Strategic Implementation Plan (SIP) for a Community-based Unified Forecast System

System Architecture Working Group

Presented by
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System Architecture WG
Membership

• Jim Kinter (GMU/COLA)**
• Cecelia DeLuca (CIRES/ESRL)**
• Tom Auligne (JCSDA)
• V. Balaji (Princeton University)
• Rusty Benson (NOAA GFDL)
• Ligia Bernardet (NOAA ESRL)
• Arun Chawla (NOAA NCEP)
• Philip Chu (NOAA GLERL)
• Tony Craig (NOAA NESII)
• Arlindo da Silva (NASA GSFC)
• Jim Doyle (NRL)
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• Co-Chair **

• Tara Jensen (NCAR)
• Jean-Francois Lamarque (NCAR)
• John Michalakes (UCAR/CPAESS)
• Tanya Peevey (CIRES)
• Phil Rasch (DOE PNNL)
• Suranjana Saha (NOAA NCEP)
• Vijay Tallapragada (NOAA NCEP)
• Gerhard Theurich (ESMF/NRL)
• Sam Trahan (NOAA NCEP)
• Mariana Vertenstein (NCAR)
• Jun Wang (NOAA NCEP)
System Architecture WG
Project Milestone Accomplishments

• **SIP project accomplishments to date:**
  - Provided coupling infrastructure and user support for UFS coupled apps and FV3GFS
  - Released ESMF (v7.1.0r) with capabilities needed for FV3GFS release, both in March 2018
  - Validated the Community Mediator for Earth Prediction Systems (CMEPS) in the CESM and released the result in a user-friendly workflow in June 2018, UFS integration with CMEPS in progress
  - Promoted communication and collaboration between the research community (NCAR, GFDL, GSD, …) and NCEP on coupled apps, for example through sharing MOM6 and CICE5 ESMF/NUOPC component “caps”

• **SIP project challenges:**
  - Ensuring compatible and efficient operation of the various parts of UFS, including component interface, physics interface, and DA interface
  - Establishing the graduate student test as a key metric and organizing principle
• **GST Activities** – How well can first-year or advanced graduate students reach various milestones?
  – *Get code.* Easily distinguish between versions of code (capabilities, readiness, limitations); easily identify which code to get and which options are available.
  – *Run code.* Easily execute workflow (script) for given experimental setup. Understand and access setups with active and passive (data) components and cold-start or DA-cycling runs. Easily access and run code on systems available to the public.
  – *Change code for research experimentation.* Either parameterizations, components (models), or coupling strategies.
  – *Evaluate code.* Easily obtain and use standard diagnostics of general behavior and individual processes. Easily interact with output data for post-analysis.

• **Metrics:**
  – Time to solution
  – Number of contacts needed
  – Qualitative ease-of-attainment

• **Transition** - Develop a clear pathway for transition from research to operations, accounting for evolving nature of public release and operational codes. Requires input from the Steering Committee.

• **Training needed** - Course or mini-curriculum, possibly online, on using codes and workflows associated with ESMF/NUOPC/CIME/CMEPS suite.
CMEPS Coupled Prototypes

- CMEPS: community (shared NCAR, NOAA) coupler based on NEMS mediator
  - CESM CMEPS milestone delivered 6/2018
  - UFS CMEPS milestone scheduled 9/2018

Hierarchical Model Development (HMD)

- Available through a github “umbrella” repository
- Supported by established community workflow (CIME)
- Data components available
- Data inputs included in workflow
- Verification included in workflow

Graduate Student Test (GST)

- Easy to get code
- Easy to port and run code
- Change configuration
- Verify correct operation
Successes

- Global Model Suites and Marine – provided coupling framework and support for coupled systems including FV3GFS-MOM6-CICE5, FV3GFS-wave
- Aerosols and Atm Comp WG – provided coupling framework and support for FV3GFS-Chem system, working on FV3GFS-CMAQ (air quality)
- Infrastructure (Repo) WG – coordinated on proposed repository strategy
- Dynamics and Nesting WG – provided coupling framework and support for atm-space weather application, coordinated on Hurricane Supplemental planning for nested systems

Open Issues:

- Land and Physics WGs – coordination on a flexible implementation strategy for land surface (inline or component)
- DA WG – coordination on design strategies for efficient implementation and coupled DA
- Infrastructure (Workflow/Data) WG – just getting started, critical for ease of use and satisfying the graduate student test
- UFS-SC, Infrastructure WG, others – R2O transition