# Evaluation of Concurrency & Parallelism Mechanisms in Java

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# Learning Objectives in this Part of the Lesson

- Know which Java mechanism(s) to understand & apply

# Which Java Mechanism(s) to Understand & Apply

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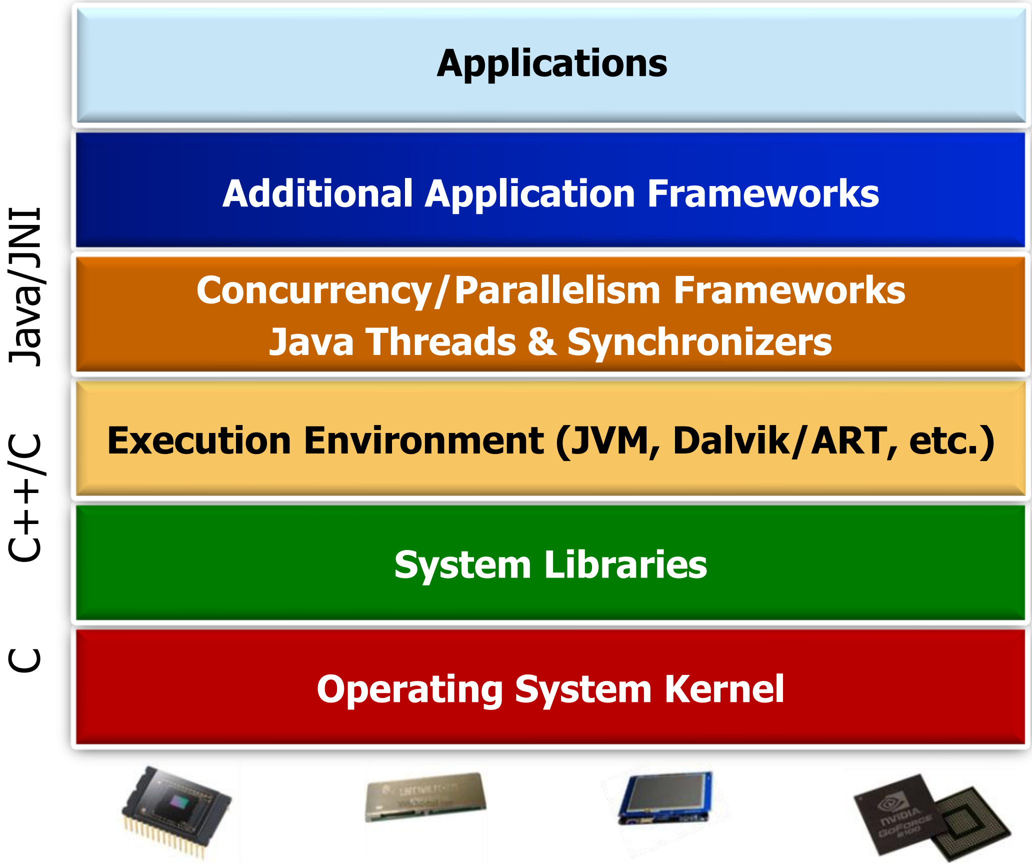
- Java's concurrency & parallelism mechanisms span multiple layers in the software stack



