IS MLC READY FOR THE ENTERPRISE?

Esther Spanjer

Director, SSD Technical Marketing

esther.spanjer@smartstoragesys.com

IS MLC READY FOR THE ENTERPRISE?

Esther Spanjer

Director, SSD Technical Marketing

esther.spanjer@smartstoragesys.com

SMART STORAGE™ SYSTEMS

Making NAND Better

Meet Tom

SMART STORAGE SYSTEMS
Making NAND Better

Meet Tom

Meet Tom

Meet Tom


38 YEARS OLD, MARRIED, 2 KIDS
DEGREE IN COMPUTER SCIENCE
IT MANAGER AT LARGE DATA CENTER THAT PROVIDES CLOUD HOSTING SERVICES

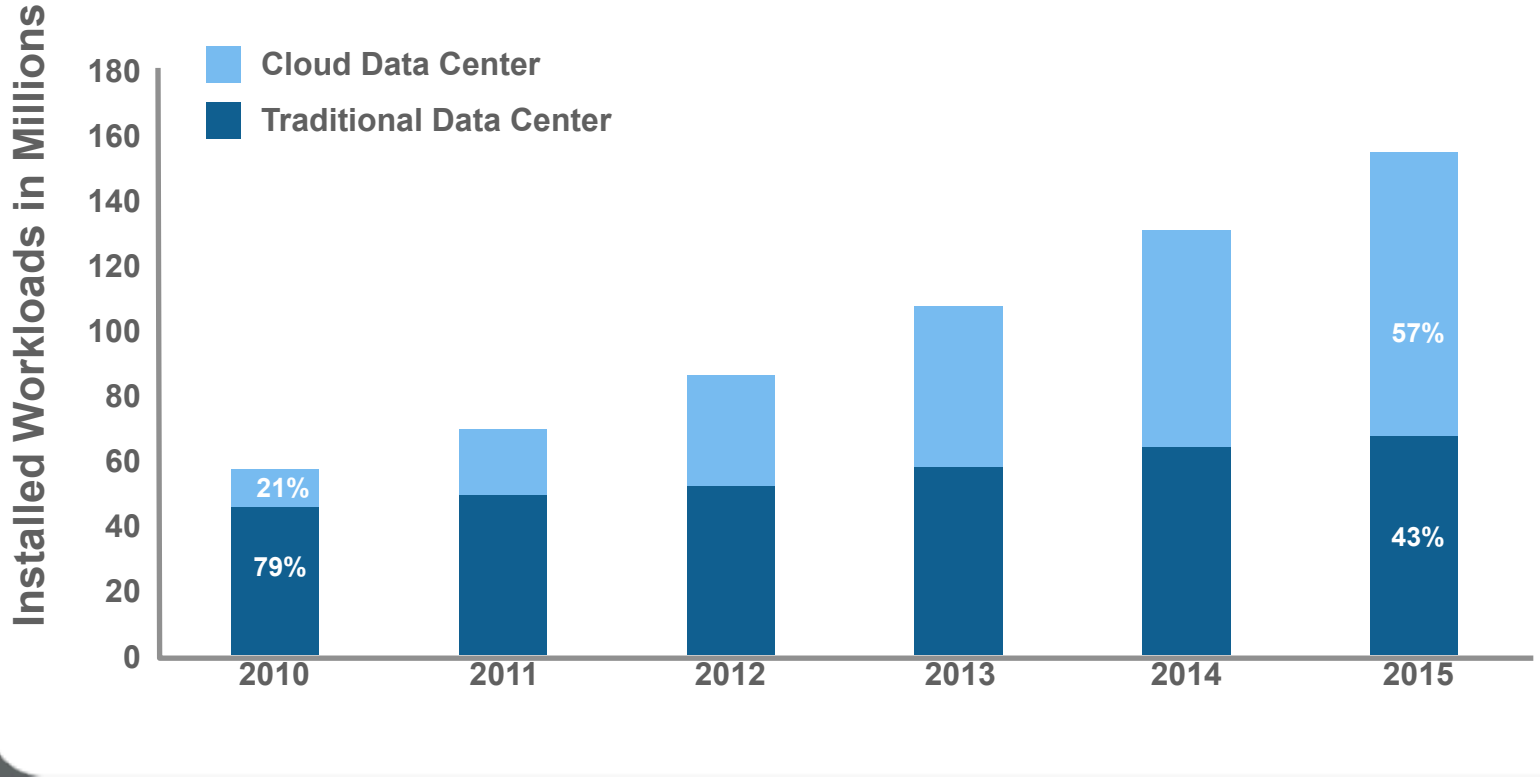
SMART STORAGE SYSTEMS
Making NAND Better

Meet Tom

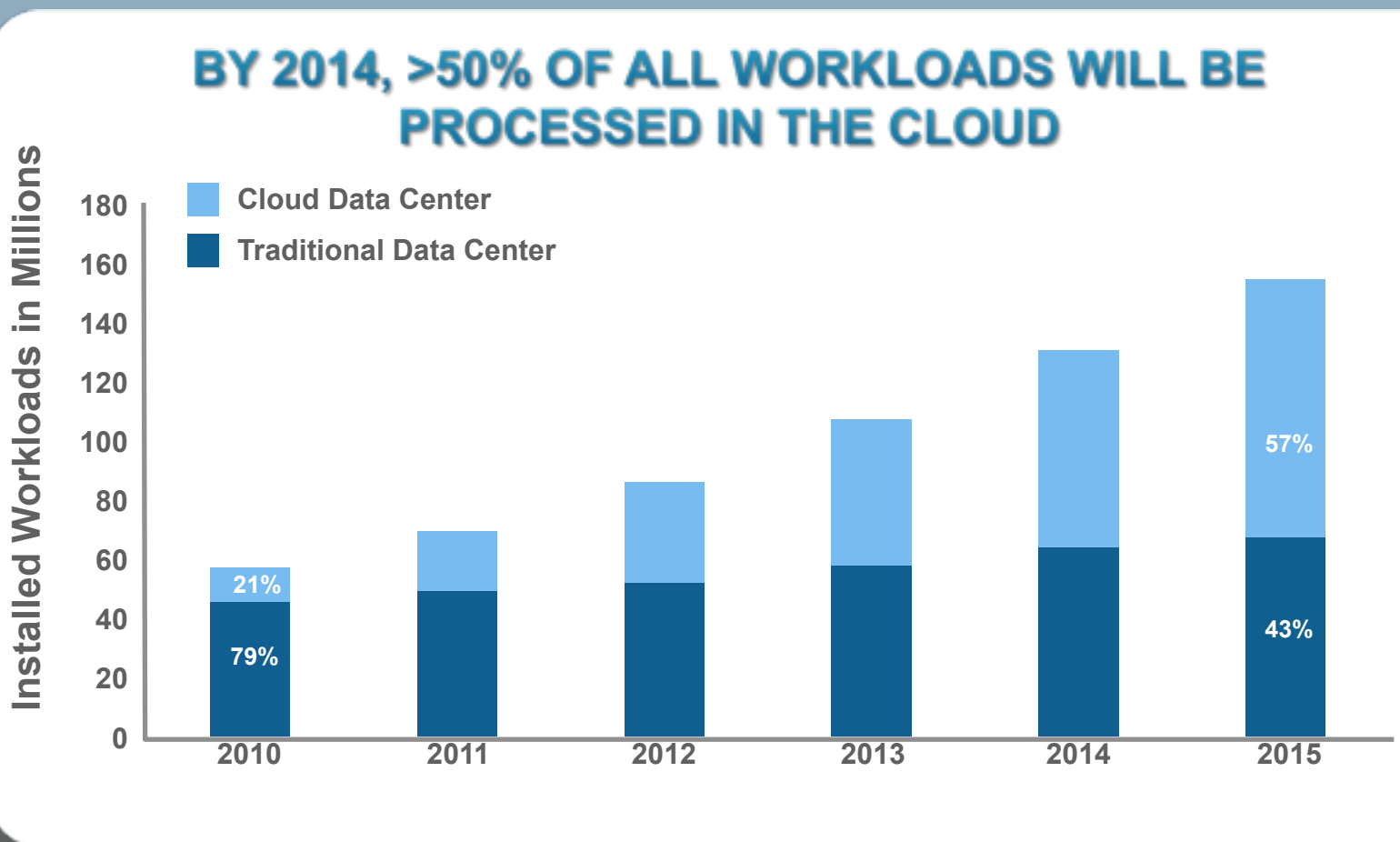
SMART STORAGE SYSTEMS
Making NAND Better

Tom's New Assignment

The demands on the datacenter



The demands on the datacenter



Tom runs some experiments
JetStress 2010 Benchmark

4x 15K SAS HD

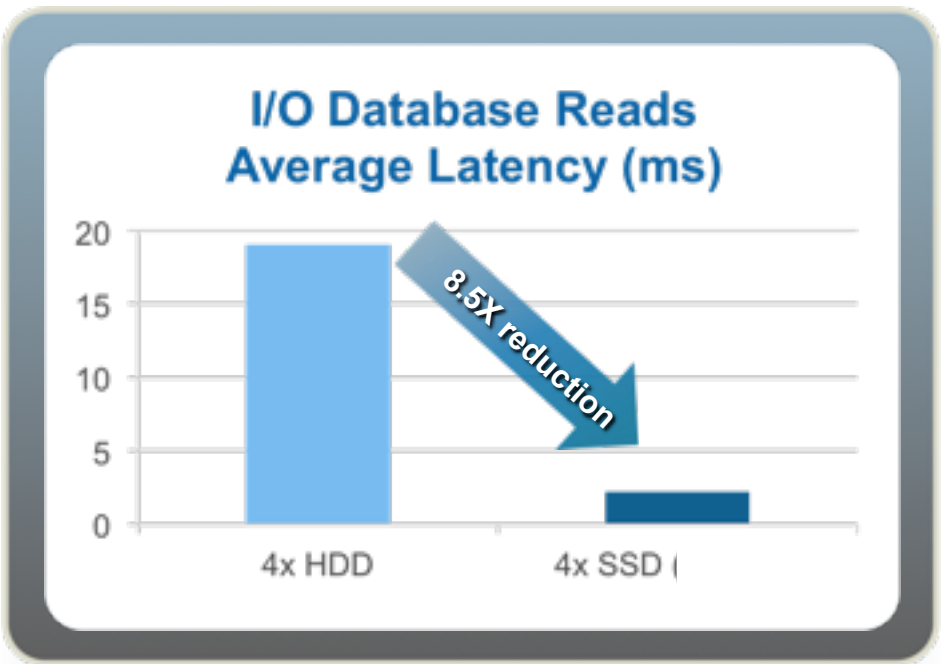
VS.

