

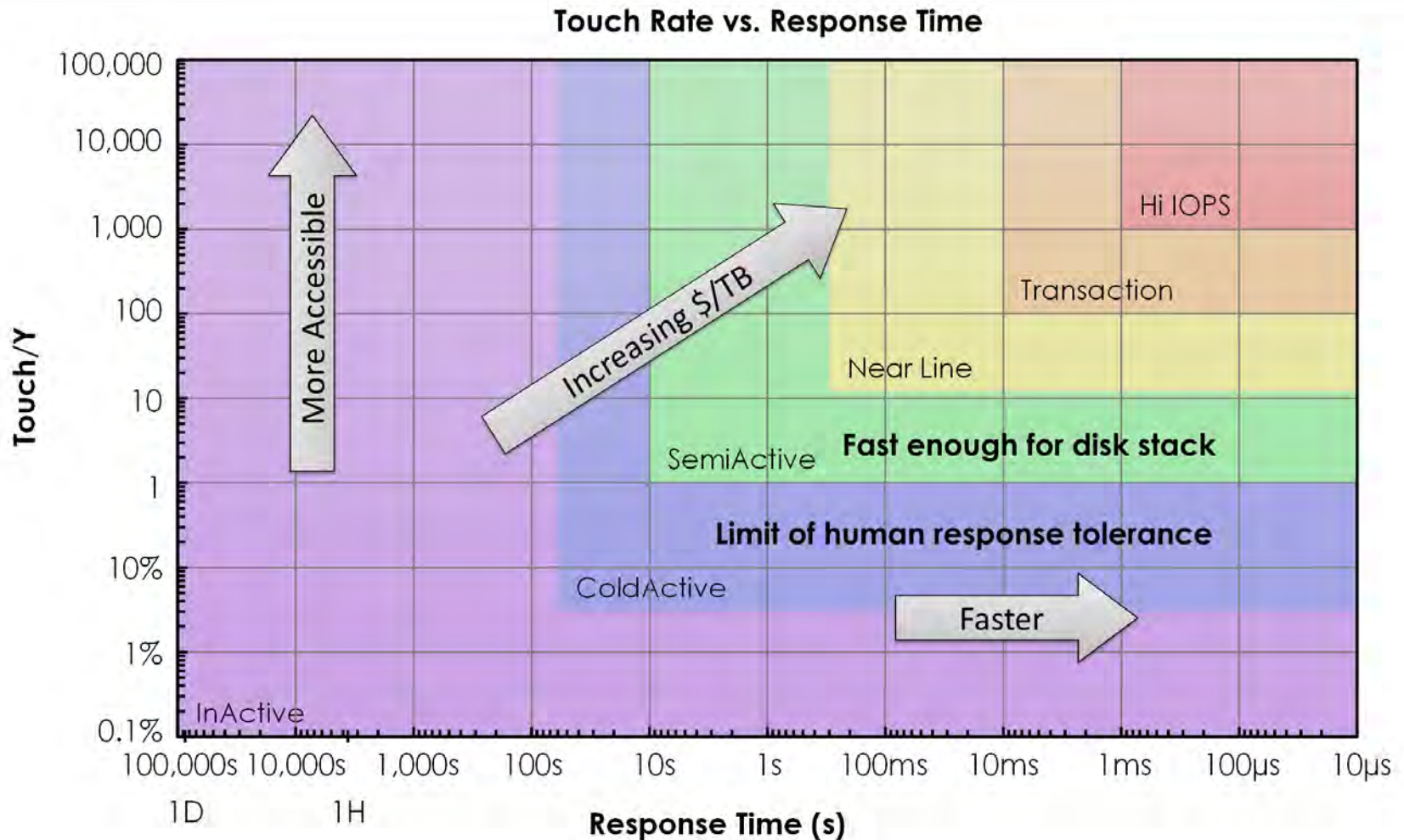
# Beyond the Data Event Horizon

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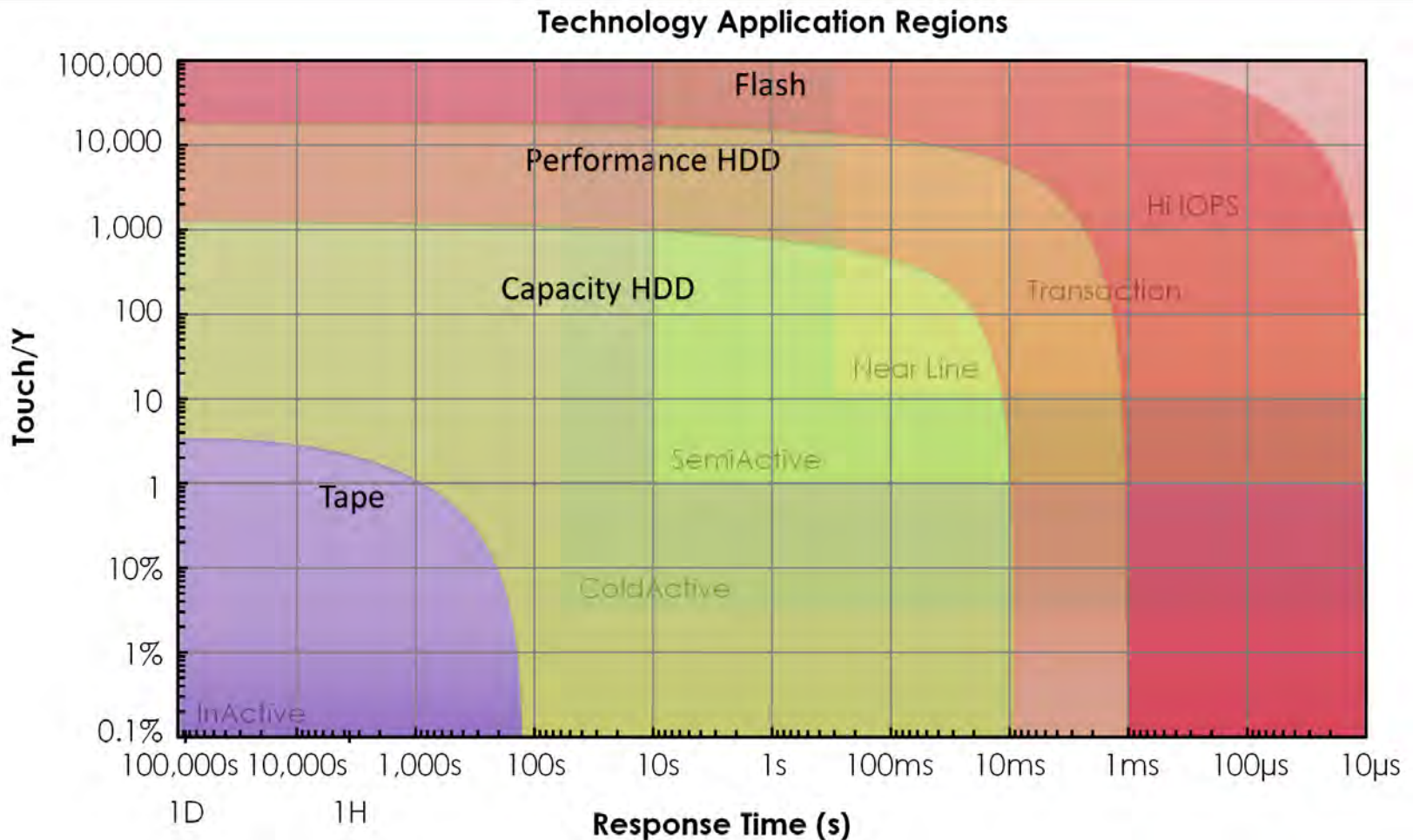
# Definitions

- *Touch rate* is defined as the portion of the total capacity of a system that can be accessed in a given interval of time.
  - Touch Rate/Year  $Touch/Y = \frac{ObjectSize(MB)}{ResponseTime(s) \times Capacity(PB) \times 0.0315}$
- The *response time* is the time to complete an IO operation, including the transfer of data and restoring the system for a subsequent IO operation. The response time is therefore a function of the IO object size as well as the speed of ancillary support operations.

