Adaptive Virtual Machine Management in the Cloud: A Performance-Counter-Driven Approach

Chen Liu and Gildo Torres • Department of Electrical and Computer Engineering • Clarkson University • {cliu, torresg}@clarkson.edu

Problem:
• Cloud computing and virtualization technologies have become pervasive
• Co-running virtual machines (VM) introduce contention on shared resources
• OS scheduler is unaware of potential contention on processor resources among concurrent VMs

Technical Approach:
• Platform: Kernel–based Virtual Machine (KVM)
• Hardware Events: Monitor Last-Level Cache (LLC) misses, L1 misses, and committed instructions
• Runtime Model: Regression model based on memory access behavior to capture the phase change of VMs

Key Idea:
We propose to adaptively assist the OS scheduler to monitor and manage the co-running VMs:
• Use Hardware Performance Counters (HPC) to collect runtime information of VMs
• Construct statistical model to represent the phases of execution of each VM
• Assist Linux scheduler by scheduling/migrating VMs based on dynamic evaluation of resource demands

Benefits:
• Dynamic model to capture VM’s runtime behavior
• Manage VM-to-Core mapping in an adaptive and autonomous fashion

Expected Results:
• Mitigating resource contention among VMs
• Improvement of overall system throughput

Future Work:
• Perform dynamic phase detection and prediction
• Machine learning-based online performance model