


Where Does Solid State Storage Fit?

Jim Handy

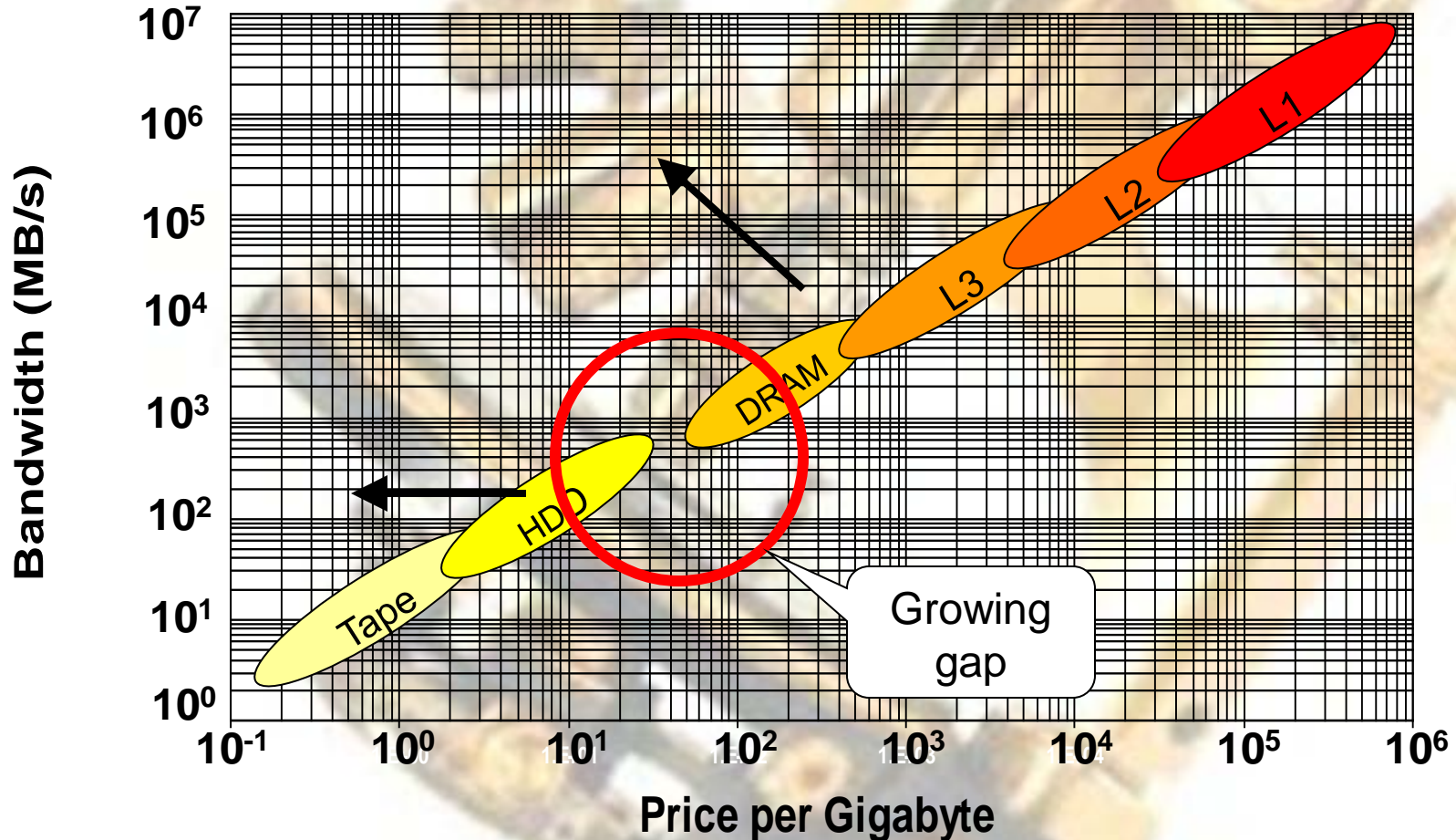


OBJECTIVE ANALYSIS – Semiconductor Market Research



**The Problem:
A Growing HDD/DRAM Speed Gap!**

