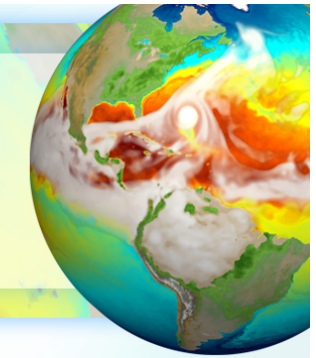
E3SM v3 and v4 Strategy

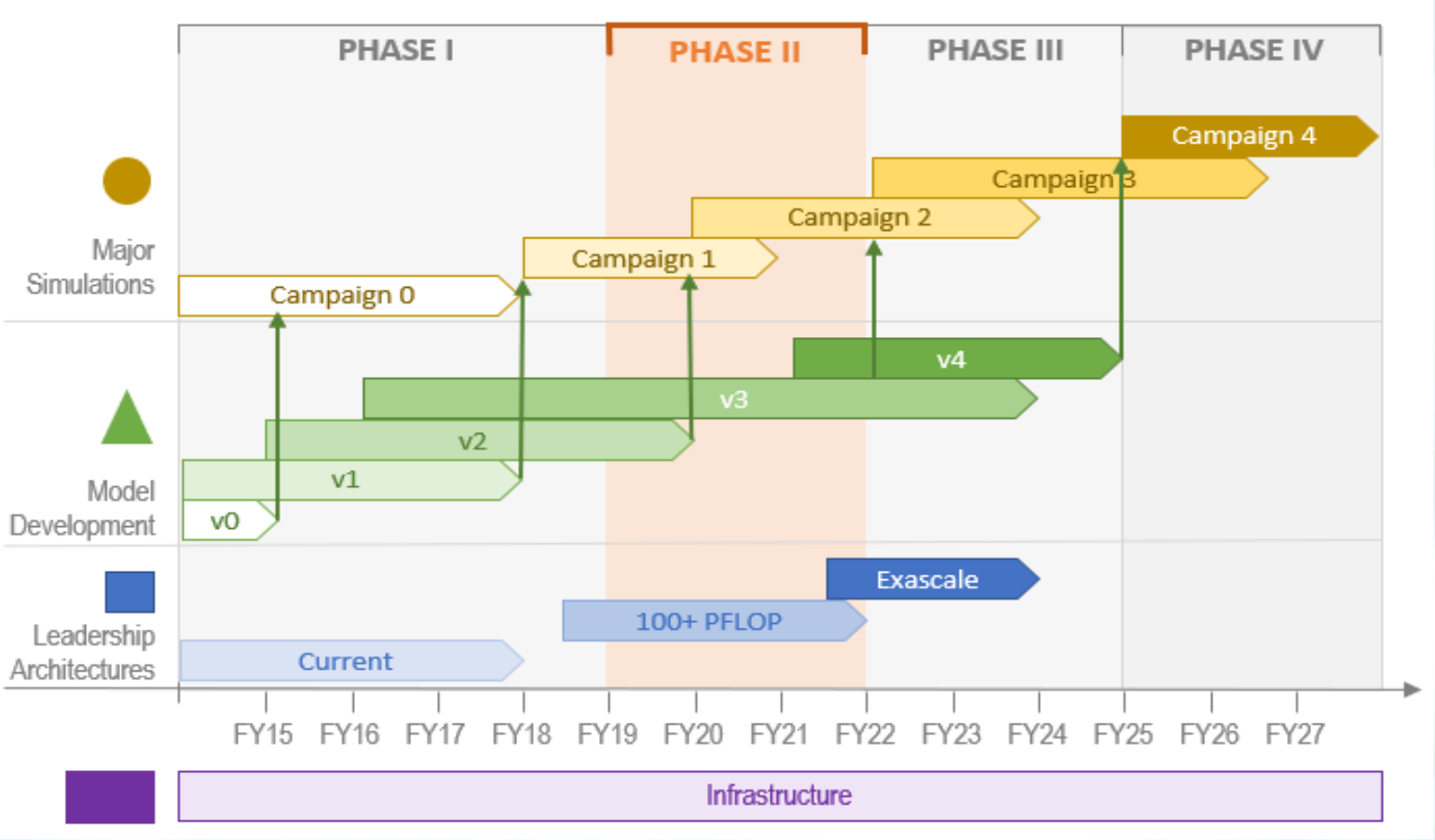


The E3SM Council
