

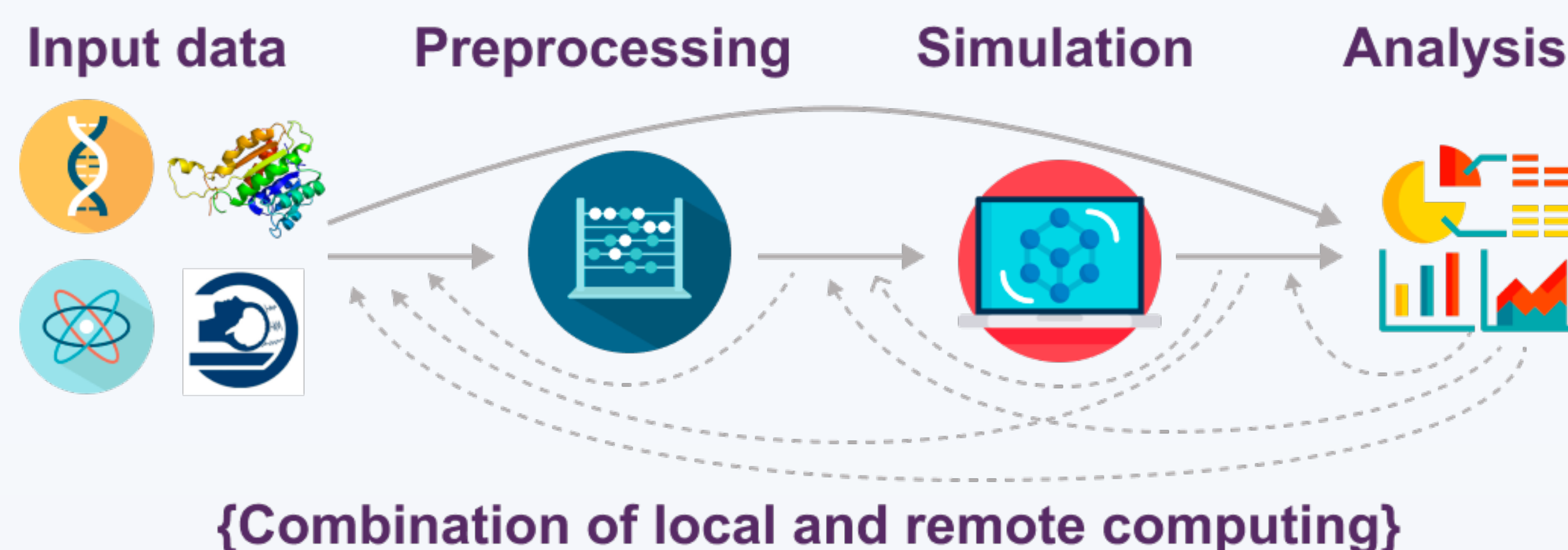
Cybershuttle: An End-to-End Cyberinfrastructure Continuum

A multi-institutional collaboration between Georgia Tech, Indiana University, University of Illinois at Urbana-Champaign, University of California at San Diego, and Allen Institute

