Accelerating Databases with Flash:
The Need for Speed

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Agenda

- Spinning disk are the bottleneck
- All databases can benefit from flash
- Flash deployment methods and example results

Flash Storage – a DBA's Dream!

In the last 10 years…

CPU Speed: Performance increase roughly ***8-10x***

DRAM Speed: Performance increase roughly ***7-9x***

Network Speed: Performance increase of ***100x***

Bus Speed: Performance increased roughly ***20x***

Yet…

Disk (storage) speed: Performance increased only *1.5x*

With Flash, storage finally catches up!

Before flash, the costly ways to increase database performance…

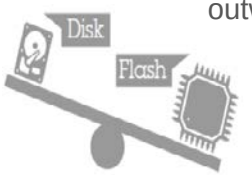
Typical Performance Mitigation Tactics

Most Costly & Volatile	Add More Memory	HDD Performance Enhancement	Wasteful, Expensive & Ineffective with Storage Latency Issues
Expensive & Ineffective for Storage Performance Issues	Add CPUs	Tune & Modify Application	Time Consuming, Very Expensive & Risky

Understanding Application Efficiency using Flash Storage

Servers, Applications and Databases are FASTER!

Benefits & economics outweigh disk



No application Or architecture Changes

Reduce floor space, power & cooling

CPU Utilization
& App. Efficiency
4%

Total Application Processing Time
5,200us (5.2ms)

5,000us (5ms)

200us (.2ms)

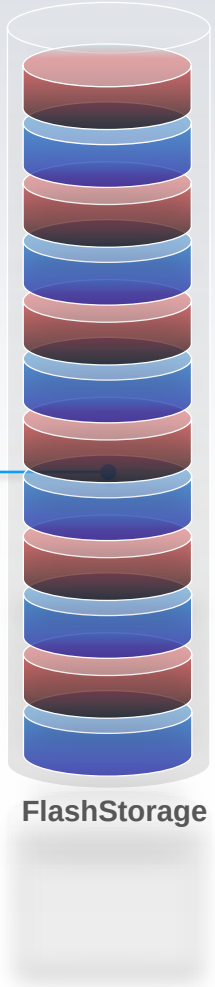
Disk/Hybrid

Application
Processing Time

What do you do with the Extra Time?

Time Waiting for I/0
(Waiting for Array)

Time Processing Data
(Server CPU)



FlashStorage

CPU Utilization
& App. Efficiency
50%

Total Application Processing Time
400us (.4ms)

200us (.2ms)

200us (.2ms)

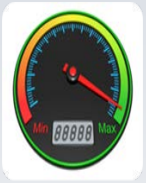
Industry leading databases accelerated with flash

Improve Performance

DB2	SQL Server	Oracle	Sybase SAP HANA
	• Standalone • Clustered • Always-On	• Standalone • RAC MySQL	

Flash is an equal opportunity database accelerator.
You name it, flash makes it faster.

Manual Data Placement



Great application benefits

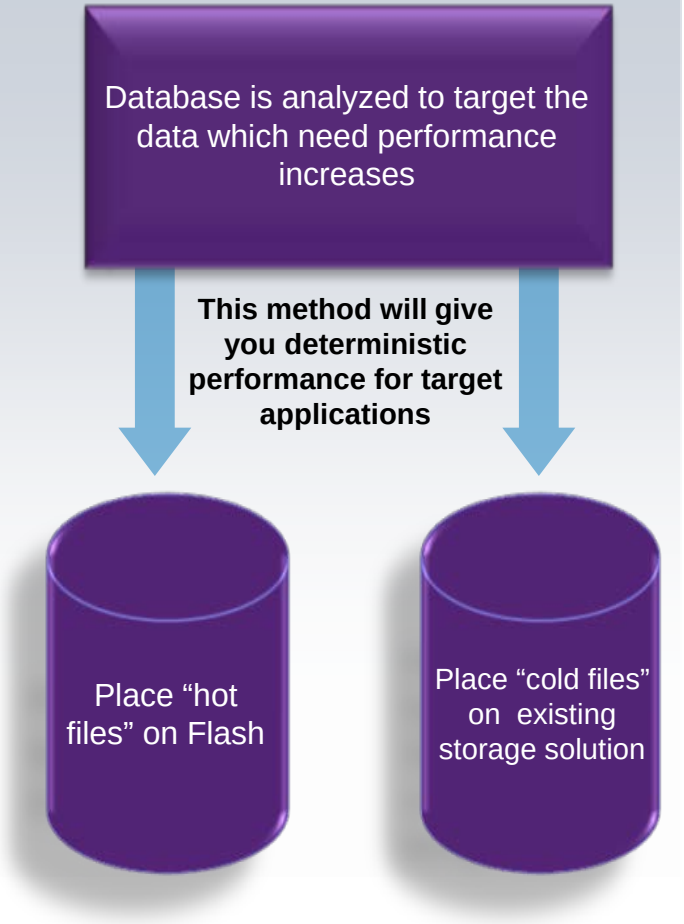
- Highest possible write performance, essential for database transaction logs
- Highest possible read performance, no cache missed