Applications

Additional Application Frameworks

Concurrency/Parallelism Frameworks
Java Threads & Synchronizers

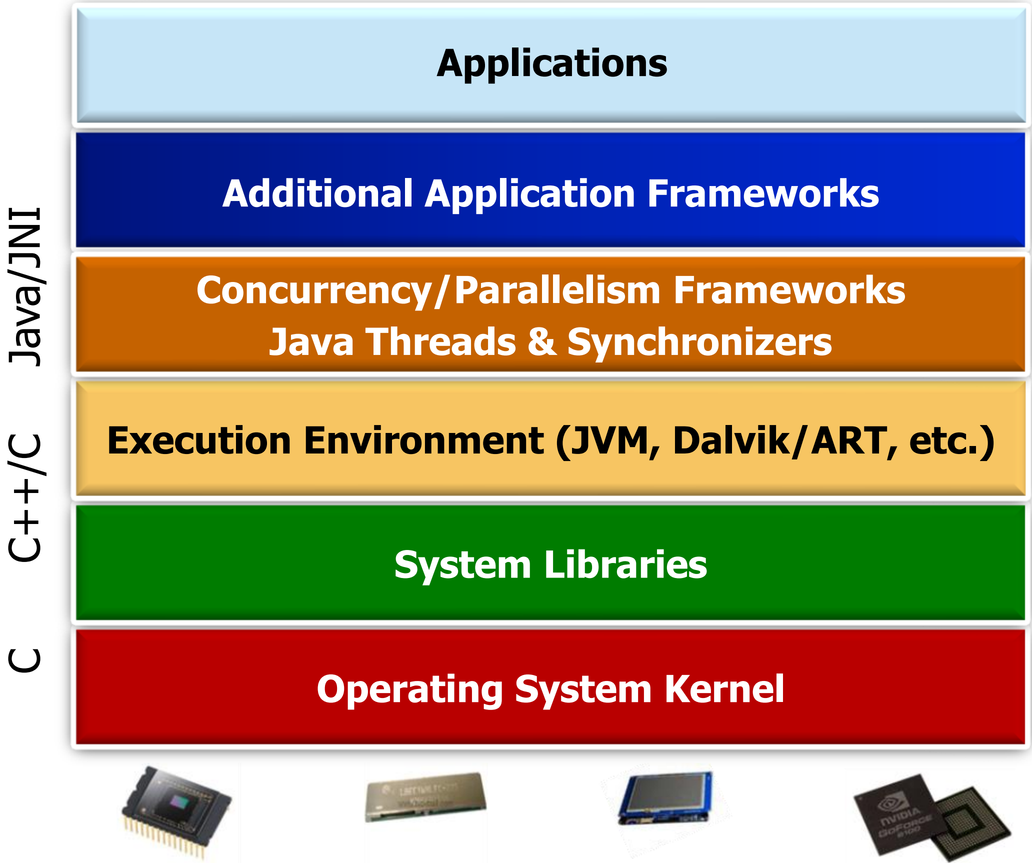
Execution Environment (JVM, Dalvik/ART, etc.)

System Libraries

Operating System Kernel

# Which Java Mechanism(s) to Understand & Apply

- Java’s concurrency & parallelism mechanisms span multiple layers in the software stack
  - Choosing best mechanism(s) depend on various factors


