Understanding the Intel/Micron 3D XPoint Memory

Jim Handy
Objective Analysis

Agenda

□ What Is It?

□ Why Is This Happening?

□ Who Wants It?

□ Is The World Ready For It?
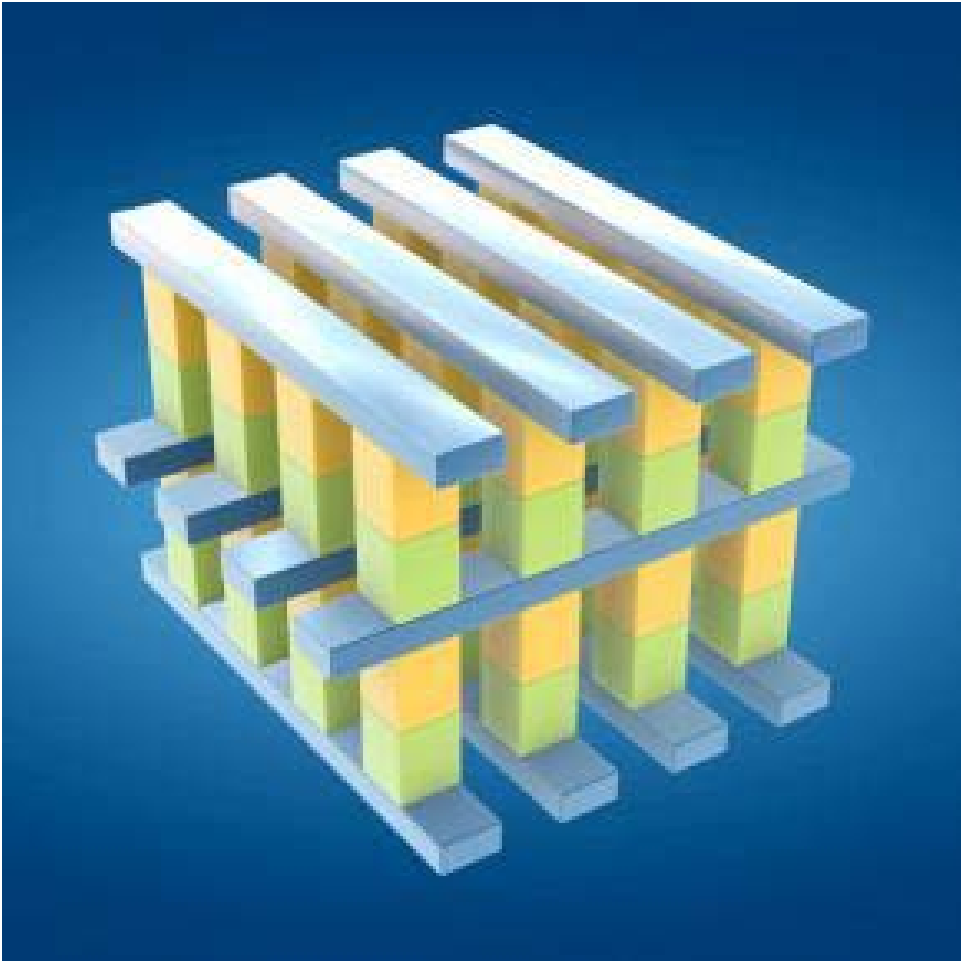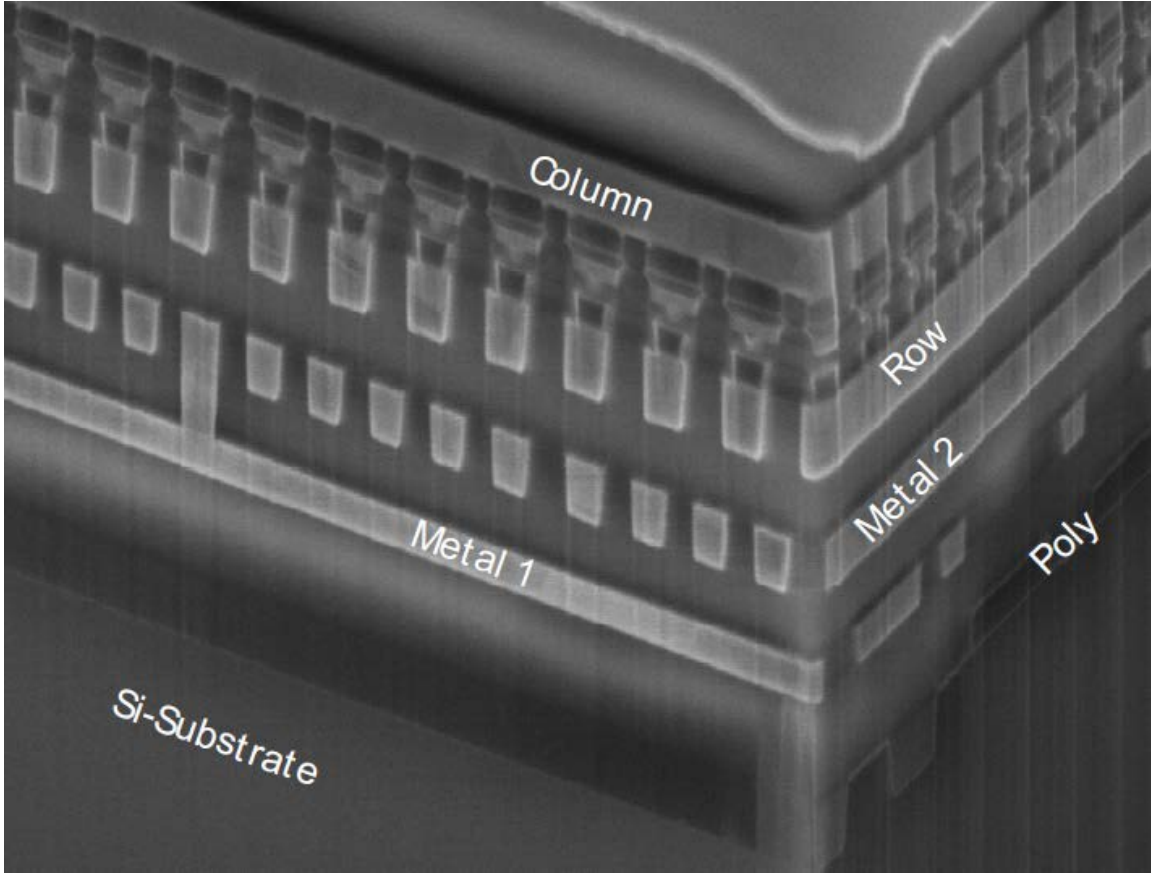
□ Why Should I Care?

□ When Will This Happen?

