Evaluator Group

In-Memory Computing and the Emergence of Tier -1 Storage

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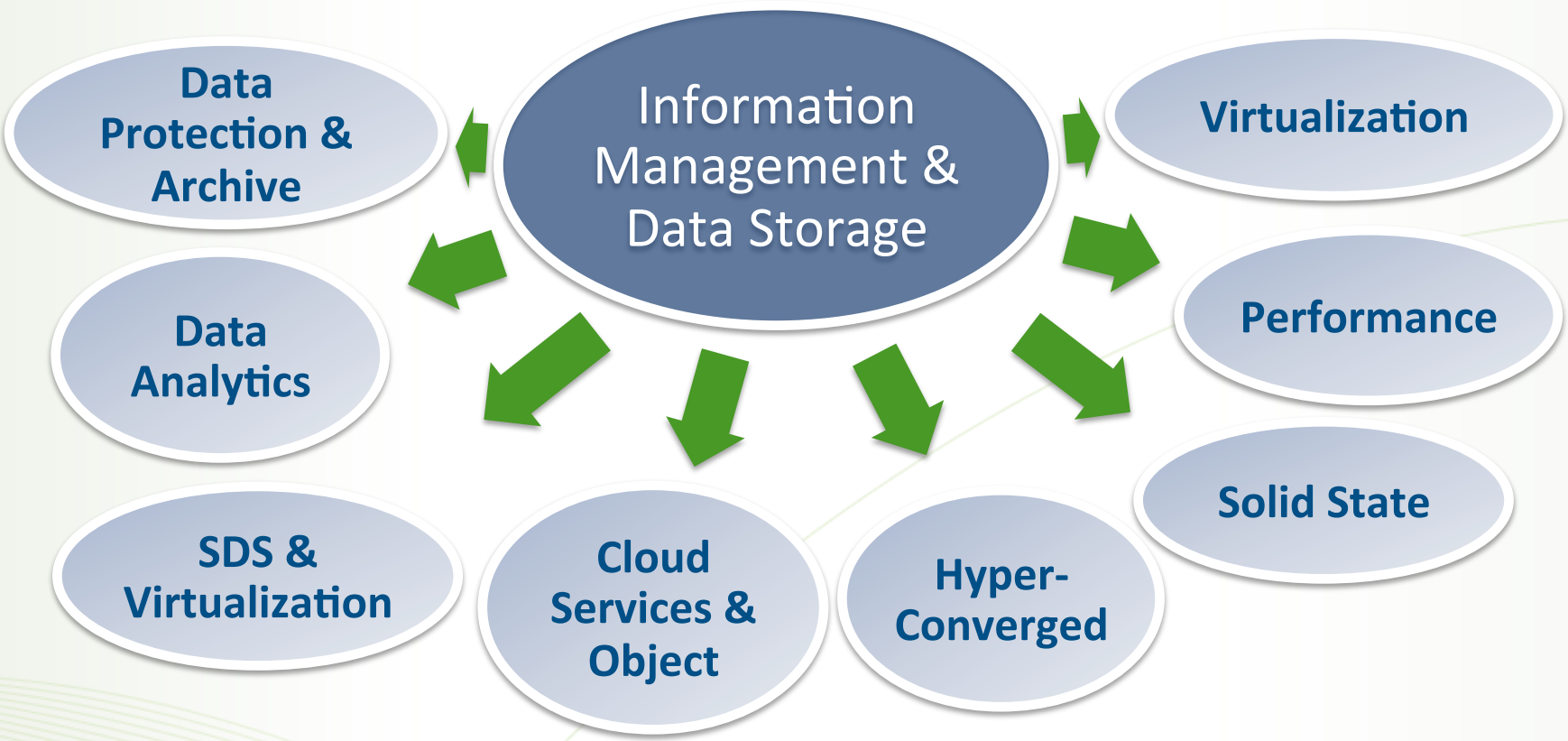
Overview of Evaluator Group

- Since 1997 delivering comprehensive and objective analysis of storage systems and related issues
  - A team of engineers, systems performance experts and go-to-market specialists
  - Expert analysis with detailed information and unbiased opinions
- Practical, business-oriented, technical perspectives