Java/JNI
C++/C
C
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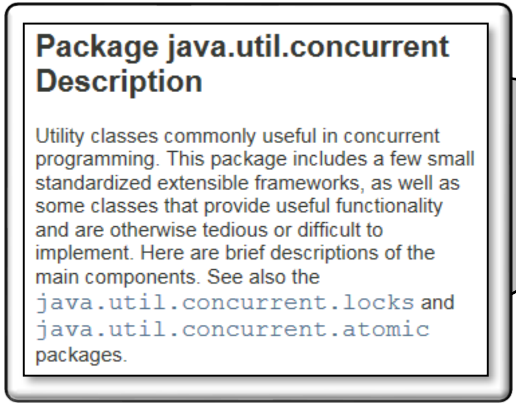
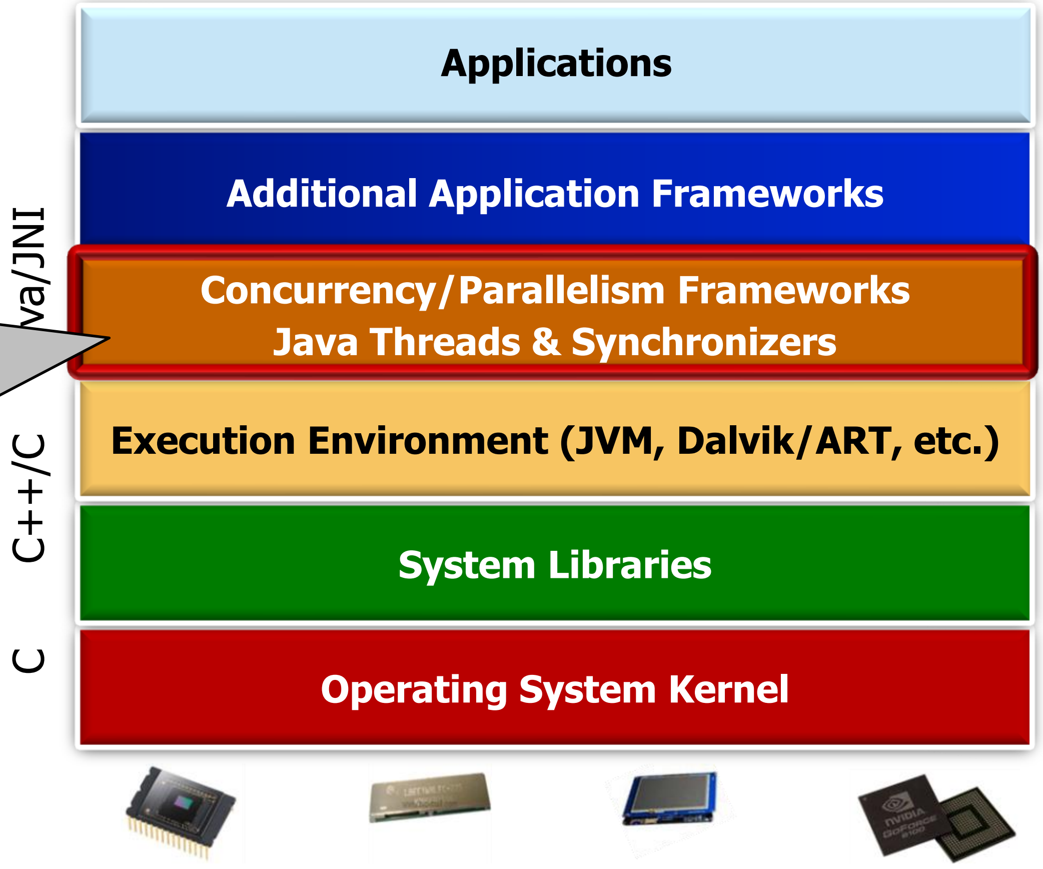
# Which Java Mechanism(s) to Understand & Apply

- Developers of low-level classes & performance-sensitive apps may prefer shared object mechanisms



**Package java.util.concurrent Description**

Utility classes commonly useful in concurrent programming. This package includes a few small