

**virtFlow: Guest Independent Execution Flow Analysis Across Virtualized Environments**

**Abstract:**

An agent-less technique to understand virtual machines (VMs) behavior and their changes during the VM life-cycle is essential for many performance analysis and debugging tasks in the cloud environment. Because of privacy and security issues, ease of deployment and execution overhead, the method preferably limits its data collection to the physical host level, without internal access to the VMs. We propose a host-based, precise method to recover execution flow of virtualized environments, regardless of the level of virtualization. Given a VM, the Any-Level VM Detection Algorithm (ADA) and Nested VM State Detection (NSD) Algorithm compute its execution path along with the state of virtual CPUs (vCPUs) from the host kernel trace. The state of vCPUs is displayed in an interactive trace viewer (TraceCompass) for further inspection. Then, a new approach for profiling threads and processes inside the VMs is proposed. Our proposed VM trace analysis algorithms have been open-sourced for further enhancements and to the benefit of other developers. Our new techniques are being evaluated with workloads generated by different benchmarking tools. These approaches are based on host hypervisor tracing, which brings a lower overhead (around 1%) as compared to other approaches.