

A misty mountain landscape with a large rock formation and evergreen trees. The scene is hazy, with fog or low clouds obscuring parts of the mountain and the sky. The rock formation is a prominent feature, showing vertical fissures and textures. The trees are dark green and scattered across the mountain slopes.

Is there room for everyone?

**—Mutual stimulus vs. direct
competition in digital storage for C**

Tom Coughlin

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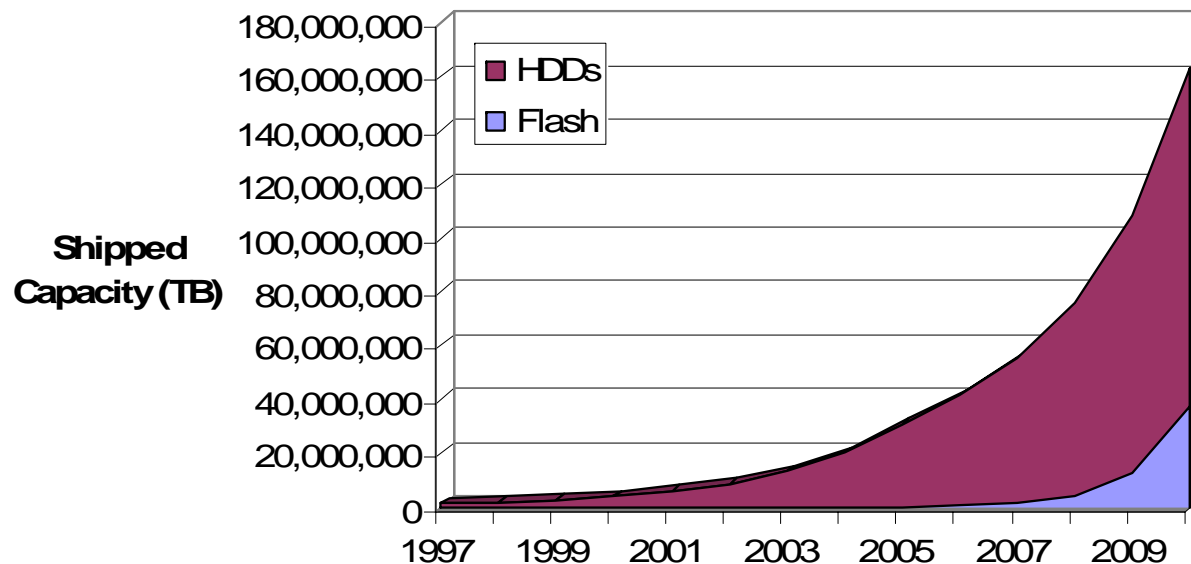
www.tomcoughlin.com

The background of the slide features a collection of various coins and tokens. There are several copper-colored coins, some with a hole in the center, and several silver-colored coins, also with holes. The coins are scattered across the slide, with some overlapping. The word "Outline" is centered at the top in a large, black, sans-serif font.

Outline

- Growth in Flash and HDD storage
- Flash vs. HDD price parity with time
- Where will flash win, where will HDDs win?
- Conclusions

Room for all!