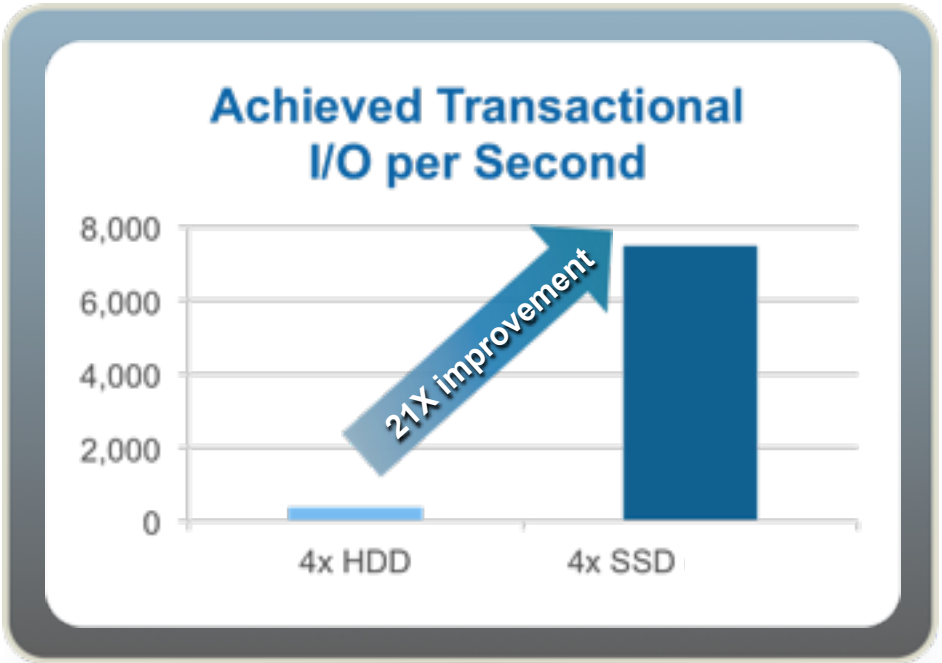
Drives for OS and logging:
C: 1x drive RAID-0 for OS
D: 3x drives RAID-5 for log files

4x Client MLC SSD

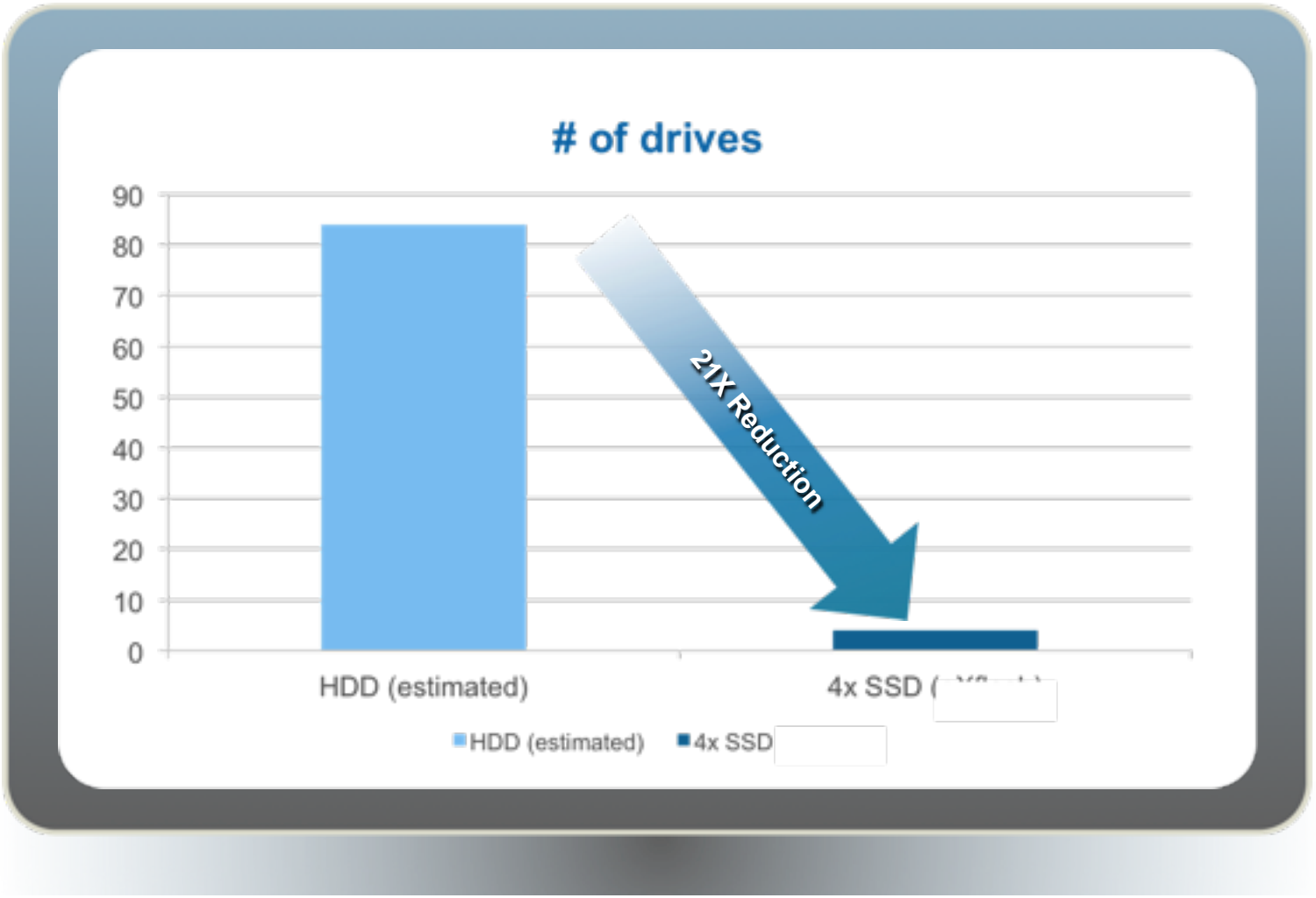
- **Hardware Configuration**: IBM System x 3850 x5, 4 x 2.27GHz CPU, and 64GB RAM
- **OS**: Windows Server 2008 R2 Enterprise x64
- **Application**: Windows Server 2008 R2 Enterprise x64, Jetstress 2010 Database Benchmark

JetStress 2010 Benchmark Results





JetStress 2010 Benchmark Results



SMART STORAGE SYSTEMS
Making NAND Better

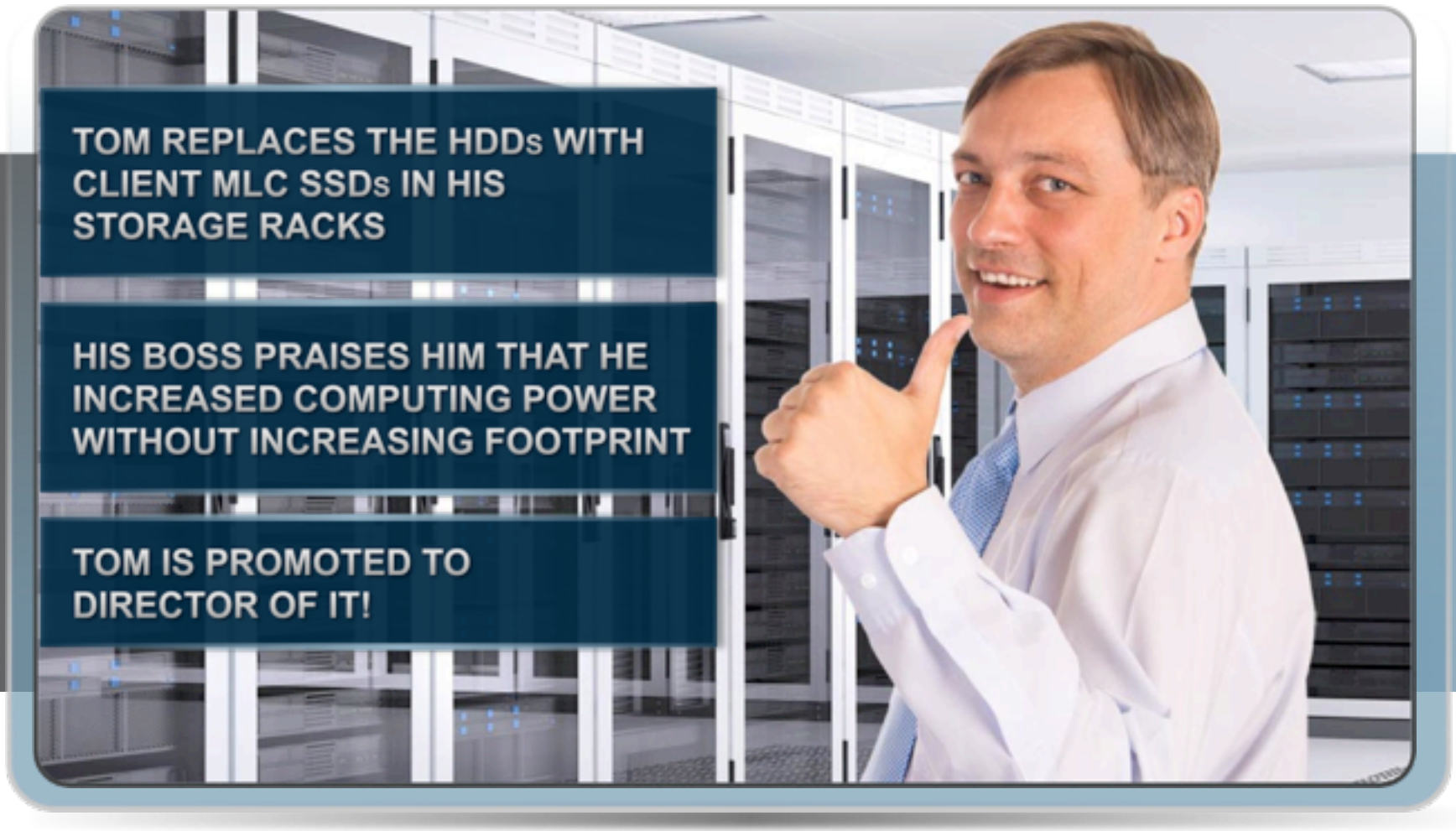
Client MLC SSDs are the solution!