Implementation peace of mind

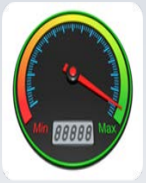
- FlashSystem with 2D RAID and IBM patented Variable Stripe RAID provides data protection
- Still uses replication for DR

Extend value of existing investments

- Continue use of existing storage for “cold files”
- Frees resources for other workloads on SAN



Preferred Read Architectures



Great application benefits

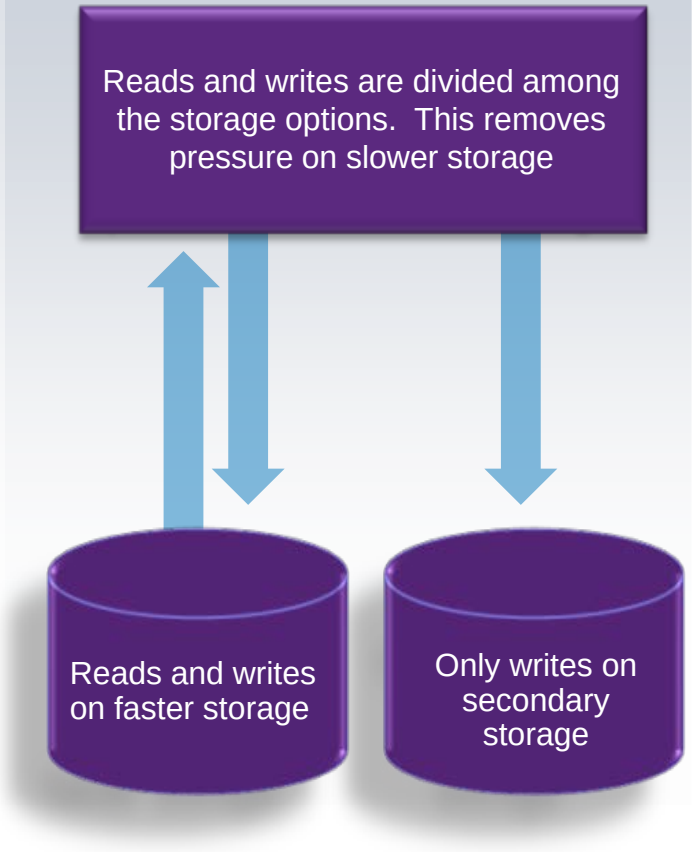
- Reads become “Flash fast”
- Writes are as fast as the other SAN array
  note that you usually write to array cache

