SAND2018-1523C

Plato Engine: MPMD-enabled Topology Optimization

PRESENTED BY

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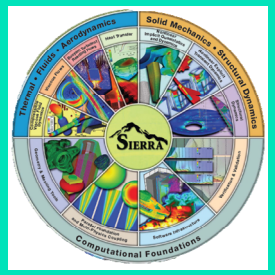
Motivation



Sierra/SD

Implement:

- Objective Evaluation
- Gradient Evaluation
- Optimization loop

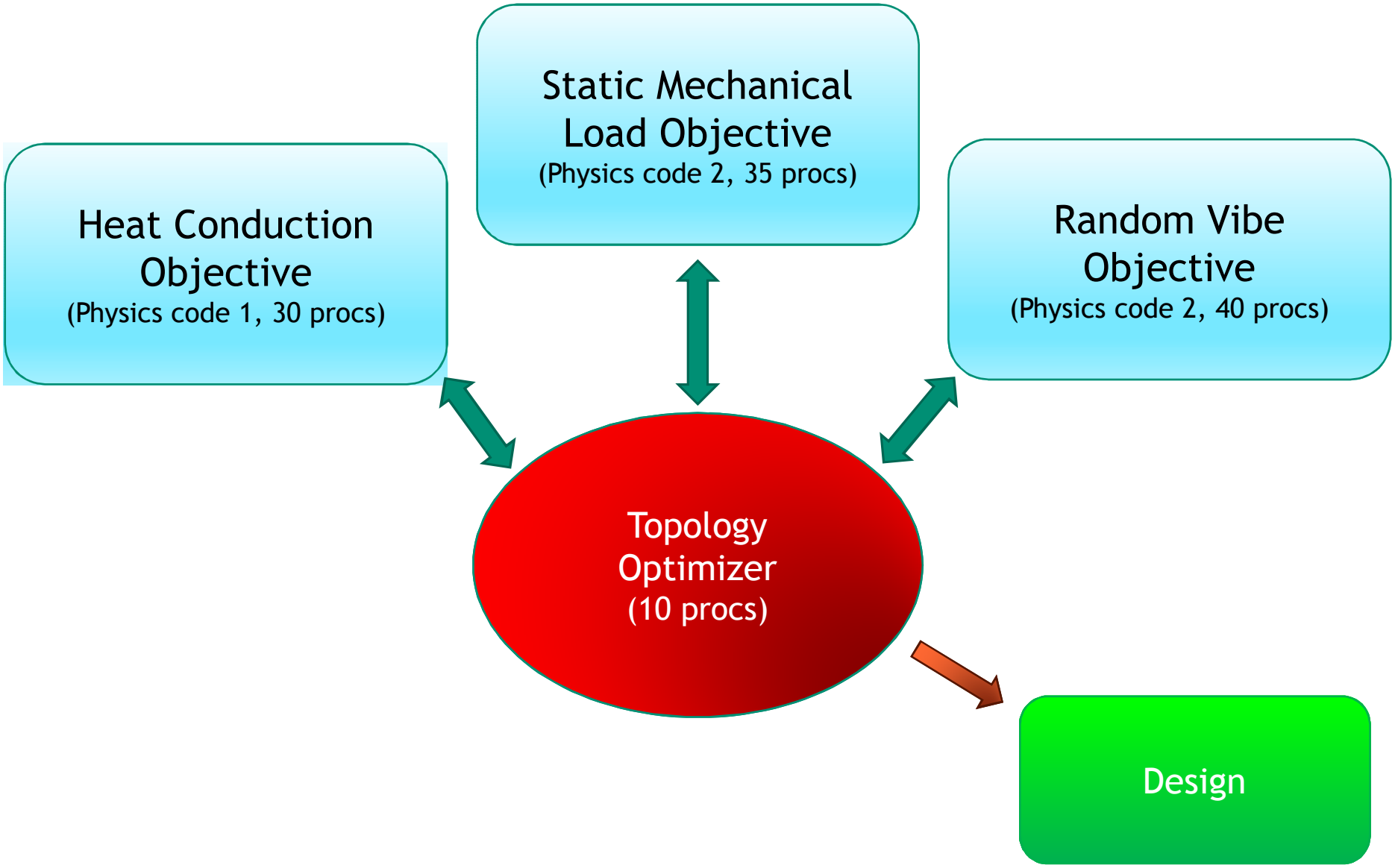
Albany

Implement:

