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Chameleon: Taking Science from Cloud to Edge

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The increasing popularity of IoT devices allows us to communicate better, interact better, and ultimately build a new type of a scientific instrument that will allow us to explore our environment in ways that we could only dream about just a few years ago. This disruptive opportunity raises a new set of challenges: how should we manage the massive amounts of data and network traffic such instruments will eventually produce? What types of environments will be most suited to developing their full potential? What new security problems will arise? And finally: what are the best ways of leveraging intelligent edge to create new types of applications?

In a research area that creates a new deployment structure, such questions are too often approached only theoretically for lack of a realistic testbed — a scientific instrument that keeps pace with the emergent requirements of science and allows researchers to deploy, measure, and analyze relevant scientific hypotheses. To help create such instrument, the NSF-funded Chameleon testbed, originally created to provide a platform for datacenter research, has now been extended to support experiments from cloud to edge.

In this talk, I will first describe Chameleon — a scientific instrument for computer science systems research, originally created to allow exploration of research topics in cloud computing such as virtualization, programmable networking, or power management — as well as its recent extension to support experimentation at the edge. I will describe the testbed capabilities and operational practices required to provide a platform for experimentation in the edge to cloud continuum, and give examples of edge to cloud research and education projects our users created. I will also describe tools and services that Chameleon provides to improve experimental methodology and reproducibility of experiments in this environment, and illustrate how a common experimentation platform can enhance sharing and scientific productivity.

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