# Touch rate versus response time indicating various types of uses



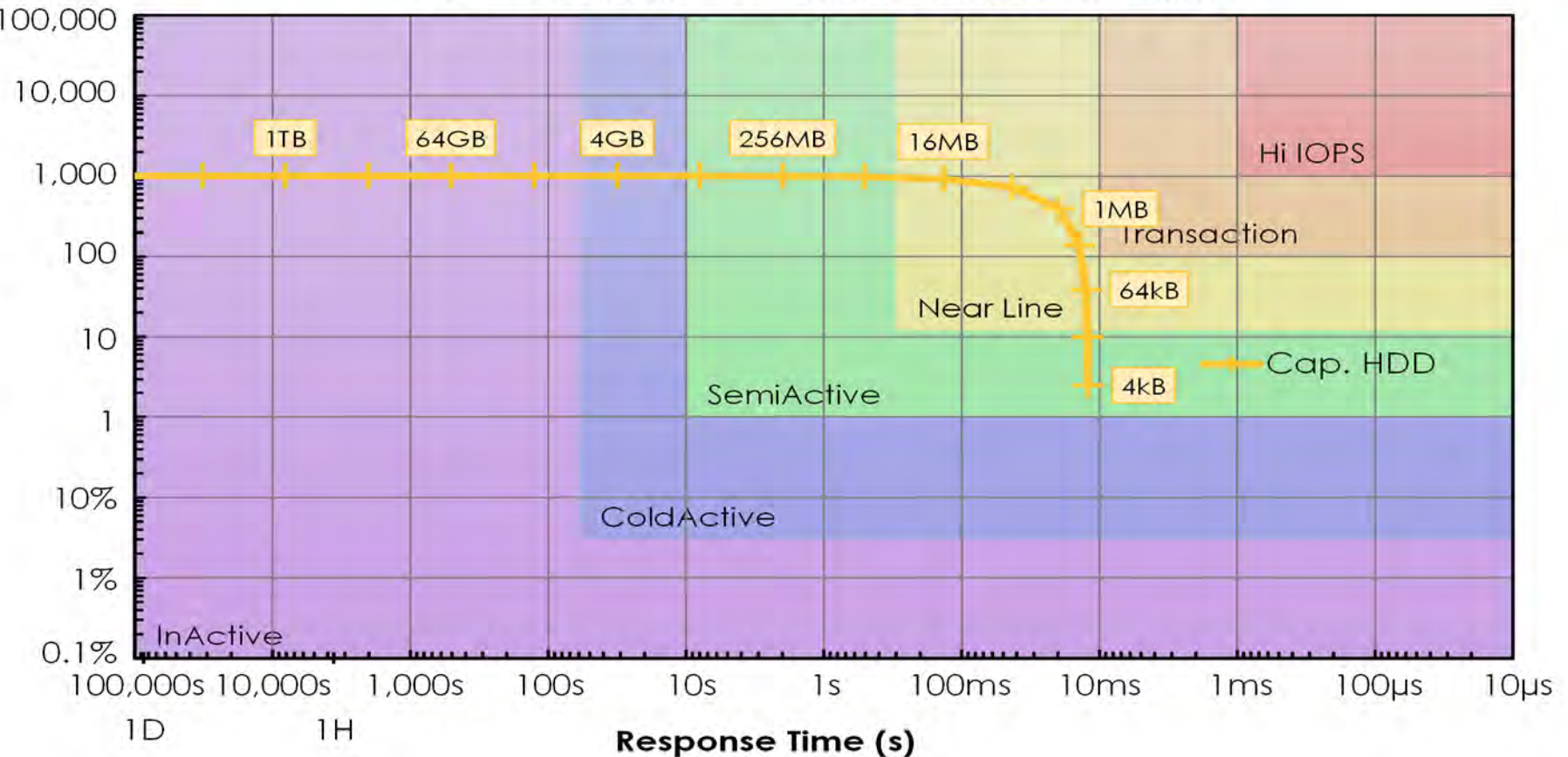
# Digital storage technologies regions overlaid on the Touch Rate/Response Time chart



