Software Sustainability – Application Perspective

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Importance of Software Sustainability to Applications

- *ECT*: Enabling Computational Technology = Software that applications use
- Premise: Increased complexity of HPC systems leads to increased willingness to on ECTs.
- **Two major challenges** to ECT adoption apply to a broad class of ECTs.

Software without a plan for future investment is too risky to adopt

1. *Sustainability*: Is there any guarantee of continued future support for the ECT?
   - Adopting/building/maintaining source is generally not desirable for applications
   - Existential risk if critical dependence on a specific tool(s) with no future support
   - Can be mitigated by standardizing interfaces, but harder in practice than reality for many ECT classes

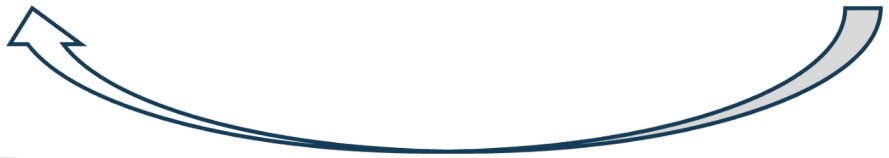
- Sustainability in this context is used broadly, must include continued evolution of ECT

Software often needs process to co-evolve with applications

2. *Application Fit*: Does the ECT provide the right abstractions for the specific needs of application
   - Often ECT has baked-in assumptions about application needs that differ slightly from reality
   - Pull: ECT has to broaden or modify abstractions to make useful for a particular application
   - Push: Application has to adapt to fit limitations of ECT
   - This can include functionality, performance, accuracy, etc.

- Singular “over the fence” mentality too limiting for HPC

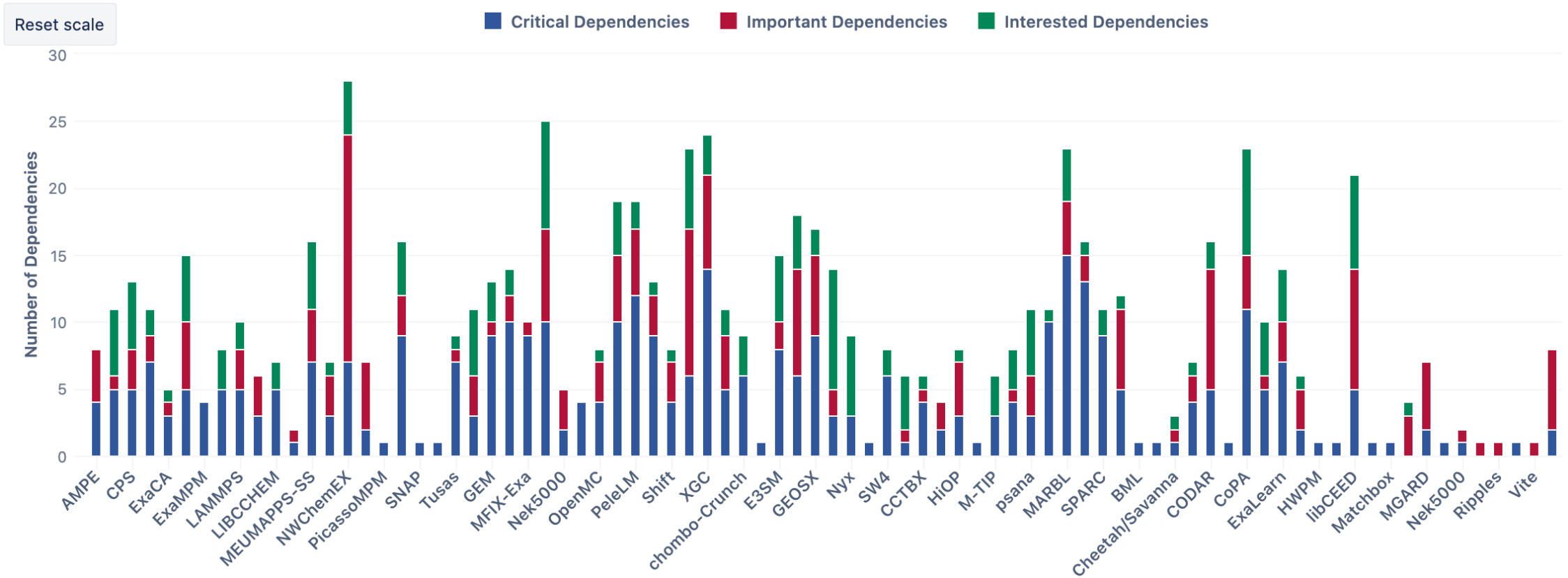
- Develop → Deploy → integrate → Modify/Accrete



