The Pros & Cons of Asynchrony

Douglas C. Schmidt
d.schmidt@vanderbilt.edu
www.dre.vanderbilt.edu/~schmidt

Professor of Computer Science

Institute for Software Integrated Systems

Vanderbilt University
Nashville, Tennessee, USA

Learning Objectives in this Part of the Lesson

- Motivate the need for Java futures by understanding the pros & cons of synchrony
- Motivate the need for Java futures by understanding the pros & cons of asynchrony

Overview of Asynchrony & Asynchronous Operations

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- Asynchronous operations can alleviate limitations with synchronous operations

See en.wikipedia.org/wiki/Asynchrony_(computer_programming)

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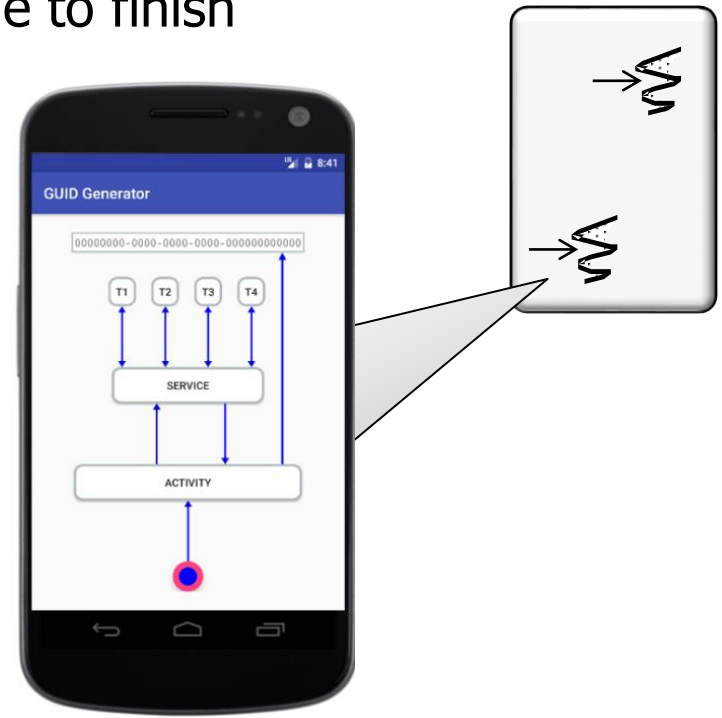
- Asynchronous operations can alleviate limitations with synchronous operations
  - Asynchrony is a means of concurrent programming where the caller does not block while waiting for the called code to finish



See en.wikipedia.org/wiki/Asynchronous_method_invocation

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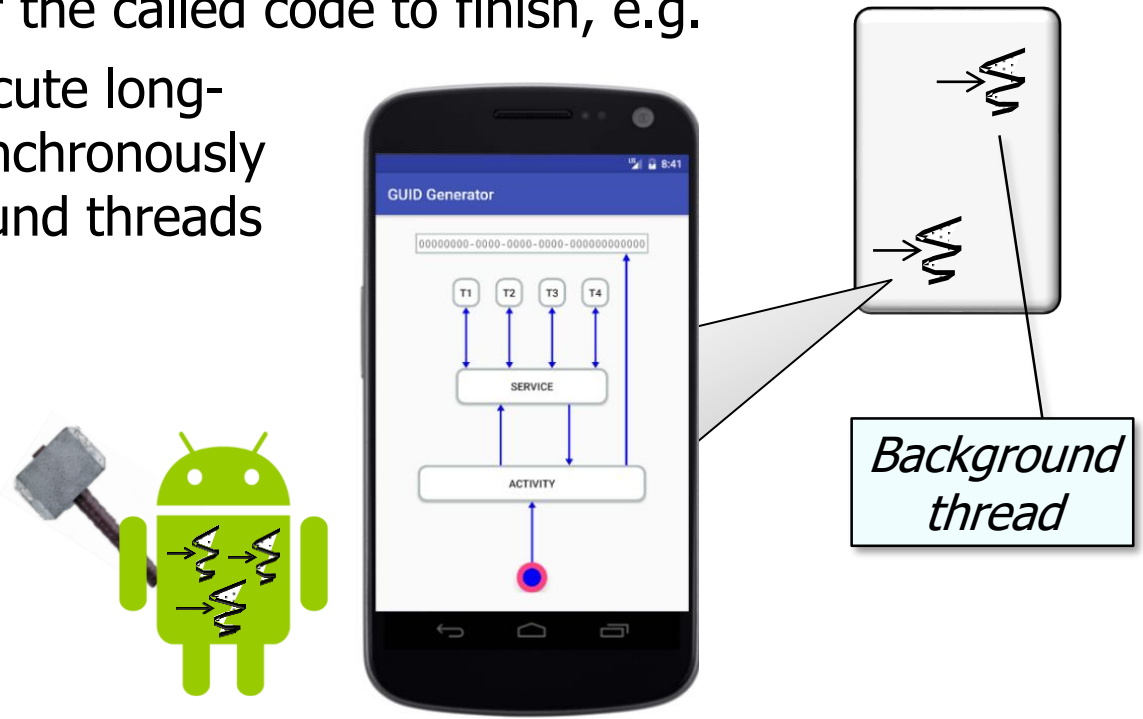
    - Android AsyncTasks execute long-duration operations asynchronously in one or more background threads



