructure and MOM6
- CESM2/DART Data Assimilation
- Next Steps in CIME/CESM development

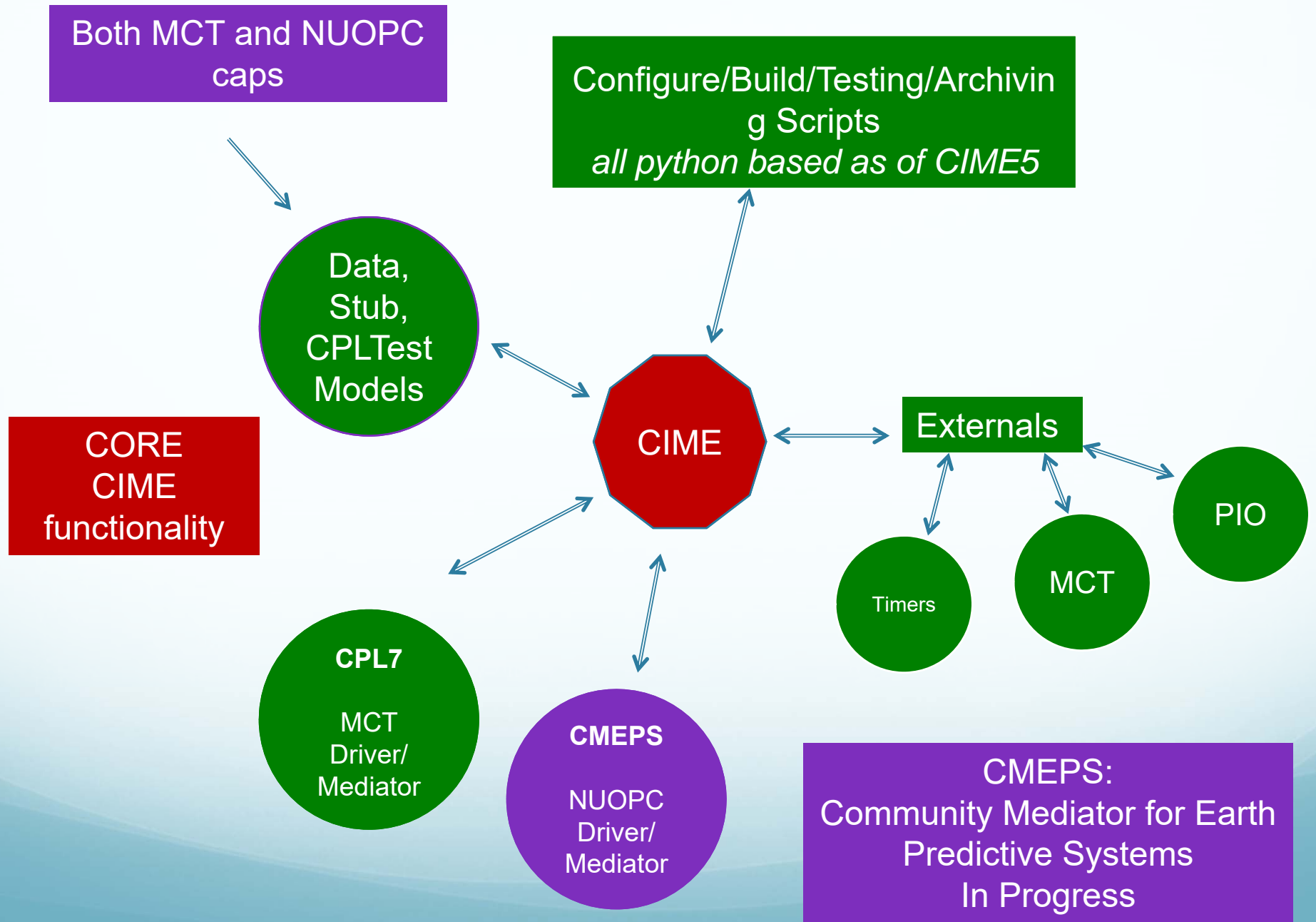
CIME

(new python-based CESM infrastructure)



