



STEP

SUSTAINABLE TOOLS
ECOSYSTEM PROJECT

Coordination Challenge

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Proposal Definition

The coordination challenge: Tools themselves are uniquely and closely tied to design decisions across different layers of the execution stack, including: hardware, system software, middleware, and applications.

The current siloed nature of HPC tool development precludes large community coordination, which in turn limits the breadth of domain expertise that can be brought to bear. The ultimate impact of this coordination challenge is that there is limited interoperability between key tools and piecemeal response to technology trends. At present there is no venue facilitating communication between the HPC tool community at large and key stakeholders such as vendors or facility operators. There is also no ongoing forum for promoting interoperability.



East Coast Townhall Breakouts

Four parallel breakout sessions related to Coordination:

- Conventions and Standards
- Deployment
- Facility Coordination
- Dependencies



East Coast Breakout - Conventions and Standards

- Interoperability
 - Allow two or more tools to operate correctly on a single program (without interference)
 - Analysis of two or more tools greater than the sum of each
 - pass data between them without the user needing to explicitly be involved
- Challenges
 - How to bridge the gap between different hardware capabilities/definitions
 - How to achieve standardization/conventions within a rapidly changing environment
- Discussion
 - LLVM, kokkos as a successful example of a layer that provides functionality
 - Define a broad set of meaningful standards that could be adopted
 - New opportunities with accelerators to define a desired path in what might be a more greenfield area



East Coast Breakout - Deployment

- Pain points for deploying tools
 - Dependencies for build/run
 - compatibility with larger build environment
 - Sufficient expertise in all tools
 - STEP should support deployment across DOE ecosystem
- STEP should cultivate an app test suite with tool plugin framework
- Spack is useful for deployment but still has issues for tools
 - improvement are possible
- Mixture of users deploying tools on their own as well as facility deploying certain tools



East Coast Breakout - Facility Coordination

- Need ability to share use cases across facilities
 - mini-app use cases
 - problematic use cases
- Need mechanism for efficient information sharing
 - address different types of communications (active, passive, coordination)
 - Anonymization of data to allow sharing more freely
 - establish best practices
- Early Access/NDA restrictions severely hamper progress
 - Need early NDA to provide feedback to vendors for requirements before it is too late
 - Need NDA framework for information sharing

East Coast Breakout - Dependencies

- “Competition” for the same APIs (such as interception, callback API, etc.)
 - Lead to a host of failures, not all obvious to the user
- Need for libraries to be built in a particular way or with a particular set of flags to enable needed capabilities
 - often times as a specific version of library
- System/Tool configuration data collection
 - Significant class of data that impacts performance of applications that occurs outside of application
 - Tuning environment variables
 - Versions of software
 - Contention of system
 - Need method to collect this data
 - Need to communicate impact of this
- e4s and spack can help resolve some of the above dependencies for build and run
 - still issues remain
- Discussion about tools on by default and the impacts of that

Midwest Town Hall Summary

- Focus on structure and management of STEP
- Less focus on technical aspects of related to Coordination
- Breakout: Processes for Tracking Vision & Gaps Over Time
 - Feedback and engagement from users
 - Evaluation via benchmarks
- Breakout: Reporting & Maintaining Efforts
 - Tool Demonstrations
 - Use Case collection

Recommendation Slide Format

- Midwest recommendations form structure of STEP
- Midwest recommendations are at the top level
- East Coast recommendations are then layered underneath
 - matched with organizational initiatives



Recommendations (1)

Finding: Tracking stakeholder needs over time will be crucial to sustainability.

Recommendation: Conduct ongoing surveys and interviews, particularly with facility operators and application developers, to maintain an accurate view of what is and isn't working.

- The STEP center should establish continuous communication channels (options include alliance organizations, recurring meetings, and public forums) with the explicit goal of gathering and formulating requirements, engaging diverse expertise, and exchanging information for the benefit of the entire ecosystem. This may require new strategies to address intellectual property (IP) and non-disclosure agreement (NDA) concerns.
[Collaborative teams, Codesign, Community activities]

Recommendations (2)

Finding: Tracking stakeholder needs over time will be crucial to sustainability.

