

The logo for SNIA (Storage Networking Industry Association) features the letters 'S', 'N', and 'I' stacked vertically in a bold, sans-serif font. To the right of the 'I' is a small square icon divided into four quadrants, with the top-left and bottom-right quadrants filled with a light blue color.

SNIA

# PERSISTENT MEMORY PMM SUMMIT

JANUARY 18, 2017 | SAN JOSE, CA

Analysts Weigh In On Persistent Memory. . .

# Your Experts Today

- Jeff Janukowicz, IDC
- Tom Coughlin, Coughlin Associates
- Jim Handy, Objective Analysis

The logo for the Storage Networking Industry Association (SNIA), featuring the letters 'S', 'N', and 'I' stacked vertically in a stylized font, with a small square icon to the left.

# PERSISTENT MEMORY PMM SUMMIT

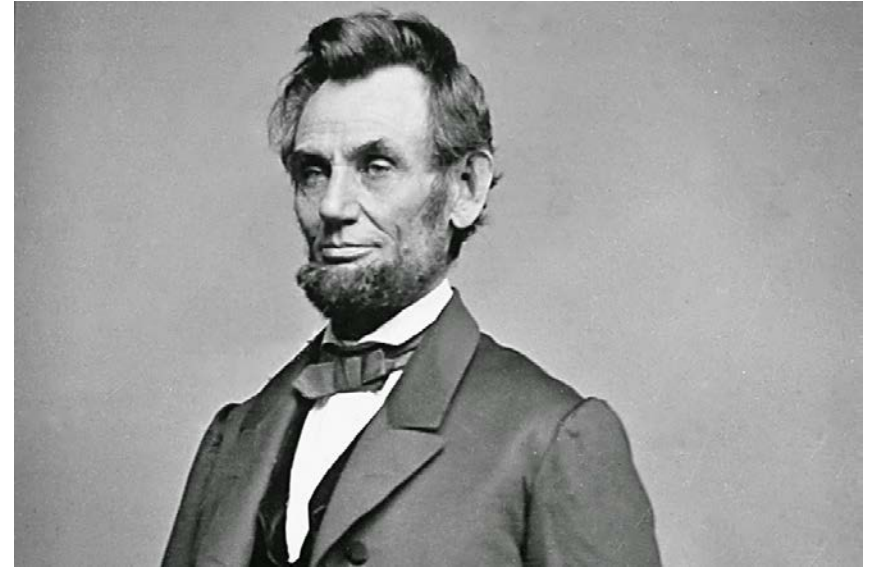
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## Perspective on the Market and Persistent Memory

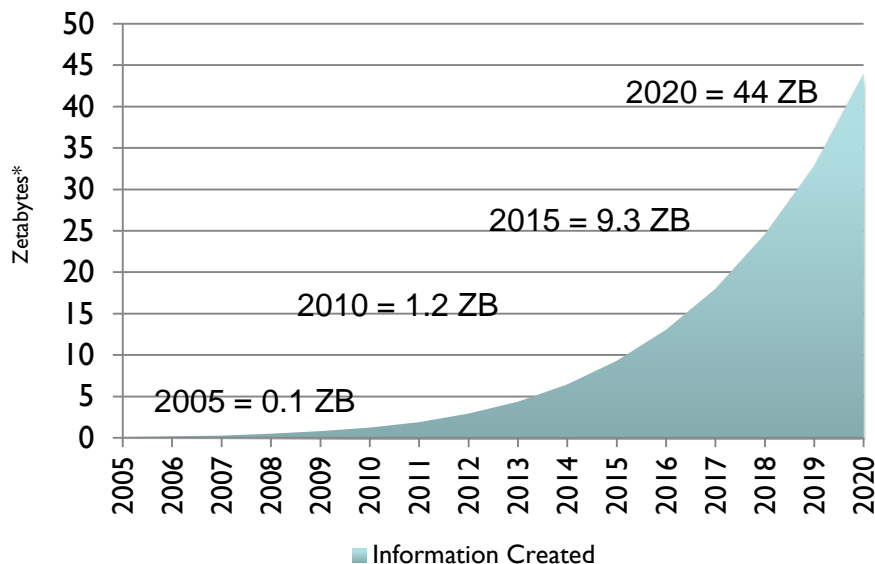
Jeff Janukowicz  
Research Vice President  
IDC

➤ “The best way to predict your future is to create it.”

