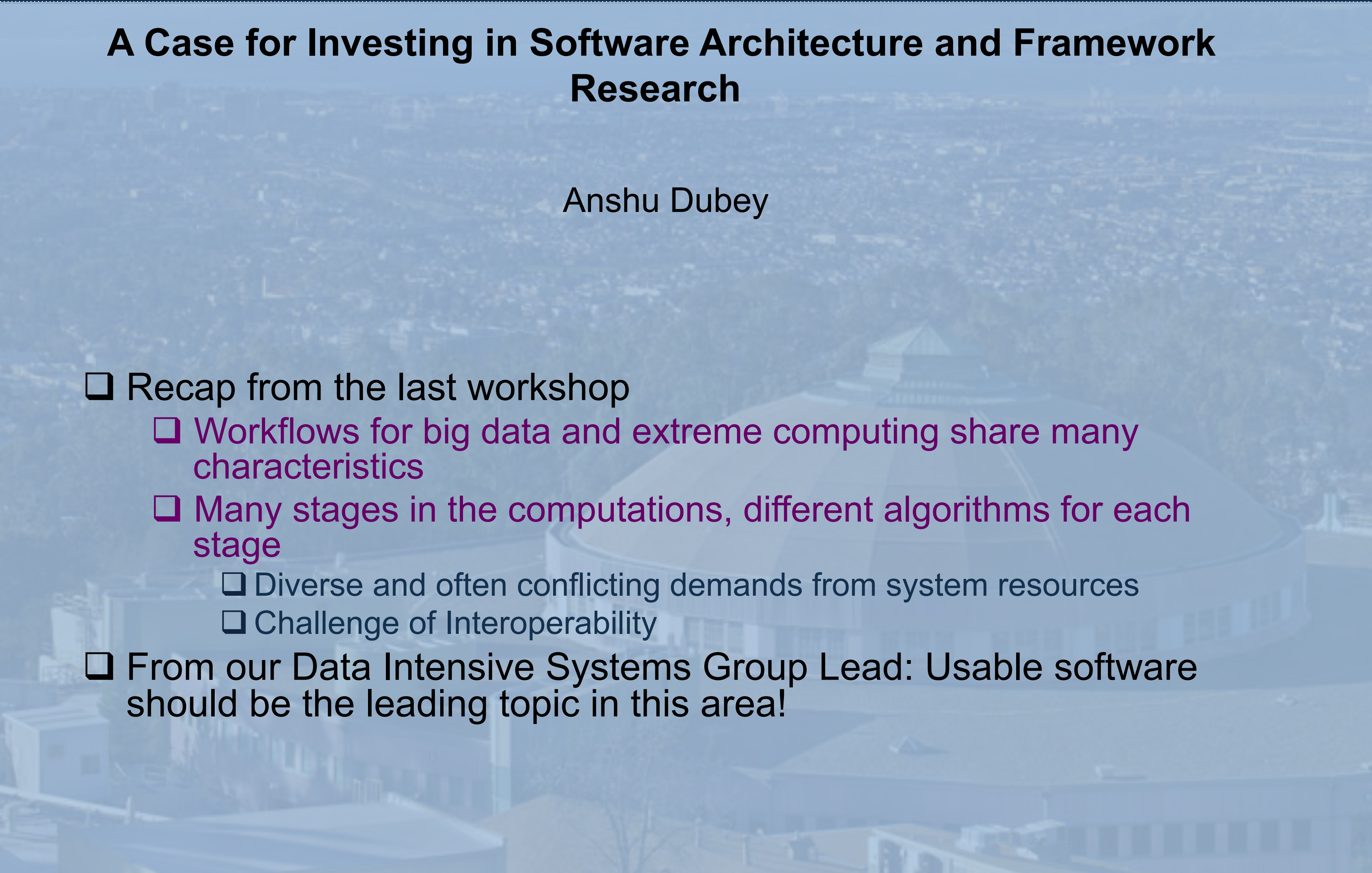


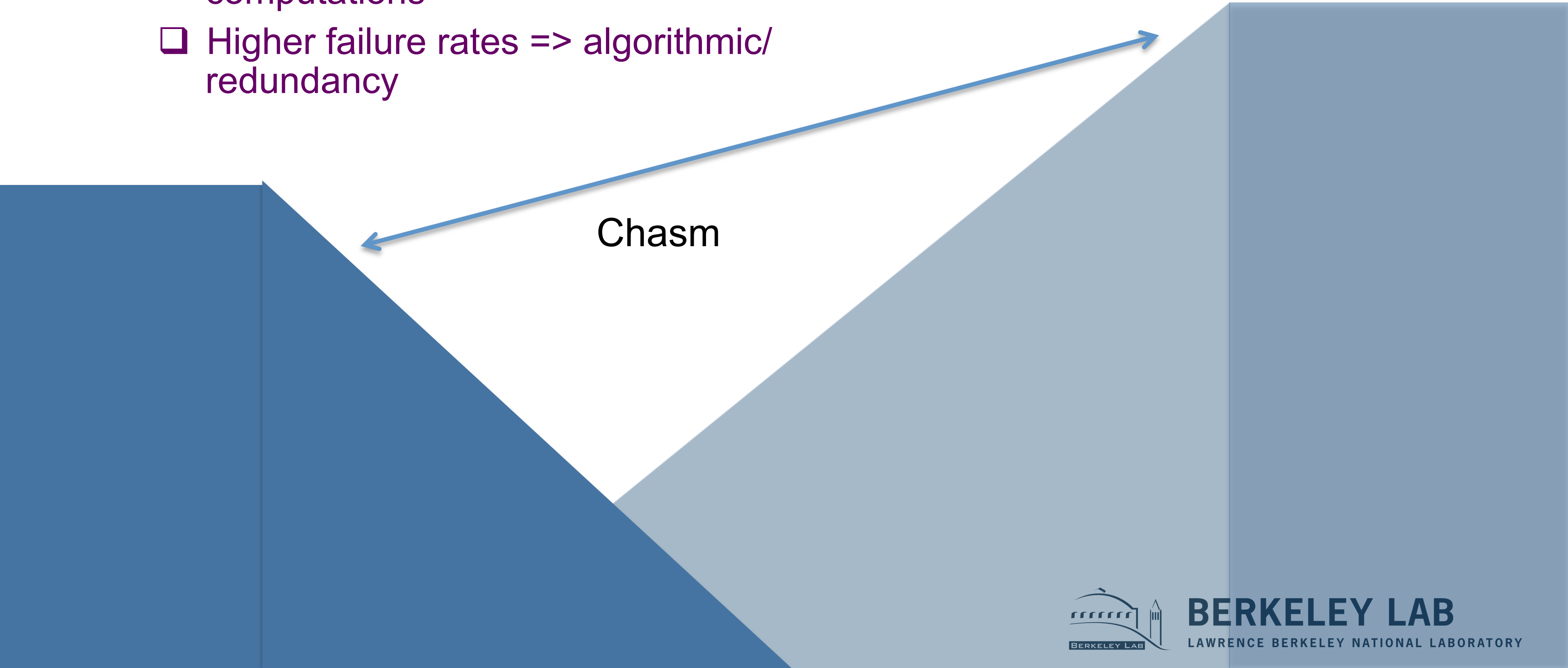
A Case for Investing in Software Architecture and Framework Research

Anshu Dubey

- Recap from the last workshop
  - Workflows for big data and extreme computing share many characteristics
  - Many stages in the computations, different algorithms for each stage
    - Diverse and often conflicting demands from system resources
    - Challenge of Interoperability
- From our Data Intensive Systems Group Lead: Usable software should be the leading topic in this area!