SMART STORAGE SYSTEMS
Making NAND Better

Client MLC SSDs are the solution!

SMART STORAGE SYSTEMS
Making NAND Better

Client MLC SSDs are the solution!

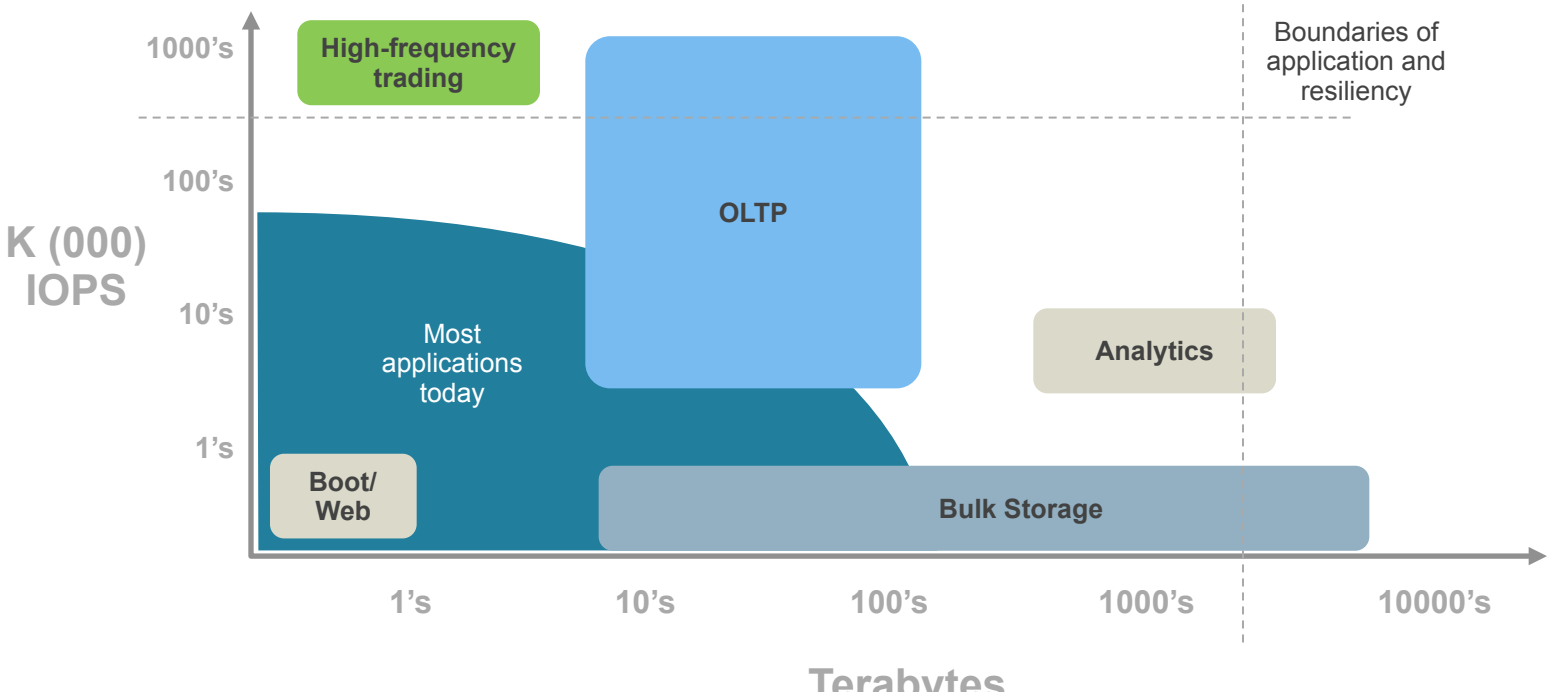


One year later…

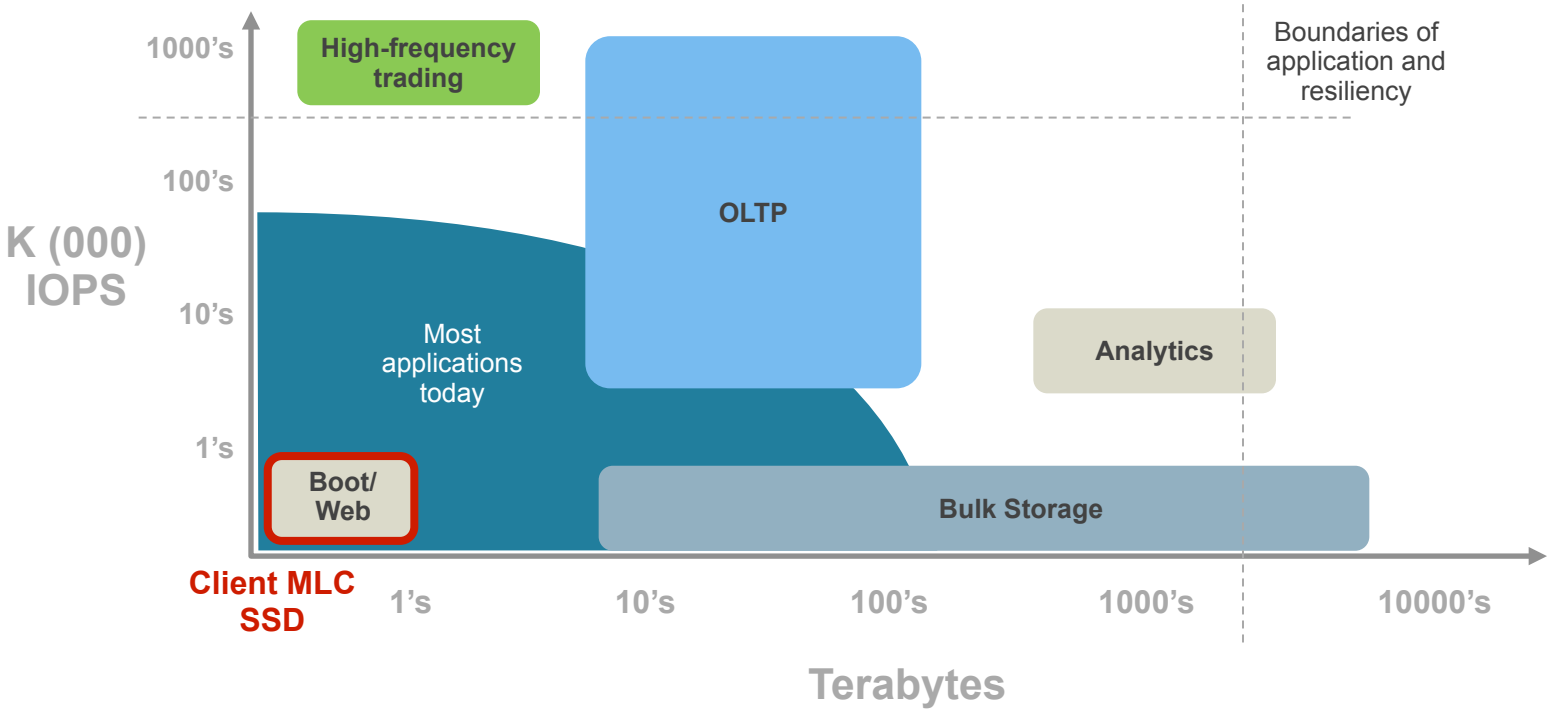
One year later…

SMART STORAGE SYSTEMS
Making NAND Better

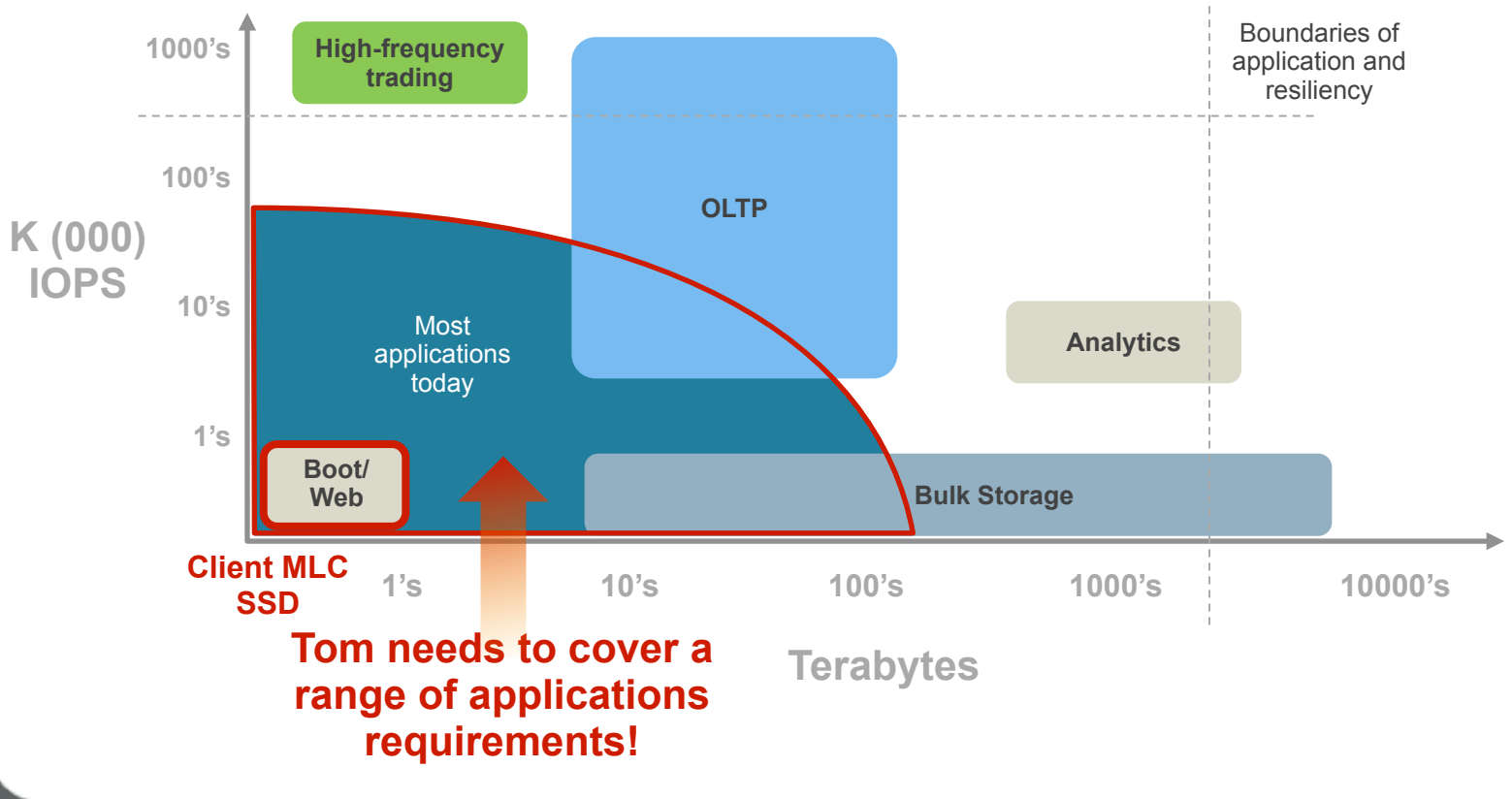
Wide Range of Applications



Wide Range of Applications



Wide Range of Applications



Lets do the Math

Lets do the Math

WEB SERVER
95/5% Read/Write
4, 8, 64KB transfer size
75% seq/25% random
240GB MLC SATA

Drive Life
1.6 Years

Lets do the Math

WEB SERVER
95/5% Read/Write
4, 8, 64KB transfer size
75% seq/25% random
240GB MLC SATA

Drive Life
1.6 Years

EXCHANGE SERVER
67/33% Read/Write
4KB transfer size
100% random
240GB MLC SATA

Drive Life
0.3 Years

Lets do the Math

WEB SERVER
95/5% Read/Write
4, 8, 64KB transfer size
75% seq/25% random
240GB MLC SATA

Drive Life
1.6 Years

EXCHANGE SERVER
67/33% Read/Write
4KB transfer size
100% random
240GB MLC SATA

Drive Life
0.3 Years

SQL LOGGING
100% Write
8KB transfer size
100% sequential
240GB MLC SATA

Drive Life
0.08 years

Lets do the Math

WEB SERVER
95/5% Read/Write
4, 8, 64KB transfer size
75% seq/25% random
240GB MLC SATA

Drive Life
1.6 Years

EXCHANGE SERVER
67/33% Read/Write
4KB transfer size
100% random
240GB MLC SATA

Drive Life
0.3 Years

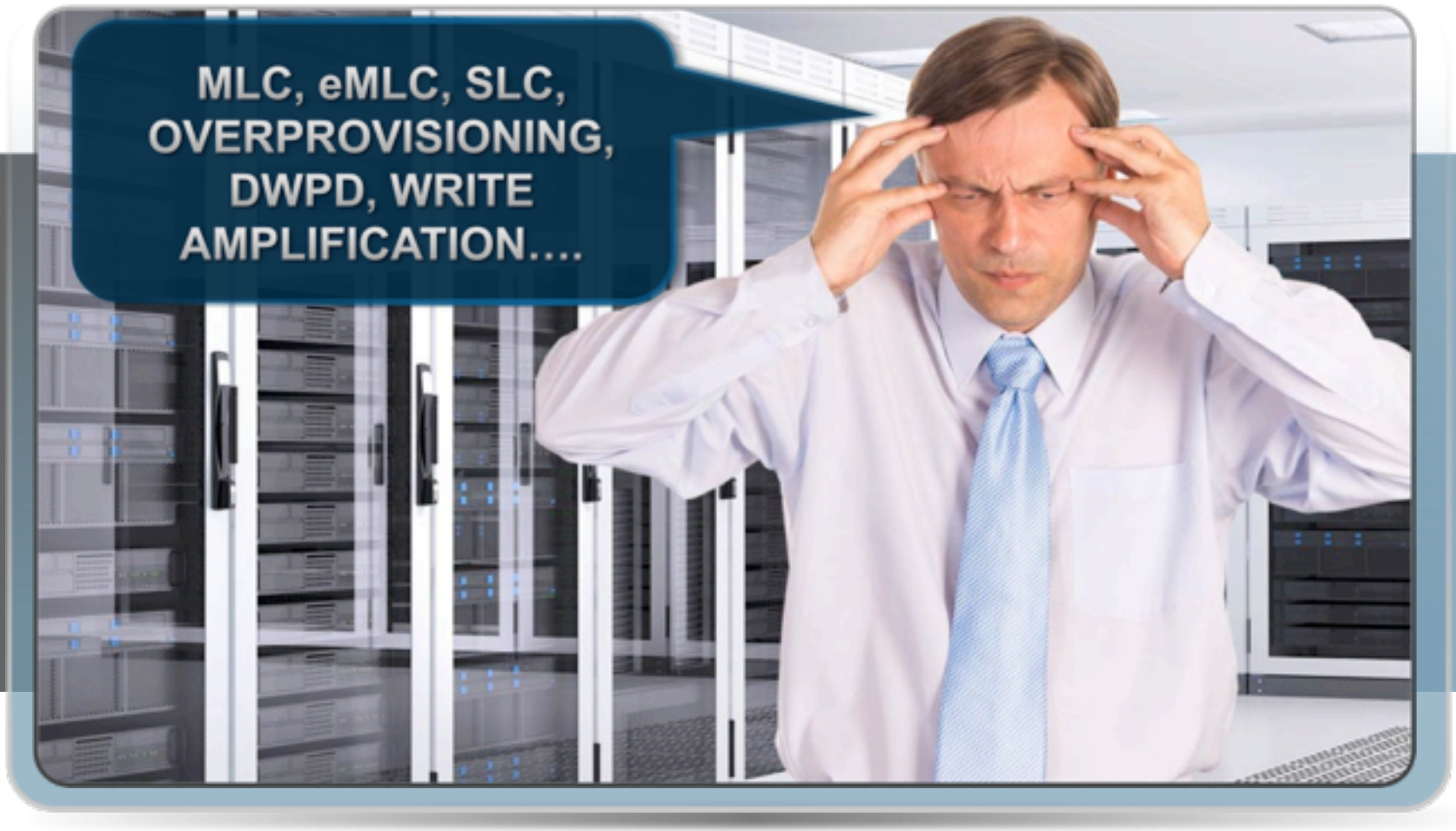
VIDEO ON DEMAND
100% Read
512KB transfer size
100% random
240GB SATA