- Abraham Lincoln



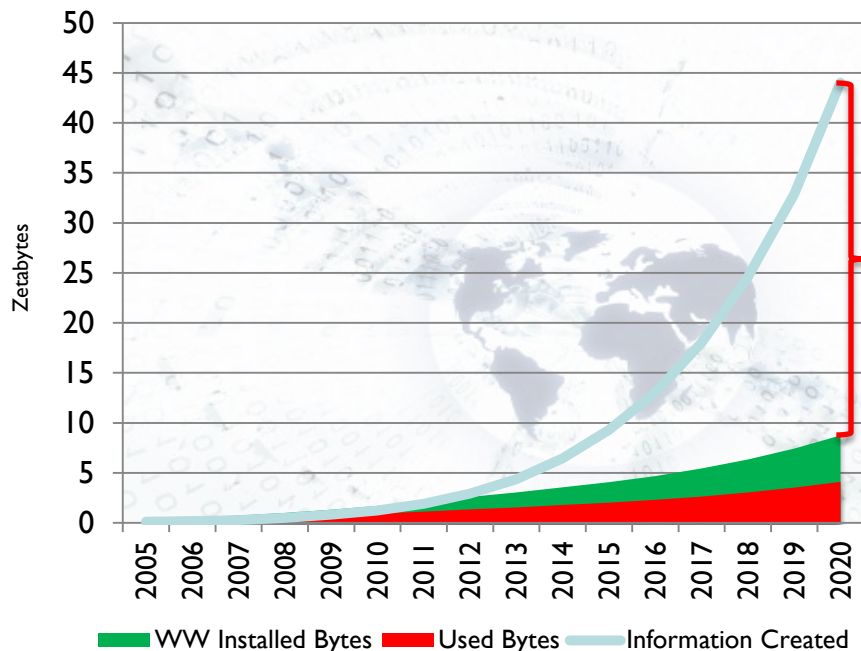
## Information Created WW



Source: IDC Digital Universe Study

- ◆ 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.