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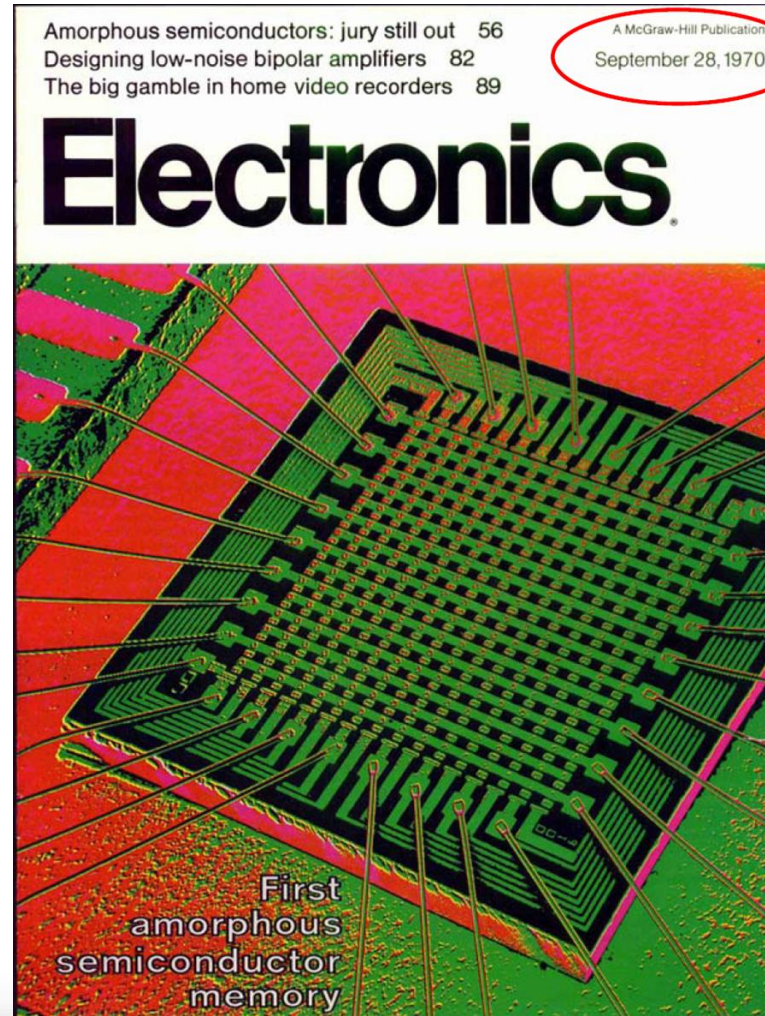
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3D XPoint Concept

The Real Thing

Intel Has Researched PCM For 45 Years!

Amorphous semiconductors: jury still out 56
Designing low-noise bipolar amplifiers 82
The big gamble in home video recorders 89

