Symbolic IO™ Innovation Roundup

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The Sermon

- ★ All good sermons have three points and a joke
- ★ The topic is **The Brave New World of Big I/O**
- ★ So here it comes…ready or not…

Left to our Own Devices…

- Can you identify the device here? ———>
- Sadly, we're still doing I/O much like this
  - Blocks (512B, 4KB, etc.)
  - SSDs are no different
  - Address + offset (LBA)
  - The POSIX Five
    - read, write, open, close, ioctl
  - App wants to persist something
  - CPU gives up
  - Hands off the duty to the peripheral subsystem
  - RAM <—> DMA <—> Bus <—> Cache <—> Media
  - Context switches and interrupt handling
  - **<u>Can we please stop doing this to ourselves? Please?</u>**

What if We…

- Can you identify the machine here? ———>
- What if we went Back to the Future?
  - Persistent Memory
  - Block I/O to disk was the last resort
  - Memory was dear
  - Optimization ruled the day
  - The address space was wide enough
  - We didn't really need virtual memory (see prior bullet)
  - Programmers went to great lengths to write efficient code
  - We used self-modifying code - AI by definition (ML)
  - All of the above equalled the fastest computing on the planet
  - Bar none
  - **"In-Memory Computing" defined:**
    - **If your data isn't in memory…you're not computing**

Redemption at Last

- Can you identify the machine here? ————>
- The Advent of Byte-Addressable Storage
  - Persistent Memory (StorModules)
  - Block I/O to disk is not done (translated to compute, load/store bytes)
  - Memory is cheap - if you know how to use it correctly
    - Never persist raw data in memory - wasteful, inefficient
    - Persist the vectorized symbolic representation of it - compute results
  - Optimization rules the day
  - The address space is wide enough (48 bits physical = 256 TB per socket)
  - We don't really block storage (see prior bullet) except for 2nd tier/archive
  - Systems go to great lengths to persist efficient data
    - DNA-like encoding - markers, not raw data - amplify memory by 10X or more
  - We use self-modifying data - AI by definition (ML)
  - All of the above equals the fastest computing on the planet for its size & $
  - We are now always computing in-memory by definition
  - **<u>Because the best I/O is no I/O - so Big I/O becomes Big Compute</u>**

Wasn't That Fun?

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