Implementation peace of mind

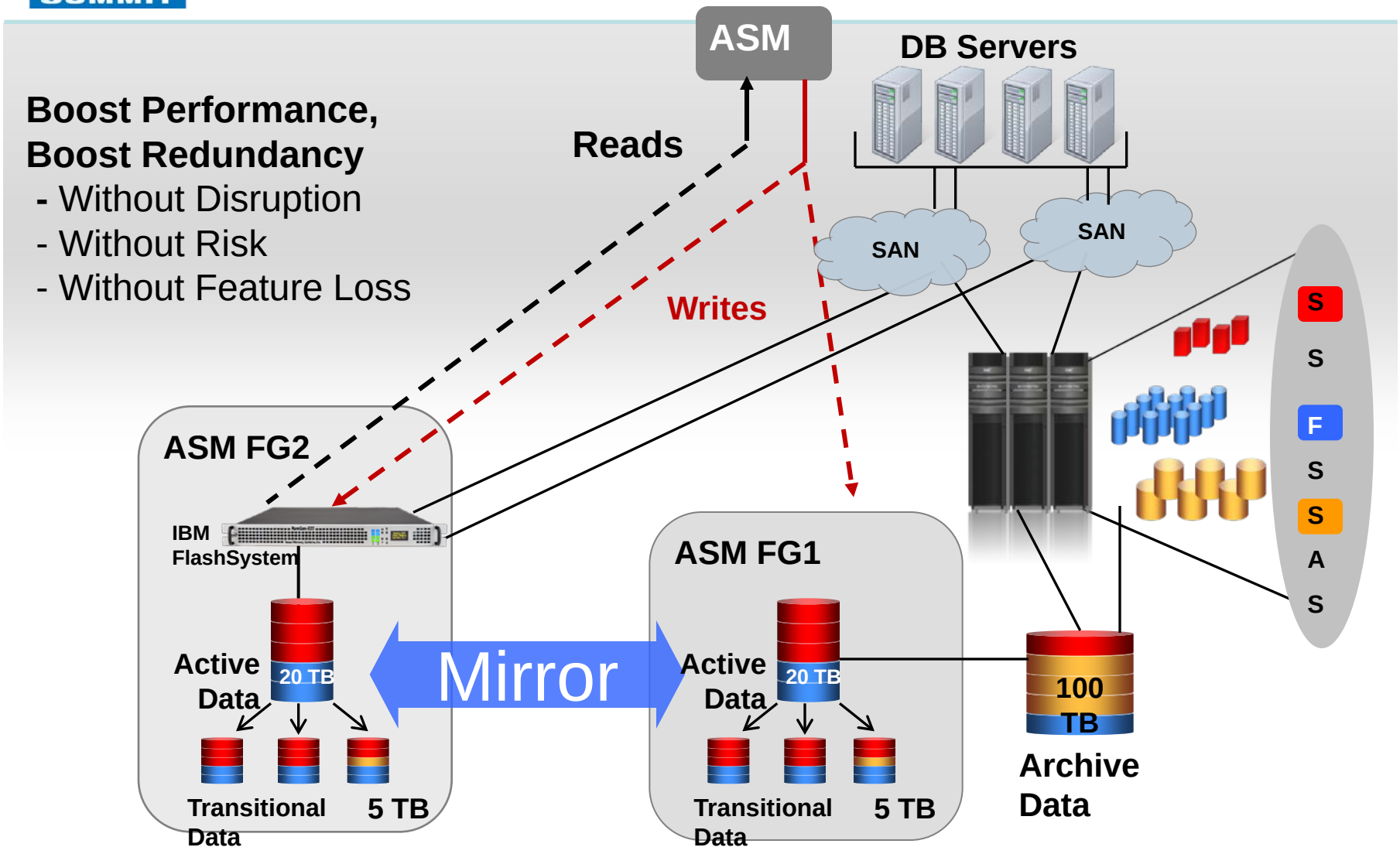
- Adding redundancy without introducing risk
- Data is still stored on the other SAN array

Extend value of existing investments

- Continue use of array SW features
- Frees resources for other workloads on SAN



Preferred Read Example



Preferred Read Acceleration – Comparing Oracle AWR logs

Before
Read From Disk

Top 5 Timed Foreground Events

Event	Waits	Time(s)	Avg wait (ms)	% DB time	Wait Class
db file sequential read	3,661,832	56,084	15	99.63	User I/O
DB CPU		157		0.28	
reliable message	18	11	595	0.02	Other
gc cr grant 2-way	16,472	3	0	0.00	Cluster
gc current block busy	110	1	8	0.00	Cluster

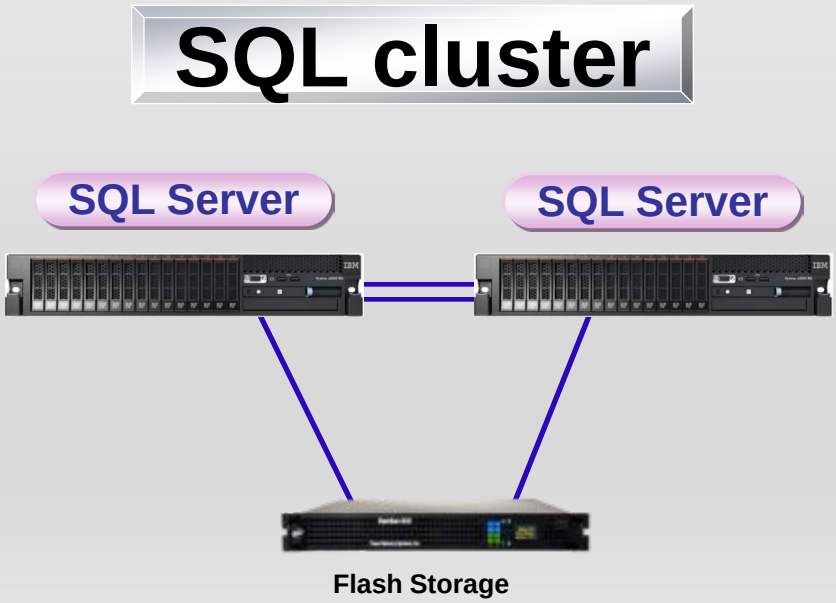
Top 5 Timed Foreground Events

Event	Waits	Time(s)	Avg wait (ms)	% DB time	Wait Class
db file sequential read	142,500,177	63,163	0	90.45	User I/O
DB CPU		4,711		6.75	
gc cr grant 2-way	522,320	133	0	0.19	Cluster
enq: WF - contention	20	12	580	0.02	Other
latch: cache buffers chains	86,275	2	0	0.00	Concurrency

