



Semi-Custom Solid State Storage Why or Why Not? Session 101-C

Tuesday, August 5th
8:30 - 9:35am

Anton Roug (Unigen)

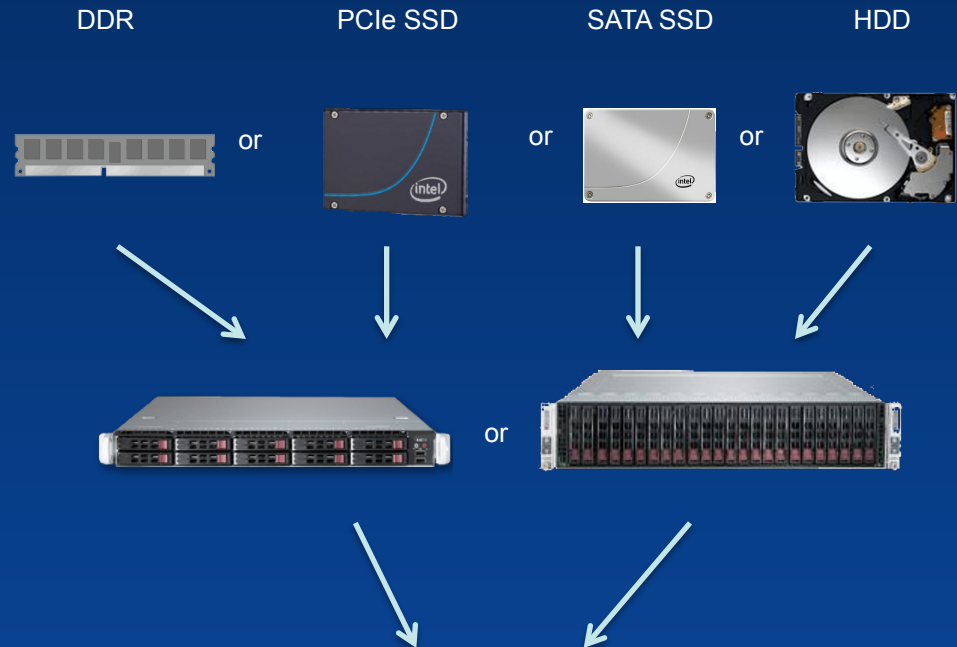


Agenda

- SSD Value Baseline
- SSD Cost Model
- SSD Markets
- Value of Semi-Custom SSDs
- Summary

Simple Datacenter Solution Model

- Storage decision are driven by
 - Capacity
 - Performance
 - Price
 - Power
- In a world of many technologies and usage models
 - simple visualization of the above
 - Use data to drive decisions



What's the low cost
for a Performance/Capacity requirement
assumes a "commodity" model for storage hardware

