Enhance Your Data Architecture with the Persistent Memory Tier

Flash Memory Summit

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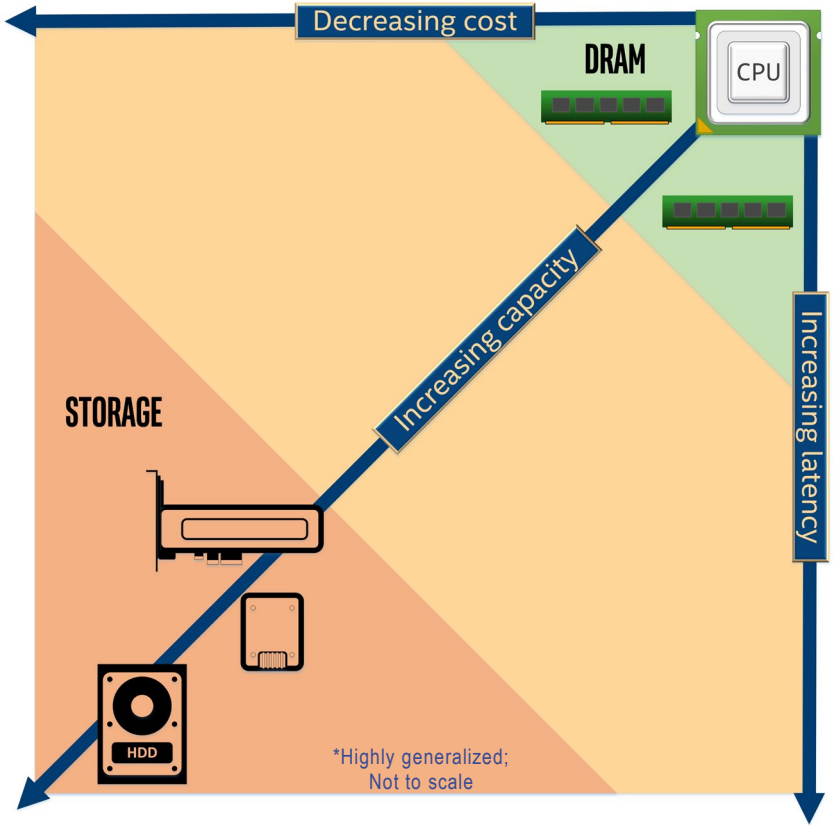
Another view of the memory-storage hierarchy

- An abstract view of resources in a server
- In general, resources farther from CPU are
  - Cheaper and larger
  - Slower



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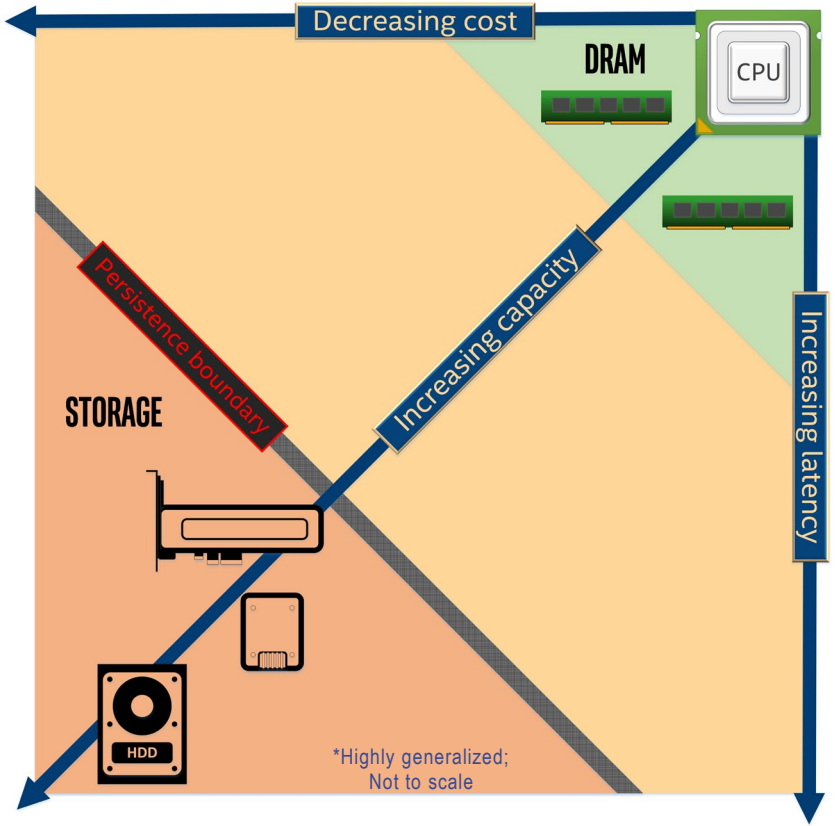