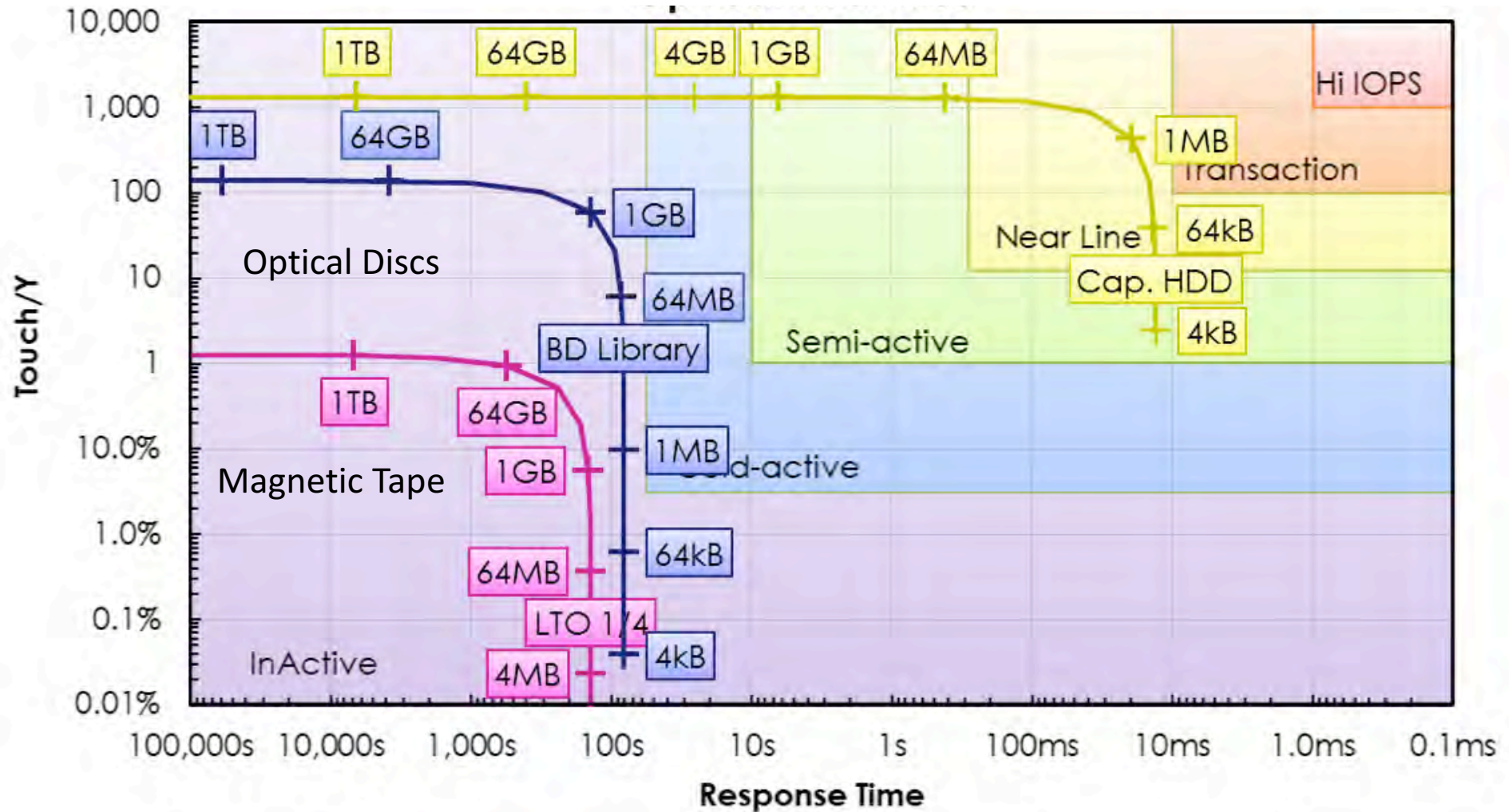


# Touch/Y and response time for 100% random IO in a 4 TB