ParFUM:

A **Par**allel **F**ramework for **U**nstructured **M**eshes

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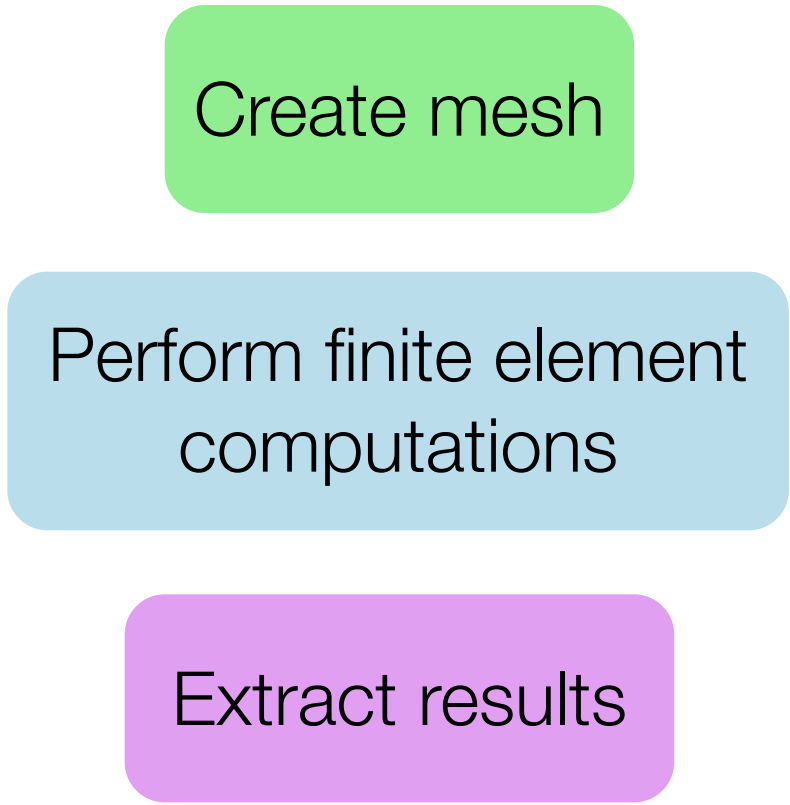
What is ParFUM?

- A framework for writing parallel finite element codes
- Takes care of difficult tasks involved in parallelizing a serial code
- Provides advanced mesh operations such as mesh adaptivity
- Constantly evolving to support application needs (for example, now supports cohesive elements and collision detection)
- Based on Charm++, supports C, C++, and Fortran

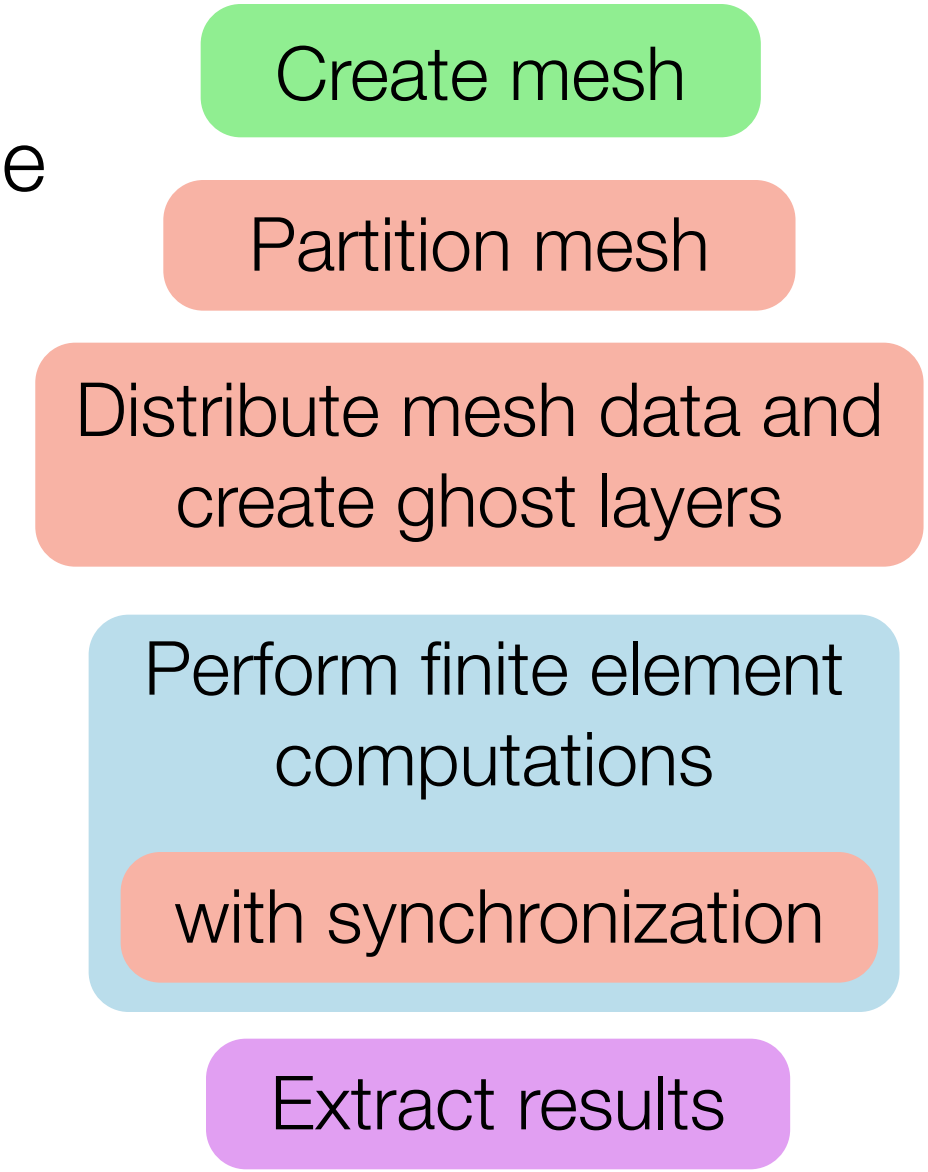
Making Parallel Finite Element Codes Easier

