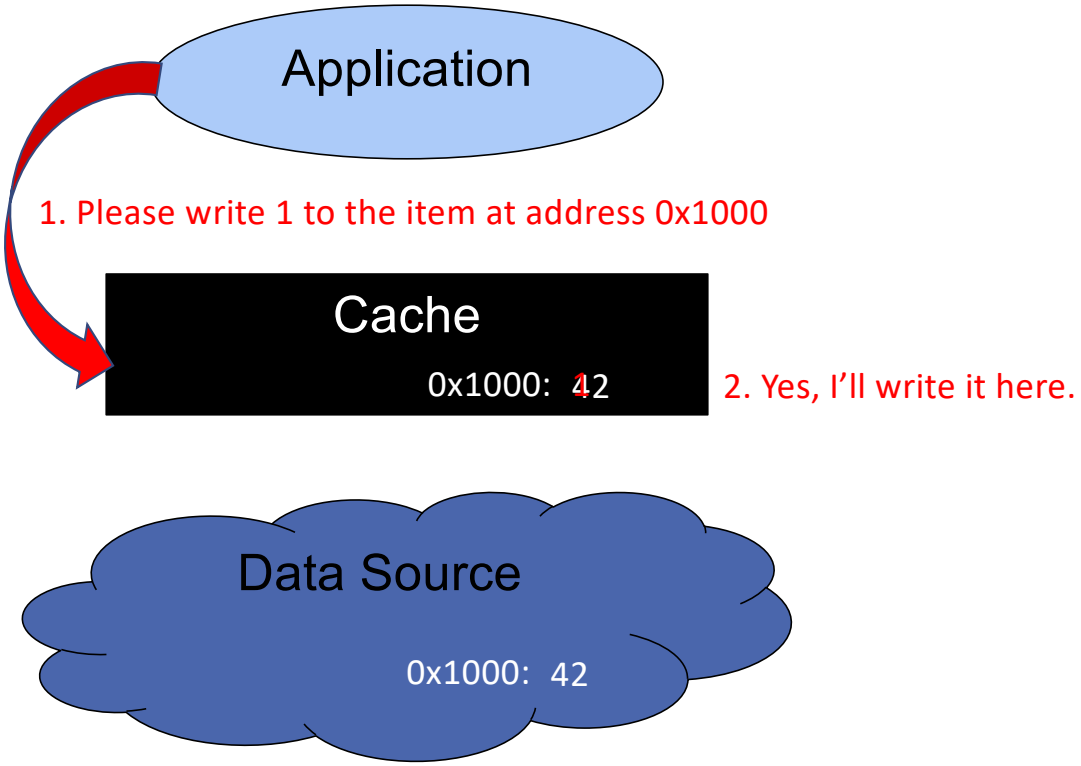
Today

- Learning Objectives
  - Enumerate all the different ways that caches handle writes.
- How we'll get there
  - Review the decisions we make around write caching
  - Examine possible architectures
- Reading
  - Section 6.4.5

Recall:

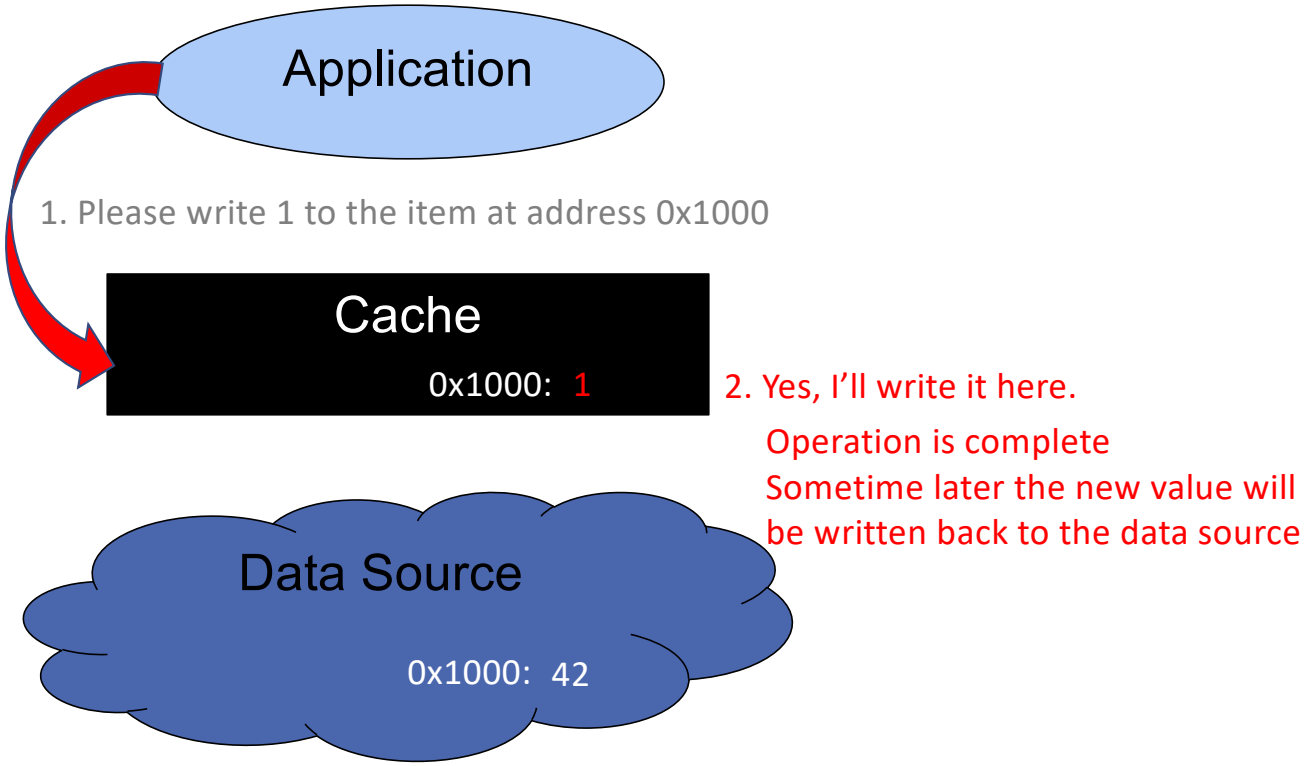
- We had to make some design decisions about how we handle writes.
- When do writes become visible below the cache?
  - Writeback: Sometime later after we write into the cache
  - Writethrough: Immediately upon writing to a cache
- When we take a miss, do we automatically allocate a slot in the cache to the missed cache line?
  - Write allocate: Yes
  - No Write allocate: No
- How does this generalize when we have a hierarchy of caches?

