

Getting the Most Out of SSDs – IT System Optimization Best Practices

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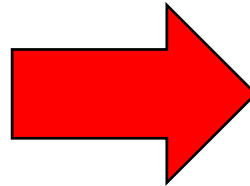
Storage Myths & Facts

- ❑ Facts: Storage has always been sold on \$/GB
 - ❑ HDDs are optimized for cheap \$/GB
 - ❑ Storage performance has lagged market requirements
 - ❑ A SSD will not be less expensive than a HDD
- ❑ Myth: SSDs can be sold on performance (alone)
- ❑ Conclusion: Cost effective solutions are possible
 - ❑ And we will show how this can be done...

Filling the Performance Gap

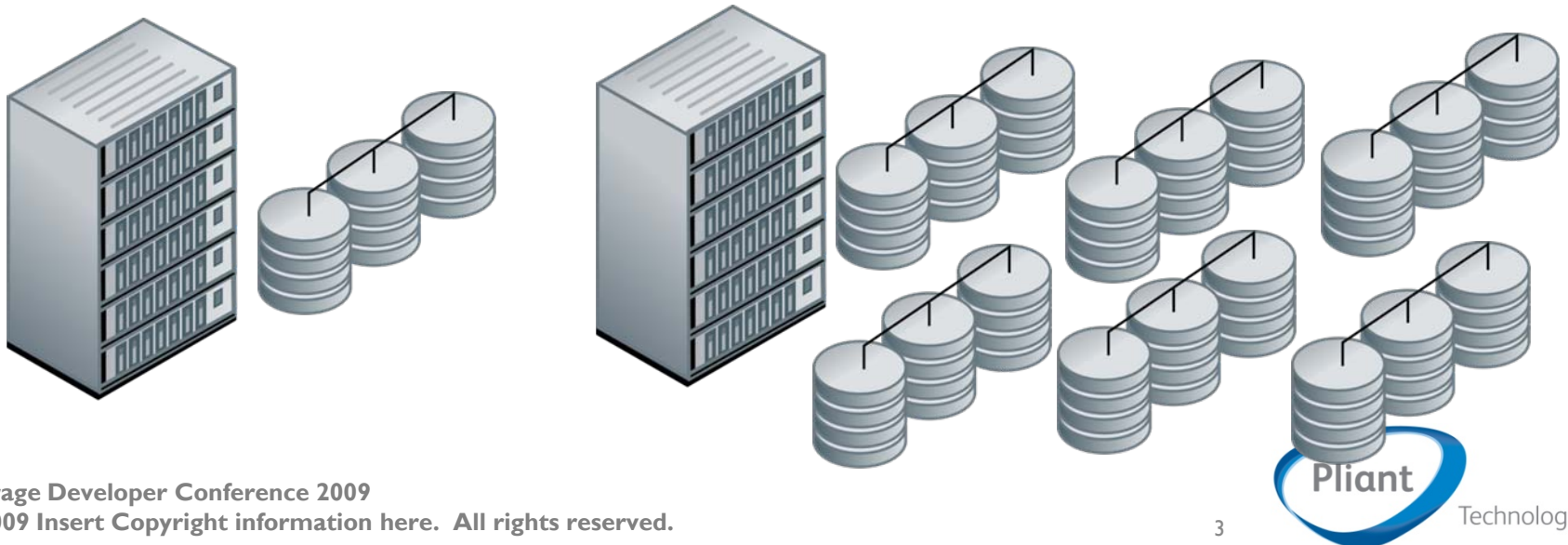
HDD Attributes

- Higher RPM (10K/15K)
- Short stroke HDD's
- Smaller FF drives
- Over provision HDD's
- Low capacity HDD's
- Striped data for MB/s