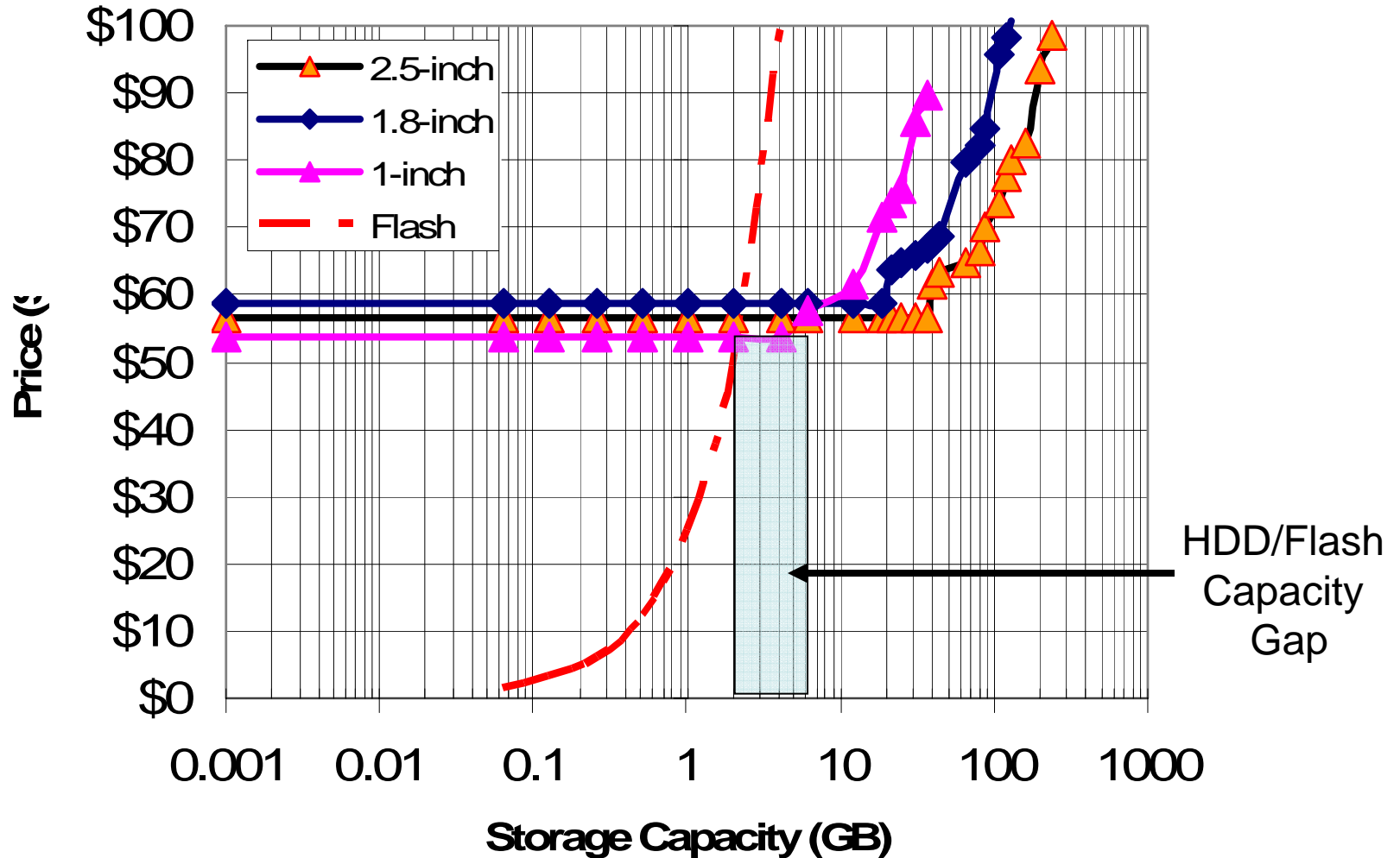


By the next decade over 1 Billion disk drives will be shipped per year.