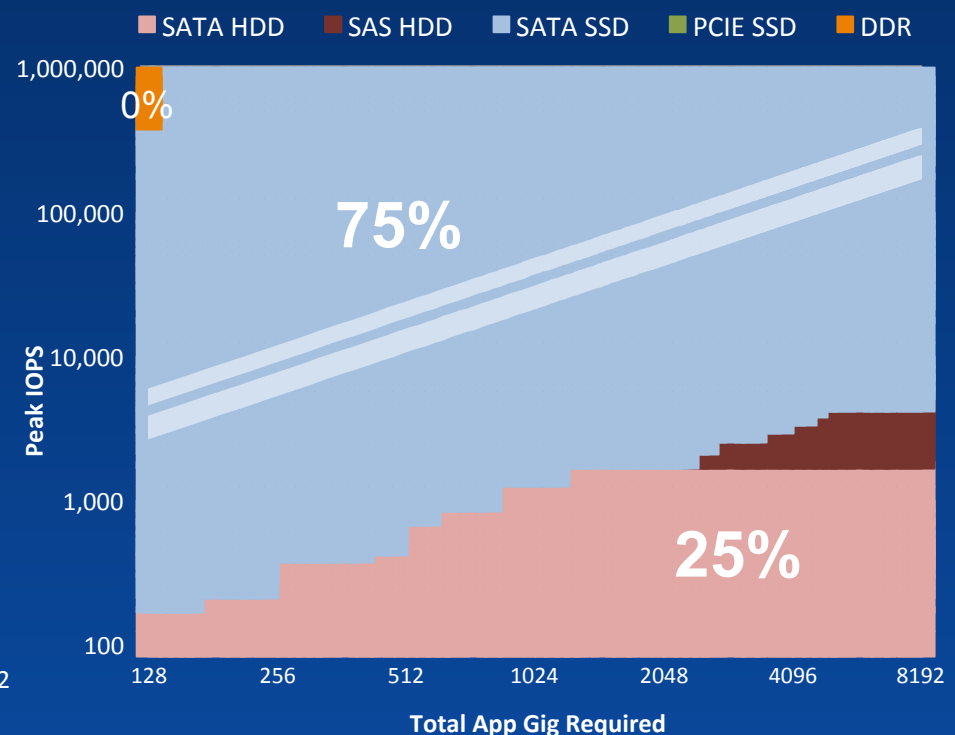
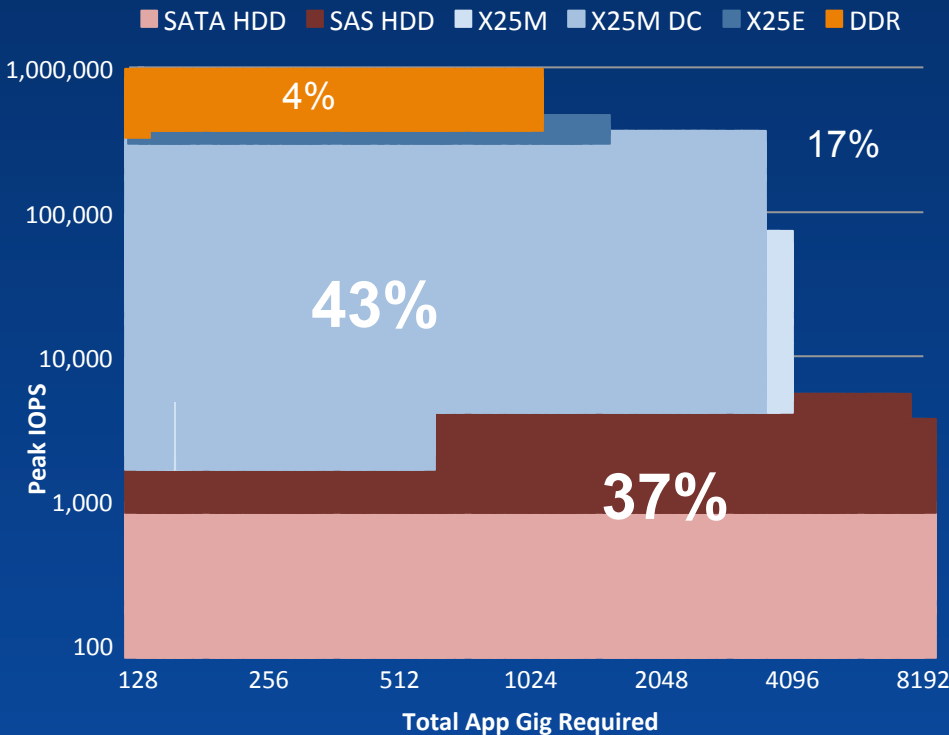
A "Big Data" SSD analysis



