Solving the Small Write Problem with RAID4S

Solid State Drives (SSDs):
- Constructed of flash RAM
- Faster random I/O
- Lower power consumption
- More expensive

Small Write Problem
- Read:
  - old data
  - old parity
- Compute new parity
- Write:
  - new data
  - new parity

4 I/Os per data block written

RAID4S stores parity data on solid state drives in a disk drive-based RAID4 layout. Initial results show up to 1.6X performance improvement.

RAID4S is Faster Than Disk-Based Alternatives

Random write via block interface
RAID4S up to 1.6X faster than RAID5

RAID4S throughput beats other RAID layouts for writes smaller than 128KB. This indicates that workloads with mostly reads still benefit from RAID4s.

RAID4S performs slightly better than other RAID layouts at all write sizes. I/O is typically performed with a filesystem, so this is a great result.

Conclusions
SSDs provide faster random I/O performance and new research opportunities. This work replaces the parity disk drive in a RAID4 system with SSD.
RAID4S is faster:
- 3X RAID4
- 1.6X RAID5

Rest of Summer
More experiments:
- XDD: mix small and large writes
- TPC-C database benchmark: designed to represent a realistic database workload. Simulates orders and inventory changes at one or more warehouses.