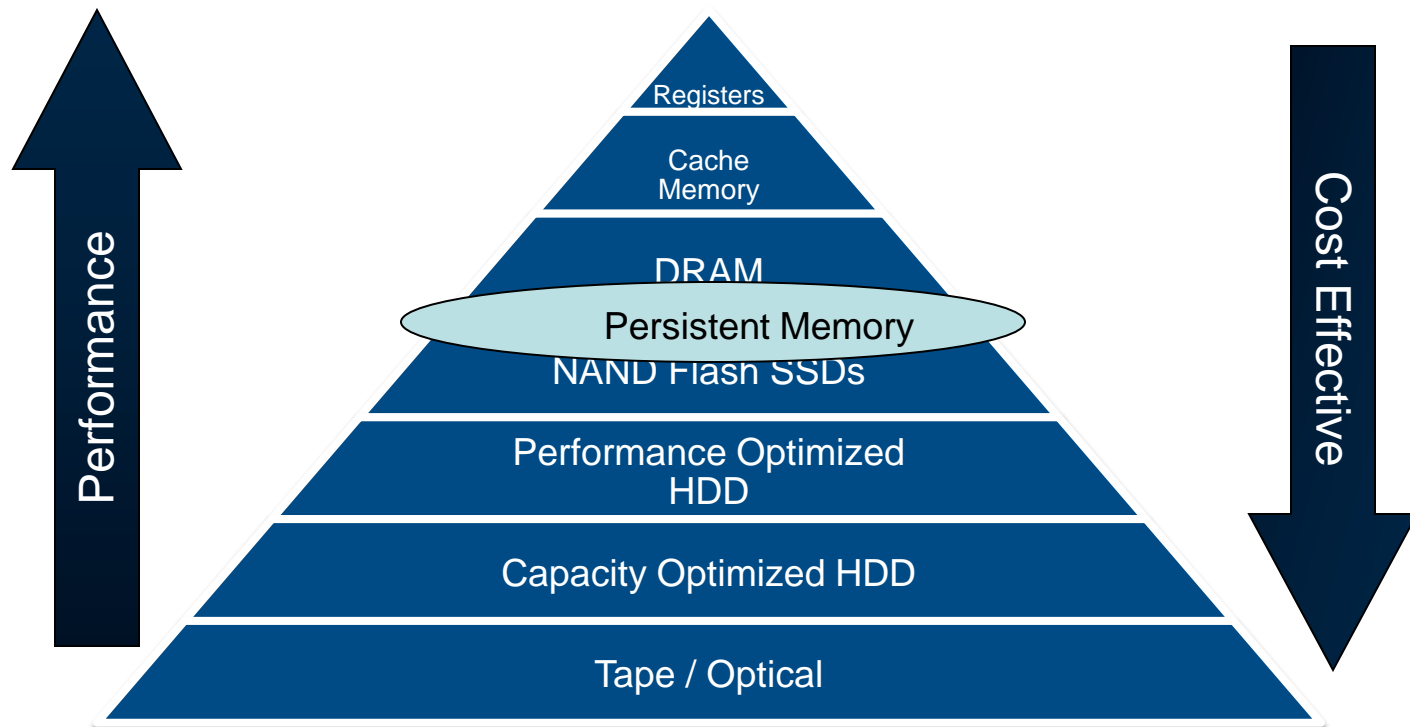
# 'Storing' our Digital Universe



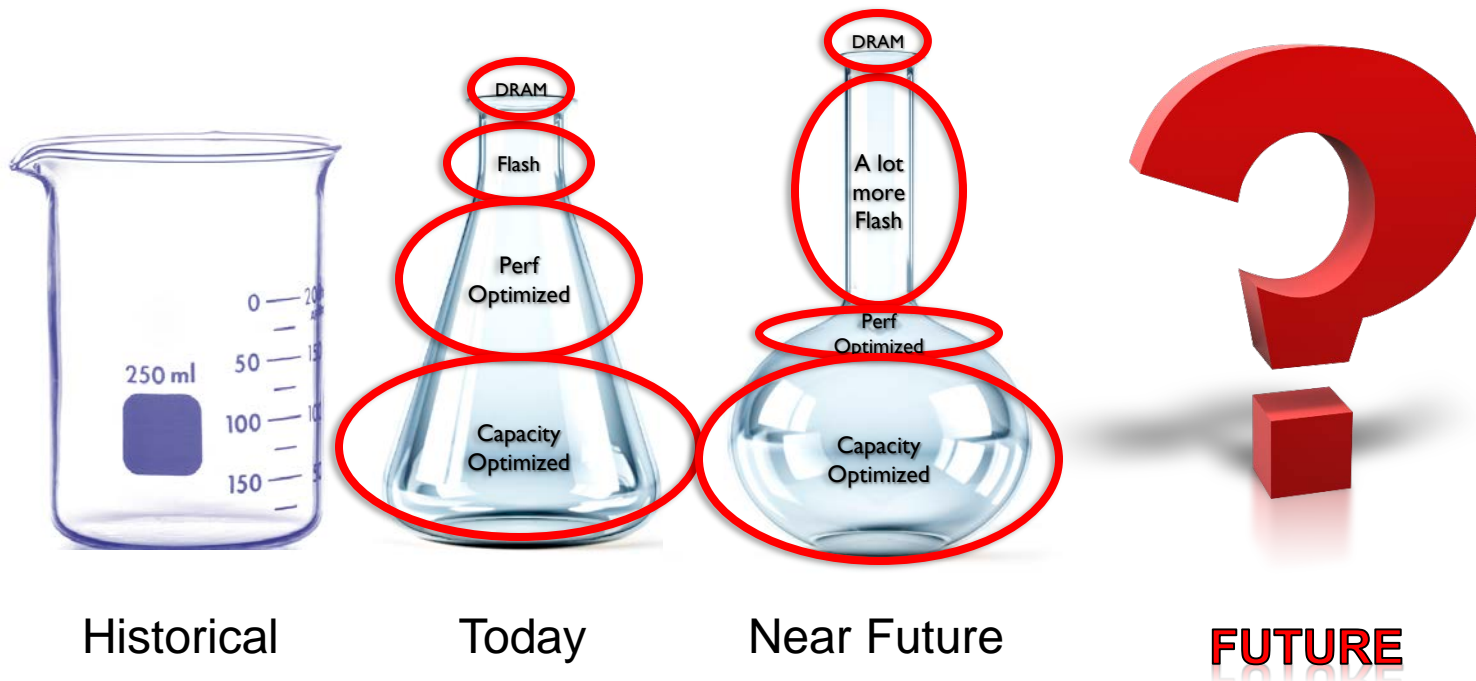
Source: IDC Digital Universe Study and Where in the World is Storage Study

- ◆ A storage device is rarely filled up to its capacity
- ◆ By 2020, we estimate a 50% utilization rate across all storage mediums.
- ◆ *Transient Data* 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