Recommendation: Create, publish, and continually update a strategic plan that serves as a roadmap for how the STEP Center will focus its activities.

- The STEP center should actively engage vendors, facilities, applications, hardware designers, and tool developers to help establish desired requirements, guidelines, testing methods, and early system access. These collaborative efforts will benefit all parties involved, fostering a culture of proactive collaboration and continuous improvement. [*Codesign*]
- The STEP center should establish continuous communication channels (options include alliance organizations, recurring meetings, and public forums) with the explicit goal of gathering and formulating requirements, engaging diverse expertise, and exchanging information for the benefit of the entire ecosystem. This may require new strategies to address intellectual property (IP) and non-disclosure agreement (NDA) concerns. [*Collaborative teams, Codesign, Community activities*]

Recommendations (3)

Finding: The STEP Center needs to embrace external review and feedback from a broad perspective

Recommendation: Curate use cases for the community to use for experimentation and evaluation. This may take the form of benchmarks or mini-applications that can be used for standardized evaluation of tools and techniques that are developed and sustained within STEP. Development of these use cases could be pursued within the Codesign initiative.

- Establish a collaborative platform that is independent of any one facility to foster the exchange of best practices, mini-apps, case studies, and profiling data among various deployment sites. [*Codesign, Community activities*]
- The STEP center should actively engage vendors, facilities, applications, hardware designers, and tool developers to help establish desired requirements, guidelines, testing methods, and early system access. These collaborative efforts will benefit all parties involved, fostering a culture of proactive collaboration and continuous improvement. [*Codesign*]

Recommendations (4)

Finding: Excessive administrative overhead is a hindrance to productive sustainability efforts. We should streamline the participant experience and make sure that reporting efforts maximize benefit to the community

Recommendation: Project reports should take the form of instructions for a reproducible demo of the work along with a concise report. An artifact evaluation team (perhaps funded in part by grants or stipends) will evaluate the demos. Badges will be awarded to projects that meet clear sustainability criteria.

- Produce and broadly adapt a tool portability layer (or layers) that enables tool developers to share common functionality, drawing inspiration from successful examples from other communities such as LLVM and Kokkos. Additionally, establish community guidelines to promote interoperability among stakeholders. [*Codesign, Community activities*]
- Develop methods to effectively document and streamline tool dependencies, accounting for subtle interactions such as required build options for underlying libraries, implicit dependencies, and performance dependencies. Utilize existing tools like Spack and E4S, where appropriate, to leverage their capabilities in this regard. [*Collaborative teams, Community activities*]

Recommendations (5)

Finding: Excessive administrative overhead is a hindrance to productive sustainability efforts. We should streamline the participant experience and make sure that reporting efforts maximize benefit to the community

Recommendation: Annual STEP meetings will be held to bring together stakeholders and developers to highlight new developments and requirements. Smaller special-interest group meetings may be held at a higher cadence.

- The STEP center should actively engage vendors, facilities, applications, hardware designers, and tool developers to help establish desired requirements, guidelines, testing methods, and early system access. These collaborative efforts will benefit all parties involved, fostering a culture of proactive collaboration and continuous improvement. [*Collaborative teams, Codesign, Community activities*]



Recommendations (6)

Finding: The STEP Center should actively seek to engage in additional sources of funding.

Recommendation: Act as a clearinghouse for expertise that can be engaged in activities such as:

Participation in procurement and evaluation activities (both as a service to the community and to increase visibility)

Participate in proposals to advocate for cases in which tools sustainability are needed to support the needs of scientific activities.

- ... This may require new strategies to address intellectual property (IP) and non-disclosure agreement (NDA) concerns. [*Collaborative teams, Codesign, Community activities*]
- Produce and broadly adapt a tool portability layer (or layers) that enables tool developers to share common functionality, ... Additionally, establish community guidelines to promote interoperability among stakeholders. [*Codesign, Community activities*]
- Develop methods to effectively document and streamline tool dependencies, ... [*Collaborative teams, Community activities*]

West Coast Breakout - Monterey Room

- Refine and summarize points
- Review recommendations
 - rank list on priorities (1-3)
 - rank list on impact (1-3)
- Highlight gaps