Random 4K 90% Read, 10% Write Workloads: TPC-E

July 8, 2010

July 31, 2014



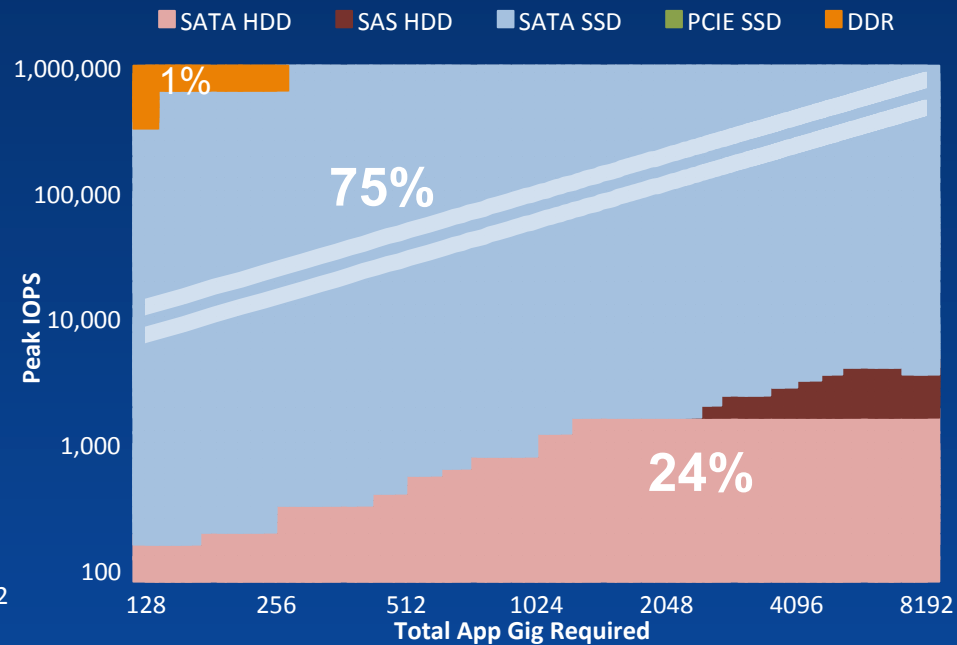
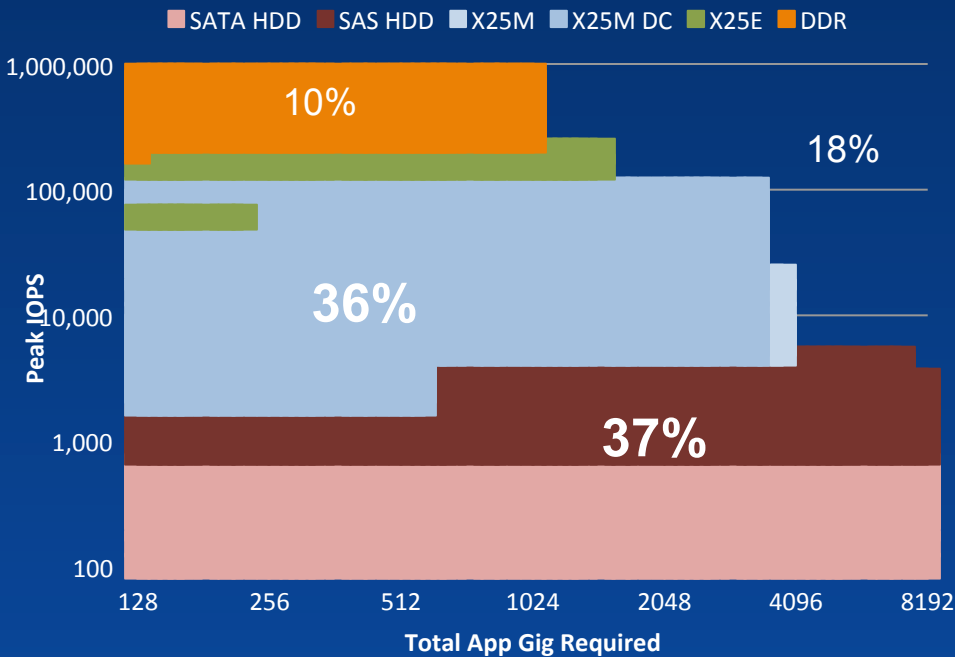
5 years: SATA SSDs (Intel 3500/S3700) cost effectiveness increased 32%



