**Mercury: host-side flash caching for the datacenter**

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**Shared-pool datacenter**
- **Shared VM servers**
  - No persistent state
  - VMs not tied to servers, can be dynamically added, moved
  - Servers can be added, upgraded, repurposed on-the-fly
- **Shared Storage**
  - Unified central storage management
  - Shared pool scales more easily; resources can be reassigned on-the-fly
  - Data can be moved to most appropriate media

**Integrated flash memory**
- 10s-100s GB of flash being integrated into servers
- New price/perf tier between disk and DRAM
- Flash is 10-100x faster than disk, ¼ price of DRAM
- High IO-per-second (IOPS) storage close to CPU

...but using integrated flash for primary storage breaks the shared-pool datacenter model
- Binds software services to specific servers
- Puts flash primary storage out of reach of storage management tools

**Mercury portable flash cache**
- Uses integrated flash or other local storage as a cache for centrally-managed shared storage
- Implements a block-oriented cache; write-through to maintain coherence with backing store
- Deployable as
  - Hypervisor filter driver, transparent to guest OS
  - OS filter driver, transparent to applications
  - Application cache
  - Proxy cache for a network storage protocol

**Prototype deployment**
- KVM/QEMU block driver, loads into stock QEMU
- Provides new disk format, *hg*
- Requests sent to *hg* device handed to SSD cache or passed to raw backing device

**Performance results**

- **Desktop traces**
  - Replayed disk-level traces from Windows XP desktop
  - Cache warmed with one to three days of traces
  - All tests run on same trace
  - Nearly 40% reduction in mean I/O service time
  - Near 50% reduction of requests sent to server (almost all reads handled by Mercury)

- **iozone**
  - iozone run directly against server iSCSI volume and via Mercury cache
  - Serial I/O showed small improvement
  - Random I/O had substantial speedup (almost all reads handled by Mercury)