



NVDIMMs: Powerful Persistent Memory Arrives in a Familiar Form

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Today's Panelists

- Alex Fuxa, Section Manager for Persistent Memory Engineering
- Neal Christiansen, Principal Software Development Lead for Windows Storage and File Systems Group





But First, The Basics...

NVDIMM



But First, The Basics...

NVDIMM

Non-Volatile Dual Inline Memory Module:
[Hardware] A dual inline memory module that operates as standard RAM while also having persistence across power cycles.

- pg 190, 2016 SNIA Dictionary



There Are Different Types of NVDIMMs

NVDIMM-N

NVDIMM-F

NVDIMM-P

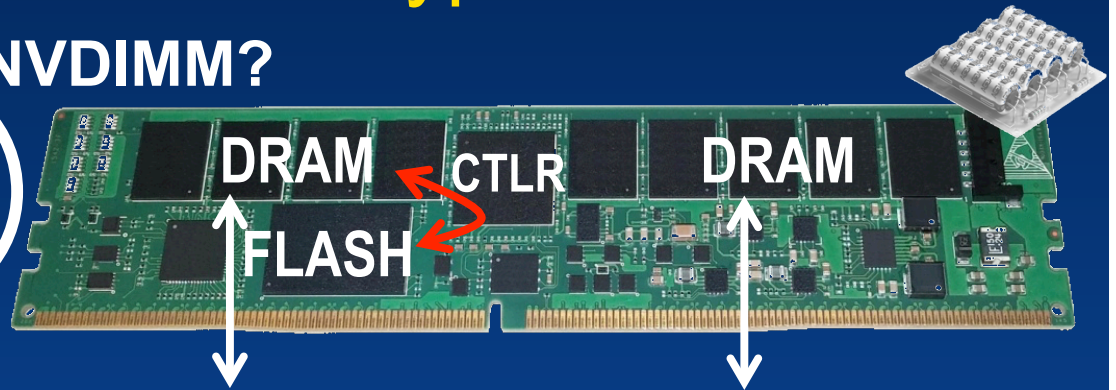
There Are Different Types of NVDIMMs

NVDIMM?

NVDIMM-N

NVDIMM-F

NVDIMM-P



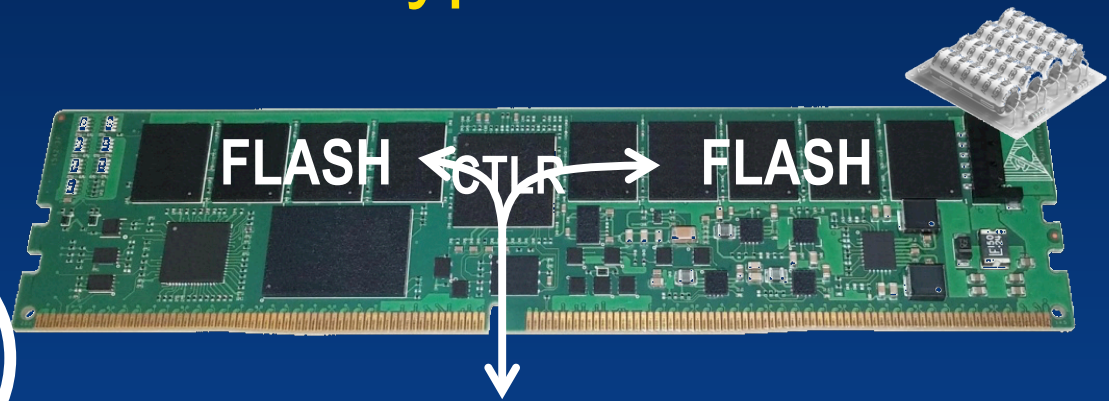
- “Flash-Backed DRAM”
- Memory mapped DRAM. Flash is not system mapped.
- Access Methods: byte- or block-oriented access to DRAM
- Capacity = DRAM DIMM (1’s -10’s GB)
- Latency = DRAM (10’s of nanoseconds)
- Energy source for backup
- HW & SW interface standards defined by JEDEC

