

Abstract

One Bit is Not Enough: The Benefit of Reference Analysis in Virtual Memory Management

For half a century operating systems used a single bit to make placement and migration decisions for pages of memory. The historic reference (“use”) bit in the page entry indicates if a memory page was used in the past. Heuristics (e.g., clock algorithms) were built upon this single bit to extract the reference characteristics supporting higher memory management strategies.

With the upcoming of heterogeneous memory architectures with non-uniform memory access, the time has come to rethink the interface between the memory subsystem and the operating system to provide comprehensive memory-reference information that guides memory management decisions. The talk demonstrates the demand of operating systems for information about access frequency, gap distribution, and request origin to find the best location and access policy for a memory region with respect to latency, bandwidth, and energy consumption.