Eleven Crucial Changes Coming

Jim Handy

OBJECTIVE ANALYSIS

Session Description

1. Evolving storage and memory technologies
2. Gen-AI & data center demand growth
3. Performance vs. TCO
4. HDD & SSD
5. Emerging semiconductor technologies
6. The rise of enterprise SSDs
7. DRAM and NAND dynamics
8. Global economic and strategic factors
9. Memory foundries?
10. PIM Opportunities & challenges
11. Tech and market changes storage & memory

1.

Evolving Storage and Memory Technologies

How Can I Feed Thee? Let Me Count the Ways!

1. HBM
2. High-Bandwidth Flash
3. Enormous QLC SSDs
4. AI-friendly SSD addressing
5. CXL
6. Within the processing element or nearby
7. Etc.

CXL Looks for the Perfect Home

Objective Analysis In-Depth Report

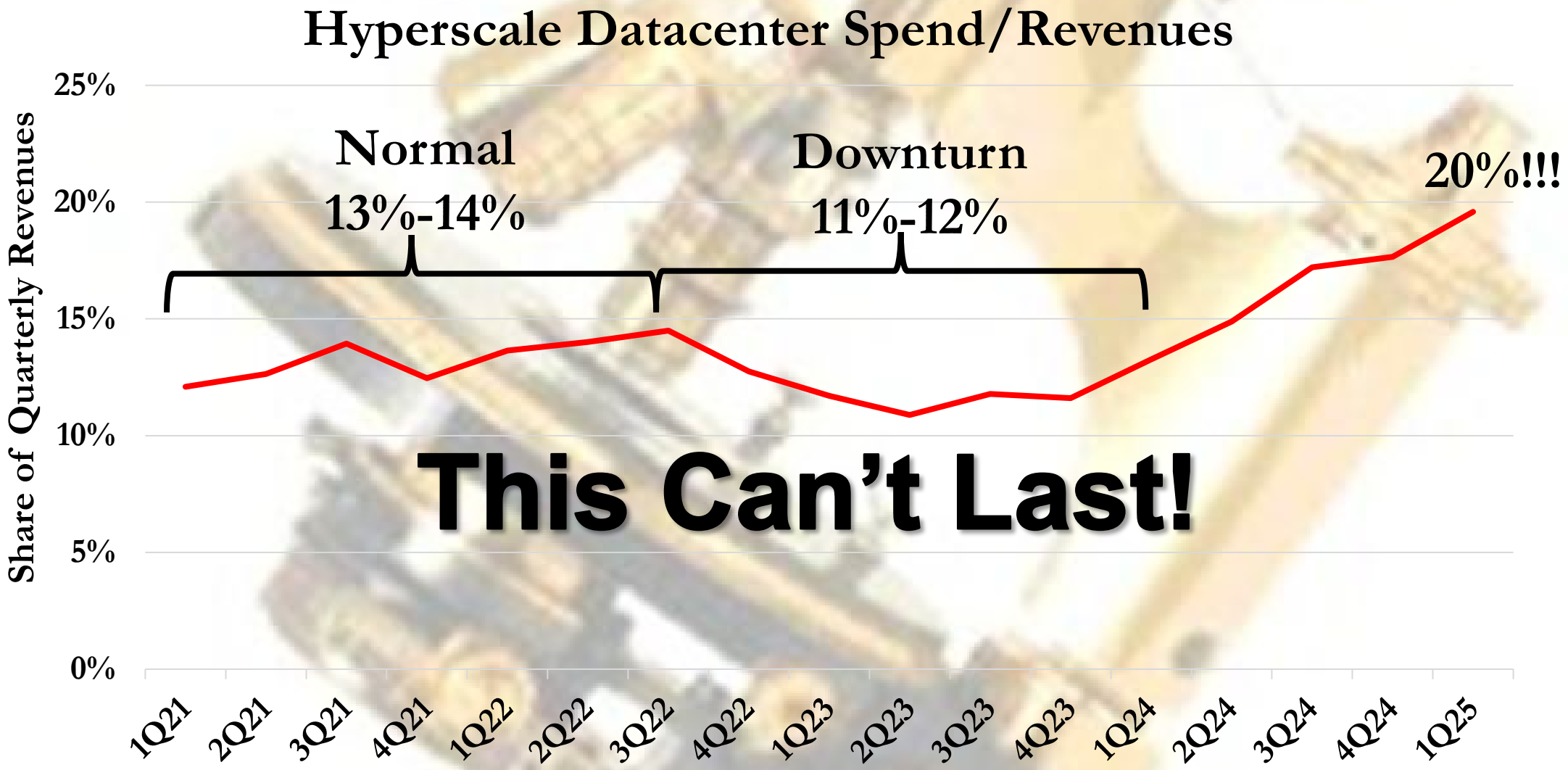
- Covers all perspectives
  - Where CXL is useful, and where it isn't
  - Demand drivers for CXL DRAM modules
  - Opportunities outside of DRAM
  - Forecast (Revenues, units, ASP)
- Available for immediate download:

Objective-Analysis.com/reports

2.

Gen-AI & Data Center Demand Growth

Hyperscaler CapEx Share of Revenues



Will HBM Rescue the DRAM Market?

New report from Objective Analysis

- Covers all perspectives
  - What is HBM and why it's so costly
  - Supply Chain – who buys it and why
  - Price dynamics: HBM vs. DRAM
  - Forecast (Revenues, units, ASP)
- Coming soon for immediate download:

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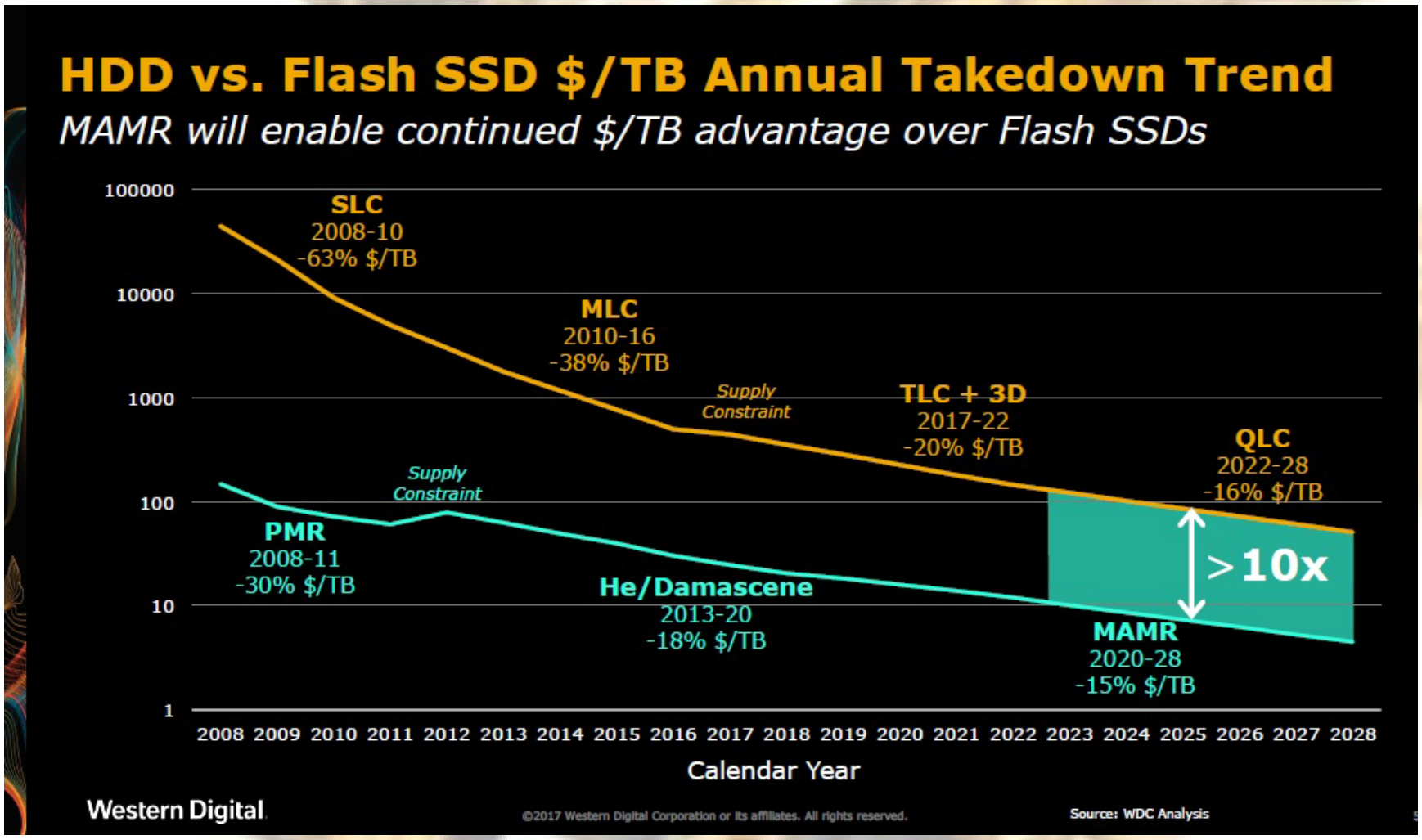
3.

