Key outcomes from the Model Architecture and Numerics Working Group

Working groups needed

Two related groups:
1. A **user experience** working group dedicated to ensuring **portability**, checking configuration compatibility, ensuring clear reporting of performance - including infrastructure overhead - and user support - for the **entire community.**. Includes **documentation on model use**. Need to encourage user input - even if that sometimes compromises ideal architecture
2. An **infrastructure** working group focused on infrastructure-specific questions: efficiency, data structures, propagating uncertainty through the infrastructure, identifying process jurisdiction. Includes **documentation on interfaces and component construction**. More code focused. Ensuring that modularization does not compromise science.

General note: for these WGs in particular, need to recruit WG members who reflect the full range of applications. Key examples: scales, usage (operational vs research vs forecasting, low-resource vs HPC, cloud vs supercomputers vs workstations)

General note: WGs need some permanent structure, and need higher-level governance across WGs.

Priorities

1. Both: encouraging user engagement and contribution - want a **community model**. Governance needs to reflect this!
2. User experience:
   - Ensuring ease of installation and use - probing possibilities such as spack for model installation, KOKOS for multi-platform parallelization. Generally: can we leverage work being done in other communities to ease installation and improve the UX?
   - Ensure full range of user community can install, run, and develop the model - not just those in the WG
3. Infrastructure:

- Need to establish an **evaluation infrastructure in concern with the model evaluation WG**. Infrastucture and UX WGs will need to benchmark model vs model
- Output should be done through the coupler - avoiding dumping out entire model state to disk, enabling runtime inspection of variables. Also desirable to have output which is at a different resolution than the model, e.g. coarse stratospheric circulation
- How is infrastructure preventing science? E.g. parallel resolutions, parallel chemistries, sub-grid variability, uncertainty propagation, data assimilation (can model run backwards); missing: non-hydrostatic, 1 km grids, non-column physics
- Codifying how data flows and can be interrogated from outside the system. Users need to be able to see exactly what the configuration does by seeing how the data flows between components in any given configuration. This will mean discussions between infrastructure WG and designers of every other component - wherever there's an interface
- Codifying **data structures**. How common data is described, and ensuring that all components use this common understanding

Those questions being posed…

- Working groups: UX and Infrastructure, with a governance group above (made up of WG chairs?). Need WGs to be long-term if they're going to be any use.
- Scale dependencies: many; most importantly, multi-resolution coupling. Most other issues are component-specific.
- Major obstacles: user engagement. Users reject plan - useless.
- Does proposed MUSICA address research needs: yes, incompletely.
- What new science: plenty; bigger questions is what can't be.
- Next major development steps: concerted effort to engage larger community.
- Diagnostics: not relevant - except that diagnostics should come through coupler.
- Dependencies: yes - all of them!
- Strategic partnerships: incorporation of representatives from ENTIRE community into MUSICA working groups, including:
  - HPC and low-resource users
  - Operational, research, and forecasting users (inc. US agency + university)
  - Cloud computing users and supercomputing users