Research Coverage



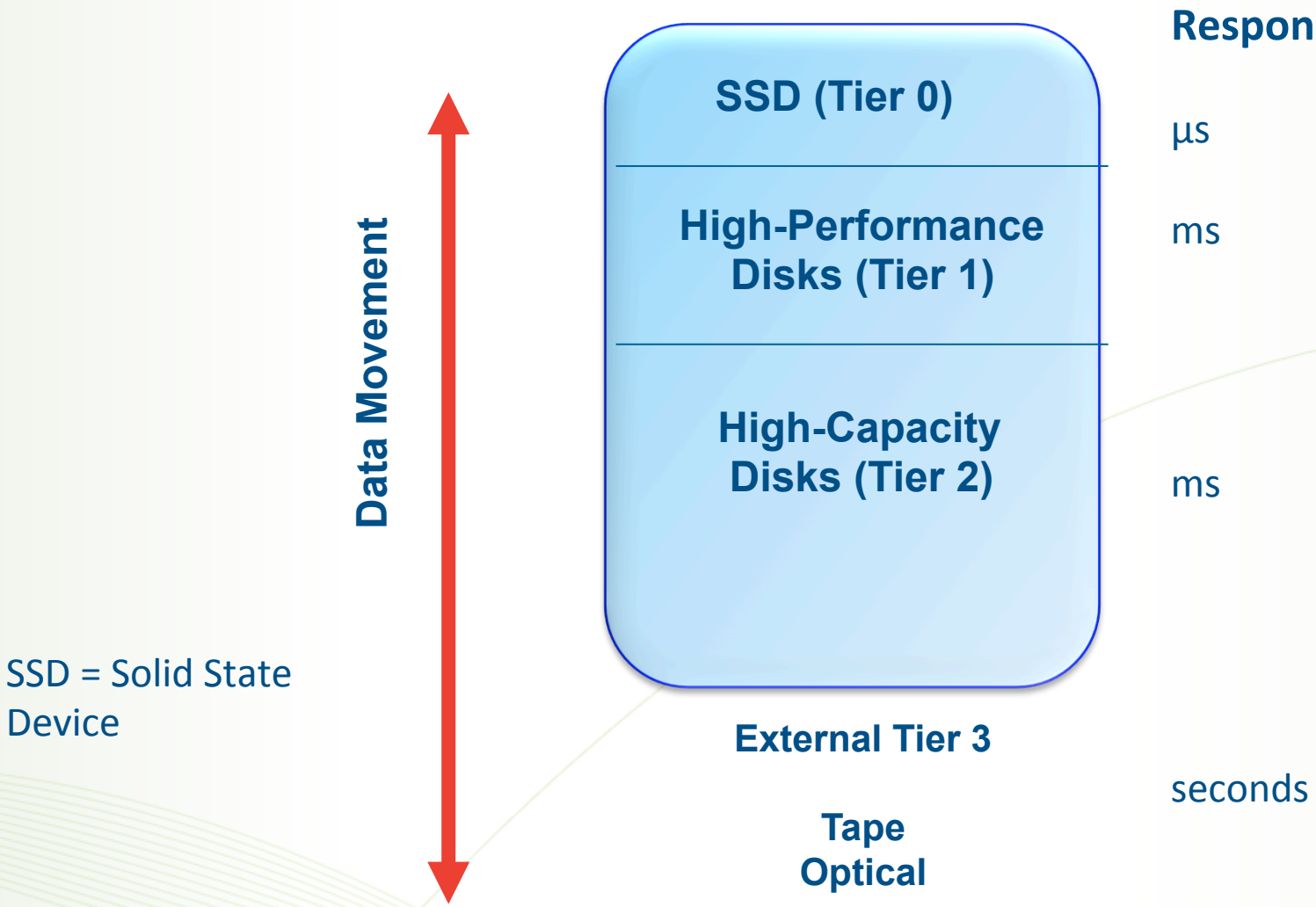
A Few of Our Customers

What's the Point?

- A new scalable, very high performance, low cost tier is persistent storage is emerging (Tier -1).
- Adoption will be accelerated by rapid advances in price for performance and capacity.
- It will, converged with other technologies, enable broad adoption of real time analytics.
- Market potential for real time analytics—and real time computing in general—already exists (and has existed for years).
- At present, the possibilities can only be partially imaged.