See developer.android.com/reference/android/os/AsyncTask

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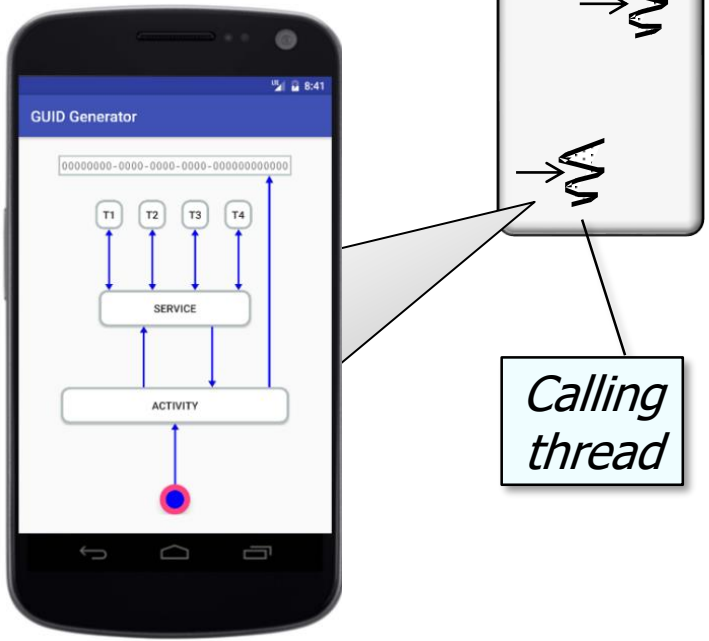
- Asynchronous operations can alleviate limitations with synchronous operations
  - Asynchrony is a means of concurrent programming where the caller does not block while waiting for the called code to finish, e.g.
    - Android AsyncTasks execute long-duration operations asynchronously in one or more background threads
    - The caller (UI) thread can be notified upon completion, failure, or progress of the background task



See developer.android.com/reference/android/os/AsyncTask

The Pros of Asynchrony

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- Pros of asynchronous operations

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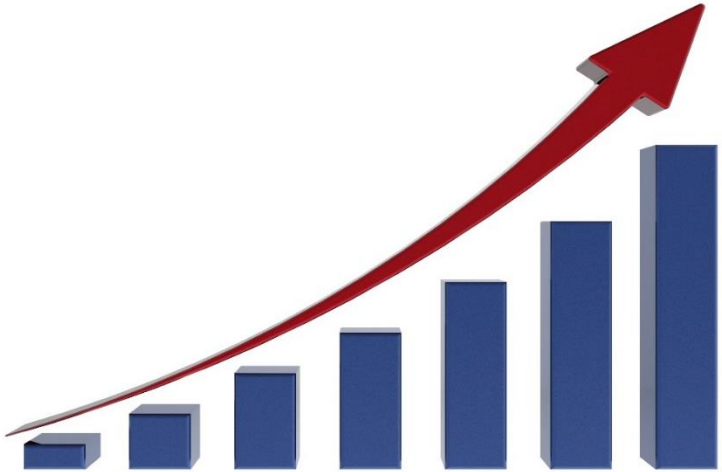
- Pros of asynchronous operations
  - Responsiveness
    - A calling thread needn't block waiting for the async request to complete