Dave Bader, Presenting

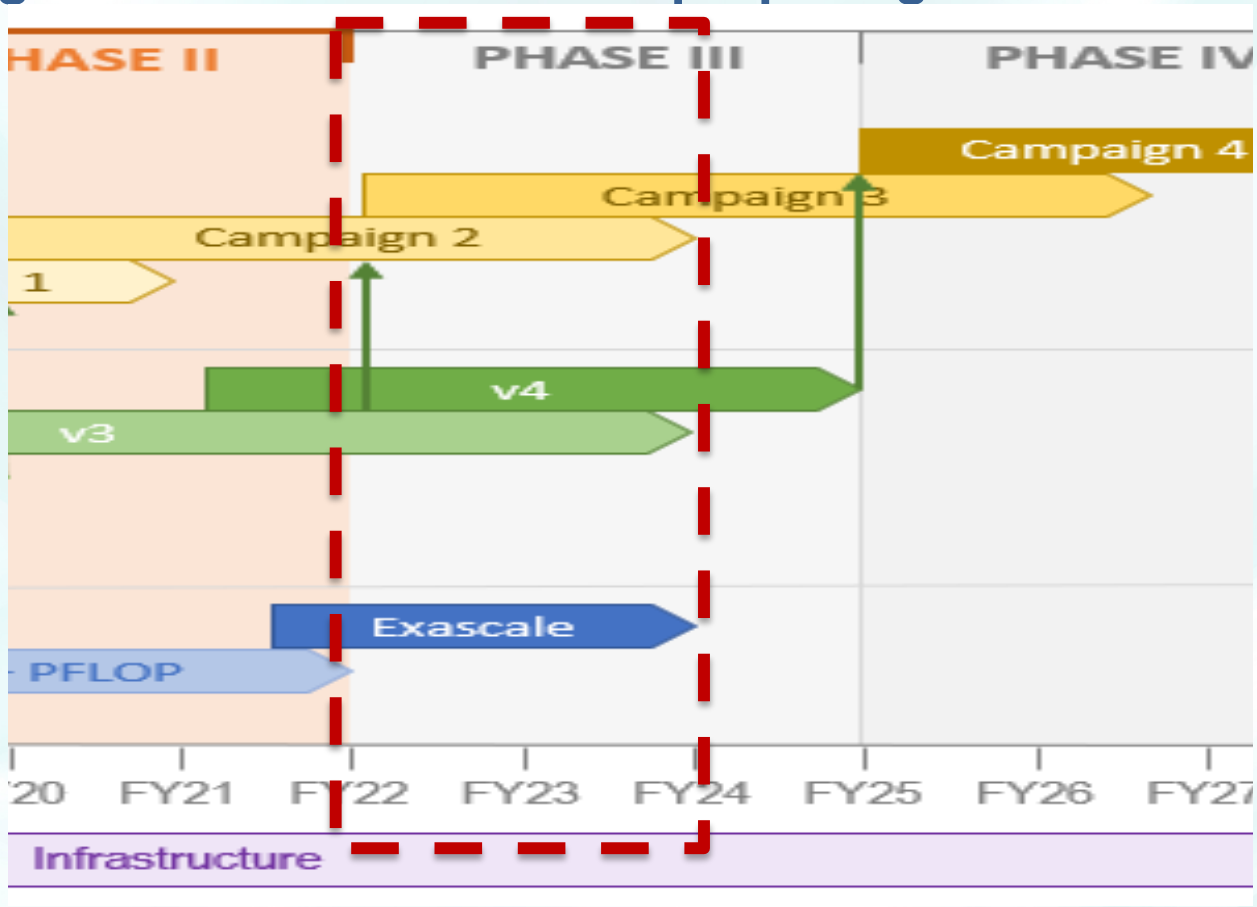
Earth System Model Development (PI) Virtual Meeting