A McGraw-Hill Publication
September 28, 1970

Electronics.

First
amorphous
semiconductor
memory

SDC 15

How Many Ways Have Been Tried?

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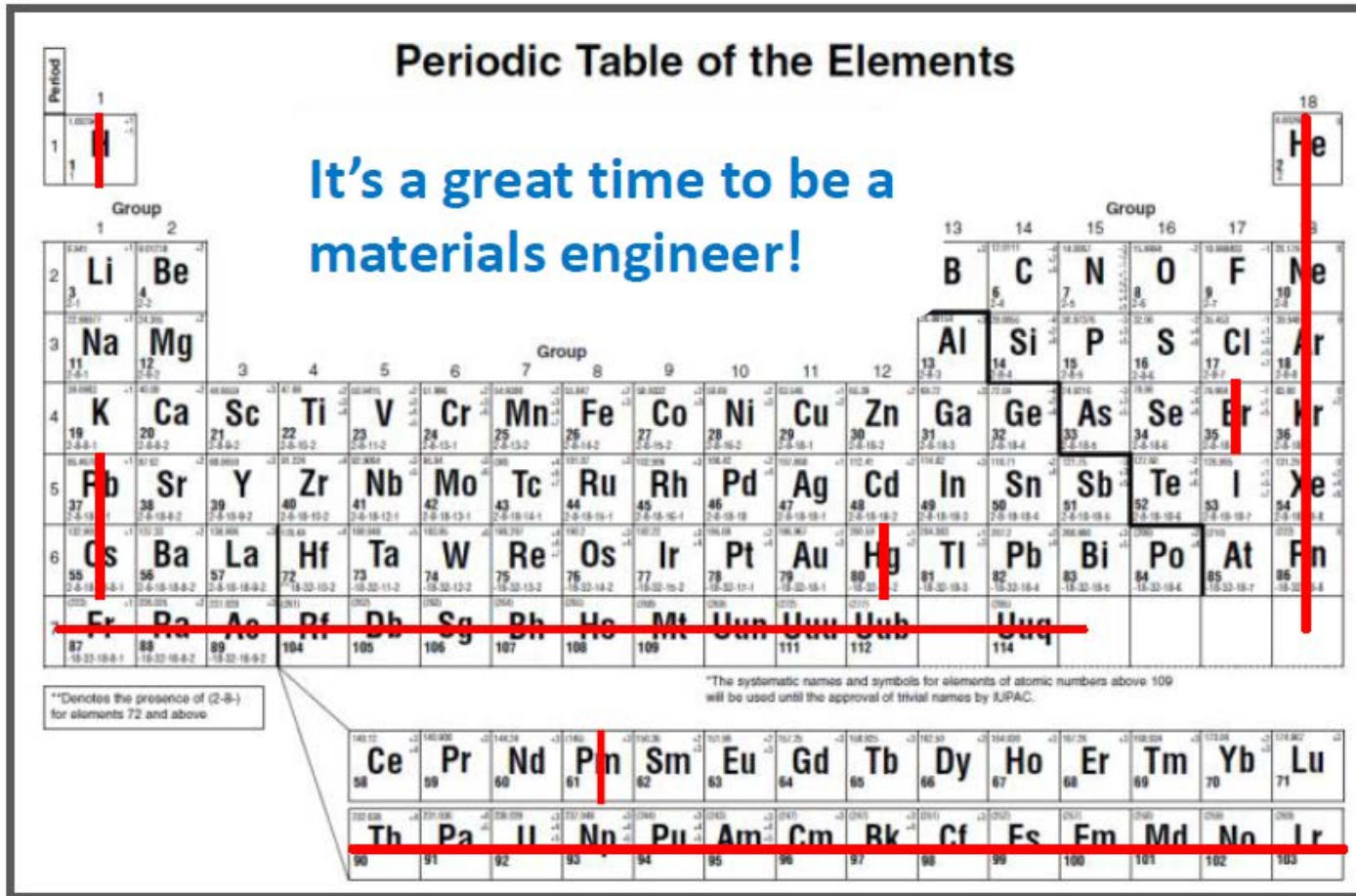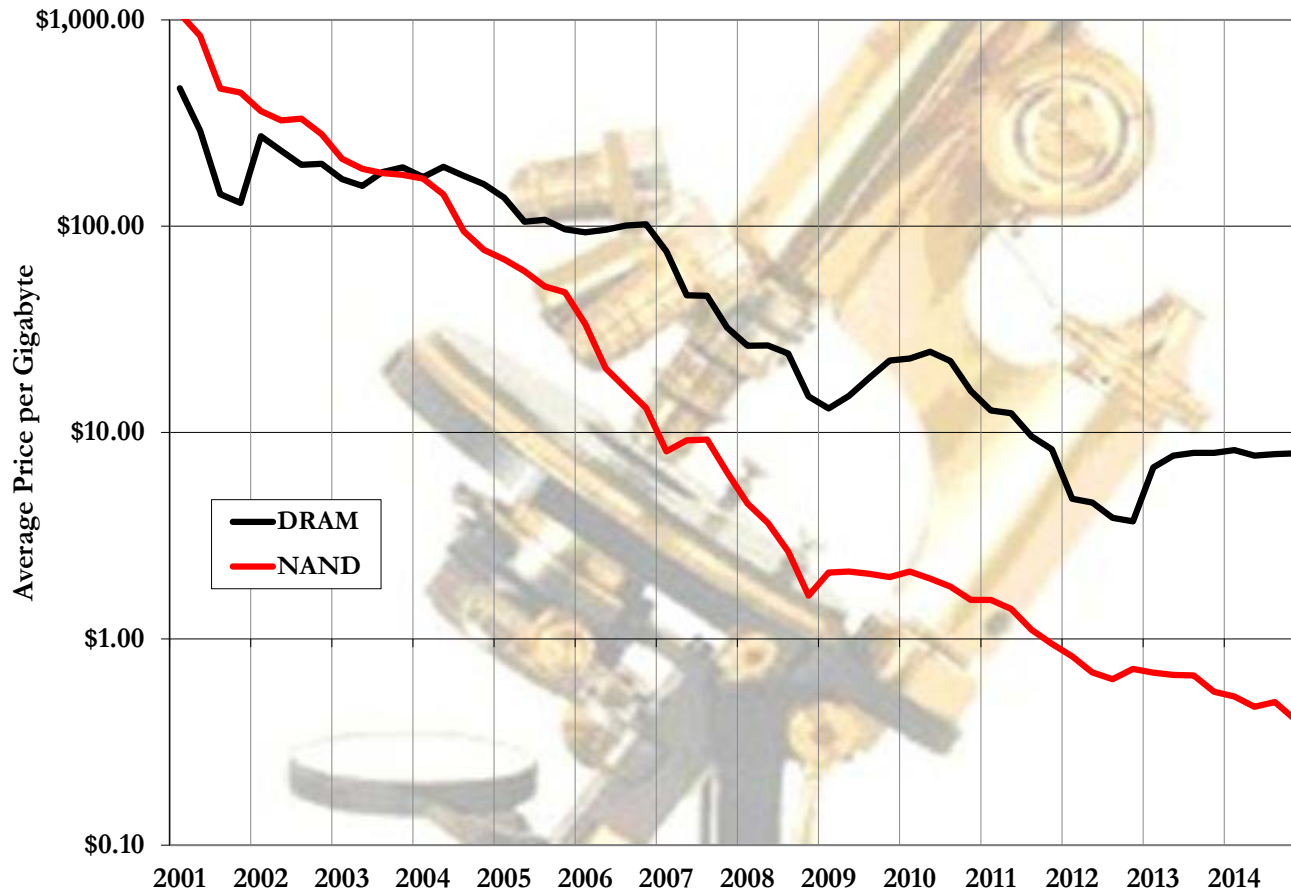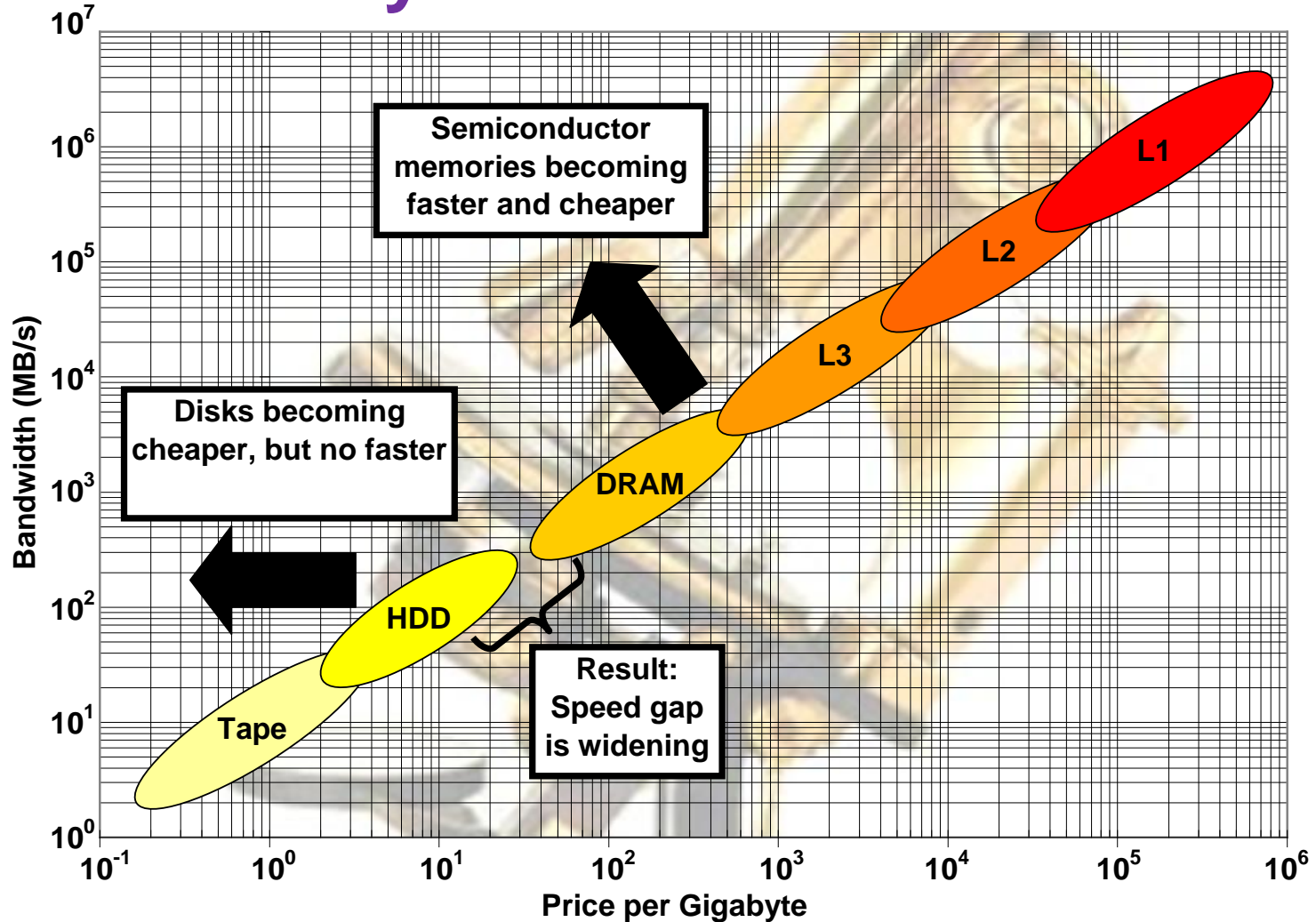# NAND Laid The Path To Increased Hierarchy Levels