standardized extensible frameworks, as well as some classes that provide useful functionality and are otherwise tedious or difficult to implement. Here are brief descriptions of the main components. See also the `java.util.concurrent.locks` and `java.util.concurrent.atomic` packages.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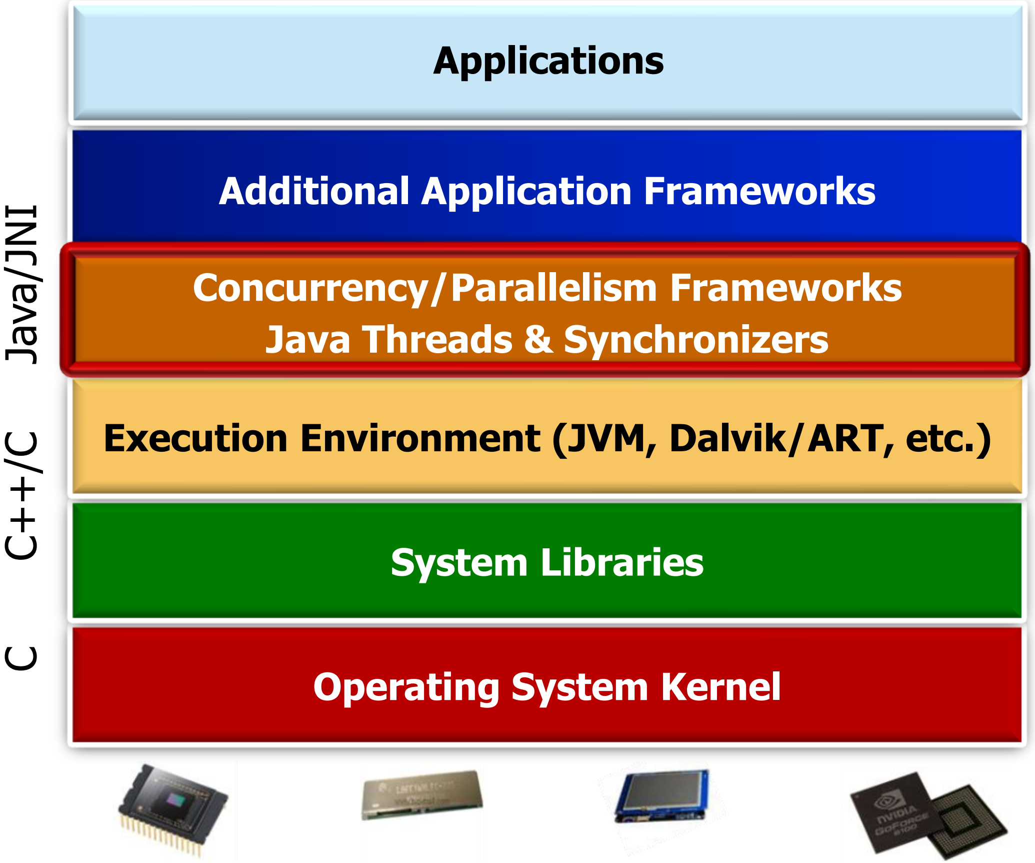
e.g., java.util.concurrent as per www.youtube.com/watch?v=sq0MX3fHkro

