

Persistent Memory in ML

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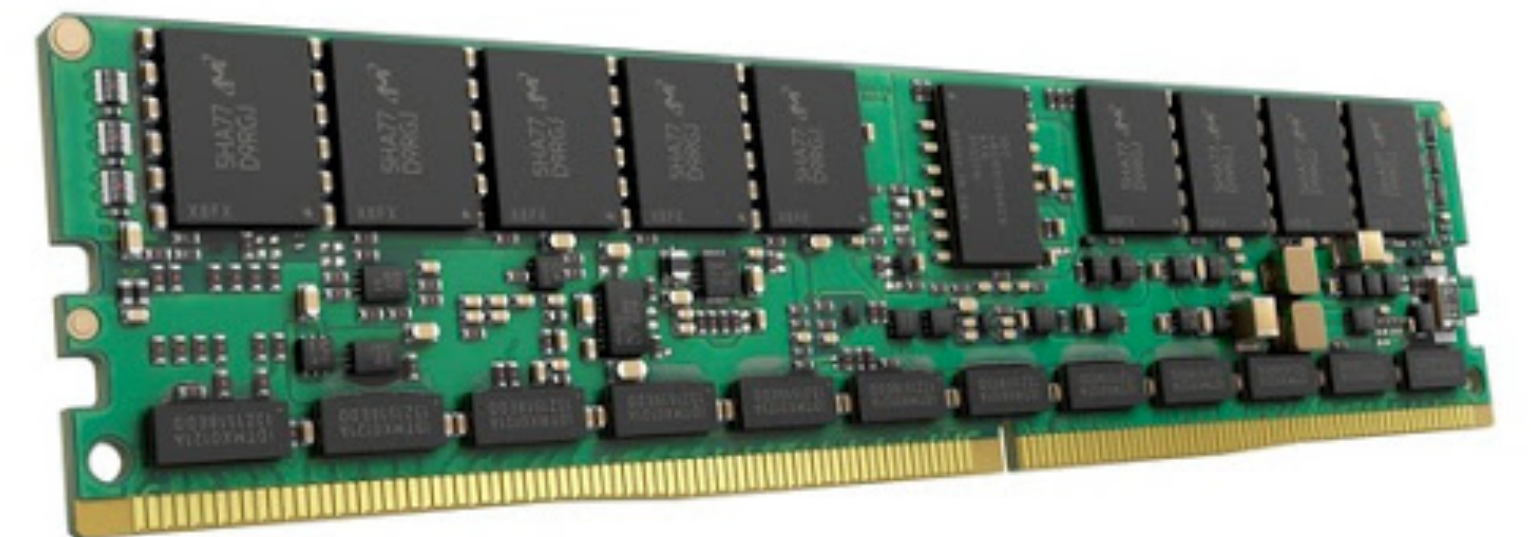
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Introduction