See en.wikipedia.org/wiki/Asynchronous_method_invocation

The Pros of Asynchrony

- Pros of asynchronous operations
  - Responsiveness
  - Elasticity
    - Multiple requests can run scalably & concurrently on multiple cores



See en.wikipedia.org/wiki/Elasticity_(cloud_computing)

The Pros of Asynchrony

- Pros of asynchronous operations
  - Responsiveness
  - Elasticity
    - Multiple requests can run scalably & concurrently on multiple cores
      - Elasticity is particularly useful to auto-scale computations in cloud environments

See en.wikipedia.org/wiki/Elasticity_(cloud_computing) & en.wikipedia.org/wiki/Autoscaling

The Cons of Asynchrony

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- Cons of asynchronous operations

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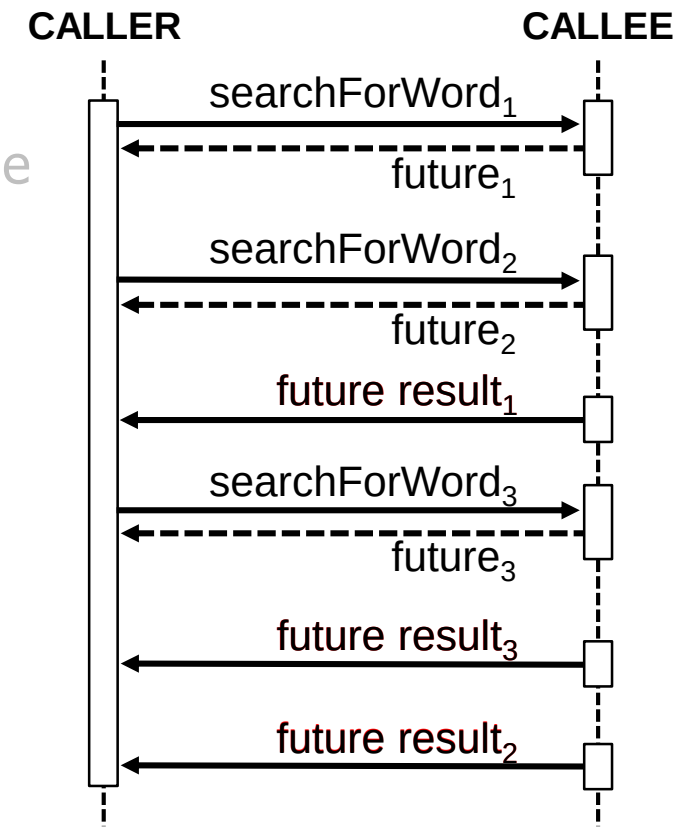
- Cons of asynchronous operations
  - Unpredictability
    - Response times may not unpredictable due to non-determinism of async operations

Non-determinism is a general problem with concurrency & not just asynchrony

The Cons of Asynchrony

- Cons of asynchronous operations
  - Unpredictability
    - Response times may not unpredictable due to non-determinism of async operations
    - Results can occur in a different order than the original calls were made



Additional time & effort may be required if results must be ordered somehow

The Cons of Asynchrony

- Cons of asynchronous operations
  - Unpredictability
  - Complicated programming & debugging

The Cons of Asynchrony

- Cons of asynchronous operations
  - Unpredictability
  - Complicated programming & debugging
    - The patterns & best-practices of asynchronous programming are not well understood

See dzone.com/articles/callback-hell

The Cons of Asynchrony

- Cons of asynchronous operations
  - Unpredictability
  - Complicated programming & debugging
    - The patterns & best-practices of asynchronous programming are not well understood
    - Errors can be hard to track due to unpredictability

See www.jetbrains.com/help/idea/tutorial-java-debugging-deep-dive.html

The Cons of Asynchrony

- Cons of asynchronous operations
  - Unpredictability
  - Complicated programming & debugging
    - The patterns & best-practices of asynchronous programming are not well understood
    - Errors can be hard to track due to unpredictability

Again, this non-determinism is a general problem with concurrent processing

Weighing the Pros & Cons of Asynchrony

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- Two things are necessary for the pros of asynchrony to outweigh the cons