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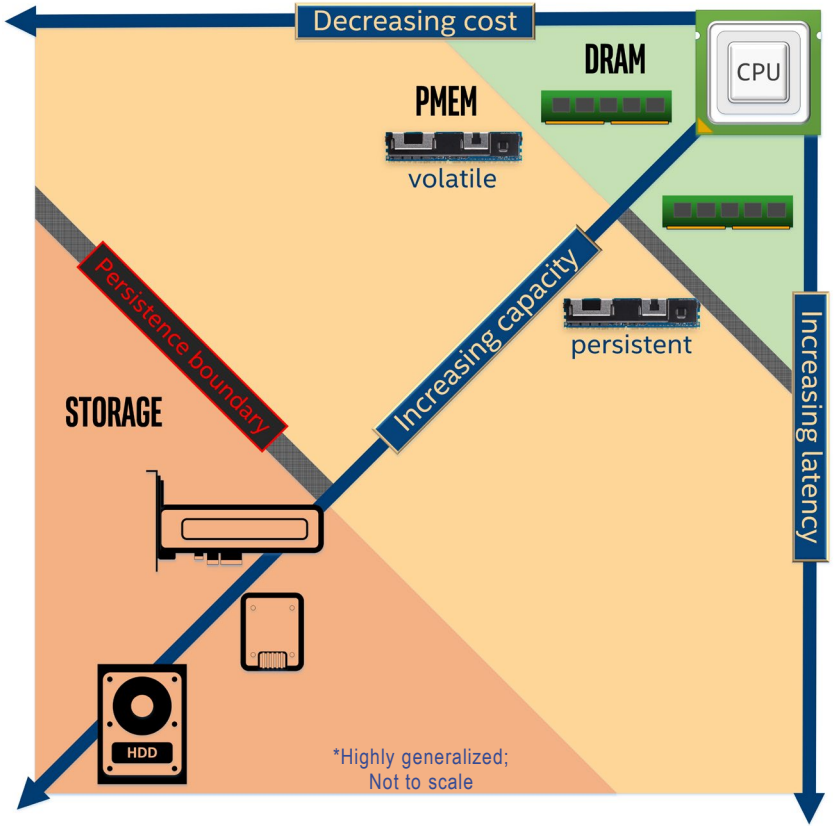
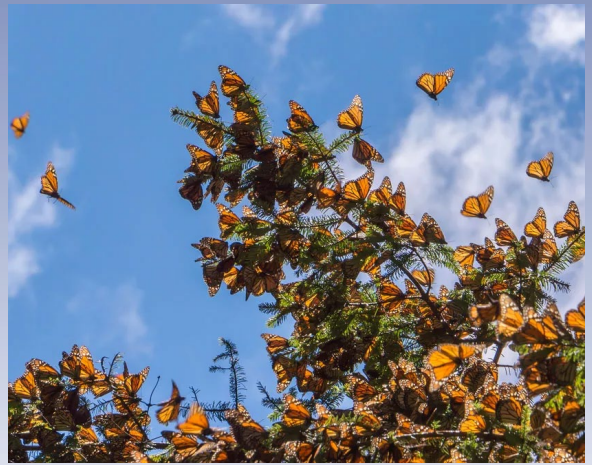
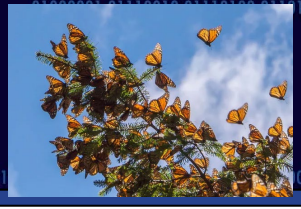
- Data in DRAM is volatile; Persisting to storage is costly
- PMEM has aspects of both memory and storage
- Persistence domain is much closer to CPU



The great migration



https://www.treehugger.com/greatest-animal-migrations-4869293



On to warmer climates…

The Monarch butterfly

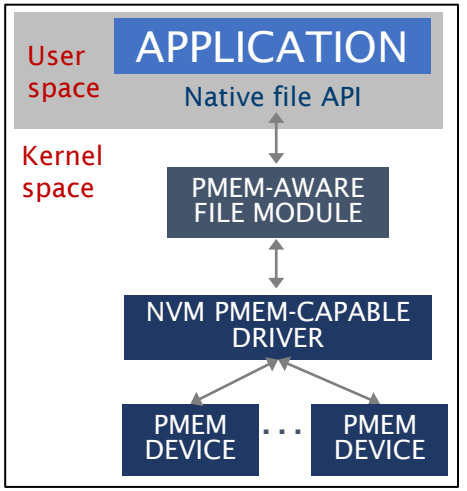
- Annual migration up to 3,000 miles
- Sometimes crosses the Atlantic Ocean
- Motivation (in winter): Warmer climate

The performance hog

- Need data persistence
- Storage devices are too slow
- Motivation: “Warmer” data