- Objective Evaluation
- Gradient Evaluation
- Optimization loop

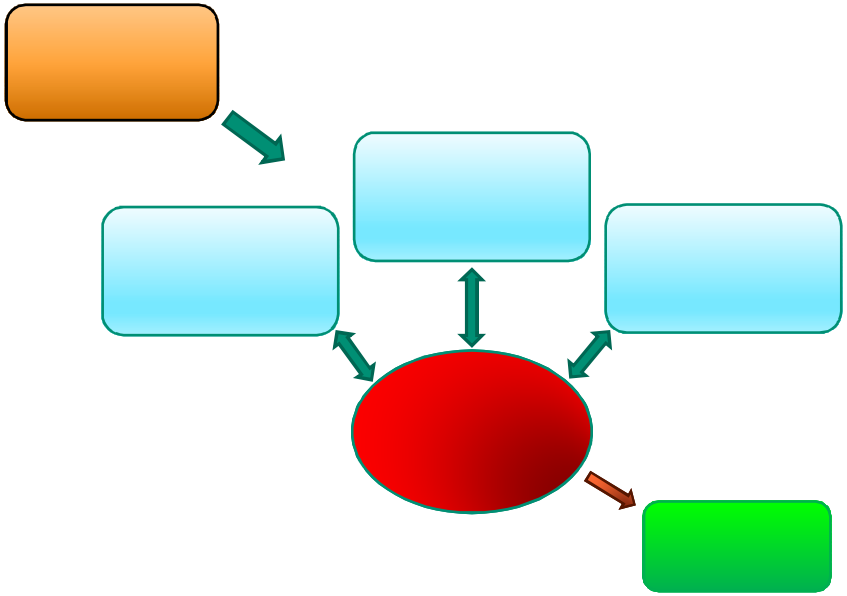
Early development consisted of embedding topology optimization directly in the physics code---Does not scale well to multiple physics codes!

