

AEROSPIKE USER SUMMIT 2018

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# Aerospike + Intel® persistent memory

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# Agenda

- **Introduction to Intel® persistent memory**
- **Benefits for Aerospike users**
- **Conclusion**
- **Resources**



# Intel® persistent memory

- **Based on Intel® 3D XPoint™ Technology**

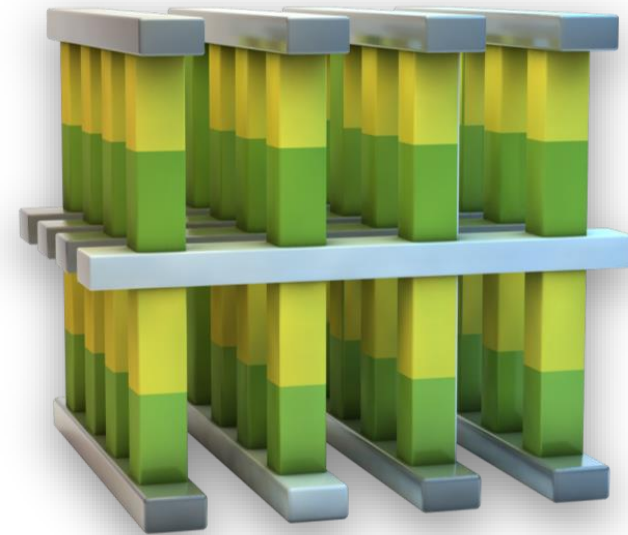
- Breakthrough **non-volatile** memory technology invented by Intel® and Micron
- Two form factors: SSDs, persistent memory modules (DIMM socket)

- **Intel® Optane™ SSD DC P4800X Series**

- Available today

- **Persistent memory modules**

- Supported on the next-generation Intel® Xeon® Scalable Processors (*Codename “Cascade Lake”*)

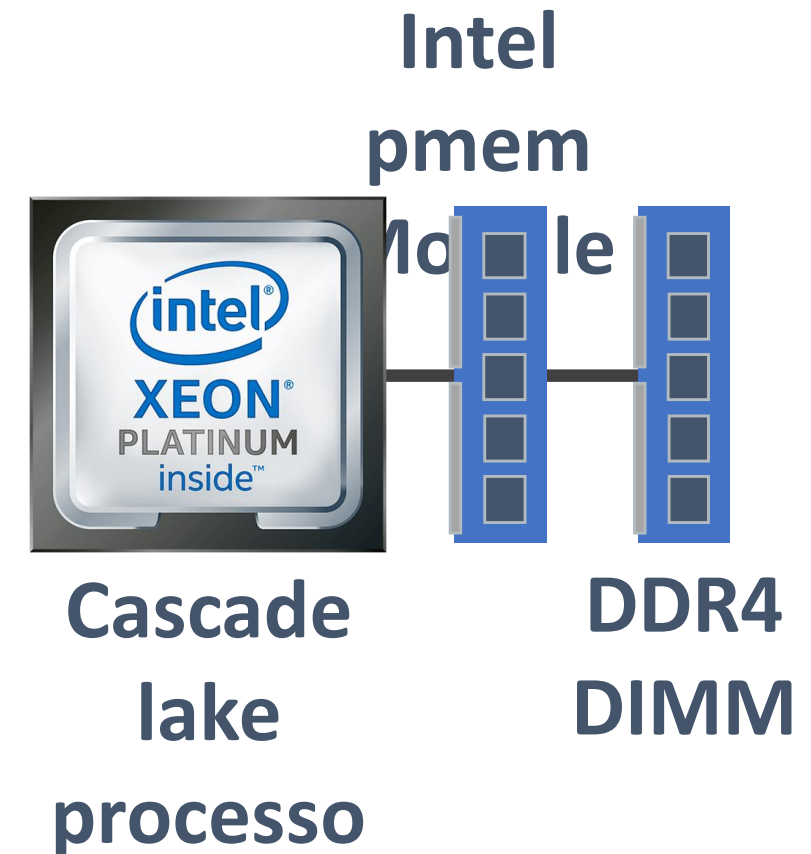


**Note:** Intel persistent memory **modules** are DDR4 DIMM socket compatible

# Intel® persistent memory modules

- **DDR4 DIMM compatible**
  - Co-exist with conventional DDR4 DRAM DIMMs on the same platform
  - Lower cost than DRAM\*
- **Retain data after a power cycle**
- **Implications to software**
  - Another tier in memory hierarchy
  - Software modified to take advantage of persistent memory

*\*Expected, based on similar capacities*



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# Storage vs. persistent memory