# The New Paradigm

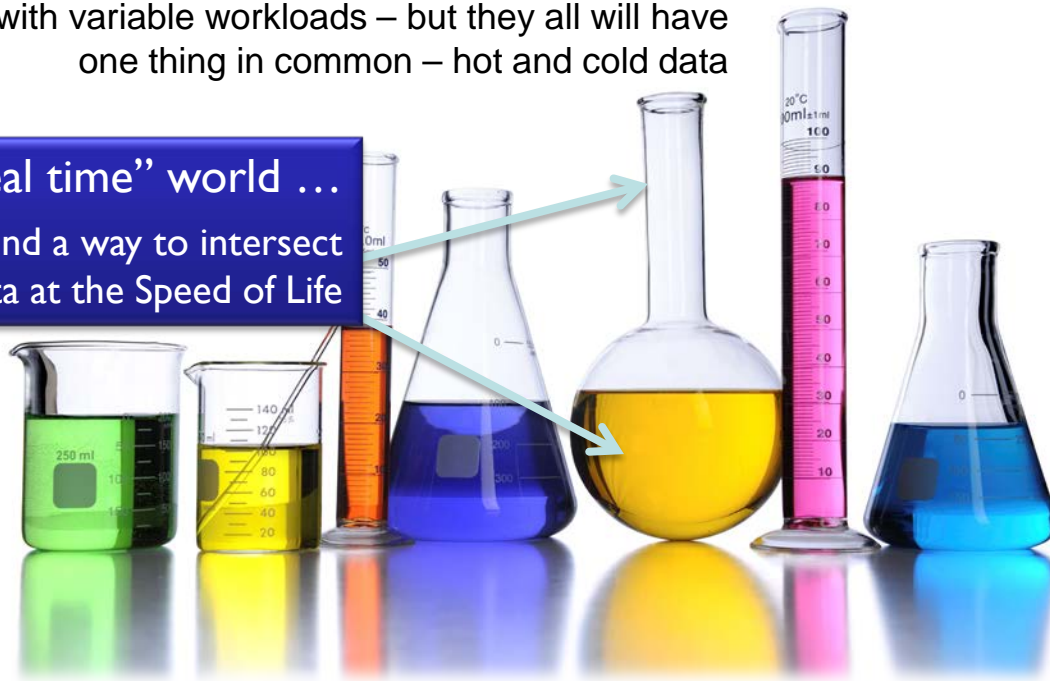




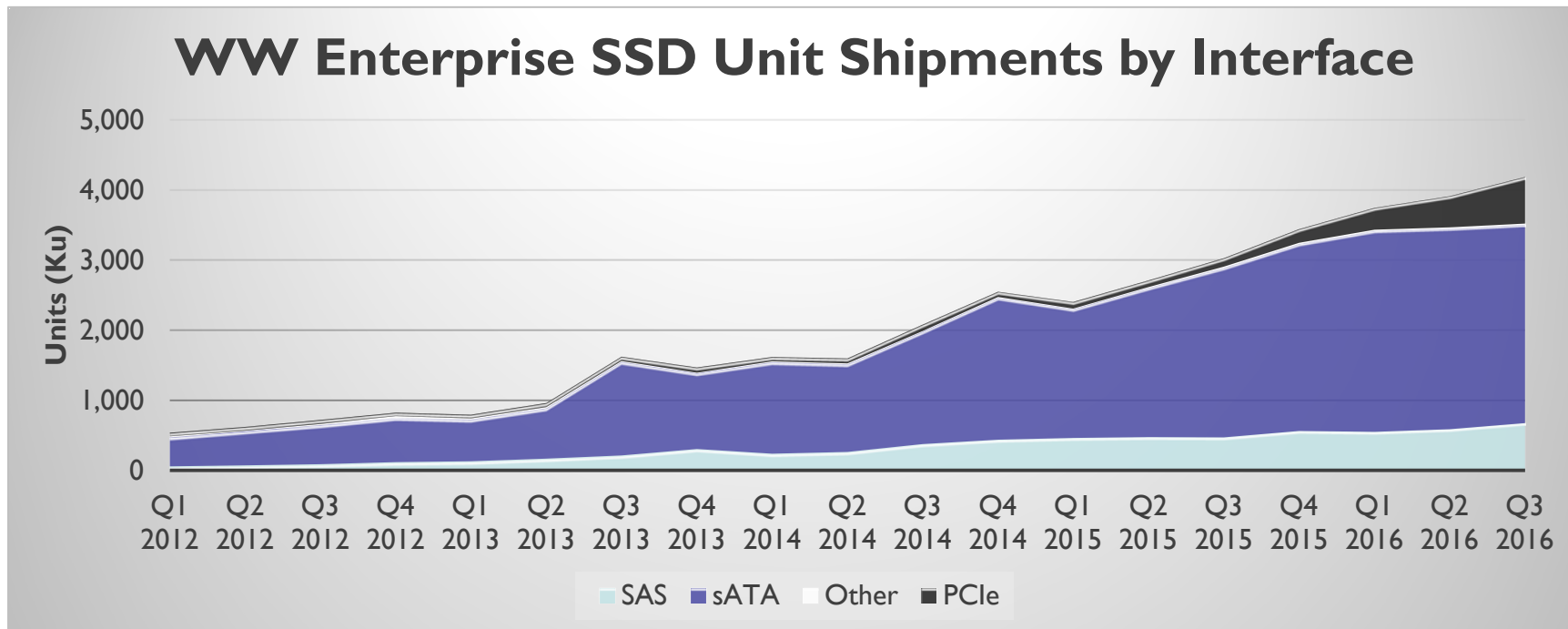
# The New Paradigm

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



Source: Worldwide Solid State Storage Quarterly Update: 3Q16 Summary  
Nov 2016 - Doc # US40809016

# Closing Thoughts ...



- “The best way to predict your future is to create it.”  
- Abraham Lincoln
- To capitalize on the opportunity:
  - ◆ Embrace the new paradigm
  - ◆ Taylor the solution for the targeted applications
  - ◆ Build an Ecosystem

The logo for the Storage Networking Industry Association (SNIA), featuring a small square icon to the left of the letters "SNIA" which are arranged vertically.

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# PERSISTENT MEMORY PMM SUMMIT

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## Persistent Memory, IOPS, & Latency

Jim Handy, Objective Analysis  
Tom Coughlin, Coughlin Associates

# Agenda

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- IOPS & latency requirements by application
- Alternative types of PM
- Outlook for memories
- Q&A