A simple serial finite element code:



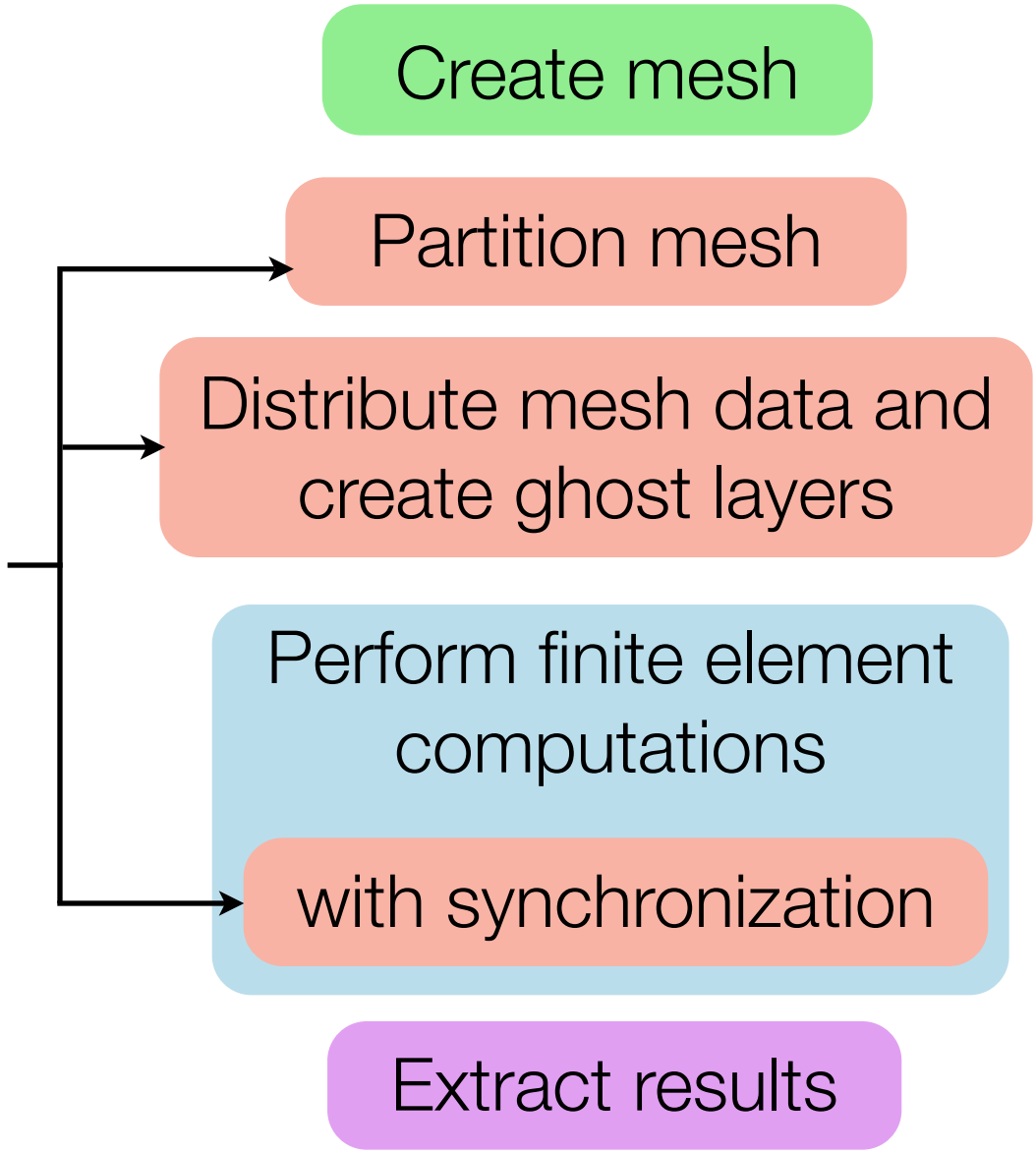
Making Parallel Finite Element Codes Easier