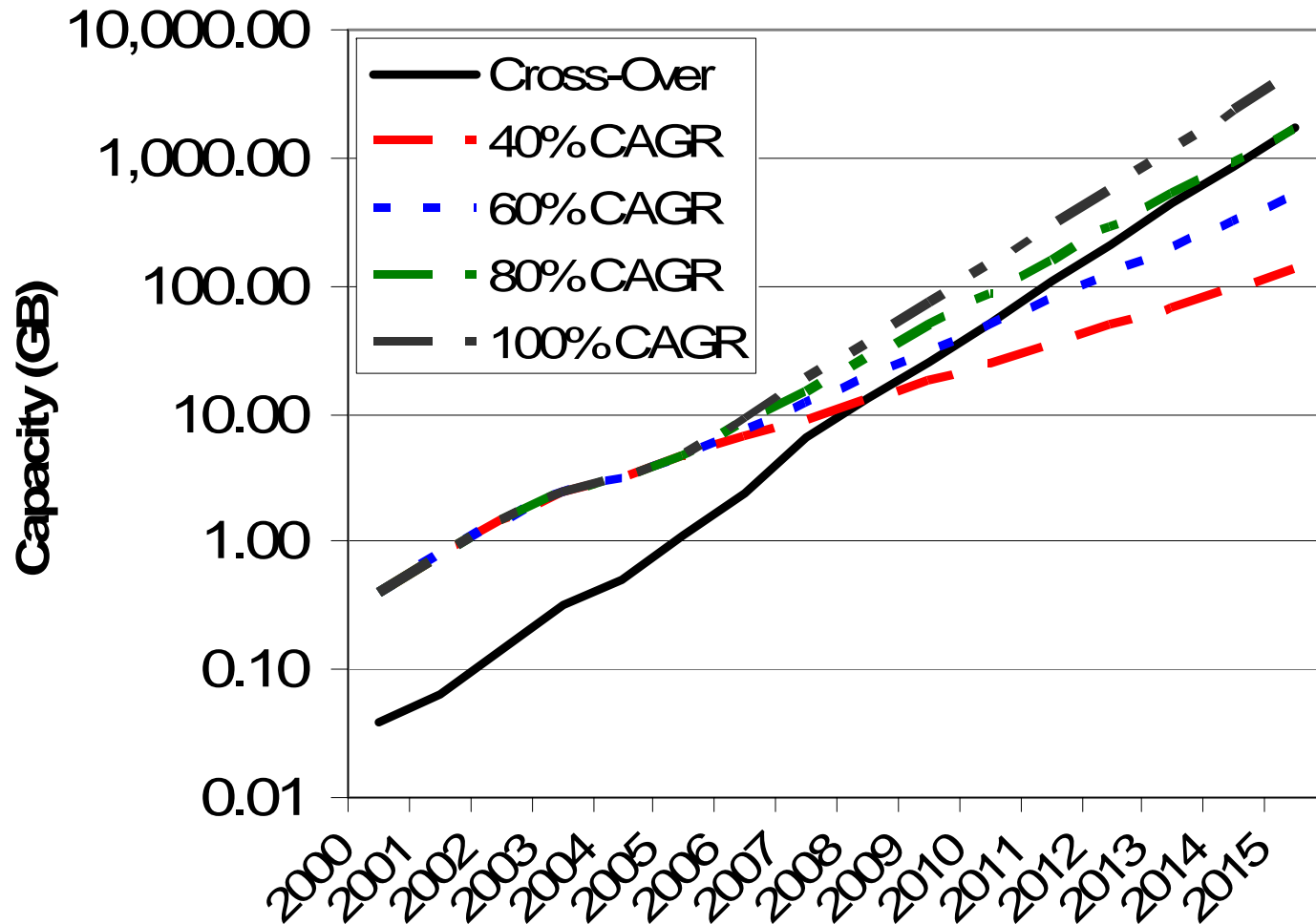
(Drive Data: Coughlin Associates, Flash Data: Objective Analysis)

- Storage in flash-based devices is usually ancillary to storage on a HDD, e.g. a computer downloads content that is then loaded on an MP3 player
- Long term accessible storage will remain on hard disk drives and hard disk drive enabled storage networks
- Having many storage choices will create multiple market niches serving multiple clients

Comparison of Price vs. Capacity of HDDs and Flash in 2006



Minimum 1-Inch Drive Capacity as a Function of Areal Density CAGR and Flash vs. HDD Cross-Over Price Point vs. Time