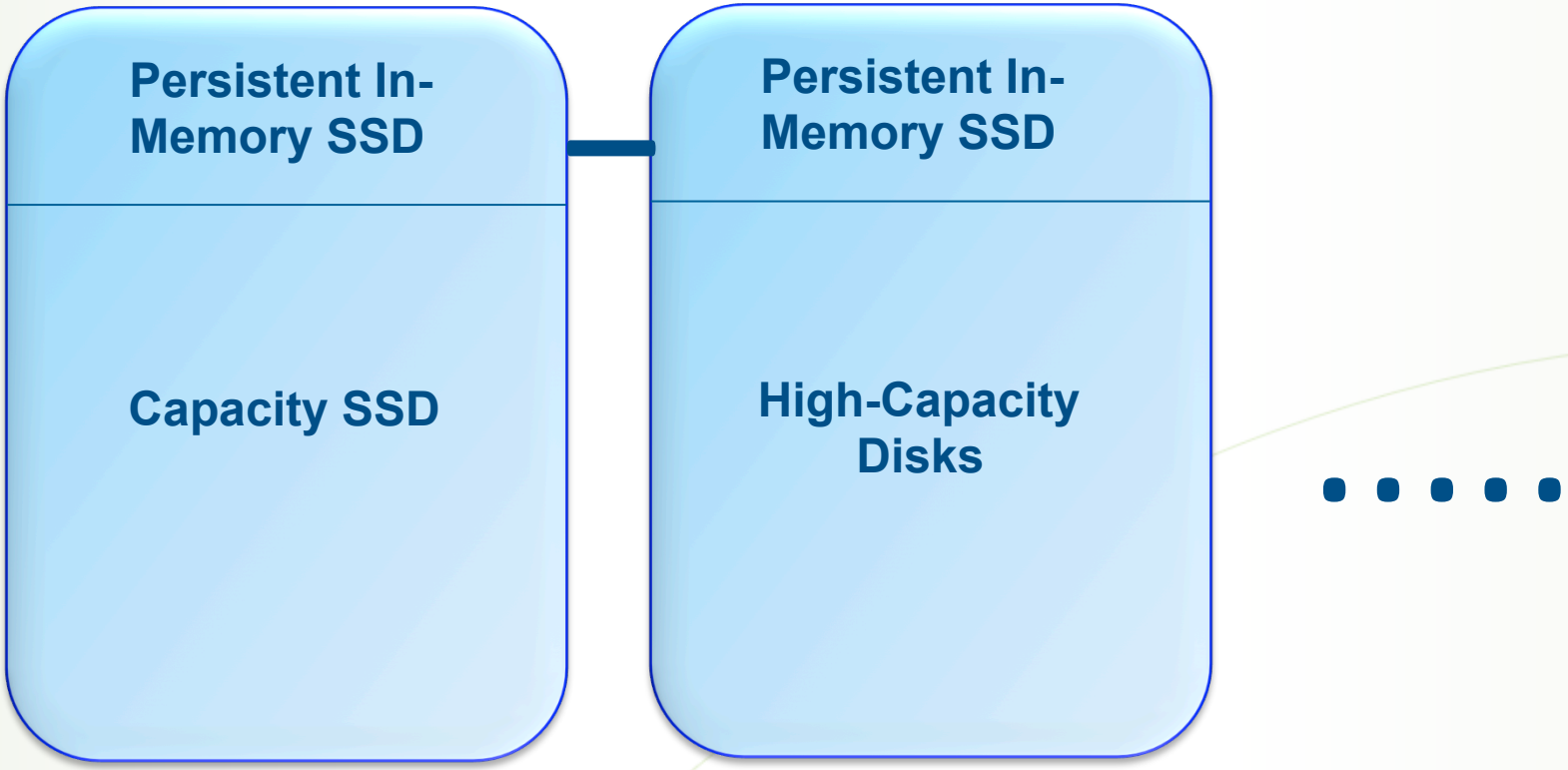
What is Tier -1?

Storage System Tiering "Within the Box" and External



SSD = Solid State Device

Tier -1 Data Persistence In-Memory



SSD = Solid State Device

What Does the Future for SSD Look Like?

