The Pros & Cons of Asynchrony

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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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- 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](en.wikipedia.org/wiki/Asynchronous_method_invocation)
Overview of Asynchrony & Asynchronous Operations

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- 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.

See developer.android.com/reference/android/os/AsyncTask
Overview of Asynchrony & Asynchronous Operations

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- 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.

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 synchronous 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
The Cons of Asynchrony

- 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

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.
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.

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