# Agenda

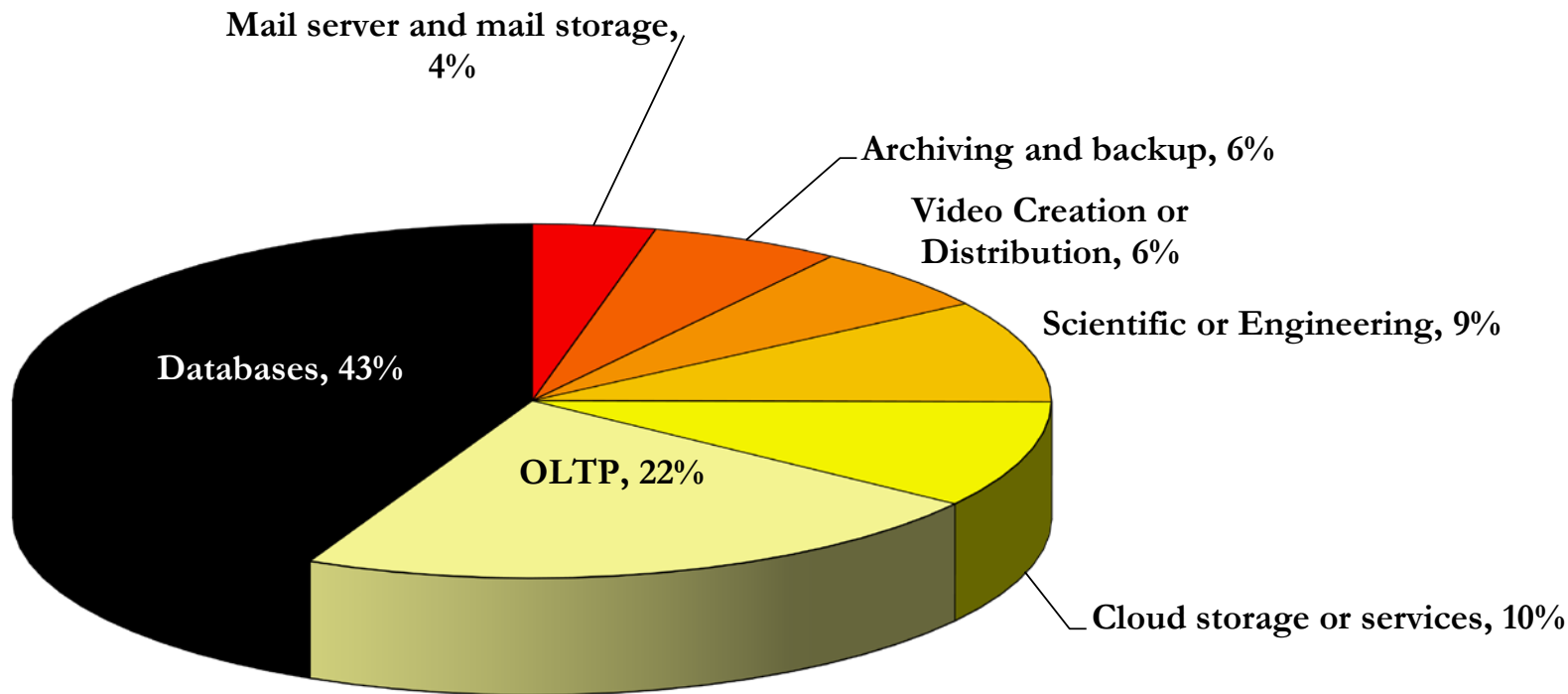
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# How Many IOPS Is Enough?

- ▶ Brief On-line survey of IT managers' needs:
  - ◆ IOPS
  - ◆ Capacity
  - ◆ Latency
  - ◆ Primary applications
  - ◆ System bottleneck
- ▶ Original data 2012. Update 2016
- ▶ 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](http://TinyURL.com/IOPSsurvey)

