Market Research Panel
MRES-201A-1

Market Research Track
8:30AM to 9:35AM
August 8, 2018
Industry Analyst Panel

**Moderator:** John Rotchford, Managing Director, SASI

Camberley Bates, Managing Director, Evaluator Group
Jean S. Bozman, Vice President, Hurwitz & Associates
Thomas Coughlin, President, Coughlin Associates
Chris DePuy, Co-Founder, The 650 Group
Jim Handy, Director/Chief Analyst, Objective Analysis
Jeff Janukowicz, Research VP SSDs, IDC
Flash Memory Venture Funding
&
M&A Insights
John Rotchford, SASI

August 8, 2018
Flash Memory Venture Funding

Top Five Rounds

- Violin Memory $50M 6th
- Nimble Storage $40.7M 5th
- Pure Storage $40M 4th
- STT $36M 1st
- Avalanche Technology $30M 3rd

- Tintri $75M 5th
- Pure Storage $225M 6th
- PermixData $35M 3rd
- Reduxio $15M 2nd
- NVMDurance $1M 1st

- Elastifile $50M 2nd
- Diablo Tech $37M 3rd
- Avalanche Tech $23M 6th
- Nantero $21 6th
- E8 Storage $12M 2nd

- Crocus Tech $35.0M
- Pavilion $33.0 2nd
- Nantero $29.7M 6th
- ScaleFlux $25.0 2nd
- NGD Systems $12.4M 2nd

Total Funding ($M)

- 2012: $335 (12 Rds. Avg. $27.9M)
- 2013: $388 (5 Rds. Avg. $70.2M)
- 2014: $351 (9 Rds. Avg. $25.5M)
- 2015: $165 (11 Rds. Avg. $15.0M)
- 2016: $280 (8 Rds. Avg. $35.0M)
- 2017: $135 (5 Rds. Avg. $27.0M)
- H1 2018: [VALUE]
Flash Memory M&A Transactions

**Top Deals**

- **2012**
  - 9 Deals
  - Median Deal Size: $860M
  - Deals: EMC/XtremIO $430M, IBM/Texas Mem Systems $250M, NetApp/CacheIQ $90M, and SanDisk/FlashSoft $70M

- **2013**
  - 9 Deals
  - Median Deal Size: $2.04B
  - Deals: SanDisk/Fusion-io $1.1B, Seagate/LSI $450M, and EMC/DSSD $150M

- **2014**
  - 6 Deals
  - Median Deal Size: $1.72B

- **2015**
  - 4 Deals
  - Median Deal Size: $19.93B
  - Deals: WD/SanDisk $19.0B, NetApp/SolidFire $870M, Silicon Motion/Shannon Sys $57.5M

- **2016**
  - 6 Deals
  - Median Deal Size: $25M
  - Deals: Nutanix/PernixData $25.3M, Pivot3/NexGen Stg $2M, Kingston/Imation $1M

- **2017**
  - 3 Deals
  - Median Deal Size: $1.455B
  - Deals: HPE/Nimble Storage $1.1B, WD/Tegile $350M, Soros/Violin $14.5M

- **H1 2018**
  - No M&A
Flash Memory Venture Market Map

**Systems**
- Aupera
- E8 Storage
- Excelero
- EXTEN
- Reduxic
- Nimbus Data
- Panviva
- Vexata

**Memory/Controllers**
- CNEX (NVMe)
- Aprión
- APTA
- CROCUS Technology (MRAM)
- Crossbar (MRAM)
- Mobveil
- Nvdian
- Nantero (MRAM)
- Spin Transfer Technologies
- Xitore

**Software**
- Kaminario
- Applicata
- Burlywood
- Radian
- Primary IC
- NGD Systems
- ScaleFlux

**Sub-Systems**
- Excelero

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STRATEGIC ADVISORY
SERVICES INTERNATIONAL, LLC
Enterprise and Solid State Adoption

Camberley Bates, Managing Director

@camberleyb
Tier 1 On and Off Premises

Which of the following statements best describes how you use public cloud for Tier 1 applications?

- We primarily use private data centers for Tier 1 applications, with some application migration to the public cloud
- We primarily use the public cloud for our Tier 1 applications, with some application migration to private data centers
- Public cloud is our only environment for Tier 1 applications
- Private data center is our only environment for Tier 1 applications
- Uncertain
- Other

Evaluator Group “Enterprise Hybrid IT Storage Research, Aug 2018”
Solid State Storage Adoption, April 2018

- All Flash Systems used for 70 – 100% of Business Critical and Virtualized environments
- Arrays stay the preference over SDS, by over 2:1

Evaluator Group “Solid State Adoption in the Enterprise, Apr 2018”
Enterprises Reduced Primary Storage Capacity

Result of:

- Data Reduction Techniques
- Capacity Utilization
- Moving Inactive Data

Evaluator Group “Solid State Adoption in the Enterprise, Apr 2018”
No changes yet, in Array Life

- Expect to see 7 year life – as accounting catches up or leases expire
- Requires matching warranties / support by vendors