After Acceleration
Read From FlashSystem

The average read response time for the first instance ***accelerated from 15.33 ms to 0.43 ms*** *and average IOPS* ***accelerated from 3644 to 111831***

All Flash Case Study: Life Sciences Client



Problem

- Experiencing pain with JDE BD loads / backups / restores
- Needed better system performance for the end user

Solution

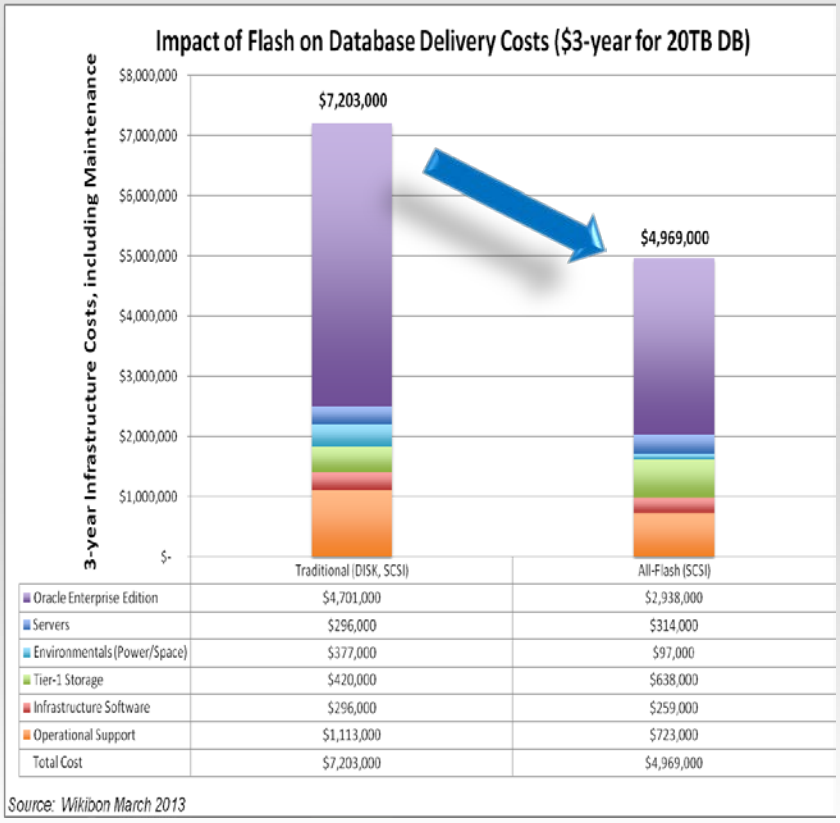
- Installed IBM FlashSystem into a SQL DB, clustered, running Oracle JDE
- Included Oracle OLAP processes

Benefit

- Backup Time improved from 5 hours to 42 minutes
- Restore Time improved from 6.5 hours to 1.2 hours
- Batch times went from 7:30 hours to 2:37 and 17:47 to 7:07

Cost savings is **BONUS!**

- **38% Lower** software license costs
  - Due to fewer cores
  - Lower software maintenance
- **More Efficient** Infrastructure
  - 13% lower infrastructure software costs
  - 35% lower operational support costs
  - Server / Storage Admin
- **Much better** storage utilization
  - As much as 50%
  - Lower maintenance
  - Ease management by 50%
- **17% Fewer** Servers
  - Fewer cores
  - Lower Memory
  - Fewer network connections
  - Lower maintenance
- Environmentals **74% Lower** Cost
  - Lower power / cooling
  - Less floor space



	Traditional (DISK, SCSI)	All-Flash (SCSI)
Oracle Enterprise Edition	$4,701,000	$2,938,000
Servers	$296,000	$314,000
Environmentals (Power/Space)	$377,000	$97,000
Tier-1 Storage	$420,000	$638,000
Infrastructure Software	$296,000	$259,000
Operational Support	$1,113,000	$723,000
Total Cost	$7,203,000	$4,969,000

Source: Wikibon March 2013

All Flash is 31% Less Expensive Overall

Questions and Thank You!