The DRAM/HDD Speed Gap

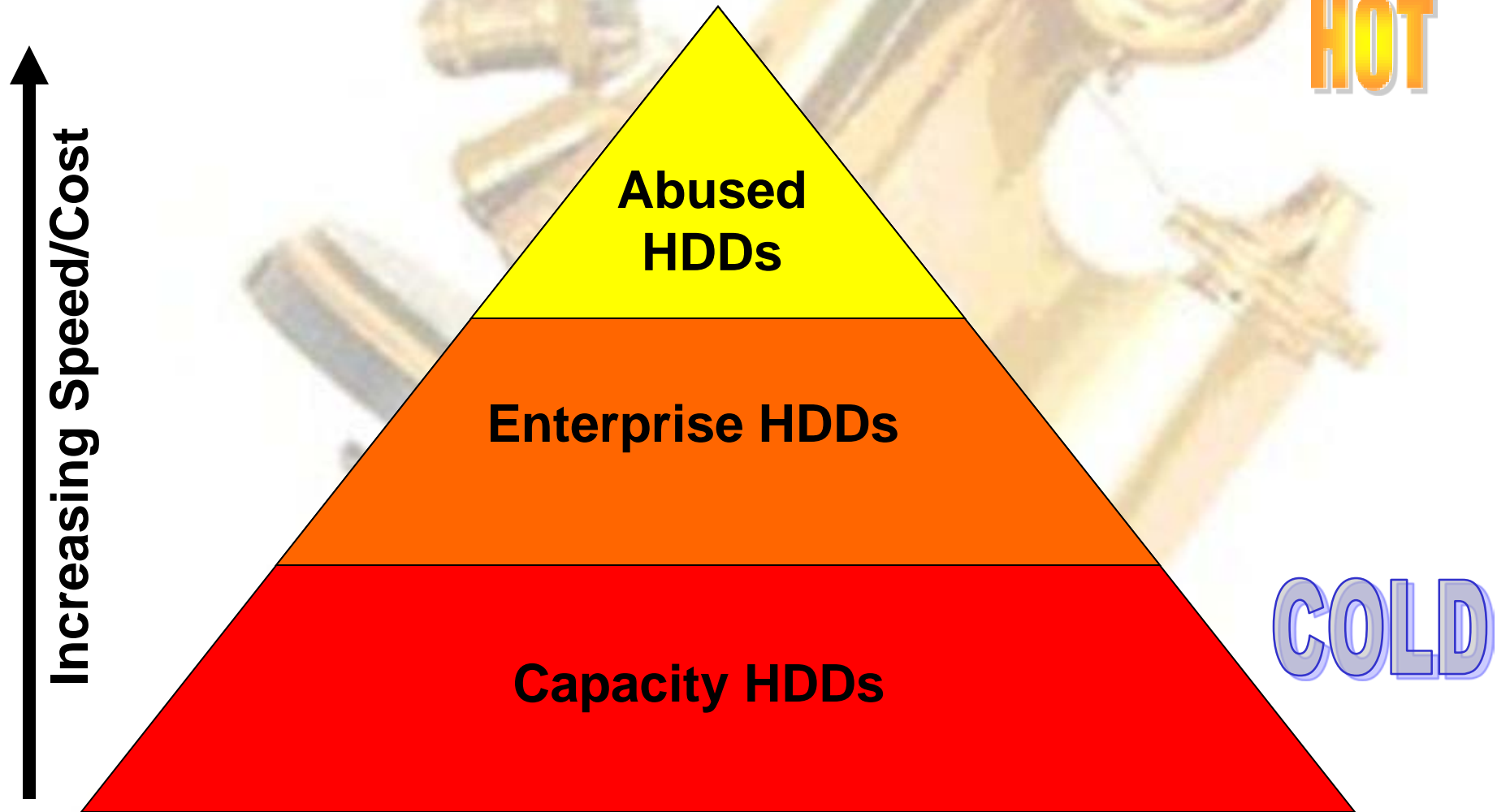


From: ***Solid State Drives in the Enterprise***

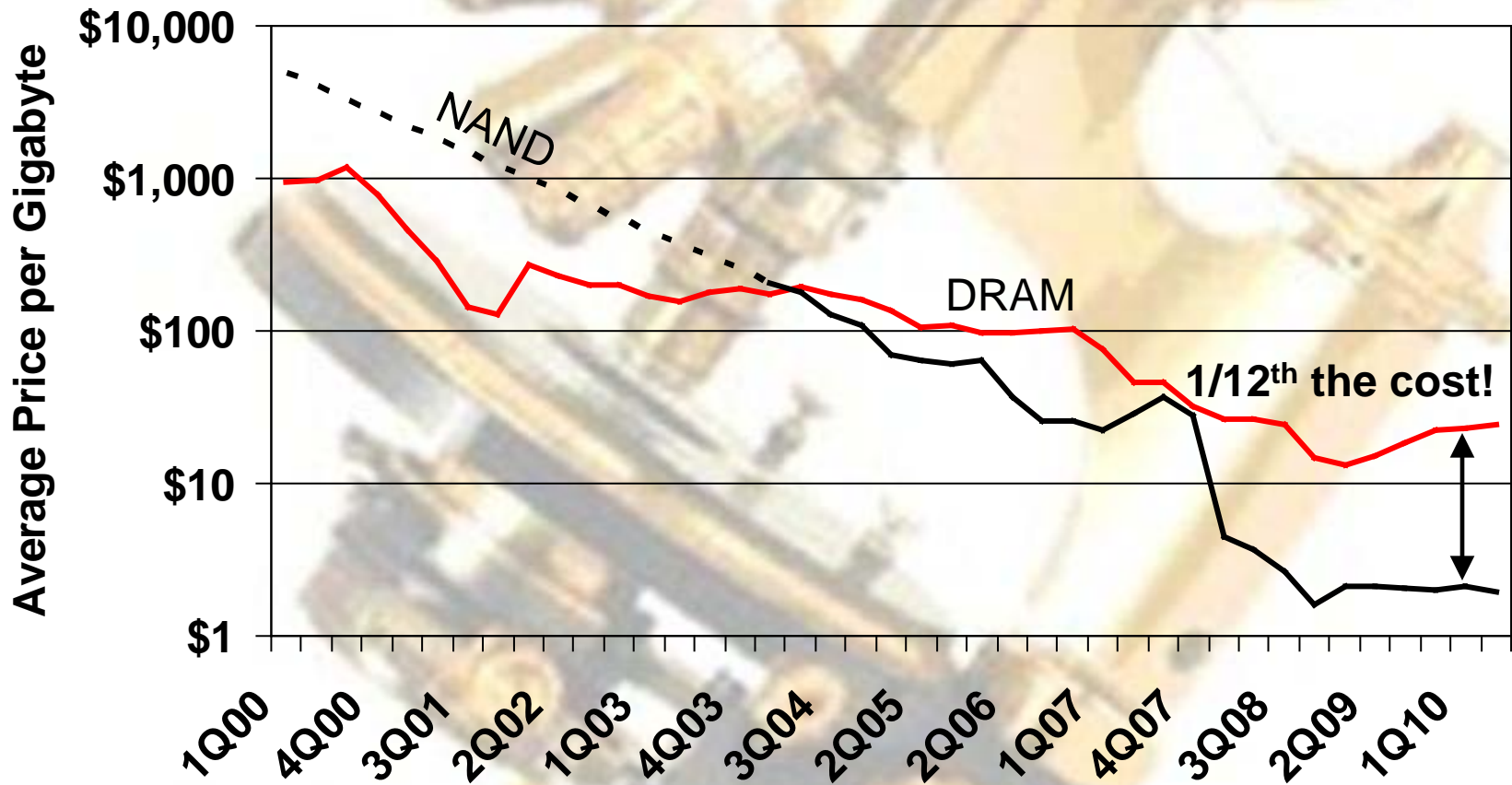
Solving the Problem

- Keep more data in DRAM
 - Use maximum main memory in each server
 - Spread problem across multiple servers
- Use accelerated HDDs to fill the gap
 - Enterprise HDDs - \$300+ each
 - Striped HDD arrays: JBOD, RAID
 - Short Stroking