Performance = TCO

4.

HDD & SSD

HDD & SSD Will Coexist



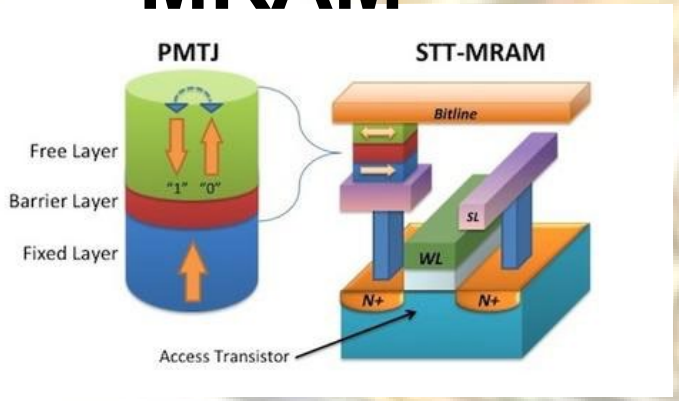
Source: Western Digital Corp., 2017 (Used with Permission)

5.

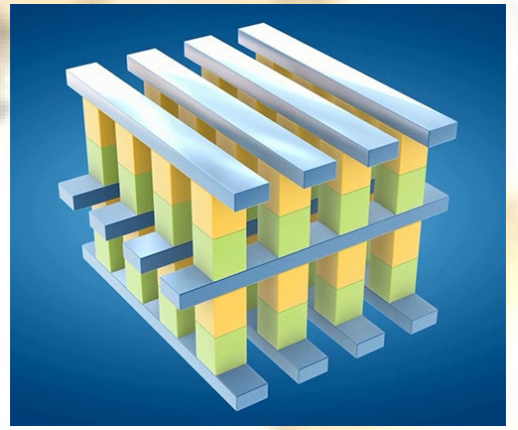
Emerging Semiconductor Technologies

Persistent Memories are Coming

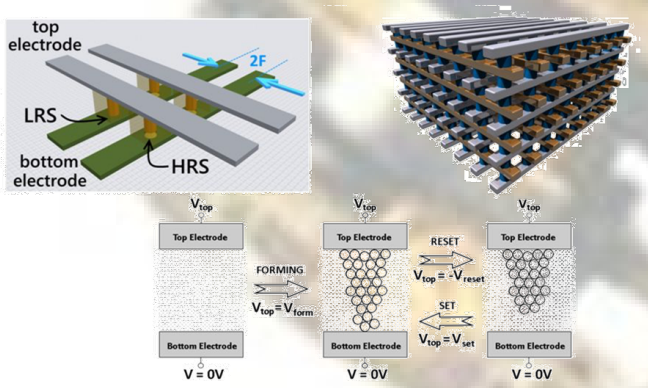
MRAM



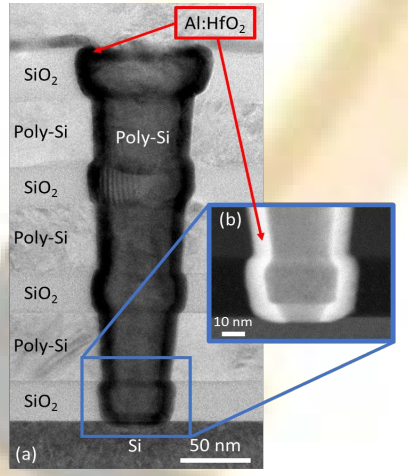
PCM



ReRAM



FRAM