Source: *A Close Look at the Intel/Micron 3D XPoint Memory*, Objective Analysis 2015

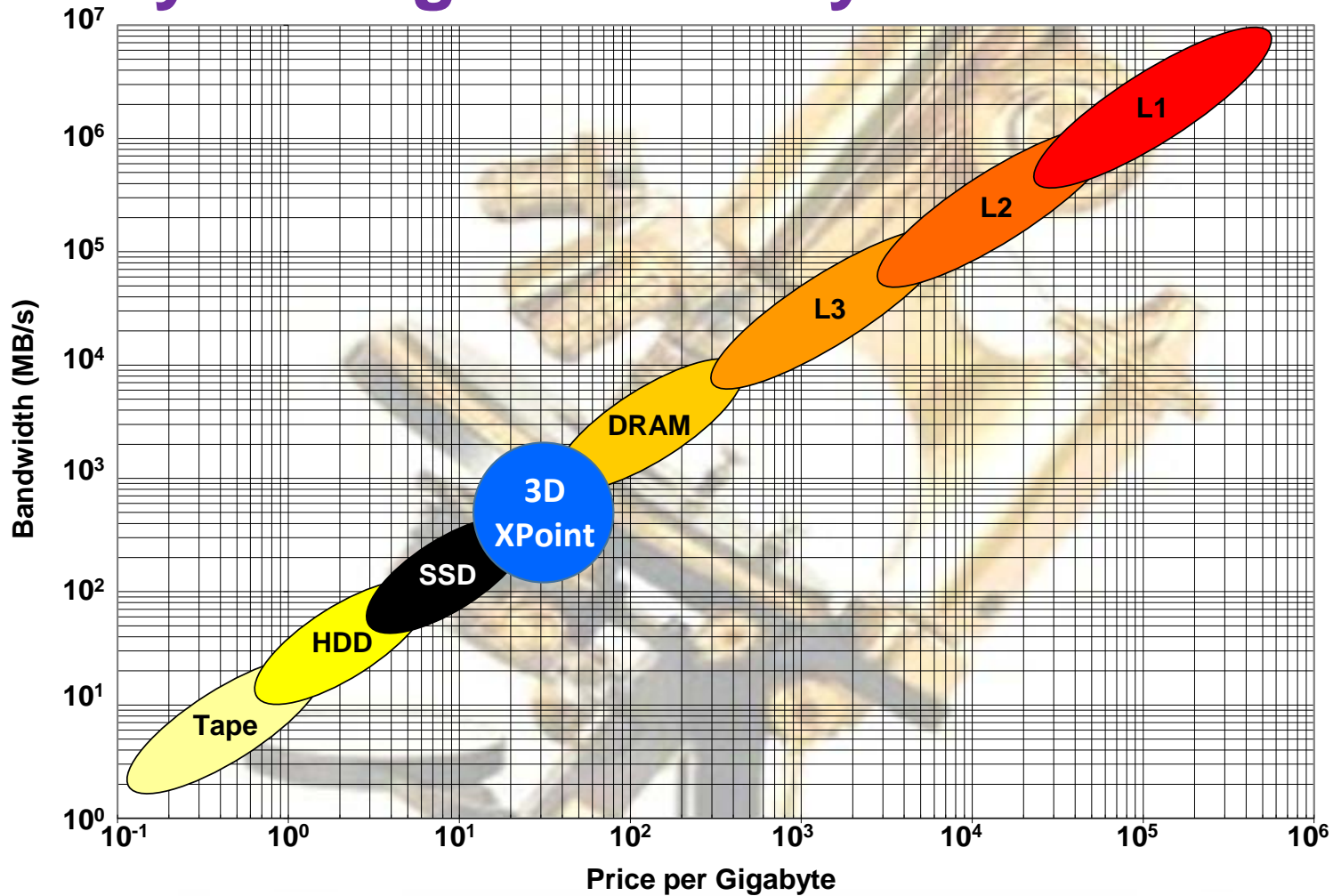# Ratio of DRAM-NAND Prices

Source: *A Close Look at the Intel/Micron 3D XPoint Memory*, Objective Analysis 2015

Why This? Why Now?

Source: *A Close Look at the Intel/Micron 3D XPoint Memory*, Objective Analysis 2015

Where 3D XPoint Fits In The Memory/Storage Hierarchy
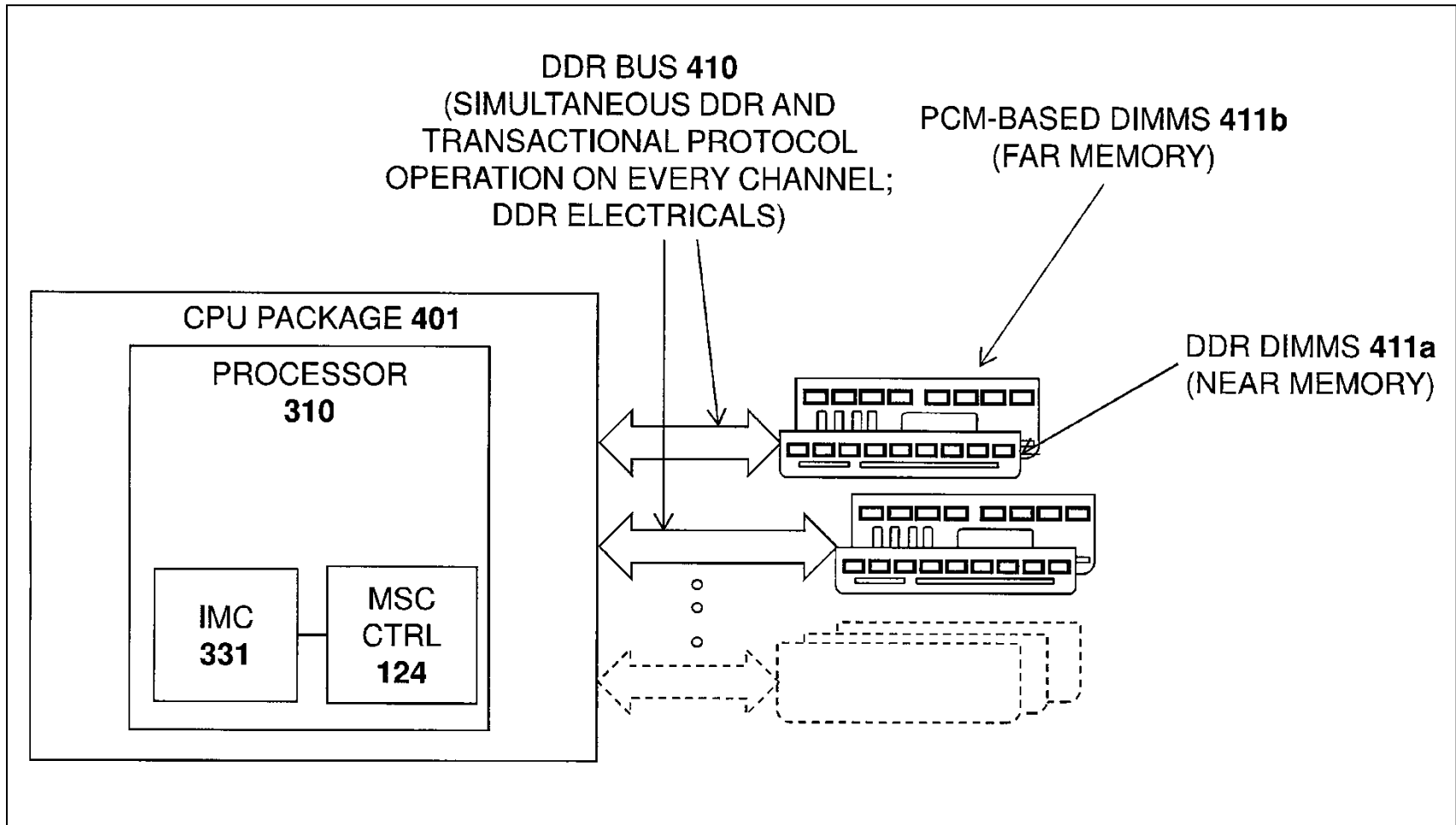

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Patents Leaked Intel's Plans

DDR BUS **410**
(SIMULTANEOUS DDR AND TRANSACTIONAL PROTOCOL OPERATION ON EVERY CHANNEL; DDR ELECTRICALS)

PCM-BASED DIMMS **411b** (FAR MEMORY)

DDR DIMMS **411a** (NEAR MEMORY)

CPU PACKAGE **401**

PROCESSOR **310**

IMC **331**

MSC CTRL **124**

How Much Does XPoint Help?