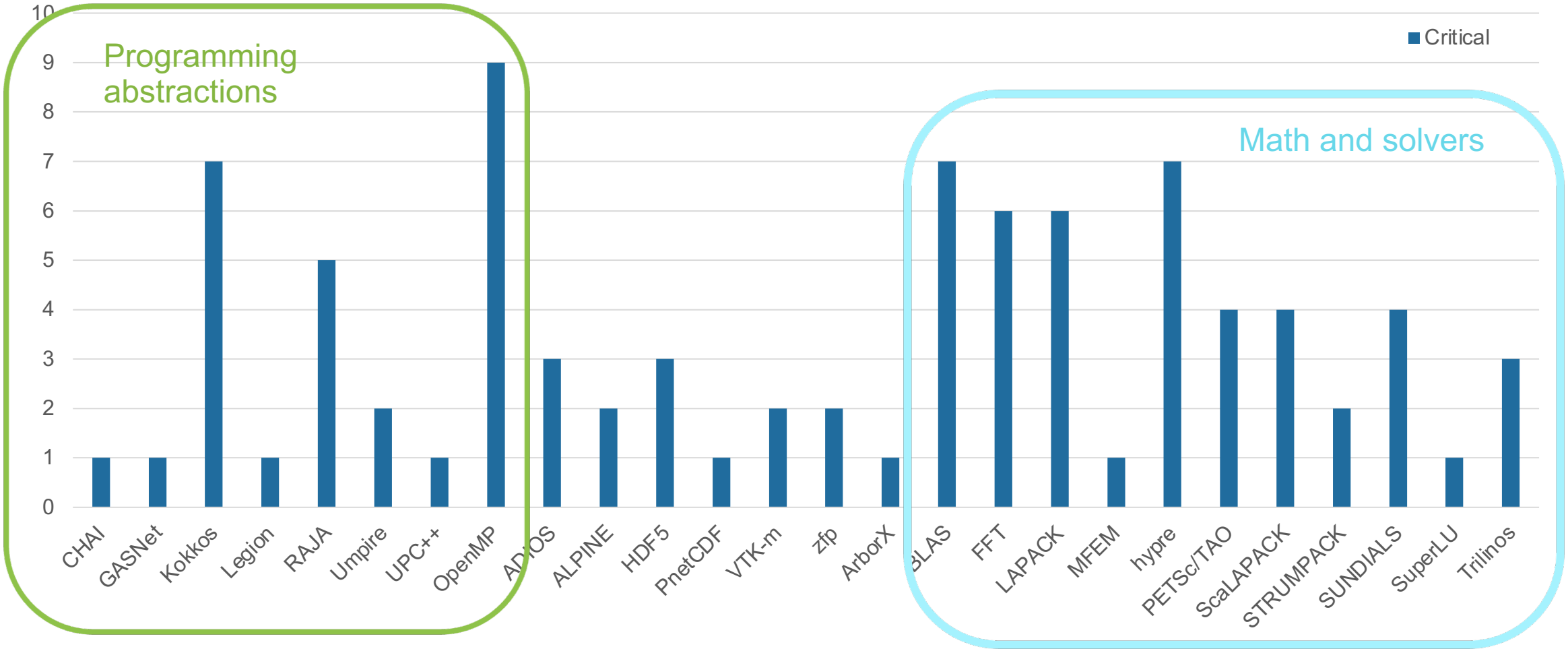
Examples from ECP

- FFT libraries for image reconstruction
- LibMesh for particle tracking
- AMReX for octree-based refinement
- OpenMP/LLVM for GPUs
- CEED for AMG
- Sparse, indefinite solvers for GPUs