Report: A Deep Look at New Memories

OBJECTIVE ANALYSIS
Semiconductor Market Research

Coughlin Associates

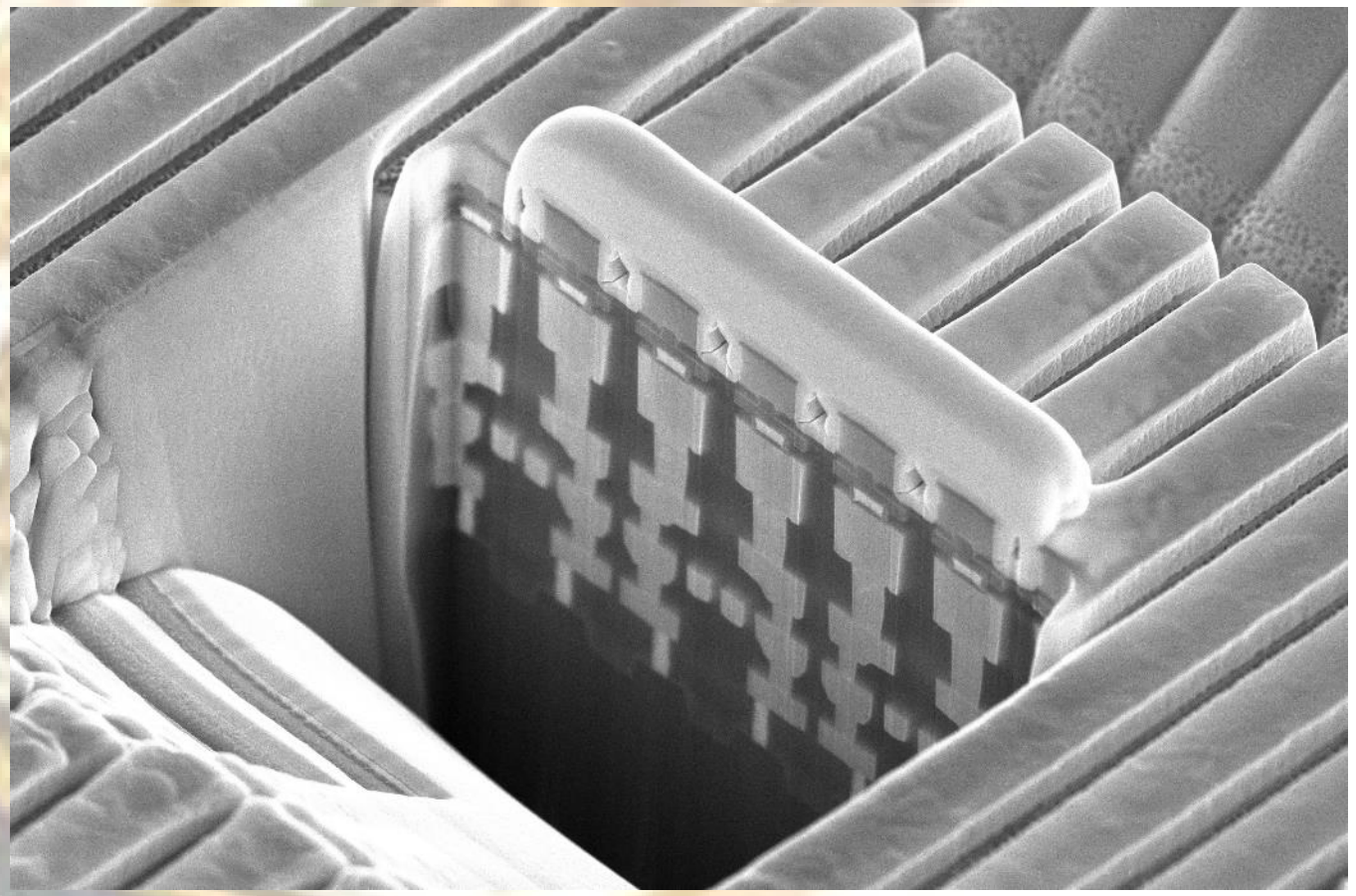


Photo courtesy of CEA Leti, 2023

Now Available! https://Objective-Analysis.com/reports/#Emerging
http://www.TomCoughlin.com/techpapers.htm

Other New Semi Technologies

- Chiplets/Packaging
- Silicon Lasers
- Backside Power
- EUV
- RibbonFET
- AI floor planning

6.