Source: Storage Technologies Group, Intel
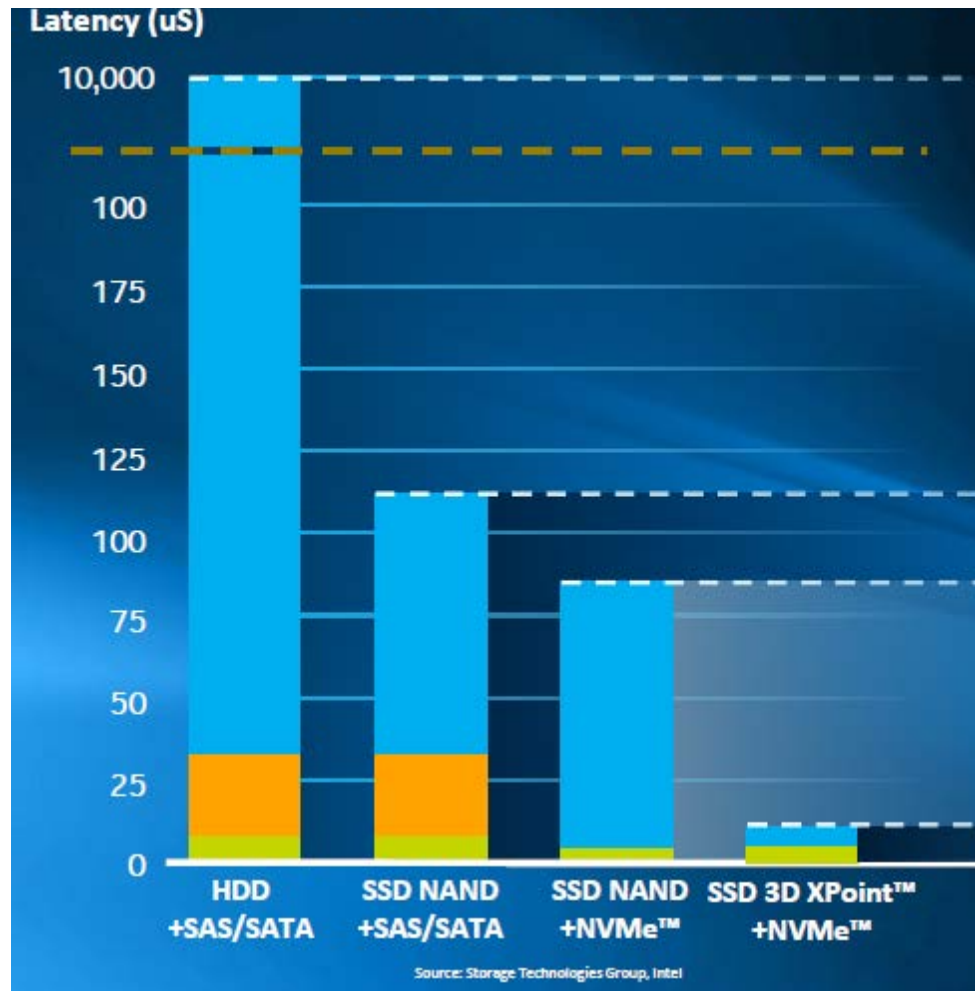
3D XPoint's Place in the Memory/Storage Hierarchy

Great Gains at Low Queue Depths

800GB SSD Read IOPs using 16GB die

4KB Read IOPS Performance vs. Concurrencies/Queue-Depth

NAND — Projected 3D XPoint™ Technology

SDC 15
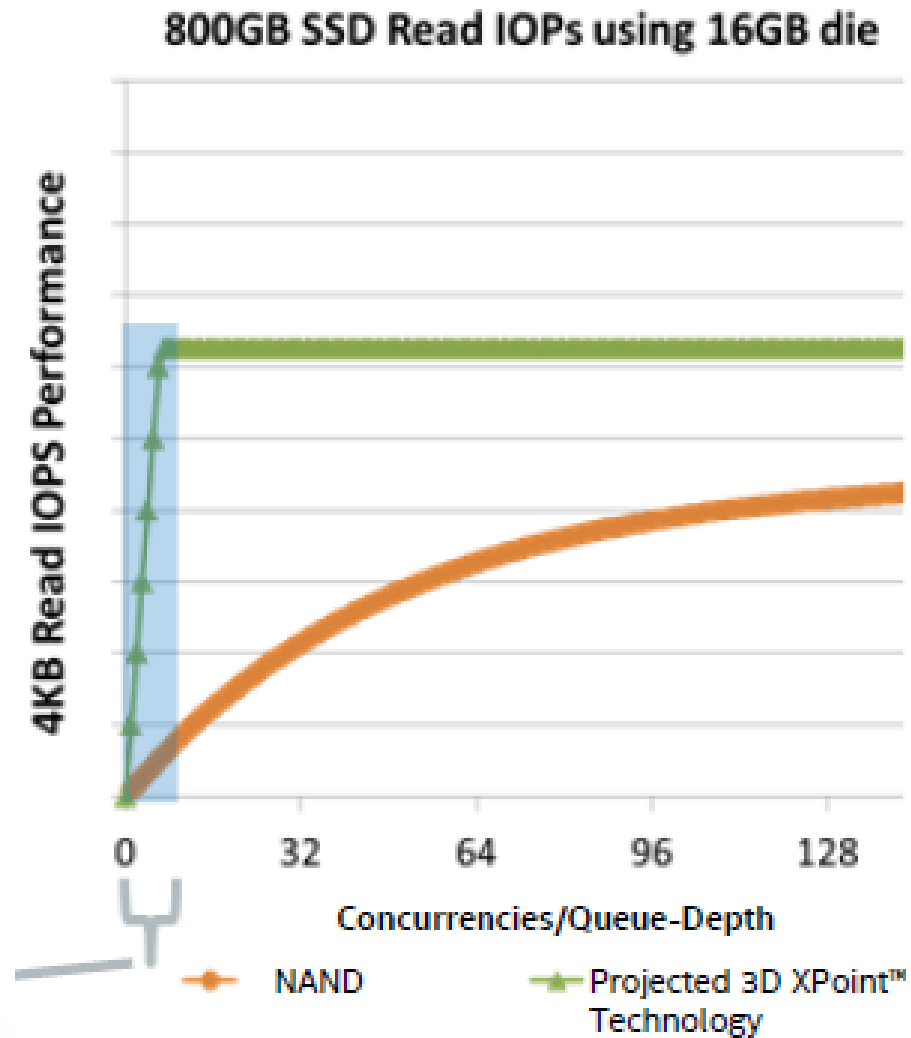
Clear, But Complex Economic Benefits
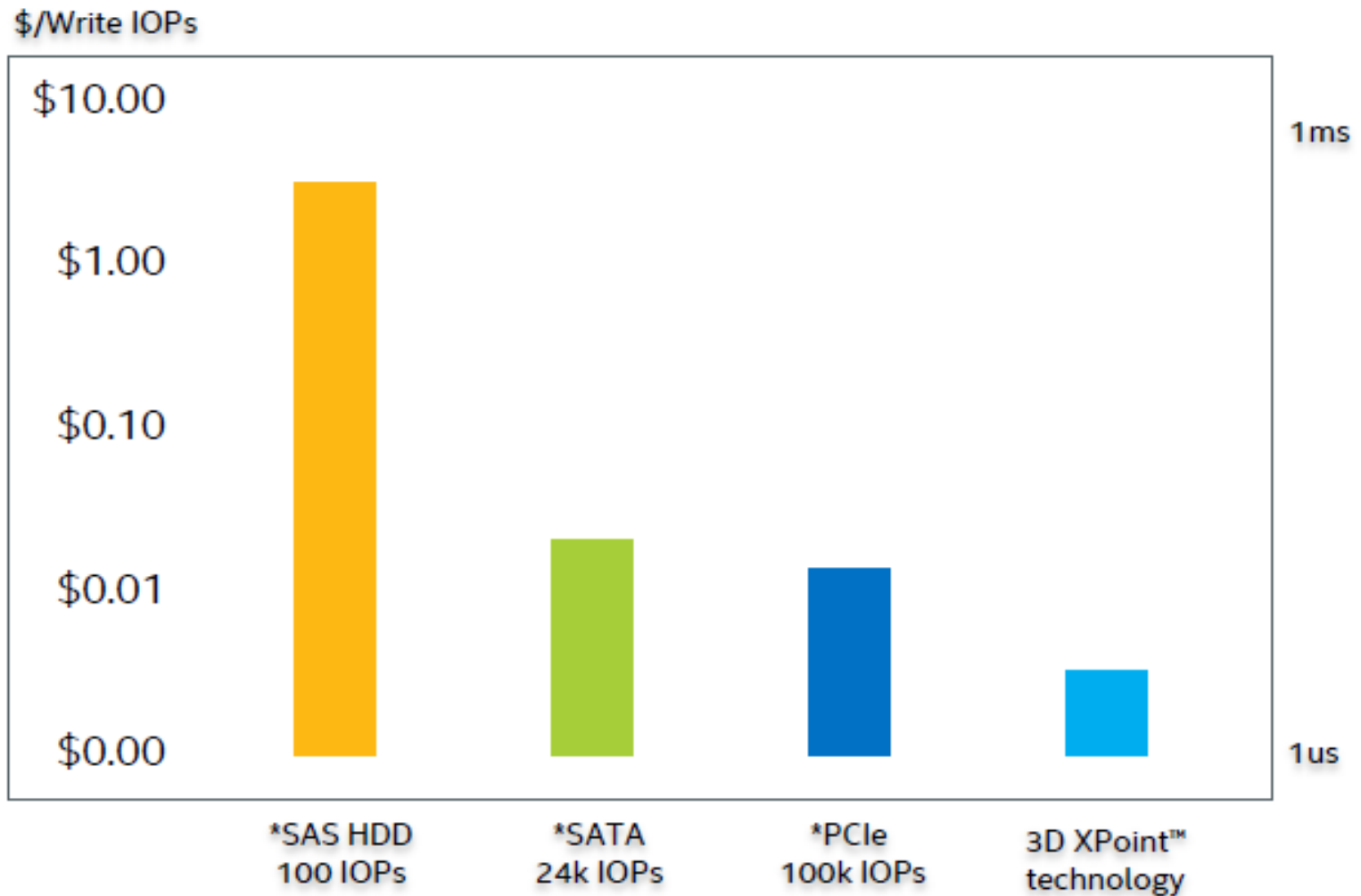
$/Write IOPs

