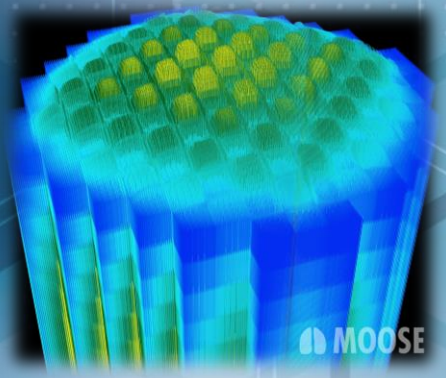
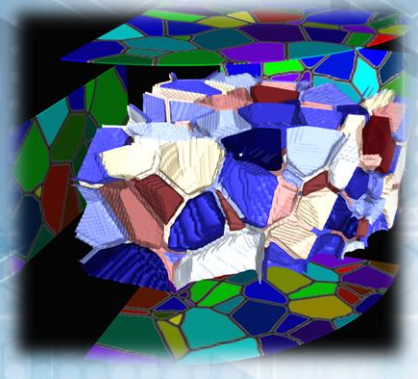




MOOSE* - Continuous Integration, In-Code Documentation and Automation for Research Software

Team: C. Permann, D. Gaston, J. Miller, A. Lindsay, R. Stogner, G. Giudicelli, L. Charlot, O. Marin, J. Hansel, P. German, R. Liu, N. Peat, V. Kyriakopoulos, C. Icenhour, L. Harbour … and growing

Presenter: Oana Marin

Computational Scientist – Numerical Analyst

SuperComputing 2022

Nov. 16, 2022

*Multiphysics Object Oriented Simulation Environment

https://mooseframework.inl.gov/

2008 - inception

2014 - open-sourced

2022 - 30+ different applications ecosystem

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy

Idaho National Laboratory

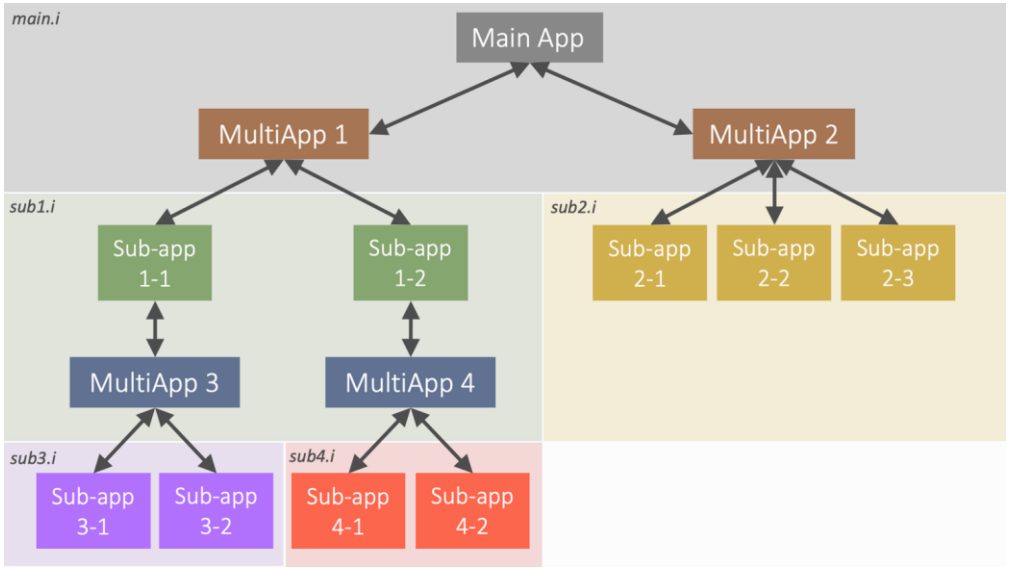
MOOSE Ecosystem - *mooseframework.inl.gov*

- ***Concept:*** object-oriented ***FEM/FV*** framework for rapid development of simulations
- ***Credo: "The user is king"*** - take the best from any DOE/University scientific tool; if it does not exist or perform then code it in MOOSE
- **MOOSE farms out software** capabilities to many other applications: Bison, Griffin, Cardinal etc.

MOOSE overview - *mooseframework.inl.gov*

- ***What can MOOSE do?*** Everything!* 😁
  - ✓ Any mesh element shapes/dimensions/topology
  - ✓ Adaptivity (space/time), automatic differentiation, mesh generation, parsed inputs
  - ✓ Parallelism - Everything defined per grid point
  - ✓ Flexible for multiscale applications, harder to vectorize.
  - ✓ Focus on nonlinear solvers – linear is a subclass

Couples any physics modules (***MultiApp*** transfers)



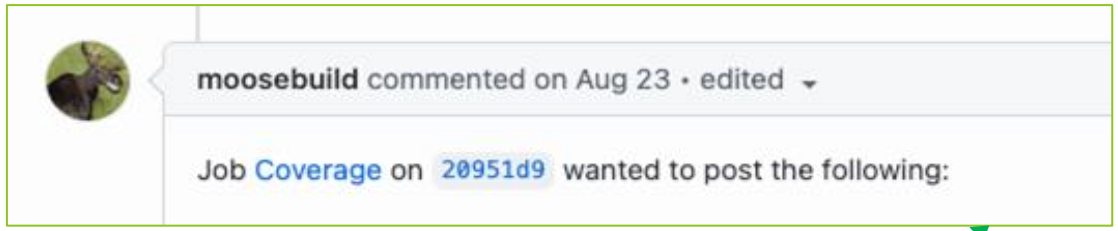
User friendly input files (YAML-like code)

```
[Postprocessors]
  [./without]
    type = ElementIntegralVariablePostprocessor
    variable = c
    execute_on = initial
  [../]
  [./with]
    type = ElementIntegralVariablePostprocessor
    variable = c
    use_displaced_mesh = true
    execute_on = initial
  [../]
[]
```

*If you don't find ***it*** or like ***it***, join us! We link to ***it***, seek funding for ***it***, or hire ***you*** to make ***it*** happen.

MOOSE design choices - *mooseframework.inl.gov*

- Meets ASME ***NQA-1*** (Nuclear Quality Assurance) requirements
- MOOSE automates developer compliance
- ***On-the-fly*** generated for each PR
  - Review feedback
  - Documentation – `moosedoc.py`
  - Testing - CIVET



`clang-format`

- ***Conda***-based build system - `mamba install moose-tools moose-libmesh`
- ***github*** integration (submodules) – `github.com/idaholab/moose.git`
- Dynamic linking for graph-based coupling at any level (software tools wear many hats: library/stand-alone application/3rd-party)
- Any physics application can be written as input file, little need to alter the C++ backend