An On-line approach to ARC, the Adaptive Replacement Cache

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Outline

1 Introduction

2 ARC

3 Experts
Two Cache Lists

- L1 - Recent pages (Like LRU)
- L2 - Pages with 2+ hits

Pages are always added to the tops of the lists and may fall off the end.
Pages which aren’t in L1 or L2 are added to top of L1.
Pages already in L1 or L2 are moved to top of L2.
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At capacity, Cache Size $c = |L1| = |L2| = |T1| + |T2|

Ghost cache $B1$ and $B2$ - pages not in the real cache

Ghost cache used to evaluate whether $T1$ or $T2$ should be longer
• **p is Target size of** $T_1$
  • When page needs to be moved from real cache to ghost cache,
    • If $p < |T_1|$, page removed from $T_1$
    • Otherwise page is removed from $T_2$
  • ARC updates $p$ when there is a hit in the ghost cache
Cache hit in T1 or T2

- No update to p

Diagram:

- T1
- B1
- L1

- T2
- B2
- L2
Increase $p$, Shrink B1

\[ p = \min \left\{ c, p + \max \left( \frac{|B_2|}{|B_1|}, 1 \right) \right\} \]
Cache Miss: Page is in Ghost Cache B2

- Decrease $p$, Shrink B2

$$p = \max \left\{ 0, p - \max \left( \frac{|B_1|}{|B_2|}, 1 \right) \right\}$$

![Diagram showing T1 and T2 with B1 and B2 shaded and L1 and L2 labeled.](image)
Page is not in L1 or L2

- Fetch page and put on top of T1
- No update to $p$

![Diagram showing caching structures]

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Experts

- One expert per partition of the cache
  - Expert specifies best value for $p$
  - Experts $= \{0, 1, 2, \ldots, \text{Cache Size}\}$