SNIA PERSISTENT MEMORY PM SUMMIT

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Persistent Memory in Mission-Critical Architecture (How and Why)

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Forward-Looking Statements

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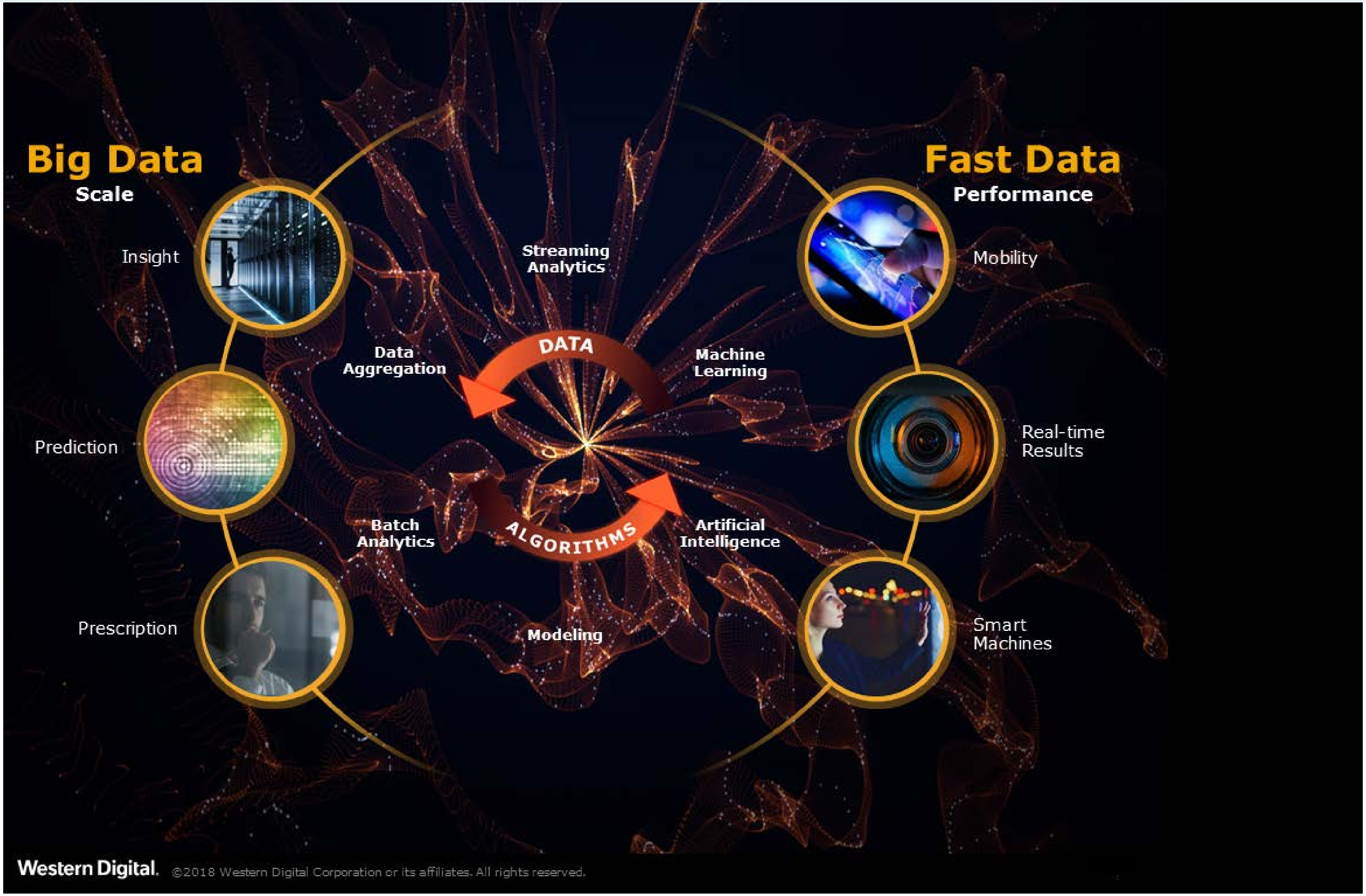
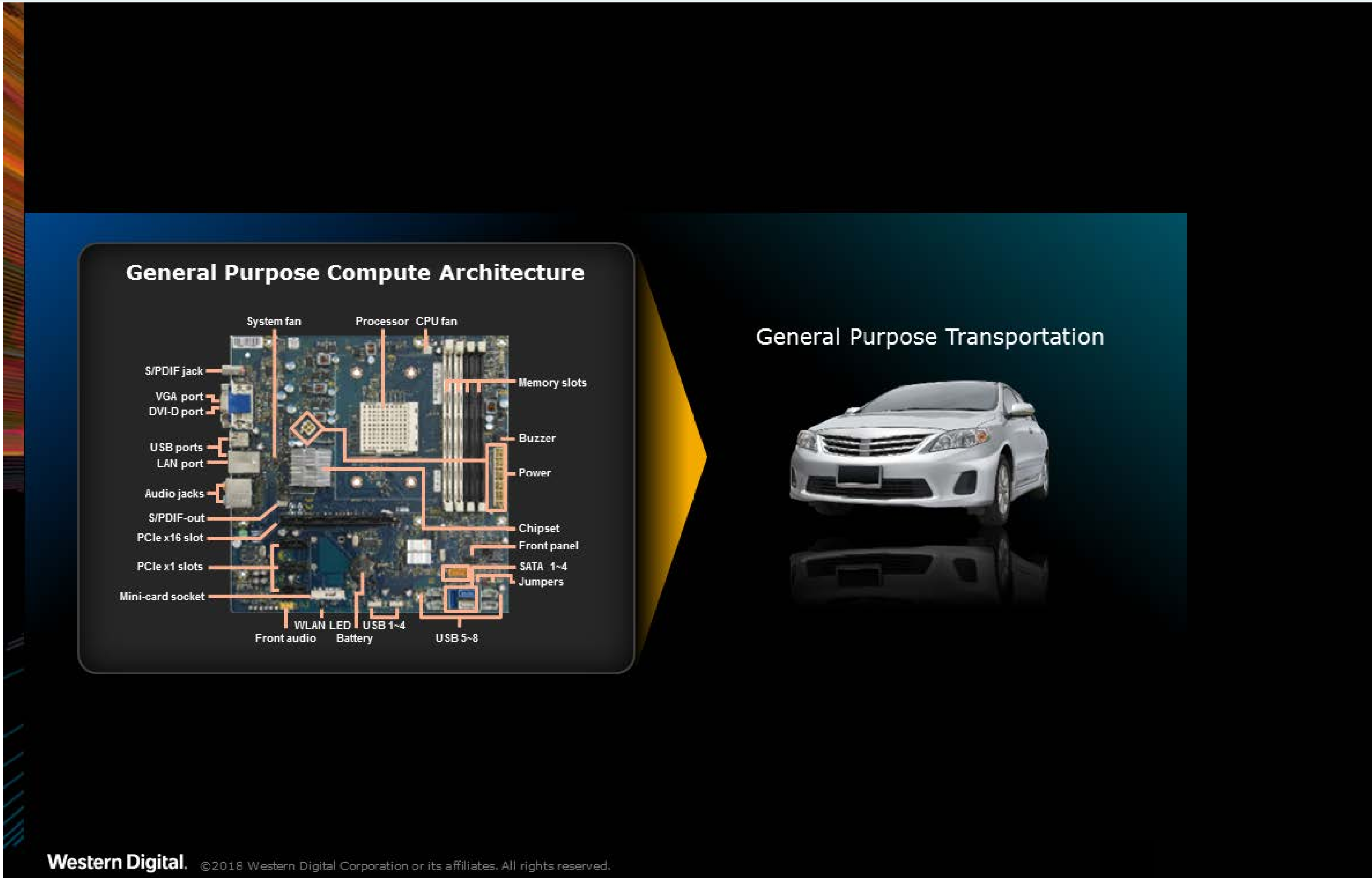
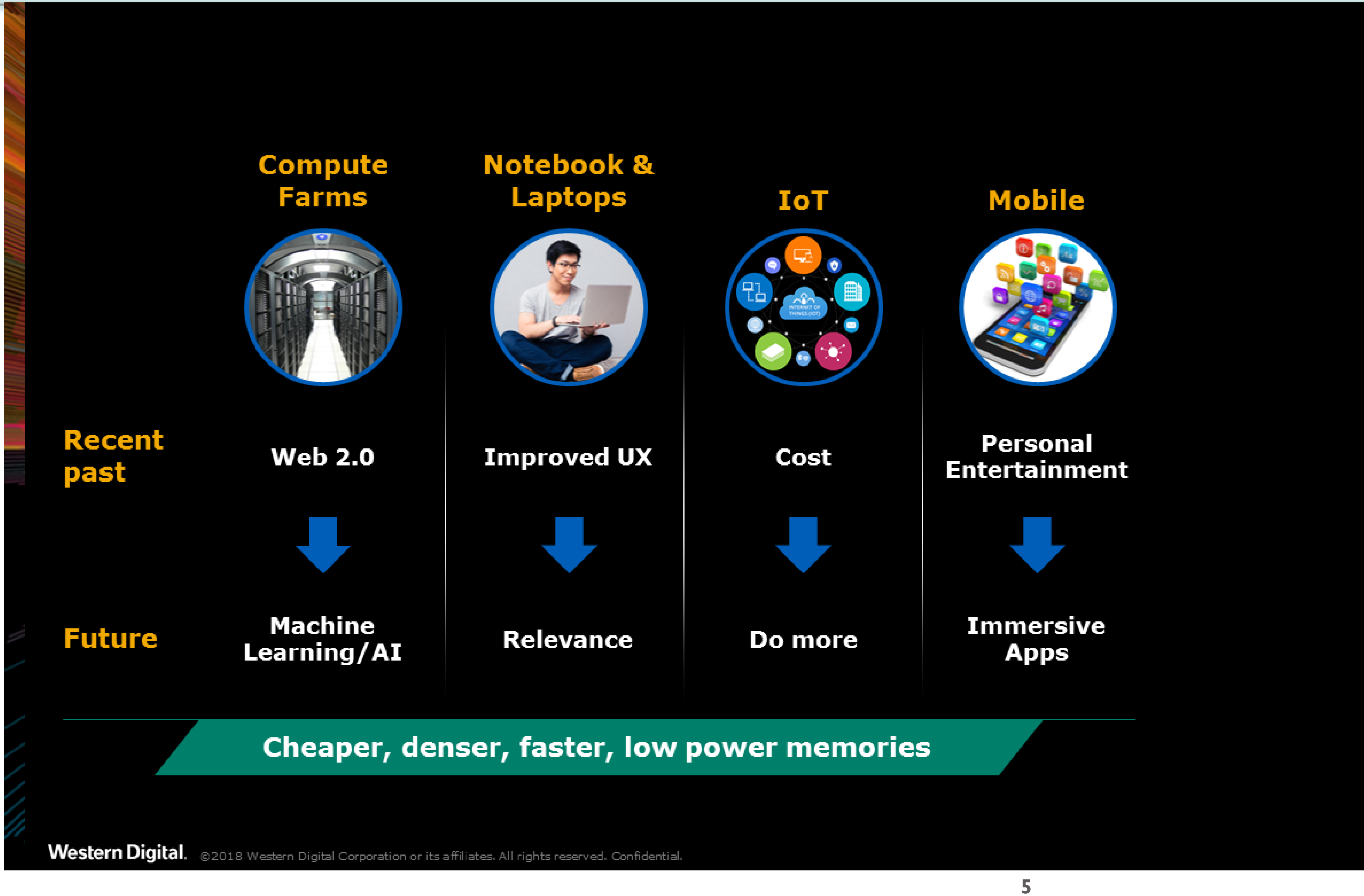
Dizzying Diversity of Data