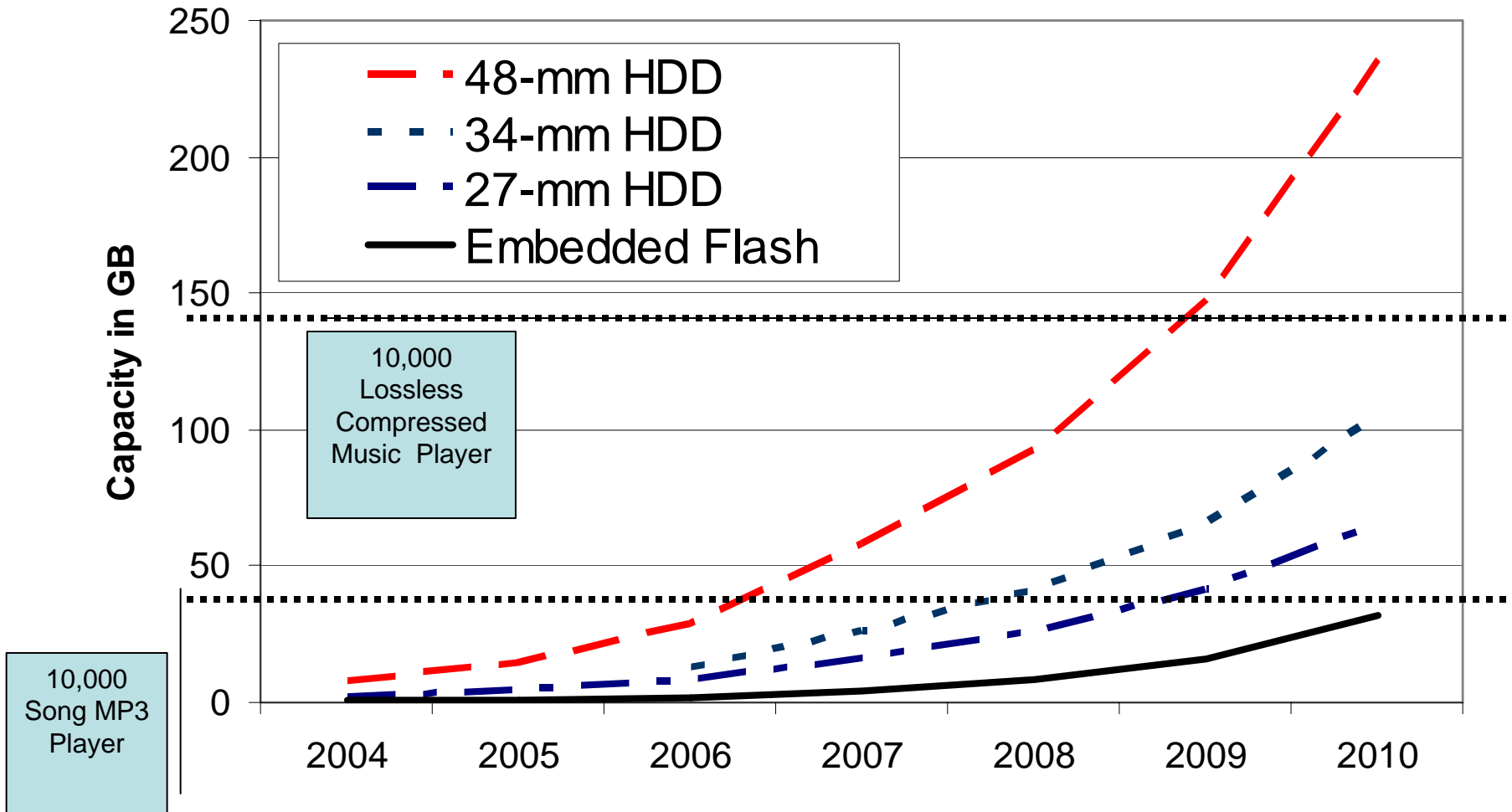


Higher Resolution Mobile Device Storage Needs (HDD's Still Have a Role)

