In the post-Moore era, using specialized hardware tuned to specific applications is a promising direction to get higher performance. To create a cohesive specialization roadmap for the future, we must ask: how far can we go by optimizing software for existing hardware, and when must we turn to the more expensive option of deploying specialized hardware? I argue that for many important systems problems for which specialized hardware---intelligent NICs, FPGAs, programmable switches, and GPUs---has been proposed, software-optimized systems can provide competitive performance.

In this talk, I will focus on this optimization-specialization tradeoff in the context of distributed systems for modern datacenter networks. By using new techniques to better use existing CPUs and networks, my work invalidates the commonly-held belief that software-based networking cannot match datacenter network speeds, and allows building fast distributed systems that run entirely in software. I show that such designs have a fundamental latency advantage over distributed systems that use specialized hardware, whose limited flexibility often increases network round trips. I will describe in detail the design of eRPC, the first networking library to provide near-network performance in commodity datacenters. eRPC aligns with the end-to-end principle, and answers long-standing networking questions about reliability and congestion control.

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