Analysts Weigh In On Persistent Memory...
Your Experts Today

- Jeff Janukowicz, IDC
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- Jim Handy, Objective Analysis
Perspective on the Market and Persistent Memory

Jeff Janukowicz
Research Vice President
IDC
“The best way to predict your future is to create it.”

- Abraham Lincoln
Information Created WW

- Measured by the digital data we create, capture, and replicate each year
- Over the last many years, data has become richer
- However, in the advent of the Internet of Things, machine to machine communication, and intelligent systems, data is being captured in many more ways.
- Much of the data that is created is never stored for more than microseconds as data is created in the process of delivering content to devices that are requesting it for various reasons.

Source: IDC Digital Universe Study

*A Zettabyte = 1 million Petabytes*
A storage device is rarely filled up to its capacity.

By 2020, we estimate a 50% utilization rate across all storage mediums.

The resulting gap between the content we create and the content we store is called transient data.

This is where services are provided (e.g., OTT), real-time analytics and decision making occur, and where our digital world evolves along side of our physical world.

Data is moving from the background into the foreground as a valued commodity.
Memory / Storage Hierarchy

- **Registers**
- **Cache Memory**
- **DRAM**
- **NAND Flash SSDs**
- **Performance Optimized HDD**
- **Capacity Optimized HDD**
- **Tape / Optical**
- **Persistent Memory**

*Performance* vs. *Cost Effective*
The New Paradigm

Historical  Today  Near Future

DRAM
Capacity
Optimized
Perf
Optimized
Flash

DRAM
Capacity
Optimized
Perf
Optimized
A lot more Flash
Fact is, Datacenters come in all different shapes and sizes with variable workloads – but they all will have one thing in common – hot and cold data.

In a “real time” world …
Need find a way to intersect Data at the Speed of Life
Challenge of Creating a new Paradigm

**WW Enterprise SSD Unit Shipments by Interface**

Source: Worldwide Solid State Storage Quarterly Update: 3Q16 Summary
Nov 2016 - Doc # US40809016
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To capitalize on the opportunity:
- Embrace the new paradigm
- Taylor the solution for the targeted applications
- Build an Ecosystem
Agenda

- IOPS & latency requirements by application
- Alternative types of PM
- Outlook for memories
- Q&A
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How Many IOPS Is Enough?

- Brief On-line survey of IT managers’ needs:
  - IOPS
  - Capacity
  - Latency
  - Primary applications
  - System bottleneck


- Report interprets the results in depth:
  - 150 Pages, 147 Figures, 9 Tables
  - Analyzed by application showing changes with time

- Survey continues at TinyURL.com/IOPSsurvey
Respondents’ Application Types

- Mail server and mail storage, 4%
- Archiving and backup, 6%
- Video Creation or Distribution, 6%
- Scientific or Engineering, 9%
- Cloud storage or services, 10%
- OLTP, 22%
- Databases, 43%

76% between 10K and 1M IOPS

The 2016 data shows a 54% higher mean in IOPS required that the 2012 data

IOPS by Form Factor

- HDD
- SATA/SAS
- NVMe/PCIe

Memory Channel

IOPS Supported

- $10^2$
- $10^3$
- $10^4$
- $10^5$
- $10^6$
- $10^7$
Latency vs. IOPS Requirements

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2020 Emerging Memory Market >$2B

- 3D Xpoint (Optane at Intel and QuantX at Micron) or RRAM to provide intermediate layer between DRAM and NAND Flash
- Intel announced that its upcoming Optane non-volatile memory will ship in the second quarter of the year as 16GB and 32GB M.2 expansion cards. Micron will also ship in Q2
- Company’s readying RRAM products, including some noise about carbon nano-tube products in 2017
STT-MRAM

- Everspin IPO, Other start-ups in wings
- ES STT MRAM with 1 Gb capacities--replace DRAM/SRAM?
- Global Foundries and others--embedded MRAM (GF eMRAM 22FDX)
- Low Power Requirements make MRAM a great option for battery powered IoT products and automobiles
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NAND Flash Cycles Will Continue

Source: NAND Flash Update, 4Q16
Objective Analysis, 2016
Optimistic 3D XPoint Revenue Forecast

Source: A Close Look at the Micron/Intel 3D XPoint Memory Objective Analysis, 2015
Flash M&E Revenue Share Is Growing

2015

- Flash: 38%
- HDD: 55%
- Optical: 1%
- Tape: 6%

2021

- Flash: 51%
- HDD: 46%
- Tape: 3%

2016 Digital Storage in Media and Entertainment Report, Coughlin Associates
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IOPS report available for immediate download online at:
www.Objective-Analysis.com

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