# Which Java Mechanism(s) to Understand & Apply

- Developers of low-level classes & performance-sensitive apps may prefer shared object mechanisms
  - **Pros**: Efficient & lightweight
  - **Cons**: Tedious & error-prone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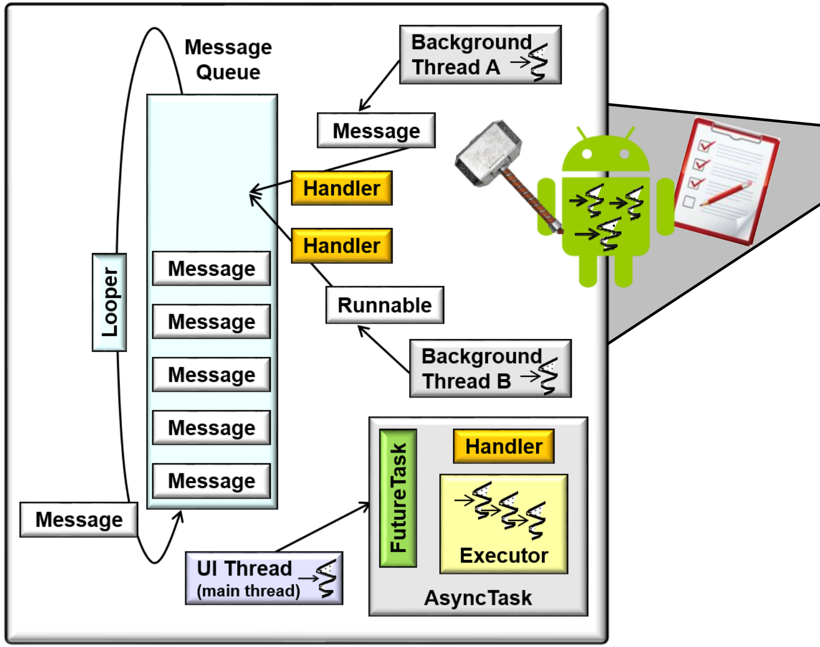
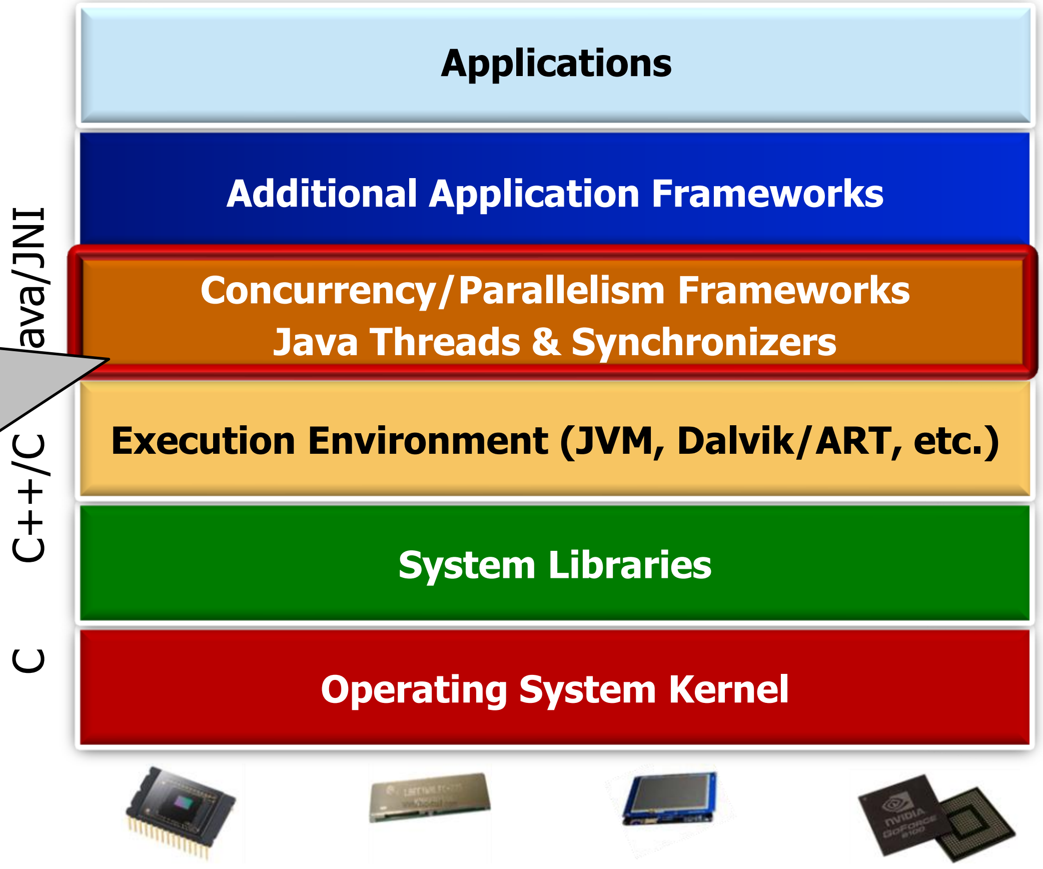
Shared objects are often best used by infrastructure vs. app developers