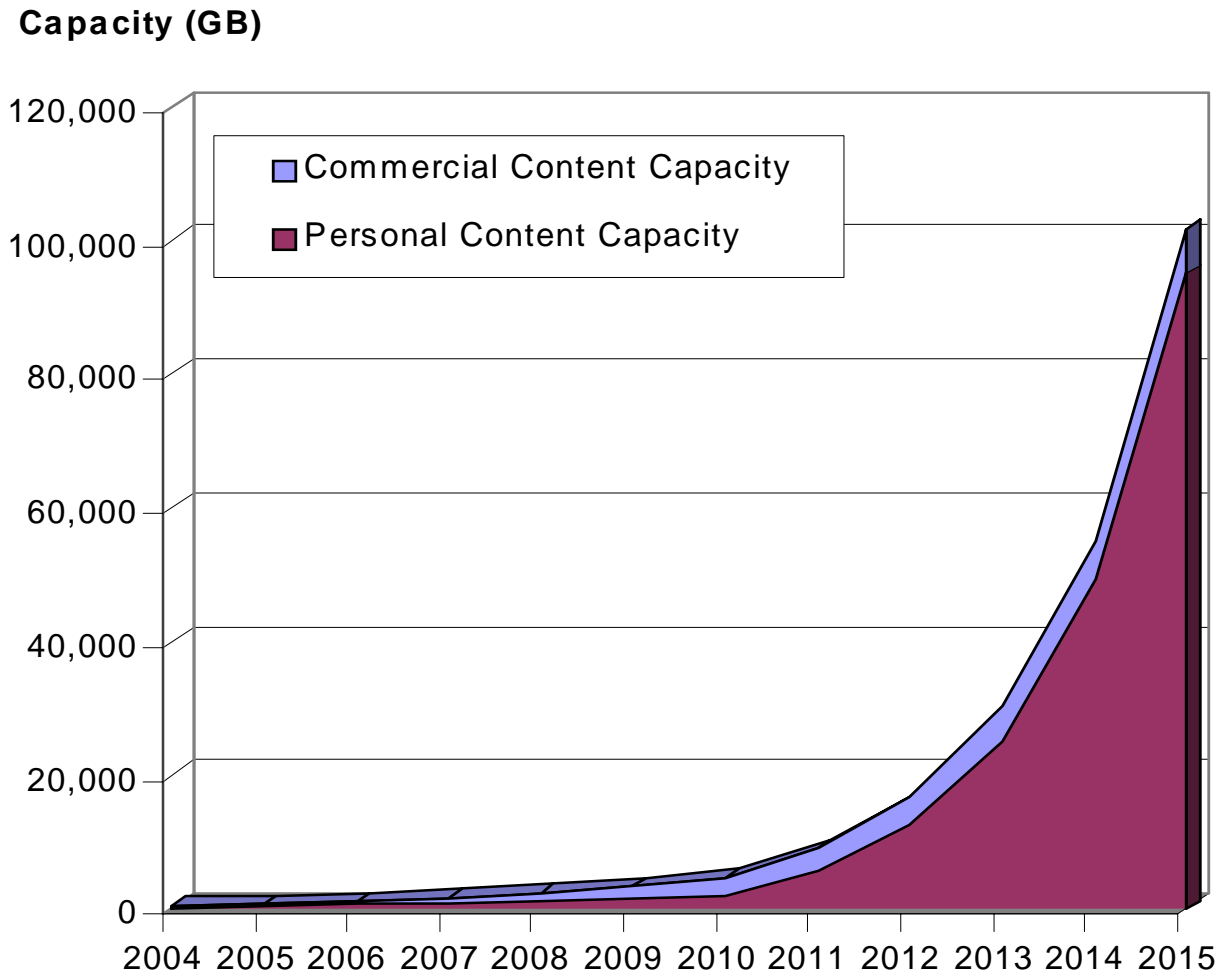
- A pure 4-MPixel photo viewer with 20,000 maximum images has 20 GB
- A combination camera and photo viewer with 8 MPixel Resolution and 20,000 images has 40 GB
- A 10,000 song MP3 player has 40 GB
- A 10,000 song loss-less compression player has 140 GB
- A 10,000 CD quality song player has 280 GB
- A 100 movie player at VGA resolution has 70 GB
- A 100 movie player at DVD resolution has 417 GB

- A combination 20k 4-Mpixel photo, 10k MP3 song, 100 VGA movie player has 130 GB
- A combination 20k 8-Mpixel photo, 10k loss-less compressed song, 100 DVD movie player has 597 GB