$10.00			1ms
$1.00			
$0.10			
$0.01			
$0.00			1us

*SAS HDD 100 IOPs — *SATA 24k IOPs — *PCIe 100k IOPs — 3D XPoint™ technology

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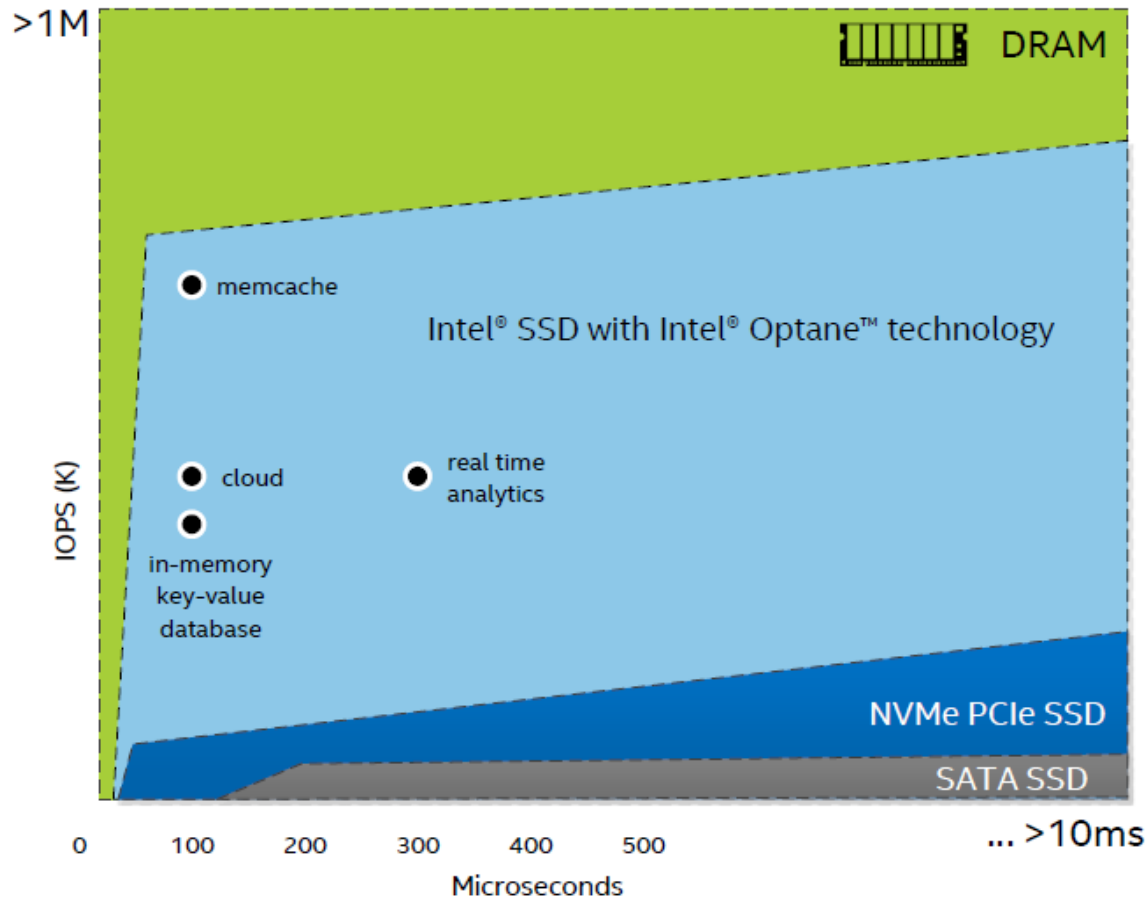- ❏ Why Should I Care?
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About That Timing…

- Timing is <u>good</u> because:
  - DRAM is running out of speed
  - NVDIMMs are catching on
  - <u>Some</u> sysadmins understand how to use flash to reduce DRAM needs

- Timing is <u>bad</u> because:
  - Nobody can make it economically
  - No software supports SCM
  - New layers take time to establish

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What 3D XPoint Means To You
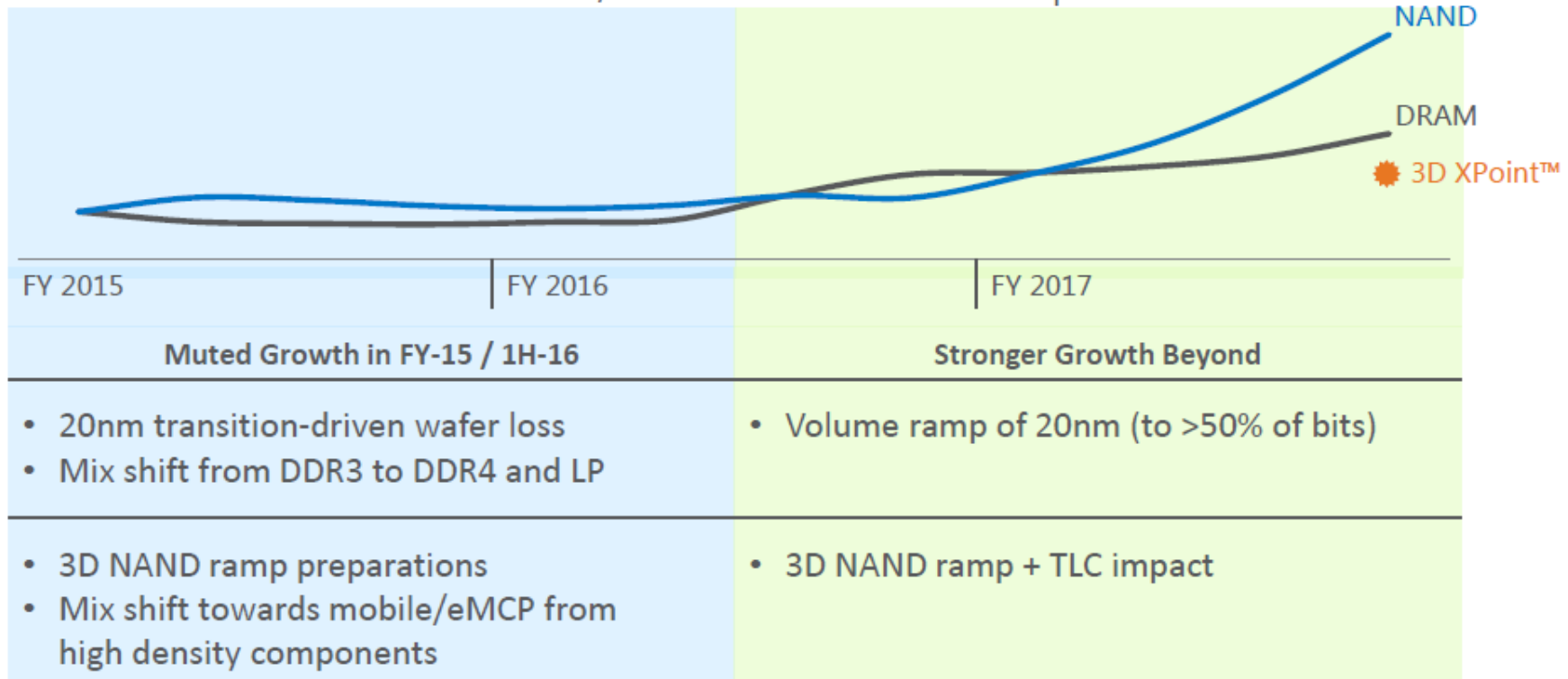
- Better cost/performance ratio
- Lower power consumption
  - Less DRAM
  - More performance per server
  - Lower OpEx
- In-memory databases start to make sense