Case 1: Data was read into the cache already



Case 1a: Data was read into the cache already

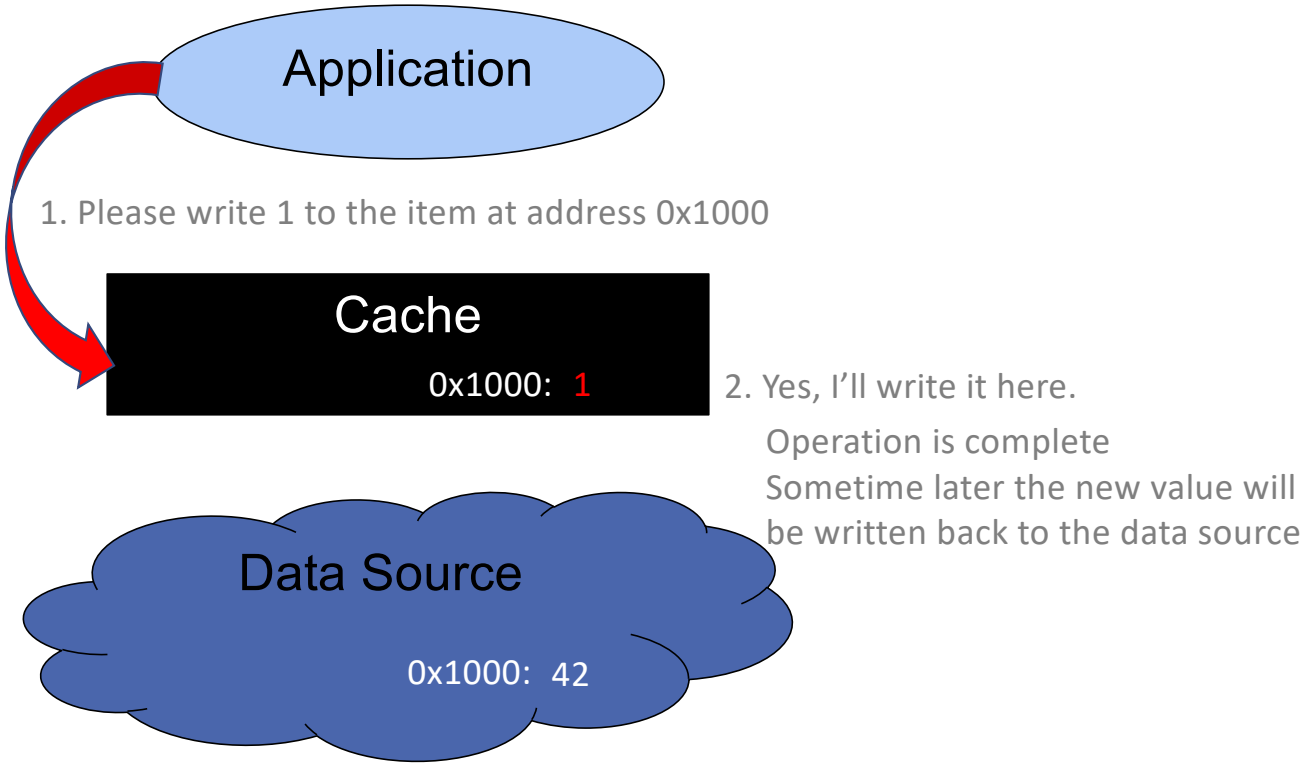
Writeback cache



Case 1a: Data was read into the cache already

Writeback cache

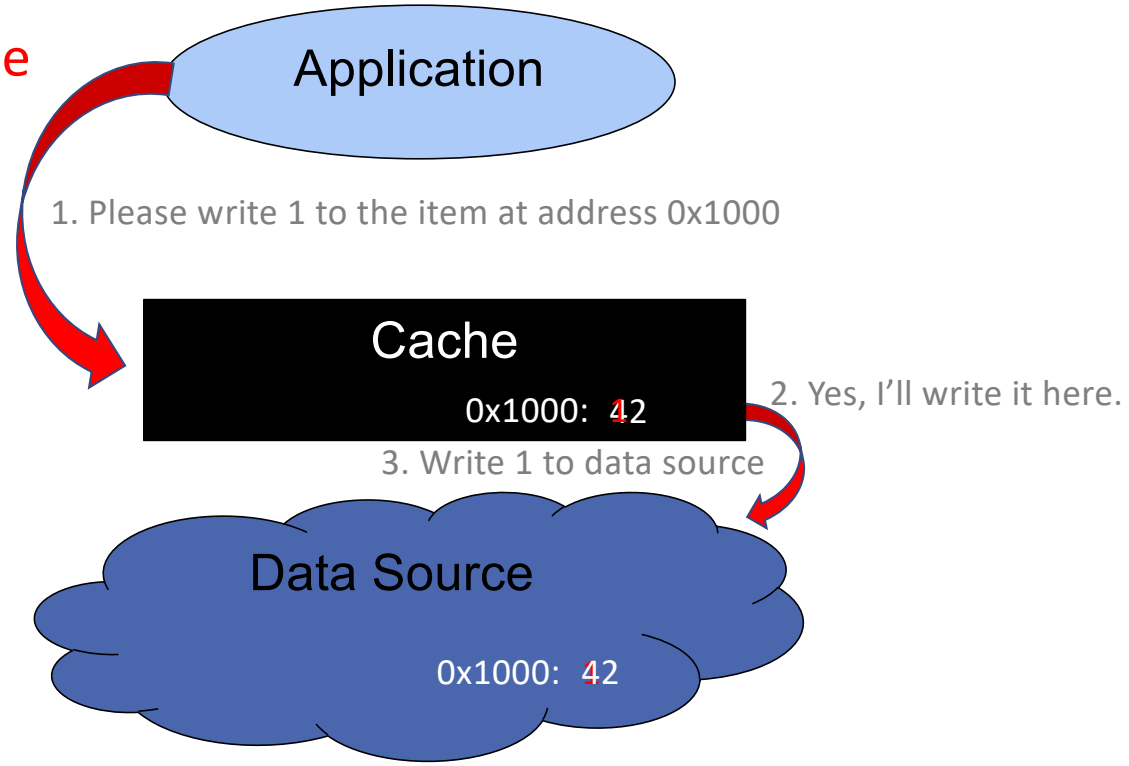
We must maintain a bit in the cache metadata indicating that the data is dirty (and therefore must be written back)



