Fast Data Tier

- Needs to quickly ingest and process large amounts of data
- Needs to make decisions and respond to queries based on large amounts of data from
  - Incoming streams
  - Historic data and prior analysis results
- Aging data is less valuable
  - Analytics cannot be I/O bound
  - Typically uses in-memory databases
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Scaling the In-Memory DB

- Approach 1: Buy more
  - More RAM to fit the data
  - Higher-end servers: motherboards and CPUs that can support more DIMMS & memory channels.

- Could be costly
- Still limited
Scaling the In-Memory DB [2]

- Approach 2: Scale horizontally
  - Add more servers and Distribute the DB into multiple shards
  - Each shard fits in the hosting node’s memory

- It works! Overcomes the single node’s memory limit
- Programmatic and operational complexity overhead
  - Asymmetric behavior intra vs inter-shards
  - Need to re-balance

- Cost Inefficient/Wasteful
  - CPU usage under 20%/node. Gets worst as we scale
  - less than linear scaling: hot spots end up replicated on all nodes
Overcoming the memory limitation

- We need to scale memory independently
  - We can already do this today with storage
- Use storage as memory
  - Need memory-grade storage ➔ Low latency NVMe
  - Need a flexibility of access and efficiency of re-use of external NVMe
  - Deterministic behavior
    - Low latency from host to non volatile memory
    - Limited jitter
Implementation Example

Key enabling technologies:

- NVMe JBOF
- < 8 us latency NVMe disks
- IMDT/ScaleMP
Results & Conclusion

- Small performance impact – around 15%
  - YCSB benchmark against the In-memory database shows
    - 10% slower on a 50-50 read/update workload
    - 19% slower on 100% read workload

- Reasonable cost. Close to 50% the total cost of all DDR solution.
What we make, makes a difference™