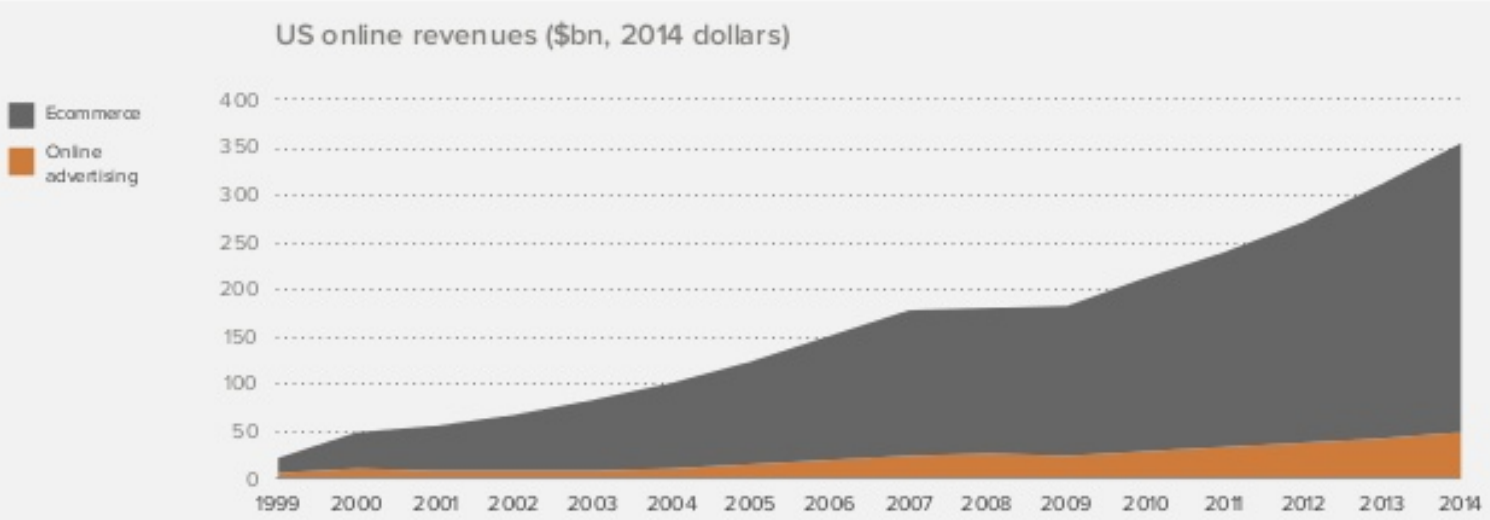
Why Enterprise IT Likes SSD

- Elongate tech refresh cycles
- Increased efficiency/reduced cost of virtualized servers
- Deduplication yields gains in price/GB vs. disk
- Lower Opex for machine room environmentals
- Application performance (turn muts into show dogs)

