The Java Executor Framework:
Overview of Thread Pools

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Learning Objectives in this Part of the Lesson

• Understand the purpose of the Java executor framework

• Recognize the features & benefits of thread pools
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• Understand the purpose of the Java executor framework
• Recognize the features & benefits of thread pools
• Note a human known use of thread pools
Overview of Thread Pools
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• Concurrent programs must often handle a large # of clients

e.g., consider a web server that must handle thousands of client requests simultaneously
Overview of Thread Pools

• However, spawning a thread per client doesn’t scale
Overview of Thread Pools

• However, spawning a thread per client doesn’t scale
• It often incurs excessive processing overhead

```java
void handleClientRequest(Request request) {
    new Thread(makeRequestRunnable(request)).start();
    ...
}
```
Overview of Thread Pools

- However, spawning a thread per client doesn’t scale
- It often incurs excessive processing overhead
- An excessive amount of memory is also needed to store all the threads
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- However, spawning a thread per client doesn’t scale
  - It often incurs excessive processing overhead
  - An excessive amount of memory is also needed to store all the threads
- Even if it’s possible to spawn many threads, it usually means that “ya got trouble”...

See [www.jstorimer.com/blogs/workingwithcode/7970125-how-many-threads-is-too-many](www.jstorimer.com/blogs/workingwithcode/7970125-how-many-threads-is-too-many)
Overview of Thread Pools

- A thread pool is often a better way to scale performance

See en.wikipedia.org/wiki/Thread_pool_pattern
Overview of Thread Pools

- A thread pool is often a better way to scale performance
- Amortizes thread memory/processing overhead

See cs.stackexchange.com/a/25899
Overview of Thread Pools

- A thread pool is often a better way to scale performance.
- Amortizes thread memory/processing overhead, e.g.
  ```java
  new Thread(makeRequestRunnable(request)).start();
  ```
can often be replaced with a more efficient thread pool

```java
Executor executor = makeExecutor(...);
...
executor.execute(makeRequestRunnable(request));
```
Overview of Thread Pools

- A thread pool is often a better way to scale performance
- Amortizes thread memory/processing overhead
- Pool size determined by various factors
  - e.g., # of CPU cores, compute-bound vs. I/O-bound tasks, etc.

Overview of Thread Pools

• A thread pool is often a better way to scale performance
  • Amortizes thread memory/processing overhead
  • Pool size determined by various factors
• A thread pool is tightly bound to a work queue of tasks awaiting execution
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• A thread pool is often a better way to scale performance
  • Amortizes thread memory/processing overhead
  • Pool size determined by various factors
  • A thread pool is tightly bound to a work queue of tasks awaiting execution
• Worker threads are like “hungry puppies”
Human Known Uses of Thread Pools
A “call center” is a human known use of a thread pool. See en.wikipedia.org/wiki/Call_centre
End of the Java Executor Framework: Overview of Thread Pools