HDD Hierarchy

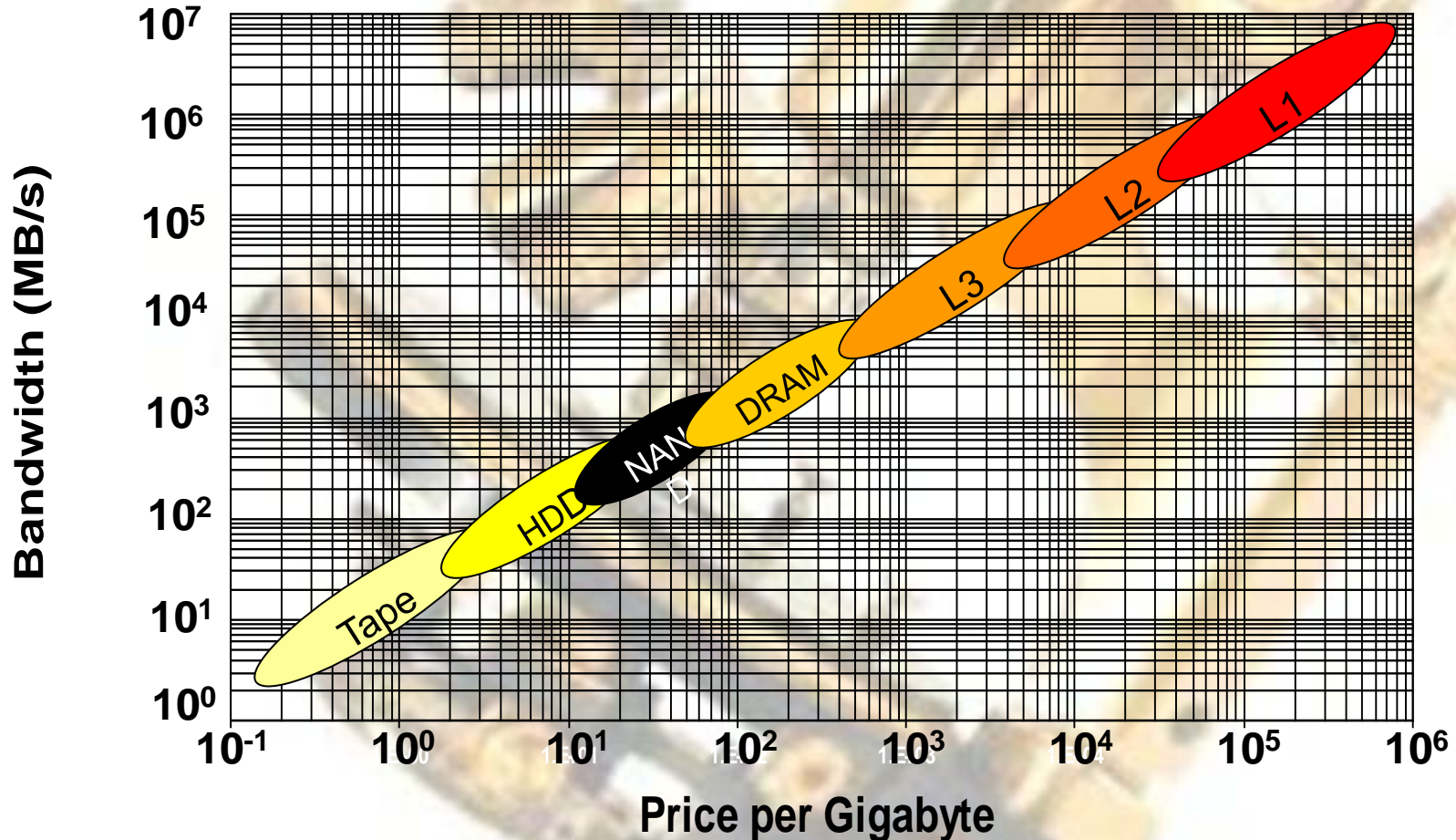


In 2004 NAND Shot Past DRAM's Price per GB



From: *Hybrid Drives: How, Why, & When?*

Now NAND Fits in Computers



From: ***Solid State Drives in the Enterprise***

How Much Flash?

- Sept 20: Violin announces 40TB SSD!
 - “Put the whole database into flash!”
- Many CIOs try to get by with less
 - Manual approach
 - Journals, Indexes, Roots...
 - Automatic approach
 - Let the system decide
- This question could use some research!