Moving from storage to persistent memory

- Treat persistent memory as a storage device
  - Faster than SSDs
  - No software modification
- Case study 1
  - Time-series database uses SSD for memory spill-over
  - Switch to pmem reduces query latency → improves performance
- Case study 2
  - Data orchestration service with tiered cache
  - Add option to cache in pmem → faster than SSD, gives customers more choice



Modified from SNIA NVM Programming Model:
https://www.snia.org/tech_activities/standards/curr_standards/npm

Photo: JHVEPhoto/Shutterstock https://www.treehugger.com/greatest-animal-migrations-4869293

Vertical migration…

The shark

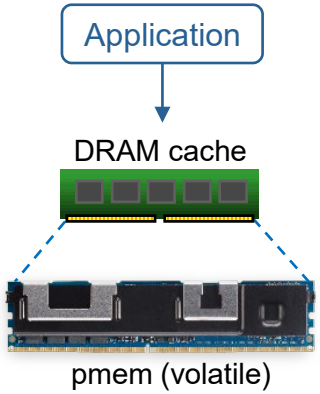
- Some travel thousands of miles each year
- Others have daily vertical migration between deeper and shallower water
- Motivation: Stick with familiar environment

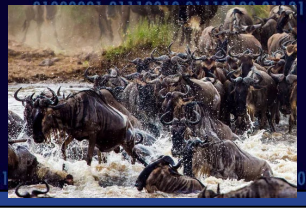
The memory hog

- Reside in memory for fast access
- Memory sizes too small and/or expensive
- Motivation: Better performance and/or reduced cost, in a familiar environment

Moving from memory to volatile pmem

- DRAM acts as cache for larger pool of pmem
  - Expand system memory resources
  - No software modification
  - Frequently accessed data in DRAM
- Case study 1
  - In-memory database scales out to multiple nodes
  - With pmem, database can support same dataset using fewer nodes → reduced cost
- Case study 2
  - Search engine stores large table of precomputed data on documents
  - With pmem, can store more of the table in memory → faster response to queries





In search of greener pastures…

The wildebeest

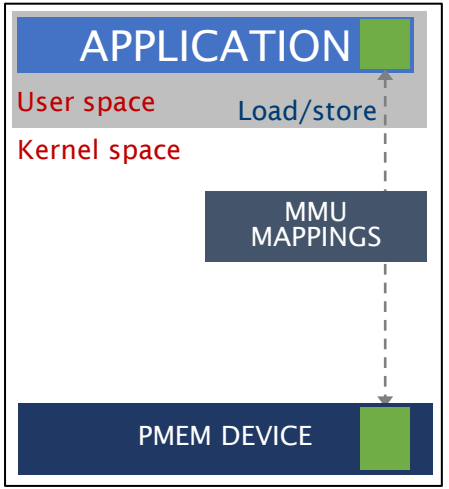
- Travel across the African savanna yearly
- Millions “get up and move at once”
- Motivation: Better resources (food)

The hybrid

- Reside in memory for fast access
- Persistence adds value
- Motivation: Better memory (persistent), better storage (faster)

Moving from memory to persistent memory

- Software modifications required!
  - Memory map pmem to app address space to get direct load/store access
  - Ensure stores are persistent with flushes
- Case study 1
  - In-memory database stores table data in memory
  - Switch to pmem to persist data → saves time on system restart and allows for larger tables
- Case study 2
  - Key-value database stores keys in memory
  - Switch to pmem to persist the keys → saves time on system restart and stores more keys per node



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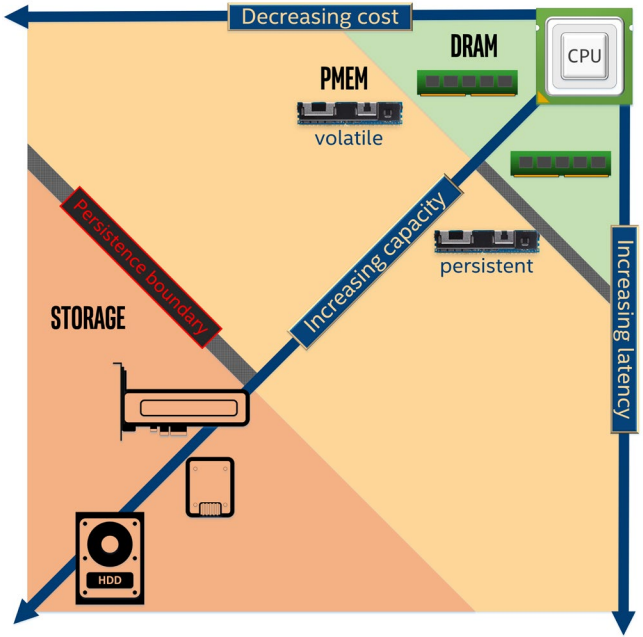
Call to action

What's your data migration motivation?



Resources

- The Storage Networking Industry Association
  www.snia.org/technology-focus/persistent-memory
- Persistent memory programming
  pmem.io/

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