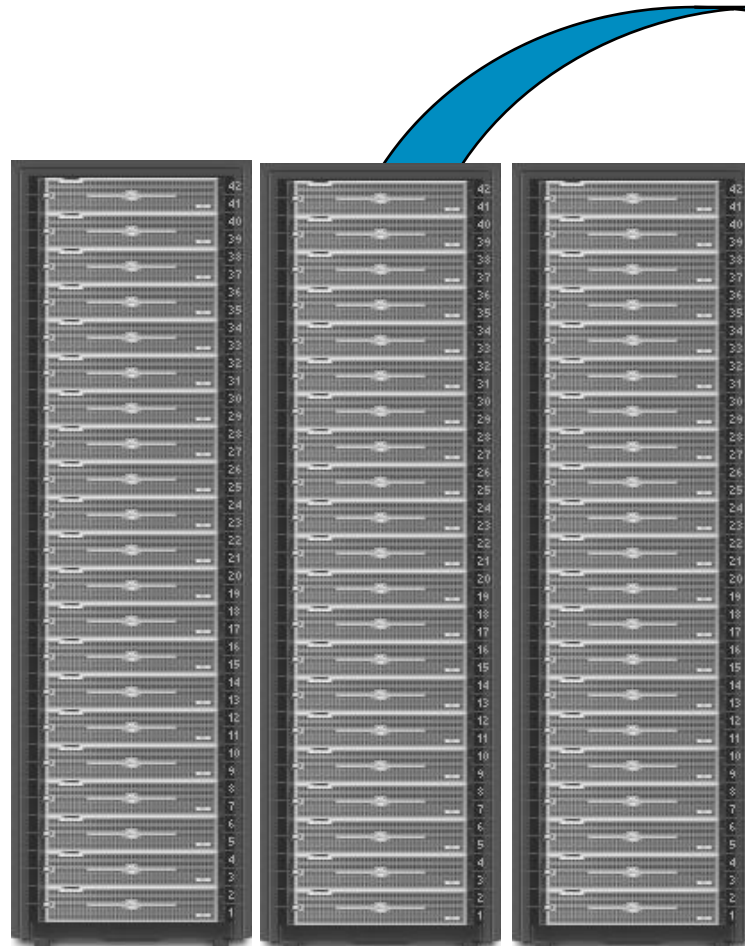


Consequences

- Increased power
- More drives required
- Reduced \$/GB
- More drives required
- Increased \$/GB
- Increased risk of data loss



Proposition: More for Lower Cost



Traditional: 1000s x HDDs

Efficient: Fewer HDD+EFD



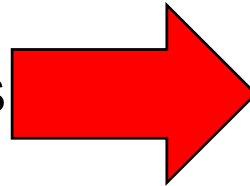
Benefits:

- Lower Costs
- More Reliable
- Lower Power
- Better Performance
- Smaller Footprint

Innovation Improves Efficiencies

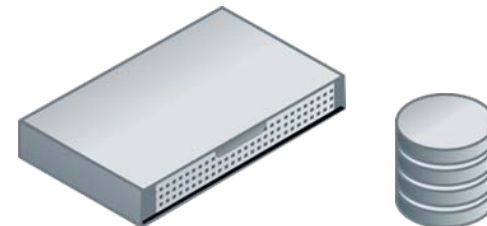
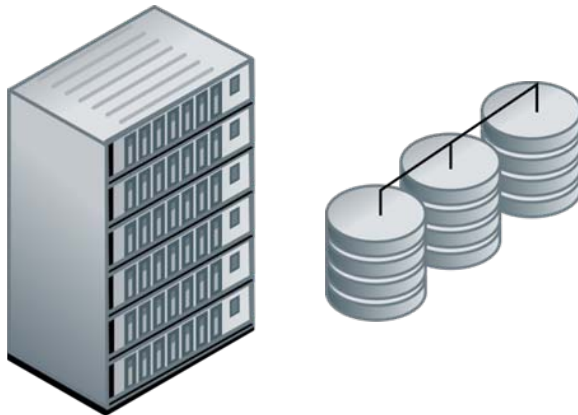
HDD Attributes

- Higher RPM (10K/15K)
- Short stroke HDD's
- Smaller FF drives
- Over provision HDD's
- Low capacity HDD's
- Scattered Data
- "More Is Faster"