The Rise of Enterprise SSDs

Enterprise SSD Formats

Old Way

New Ways

SATA

E1.L "Ruler"

AI-Specific SSD

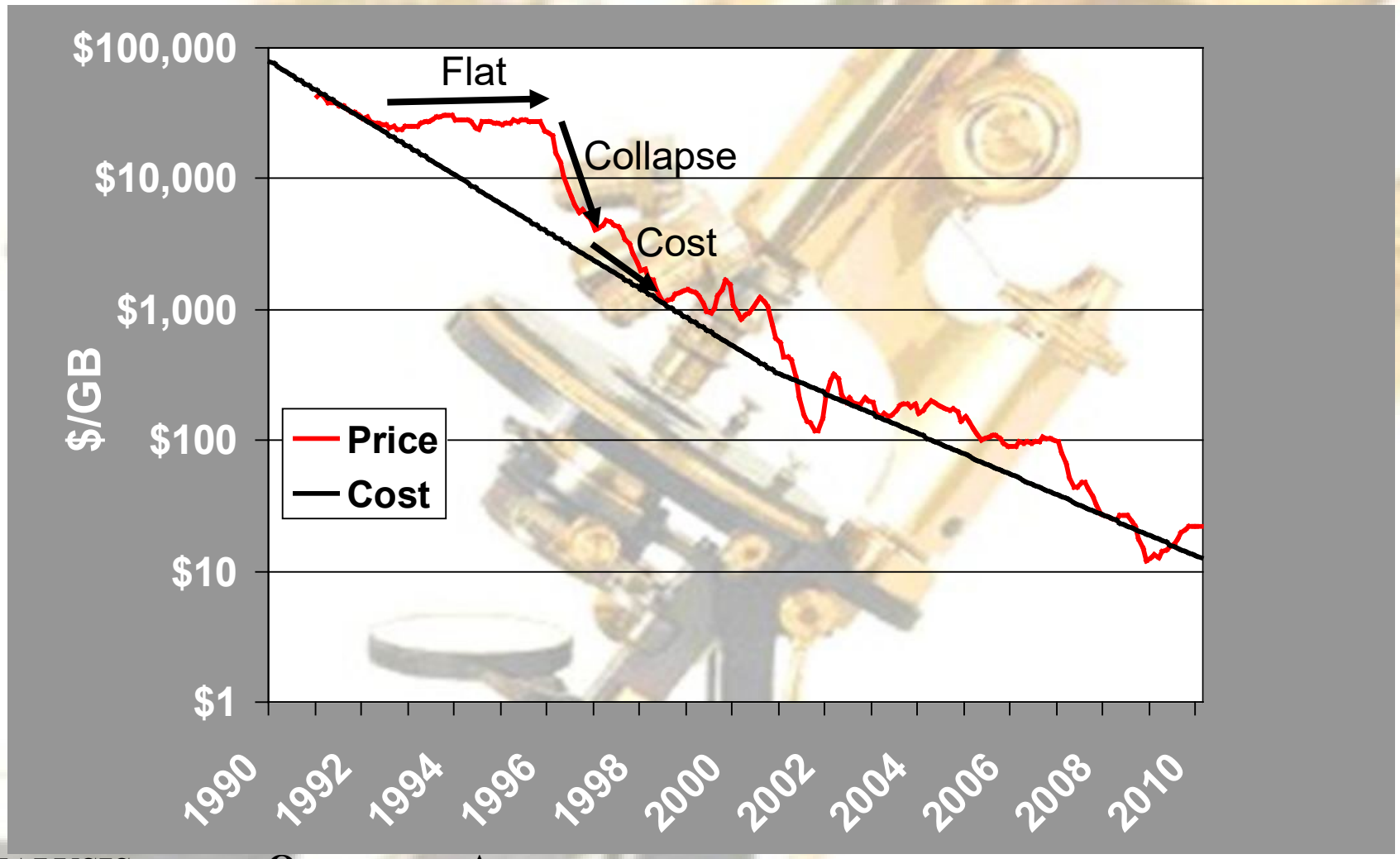
CXL "MS-SSD"

Water-Cooled SSD

7.