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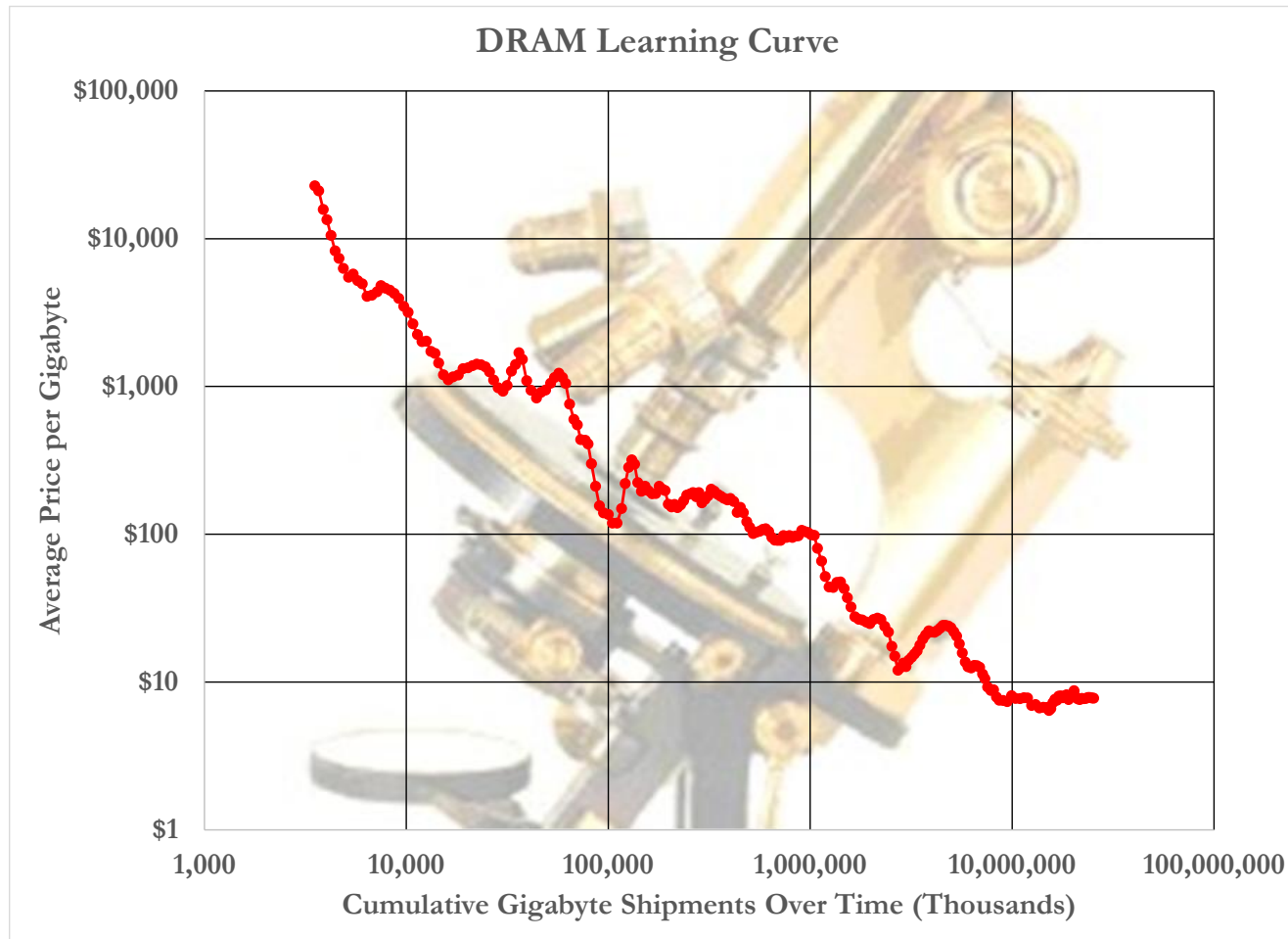
- Why Should I Care?

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When Will It Ship?

Micron DRAM / NAND Normalized Bit Output

|	Muted Growth in FY-15 / 1H-16	Stronger Growth Beyond
DRAM	• 20nm transition-driven wafer loss • Mix shift from DDR3 to DDR4 and LP	• Volume ramp of 20nm (to >50% of bits)
NAND	• 3D NAND ramp preparations • Mix shift towards mobile/eMCP from high density components	• 3D NAND ramp + TLC impact

The Issue of Learning

Source: *A Close Look at the Intel/Micron 3D XPoint Memory*, Objective Analysis 2015