Contact Project PI: Suresh Marru, smarru@gatech.edu

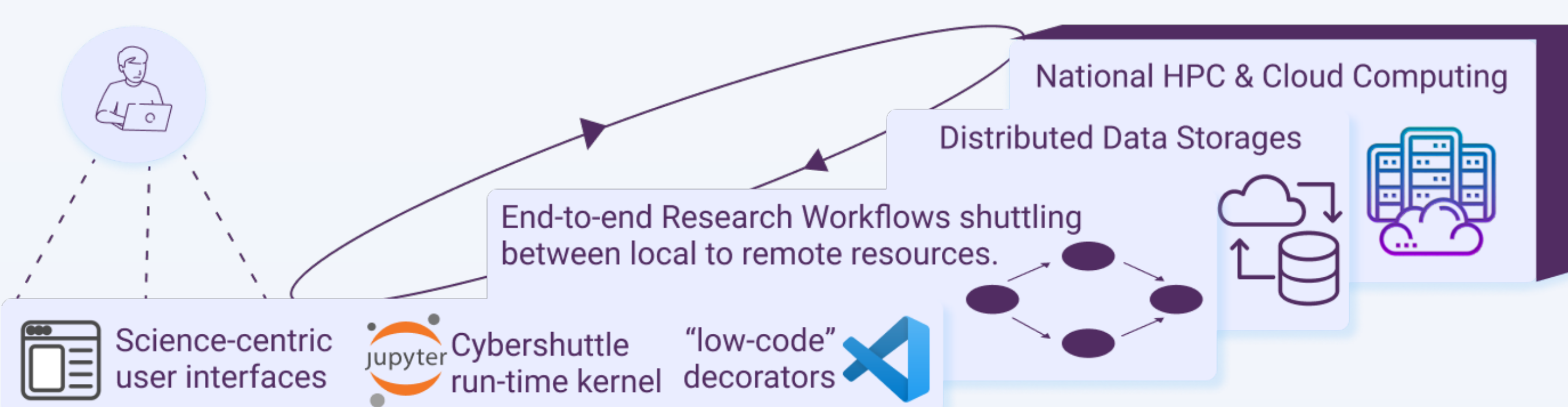
Motivating Challenges

Computational science relies on scientists' access to and integration of widely distributed resources, such as scientific software, data repositories, storage resources, analytical tools, and heterogeneous computing resources. The iterative nature of a typical computational research process entails the execution of various fragmented steps, often spanning both local and remote resources. This fragmentation can lead to researchers not consistently utilizing the best available resources due to varying accessibility and usage barriers.



Cybershuttle Continuum

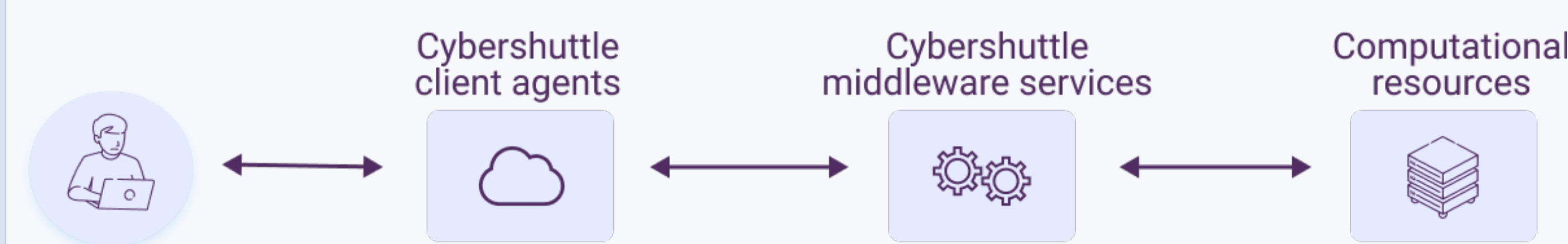
We introduce Cybershuttle, a novel user-facing cyberinfrastructure that offers researchers seamless access to a variety of resources, thereby enhancing their productivity.



The scientist-centric cyberinfrastructure continuum empowered by Cybershuttle. The research environment offers user interfaces for the science community tailored to real-life research scenarios, enabling users to manage their complete research life cycle. This includes computational experiment versioning and tracking. Cybershuttle seamlessly integrates computational resources across all scales, allowing users to scale up or down as needed.

The Cybershuttle project is inspired by our project partners' needs in computational biophysics, neuroscience, and engineering applications in artificial intelligence.