Drive Life
∞ years

SQL LOGGING
100% Write
8KB transfer size
100% sequential
240GB MLC SATA

Drive Life
0.08 years

Tom Starts To Learn About Endurance



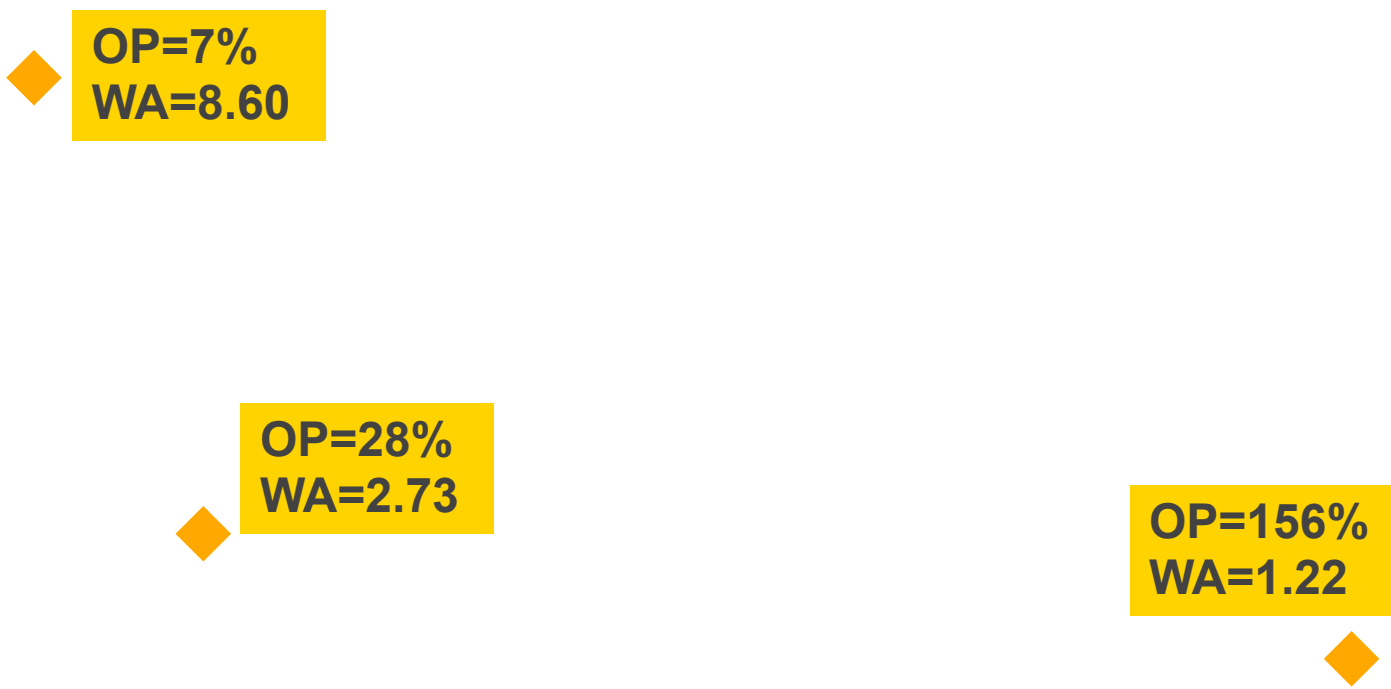
Write Amplification vs. OP

Write Amplification vs. OP

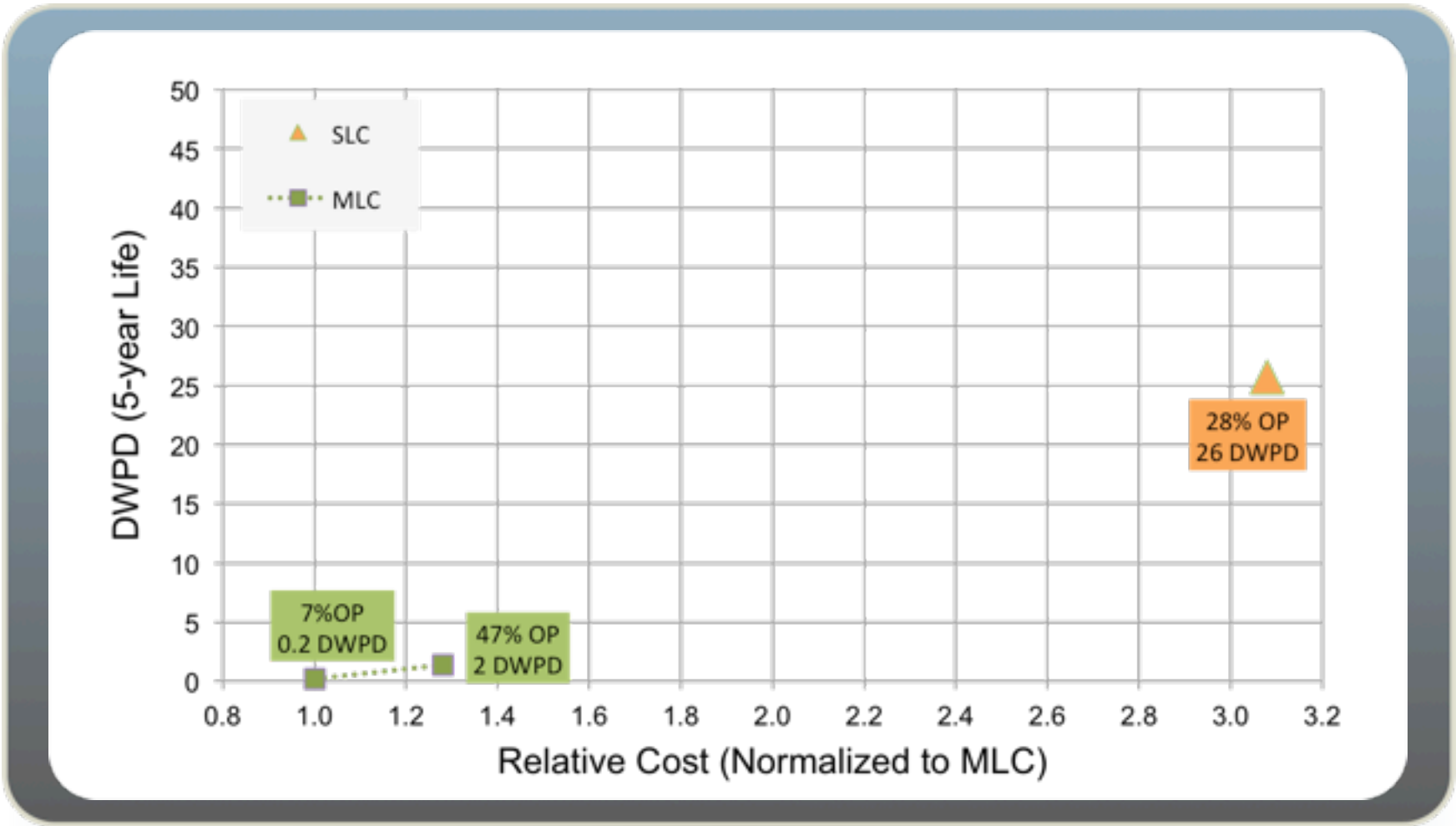
- **OP=7%**
  WA=8.60

Write Amplification vs. OP

Write Amplification vs. OP

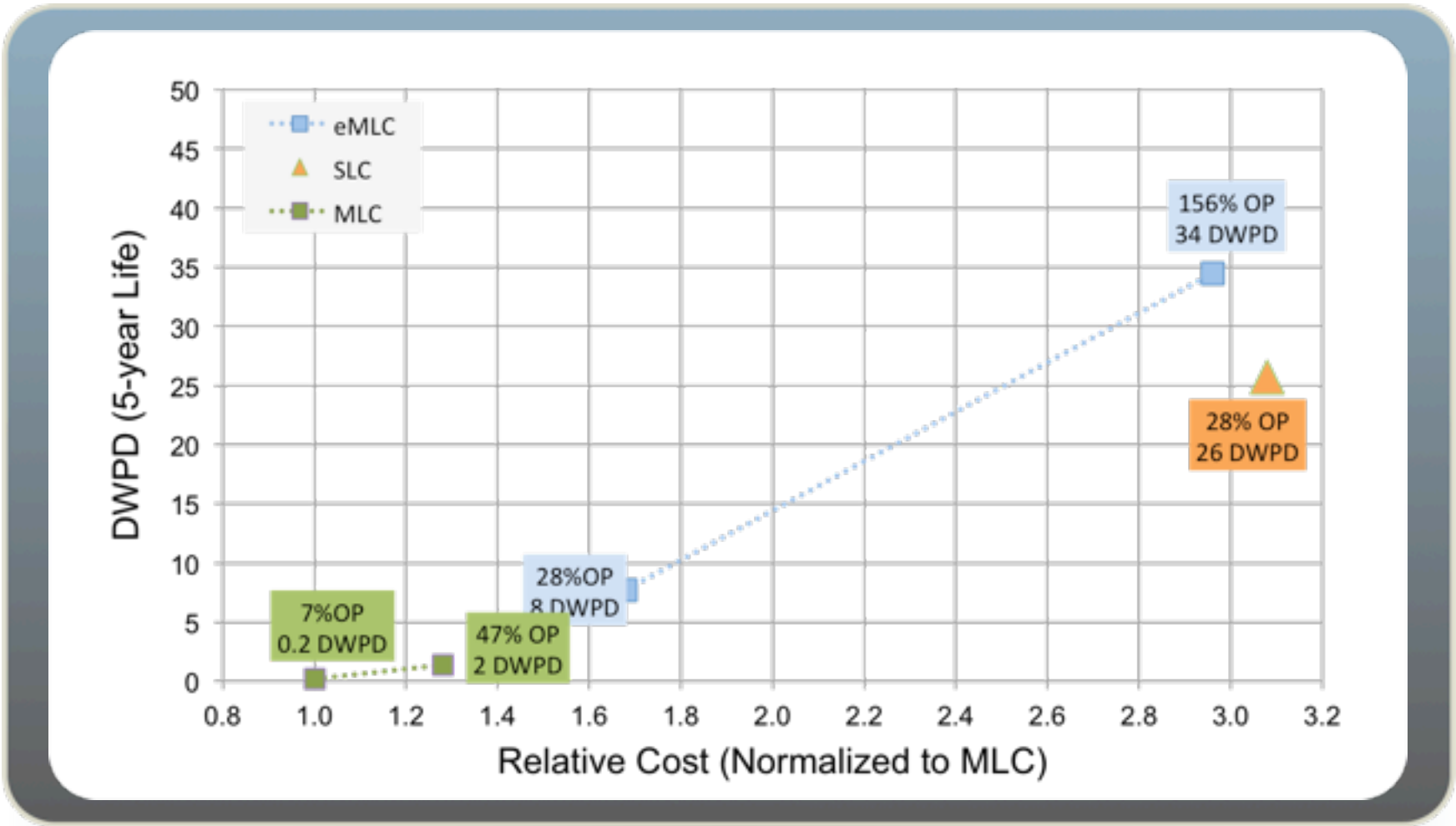


Endurance vs Cost



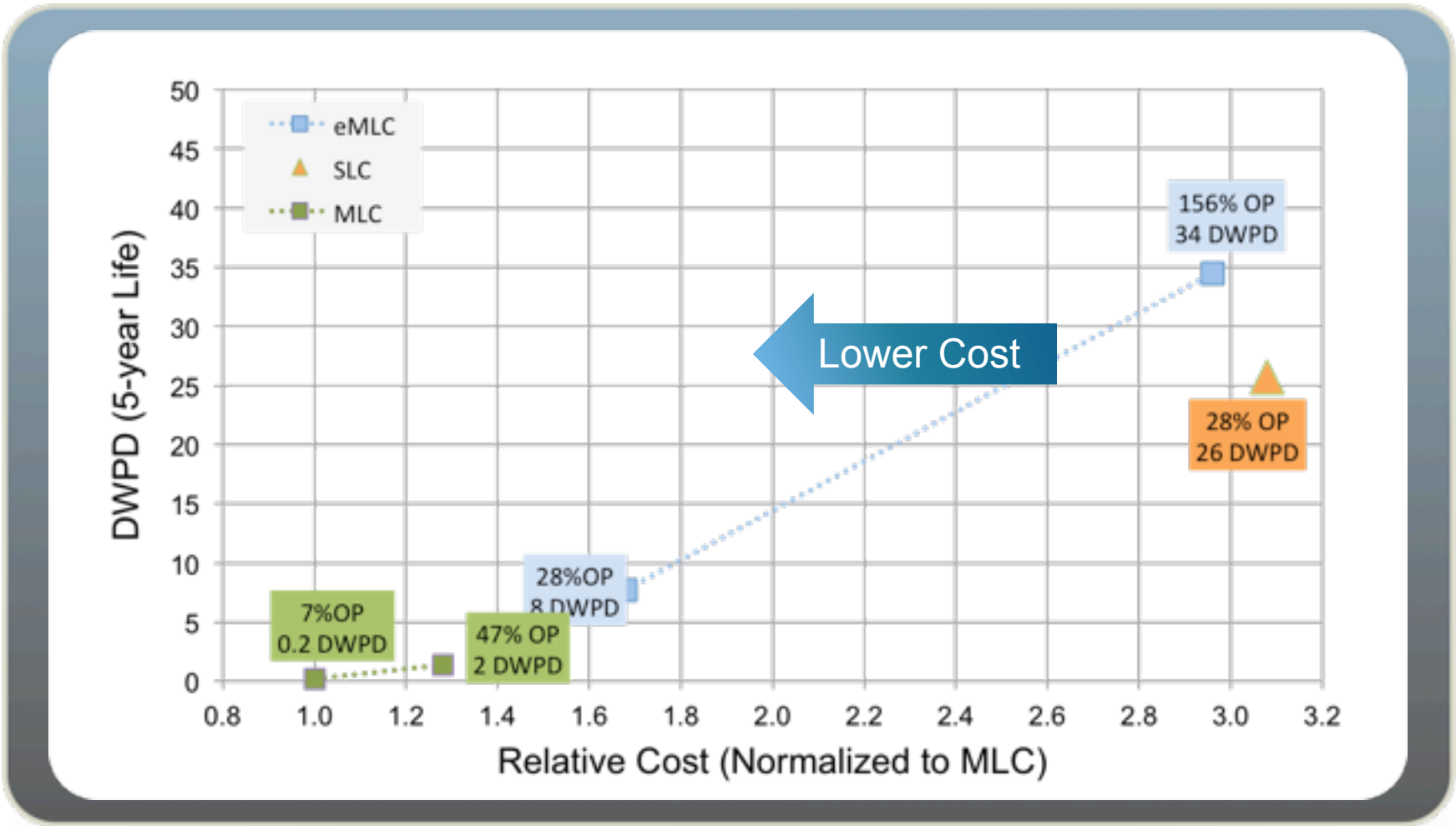
Note: Assumes reduced WA for increased OP