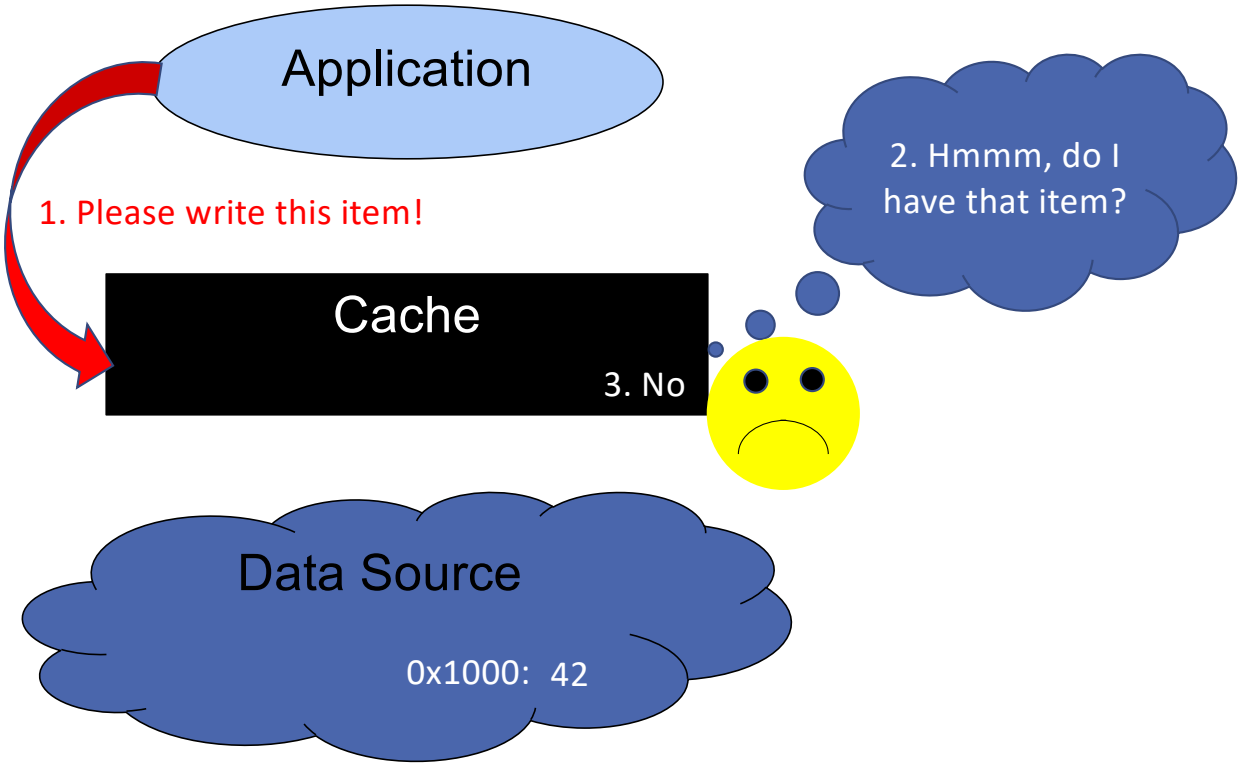
Case 1b: Data was read into the cache already

Writethrough cache

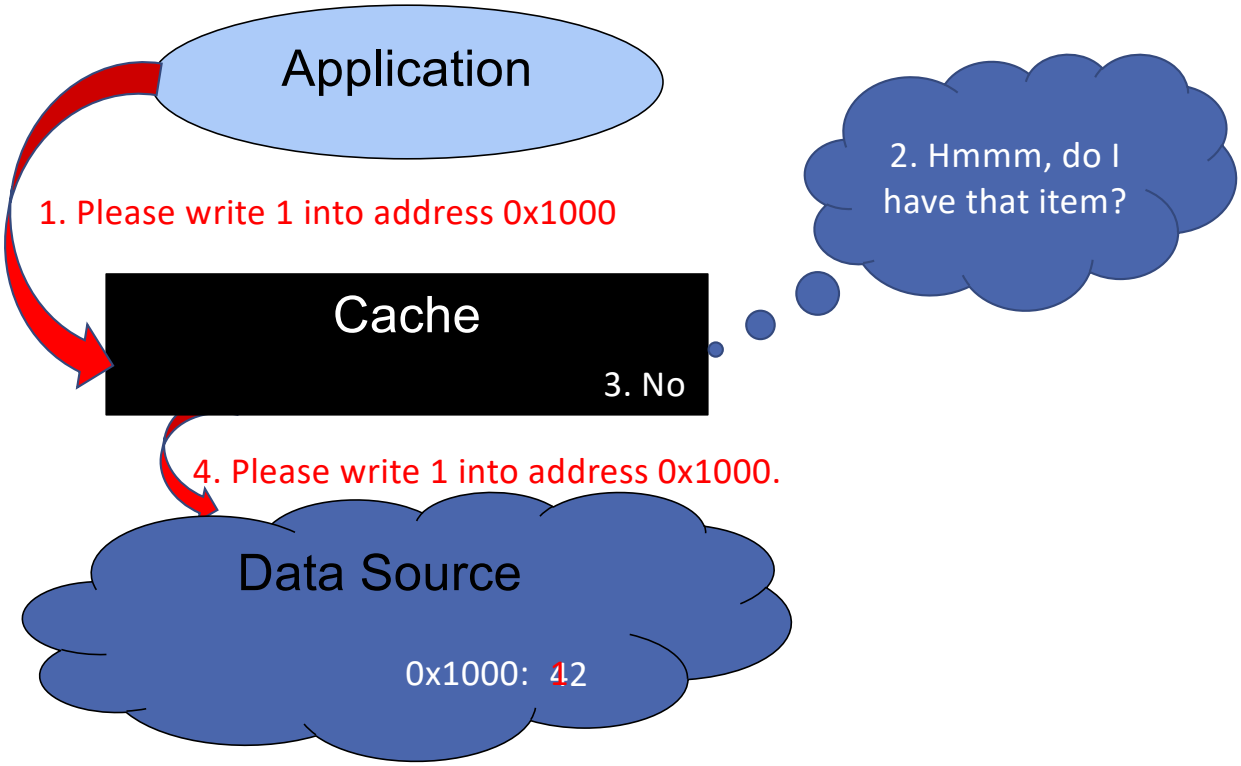
The writes to the cache and data source can happen in parallel.