# Which Java Mechanism(s) to Understand & Apply

- Framework developers may want to use the Java message passing mechanisms

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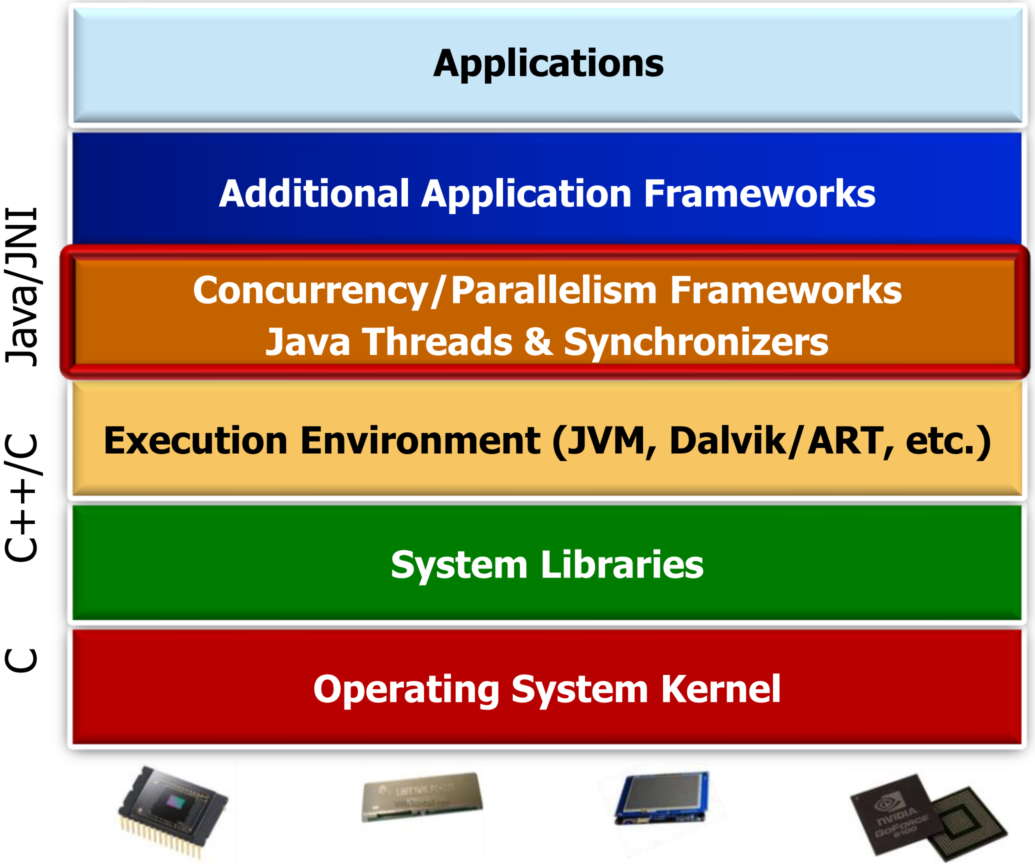
e.g., Android AsyncTask/HaMeR frameworks or Java ExecutorCompetionService

# Which Java Mechanism(s) to Understand & Apply

- Framework developers may want to use the Java message passing mechanisms
  - **Pros**: Flexible & decoupled
  - **Cons**: Time/space overhead



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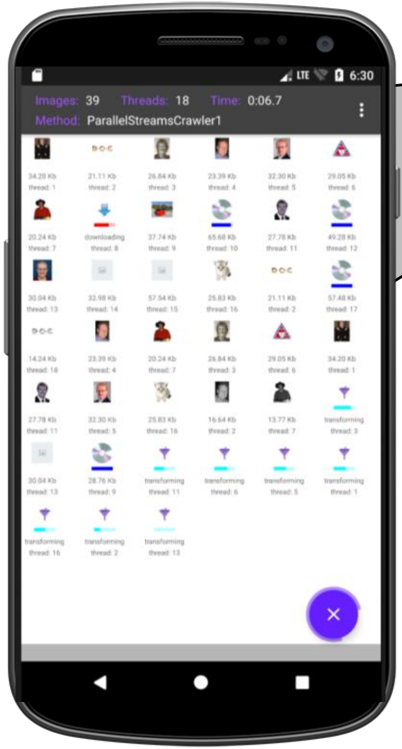
May incur higher context switching, synchronization, & data movement overhead