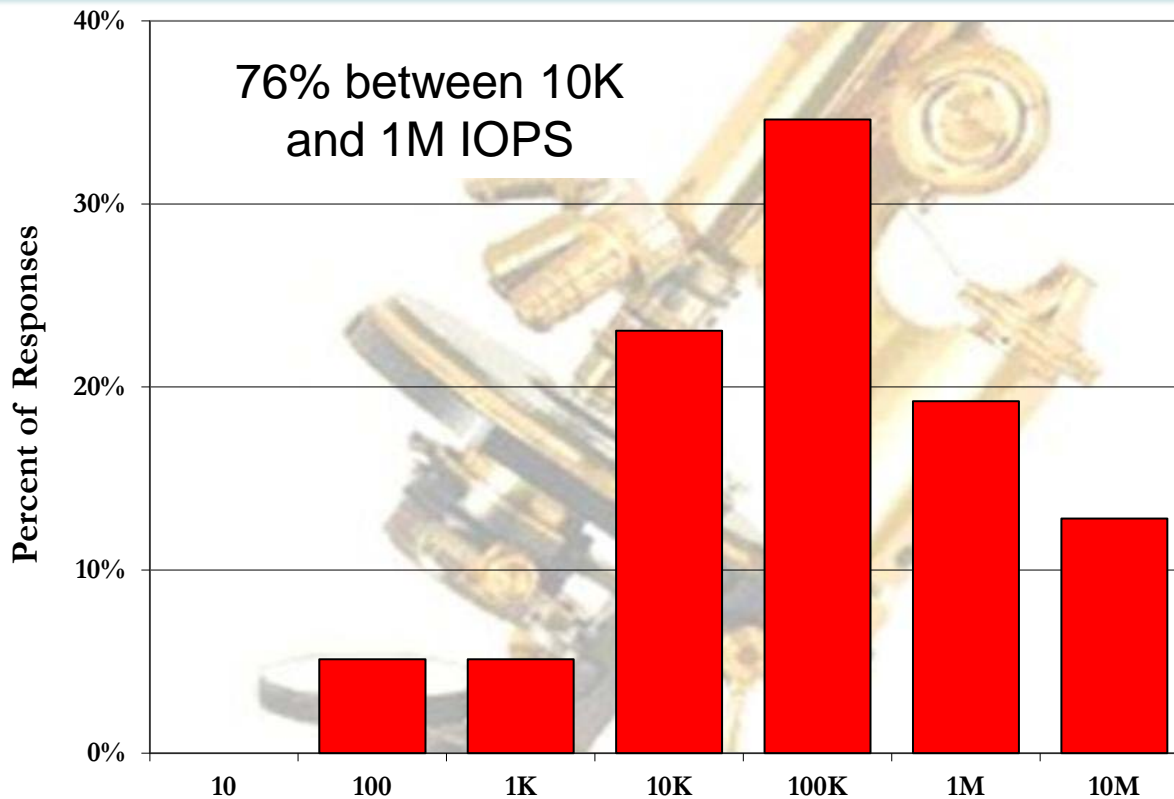
# Respondents' Application Types



Source: How Many IOPS Is Enough?  
Objective Analysis & Coughlin Assoc. 2016

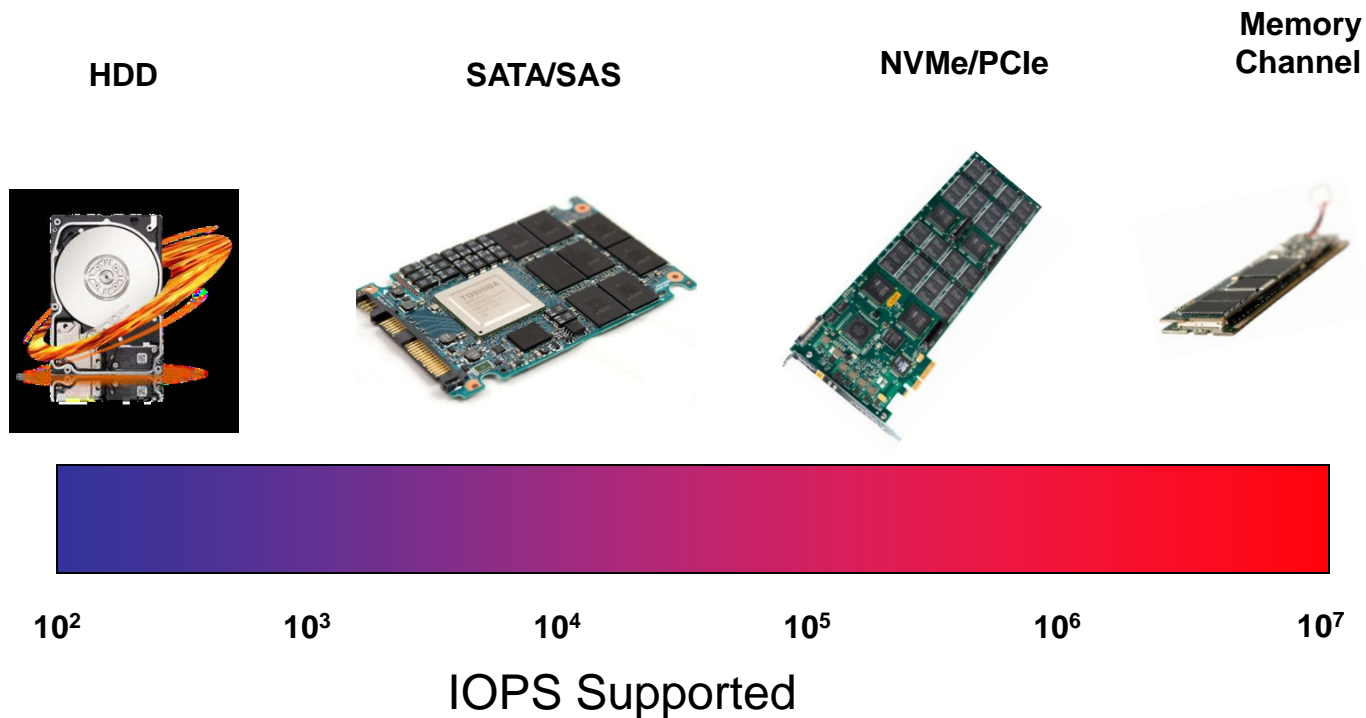


# How Many IOPS Do They Need?

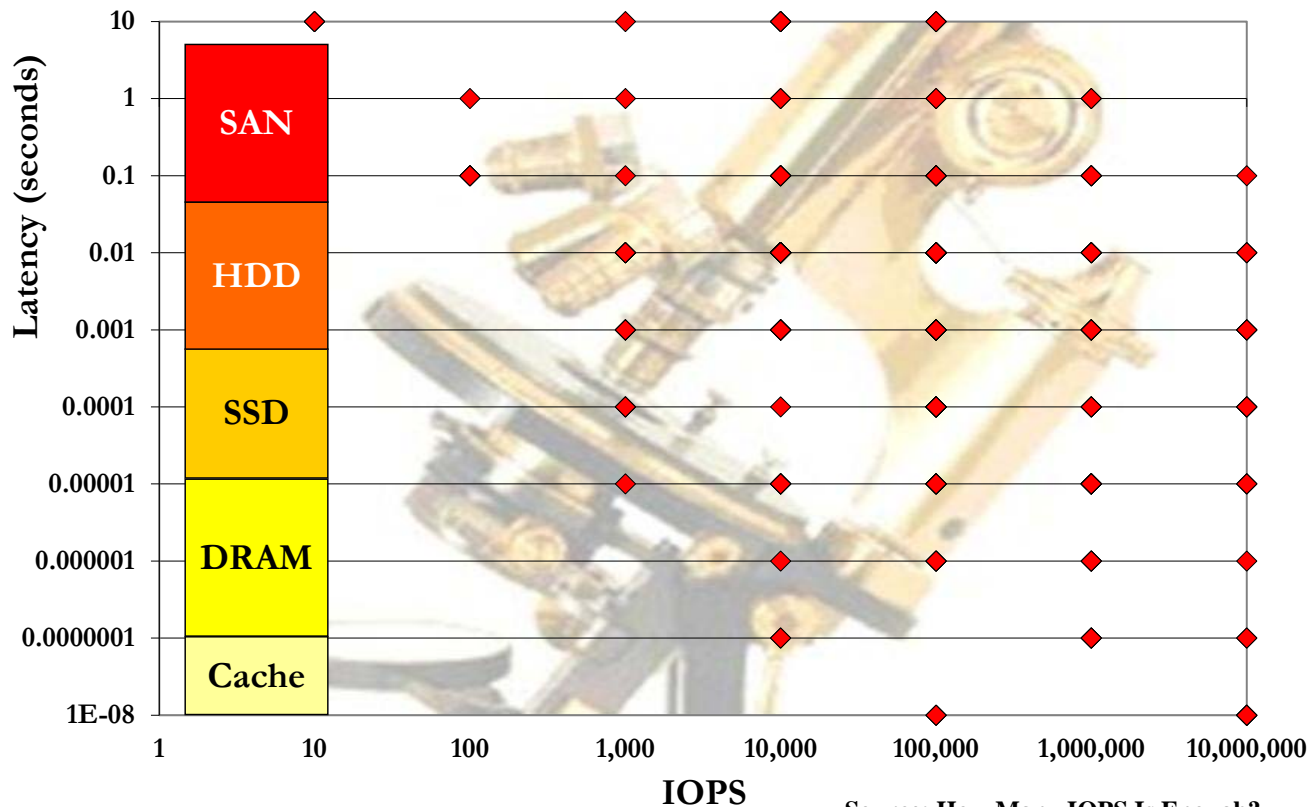


The 2016 data shows a 54% higher mean in IOPS required than the 2012 data

