Market Research Panel
MRES-201A-1

Market Research Track
8:30AM to 9:35AM
August 7, 2019
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
Flash Memory Venture Funding & M&A Insights

August 7, 2019

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Flash Memory Venture Funding

A solid first half of 2019 with $178M in funding, led by Lightbits with an impressive $50M 1st round of funding which included strategic investors, Cisco, Dell and Micron...
Flash Memory M&A

While venture funding remains strong, the M&A valve has been shut off...

Top Deals

- WD/SanDisk $19B
- NetApp/SolidFire $870M
- Silicon Motion/Shannon Sys $380M
- Nutanix/PernixData $25M
- Pivot3/NexGen Stg Kingston/Imation
- HPE/Nimble Storage $1.1B
- WD/Tegile $350M
- Soros/Violin $15M
- DDN/Tintri $60M
- Violin/X-IO Storage
- Synopsys/Kilopass

However, it’s already picking up in July/August with Storcentric acquisition of Vexata, Rambus acquisition of Northwest Logic and AWS purchase of E8 Storage
We expect VC funding to remain strong in the 2nd half of 2019 and we could also see another 3+ M&A trades happening before year end...
New(er) use cases for Flash

Camberley Bates, Managing Dir / Analyst
Flash and Data Protection

- “Using all flash arrays... not that expensive for backup and DR”
- “We need performance (backup target) to finish faster”
- “Less Hardware maintenance”
Flash and Analytics Flow

Work flow and data flow is complex

- Data Source
  - Traditional Business
  - IoT & Sensors
  - Collaboration Partners
  - Mobile Apps & Social Media
  - Legacy

- Data Preparation
  - Heavy IO
  - Data Cleansing & Pre-Processing
  - Training Dataset
  - Testing Dataset

- Build, Train, Optimize Model
  - Parallel Hyper-Parameter Search & Optimization
  - Network Models
  - Hyper-Parameters
  - Instrumentation
  - AI Deep Learning Frameworks (Tensorflow & Caffe)
  - Distributed & Elastic Deep Learning

- Inference
  - Deploy in Production using Trained Model
  - Trained Model

Years of Data: → Weeks & months: → Days & weeks training: → Seconds to results:
Composable Infrastructure

Orchestration

API

Management / Composing Software

VM
VM
VM
Cont.
Cont.
Application
Hypervisor
Container Engine
Operating System
Bare-metal server
Bare-metal server
Bare-metal server
CPU / Memory
GPUs
Network Interface Cards
Direct Attached Storage

Hardware
Next in the Data Center

• Second Generation AFA Storage

• Long-term archive
  - High density 50TB SSD
  - 10++ year life of drives – eliminates tape or HDD migration
www.EvaluatorGroup.com
Cloud and Edge Will Drive Sustained Demand for Flash

Jean S. Bozeman
Vice President and Principal Analyst
Hurwitz & Associates
The Business Impact of Hybrid Cloud

- Gathering more data for rapid decisions, business agility
- There’s a need for fast, persistent storage
- Data is being stored closer to the customer
  - Examples: Financial, Retail, Oil/Gas refineries
As more apps move to Edge and Cloud, enterprise data centers must:
- Identify apps for cloud migration
- Clean up database sprawl
- Replicate data across the hybrid cloud
- Connect cloud “front-end” apps with “back-end” transactional databases
- Partner with CSPs to apply AI to improve navigation of metadata
Edge Computing Is Accelerating

- Demand for real-time analysis
- Often in remote sites
  - Oil refineries, retail stores, factories
  - IoT appliances/devices, self-driving vehicles
  - Hyper-converged systems
- Edge systems incorporate fast SSDs
- Analytics first, data transfer later
- New network fabrics to reduce latency
  - Leveraging NVMe for faster data transfers
Hybrid Clouds Tap Data Differently

- Non-traditional data sources proliferate (social media, IoT)
- Dealing with 160 ZB+ of data worldwide by 2025
- Integrating end/end services (Transactional + Mobile)
- Cloud Object Storage
- Data Optimization for efficient use on-prem and off-prem
- Still key: Ensuring HA/DR and security for enterprise data
Use NVMe for faster end-to-end data transfers from DC to cloud to edge
Harmonize SQL databases with non-SQL ones in the enterprise mix
Establish regional data “hubs”
Replicate key data-sets across the cloud
Go to hybrid cloud, leading to multi-cloud to leverage a range of cloud usage models
Jean S. Bozman

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Time for New Memories?

