Lecture 10.2
Java Synchronization

EN 600.320/420

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1 March 2017

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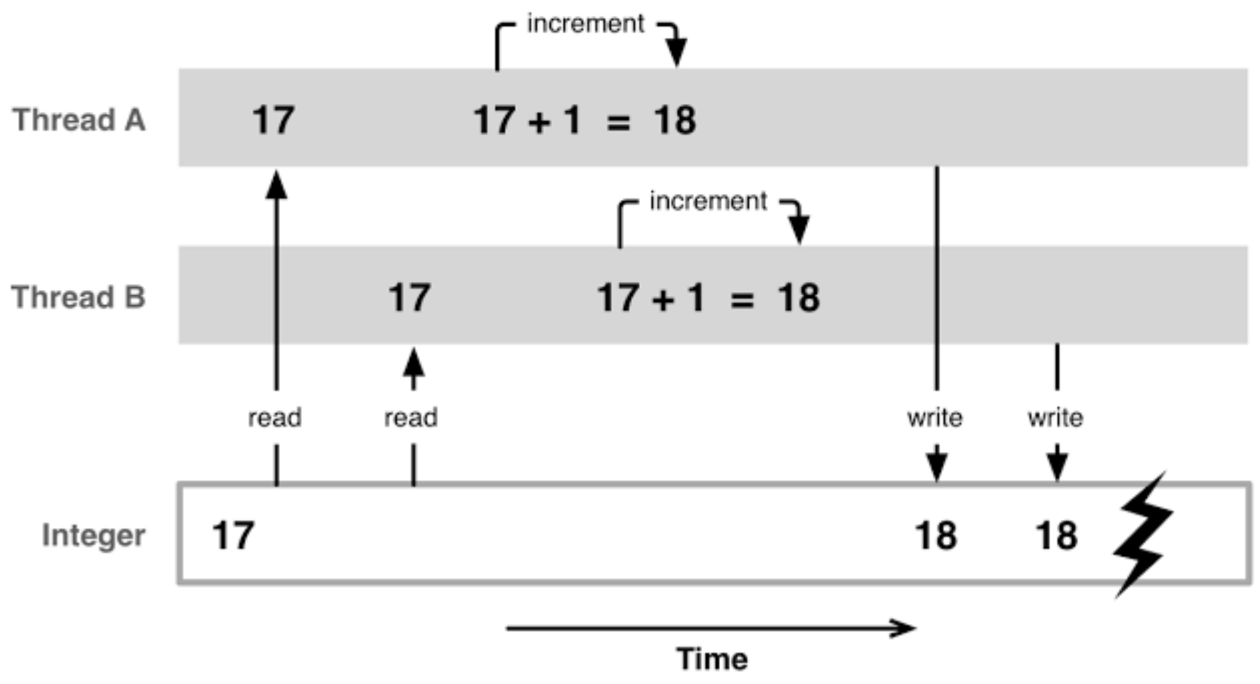
Communicating Between Threads

- read/write to shared variables
- Uncontrolled sharing leads to unpredictable outcomes
- Race conditions:
  - Conflicting operations from multiple threads
  - Ordered by OS scheduling (not program)



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Synchronization Constructs

- A real simple first look at synchronization
  - Some dos and dont’s
- The volatile declaration specifier
- Synchronized blocks
- java.util.concurrent.atomic
- wait() and notify()
- ReentrantLock: condition variables

Some Definitions

- Atomic: the all or nothing property
  - In transactions, either all actions happen or none happen
  - For sequential programs it refers to operations: a sequence of operations is executed by a processor as an indivisible unit that cannot be interrupted.
  - **java.util.concurrent.atomic:** not really atomic, but *lock-free, thread safe* encapsulation of fundamental types
- Synchronize: poorly defined, informally used
  - *v.* To make two or more events happen at exactly the same time or at the same rate
  - In Java, a synchronized block is accessed by only one thread at a time (should be called serialized)
    - Controls access to shared state

volatile: Does it work?

See VolatileWorks.java

- In Java, a *volatile* variable "is guaranteed to have memory synchronized on each access"
  - Plus atomic reads and writes to long and double
  - All other built-in types are already atomic

volatile: Almost useless

- In Java, a *volatile* variable “is guaranteed to have memory synchronized on each access”
  - Plus atomic reads and writes to long and double
  - All other built-in types are already atomic
- While underlying types are atomic, any operation performed against them is not
  - Increment is not atomic!
  - Any reason to declare variables volatile?