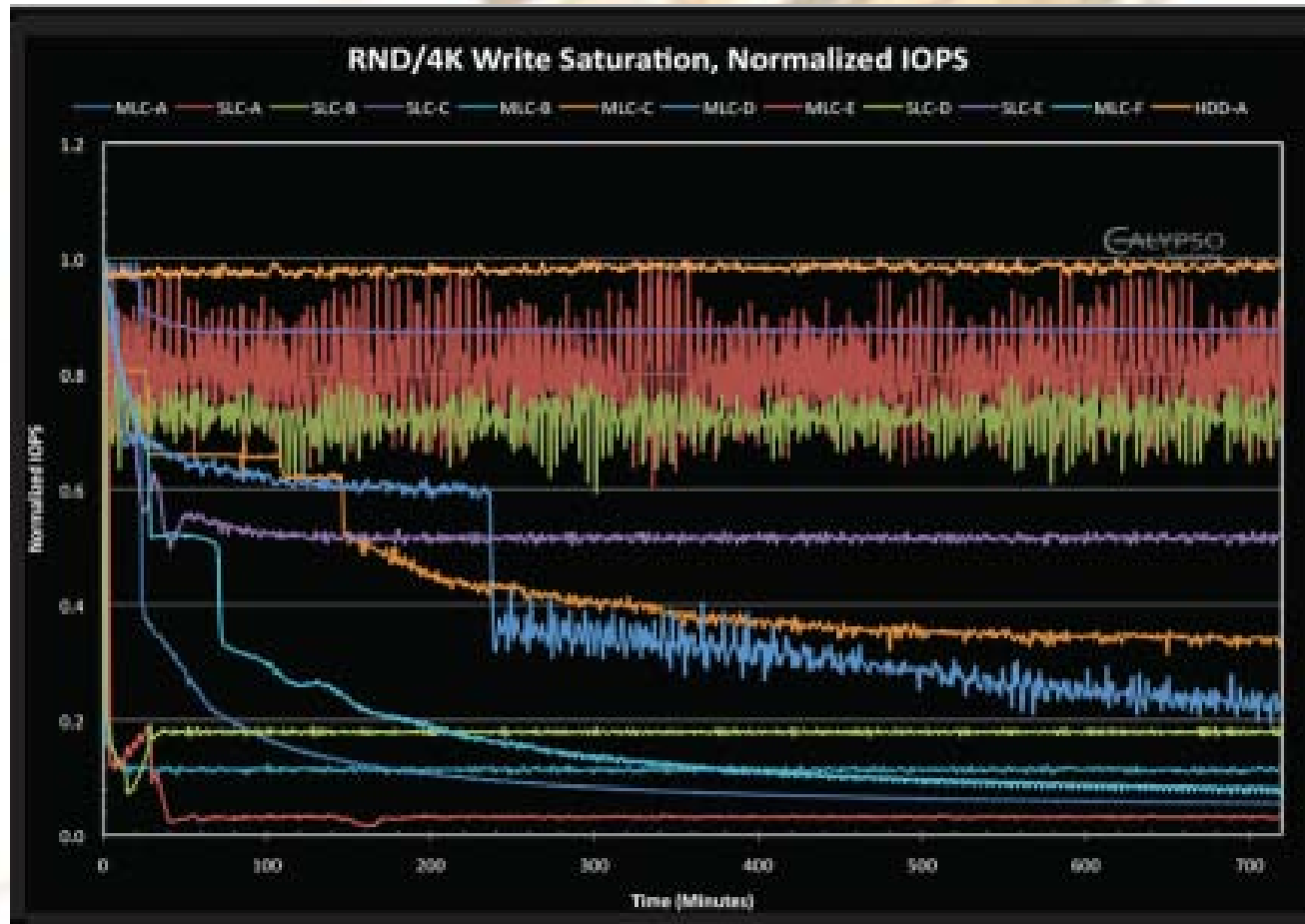
Automatic Tier Management

- Autonomous
 - Seagate Momentus XP Hybrid HDD
 - LSI CacheCade
 - Adaptech HYBRID RAID
 - NVELO Dataplex
- Operating system support
 - Sun – ZFS
 - EMC – Symetrix
 - IBM – z/OS

Many more to come!