Why Business Likes SSD

People are spending (lots of) money online

US ecommerce + online ad revenue has increased ~15x since 1999

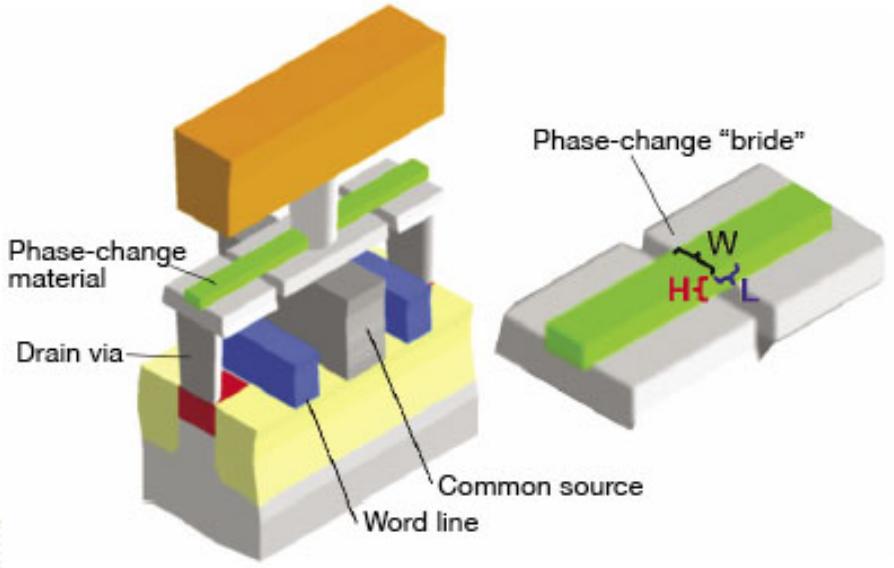


11 ANDREESSEN HOROWITZ Source: US Census Bureau, IAB/PwC, a16z

Multiple SSD Technologies Advancing in Parallel

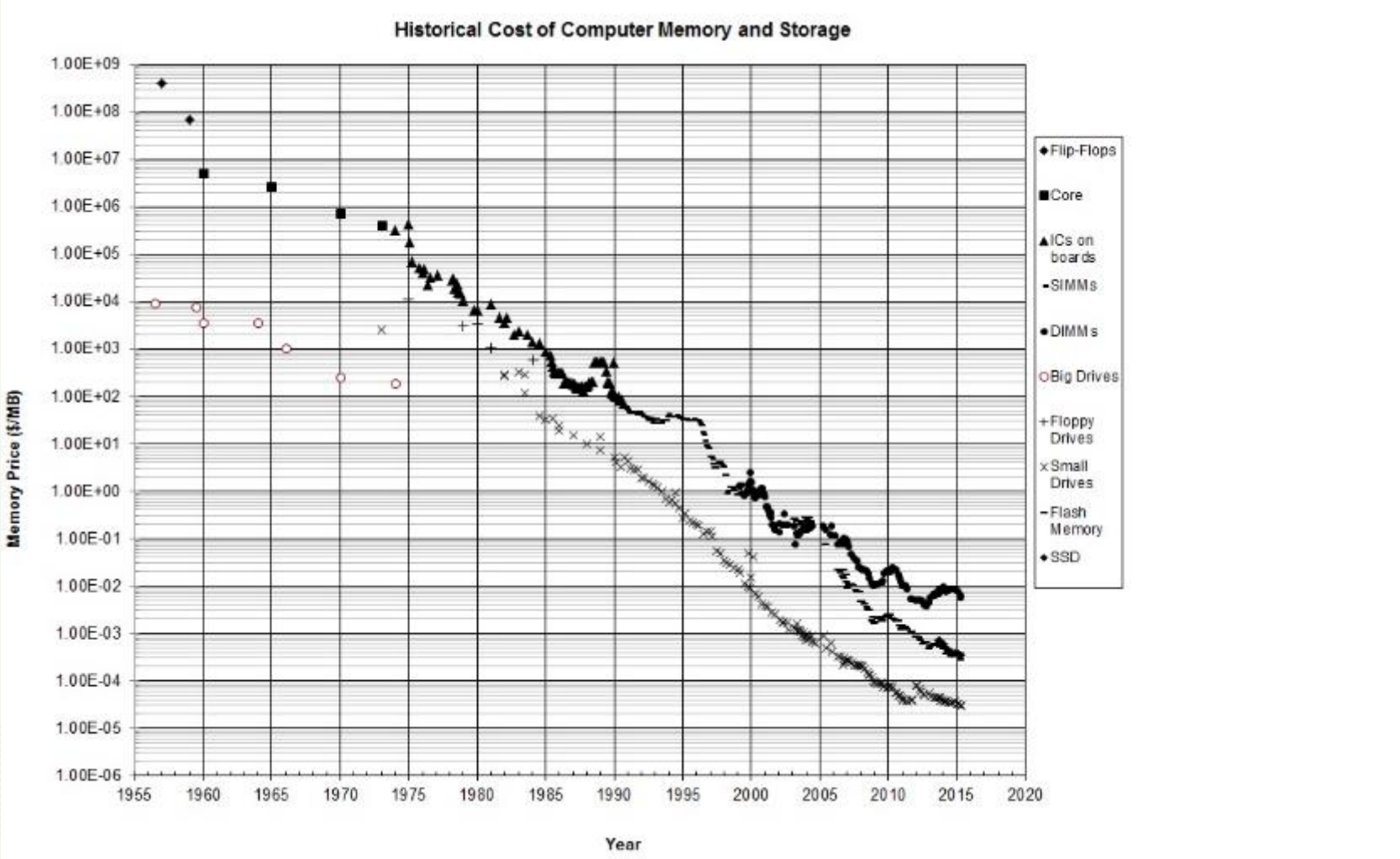
Non-volatile memory (NVM) technologies under current development