HYBRID Approach

- Storage tiers:
 - ‘Hot’ data on SSD's
- Dual port for performance
- Full stroke HDD's
- High capacity HDD's
- "Do More For Less"



Example: Order Entry System

(TPC-C Benchmark)

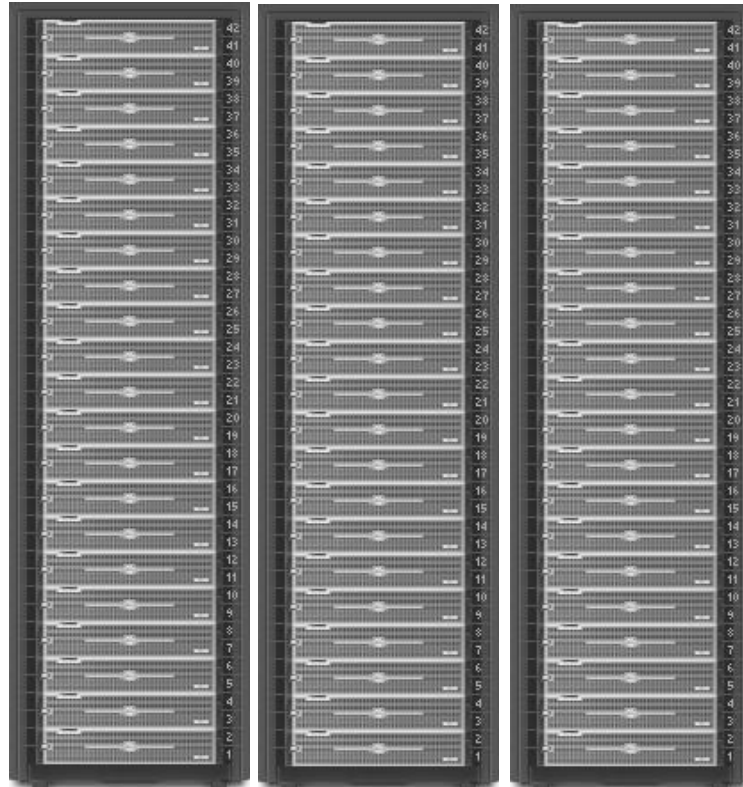
Order-entry system with transactions including entering and delivering orders, recording payments, checking the status of orders, and monitoring the level of stock at the warehouses

Requirements

- 640,000 transactions/minute
- 320,000 IOPS
- 18 TB database



Current Solution: High Cost & TCO



Traditional: 1000s x HDDs

- **40** Rack mount shelves
- **1000** 36GB HDD's
- **15K** RPM
- **>\$450K** Purchase price
- **8000** watts to operate
- **8000** watts to cool