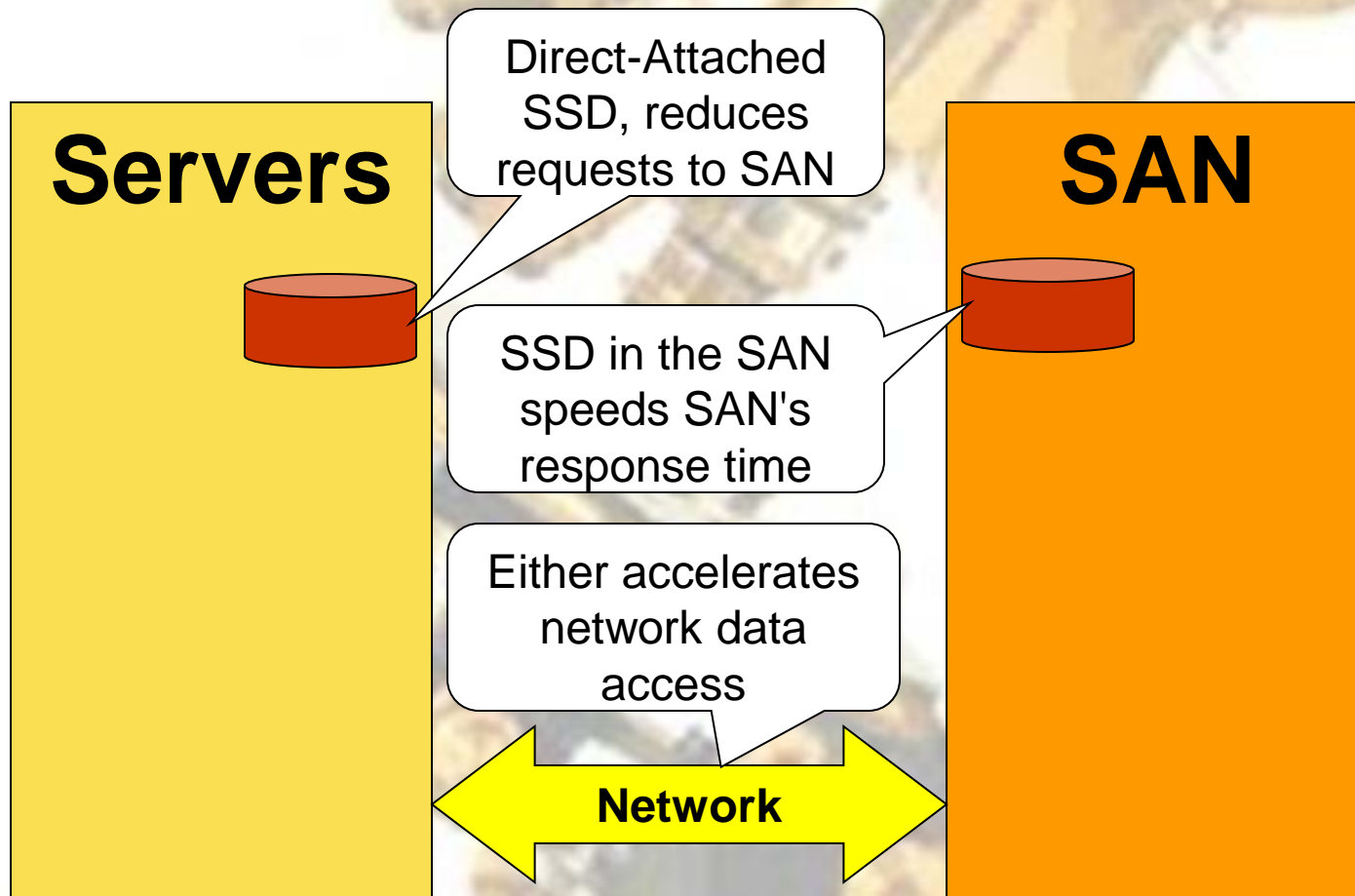
SSDs Must Be Understood

Performance is not always intuitive



From: *Putting SSDs to the Test!*

Where Do SSDs Fit?



SSDs in the Enterprise

- SSDs growing rapidly in this new space
 - 89% unit CAGR 2010-2015
- Will displace numerous enterprise HDDs
- Reasons this is happening:
 - Certain markets need SSDs
 - One SSD can replace 10+ HDDs
 - Cost savings, performance improvements