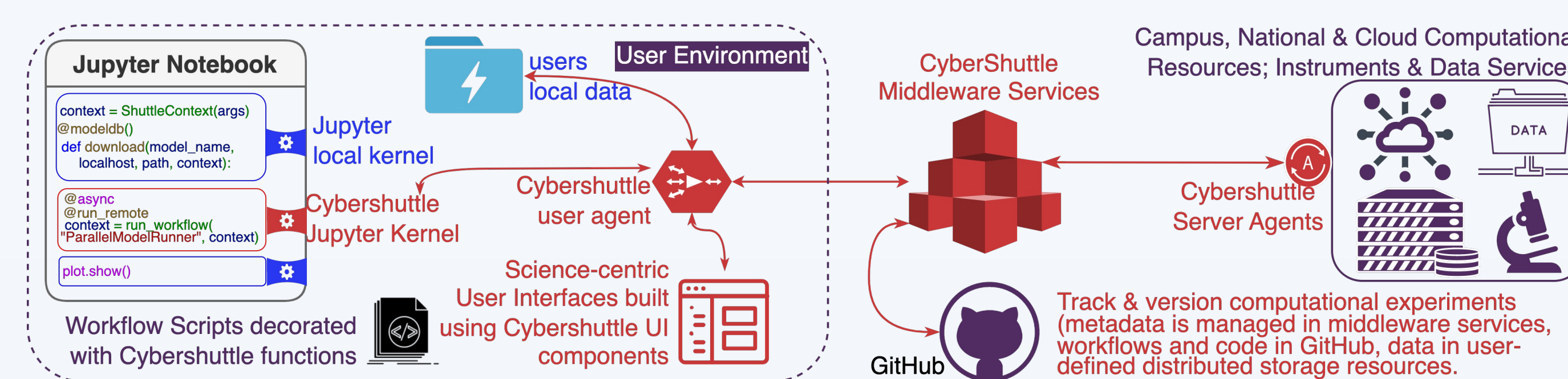
Cybershuttle Agent Concept



Different layers of Cybershuttle building on agent integration concepts:

- At the right is the hardware layer illustrating local desktops, lab clusters, and HPC centers.
- The middleware layer provides a unified interface for accessing and managing compute and data resources across different platforms.
- Finally, the application layer consists of the end-user applications that scientists use to perform their research, seamlessly synchronized with platform services.

High-Level Architecture

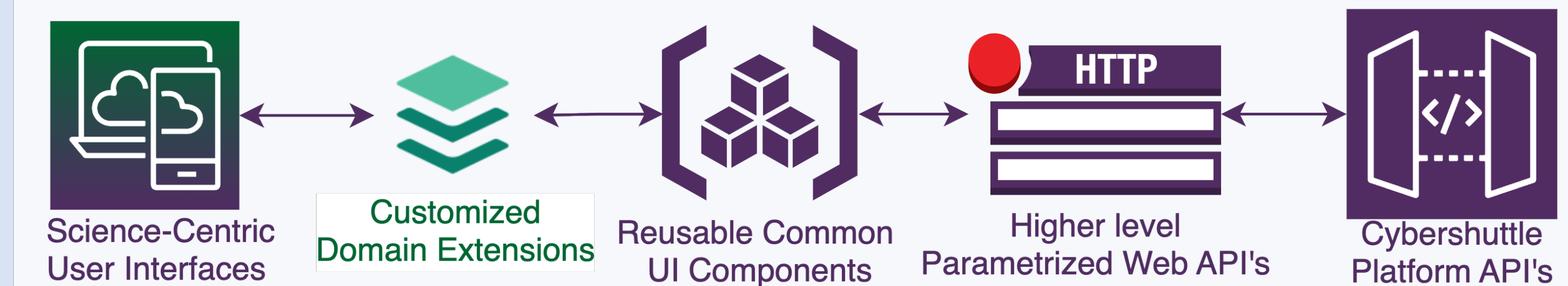


Cybershuttle builds upon Apache Airavata, evolving into an Agent-centric Architecture. Cybershuttle Agents are programs that users can install on their machines to interact directly with the Cybershuttle user environment. The Cybershuttle Platform is an intermediary between local agents and remote resources, facilitating communication and enabling advanced community features, such as metadata sharing and search.

