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

John Webster
Senior Partner
John@EvaluatorGroup.com
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
A Few of Our Customers

- Fannie Mae
- DISA
- HP
- United States Federal Reserve System
- IBM
- Logicalis
- Hudson's Bay Co.
- American Express
- TIAA CREF
- Sears
- Blue Cross Blue Shield Association
- Bank of America
- Siemens
- Rabobank
- NetApp
- BMO Financial Group
- Telindus
- Ritchie Bros.
- Belgacom ICT

Evaluator Group © 2012 Evaluator Group, Inc.
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

<table>
<thead>
<tr>
<th>Tier</th>
<th>Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSD (Tier 0)</td>
<td>µs</td>
</tr>
<tr>
<td>High-Performance Disks (Tier 1)</td>
<td>ms</td>
</tr>
<tr>
<td>High-Capacity Disks (Tier 2)</td>
<td>ms</td>
</tr>
<tr>
<td>External Tier 3</td>
<td>seconds</td>
</tr>
</tbody>
</table>

SSD = Solid State Device

- **Data Movement**
- **SSD (Tier 0)**
- **High-Performance Disks (Tier 1)**
- **High-Capacity Disks (Tier 2)**
- **External Tier 3**
- **Tape Optical**
Tier -1 Data Persistence In-Memory

Persistent In-Memory SSD

Capacity SSD

Persistent In-Memory SSD

High-Capacity Disks

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)
People are spending (lots of) money online

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

US online revenues ($bn, 2014 dollars)

Source: US Census Bureau, IAB/PwC, af6z

ANDREISSENзорowitz
Multiple SSD Technologies Advancing in Parallel

Non-volatile memory (NVM) technologies under current development

- NAND flash
- MRAM
- Memristor
- Resistive RAM
- PCM
- Nano
Cost of Disk vs Flash

Historical Cost of Computer Memory and Storage

- Flip-Flops
- Core
- ICs on boards
- SIMMs
- DIMMs
- Big Drives
- Floppy Drives
- Small Drives
- Flash Memory
- SSD
Moore’s Law for DRAM

Dynamic RAM Price
Bits per Dollar at Production
(Packaged Dollars)

Doubling time: 1.5 years
Note that DRAM speeds have increased during this period.
NVMe Performance

Sequential Workloads

4K Random Workloads, QD = 128
Bottom Line

Increasing demand + increasing competition + increasing production for SSD

= 

Continual improvements in SSD price for performance and scale

= 

Continued cost reductions and performance enhancements for In-Memory Computing

= 

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.
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

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

The first open-source web-programmable device and robotics platform.

Designed to be used by common web-site programmers, allowing device logic to be updated constantly, by simple programs/web-pages that connect to all other internet data sources and technologies.
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.
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.