DRAM and NAND Dynamics

Memory Price Dynamic

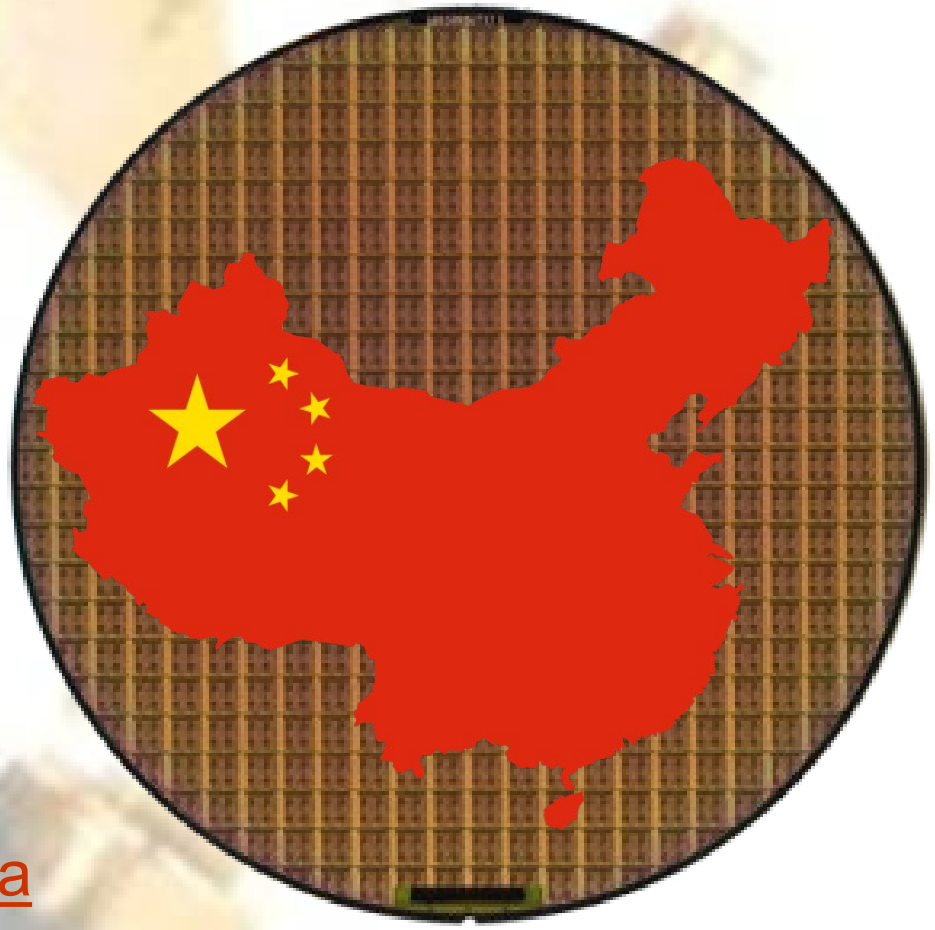


8.

Global Economic & Strategic Factors

Biggest Issue: US vs. China

- China's semiconductor priorities:
  - Participate in proportion to their size
  - Achieve a better trade balance
- US' concerns:
  - Loss of AI leadership
  - Loss of semiconductor leadership
  - China's different perspective on IP
- Report: "***China's Memory Ambitions***"
  - Available for immediate download: https://Objective-Analysis.com/reports/#China



9.

Will Memories use Foundries?

Similarities & Differences

Foundries

- CMOS logic processes
- High mix, lower volumes
- Focus on throughput
- Broad process offering
- Profit-driven business
- Processes silicon wafers

