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Systems software is a critical fabric of modern technology. Enhancing the performance of the system stack is imperative; however, due to the monumental shift of underlying hardware, conventional performance techniques do not work anymore. Datacenters are more heterogeneous than ever due to the end of Moore's law and new workloads (ML) becoming dominant. This heterogeneity is enabled by innovations in interconnects (CXL) and persistent media (3DXpoint, XL-flash), but new hardware requires redesigning the system stack to achieve peak performance. Reducing data movement, utilizing hardware resources effectively, and understanding how new hardware properties interplay have become more crucial. My research has focused on exploring new data-intensive computation paradigms for byte-addressable storage and efficient resource orchestration. I am also interested in databases, distributed storage, and systems for ML.

Recently, we developed WiscSort, a new approach to high-performance concurrent sorting for existing and future byte-addressable storage (BAS) devices. WiscSort carefully reduces writes, exploits random reads by splitting keys and values during sorting, and performs interference-aware scheduling with thread pool sizing to avoid I/O bandwidth degradation. We introduce the BRAID model that encompasses the unique characteristics of BAS devices. Many state-of-the-art sorting systems do not comply with the BRAID model and deliver sub-optimal performance, whereas WiscSort demonstrates the effectiveness of complying with BRAID. We show that WiscSort is 2-7x faster than competing approaches on a standard sort benchmark. We evaluate the effectiveness of key-value separation on different key-value sizes and compare our concurrency optimizations with various other concurrency models. Finally, we emulate generic BAS devices and show how our techniques perform well with various combinations of hardware properties.

As part of my graduate course projects, we introduced a hierarchical validation scheme for optimistic concurrency control databases, explored data structure designs for disaggregated storage, built a strongly consistent, partition-tolerant KV store using quorum protocol, and explored ML for systems (learned LSM and MLOS). At HPE labs, we developed benchmarks for disaggregated persistent fabric attached memory framework (openFAM) to evaluate it against traditional cluster-based HPC programming models (openSHMEM and MPI) and developed features for large-scale datacenter infrastructure management software. Finally, at UT Austin, we investigated the impact of privacy policies (GDPR) on storage systems. We demonstrated how retrofitting existing storage designs to work efficiently with new privacy policies is inadequate. We built a GDPR benchmark (GDPRBench) that lets users assess a storage system's compliance level and helps evaluate compliance-performance tradeoffs.

I strongly believe in the "measure, then build" ethos. As a researcher, I aspire to build strong performance intuitions and use measurements to verify the problem before inventing a solution. Through this internship, I wish to be exposed to the production systems that I can study and improve. From my collaboration with the team, I want to identify what important problems in our field need attention and improve my engineering skills in general. Considering the longer timeframes of systems projects, I am willing to work with the team for the completion of the project beyond the scope of this internship.
Looking forward to hearing from you.