# Which Java Mechanism(s) to Understand & Apply

- Mobile app developers may want to program w/higher-level frameworks



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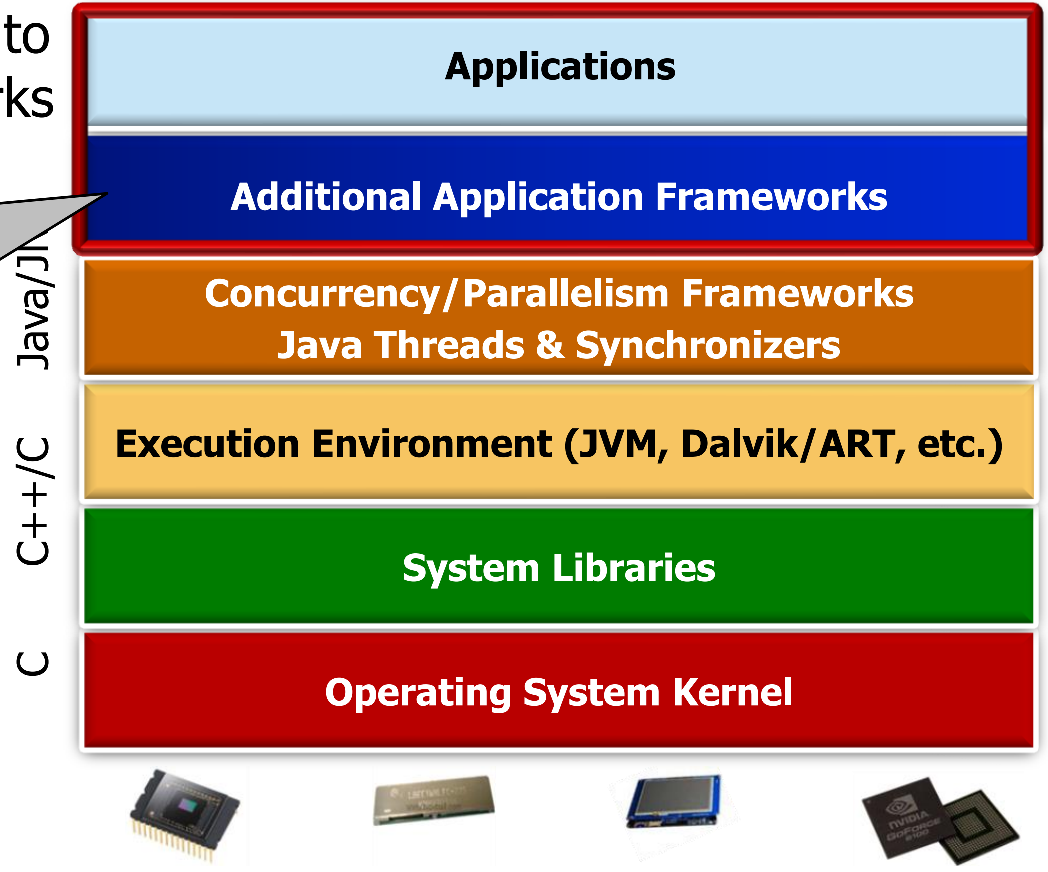
Images: 39 Threads: 18 Time: 0:06.7

Method: ParallelStreamsCrawler1



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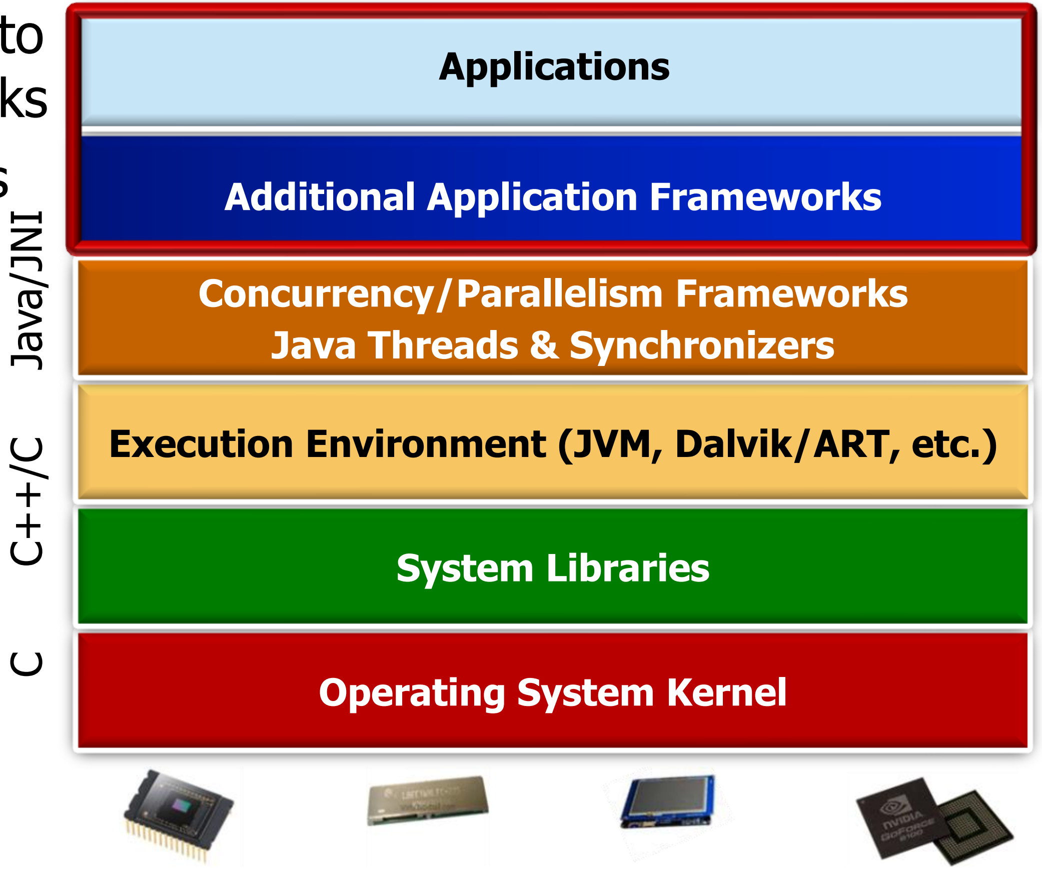
e.g., Java 8 parallel streams & completable futures, RxJava, etc.

