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PCle SSD Opportunities in Client and Enterprise
Agenda

• NAND supply dynamics
• PC/tablet market outlook
• Client SSD trends
• Enterprise SSD market outlook
• Enterprise SSD adoption trends
NAND Market Overview

New technology transitions will challenge supply/demand balance in coming years

[Bar chart showing supply and demand for 1GB equivalents from 2012 to 2017]
Wall Street Bull Thesis

• New technologies change ROIC math

• Most markets have become price inelastic
  o Cell phone and tablets purchase/capacities

• Samsung profit is tied to devices
  o Better off with higher priced memory content?

• While all great arguments for conservative capacity adds, industry still needs to hit a moving target
NAND Absorption Forecast

SSD an important driver of NAND usage
NAND Supply

• With tablet and smartphone markets maturing, NAND absorption may slow
  o Emerging markets may skew towards lower average capacities

• Despite careful expansion of NAND output in 2014, oversupply may occur

• Slow 3D NAND ramp into new fabs may temper total bit output growth this year
Why There Will Be Oversupply

- NAND growth is only expected to be off 10% Y/Y.
- Smartphone and Tablet growth rates (now over 1/3 of the end market) have slowed by ~50%.
- Cards & USB (1/3 of the market) look stagnant.
- 1H’14 is likely the worst period for supply/demand dynamics.

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<th>2013 Projected Bit Growth (YY)</th>
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<tr>
<td>Tablet/Phone</td>
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<td>Enterprise/Client SSD</td>
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<table>
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<th>% of Market</th>
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PC, Tablet Outlook

Stabilizing PC market will see SSD growth
Client SSDs

• Notebook SSD attach rate has exceeded 10%

• Drive towards thinner and convertible designs motivating OEMs to abandon HDD bays
  - M.2 will become the default form factor
  - NVMe will drive transition from SATA to PCIe

• SSD cost for 128 and 256 GB preventing adoption into mainstream $500 PCs
  - HDD bays, hence SATA, will remain for low cost PCs for the next couple of years
Enterprise Device Units

Enterprise SSDs target performance applications

2013 – 2017 CAGR
Perf. Ent./Nearline HDDs = -2%/18%
Ent. SATA/SAS/PCIe SSDs = 36%/48%/72%
Economics of the Enterprise

• Margins make the enterprise opportunity an attractive investment
  o Fusion I/O and STEC highlight margin opportunities for innovators
  o HDDs exemplify how margins are sustainable over time

• Conversely, technology shifts create greater risk

• Larger Opex requirements can blunt GM benefits
Economics of Enterprise

A look at Fusion-IO and STEC

FIO Revs and GM

STEC Revs and GM
Enterprise Drives

GM upside, but also additional operating costs

Revenues and Drives Shipped

GM% and OPM
Enterprise SSD Units

While SATA favored for cost, PCIe will post largest growth rates

2013 – 2017 CAGR
Ent. SATA/SAS/PCIe SSDs = 36%/48%/72%
PCIe Shifts

- PCIe cards have a limited sales horizon
- Product Issues
  - Expensive – conversions to SATA where the latter is “good enough”
  - Proprietary
  - Serviceability issues
- New Technology Threats
  - Non-volatile DIMMs
  - Phase Change and other non-volatile options
  - NVMe (non PCIe card form factor)
NVMe = New SATA/SAS

- If M.2 takes off, we fully expect that vendors will find ways to incorporate it into enterprise applications.

- Already seeing both hyperscale data centers and enterprise vendors working on this front.

- LSI’s Griffin provides an excellent segue into this market, assuming the chip achieves its potential.
Conclusions

- The NAND industry will overbuild at some point
  - Varied opinions on when oversupply occurs
- Client SSDs will continue to gain traction
  - But for now the pace of adoption is unlikely to spike due to capacity cost
- The Enterprise SSD market has demonstrated significant growth paced by enterprise SATA drive adoption
  - We see reason to believe that PCIe will grow faster than other portions of the market gaining share going forward
  - The form factor and protocol may not be the cards that represent the vast bulk of PCIe solutions shipped today
Thank You!

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