October 26, 2020

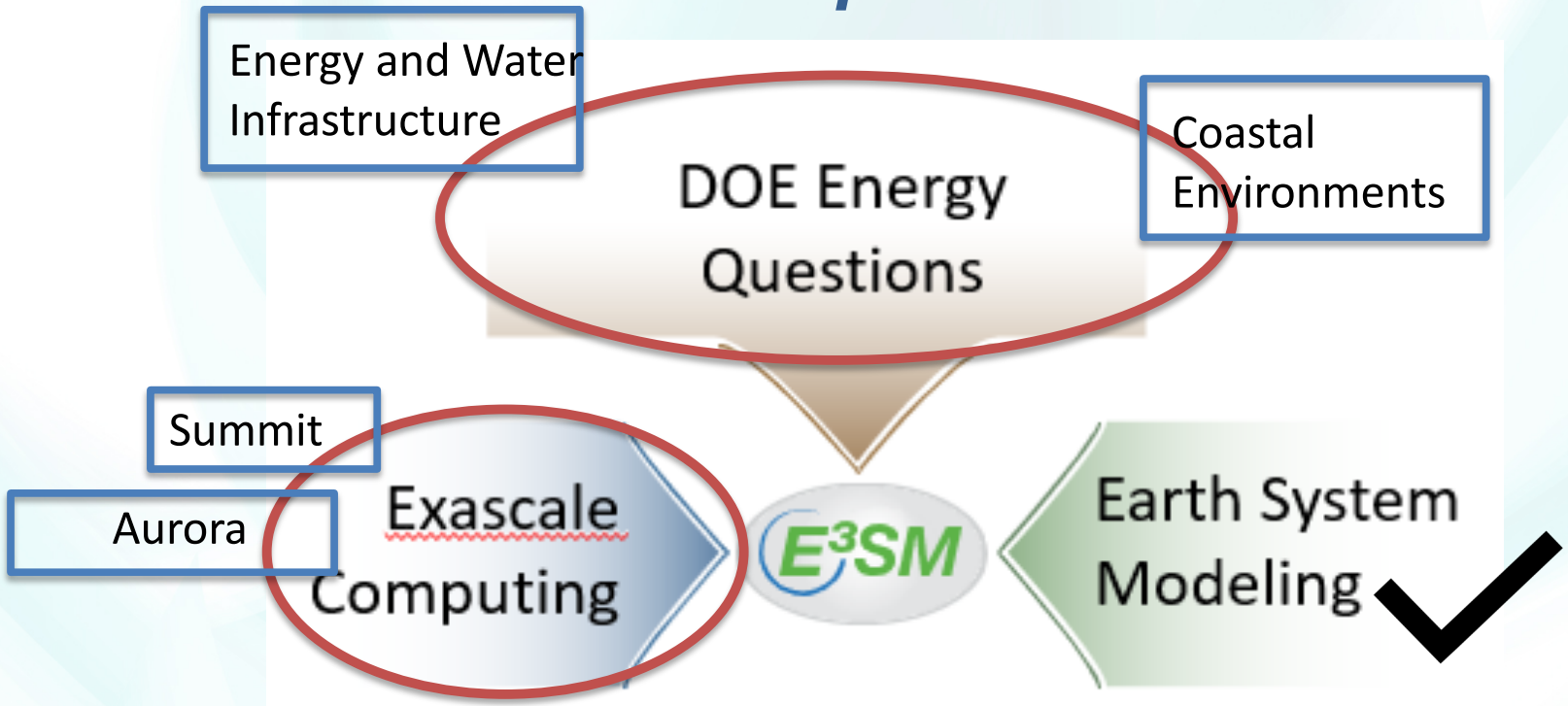
Overlapping Development Cycle Paradigm Adopted from NWP Centers



We are nearing the end of Phase II and preparing for Phase III



"A DOE Model for the DOE Mission on DOE Computers"