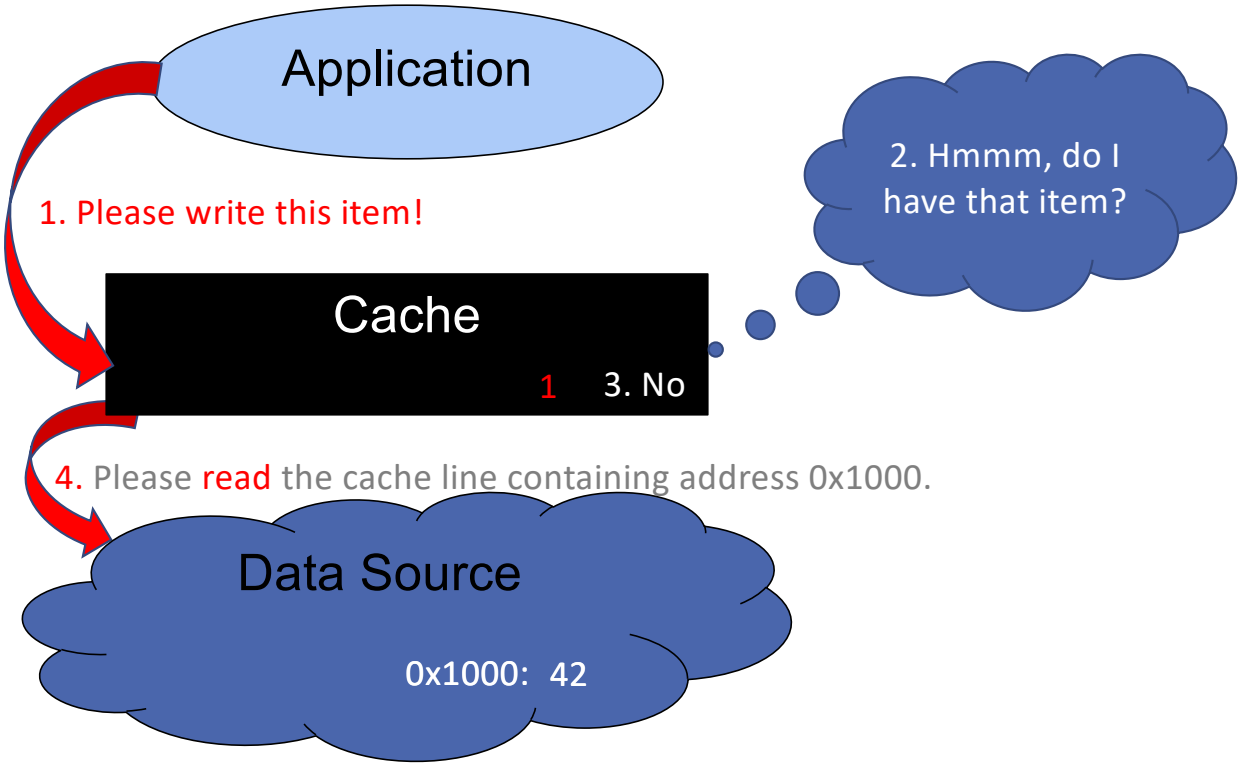
Case 2: A Cache Miss



Case 2a: No Write Allocate



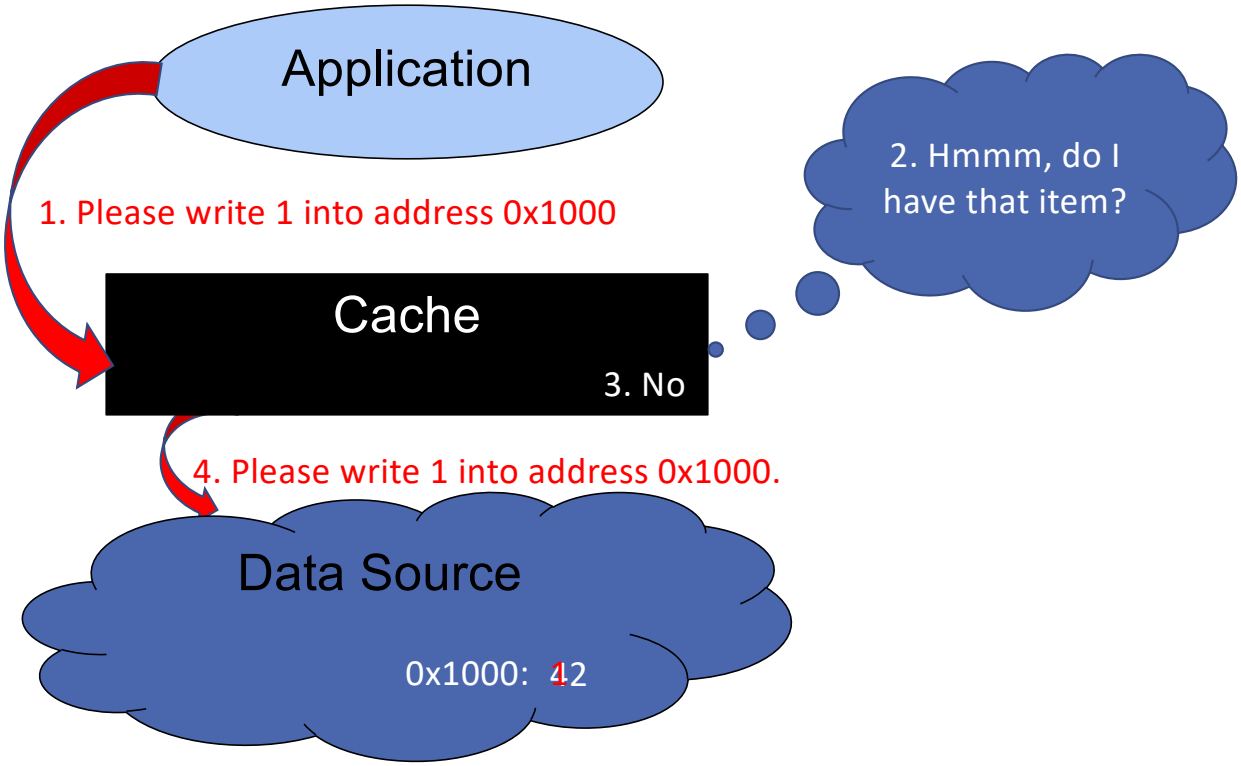
Case 2b: Write Allocate



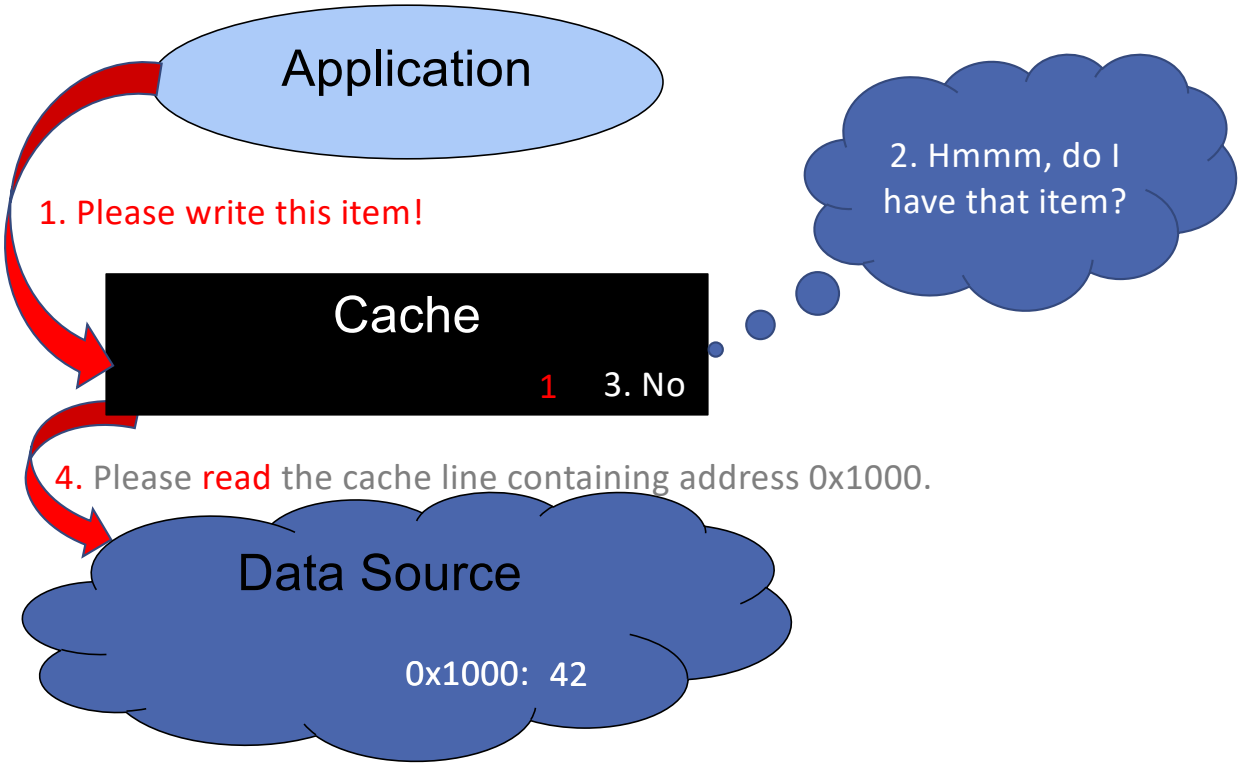
Miss Handling Taxonomy

	Writeback Case 1a	Writethrough Case 1b
No Write Allocate Case 2a	Weird Combination	Common
Write Allocate Case 2b	Common	Less Weird than the other corner

Why is Writeback/No Write Allocate Weird?