1 Disk/2 Head Capacity vs. HDD Form Factor (50% A.D. CAGR) and Flash Memory for ~\$55 OEM



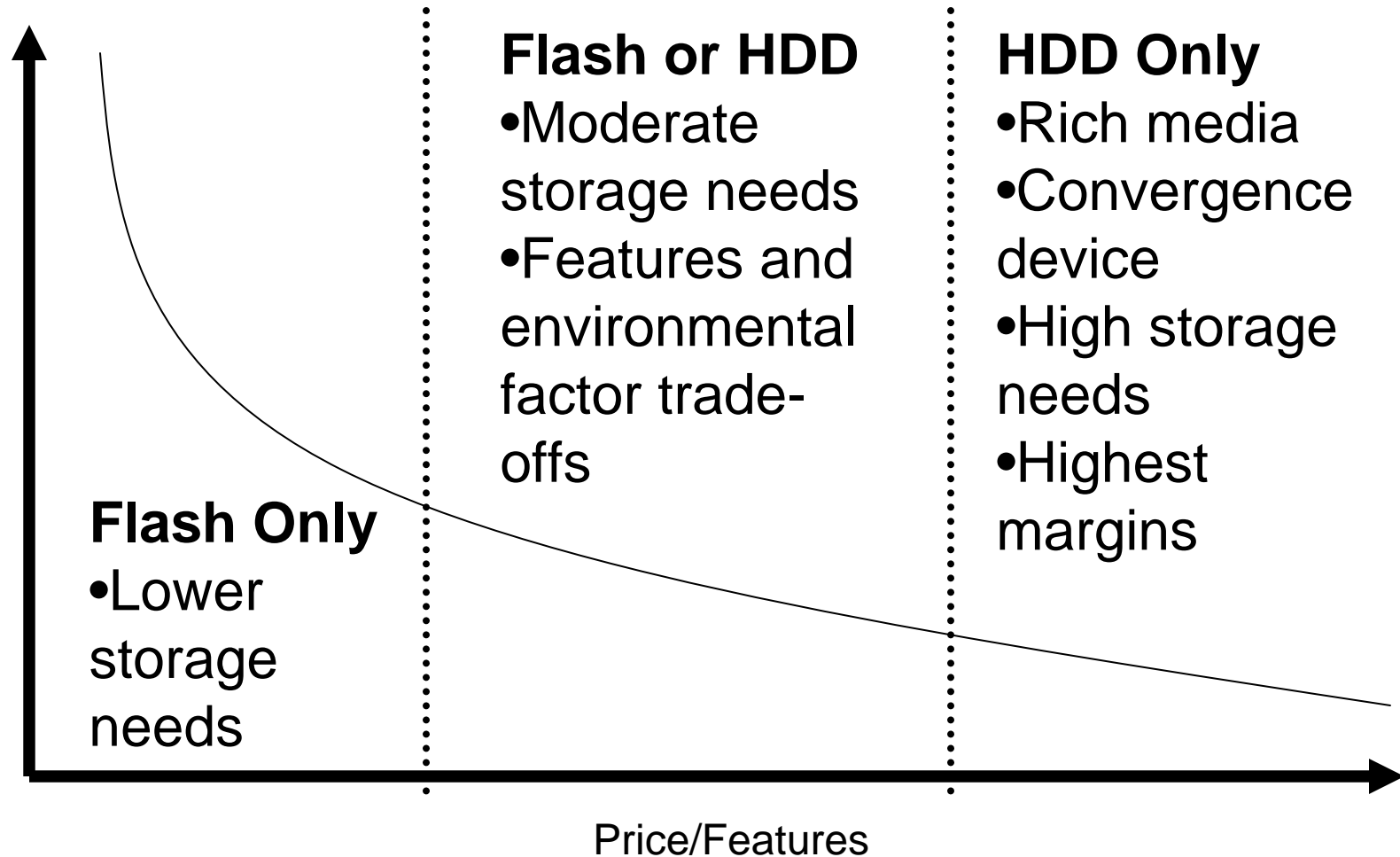
Extended Projection Showing the Impact of Life-Logs on Personal Content Generation in a Technology Savvy Home.



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Mobile CE Product Market Niches (e.g. cell phones)

