Converged Memory: Freedom of Data

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FREEDOM OF TRAVEL TOOK A CENTURY

Train was invented in 1800's

- Steam engine trains arrived in 1804
- Confined to tracks with pre-defined routes
- One central engine
- Great for moving goods heavy materials

Transporting Passengers in 1800's

- Trains were convenient as infrastructure
- Not very convenient from passengers view
- Not great for small distance travel

The automobile to move people within the city

- Freedom and convenience in transportation

DATA FREEDOM WILL TAKE LESS TIME

Storage has followed similar path to passenger trains

1956, IBM invented first HDD

- Infrastructure for IO access only
- Too much management overhead
- Great for bulk data movement
- Lots of effort was done to enhance IOs

Flash was introduced

- Convenient to leverage IO infrastructure
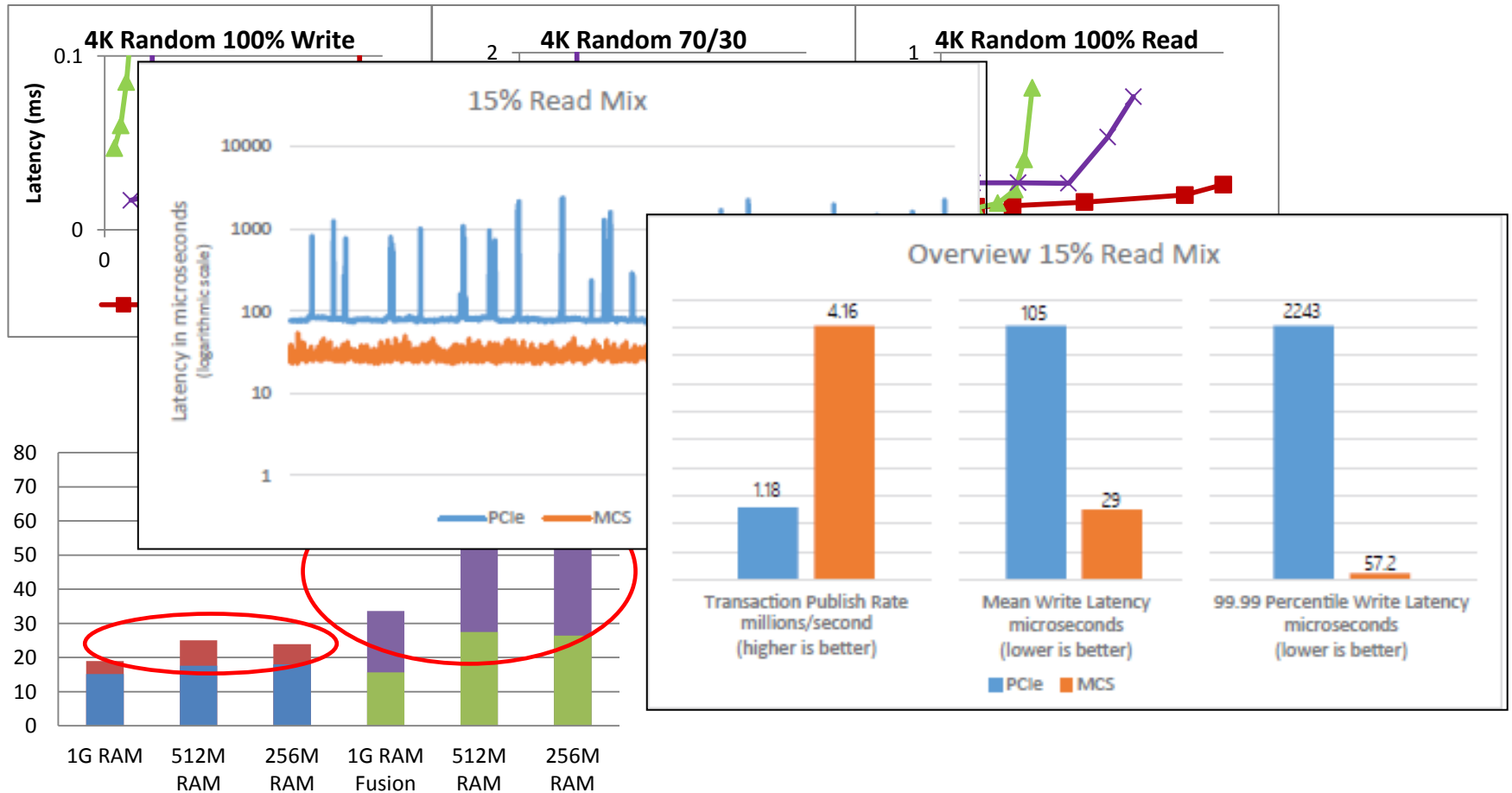- Not great for small data movement

60 centimetros

- Diablo introduced MCS technology
  - Flash module physically in memory
  - IO access through standard OS IO stack

MCS AS A BLOCK DEVICE IN MEMORY

4K Random 100% Write | **4K Random 70/30** | **4K Random 100% Read**

Latency (ms)

15% Read Mix

Latency in microseconds (logarithmic scale)

PCIe — MCS

Overview 15% Read Mix

| | 4.16 | 105 | | 2243 | |
| 1.18 | | | 29 | | 57.2 |

Transaction Publish Rate millions/second (higher is better) | Mean Write Latency microseconds (lower is better) | 99.99 Percentile Write Latency microseconds (lower is better)

■ PCIe ■ MCS

1G RAM | 512M RAM | 256M RAM | 1G RAM Fusion | 512M RAM | 256M RAM

THAT WAS NOT ENOUGH

- MCS is in memory
- MCS is distributed
- MCS is scalable

- MCS WAS NOT MEMORY YET

NanoCommit

- Memory:
  - Fast – nanoseconds access
  - Byte Accessible
  - Volatile
  - Expensive
  - Low capacity
- Block:
  - Slow – microseconds access
  - Block access only
  - Cost efficient
  - High capacity
  - Non-Volatile – persist on writes

ULTIMATE FLASH LEVERAGE

- NanoCommit is the technology that allows applications to persist variable size data structure by writing to memory at the BW and latency of memory

DATA OFF THE TRACKS

Flash Memory is not IO

- Needed to converge with System Memory

- Memory Channel Storage™ finally did this last year

  - First generation physically took us off IO Bus

- NanoCommit will now allow access to flash as memory, not IO

THANK YOU!

Attend the Diablo Keynote

Wednesday at 2:30 PM

See us also at Booth # 110