A simple parallel finite element code:

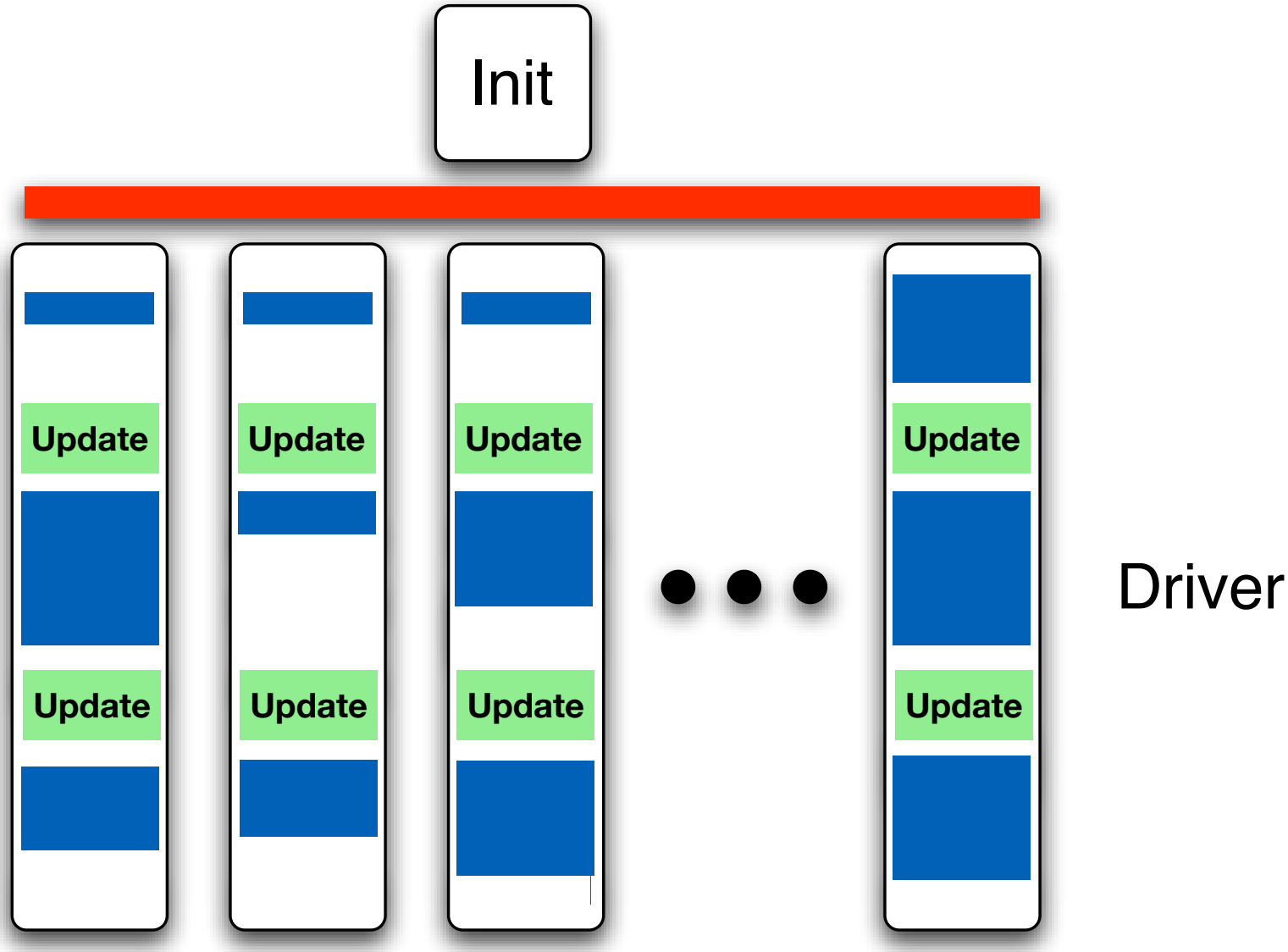


Making Parallel Finite Element Codes Easier

ParFUM can do these things automatically and let the developer concentrate on science