# IOPS by Form Factor



# Latency vs. IOPS Requirements

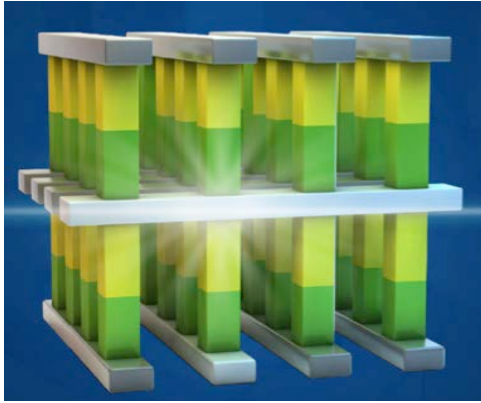


# Agenda

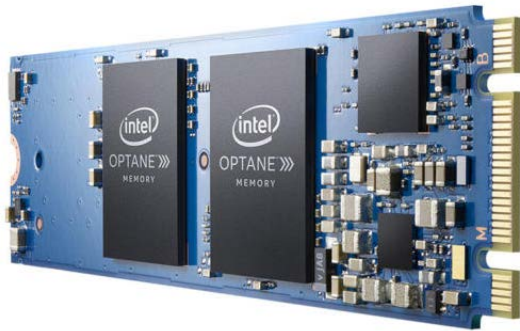
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- **Alternative types of PM**
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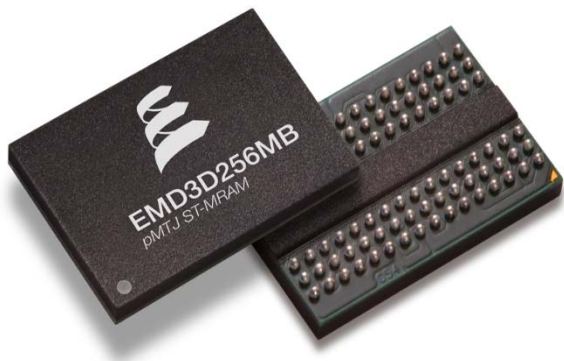
# 2020 Emerging Memory Market >\$2B