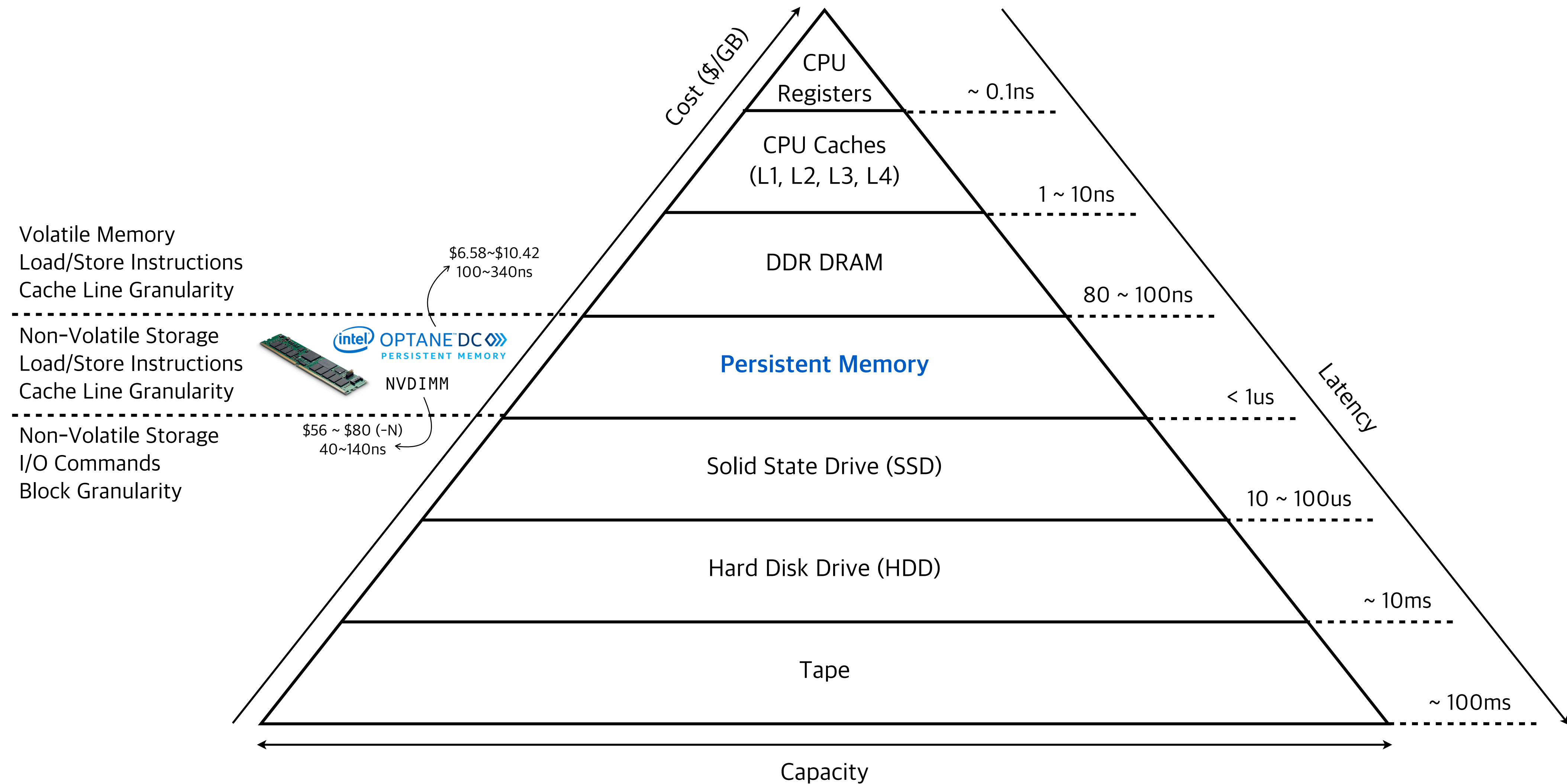
- Explosion of data creation for use by AI and ML applications
- But traditional systems are not designed to address the challenge of accessing large and small data sets
- AI and ML applications are starting to take advantage of **persistent memory** to eliminate bottlenecks and accelerate performance

What is Persistent Memory?

- **Byte-addressable** and accessed by memory semantics (Load/Store)
- **Low latency** (faster than block-accessed media)
- **Persistent** (non-volatile)
- e.g., NVDIMM, Intel Optane, ...