Random 4K 70% Read, 30% Write Workloads: TPC-C

July 8, 2010

July 31, 2014



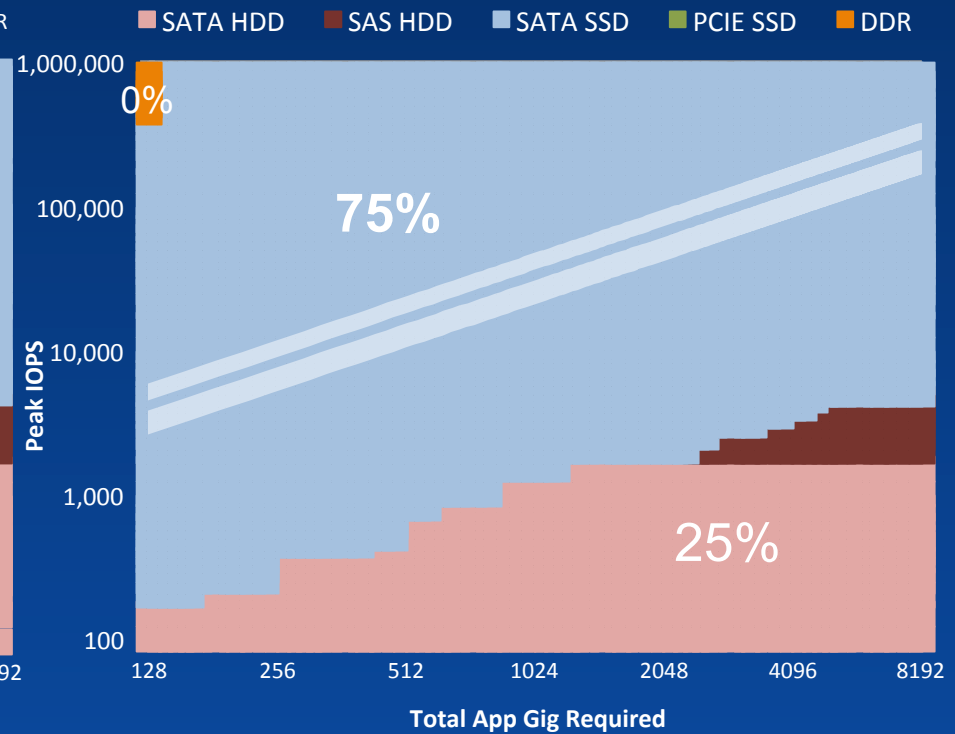
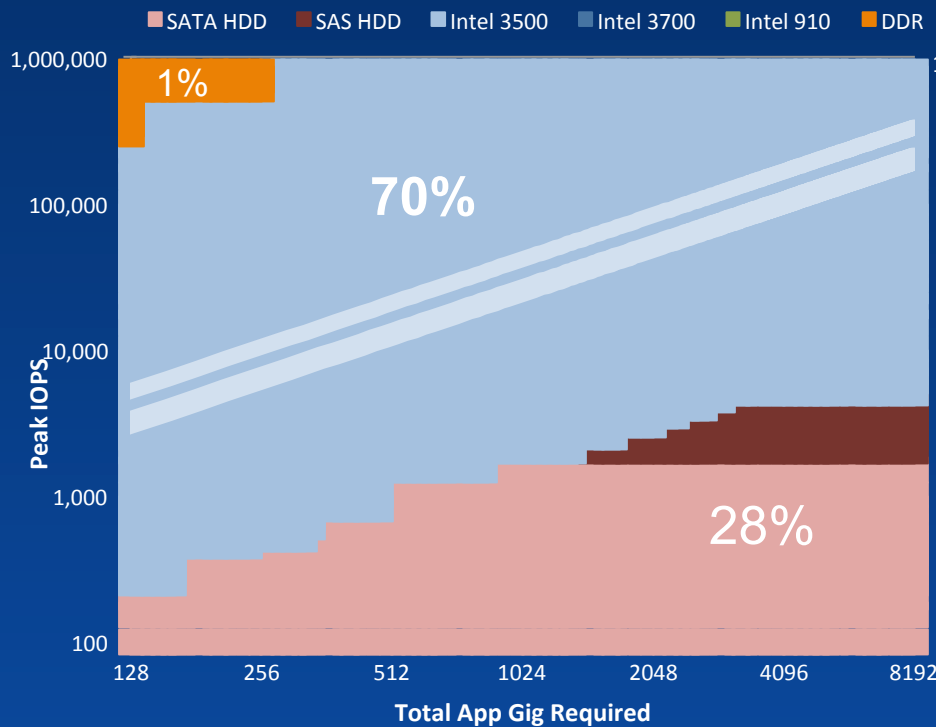
PCIe SSDs (Intel P3600/P3700) not cost effective over SATA