Plato Engine

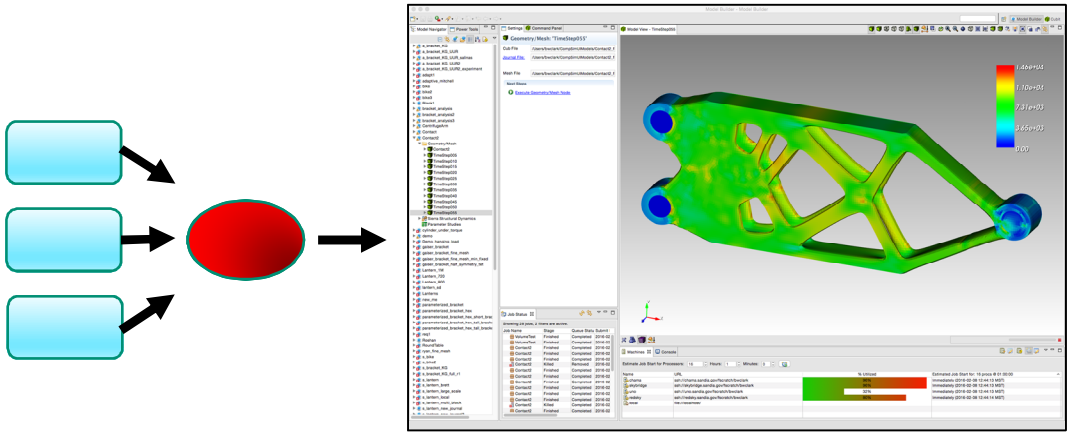


Benefits

Leveraged R&D



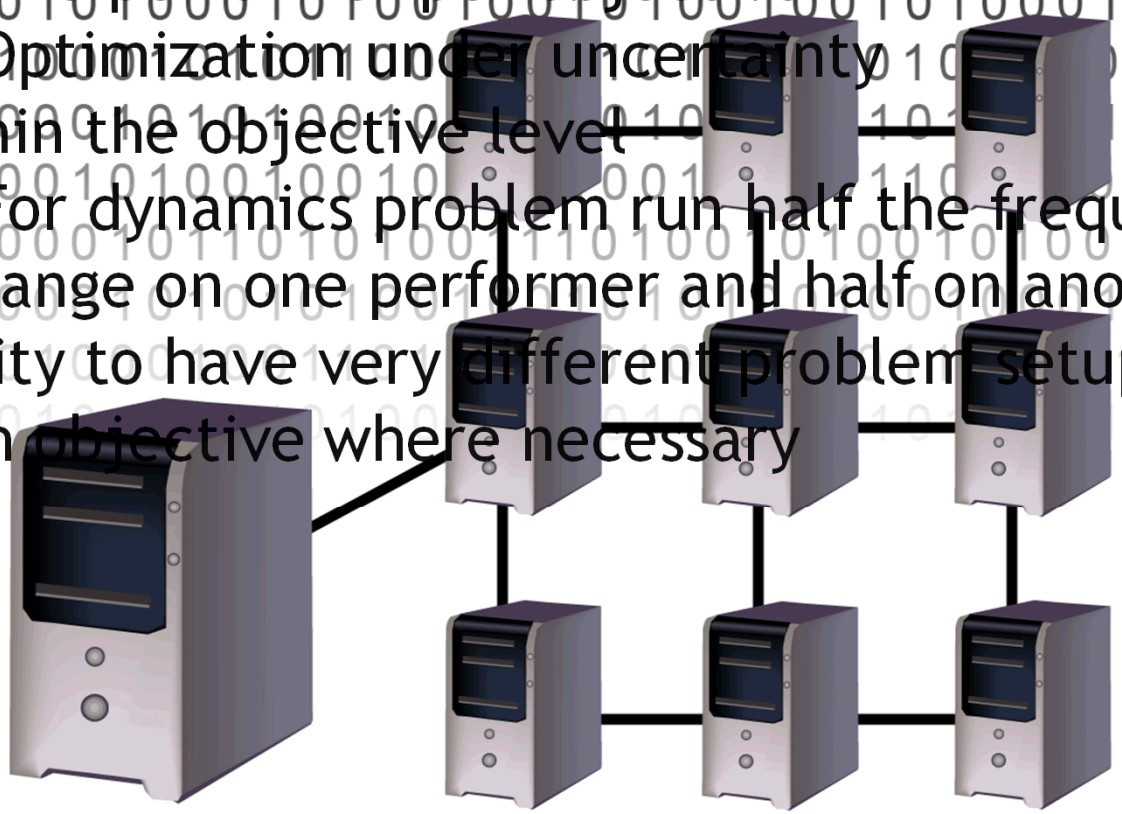
Easy Integration



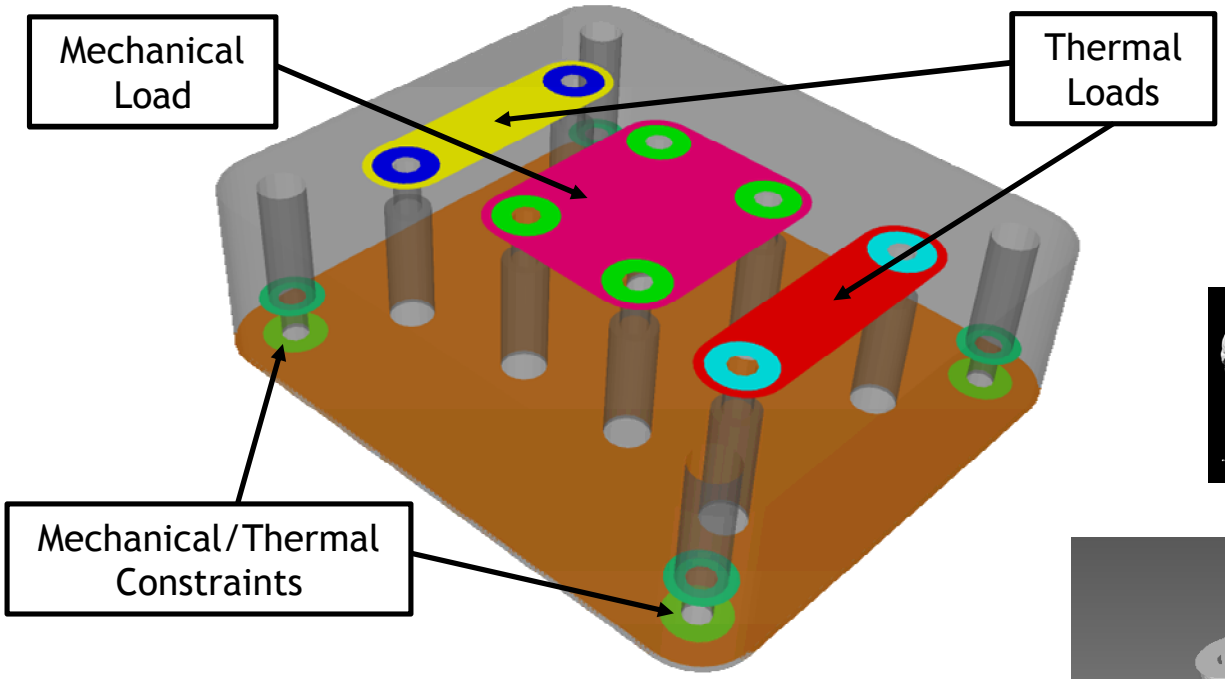
Single Front-end

Parallelization

- At the objective level
  - One performer per objective
  - Optimization under uncertainty
