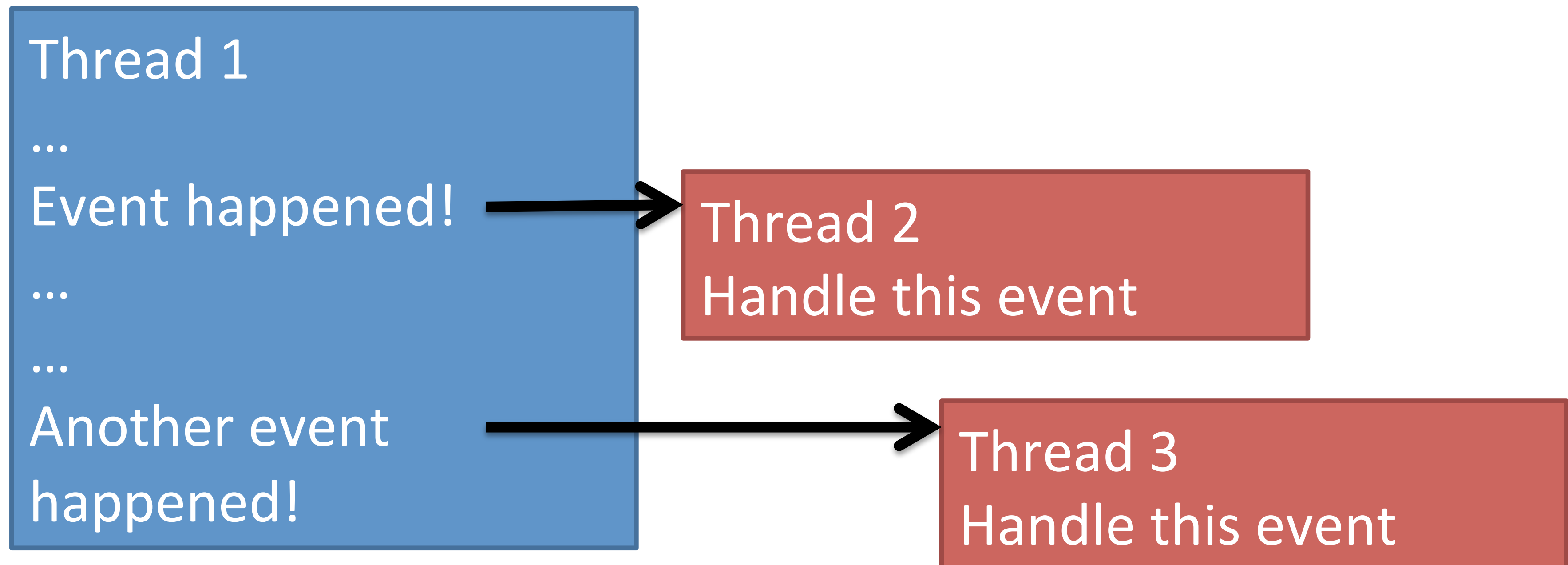
Events and Timers and Listeners, Oh My!

Control flow

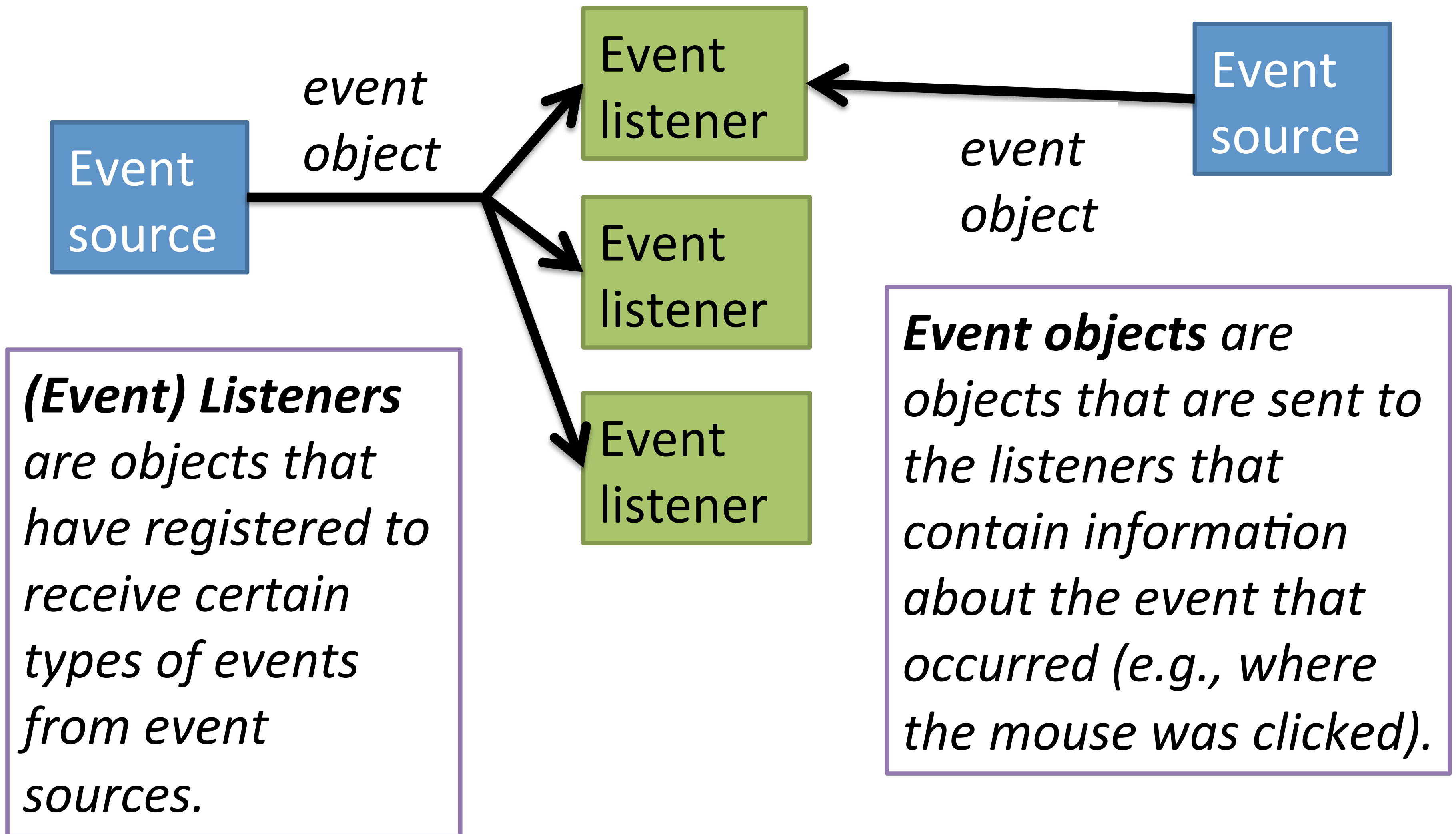
- "Traditional" program: one statement at a time, line by line.
- Threaded program: CPU determines execution order
  - Controlled with synch, wait/notifyAll
- Event-driven program: controlled by the order that "events" happen