capacity HDD

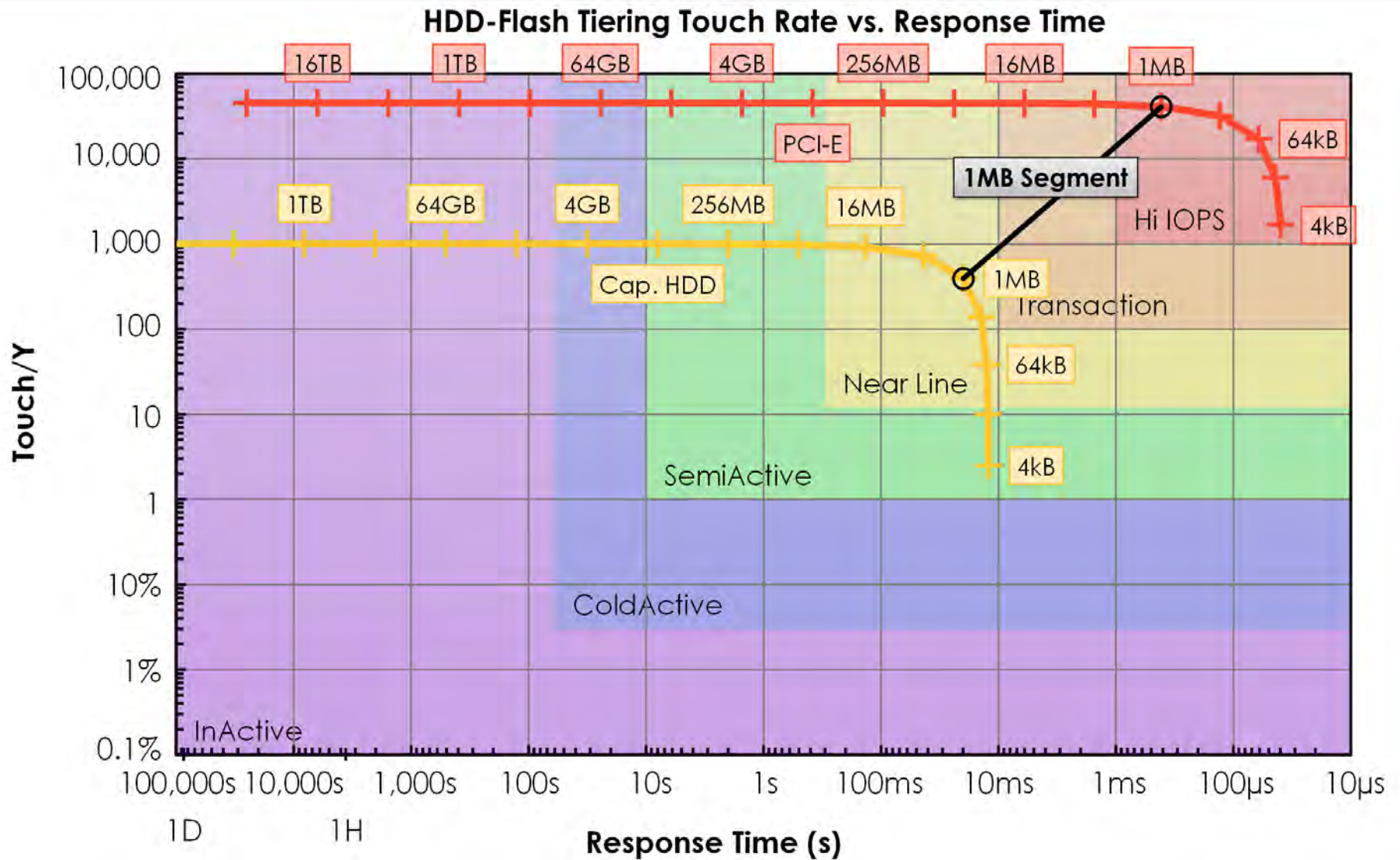
4TB Capacity HDD Touch Rate vs. Response Time



