

# Title

Automated, Distributed Systems Testing for Kubernetes Controllers

## Session Description\*

Please provide a detailed, focused description on what this session will cover, written in the [third person](#). This is what will be used in the online schedule, if accepted.

**Note:** We will not select a submission that has already been presented at a previous CNCF or Linux Foundation event **within the last year**. If your submission is very similar to a previous talk, please include information on how this version will be different.

1,000 character max

The Kubernetes ecosystem has thousands of controller implementations for different applications and platform capabilities. A controller's correctness is therefore critical, and yet, can be compromised by myriad factors, such as asynchrony in the overall distributed system, unexpected failures, networking issues, and controller restarts. This in turn can lead to severe safety violations, such as incorrectly deleting StatefulSets and PVCs. Controller-developers unfortunately lack automated testing tools to harden their code against these conditions.

In this talk, Xudong Sun and Lalith Suresh will describe common bug patterns in Kubernetes controllers. They will also present an automated testing tool called Sieve, which systematically tests Kubernetes controllers to harden them against the aforementioned scenarios. Sieve has already discovered (and led to fixes for) several safety-critical bugs in popular Kubernetes controllers for Zookeeper, Cassandra, RabbitMQ, MongoDB, XtraDB, etc.

## Benefits to the Ecosystem\*:

This is your chance to elaborate. Tell us how the content of your presentation will help better the ecosystem or anything you wish to share with the co-chairs and program committee. We realize

that this can be a difficult question to answer, but as with the description, the relevance of your presentation is just as important as the content.

Max of 1,000 characters.

Our presentation will advocate the importance of correctness for Kubernetes controllers. Our vision is to reliably and deterministically test for such distributed systems bugs at development time so as to prevent disastrous consequences in production (such as safety violations and data loss).

We will present our study of real-world Kubernetes controller bugs and their common patterns, in the hope of helping the community understand the problems and challenges involved. We will also describe our efforts in combating bugs in Kubernetes controllers via our open-source testing tool named Sieve. We will share our experience using Sieve to identify and fix more than twenty safety-critical bugs in a range of Kubernetes controller implementations.

In short: building distributed systems is hard and building a Kubernetes controller is no exception. We hope to make developers more productive in shipping robust controller implementations, and invite the community to join the Sieve effort.

## Open Source Projects:\*

*Please list out all open source projects that you will be discussing in your presentation and include any relevant links for these projects.*

The Sieve testing tool can be found at:

<https://github.com/sieve-project/sieve>

We wrote a paper describing the foundations of our testing methodology:

<https://sigops.org/s/conferences/hotos/2021/papers/hotos21-s11-sun.pdf>

## Speakers

Lalith Suresh is a researcher at VMware Research in Palo Alto. He is currently leading efforts to simplify the design, development and testing of large-scale cluster managers. He has also worked on failure detection, programmable networking, big data, and remote memory. Lalith has given talks at many academic conferences including USENIX OSDI, USENIX NSDI, USENIX ATC, HotOS, ACM SoCC, IFIP WD; a keynote at the IFIP Middleware Doctoral Workshop; talks at industrial conferences like VMware RADIO; as well as invited talks at universities like UT Austin and Rutgers.

Xudong Sun is a Ph.D. student from the University of Illinois at Urbana-Champaign. Xudong's research interest is in system reliability with a focus on bug and misconfiguration detection. Xudong is currently working on enhancing the reliability of cloud systems and applications (e.g., Kubernetes and the operators) using automated bug detection techniques. Before that, Xudong was working on detecting misconfigurations of cloud systems. Xudong has given talks at academic conferences like USENIX OSDI and HotOS.