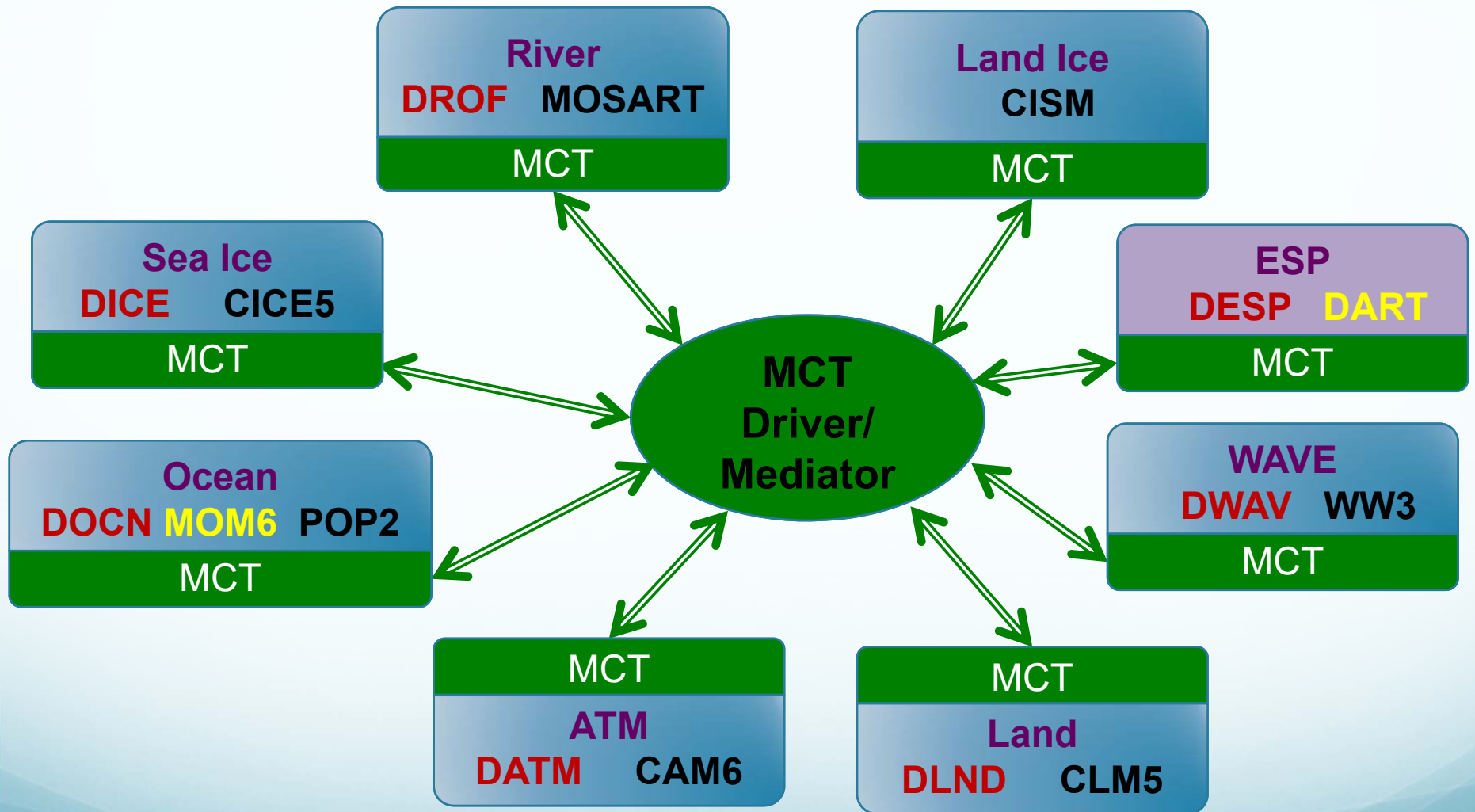
addresses needs of multiple efforts





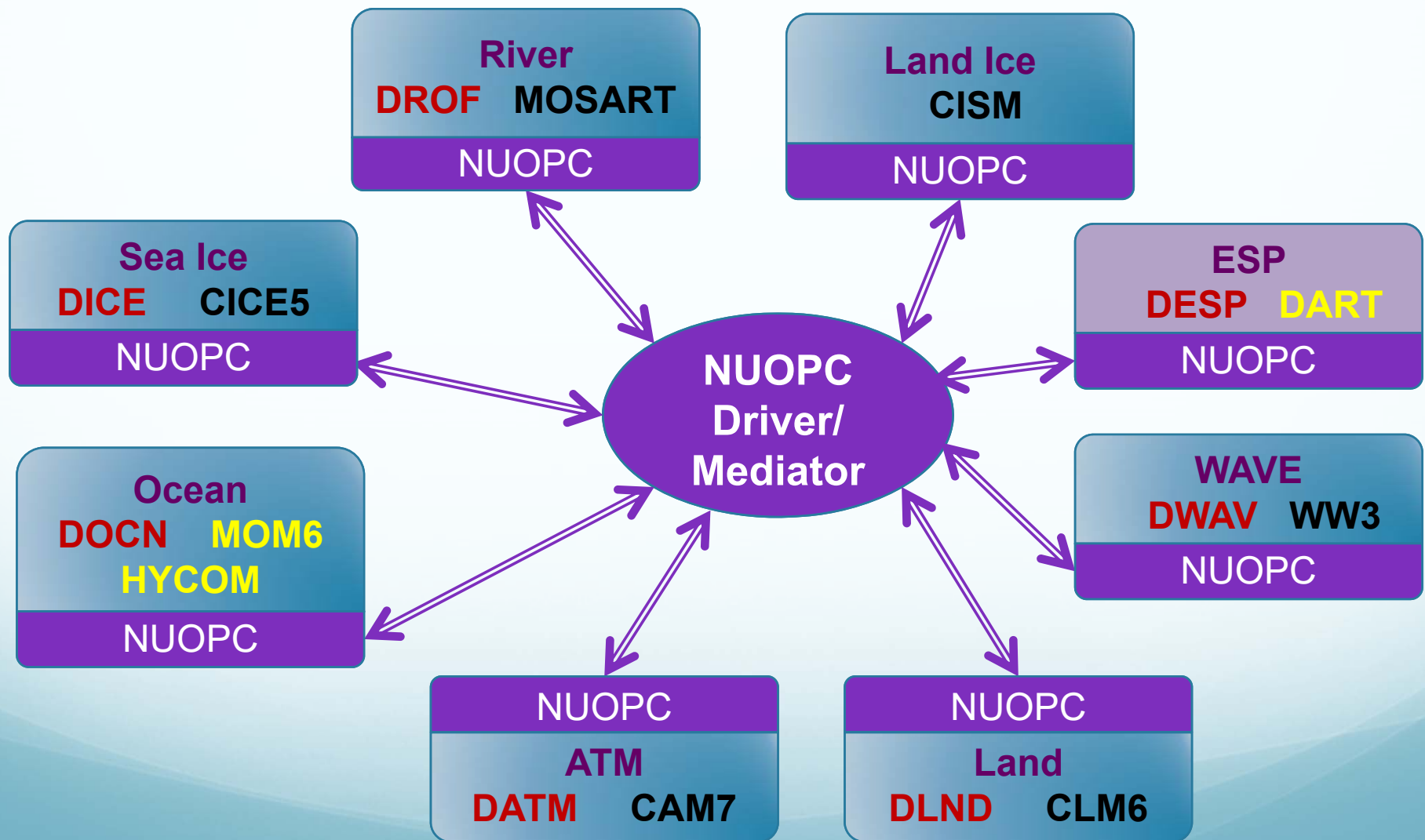
CIME – New Coupling Infrastructure and MOM6

Current CESM Coupling (cpl7) – data components permit flexible activation/deactivation of feedbacks



Short term – MOM6 will be made CPL7 compatible – HOWEVER – CESM is moving to a new ESMF NUOPC Driver/Mediator

Moving Forwards: New NUOPC Driver/Mediator will enable community collaboration with NGGPS



Advantages of NUOPC Infrastructure

- Data-driven run-time configurable sequencing of driver phases
 - currently this is all hard-coded and fragile
- Run-time generation of mapping weights
 - Eliminates need to compute AND maintain growing number of mapping files generated offline
- Support of ESMF/NUOPC
 - The ESMF group is committed to supporting the needs of CESM as this infrastructure is implemented and deployed

CMEPS

Community Mediator for Earth Predictive Systems

- An alternative inter-component coupling infrastructure **in CIME**
- Based on the NOAA Environmental Modeling Center (NEMS) mediator.
- Goals:
 - have CMEPS v0 replicate the current CPL7 functionality
 - have all CESM components be CMEPS v0 compliant by year's end.
- Status: have a version working with CIME data and cpl-test components and CIME testing infrastructure
 - Thanks to Tony Craig and lots of partnership from the ESMF group