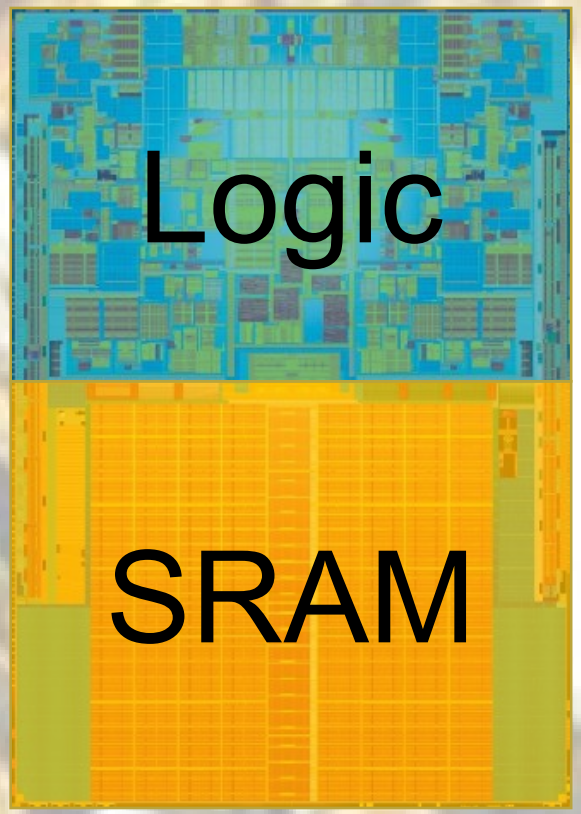
DRAM & NAND

- Memory processes
- Low mix, high volume
- Focus on cost (obsession)
- Fewest-possible processes
- Cost-driven business
- Processes silicon wafers

10.

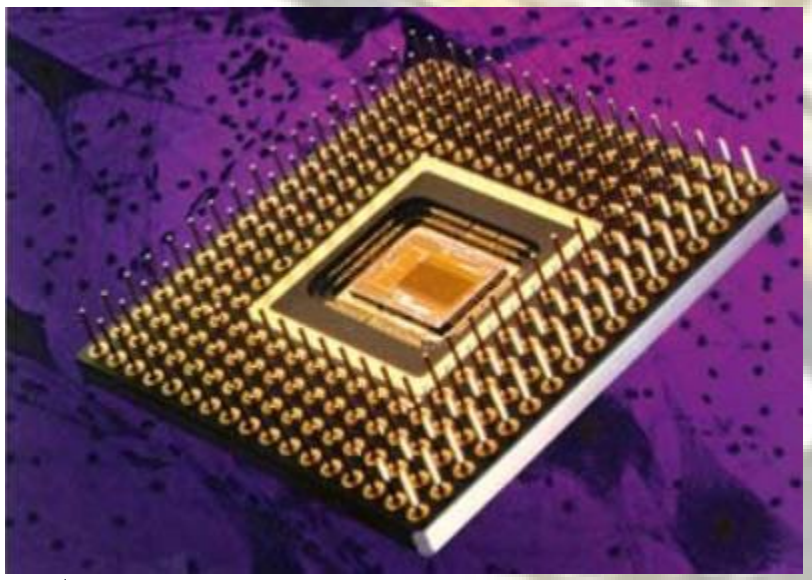
PIM Opportunities & Challenges

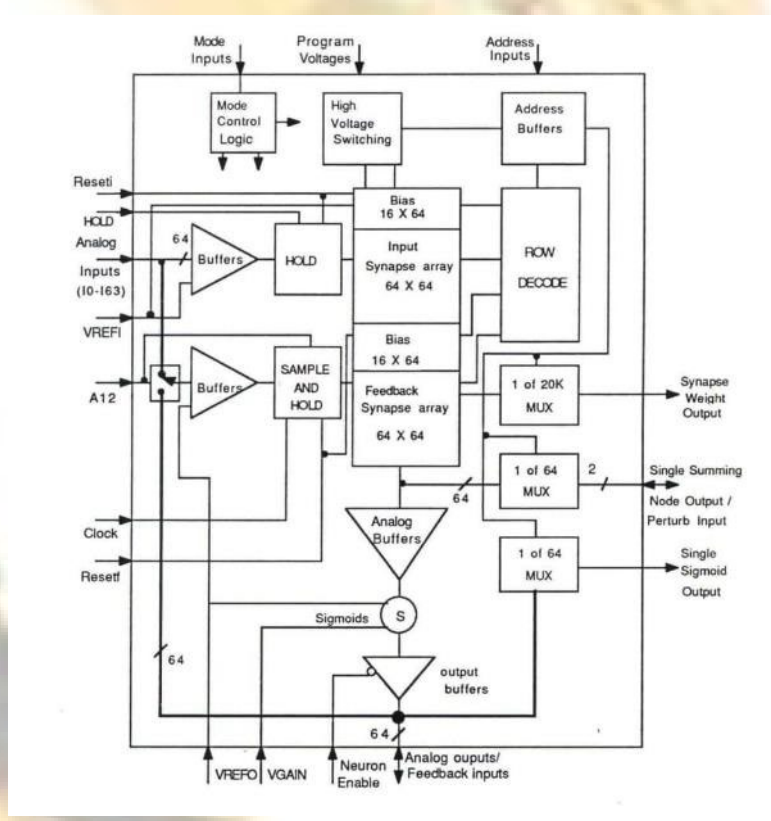
Processor in Memory, or Memory in Processor?