Memory-Storage Hierarchy



Persistent Memory Use Cases



Enterprise & Software Defined Storage

Tiering, caching,
write buffering,
meta data storage



Traditional & In-Memory Database

Log acceleration
Journaling, recovery time,
tables



High-Performance Computing

Check point
acceleration
and/or elimination



High-Performance Data Analytics

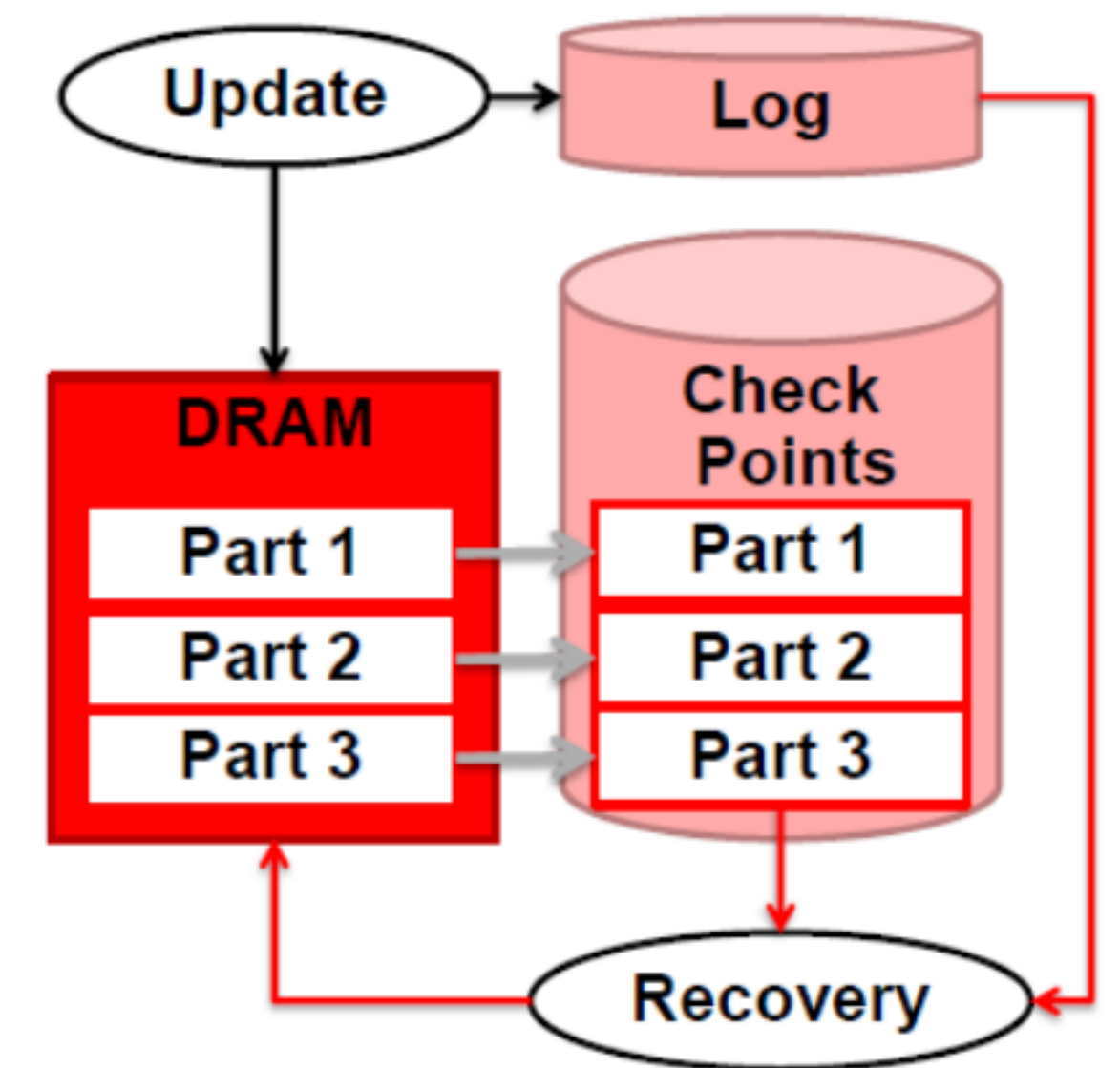
AI / ML Workflows
Checkpointing
Spark Acceleration
Data Intensive
Workflows

Why Persistent Memory in ML?

