
# Tuning For Speed: Percona Server and Fusion-io

Torben Mathiasen – Percona Live 2011 London
tmathiasen@fusionio.com

# Overview


- XtraDB performance tuning for Fusion-io
- Sharding MySQL instances locally
- Fusion-io Atomic write feature for InnoDB
- ioDrive2/VSL 3 and MySQL expectations

# Basic Tuning

- I/O Schedulers
  - Default with Fusion-io is NOOP
  - Merges requests but does not optimize for rotational devices
  - For MySQL, submitting requests directly to the device have shown performance improvements. use_workqueue=0
- File systems
  - EXT4, trim/discard
  - XFS, online discard with latest kernels
  - Write barriers
    - No cache on ioMemory modules. Acknowledged writes are guaranteed to be persistent. Even during power failure, crashes.
- Outstanding I/O
  - Default is 128 reads and 128 writes per queue. Batching can increase this further. Can make a difference with benchmarking. No clear advantage for MySQL
- Distribute Interrupts
  - Distribute interrupts among multiple cores for multi card setups to avoid soft lockups -> irqbalance

# MySQL Tuning

FUSION-IO

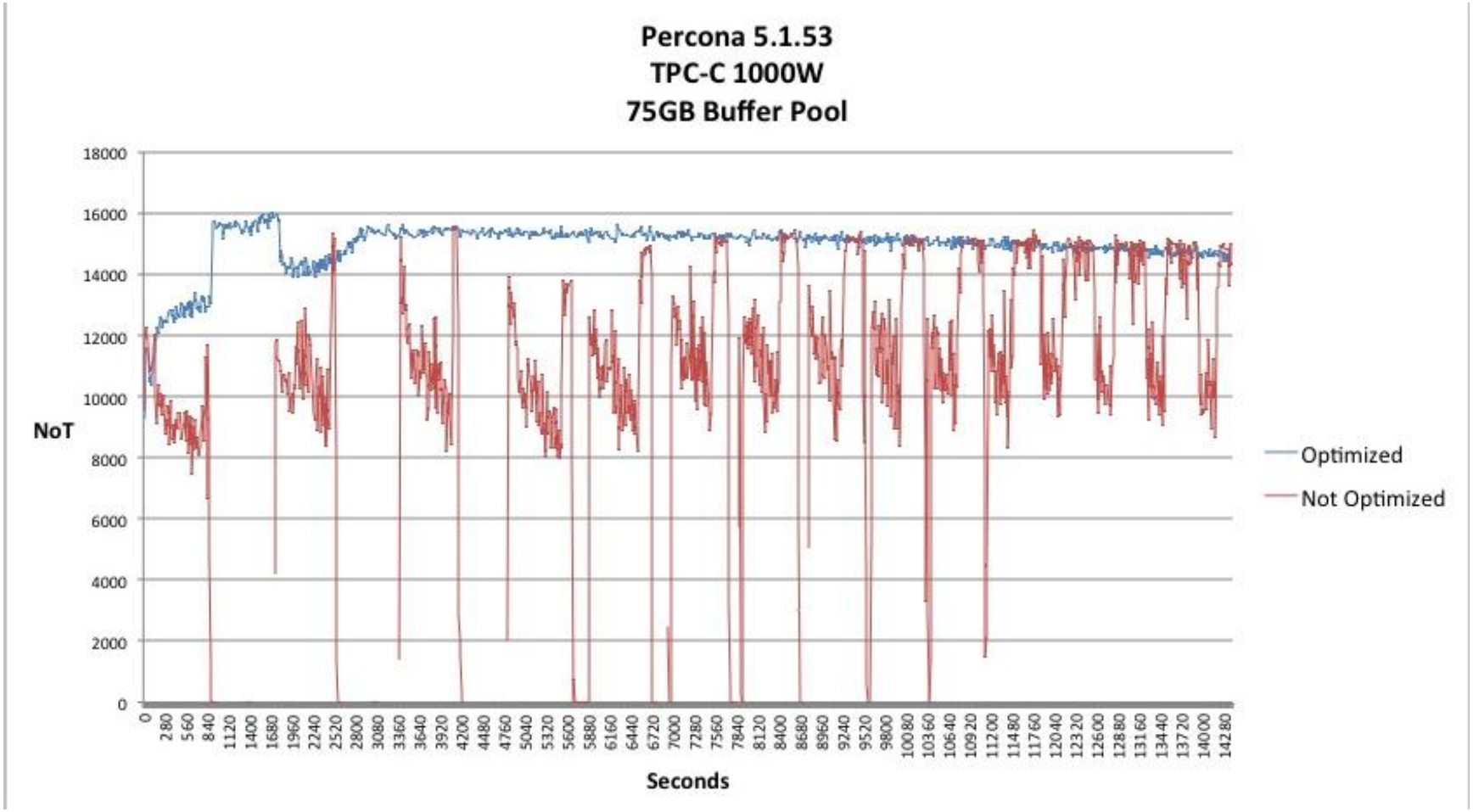
- How to test? Which workloads?
  - Settle on a few, concentrate on those and then verify in production. Production data is great, but may not be available
  - We have been using Percona tpcc-mysql and tpce-mysql. Good workloads, but may not match yours
- Direct I/O vs Buffered
  - Use direct-I/O for data. Logs are usually buffered
  - Buffered I/O introduces an extra data copy. Memory for page cache better spent in buffer pool. Less complex write path
  - When does buffered I/O makes sense?
- Block sizes
  - Linux MD on RHEL6 seems to favor 4K sectors and blocks
  - Marginal better efficiency of the Virtual Storage Layer with 4K sectors
  - For direct-io, Linux requires all I/O to be hardware sector aligned