Evaluator Group “Solid State Adoption in the Enterprise, Apr 2018”
Flash - big player in HPC & AI Architectures

Traditional HPC, ML (N-S)

Σ Storage

HPFS

Network

CPU CPU CPU CPU

Expanded for DL (+ E-W)

Σ Storage

HPFS

Network

GPU GPU GPU GPU

Data
Hybrid Cloud – Now the Mainstream – Is Spurring Flash Adoption

Jean S. Bozman
Vice President and Principal Analyst
Hurwitz & Associates
Hybrid Clouds: Driving the “Need for Speed”

- Hybrid clouds need fast data transfers, high-speed networks and flash storage.
- Having fast, persistent storage will reduce processing time.
- Processing more data at The Edge: sensors, medical imaging, audio and visuals/video.
There’s a Revolution in the IT Data Center
- Breaking down aging IT silos
- Consolidate, Simplify, Reduce

Cloud-Native Services Are Growing
- Cloud Service Providers (CSPs)/Hyperscale
- Hybrid Clouds linking data centers and CSPs
- Private Clouds Going Strong
Hybrid Clouds Will Tap Data at The Edge

- Sensor Data Generated at The Edge
- Integrating Data Across Many Environments
- AI and ML will Improve Storage Automation
Building Out: What’s Next

- All-Flash Array Growth Will Continue
- New Network Fabrics Taking Shape
  - Leveraging NVMe to Achieve Faster End-to-End Data Transfers
- More Enterprise Apps Will Move to Cloud
- Security, SLAs Are Being Reinvented
- CyberSecurity Looms Large
Jean S. Bozman

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Twitter: @jbozman
Emerging Memories and China Fabs

Tom Coughlin, Coughlin Associates
Jim Handy, Objective Analysis
Emerging Memories are Poised to Explode

Tom Coughlin
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www.tomcoughlin.com

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CHART OF HIGH, BASELINE AND LOW REVENUE ESTIMATES FOR EMERGING MEMORIES ($M)
New Report on Emerging Memories

• Flash memory will remain a dominant solid-state memory for several generations with all manufacturers having moved to 3D flash.

• The 3D X-Point technology is poised to impact DRAM production while STT MRAM will impact SRAM, NOR and some DRAM.

• Resistive RAM (ReRAM) appears to be a potential replacement for flash memory sometime in the next decade.

• The memories addressed in this 161-page report, containing 31 tables and 111 figures, include PCM, ReRAM, FeRAM and MRAM Technology as well as a variety of less mainstream technologies.

• More information: https://tomcoughlin.com/tech-papers
China’s New Chip Thrust

Jim Handy

OBJECTIVE ANALYSIS
What Would You Do?

Importing over $100B in chips
Want self-sufficiency

Over $3T in foreign reserves
Must happen quickly
## Getting China Into Memories

<table>
<thead>
<tr>
<th>Year</th>
<th>Outlook</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>Mid-year NAND flash oversupply/collapse</td>
</tr>
<tr>
<td>2019</td>
<td>DRAM, then overall semiconductor collapse</td>
</tr>
<tr>
<td>2020</td>
<td>Second “Down” year. China production delayed</td>
</tr>
<tr>
<td>2021</td>
<td>China production real. Oversupply extended</td>
</tr>
<tr>
<td>2022</td>
<td>Demand catches up with supply. New shortage/profits</td>
</tr>
</tbody>
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New Objective Analysis China Memory Report coming this month
Storage Systems Presentation at Flash Memory Summit
Session MRES-201A-1, Aug 8, 2018 8:30 AM to 9:35 AM

Chris DePuy
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Storage Systems: Equipment Type – Total (I+E)
Storage Systems:
Customer Type – Total (I+E)
Driving the Growth …

**Client**
- Increasing adoption in PCs

**Enterprise**
- Growth in All Flash Arrays, Hybrid Arrays, and Servers

**Cloud**
- Expanding use of flash and cloud infrastructure

- Portable Attach Rate:
  - 2017 = 40%
  - 2022 = >70%

- SSD as % Total Enterprise PBs:
  - 2017 = 9%
  - 2022 = >17%
SSD Pricing Plays a Key Role in Adoption

SSD Price-per-GB Premium vs. HDD

Tight Market

Multiple of HDD Price-per-GB


Overall Total SSD to Overall Total HDD: 4.9, 4.8, 6.6, 5.1, 3.1, 2.3, 5.9, 2.2
Client SSD Premium to Client HDD: 5.4, 3.5, 3.8, 3.5, 2.5, 1.8, 1.6, 1.6
Enterprise SSD Premium vs. Performance-Optimized HDD: 20.3, 17.2, 11.2, 10.5, 8.0, 6.8, 6.2, 8.6
Enterprise SSD Premium vs. Capacity-Optimized HDD: 8.9, 11.2, 8.0, 13.2, 2.0, 9.3, 4.5, 8.6

Total Worldwide Enterprise HDD and SSD Revenue Forecast, 2013-2022
Worldwide SSD Unit Forecast 2017-2022
Q & A