- NAND flash
- MRAM
- Memristor
- Resistive RAM
- PCM
- Nano

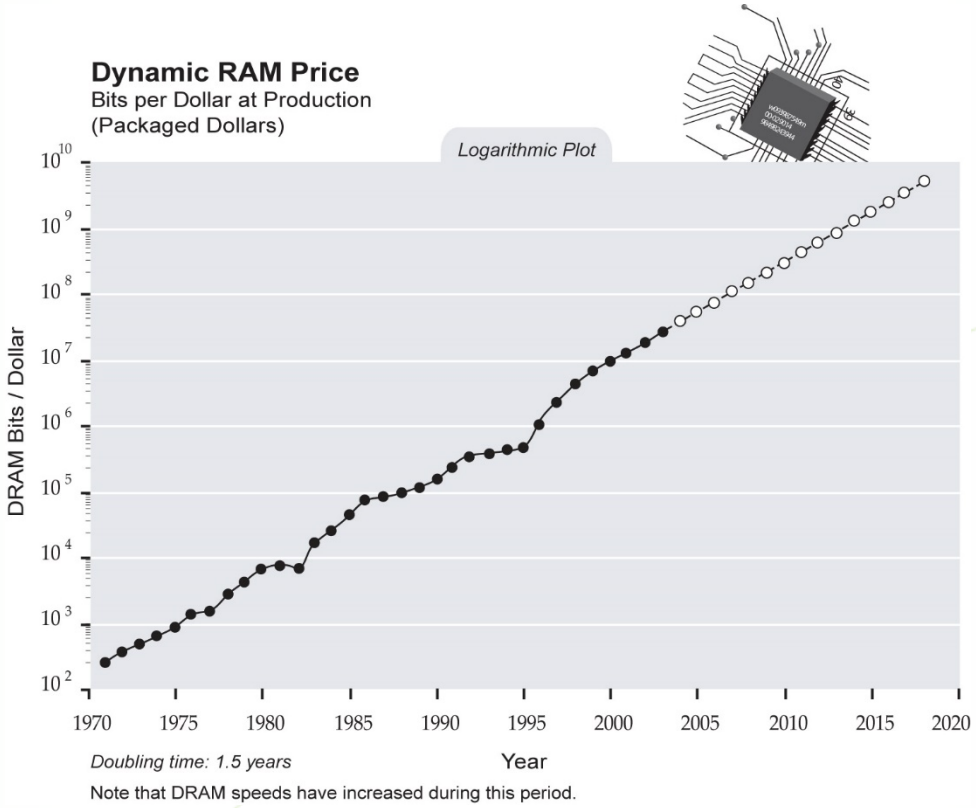


Prototype Phase-Change Memory Switch Composed of germanium antimony, the new phase-change memory potentially can run 500 times faster than current Flash memory chips.