Endurance vs Cost



Note: Assumes reduced WA for increased OP

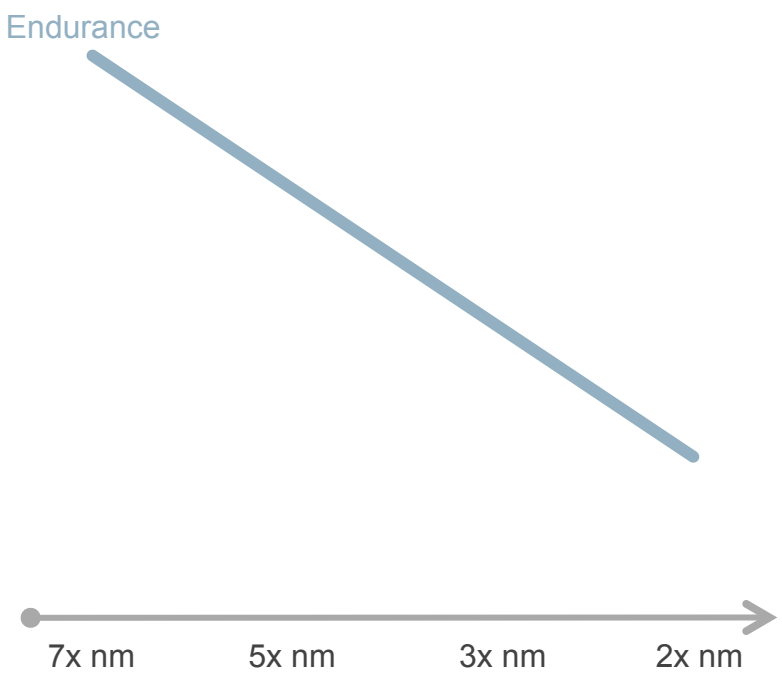
Endurance vs Cost



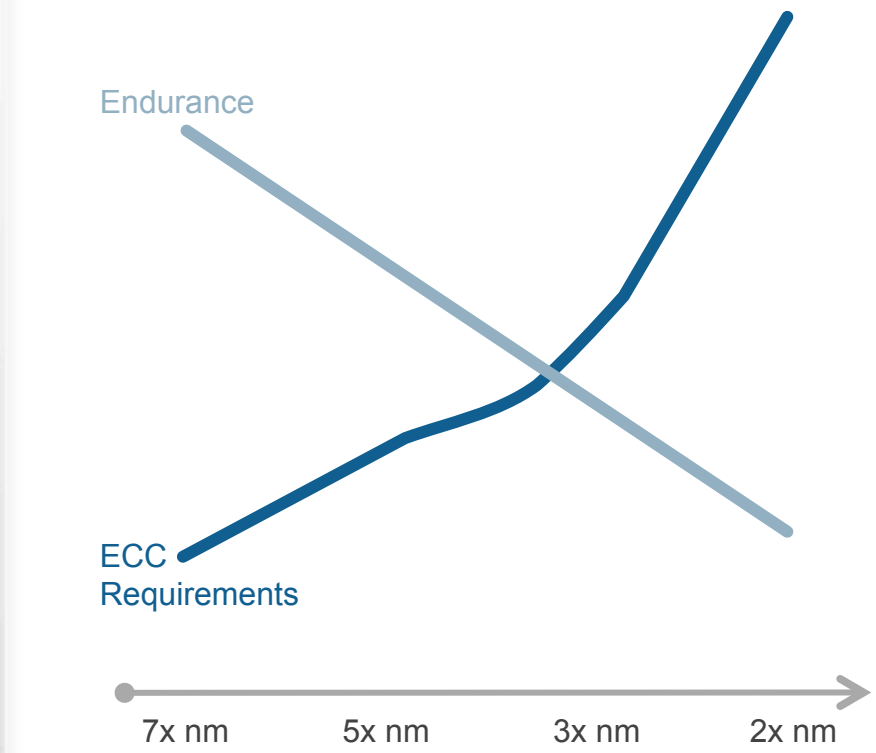
Note: Assumes reduced WA for increased OP

Managing Endurance through ECC

Managing Endurance through ECC

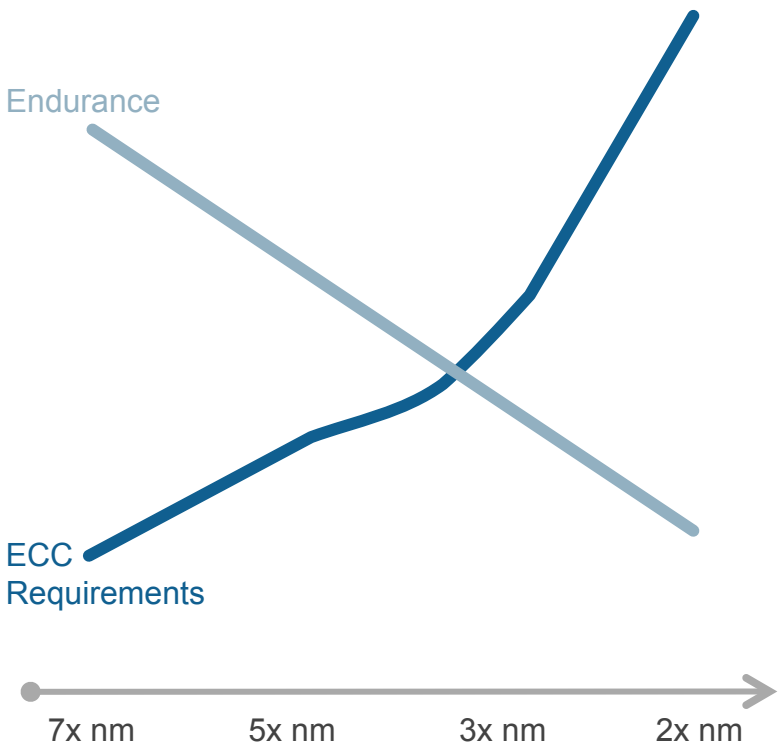


Managing Endurance through ECC



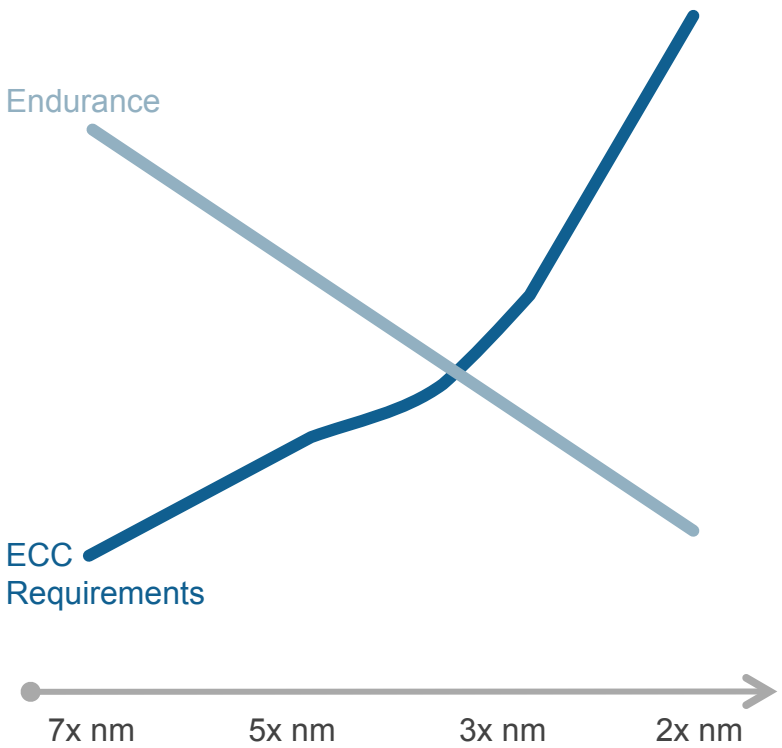
Managing Endurance through ECC

Comprehensive error recovery can lead to performance degradation and latency problems