Possible new CMEPS collaborations

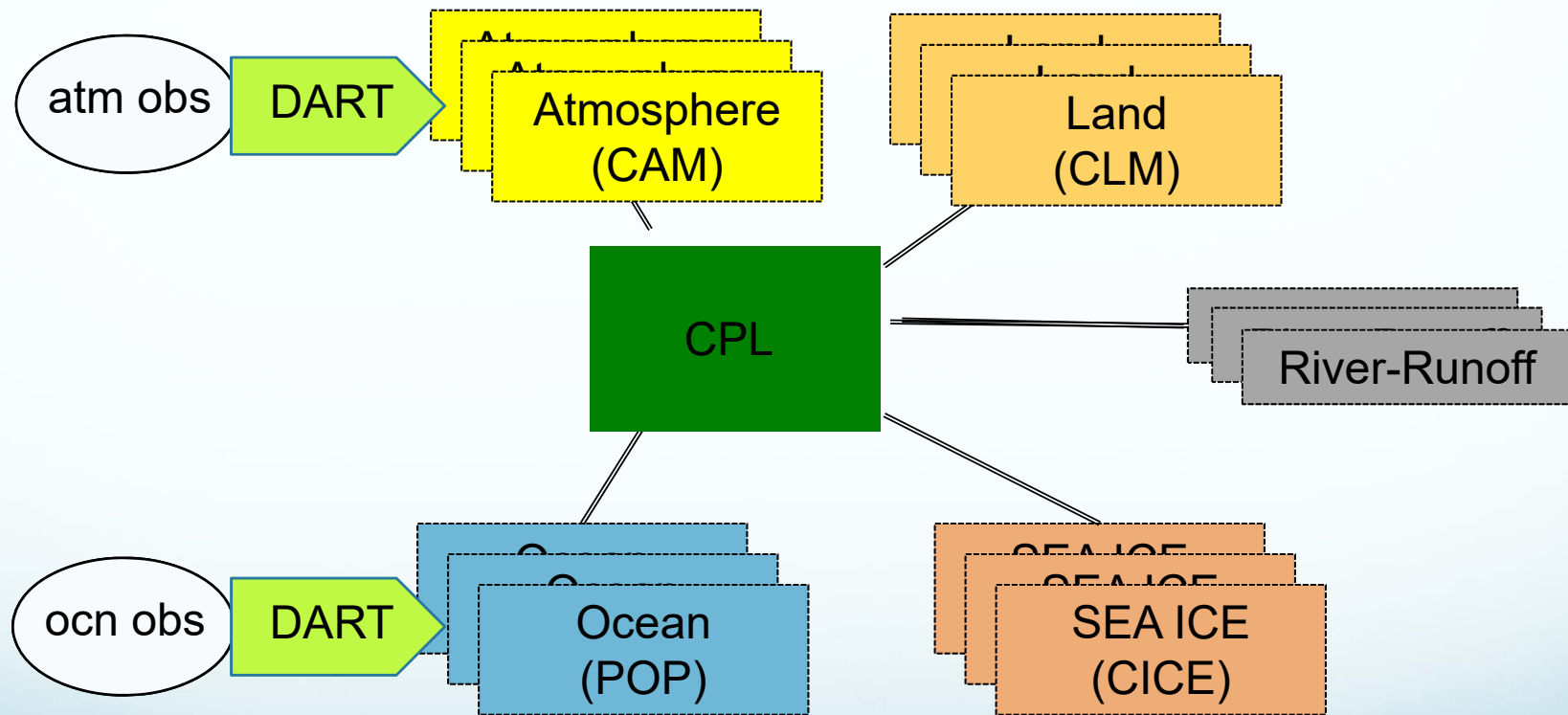
- NOAA EMC:
 - CMEPS could be run at NOAA EMC as a possible replacement for the NEMS mediator since it is so closely based on the NEMS mediator.
- GFDL:
 - Weekly calls started with ESMF and GFDL to explore collaborating on a common CMEPS mediator
- Increasing collaborating with NOAA research and operations was a recommendation from NCAR NSF SVT.

