FIRM: Fair and High-Performance Memory Control for Persistent Memory Systems

Summary:

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The paper talks about a memory controller scheme that achieves high throughput and fairness in a system concurrently running both persistent and non-persistent applications.
This paper makes the following contributions:

- Identify new problems related to resource contention at the shared memory interface when persistent and non-persistent applications concurrently access memory. The key fundamental problems, caused by memory access characteristics of persistent applications, are:
    - frequent write queue drains
    - frequent bus turnarounds, both due to high memory write intensity
    - memory bandwidth underutilization due to low memory write parallelism.
- A new strided writing mechanism is proposed to improve the bank-level parallelism of persistent memory updates. This technique improves memory bandwidth utilization of memory writes and reduces the stall time of non-persistent applications' read requests.
- A new persistence-aware memory scheduling policy is proposed between read and write requests of persistent and non-persistent applications to minimize memory interference and reduce unfair application slowdowns. This technique reduces the overhead of switching the memory bus between reads and writes by reducing bus turnarounds and write queue drains.
- Comprehensively compare the performance and fairness of our proposed persistent memory control mechanism, FIRM, to five prior memory schedulers across a variety of workloads and system configurations. Our results show that
    - FIRM provides the highest system performance and fairness on average and for all evaluated workloads
    - FIRM's benefits are robust across system configurations
    - FIRM minimizes the bus turnaround overhead present in prior scheduler designs.

Questions:

1. Does this memory controller scheme work with a system which is both persistent and non-persistent?
2. How does FIRM memory scheme affect energy consumption?