ECP Integration Database by Application



ECP Critical Dependencies Grouped by Area



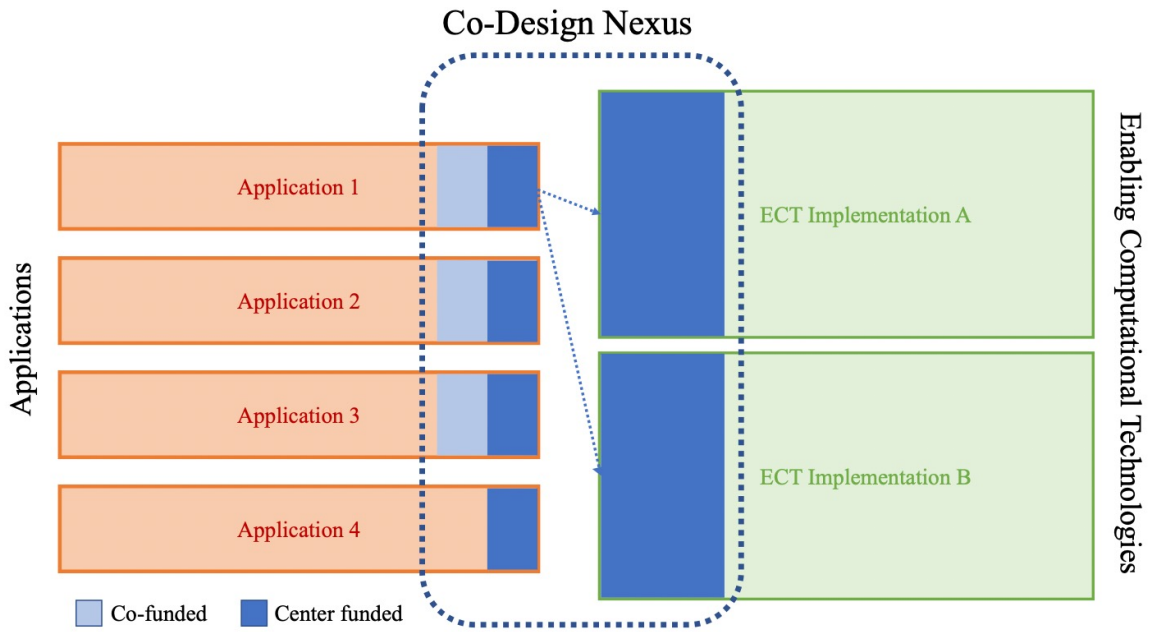
“Mission Critical Applications”

- Sustainability complicated in Office of Science by myth of “mission critical” applications.
- With few exceptions, no obvious stable of blessed applications in Office of Science to anchor ECT.
- Applied offices very different, can pick “winners”, choose to invest longer term in applications and software technologies to advance their mission.

Additional Challenges

- Verification: Can the ECT be trusted to give the correct answer?
- Is the ECT easy to deploy, installed/tested on the relevant systems, documented, versioned, etc.?
- Is there a level of mutual trust built through collaboration between ECT and AD team?

Summary



- Managing risk is the biggest challenge to increased productivity via application adoption of ECTs.
  - If no future support model, far less likely to adopt ECT as dependency
- An “over the fence” model that supports software sustainability broadly independent of applications will be useful in some cases.
- A model is needed that broadens sustainability to include continued push/pull of co-designed software/apps.