Off-the-rack Architecture in a Customized World



Memories for Evolving Applications

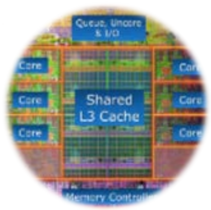


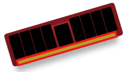
What can we do to add value that isn't narrowly focused?

Persistent memory can provide value to many of the existing architectures with minimal changes

- Allow for larger capacity SSDs by alleviating memory footprint constraints
- Get around RAM attach point limitations in IMDB
- Reduce need for non-persistent protective architecture

Where does Persistent Memory fit in the hierarchy?





Core Register | Core L1 Cache | Core L2 Cache | Shared L3 Cache | DRAM | Persistent Memories | Flash | HDD

Capacity	**64KB**	**256KB**	**2-4MB**	**16-128GB**	**128GB-1TB**	**512GB-4TB**	**4-16+TB**
Speed	1ns	3-10ns	10-20ns	50-100ns	250-5,000ns	100,000ns-2,000,000ns	5-10,000,000ns
Cost				50x	20-25x	1x	.1x

DRAM is Very Useful! … But….

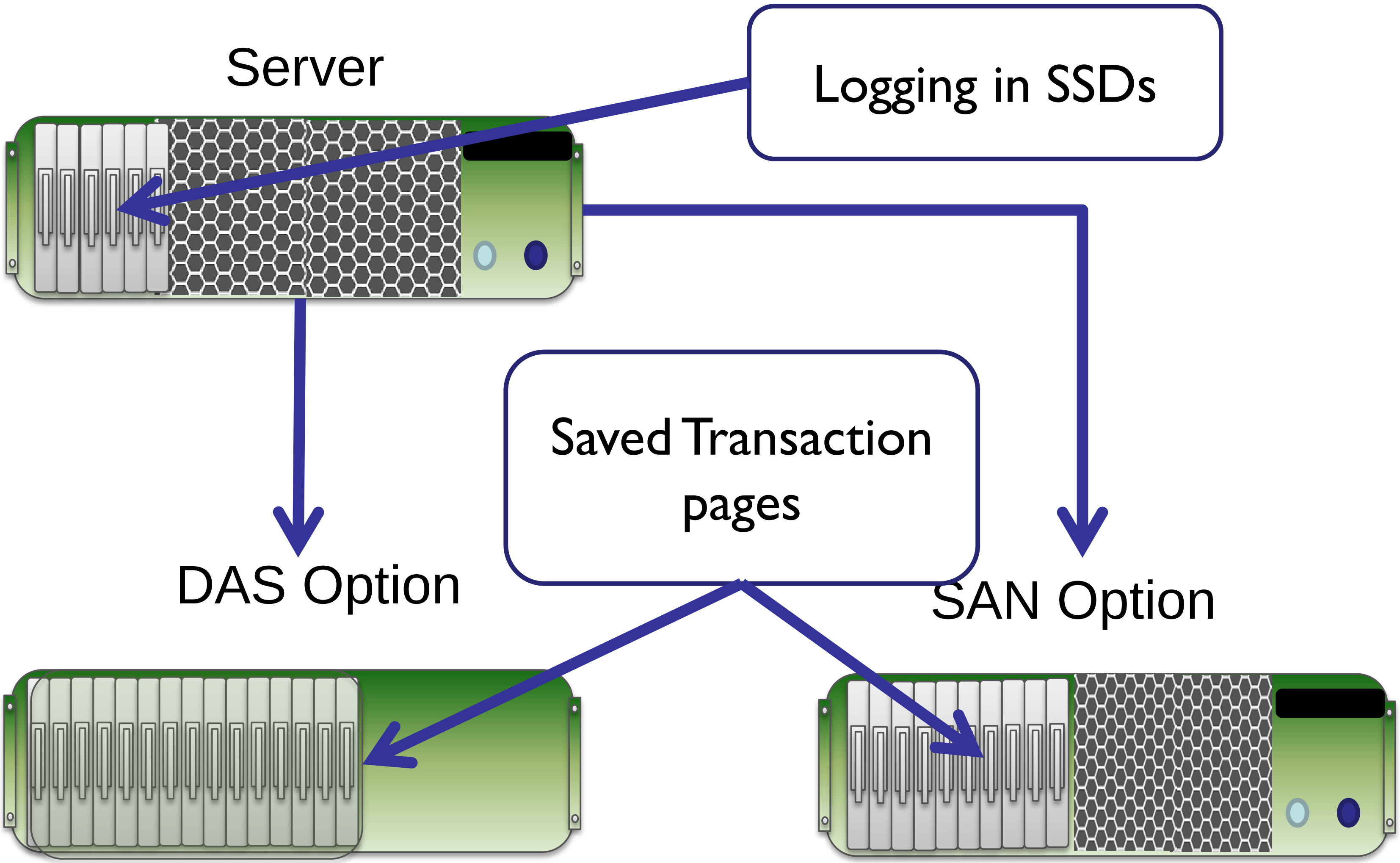
- Expensive on a $/GB basis
- Capacity point restrictions
- DRAM footprint for storage mapping adds cost
- Capacity restrictions result in devices