Server DRAM Gigabyte Forecasts: With/Without 3D XPoint
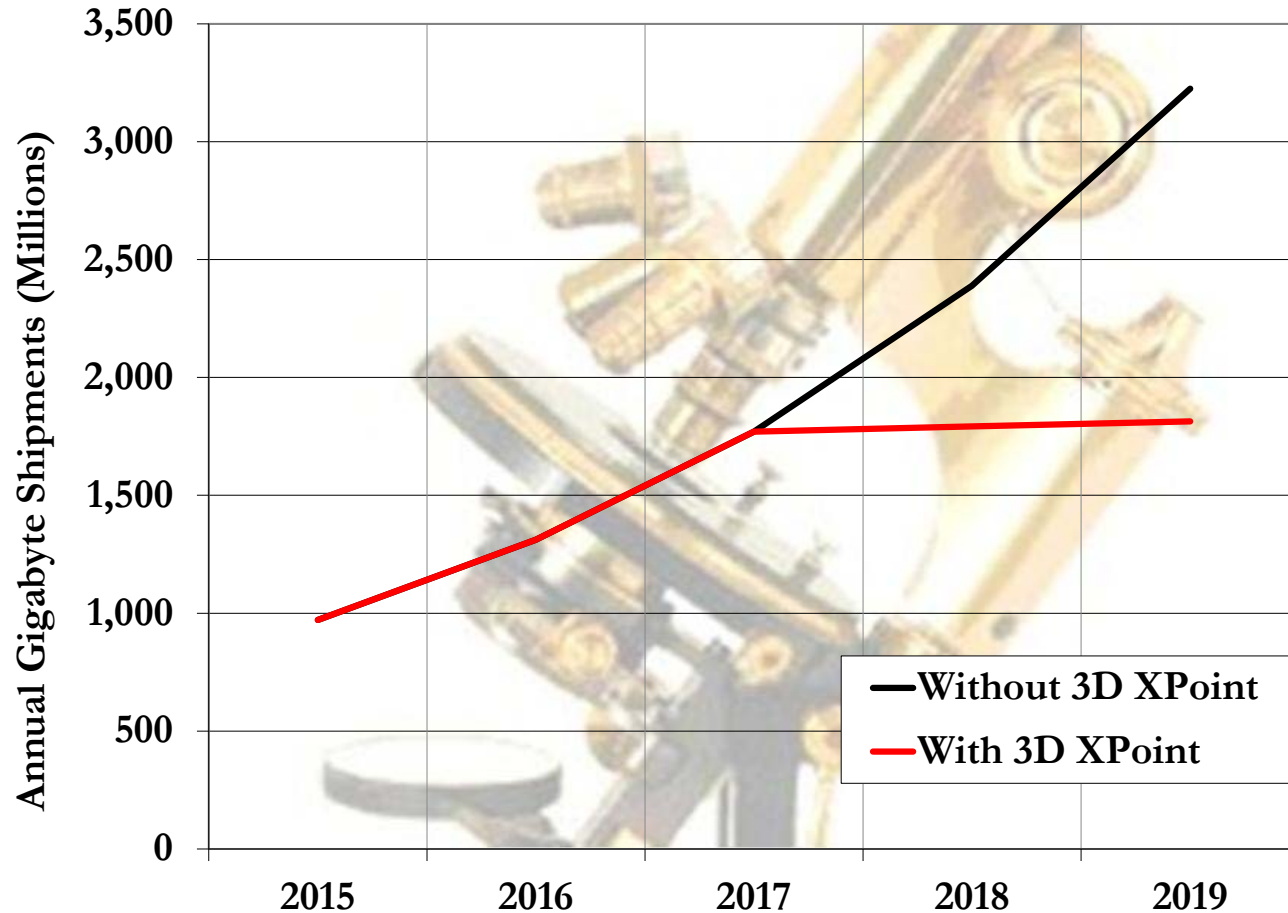
Source: *A Close Look at the Intel/Micron 3D XPoint Memory*, Objective Analysis 2015

Server DRAM Revenue Forecasts: With/Without 3D XPoint
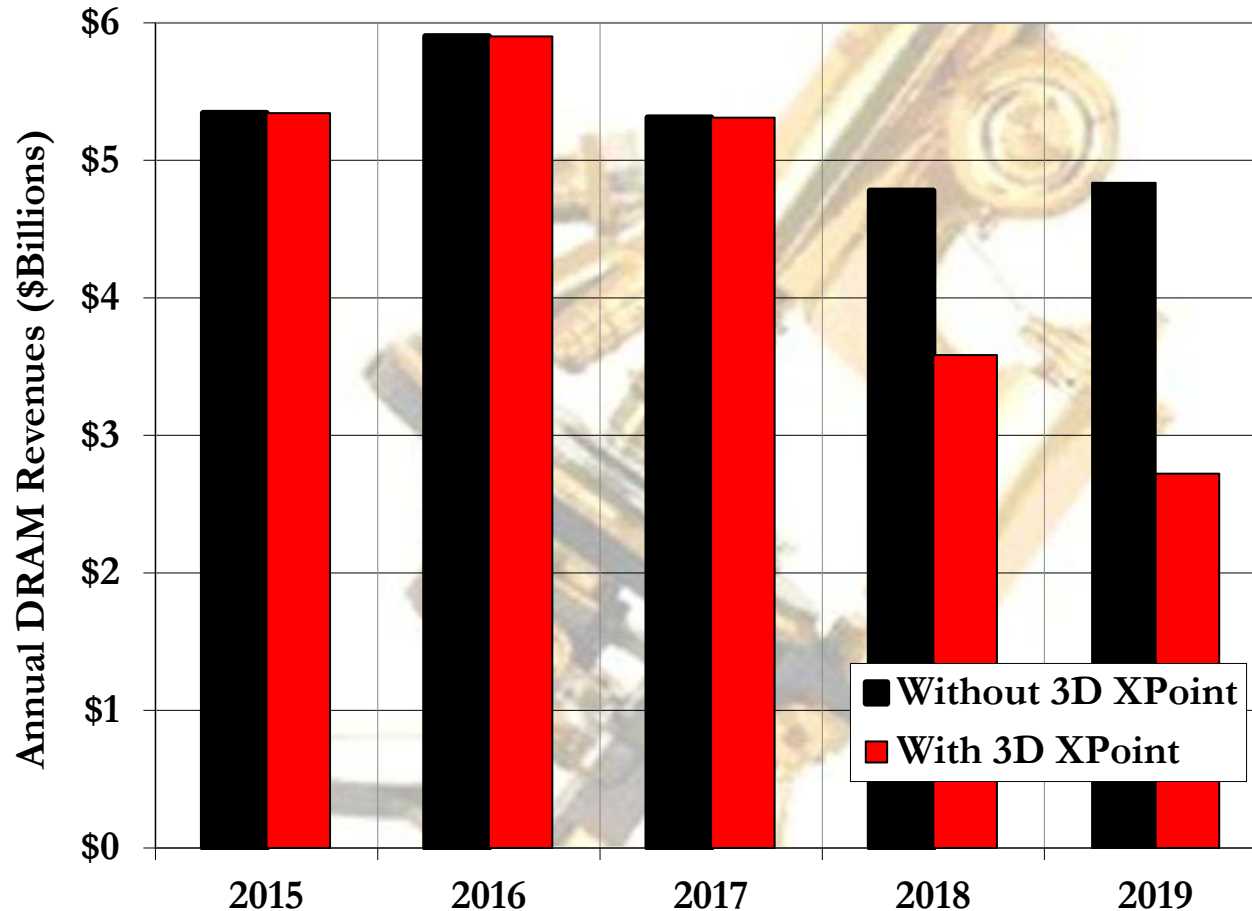
Source: *A Close Look at the Intel/Micron 3D XPoint Memory*, Objective Analysis 2015

3D XPoint Optimistic Server Revenues

Source: *A Close Look at the Intel/Micron 3D XPoint Memory*, Objective Analysis 2015

Summary

- What Is It?
    - A New, fast, cheap crosspoint memory
- Why Is This Happening?
    - The market's ready, and memory can't keep up
- Who Wants It?
    - Everyone… eventually!
- Is The World Ready For It?
    - Not yet
- Why Should I Care?
    - It has a direct impact on your systems
- When Will This Happen?
    - Launch, 2016. Big impact, much later

Resources

- ***A Close Look at the Intel/Micron 3D XPoint Memory**, Objective Analysis, September 2015:*
  http://Objective-Analysis.com/Reports.html#XPoint

- ***How PC NAND Will Undermine DRAM**,* Objective Analysis, 2011:
  http://Objective-Analysis.com/Reports.html#DRAM-NAND

- Intel/Micron 3D XPoint introduction:
  http://newsroom.intel.com/docs/DOC-6713

- Intel Developer Forum (IDF) 2015 presentations:
  http://myeventagenda.com/sessions/0B9F4191-1C29-408A-8B61-65D7520025A8/7/5

- Micron Summer Analyst Day:
  http://files.shareholder.com/downloads/ABEA-45YXOQ/363551033x0x846418/07F3EDAB-8D71-4F5D-BFB9-139E9EE1AB0F/2015_Summer_Analyst_Day_Presentation_V31.pdf