Community Engagement

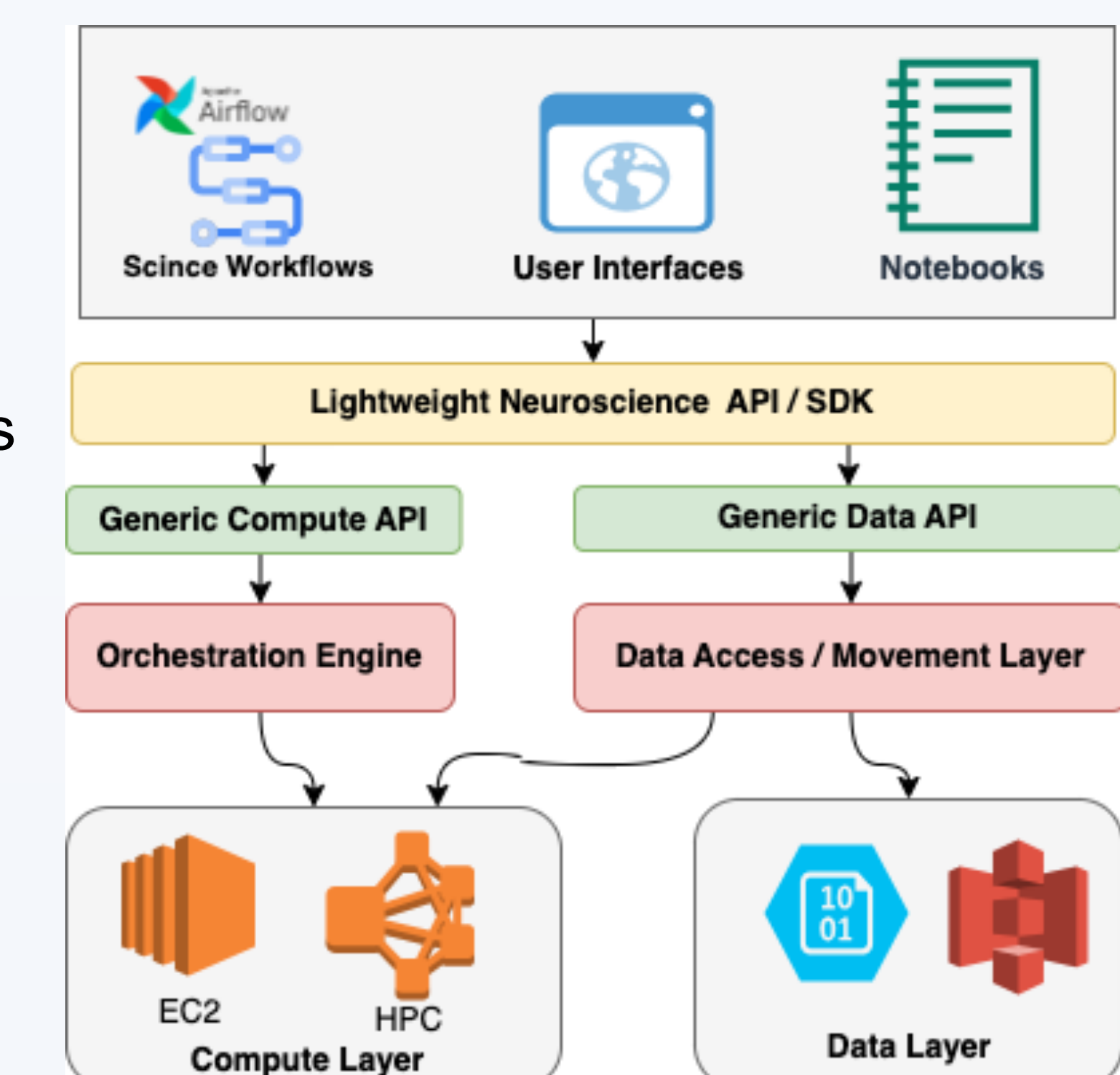
The current implementation of Cybershuttle serves as a proof of concept, showcasing its ability to scale up computational work and foster collaboration across institutions. Although our initial emphasis has been on a smaller set of computational science use cases, our plan involves a spiral approach, wherein we iteratively enhance and expand the system's capabilities to cater to the requirements of larger scientific communities.

Domain Specific Hierarchies API's



Example: Neuroscience Implementation

- Cybershuttle offers extensible modular APIs, including generic implementations and domain-specific SDKs.
- This empowers researchers to develop and program using these versatile layers as a foundation.
- Users will have the flexibility to select from commonly used standard user interfaces to customizable programming options.



Cybershuttle Team



Suresh Marru, Sudhakar Pamidighantam, Dimuthu Wannipurage, Marcus Christie, Eroma Abeysinghe



Beth Plale, Yu Lou



Emad Tajkhorshid, Barry Isralewitz, David Hardy, Seid Koric, Diab Abueidda, Jim Basney



Rafael Bernardi, Diego Gomes



Giri Krishnan, Maxim Bazhenov, Shava Smullen, Amit Majumdar, Kenneth Yoshimoto



Anton Arkhipov, Kael Dai, Shinya Ito

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