Software Architecture and Frameworks

- ❑ We know how to design for clusters
  - ❑ Componentization, Composability
  - ❑ Achieved at the cost of some performance loss
- ❑ We do not know how to design for the future
  - ❑ Heterogeneity => need for abstraction lifting
  - ❑ Data movement minimization => rethinking computations
  - ❑ Higher failure rates => algorithmic/ redundancy



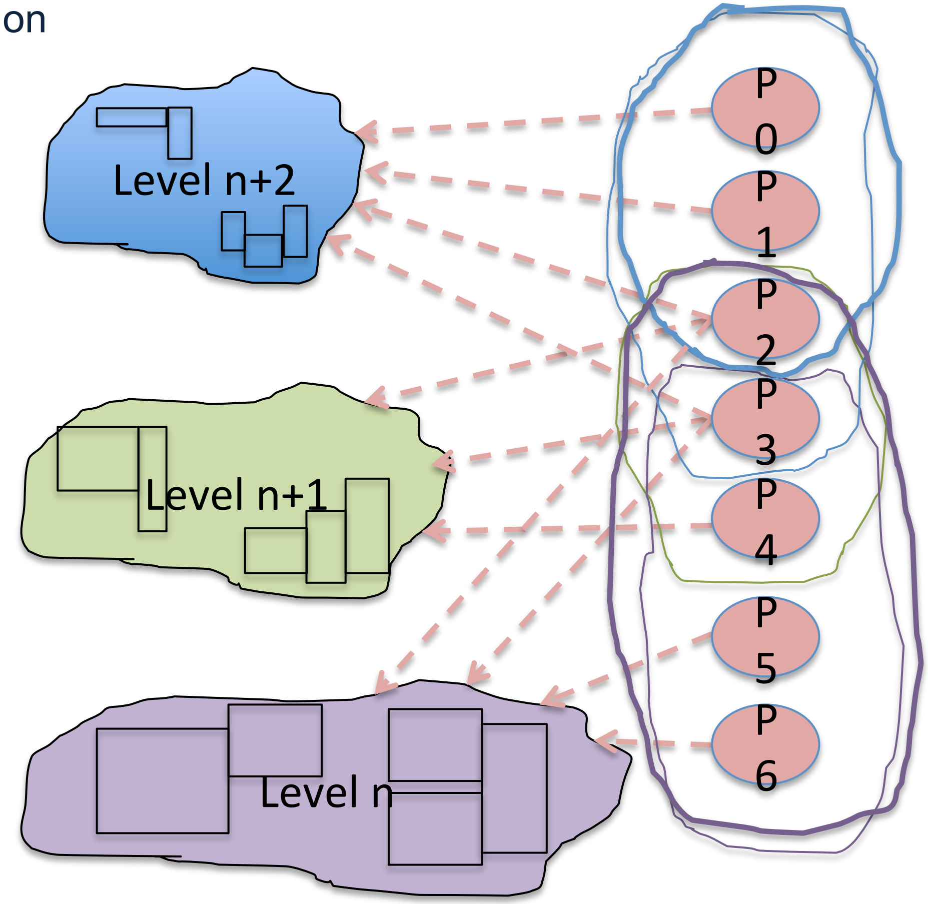
Why the Urgency ?

- ❑ A huge array of design choices
- ❑ Available benchmarks and/or applications studies focus on one programming abstraction at a time
  - ❑ Usually fine-tuned to produce the best possible results to show-case the technology
  - ❑ Do not always translate to equivalent performance at production level
  - ❑ Almost no data about what happens when you mix them
- ❑ Separation of concerns will dictate that different abstractions handle different concerns
  - ❑ We need to figure out what the framework that enables this kind of interoperability will look like
  - ❑ Then we will need to figure out how to get there from here
  - ❑ Build tools and methodologies along the way

There are some efforts to refactor, but in the absence of knowing what should a code look like after refactoring, the developers are operating blind.

Example of Abstractions (SAMR)

- ❑ Abstractions in use
  - ❑ Stencil DSL for solvers
    - ❑ Address heterogeneity and operation fusion for performance
  - ❑ Tiling for fine-grain parallelism and memory management
  - ❑ Dynamic tasking for eliminating unnecessarily expensive bulk-synchronous parallelism



Logical Vs Physical View of the physical domain