Random 4K 90% Read, 10% Write Workloads: TPC-E

July 16, 2013

July 31, 2014



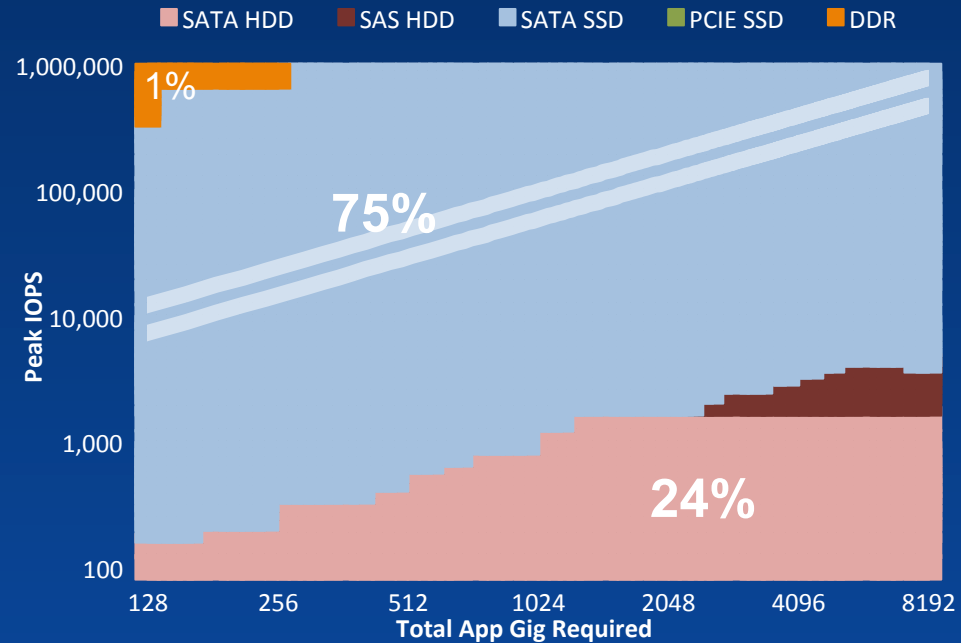
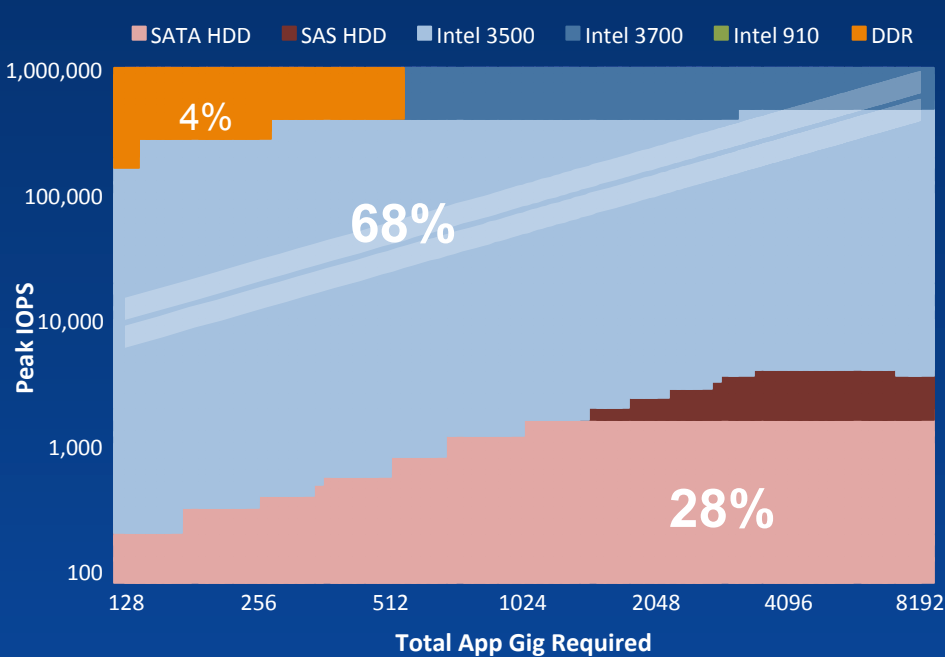
Last year: commercial SATA SSDs increased 5% over DDR and HDDs