## Storage

- Block I/O only
- Sync or async
- Path through file system, device driver

```
fprintf(fp, "Hello World!");
```

## 4 KB block



## Persistent Memory

- Byte addressable
- Sync
- Load/store access without kernel involvement

```
strcpy(pmemaddr, "Hello PMEM!");
```

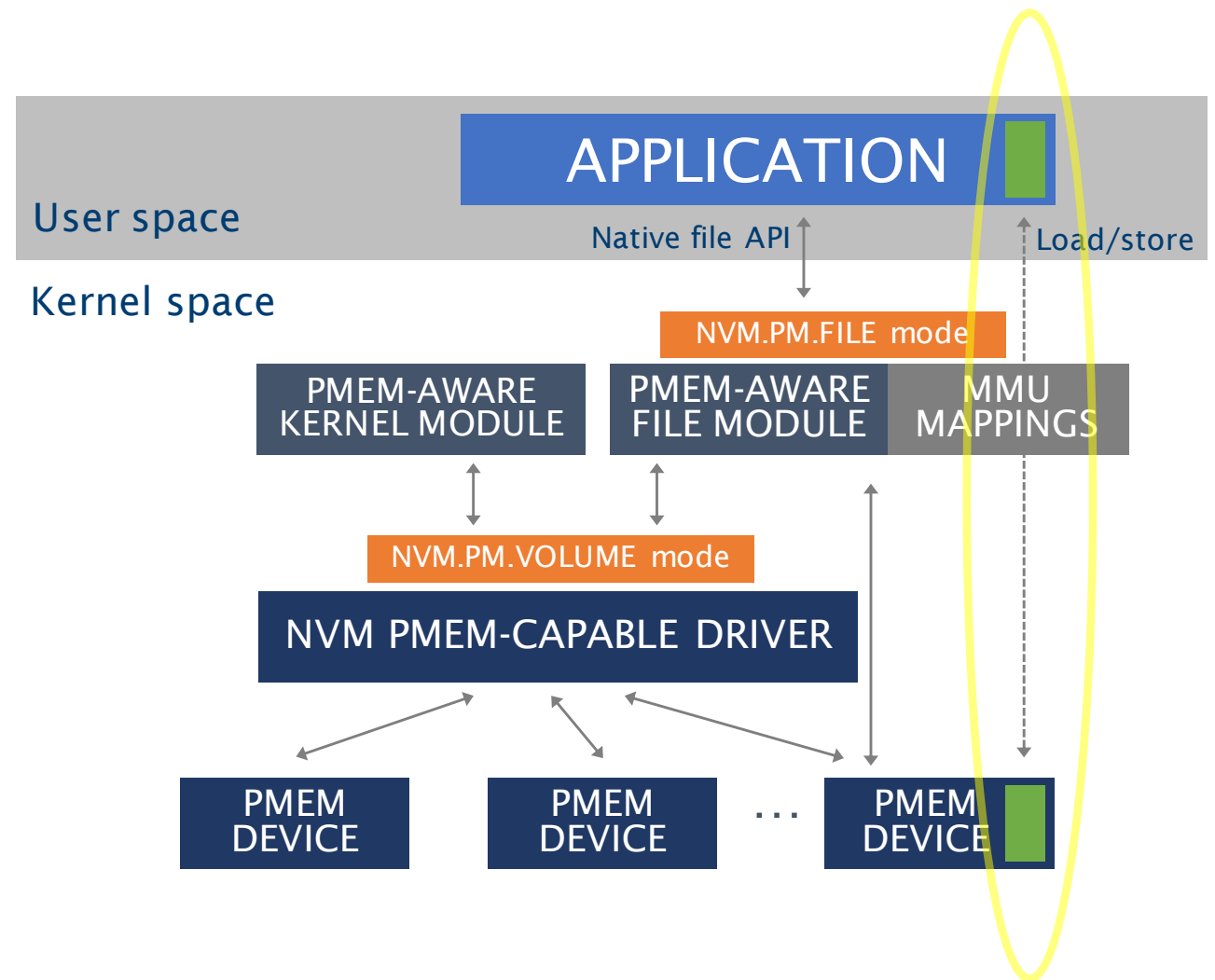
## 64 B cache line





# Memory mapping

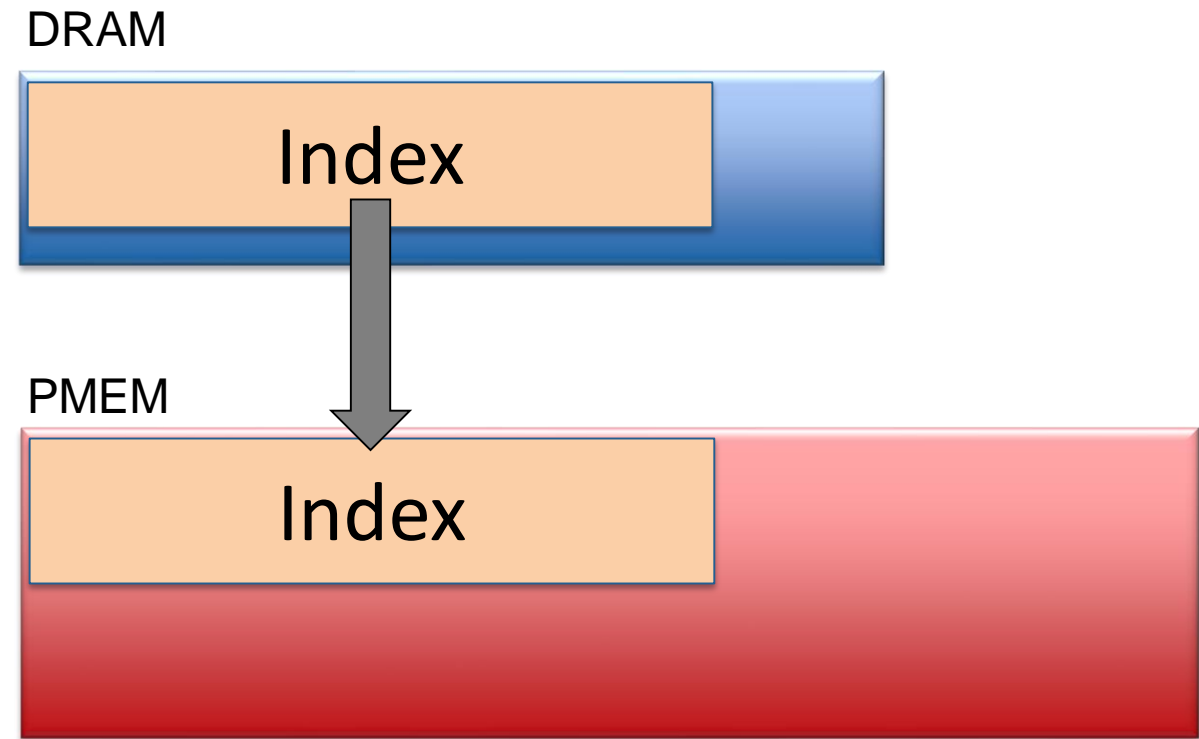
- SNIA NVM Programming Model
- PMEM-aware file system manages access to persistent memory device
- Kernel maps persistent memory to application address space
- No buffering in DRAM
- App has direct access to PMEM
  - Load/store without kernel involvement



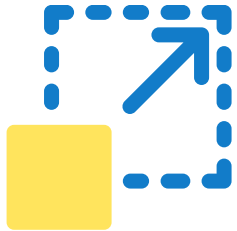
ACPI 6.0 NFIT definition: [uefi.org/sites/default/files/resources/ACPI\\_6.0.pdf](http://uefi.org/sites/default/files/resources/ACPI_6.0.pdf); SNIA NVM Programming Model: [snia.org/tech\\_activities/standards/curr\\_standards/npm](http://snia.org/tech_activities/standards/curr_standards/npm)

# Benefits for Aerospike users

- **Store primary index in persistent memory**
- **Higher capacity than DDR DIMMs**
- **Persistence**
  - Warm restart after power cycle!!
- **Maintain throughput**
  - Near-DRAM speed



# Reduce TCO and system downtime with persistent memory



## Big

High capacity for scalability



## Persistent

Data persistence without disk input/output (I/O)



## Affordable

Lower cost



## Robust

Less downtime



# Resources

- **Intel® Developer Zone**

- <https://software.intel.com/en-us/persistent-memory>

- **Persistent Memory Development Kit**

- <http://pmem.io/pmdk>

- **The Storage Networking Industry Association**

- <https://www.snia.org>



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Thank You

# Abstract

There has always been a trade-off to consider when deciding where to place data structures: DRAM (memory) is too expensive, but SSDs are too slow. Aerospike's in-memory index provides very fast lookup times, but comes with a few pain points for users. In order to store more data, one must add more costly DRAM. In addition, every system reboot requires the index to be rebuilt; a process which can take hours.

Believe it or not, these concerns can become a thing of the past, thanks to Aerospike's partnership with Intel's upcoming persistent memory technology. Come to this session to hear how Aerospike plans to take advantage of the large capacity, low cost, and persistence of Intel's new technology to store the index, saving users both time and money.

