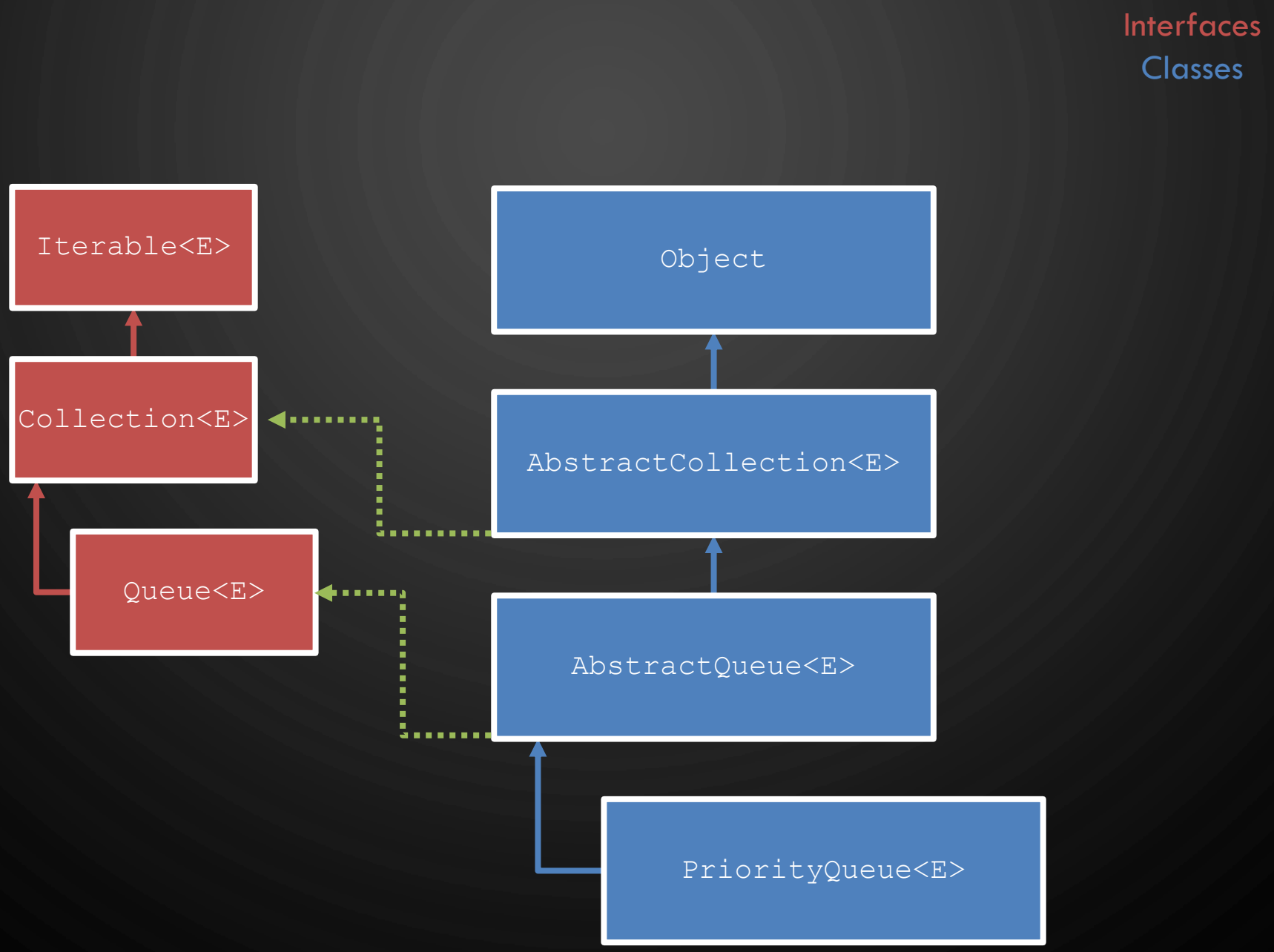
JAVA PRIORITY QUEUE

SUMMARY OF CLASSES (PRIORITY QUEUE RELATED)

- PriorityQueue<E> - array-based heap implementation of minimum priority queue
- Comparator<E> - can be useful for defining your own comparison between objects
- Others outside the scope of this course
- To find how to use them, go to the Java API!


Interfaces
Classes
Iterable<E>
Collection<E>
Queue<E>
Object
AbstractCollection<E>
AbstractQueue<E>
PriorityQueue<E>

EXAMPLE OF USING PRIORITYQUEUE<E>

```
1. Scanner s = new Scanner(new File("numbers.txt"));
2. PriorityQueue<Integer> numbers = new PriorityQueue<>();
3. while(s.hasNextInt())
4.   numbers.add(s.nextInt());
5. …elsewhere…
6. int sum = 0;
7. while(!numbers.isEmpty())
8.   sum += numbers.poll(); //poll is removeMin()
```

COMPARISON IN JAVA

- It is not a Boolean less than. It is always an integer value i. So for two objects a and b, a comparison $comp(a, b)$ returns:
  - $i < 0$ implies a is ordered before b, e.g., $<$
  - $i = 0$ implies $a.equals(b)$
  - $i > 0$ implies a is ordered after b, e.g., $>$
- First method - no new class. Have your class **`E`** implement **`Comparable<E>`**, which requires the `int compareTo(E o)` method
- Second method – separate comparator class that implements **`Comparator<E>`** interface
  - Must define `compare(E o1, E o2)` and `equals(Object o)`
    - Here equals is a comparison to another comparator

COMPARISON IN JAVA – FIRST METHOD

IMPLEMENT COMPARABLE

```
public class Foo implements Comparable<Foo> {
  private int x;
  public Foo(int x) {this.x = x;}
  // … stuff …
  public int compareTo(Foo other) {
    return x - other.x; // Note, <0 means this is before other;
                        // = 0 means this.equals(other);
                        // and >0 means this is after other

  }
}
```

COMPARISON IN JAVA – SECOND METHOD

CREATE SEPARATE COMPARATOR

```
import java.util.Comparator;
public class CompareFoo implements Comparator<Foo> {
  public int compare(Foo a, Foo b) {
    return a.getX() - b.getX(); // Assume Foo does not implement
                                // Comparable, and has a public getX()
                                // accessor
  }

  public boolean equals(Object obj) {
    return obj instanceof CompareFoo;
  }
}
```

PROBLEM
EVENT DRIVEN SIMULATION

- Event driven simulation – you want to estimate the profit for a coffee shop. There is an input file online stating the number of seats in the shop, the price per cup of coffee, and arrive events with a given time (integer) and number of partisans (integer) (1 pair per line)
- Use a priority queue of events, ordered by time to see how much profit the store will earn over this period. Rules:
  - Arrive event - If a group enters and there are not enough seats they will leave. If they stay, an order event will be created at the current time + 1 + a random number below 4
  - Order events - Every partisan of the group will buy 1 or 2 cups of coffee. Each orderEvent will also spawn a leaveEvent at the currentTime + 1 + a random number below 10.
  - Leave event – When a group leaves, their chairs are opened up to another group
- Create an object oriented solution to this problem with your team. PLAN-IMPLEMENT-TEST!

EVENT DRIVEN SIMULATION
MAIN LOOP ALGORITHM

```
Priority queue of Events PQ
while ¬PQ.isEmpty() do
  PQ.removeMin().process()
```

EVENT DRIVEN SIMULATION

POSSIBLE CLASS HIERARCHY