There Are Different Types of NVDIMMs

NVDIMM-N
FLASH

NVDIMM-F

NVDIMM-P



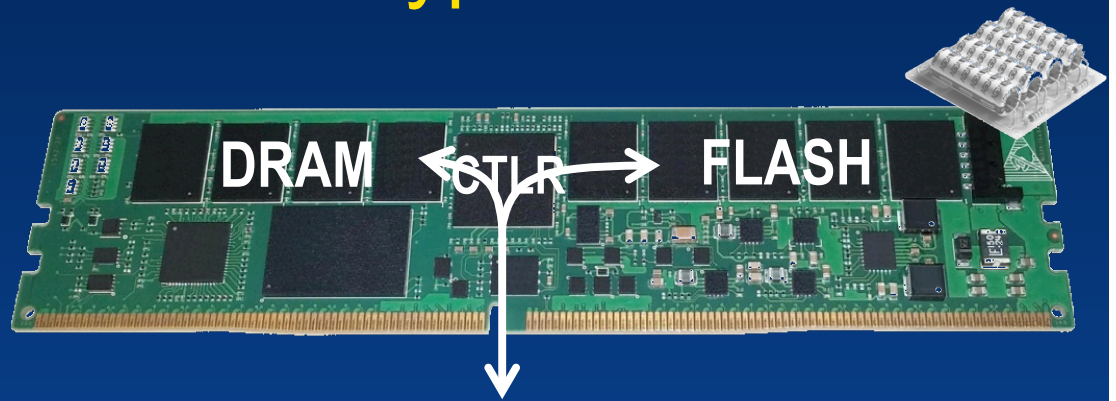
- “SSD in the Memory Channel”
- Memory mapped Flash. DRAM is not system mapped.
- Access Method: block-oriented access to NAND
- Capacity = NAND (100’s GB-1’s TB)
- Latency = NAND (10’s of microseconds)
- JEDEC SPD defined for this type, but no protocol std (yet?)

There Are Different Types of NVDIMMs

NVDIMM-N

NVDIMM-F

NVDIMM-P



- “Combination of -N and -F”
- Memory mapped Flash AND memory mapped DRAM
- Access methods: byte- and/or block-oriented access
- Capacity = NVM (100’s GB-1’s TB)
- Latency = NVM (100’s of nanoseconds)
- Definition still under discussion within JEDEC



Before We Move On...

Let's Address The Elephant In The Room





Here's What I Know...

Not much

Micron
QUANTX

10X+ IOPS Over NAND @ Low Queue Depths	10X+ Faster Response Time Than NAND	4X+ Memory Footprint Per CPU Than DRAM
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Turning Big Data into **Fast** Data

THE BREAKTHROUGH
A NEW CLASS OF NON-VOLATILE MEMORY

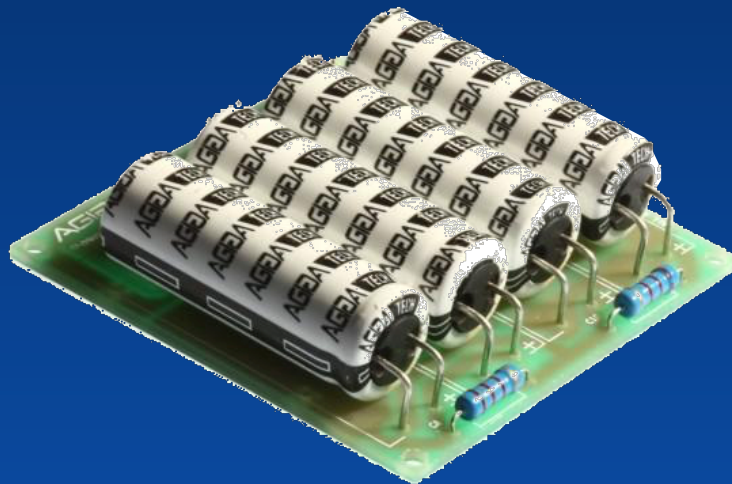
1000X FASTER THAN NAND	1000X ENDURANCE OF NAND	10X DENSER THAN CONVENTIONAL MEMORY
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However, 3DX can be complementary to NVDIMMs

- Certain workloads are better use cases for each NVDIMM Type
- May lead to a new NVDIMM Type (NVDIMM-XP?)

For Example, For NVDIMM-N

If I believe 1000x faster than NAND:



(totally to scale)



The Real Takeaway

- No Longer Your Mother's Memory Channel
- Presents a Greenfield opportunity for the industry
- There will be lots of innovation in this area in years to come
- First step: NVDIMM-N