Neural Networks Are *Not* New!

- Intel's 80170NX ETANN
  - Electrically-Trainable Analog Neural Network
- Introduced in 1989
- Not a commercial success

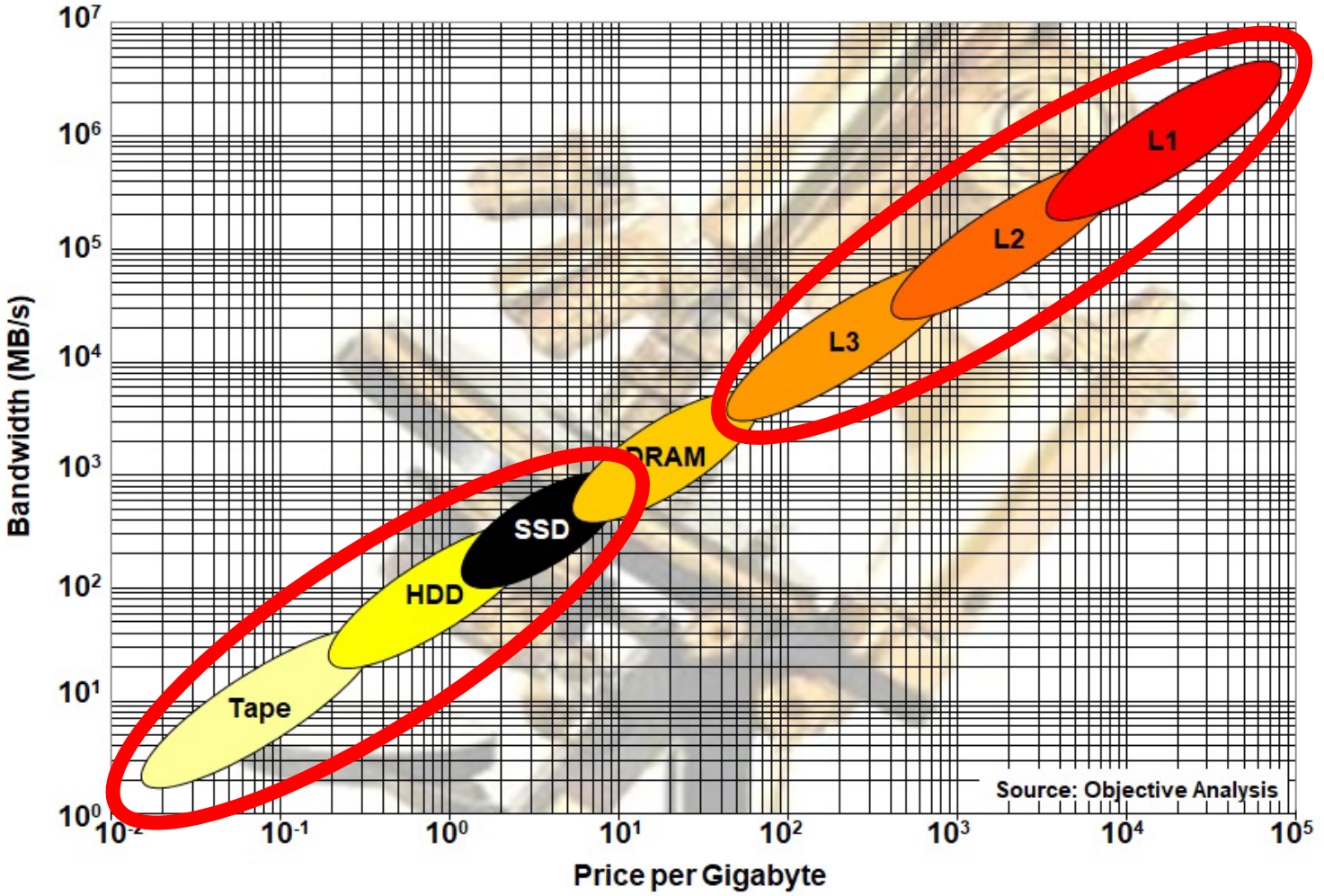




11.

Tech & Market Changes in Storage & Memory

The Biggest Change? Memory *Becomes* Storage!



I Covered Them All!

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