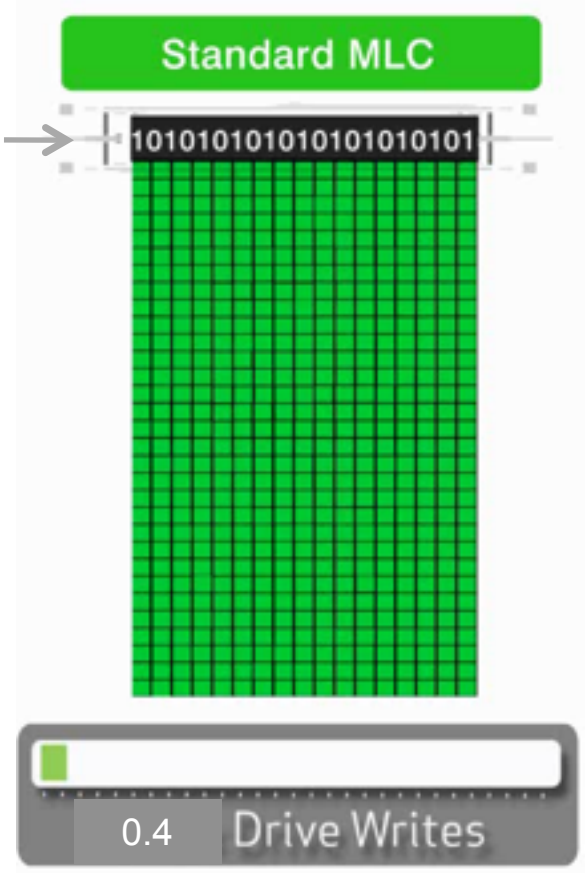
Managing Endurance through ECC

Comprehensive error recovery can lead to performance degradation and latency problems

