Seminar/Talk

Random Testing of Distributed Systems with Theoretical Guarantees

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Random testing has proven to be an effective way to catch bugs in concurrent and distributedsystems. This is often surprising, as the space of executions is enormous and conventional formalmethods intuition would suggest that bad behaviors would only be found by extremelyunlikely coincidences.Empirically, many bugs in distributed systems can be explained by interactions amongonly a small number of features. Thus, one can attempt to explain the effectiveness ofrandom testing under various “small depth" hypotheses. In particular, it may be possible totest all interactions of k features for a small constant k by executing a family of tests that isexponentially or even doubly-exponentially smaller than the family of all tests. Moreover,under certain conditions, a randomly chosen small set of tests is sufficient to cover all k-wiseinteractions with high probability.I will describe two concrete scenarios. First, I will describe bugs in distributed systemscaused by network partition faults. In many practical instances, these bugs occur due to twoor three key nodes, such as leaders or replicas, not being able to communicate, or becausethe leading node finds itself in a block of the partition without quorum. In this case, I willshow using the probabilistic method that a small set of randomly chosen tests will cover all“small partition” scenarios with high probability.Second, I will consider bugs that arise due to unexpected schedules (interleavings) ofconcurrent events. Again, many bugs depend only on the relative ordering of a small numberof events (the “bug depth” of the bug). In this case, I will show a testing algorithm thatprioritizes low depth interleavings and a randomized testing algorithm that bounds theprobability of sampling any behavior of bug depth k for a fixed k. The testing algorithmis based on combinatorial insights from the theory of partial orders, such as the notionof dimension and its generalization to d-hitting families as well as results on online chainpartitioning.

Tuesday, September 15, 2020 02:00pm - 03:00pm

https://istaustria.zoom.us/j/92615827655?pwd=OHk4TVV1bG9FcWVXSCsvNFQ3MmZrQT09
Meeting ID: 926 1582 7655 Passcode: 993438

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