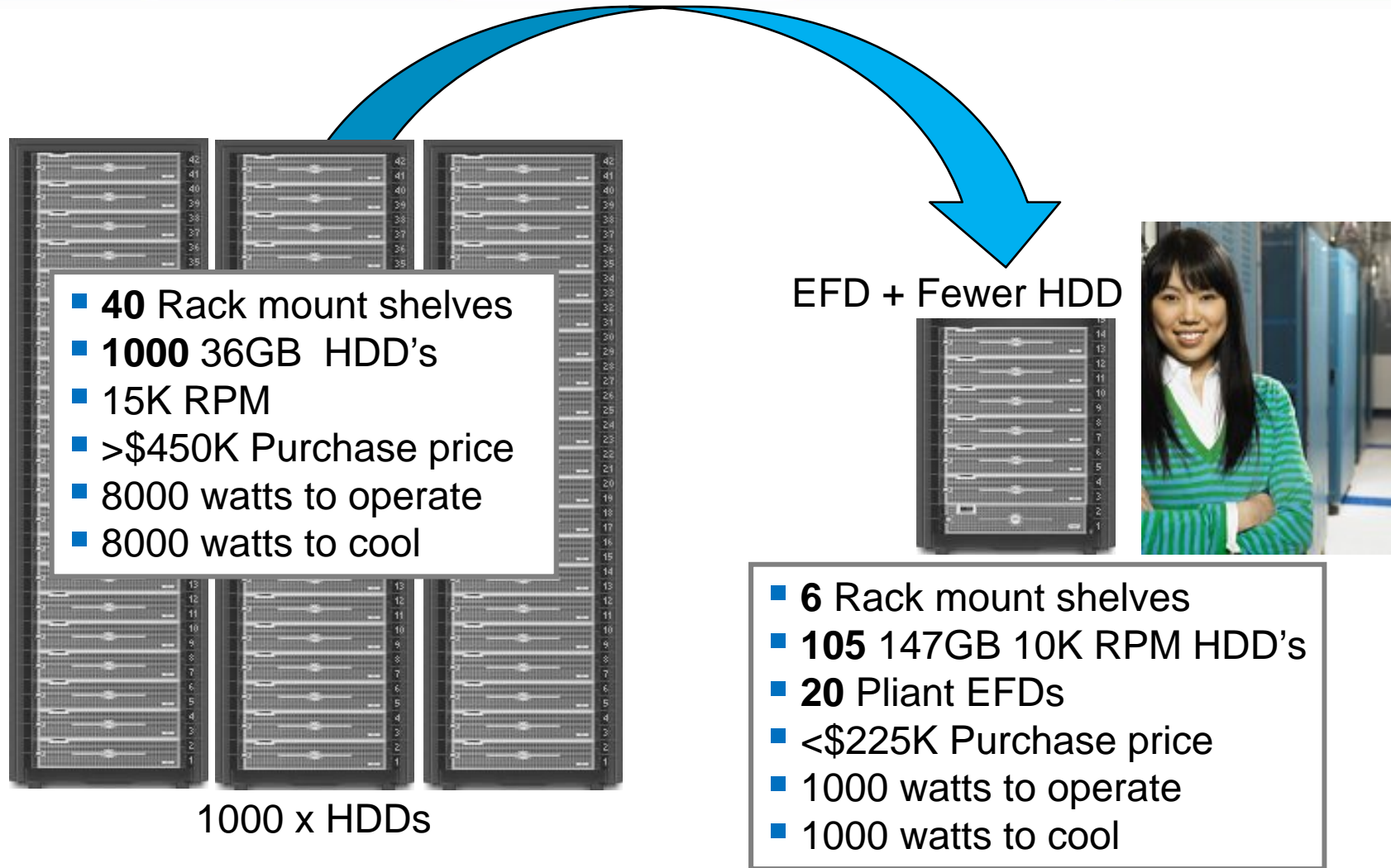
EFD/HYBRID: Lowest Cost/GB

Enterprise Rack Attributes	HDD Only Solution	EFD+HDD Solution
HDDs Capacity/Drive	25 (15K RPM) 36GB/18GB each	21 (10K RPM) 147GB each
EFDs Capacity/Drive	0 n/a	4 150GB each
Usable Capacity/Shelf IOPS/shelf	450GB 8000	3500 GB 52,500

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Usable Capacity/Shelf IOPS/shelf	450GB 8000	3500 GB 52,500
Cost per Shelf	\$11,250	\$37,500
Number of Shelves Required	40	6
Total Cost	\$450,000	\$225,000
\$/IOP	\$1.41	\$0.72
\$/GB	\$25.00	\$11.00
Power to Operate & Cool	16,000 watts	2,000 watts
Power Eff. (IOPS/Watt)	20	158