- 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



2015 Emerging Non-Volatile Memory & Spin Logic Technologies and Manufacturing Report, Coughlin Associates



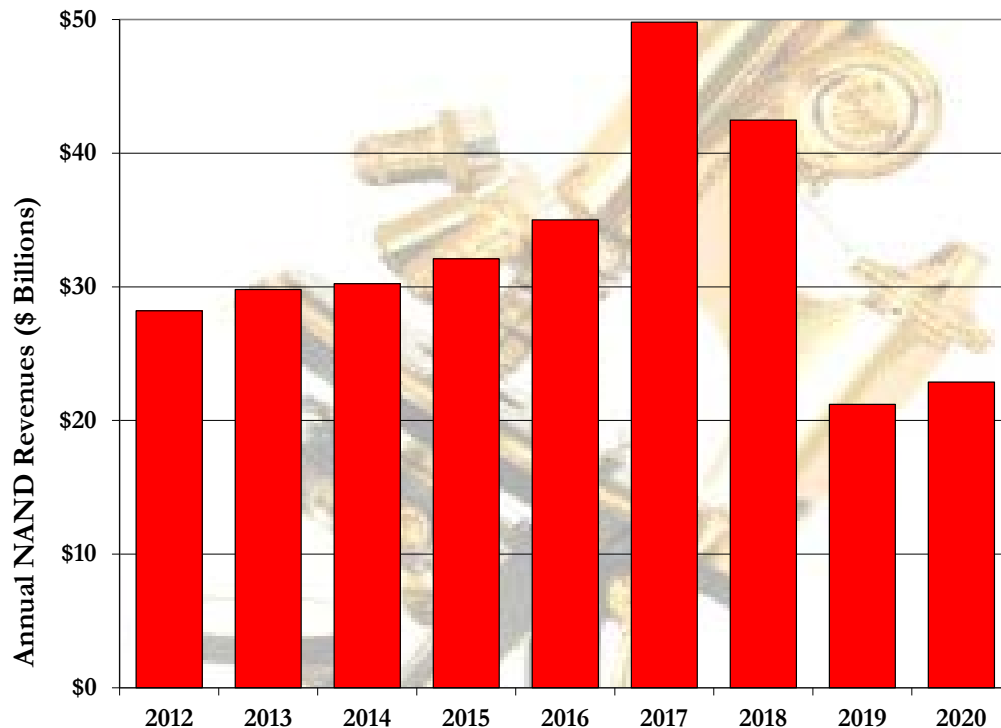
- Everspin IPO, Other start-ups in wings
- ES STT MRAM with 1 Gb capacities-- replace DRAM/SRAM?
- Global Foundries and others-- embedded MRAM (GF eMRAM 22FDX)
- Low Power Requirements make MRAM a great option for battery powered IoT products and automobiles

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# NAND Flash Cycles Will Continue



Source: NAND Flash Update, 4Q16  
Objective Analysis, 2016



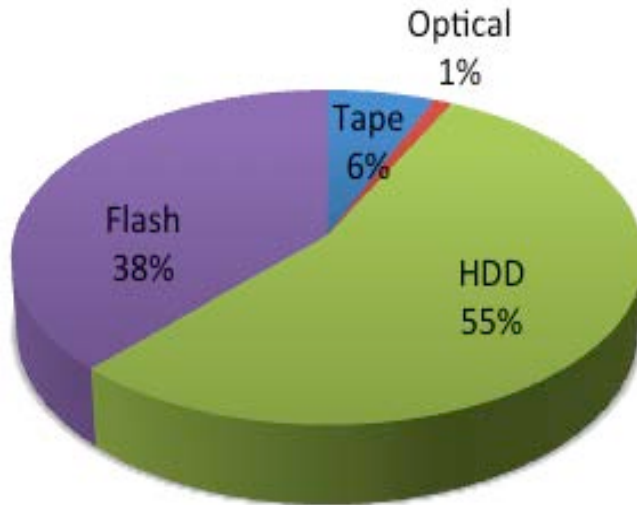
# Optimistic 3D XPoint Revenue Forecast



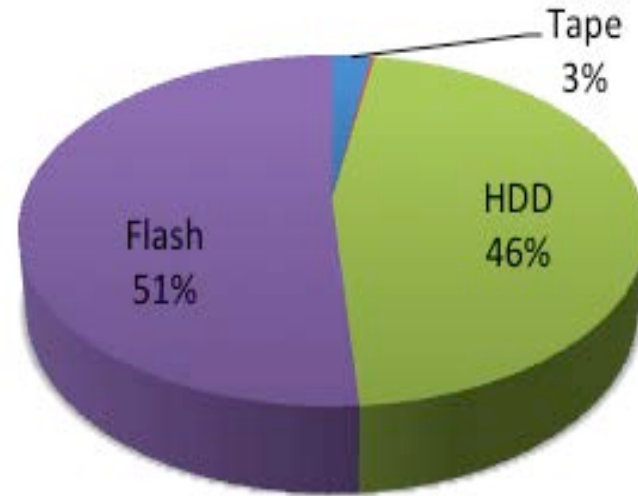
Source: A Close Look at the  
Micron/Intel 3D XPoint Memory  
Objective Analysis, 2015

# Flash M&E Revenue Share Is Growing

**2015**



**2021**



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](http://www.Objective-Analysis.com)
  
- Or order all three through Coughlin Associates at:
  - ◆ <http://www.TomCoughlin.com/techpapers.htm>
  - ◆ 408-202-5098
  - ◆ [Tom@TomCoughlin.com](mailto:Tom@TomCoughlin.com)