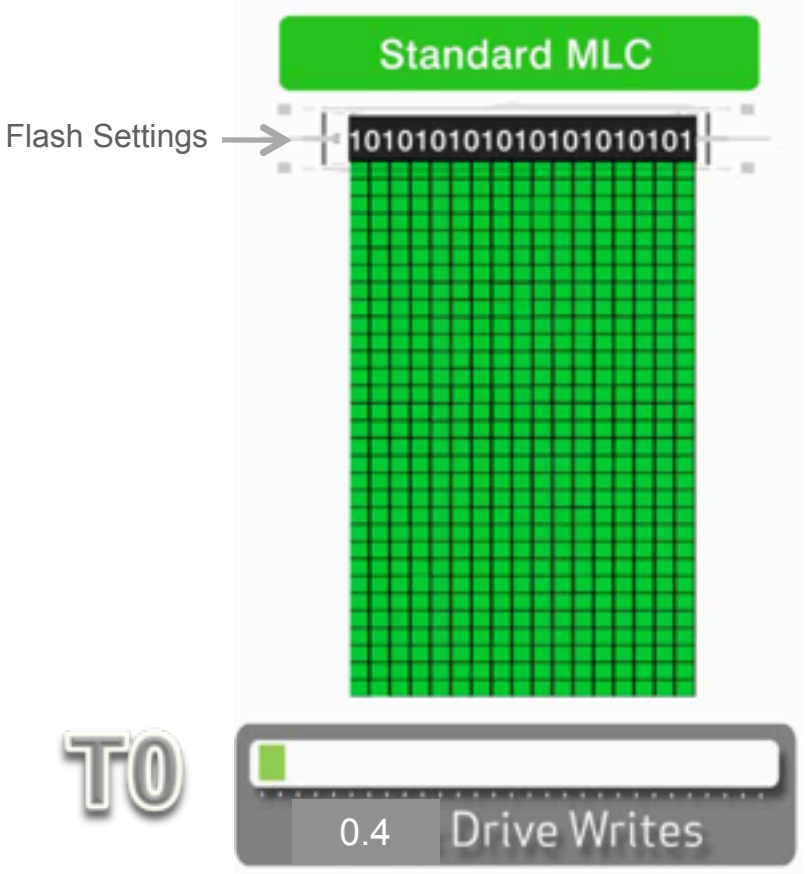


TRADITIONAL APPROACH OF ADDING ECC CAPABILITY IS NOT SUFFICIENT

Managing Endurance Through Physics

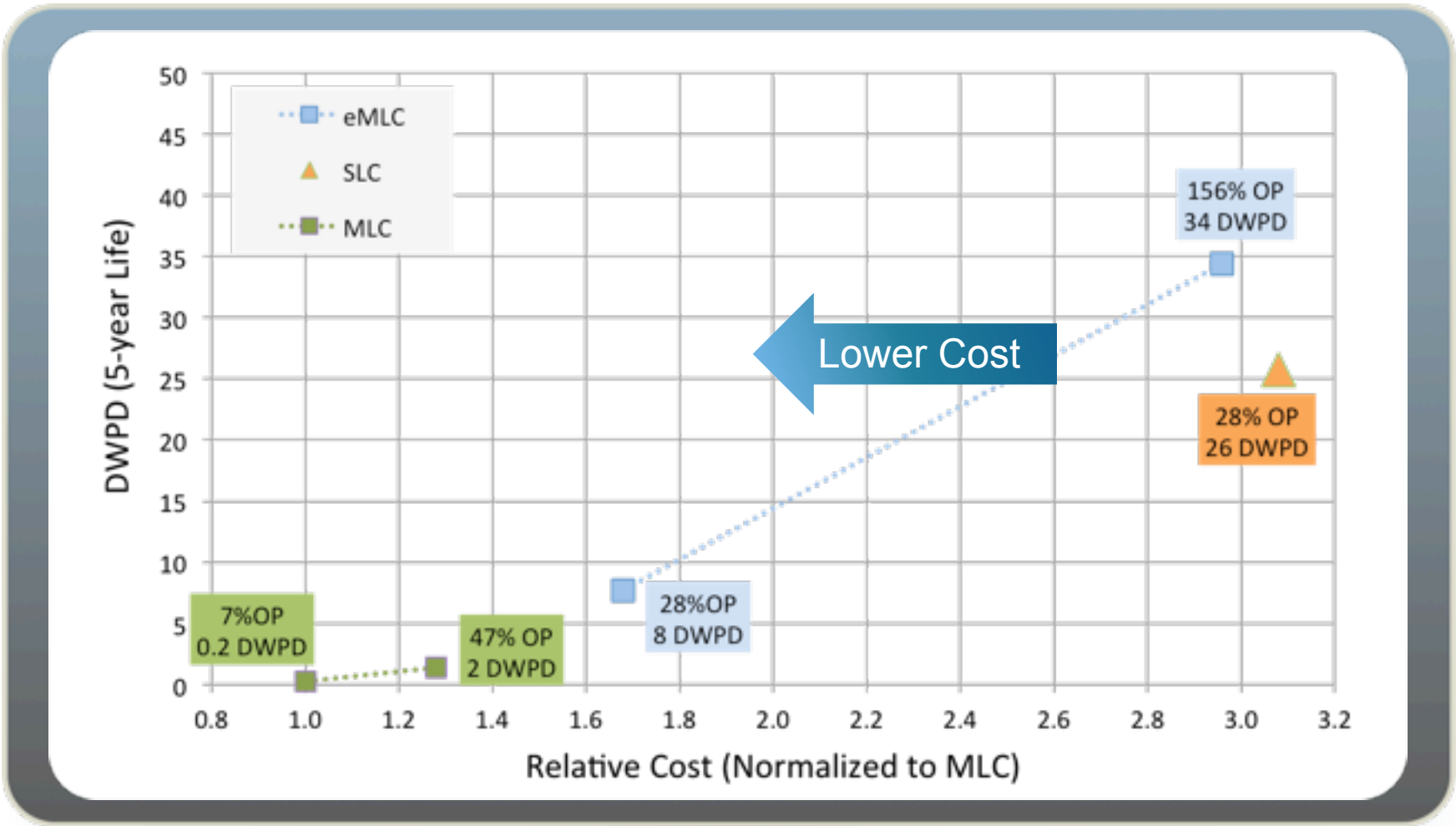


Managing Endurance Through Physics



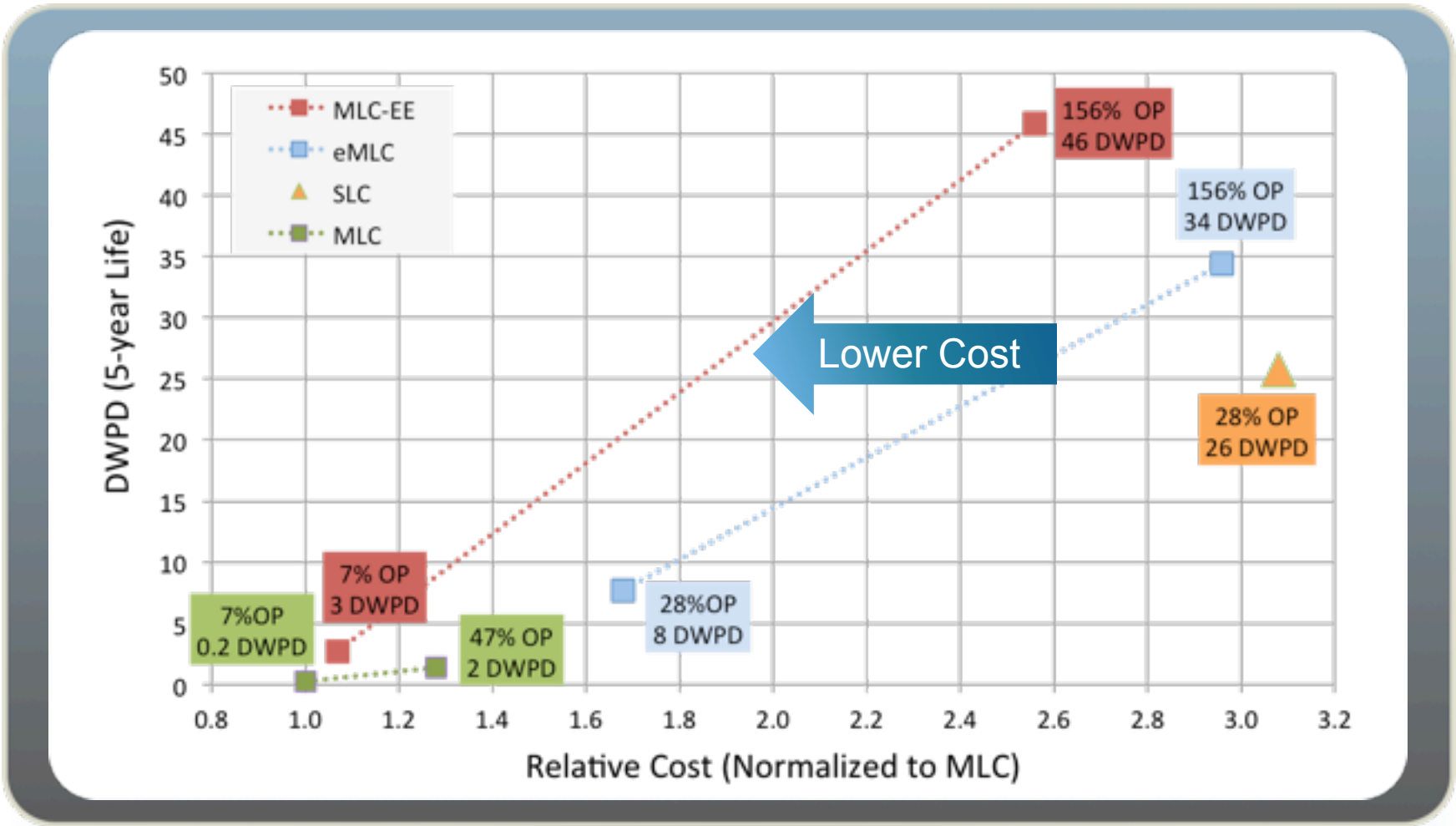
Managing Endurance Through Physics

Endurance vs Cost



Note: Assumes reduced WA for increased OP

Endurance vs Cost

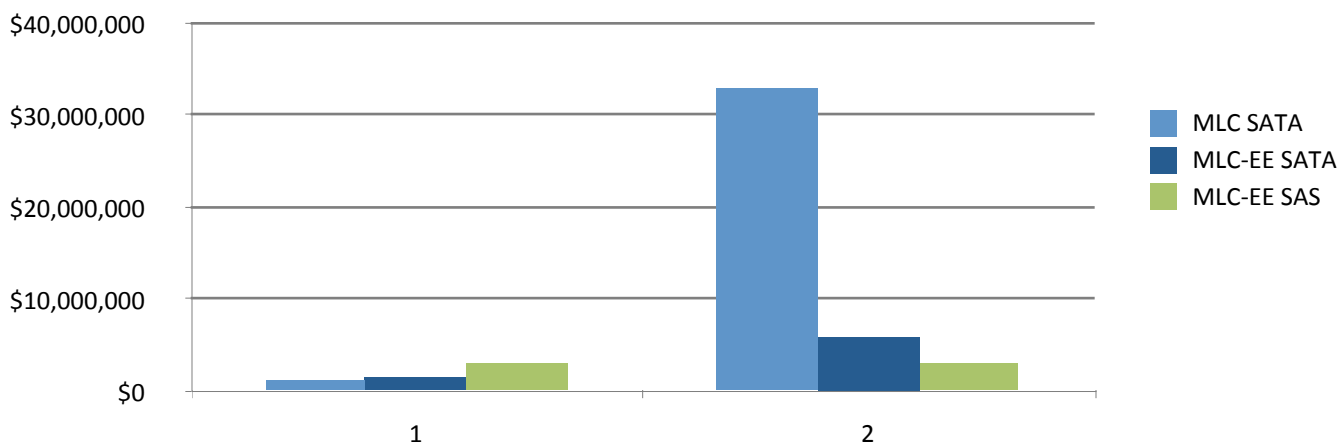


Note: Assumes reduced WA for increased OP

OLTP application - 5 Year TCO Model

1 Petabyte Install Base

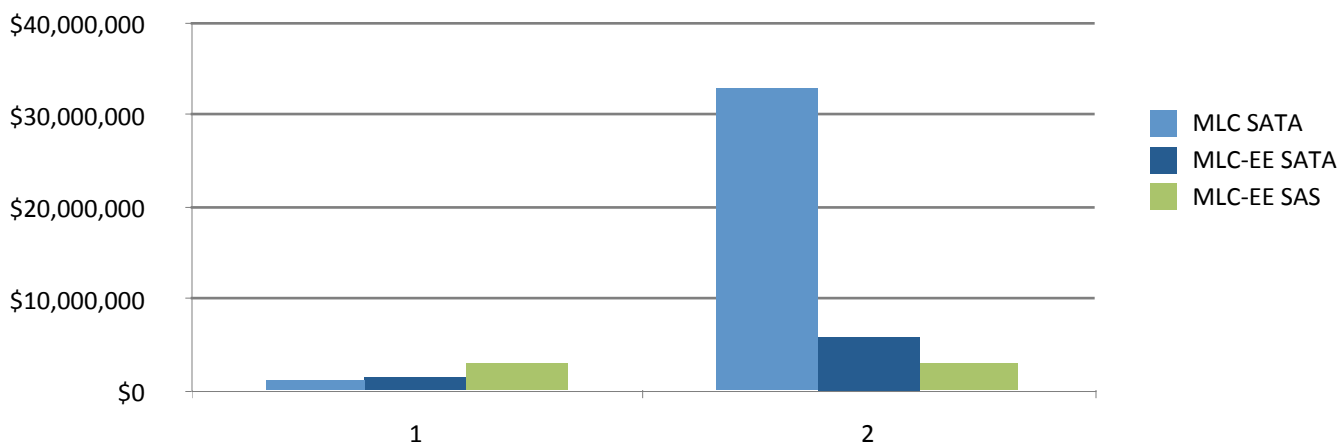
	MLC SATA	MLC-EE SATA	MLC-EE SAS
Acquisition Cost	$ 240	$ 300	$ 600
Calculated Life (in years)	0.18	1.27	4.92