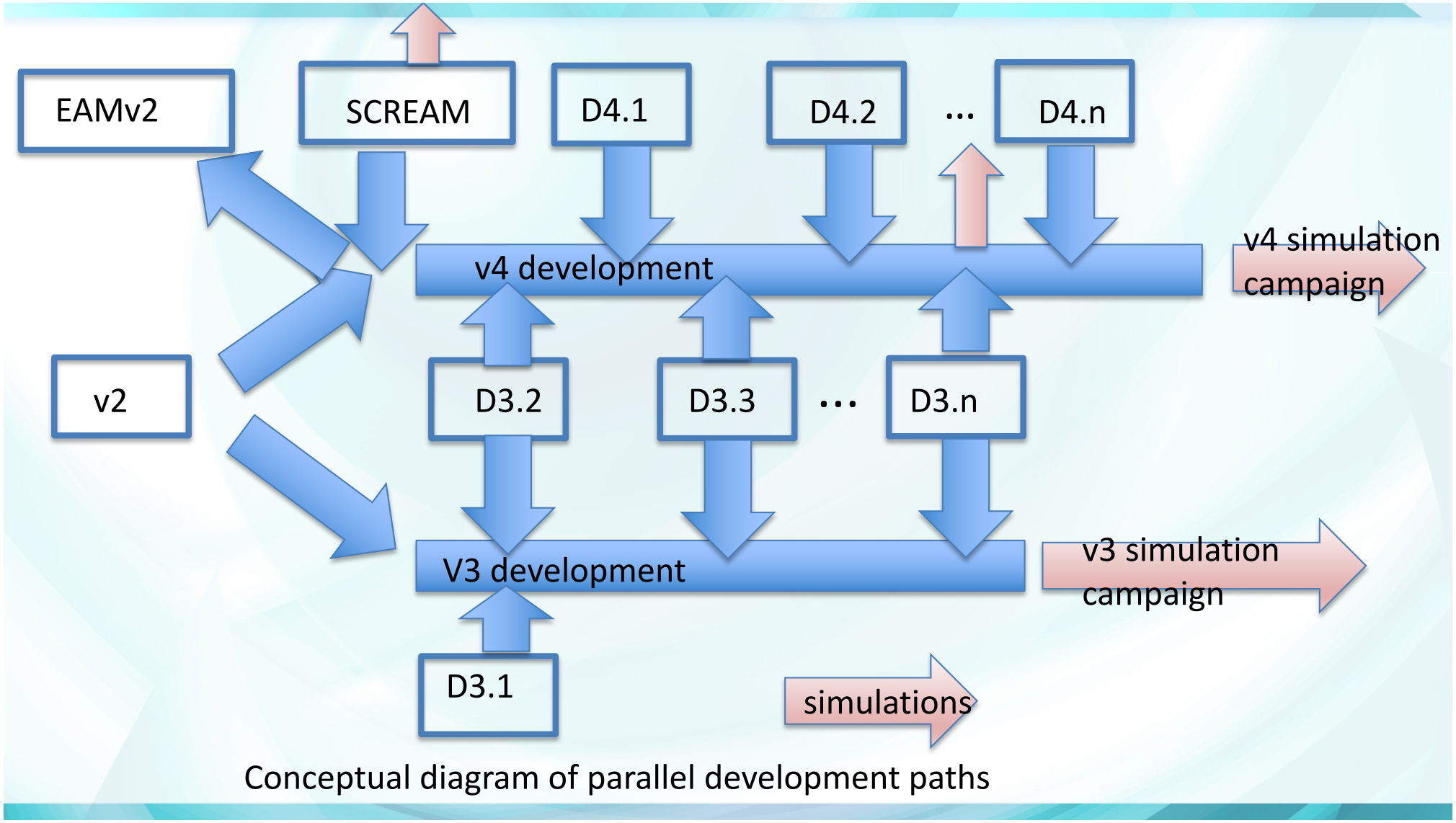


Project Direction - commence parallel, but coordinated, development of v3 and v4

- v3 release date is 6/30/23; the v4 release date is 6/30/26
- Model Science Developments are assigned priorities based on science question needs
- Model Technology Developments are assigned priorities based on needs to run on DOE LCF systems
- Single v3 code base for all v3 science campaigns. Starting point is v2 + NGD Land and NGD Atmosphere. Other developments, e.g. some ocean NGD improvements or outside contributions are possible.
- v3 will only run on CPU-based machines
- External developments more easily incorporated into v3

Why Start v4 Now?

- Single v4 code base for all science campaigns. Starting point is C++ atmosphere (SCREAM codebase) + v2 versions of other components.
- Need experience with hybrid CPU-GPU architecture and C++/Kokkos programming model
- Some early simulations are foreseen on Frontier and Summit, e.g. convection permitting global coupled simulations
- Close collaboration required to keep non-atmosphere v3 developments synchronized with v4 development.
- To the extent possible, v3 atmosphere improvements will be refactored for v4 code base and data structures.



Conceptual diagram of parallel development paths

Many Questions remain

- Project organizational changes may be needed.
- Mitigation of “dead-end” developments in v3
- Computer time availability
- Programming model for other components – currently FORTRAN w/ compiler directives for OpenMP

Feedback is welcome!

Thank you for your attention