# Which Java Mechanism(s) to Understand & Apply

- Mobile app developers may want to program w/higher-level frameworks
  - **Pros**: Productivity & robustness
  - **Cons**: Time/space overhead & overly prescriptive



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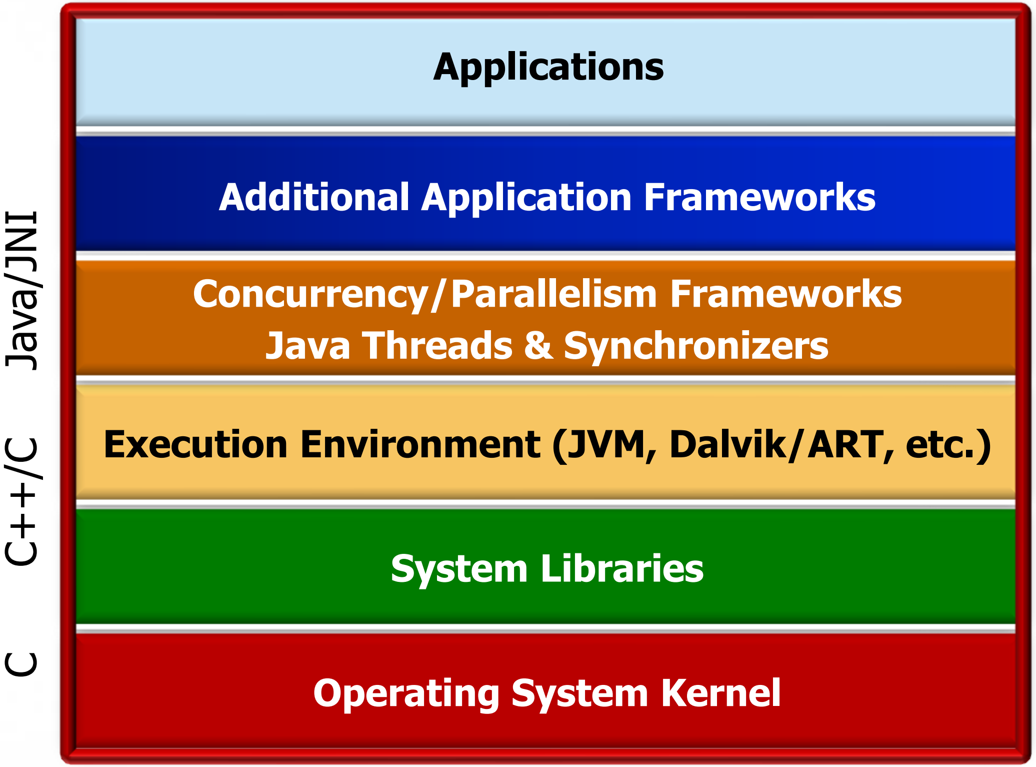

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"Full stack" developers should understand concepts & mechanisms at each layer

# End of Evaluation of Concurrency & Parallelism in Java