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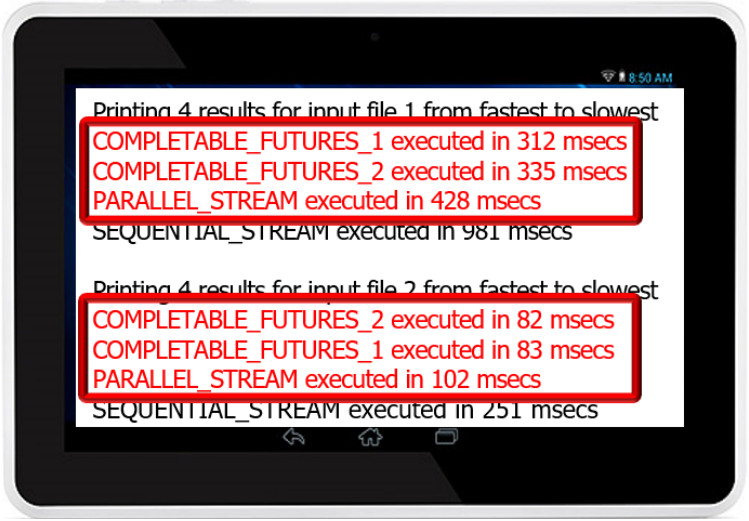
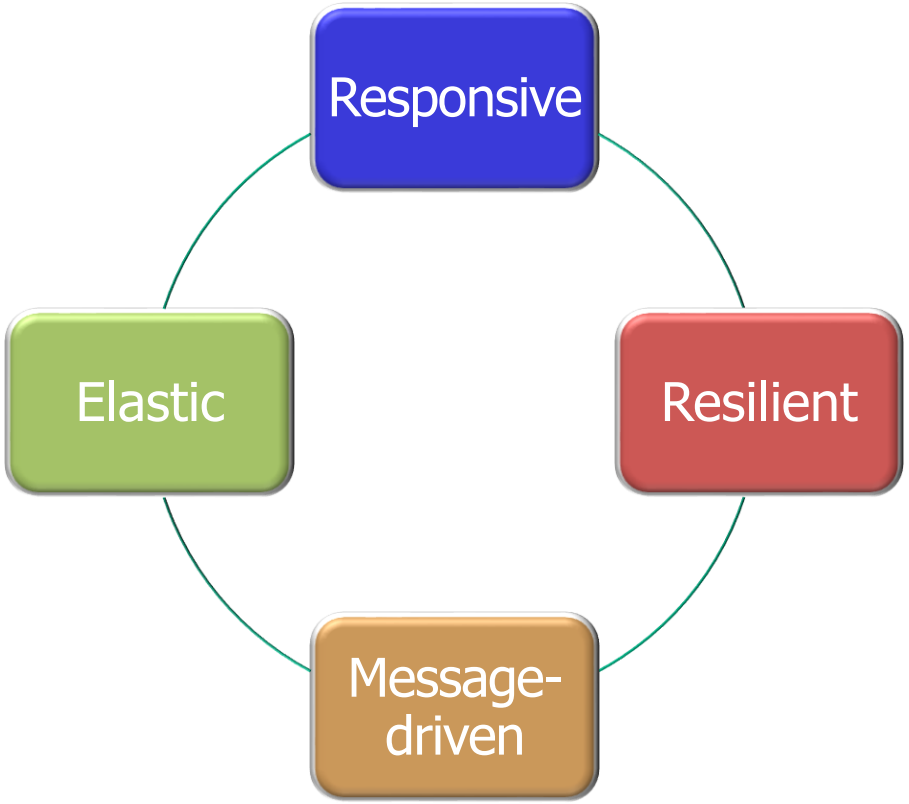
  - Performance should improve to offset the increased complexity of programming & debugging



See upcoming lesson on "*Java Completable Futures ImageStreamGang Example*"

Weighing the Pros & Cons of Asynchrony

- Two things are necessary for the pros of asynchrony to outweigh the cons
  - Performance should improve to offset the increased complexity of programming & debugging
  - An asynchronous programming model should reflect the key principles of the reactive paradigm



See earlier lesson on "*Overview of Reactive Programming*"

End of the Pros & Cons of Asynchrony