Proposition: More for Lower Cost



Reliability AND Performance

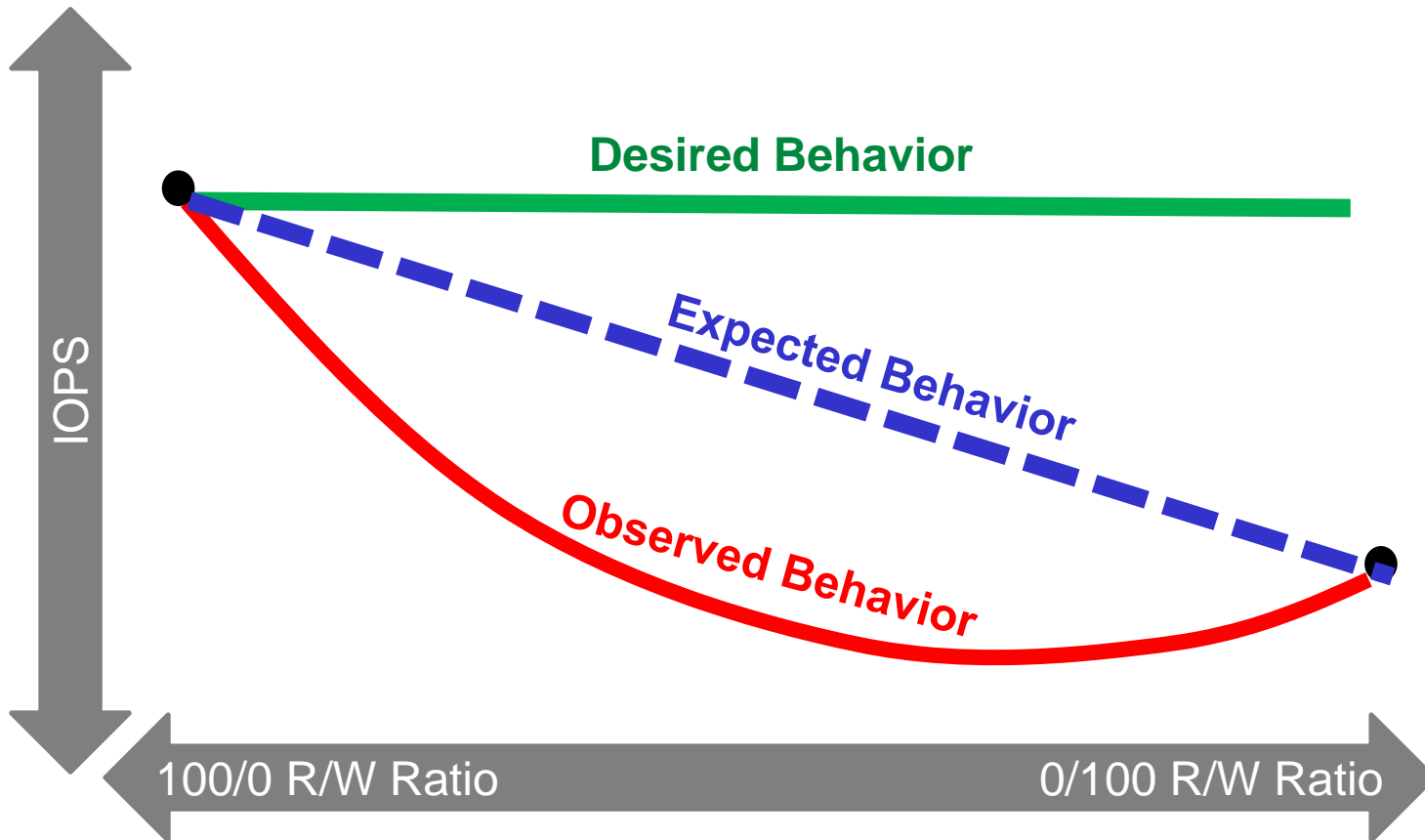


SAS
Dual Port
Full Duplex

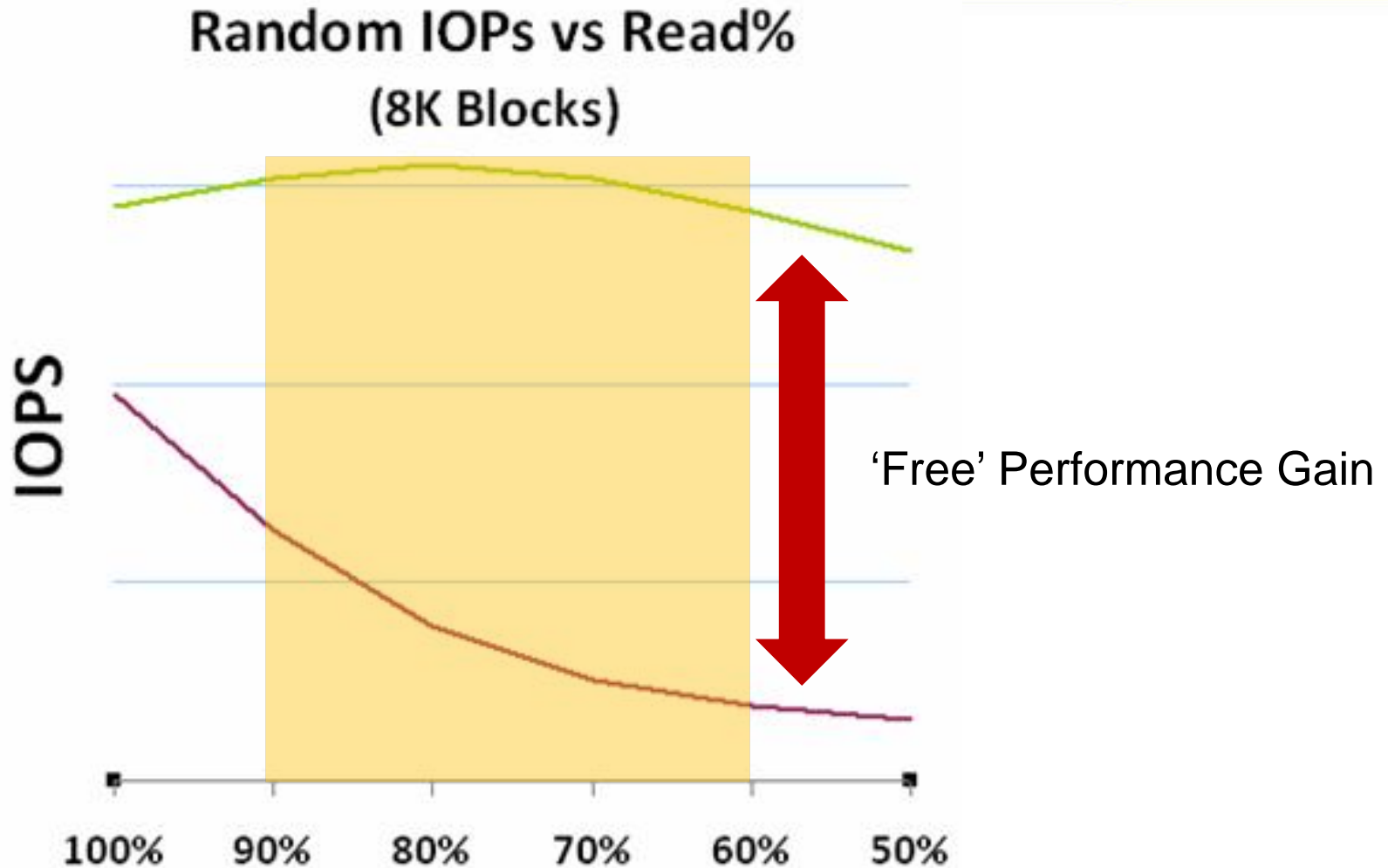
SATA
Single Port
Half Duplex

- Dual path for redundancy
- Fully independent ports
- Simultaneous Writing & Reading
- 4X the Link Bandwidth

Desired Performance, Not 'Droop'



Desired vs. Expected Profile



EFDs Enable Better Solutions

Value = “Do More For Less”

- More Performance = Lower Cost
 - Lower cost = \$\$\$, energy, space
 - Predictable across many workloads
- More Reliability = Lower TCO
 - Both data and device improvements
- No Changes Required = Easy Adoption
 - Use existing systems or software

Thank You...

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