- Event-driven programming is often seen in threaded programs, as another model of communication between threads.



- An "event" is something that happens in your program that another piece of code wants to be aware of.
  - Simple things: mouse clicks, key presses, …
  - Complex things: file is done loading, calculation is finished, received request from a client
- Event-driven programming is no better or worse than other models of thread communication, it's just different.
  - Often forced on programmers because so many graphics libraries use it.

- ***Sources***, ***event objects***, and ***listeners***.



- JButton: a class that models a button.
  - Also an event source.
- HelloWorldListener: a class designed to listen for button presses.
  - The code that runs when the action happens (inside actionPerformed) is called an ***event handler***.
- ActionEvent (arg type to actionPerformed) is the event class.
  - Whenever the JButton is pushed, it triggers (fires) an ActionEvent.
  - Has methods for determining which object caused the event, when it happened, etc.
- Connected through addActionListener function.

- Purpose of events: separate the code that **causes** the event from the code that **handles** the event.
- Lets one event source trigger multiple actions
  - JButton can have multiple listeners added.
- Lets one listener listen to multiple event sources.
  - Could have HelloWorldListener connected to a many buttons, key presses, drop-down menus, etc.

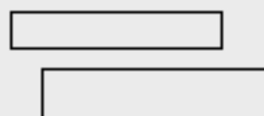
- Java has (many) classes for Events:
  - ActionEvent, MouseEvent, KeyEvent, ...
- and classes for Listeners:
  - ActionListener, MouseListener, KeyListener, ...

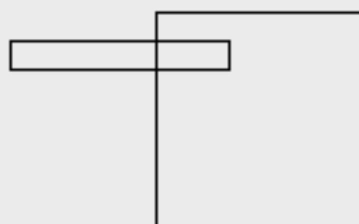
- We're going to examine just buttons and the mouse today.

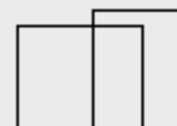
Click the Rectangles!

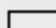
Start

Score: 0









- GameFrame: represents the window that holds the game.
  - Contains a "panel" to hold the moving rectangles, and a Jbutton to start the game.
- GamePanel: represents the moving rectangles area.
  - moveShapesToLeft: moves all rectangles to the right.
  - handleMouseClick: event handler for when the panel is clicked.
  - paintComponent: draws the rectangles on the screen.

Run It

Task 1: Start Button

- In StartButtonActionListener
  - Write actionPerformed.
  - This method should call gameArea.moveShapesToLeft().
  - Then call repaint() [tells Java to redraw the rectangles]
- Uncomment lines to attach listener to button.
- When done, you should be able to click the button and the shapes should move to the left.

Task 2: Mouse clicks

- In GameMouseClickListener:
  - Write mouseReleased.
  - This should call handleMouseClick.
    - arguments should be event.getX() and event.getY()
  - Call repaint() [asks Java to redraw the rectangles]
- In GameFrame constructor, uncomment lines to attach the listener to the mouse.

Task 3: Automatic scrolling

- We don't want to click the start button to advance the rectangles.
- We need a way to automatically fire events in rapid succession.
  - In order to repeatedly call moveShapes every few milliseconds to give the illusion of scrolling.

Solution: Timer

- Timer objects will fire an ActionEvent repeatedly every *x* milliseconds.
- Timer t = new Timer(x, <action listener>);
- t.start();

- In MoveShapesActionListener:
  - Write actionPerformed to do two things:
    - call moveShapesToLeft on gameArea
    - call repaint() [request that Java redraw the rectangles]
- Rewrite start button listener:
  - actionPerformed should do three things:
    - Create a new MoveShapesActionListener
    - Create a timer: args are 10 (milliseconds), and your move shapes action listener.
    - Start the timer.