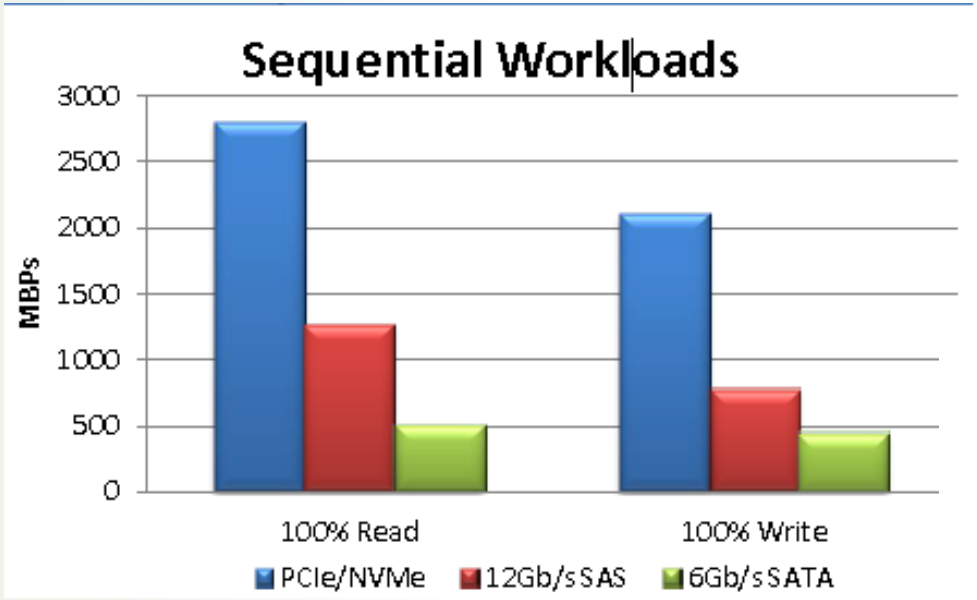
Cost of Disk vs Flash

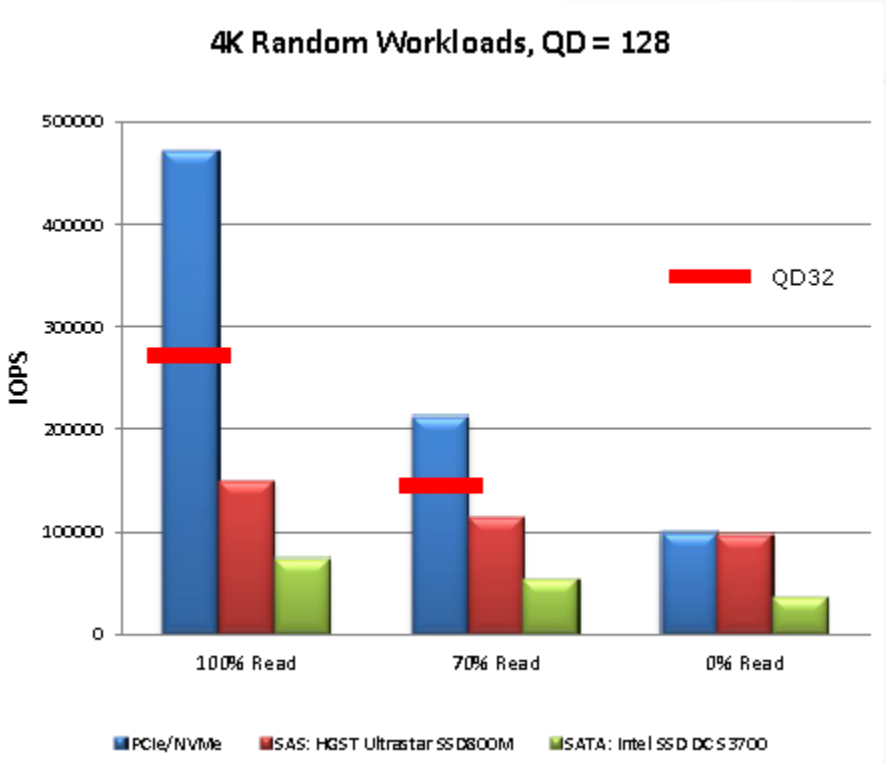


Moore's Law for DRAM



NVMe Performance





Bottom Line

Increasing demand + increasing competition + increasing production for SSD

=

Continual improvements in SSD price for performance and scale

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Continued cost reductions and performance enhancements for In-Memory Computing

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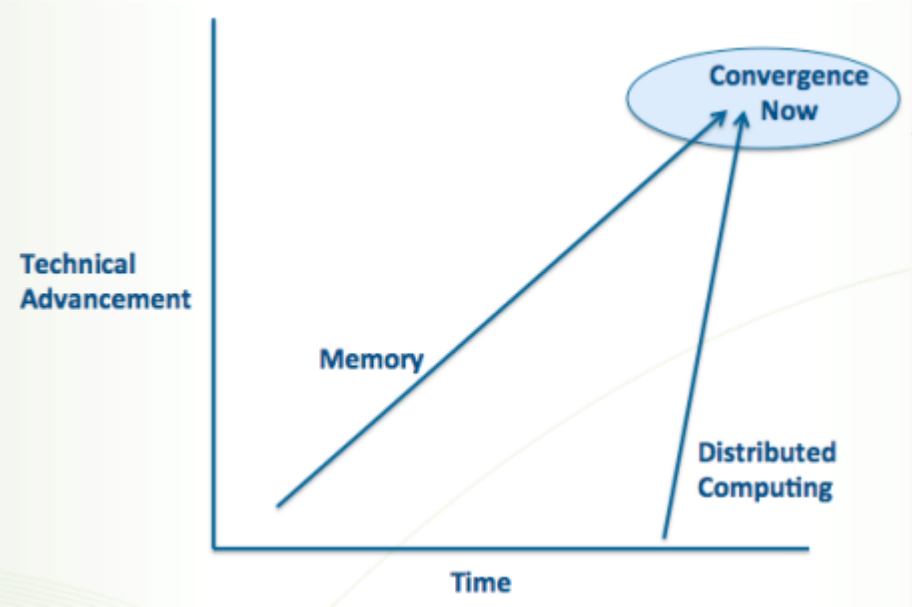
Accelerating advancements in real time computing

Where is the Demand for Real Time Computing?