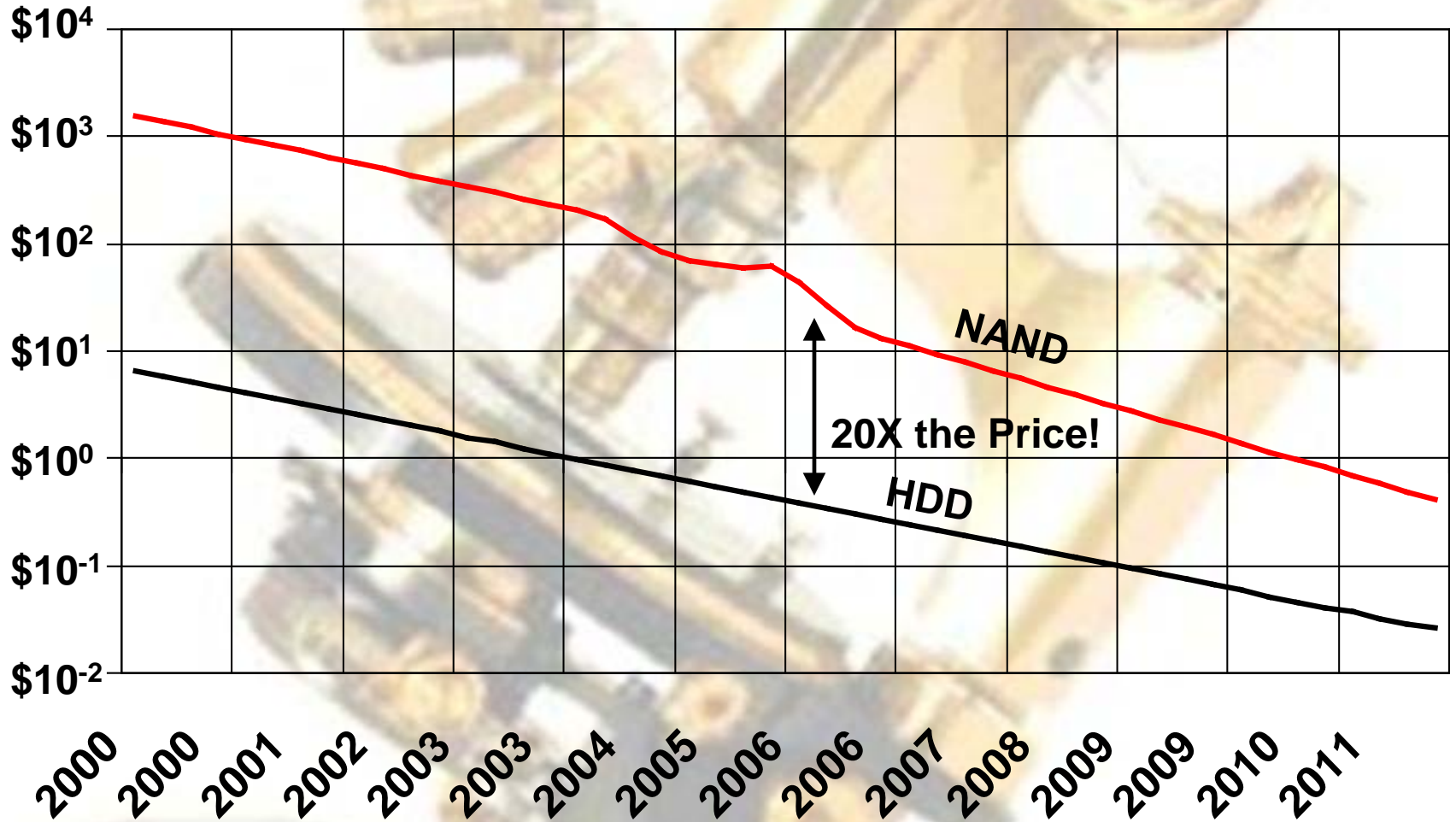
What About PCs?

Benefits of SSDs in PCs

- Longer Battery Life
 - Intel finds that battery life improves by 13%+
 - Lower SSD active power consumption
 - More time spent powered down
- Faster boot & program launch
 - Keeps users engaged
 - Improves employee productivity
- Faster execution in disk-intensive programs
- More rugged
 - If PC is smashed, move SSD to a new PC
 - User back to work *pronto!*

NAND Unlikely to Match HDD \$/GB

Price per Gigabyte



From: *Understanding the NAND Market*

PCs Are Unlike Data Centers

PC

- One HDD
- Don't currently use a storage hierarchy
- Speed is nice to have
- Modest battery life improvement

Data Center

- Thousands of HDDs
- Storage hierarchy is common
- Speed is money
- Significant collateral savings
 - Reduced server count
 - Fewer racks
 - Power/cooling
 - Etc.

PC Architectures Will Follow the Data Center Example

- Main storage cached by flash
 - Large HDD – Small flash
- This has been tried before
 - Robson/Turbo Memory
 - Hybrid HDDs of 2007
- It is being tried again
 - Seagate Momentus XP
 - NVELO Dataplex
 - (Intel Braidwood)

Eventually NAND will become standard in PCs!



Thank You!

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