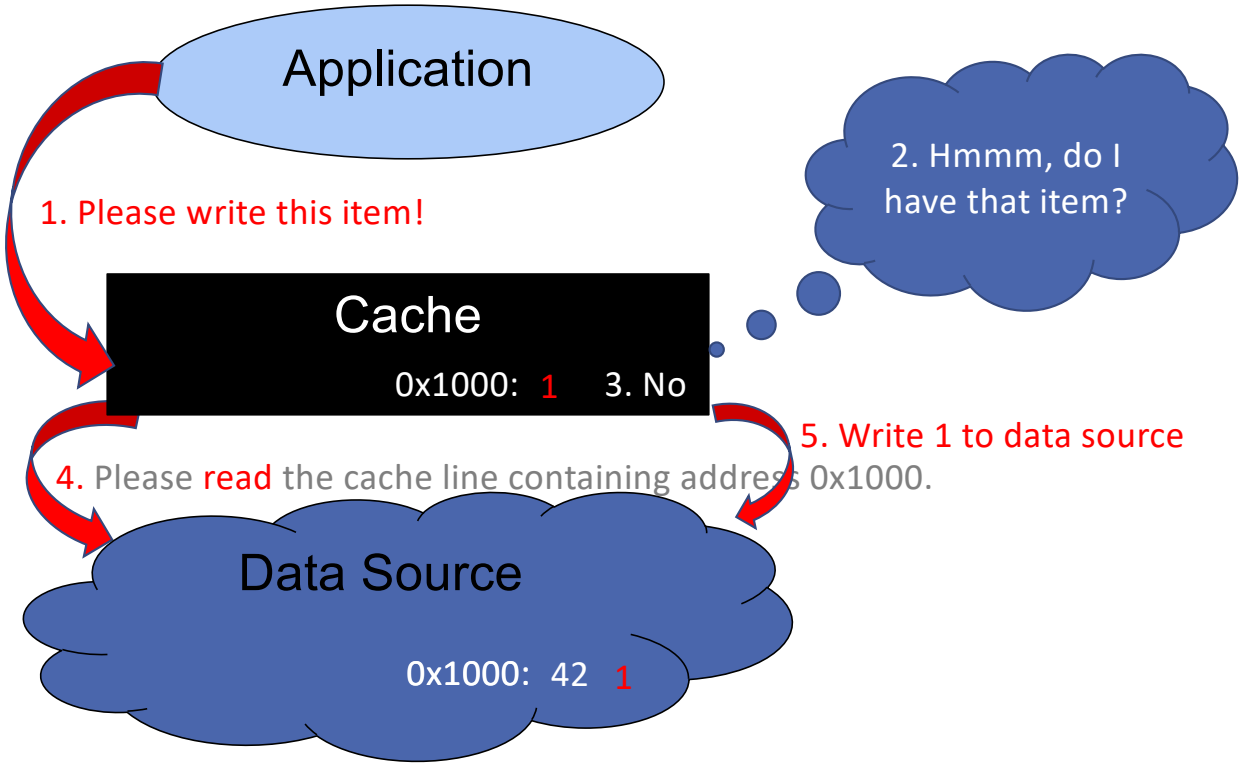


What About Writethrough/Write Allocate?



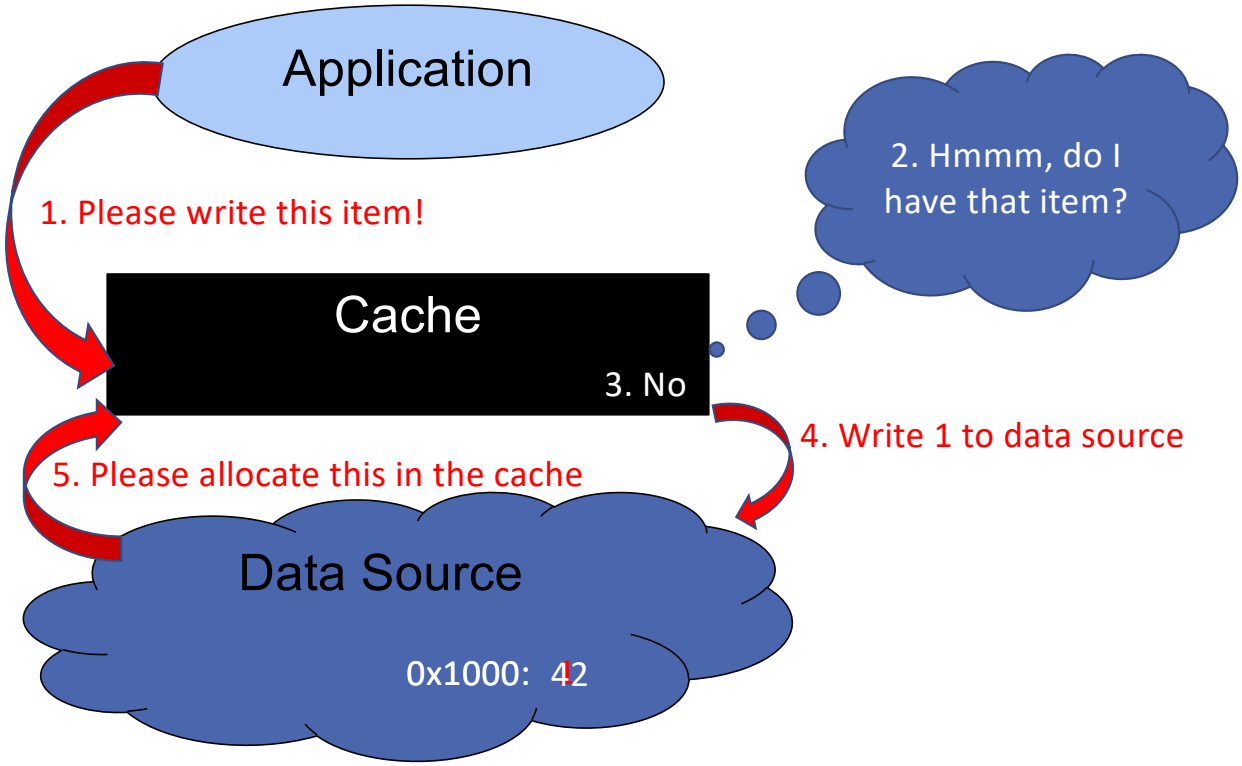
What About Writethrough/Write Allocate?

Case A: After the write allocate, write through



What About Writethrough/Write Allocate?

Case B: Write through first, then allocate



Wrapping Up

- Know your definitions:
  - Writeback
  - Writethrough
  - Write Allocate
  - No Write Allocate
- Caches with big blocks (and ridiculously slow storage) are almost always Writeback and Write Allocate
  - File system caches (Unit 4)
  - Virtual memory caches (Unit 5)
- We'll give you some practice thinking about when the different policies might make sense.