# Comparison of archive storage



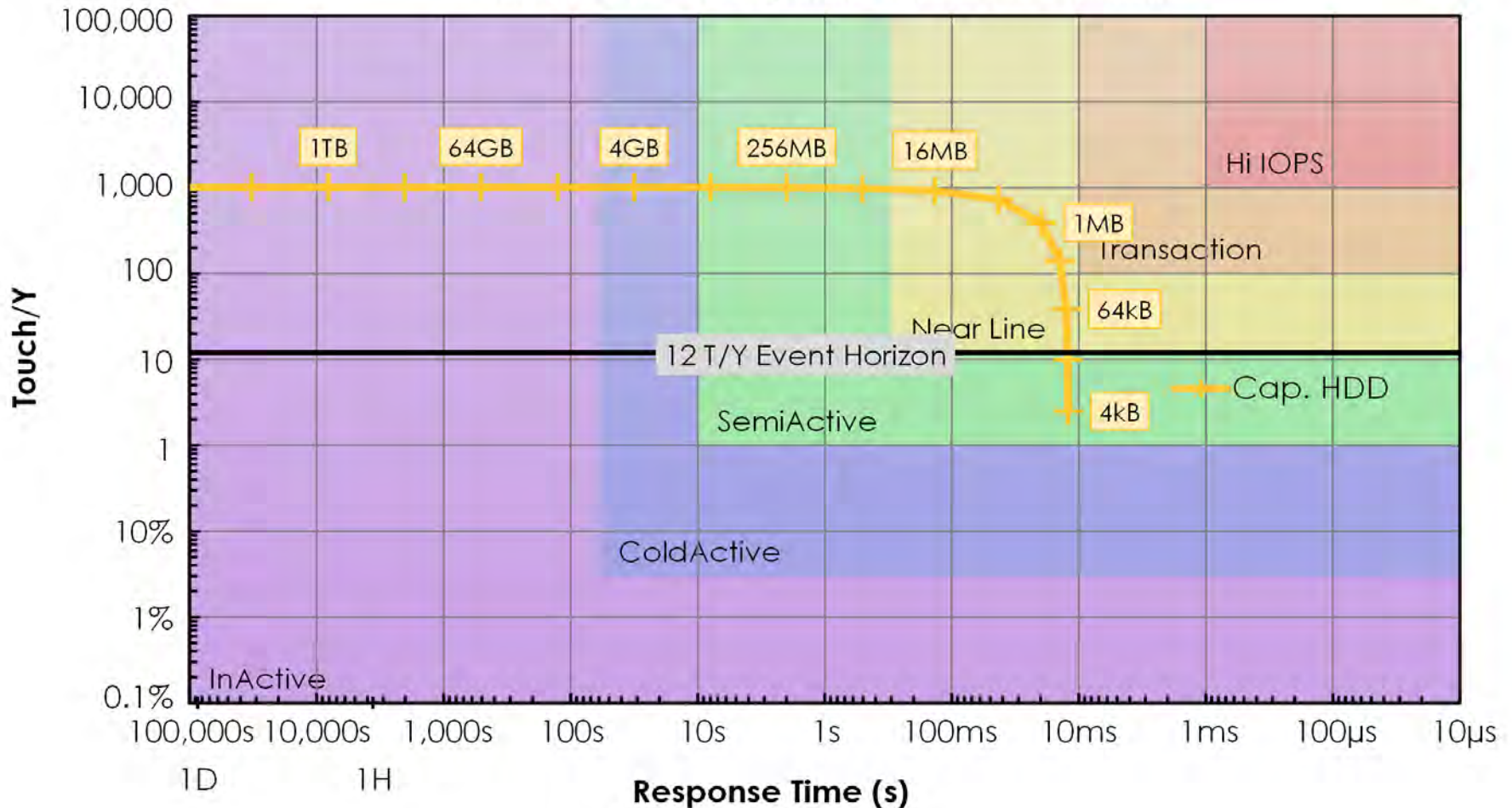
# HDD-Flash tiering/caching touch rate chart





# 4 TB capacity HDD data event horizon

Touch Rate vs. Response Time Event Horizon





# Reference

- Touch Rate: A metric for analyzing storage system performance, Steven Heltzer and Tom Coughlin, 2015,  
<http://www.tomcoughlin.com/techpapers.htm>

A scenic view of a beach with waves crashing against dark rocks. The sand is golden-brown and shows ripples. A long, dark shadow of a person is cast across the sand from the left. The word "Thanks" is written in a white, elegant script font in the center of the image.

*Thanks*