Replacement rate/year	5.48	0.79	0.20



OLTP application - 5 Year TCO Model

1 Petabyte Install Base

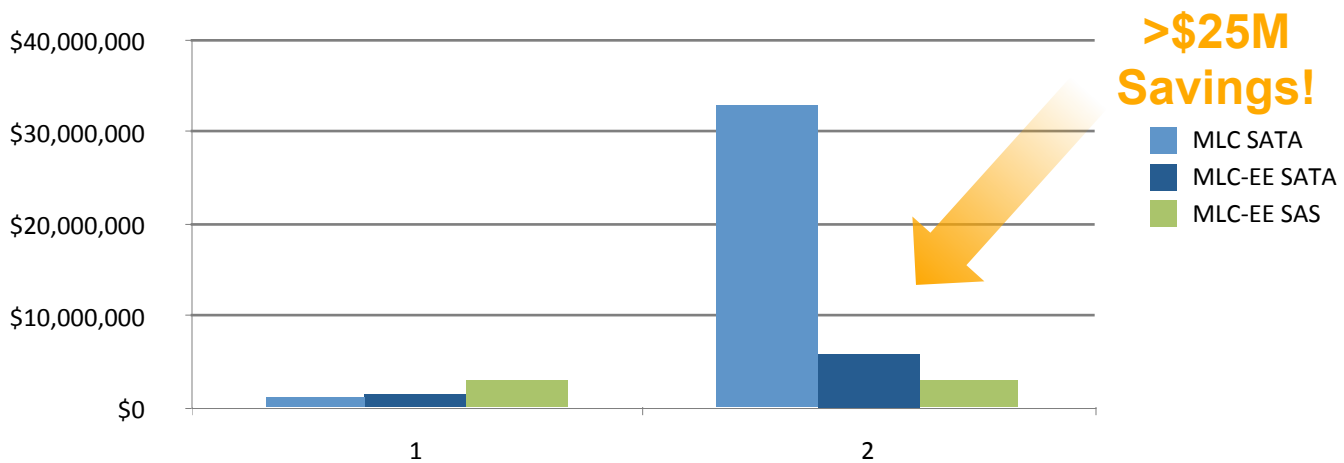
	MLC SATA	MLC-EE SATA	MLC-EE SAS
Acquisition Cost	$ 240	$ 300	$ 600
Calculated Life (in years)	0.18	1.27	4.92
Replacement rate/year	5.48	0.79	0.20



OLTP application - 5 Year TCO Model

1 Petabyte Install Base

	MLC SATA	MLC-EE SATA	MLC-EE SAS
Acquisition Cost	$ 240	$ 300	$ 600
Calculated Life (in years)	0.18	1.27	4.92
Replacement rate/year	5.48	0.79	0.20



The Moral of the Story

The Moral of the Story

The Moral of the Story

The Moral of the Story

SMART STORAGE SYSTEMS
Making NAND Better

The Moral of the Story

THANK YOU !