Enabling Converged, Real-time Analytics

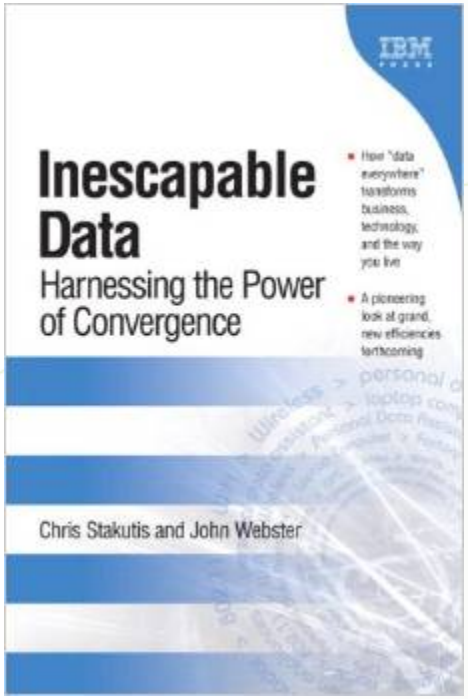
The confluence of two major computing trajectories:

- Continued improvements in memory technology that began with the first digital computers
- Advancement of MPP computing that began in the early 1980's



Visions of Real Time Analytics in 2004

- Analytic-based applications based on convergence of multiple data sources- potentially in real time
- Interviewed 50 CEOs, CIOs and Technologists from vertical industry segments
- Visions were of leveraging disparate and pervasive data sources (mobile, sensor, database) in real time.



CEO Real Time Visions 2004

- RFID converged with patient data in to prevent accidentally inducing adverse reactions to drugs in a hospital setting
- Multiple sensory data inputs to monitor and control chemical leaks in chemical production
- In-store shoe manufacturing
- …. and more

Great Visions in 2004, but…

- Data Warehousing systems built around transactional, structured data
- Reports made available to business decision makers days to weeks after data creation
- No ability to converge multiple data sources
- No ability to leverage unstructured data
- Real time? Are you kidding?

CEOs were incapable of turning their visions into reality

The Point?

For years there has been demand for analytics systems that can converge multiple data sources and deliver results in real time to:

- Business decision makers
- Healthcare and Public sector
- … and Consumers

Now we have the systems

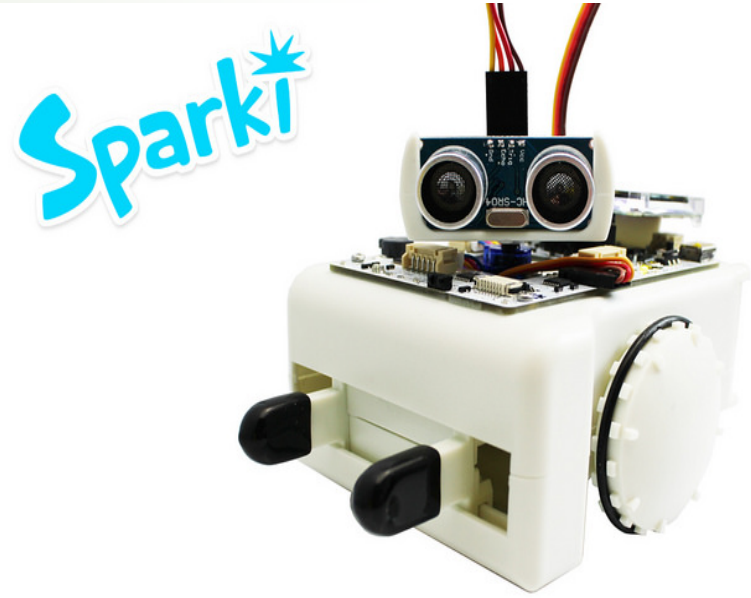
What are the Possibilities?

...

What if You Could Combine…?

- Robotics
- Electronic sensors and sensory data (like IoT)
- Bluetooth communications (mobility)
- Centralized, real time analytics
- Automated programming
- Consumerization
- Open source

Mobotics



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Does In-Memory Computing change everything?

If so, then this summit marks the beginning of a new era in computing and I hope to see you at the next one.