Tom Coughlin
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MRAM In Embedded Devices

- MRAM is smaller than SRAM (with 5-6 transistors/cell)
- NOR Flash cannot shrink beyond about 22-28 nm
- MRAM could replace SRAM and NOR flash memories in embedded AI devices consuming less power with higher memory density
MRAM AI Developments

- All the major semiconductor foundries have said they will provide embedded MRAM in SoC products including Samsung, TSMC, Global Foundries UMC, etc.
- Many of these foundries are also looking to move MRAM integration away from BEOL to earlier in the chip production process to reduce cost
- New tools are needed for MRAM, driving capital equipment spending

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## Lightspeeur® 2802M, Production AI Accelerator Chip with MRAM (from 2019 CES)

- Includes: The GME (Gyrfalcon MRAM Engine)
- 9.9 TOPS/W in a 22nm ASIC
- Produced via TSMC Collaboration
- Industry leading features, like Non-Volatile Memory

<table>
<thead>
<tr>
<th>~ 40 MB of Memory</th>
<th>Large embedded models</th>
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<tbody>
<tr>
<td></td>
<td>Multiple AI models :</td>
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<tr>
<td></td>
<td>Image Classification</td>
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<td>Facial recognition</td>
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<td>Voice identification</td>
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<td>Voice Commands</td>
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<td>Text to speech</td>
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<td>And others…..</td>
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- **Power Savings**: 20-50% when compared to SRAM or “other MRAM”
- **Custom Designs**: One Time Programmable Memory
  - up to 10 ns Read Speed (~30 TOPS/W)
  - Non-Power Leakage
Growth in MRAM Memory Shipments

- MRAM will replace the bulk of embedded NOR and SRAM in SoCs, mostly for AI apps.
- The chart shows projected baseline petabyte memory shipments from 2018-2029.

2019 Emerging Memories Ramp Up, Coughlin Associates and Objective Analysis, 2019

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MRAM Capital Spending Up

The chart shows low, baseline and high MRAM manufacturing equipment spending estimates from 2018-2029.
EMERGING MEMORIES RAMP UP  
Available June, 2019

This report, jointly produced by Objective Analysis and Coughlin Associates, provides an exhaustive look at emerging memory technologies and their interaction with standard memories, both as discrete devices and in embedded applications (the memories within logic chips like ASICs and MCUs). The report provides a well of technical information, market dynamics, forecasts, and competitive analyses of the leading companies. Forecasts show how the markets will grow not only for the technologies themselves, but also for the capital equipment used to produce them. Read this to understand the competitive landscape and market drivers for these new memories, and to learn how to profit from tomorrow’s market.

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EAI 2019  
Emerging Memory and Artificial Intelligence Workshop  
Bechtel Conference Center at Encina Hall  
Stanford University  
August 29, 2019

This is a one-day workshop featuring invited experts speaking on emerging memory technology, such as MRAM, RRAM, FRAM and PCM as well as experts on applications using various types of AI, as well as machine learning, talking about memory requirements for these applications. The morning will feature speakers on the foundational knowledge of emerging memory technologies and AI, with the afternoon featuring speakers on applications for AI including these applications using emerging memory technologies.

To register and for detailed event information, please visit:  
https://emai19.sites.stanford.edu

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For Further Information

Report on Emerging Memories and Workshop on Emerging Memories and AI
Storage Systems:
Equipment Type – Total (I+E)
Storage Systems: Vendor Landscape – Total (I+E)
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• Founded in 2017 by Chris DePuy and Alan Weckel
• Headquartered in Silicon Valley
• Trusted source of research for system vendors, component manufacturers, service providers, sell-side, buy-side, and standards bodies
Q & A