# MySQL Tuning Cont.


- Check pointing -> heavy writes
  - Adaptive, push I/O constantly.
    Innodb_adaptive_checkpoint=keep_average, keep short loop cycle
  - Buffer Pool vs Dirty pages
    - Large buffer pool can mean a lot of dirty pages. A LOT!

- Mount points
  - Sequential vs Random I/O
    - Spindles are ok at sequential platter access. Flash is better
    - A 500GB database is a big database. But a 640GB io-duo can fit it all
    - If possible, put everything on flash. If needed, put logs on hard drives
  - Spindle hosted database logs
    - Make sure that the spindle does not receive other I/O. Multiple database logs may be sequential individually, but still cause the heads to seek

# What simple optimization can do



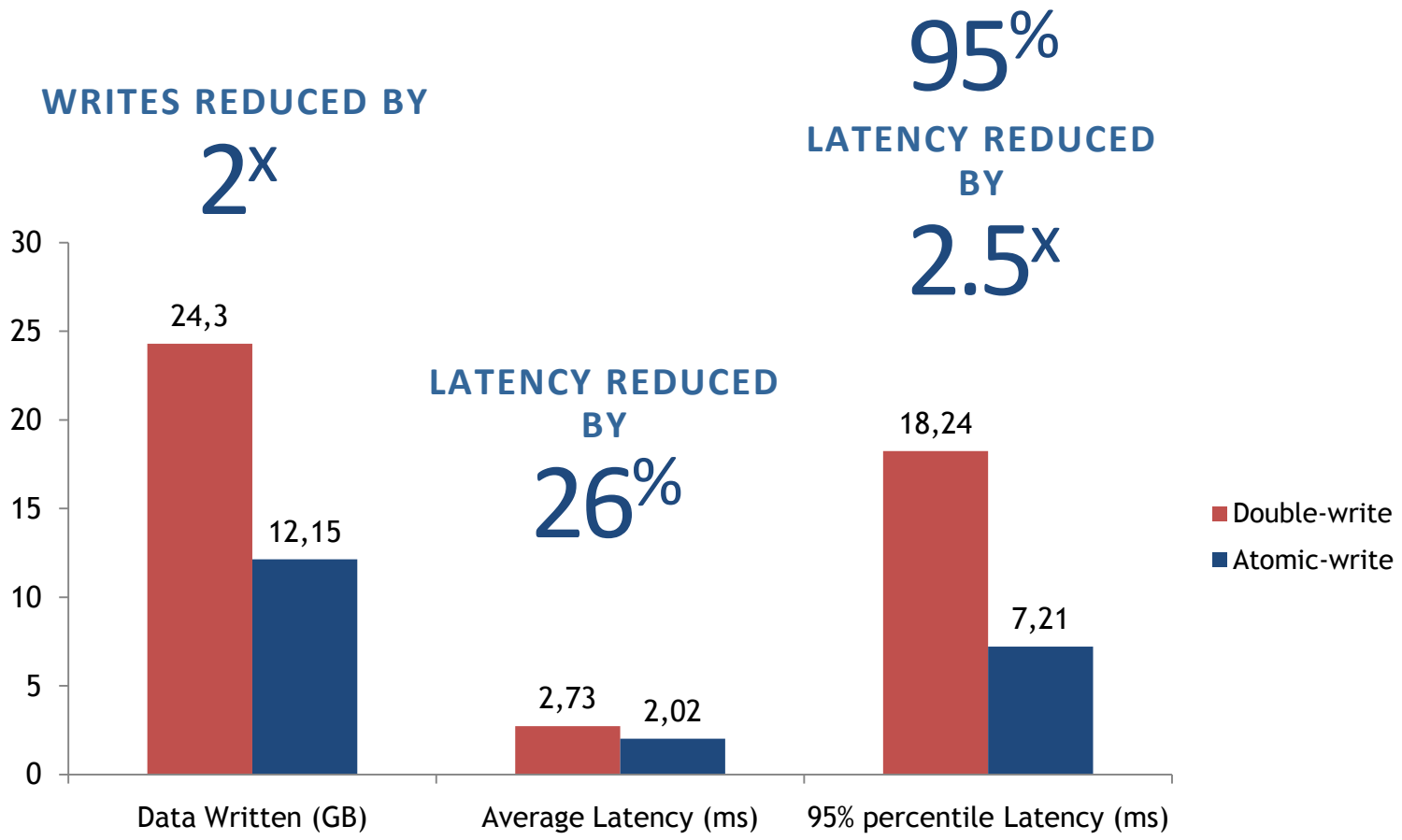
# MySQL Tuning Cont.


- Configuration Parameters
  - innodb_thread_concurrency=0 (limit if CPU bound)
  - innodb_read_ahead=0
  - innodb_read_io_threads=8 (16 for writes)
  - innodb_adaptive_checkpoint=keep_average
  - innodb_flush_method=O_DIRECT
  - innodb_io_capacity=10000
  - Innodb_flush_neighbor_pages=0

# Atomic write or Double Write buffer


- Why is the double write buffer needed?
- Introducing the Fusion-io Atomic Write feature
  - Moves atomicity into the storage device
  - Multiple page writes will either occur in its entirety or not all
  - Less writes, less complexity, better scalability
  - Improves performance considerably compared to using the double write buffer