Coupling Infrastructure and CESM/DART Data Assimilation

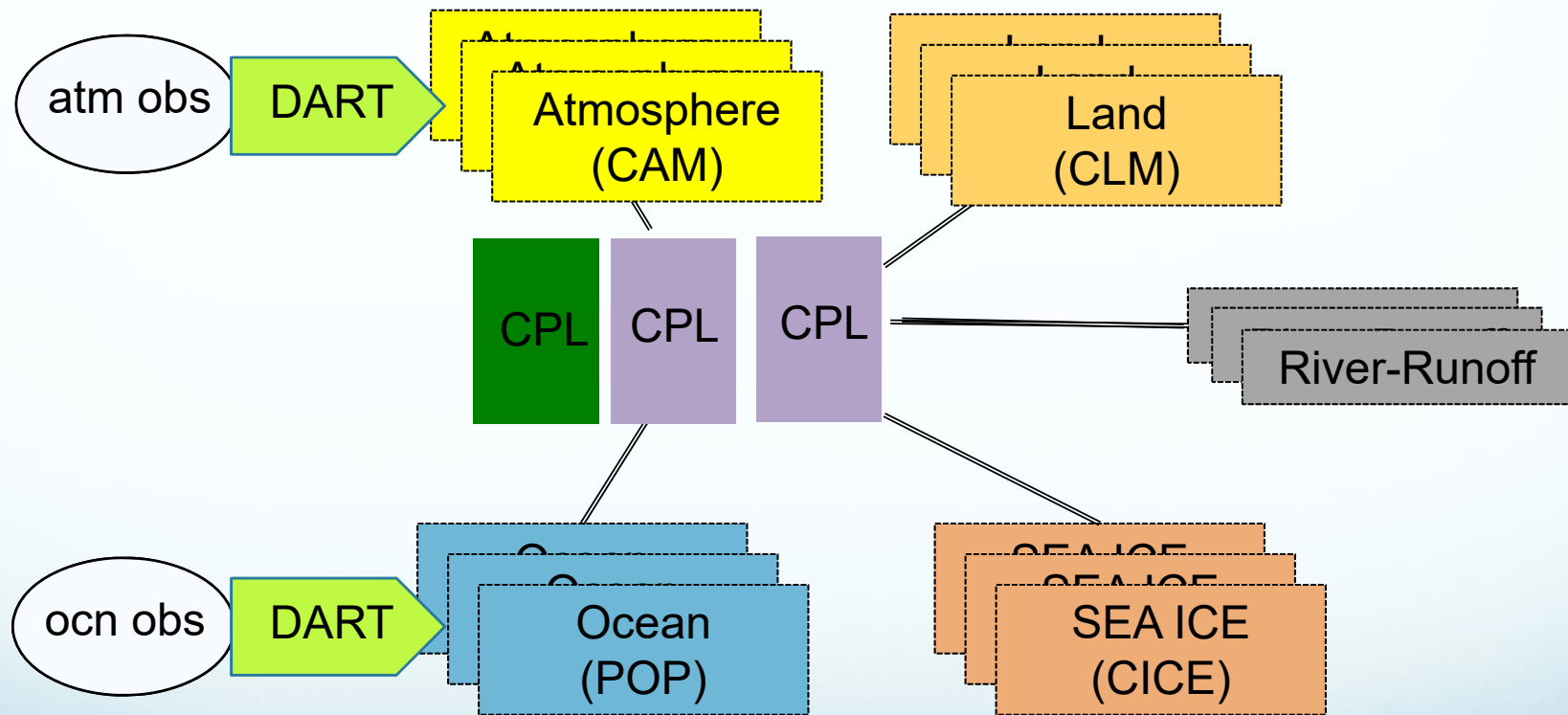
Data Assimilation in CESM

- CESM uses the DART ensemble Kalman Filter for file-based data assimilation.
- Requires CESM to run multiple-instance simulations.
- **Two big performance bottlenecks:**
 1. Only *one* coupler instance versus *multiple* component instances.
 2. CESM and DART are run as separate executables, system must start and stop for each assimilation cycle.

