# GCLab

Modeling Nondeterminism for Reproducibility of HPC Applications

**Dylan Chapp, Danny Rorabaugh, Michela Taufer**

Project Overview

HPC applications at exascale must content with an **unprecedented degree of nondeterminism**, leading to:
- Loss of computational reproducibility
- Hampered debugging

Record-and-Replay (R&R) tools offer a means to capture, then **deterministically replay executions**
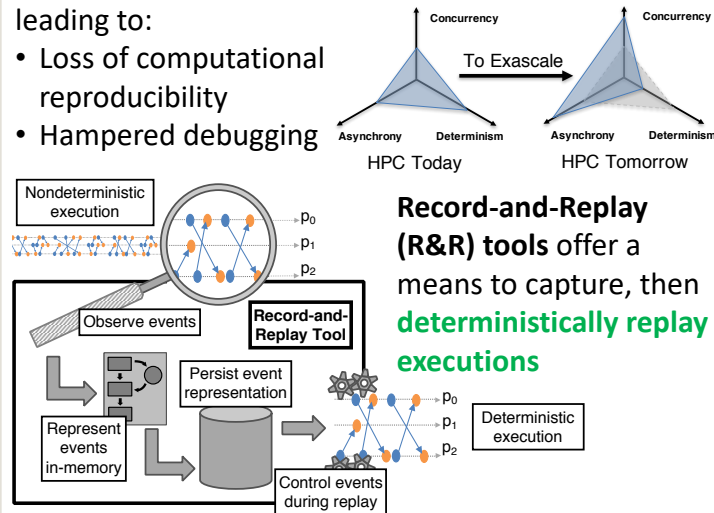

Modeling Methodology

We model parallel executions as directed acyclic event graphs and simulate the recording phase of R&R tools on the modeled executions.
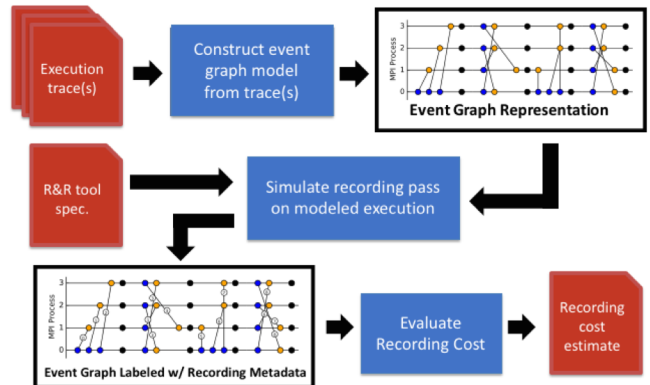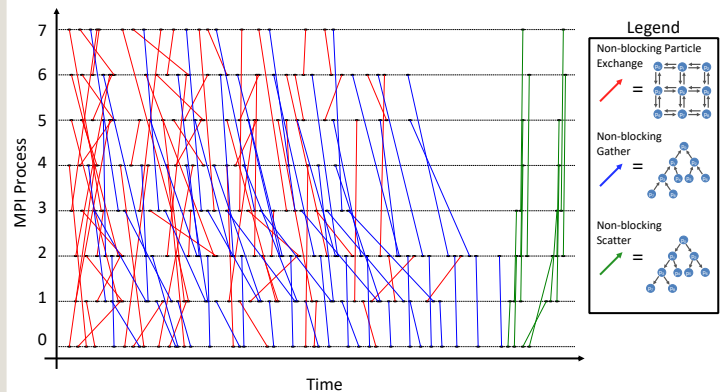

Our modeling methodology enables study of the links between message-passing patterns and recording cost

Motivating Case Study

We study the cost of recording the **Monte Carlo Benchmark (MCB)** using the **R&R tool ReMPI** under varied application and tool configurations
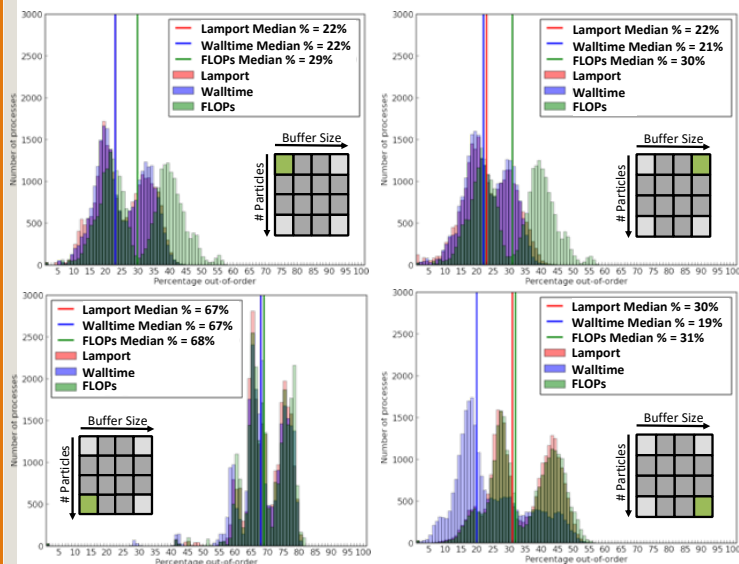
Initial Results and Future Directions

We extract the communication patterns that contribute most to recording cost from event graph models

Publication

D. Chapp, D. Rorarbaugh, and M. Taufer: **Modeling Record-and-Replay for Nondeterministic Applications on Exascale Systems.** Poster at Workshop on Modeling and Simulation of Systems and Applications (ModSim), 2018.

THE UNIVERSITY OF TENNESSEE KNOXVILLE

Lawrence Livermore National Laboratory

NSF

GCL