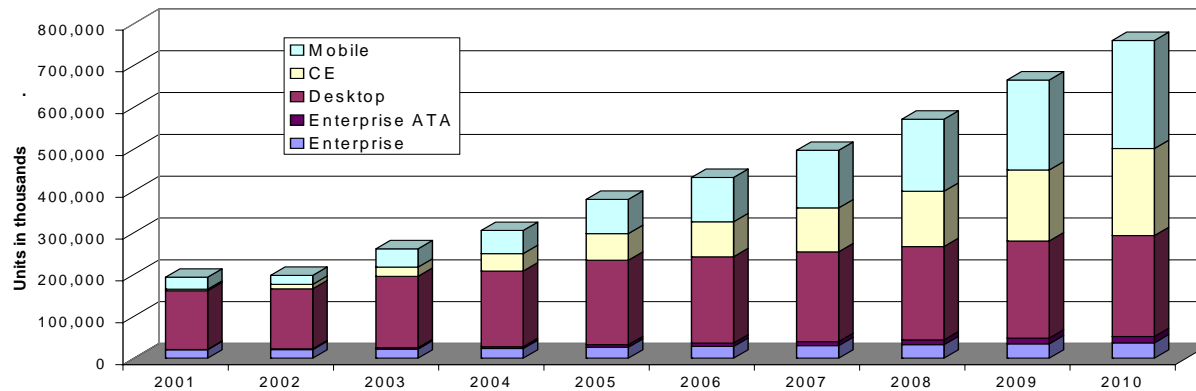
Market Volume



HDD Projections

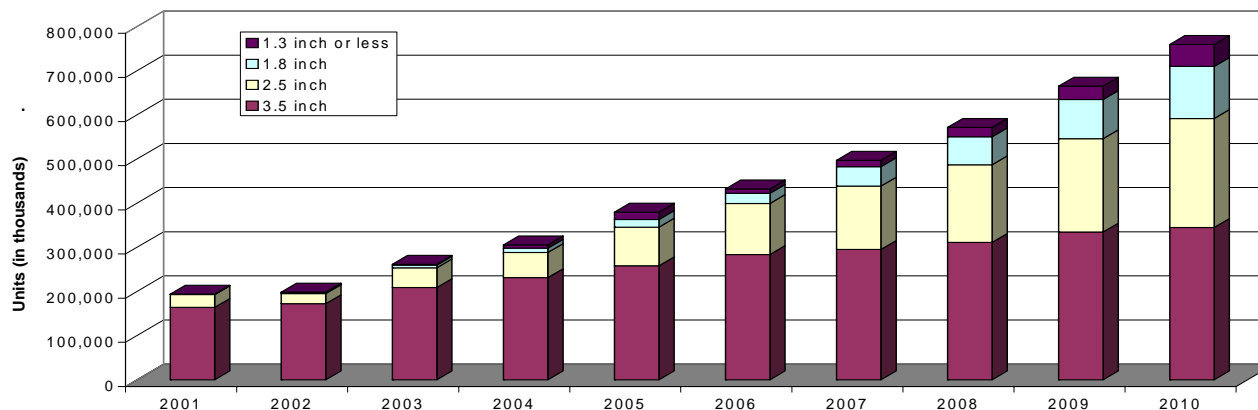
(Coughlin Associates, 2006)

Market Niches



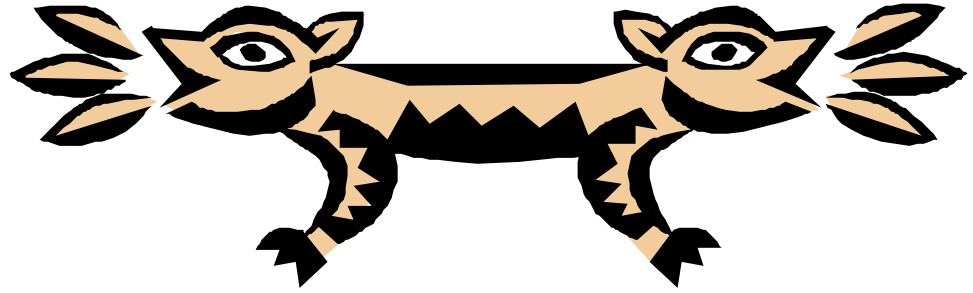
Majority of HDDs in CE and mobile computers by 2010

Form Factor



Majority of HDDs in 2.5-inch or smaller by 2010

Conclusions



- Growth for flash and HDDs. Room for all!
- To play a continuing role in mobile CE very small HDDs must have Areal Density CAGR's exceeding 80%.
- Flash will serve to gather digital content that will ultimately be stored on larger form factor HDDs
- Some applications will require more storage than flash can provide for the price—this is role for HDDs in mobile devices
- Storage demand for CE applications is unlimited—1 TB in your pocket and 1 PB in your home by 2020!
- Multiple product niches enabled by choices in digital storage devices in CE products



*Thank
You!*