Parallel Log Cleaning

- Datacenter storage system
- All data stored in DRAM at all times
- Low-latency: 5 - 10µs small RPCs across datacenter
- Large scale: 1,000 - 10,000 servers
- Goal: Enable novel applications with 100 - 1,000x decrease in storage latency / increase in ops/second

Problem with Conventional Memory Allocators

- 50% of RAMCloud hardware cost is DRAM, but
- Existing memory allocators don't use memory efficiently, particularly when access patterns change:
  - Non-copying allocators (e.g. malloc) suffer fragmentation
  - Language-based copying garbage collectors waste memory to improve performance
  - How to get high memory utilization and high performance?
  - Exploit restricted use of pointers in storage systems

Two-Level Cleaning

- Level 1: Compact segments in memory (no cleaning on disk)
- Level 2: Clean segments on disk (see "Parallel Log Cleaning")
- 30-100x more memory bandwidth than net/disk bandwidth

Client Write Performance

- Compaction improves client throughput by 2-8x
- Up to 400,000 durable writes per second at 90% memory utilization
- Bandwidth overhead of cleaning reduced by 2-20x