- Within the objective level
  - For dynamics problem run half the frequency range on one performer and half on another
- Ability to have very different problem setup for each objective where necessary



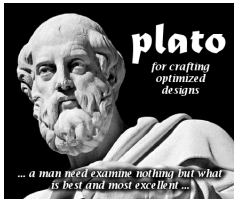
Current Status



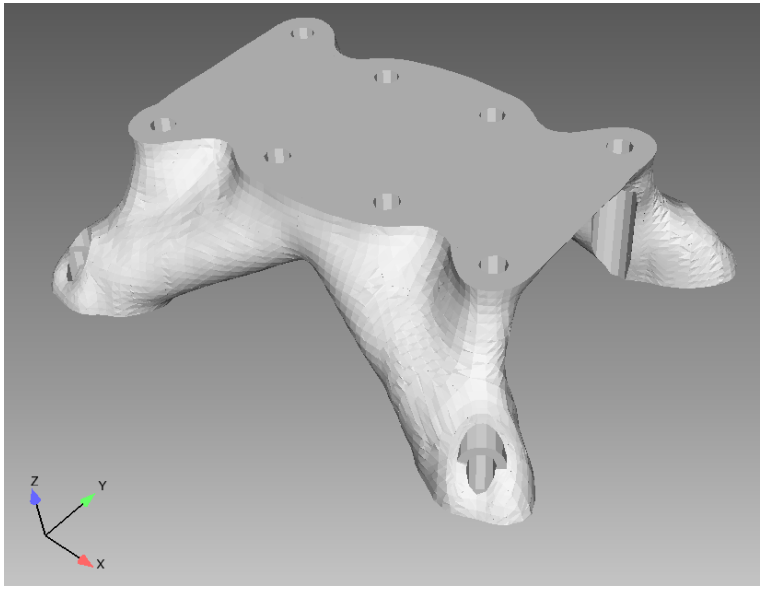
1 Sierra/SD Performer
(40 procs)