- Challenge: Reducing overall time to discovery and insight based on **data intensive ETL** and **checkpoint** workloads
- Demanding I/O and computational performance for GPU accelerated ETL
- Varying I/O and computational performance is driven by bandwidth and latency
- Generate metadata databases using emerging computational storage PM solutions as an integrated AI inference engine

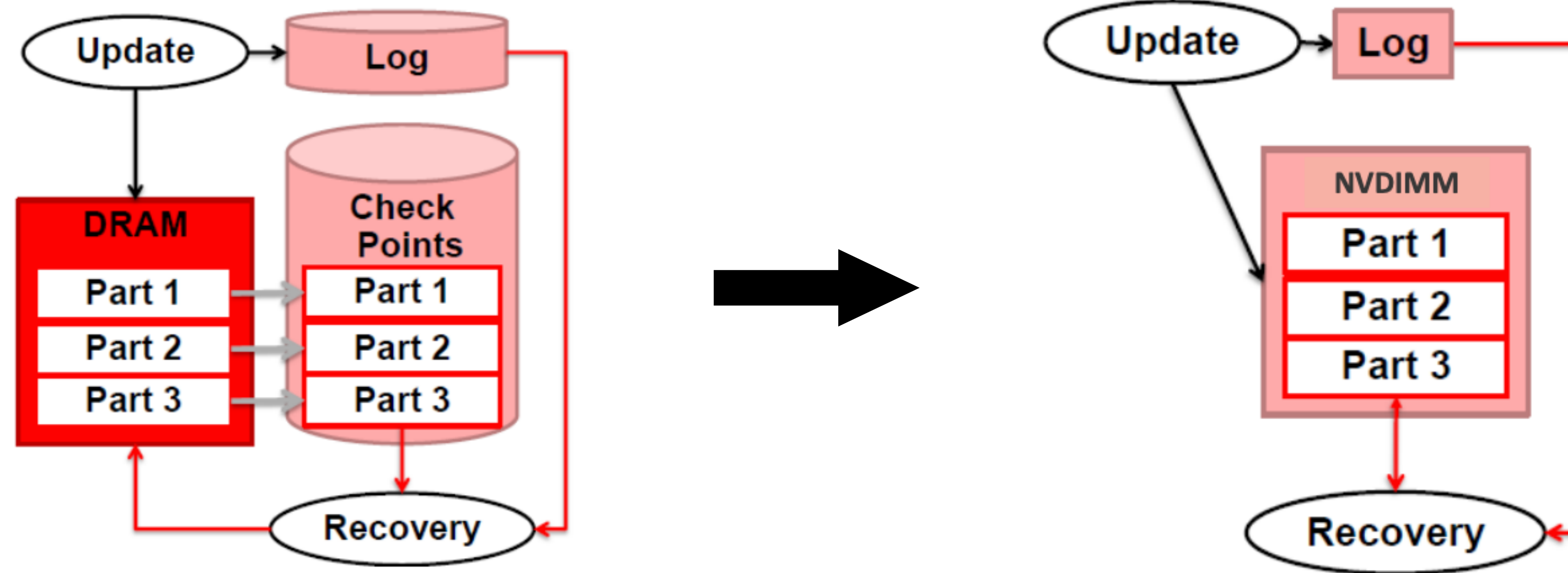
Checkpointing Today

- Checkpointing: Taking a snapshot of the DBMS state
- By taking checkpoints periodically, DBMS can reduce the work to be done during restart in the event of a subsequent crash
- Checkpointing is done in storage (SSD, NAND)
- But, checkpointing takes time (I/O + fsync + NAND latency)



Checkpointing with Persistent Memory

- Checkpointing is an ideal use-case for NVDIMMs
- NVDIMMs allow checkpointing to be done at DRAM's speeds (**ns** vs. μ s)



ML with Persistent Memory

- It is essential to make fast ETL processes, where move vast amount of information from data lakes to the faster storage and then into the GPU complex



- Dramatic acceleration of the ML process can be achieved by using fast persistent memory (vs. writing to NAND storage)

Reference

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