Random 4K 70% Read, 30% Write Workloads: TPC-C

July 16, 2013

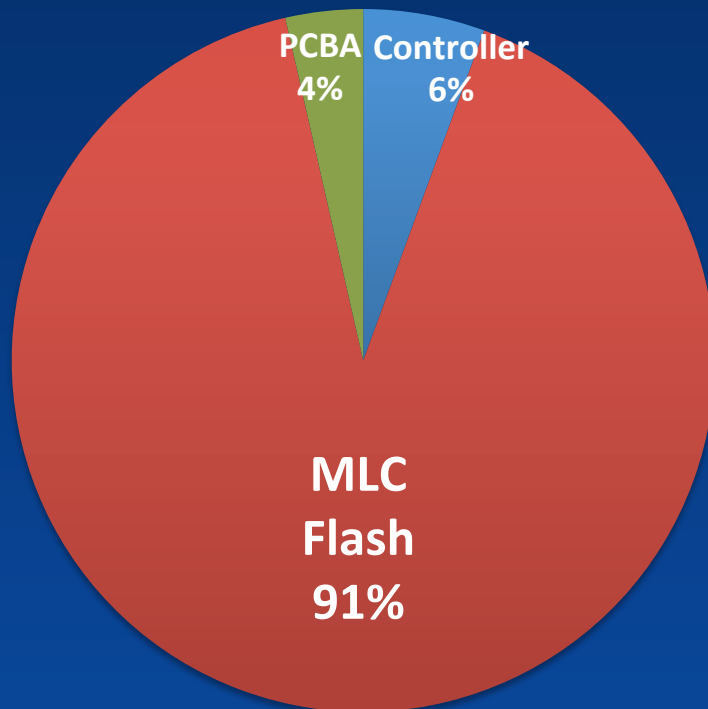
July 31, 2014



Improved 7% for write intensive over DDR and HDDs

SSD component cost example

2.5 SSD SATA III 512GB MLC C-TEMP



- 91% of cost is MLC Flash
 - eMLC
 - SLC
- 14% make SSD be HDD
 - 7% Flash Management
 - 7% Over provisioning

Optimize Flash management for workloads?

Start with Market Segments

Segment

Flash Control

- HyperScale → App Specific
- Enterprise → App Independent
- Client → App Independent
- Embedded → App Specific
- Government → App Specific

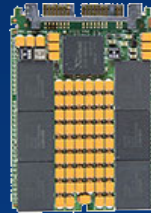
Emerging Form Factors



eUSB



M.2



SATA/PCIe
1.8"



SFF8639
2.5"



PCI
MD2



DDR4 NV
DIMM

Leading Controllers



Flash Suppliers



SLC and MLC focus



Solid State Storage Solution Summary

- Off-the-shelf SSD solutions 75%
- Flash great than 90% of costs
- App specific customization growing



Data for model

Media	Capacity	Random IOPS from specs (K)		
Type	GB	100R	100W	\$/G
DDR-1600	2, 4, 8, 16, 32	25,000	25,000	\$19.50, \$14.63, \$12.38, \$11.09, \$14.84
Intel P3700	400, 800, 1638.4, 2048	460, 460, 460, 460	75, 90, 150, 175	\$75.00, \$90.00, \$150.00, \$175.00
Intel P3600	400, 800, 1228.8, 1638.4, 2048	320, 430, 450, 450, 450	30, 50, 50, 56, 56	\$30.00, \$50.00, \$50.00, \$56.00, \$56.00
Intel S3700	100, 200, 400, 800	75, 75, 75, 75	9.5, 16.5, 19.5, 20	\$9.50, \$16.50, \$19.50, \$20.00
Intel 3500	80, 120, 160, 240, 300, 400, 480, 600	70, 75, 75, 75, 75, 75, 75, 75	7, 4.6, 7.5, 7.5, 9, 11, 11, 11	\$1.38, \$1.04, \$1.05, \$0.83, \$1.11, \$1.00, \$0.83
Intel 2500	120, 180, 240, 480,	48, 48, 48, 48	80, 80, 80, 80	\$0.96, \$0.88, \$0.80, \$0.86
SAS HDD-15K	300, 450, 600	0.20	0.18	\$0.58, \$0.61, \$0.46
SAS HDD-10K	300, 450, 600, 900, 1228.8	0.14	0.13	\$0.55, \$0.57, \$0.49, \$0.44
SATA HDD-7.2K	500, 1024, 2048, 3072, 4096, 6144	0.08	0.07	\$0.11, \$0.09, \$0.08, \$0.06, \$0.07, \$0.07