Current DART/CESM architecture

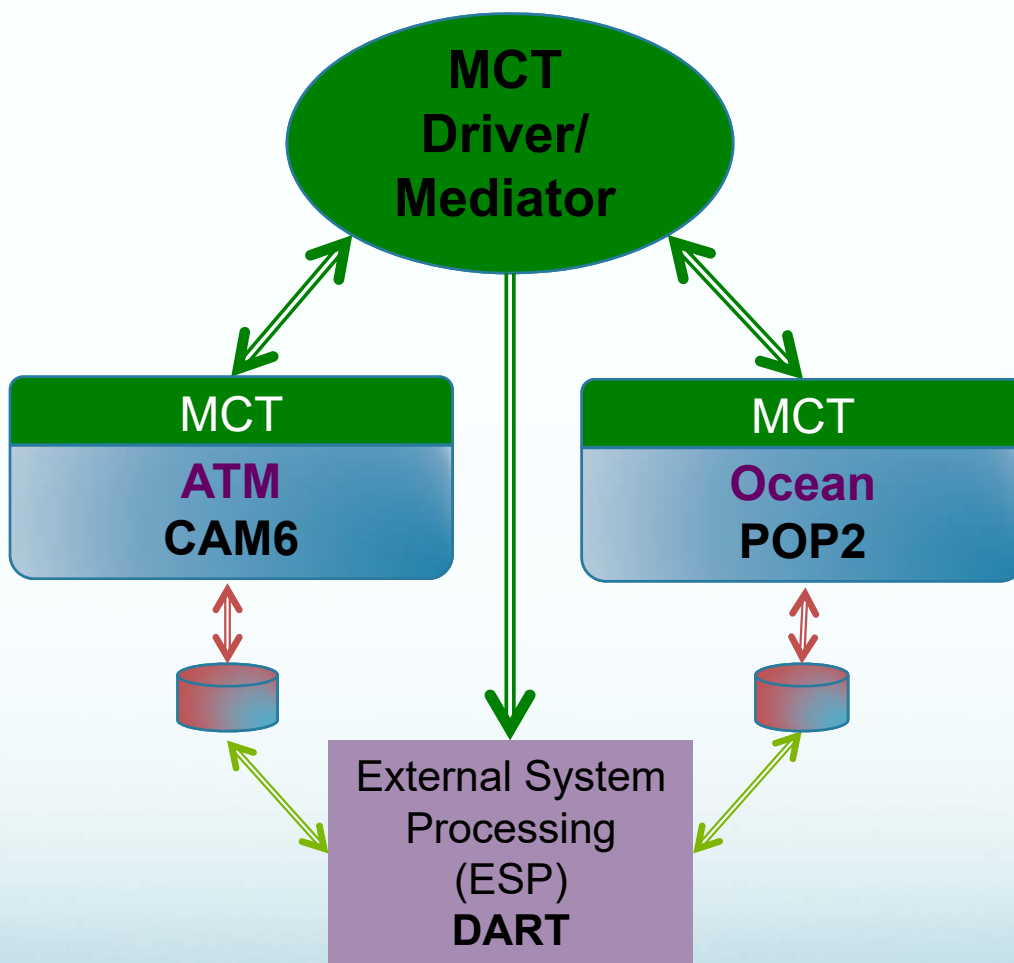


Solution to Bottleneck 1: Multiple couplers (imminent)



Multi-coupler functionality created by Raffaella Montuoro (NOAA/ESMF)

Solution to Bottleneck 2:
New ESP component allows DART to interact directly with
component data via I/O files



External tools can easily interact with CESM during simulation

New ESP component will facilitate coupling with data assimilation

- Status

- New data ESP component introduced in CIME
- Pause/Resume has been implemented in coupler and POP

- Next Steps

- DART will be a prognostic ESP component of CESM coupled system
- Other CESM components will implement Pause/Resume (CAM is next)

- Future enhancements

- Pause/Resume can also be extended to Pause/Rewind – to explore new approaches to fault tolerance
- Implement in-memory communication between DART and CESM

New ESP component created by Steve Goldhaber (NCAR)

Next Steps for CESM/CIME development

Next Steps in CIME/CESM development

- **Move all CESM prognostic components to github!**
- Create CMEPS v0 NUOPC driver/mediator in CIME that duplicates the functionality of the current CESM cpl7 MCT driver/mediator
- Incorporate DART as an ESP component and pause/resume functionality in the CESM system

Thank you!

Questions?