Albany

2 Albany Performers
(30 and 35 procs)



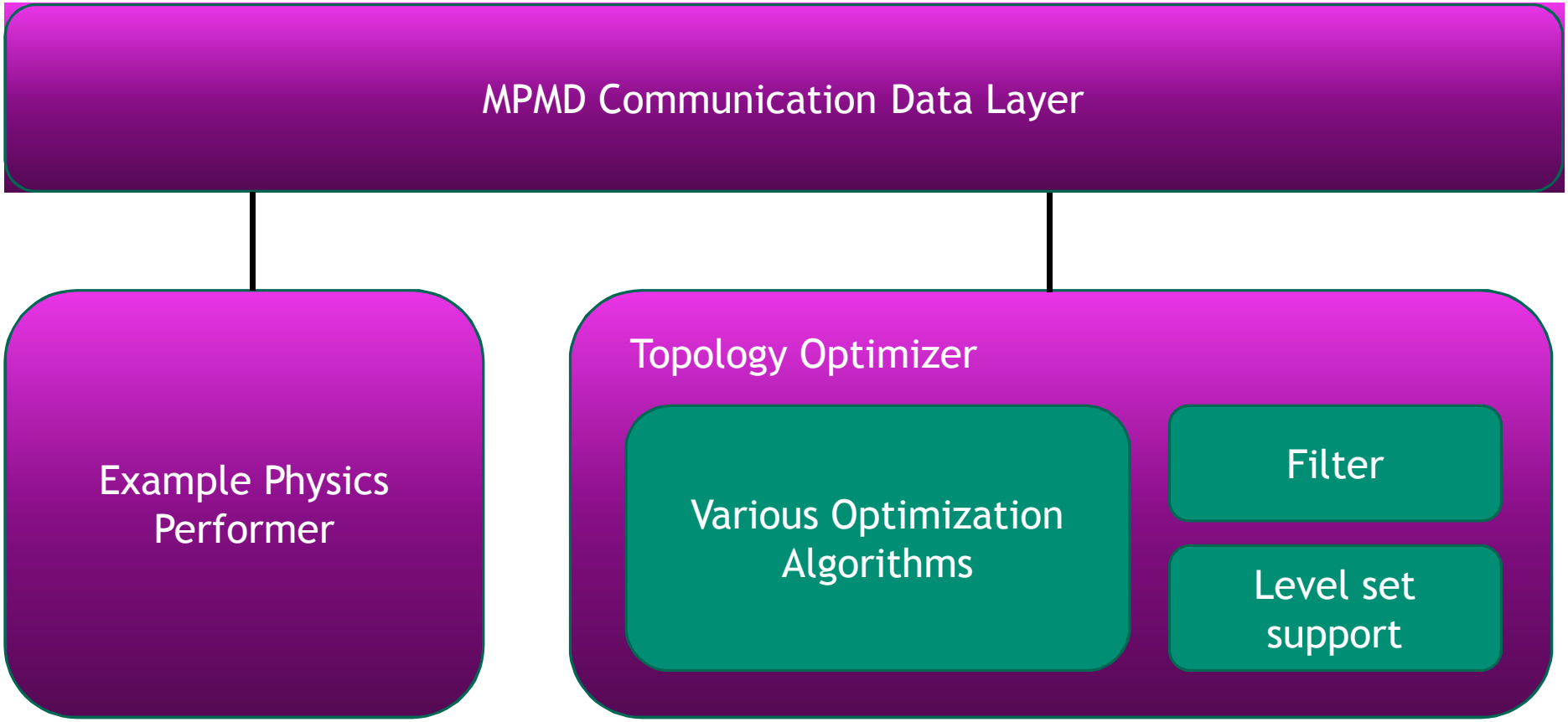
Plato optimizer
(10 procs)



Integrated Physics codes

- Sierra/SD
- Albany (open source)
- Plato Analyze
- Alexa GPU performer
- Aleph

Services Included in Plato Engine



Plato Engine Wrapper

Physics Code

Calculate Objective, Calculate Gradient

Data Communication Interface

1. Initialize()
2. Finalize()
3. Compute(Operation Name)
4. ImportData(Argument Name,Data)
5. ExportData(Argument Name,Data)
6. ExportGraph(DataLayoutType,Owned Ids)

Some Details about Plato Engine Implementation

Multiple Program Multiple Data (MPMD) enabled with MPI "split technology

Main Plato Engine Driver/Optimizer orchestrates synchronous execution of all performers

Trilinos Epetra vectors leveraged in data layer for supporting varied problem decompositions

Optimization Data and Stages defined in XML files and registered at beginning or run

Accessibility

- Currently working on an open source license for Plato Engine
  - Front-end GUI is currently not a part of Plato Engine because of non-open source components
- The up-coming level set capability is partially provided by the XFEM Toolkit (XTK) authored by the University of Colorado. XTK is already under an open source license
- For more information email plato3d-help@sandia.gov