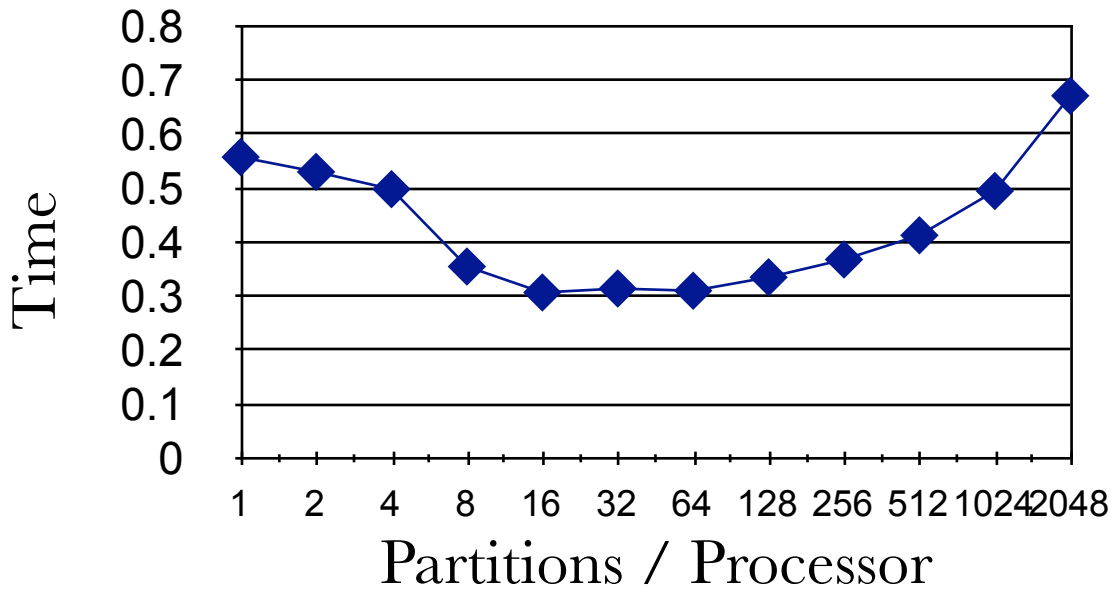


The Structure of a ParFUM Program

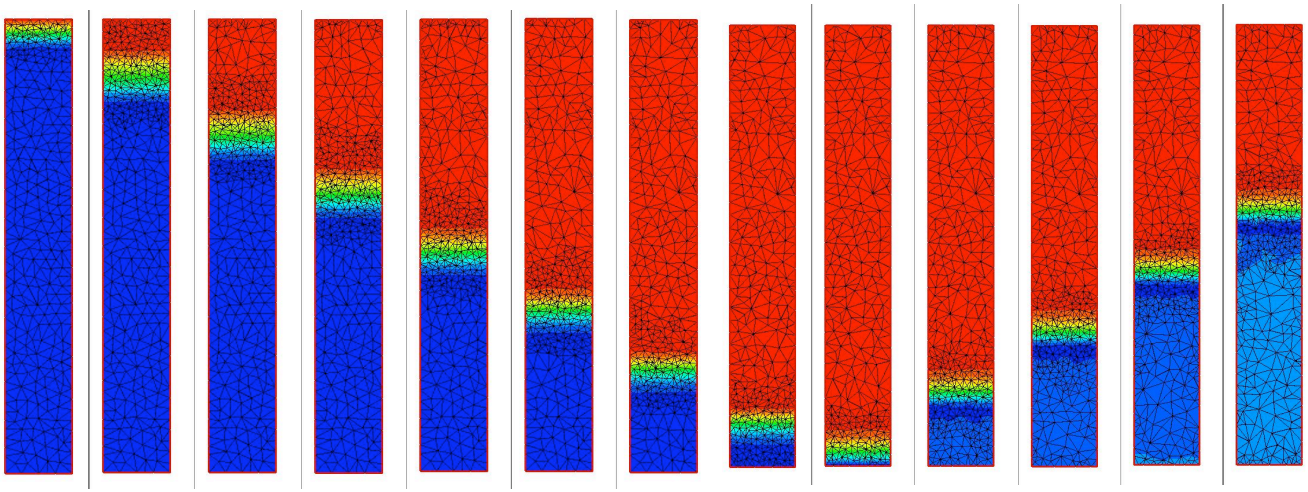


Why Charm++ and AMPI?

- Some mesh operations (such as local adaptivity) are very well suited to the Charm++ message driven style of programming
- The Charm++ runtime provides dynamic load balancing
- Virtualization (multiple mesh regions per processor) can dramatically improve performance:



Parallel Refinement and Coarsening



Shock propagation and reflection down the length of the bar

Adaptive mesh modification to capture the shock propagation