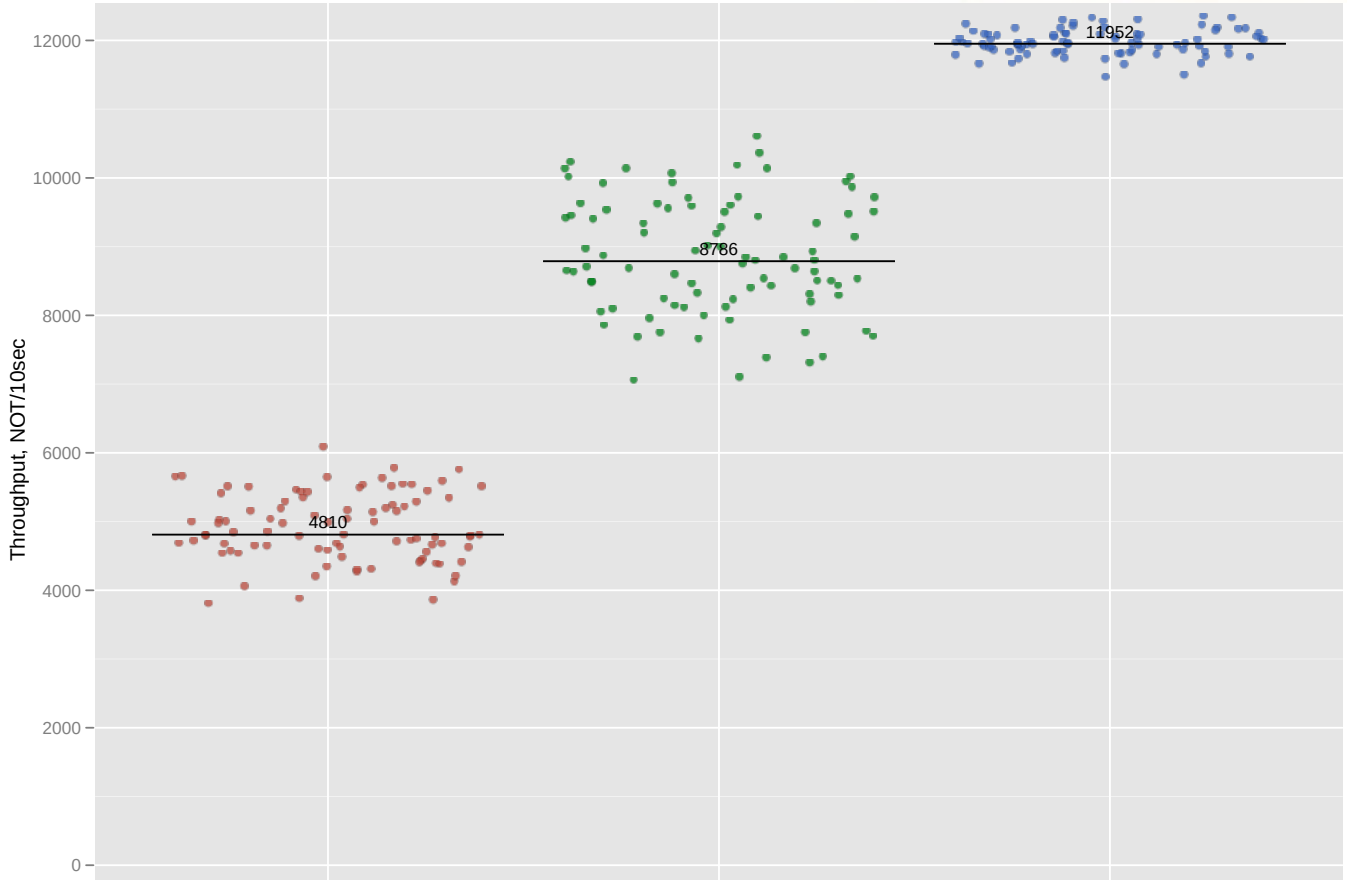
# Atomic Write Performance



# MySQL Multi-instance


- Improving performance with local shards
  - Split a 200GB DB/64GB Buffer pool setup into 4 instances
  - Get 2.4x the performance on the same system
- Multiple independent MySQL instances can better utilize the fast storage device
- Less software locking, better CPU utilization
- Gets more important as core count increases

# Multi-instance - TPC-C




Testing by Percona with Fusion-io:

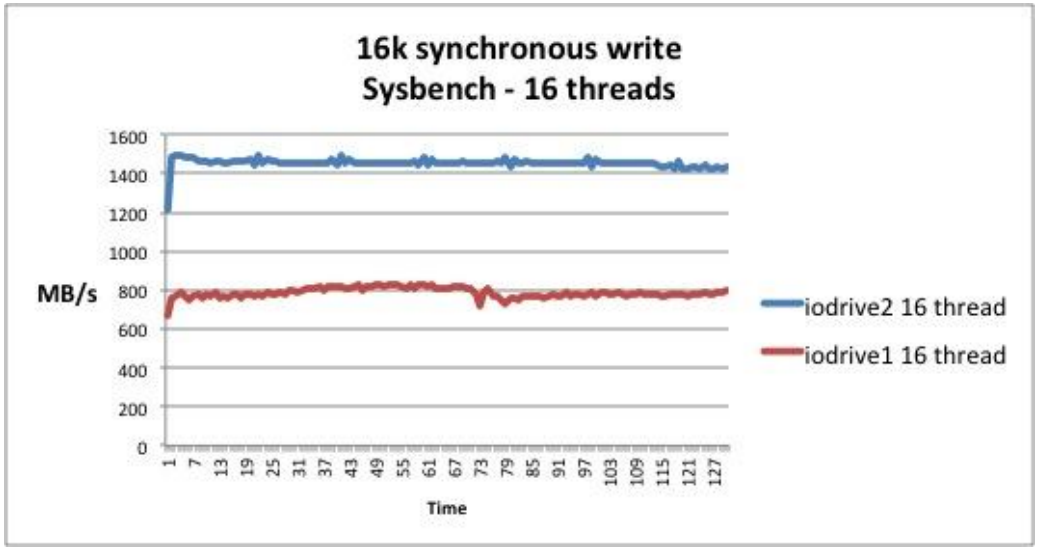
http://www.mysqlperformanceblog.com/2011/10/07/multiple-mysql-instances-on-fusion-io-iodrive/

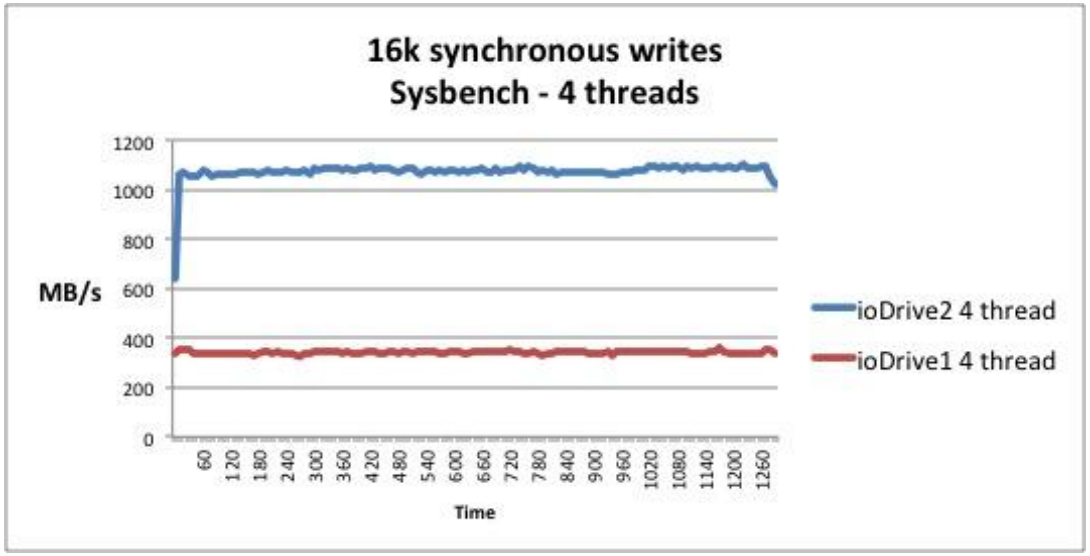
# The ioDrive2 and MySQL

- Virtual Storage Layer 3 improvements
  - Adaptive Flashback
  - Low queue depth performance improvements
  - Synchronous I/O enhancements
  - Better performance on large boxes
  - Improved I/O submission


- Performance consistency
- Low-queue depth performance that matters
- 16K synchronous read/write performance improvements for MySQL

# ioDdrive2 and MySQL cont.




# Questions? - Thank You!

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