In Memory Databases can Benefit

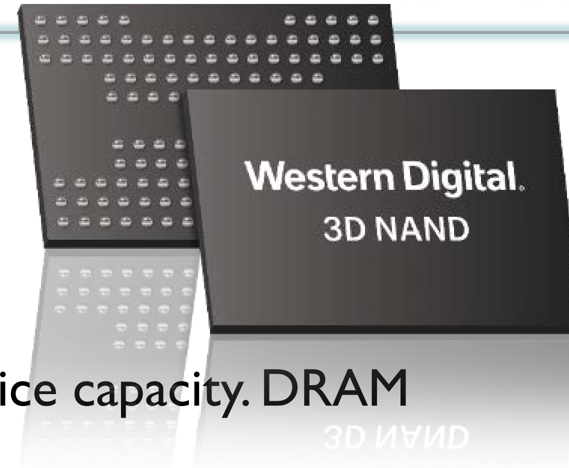
- A core requirement for an enterprise database is durability
  - DRAM provide performance but no durability
  - Storage currently provides the durability
- In database technology, atomicity, consistency, isolation, and durability (ACID) must be met to ensure that database transactions are processed reliably:
  - A transaction must be atomic. This means if part of a transaction fails, the entire transaction must fail and leave the database state unchanged.
  - The consistency of a database must be preserved by the transactions that it performs.
  - Isolation ensures that no transaction interferes with another transaction.
  - Durability means that after a transaction is committed, it remains committed.

When a dataset primarily lives in main system memory, additional functionality that is not required with a standard storage based database must be put in place to ensure that durability is achieved.

Lack of DRAM persistence requires expensive protection



SSD Density can be increased at Lower Cost



- Space on SSD circuit board is limited
- More DRAM is needed for mapping as we add device capacity. DRAM footprint limits NAND placement
  - Persistent memory provides dense option and allows for fewer chips ands thus more NAND
- Combination of DRAM and persistent memory can reach a good compromise

BiCS4

96-layer
3D NAND
technology

X4
Technology

Four bits
per cell
Flash memory

Caching and other similar concepts can be enhanced

- Persistent memory is slower than DRAM but denser solutions can provide a larger cache or tier with better hit rate.
    - A slow hit in persistent memory is faster than a miss that leads to back end storage

- True for system level caches and device caches

- Persistent memory can find a home in Composable Infrastructure
    - Fabric attached nodes that be used globally
    - Persistent memory imbedded in storage and compute nodes on fabric

Takeaways

Explosion in data means more DRAM to map it

New form factors require dense material to allow capacity growth

IMDB can be simplified with persistent memory

Persistent memory could play a role in composable infrastructure

Architecture changes needed to allow for this growth

Thanks!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