Advanced Java CompletableFuture Features: Handling Runtime Exceptions (Part 1)

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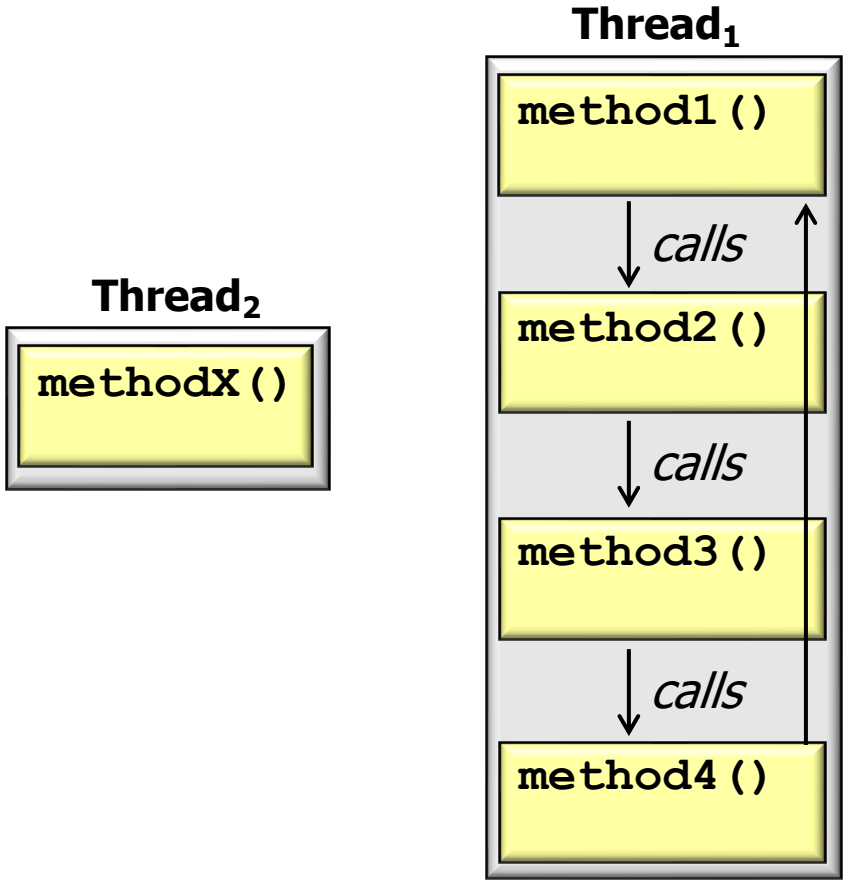
Learning Objectives in this Part of the Lesson

- Understand how completion stage methods chain dependent actions
- Know how to group these methods
- Single stage methods
- Two stage methods (and)
- Two stage methods (or)
- Apply these methods
- Handle runtime exceptions
  - Sync vs. async exceptions



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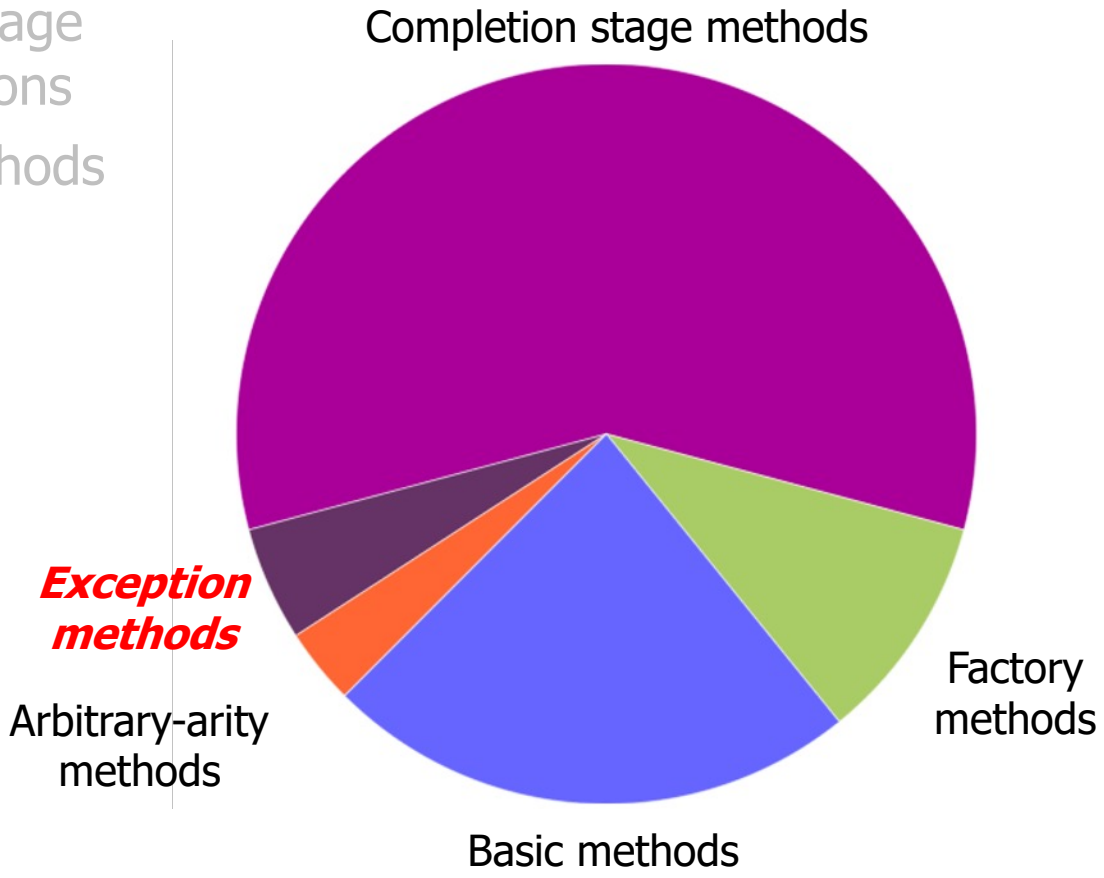
  - Overview of methods



Synchronous vs. Asynchronous Exception Handling

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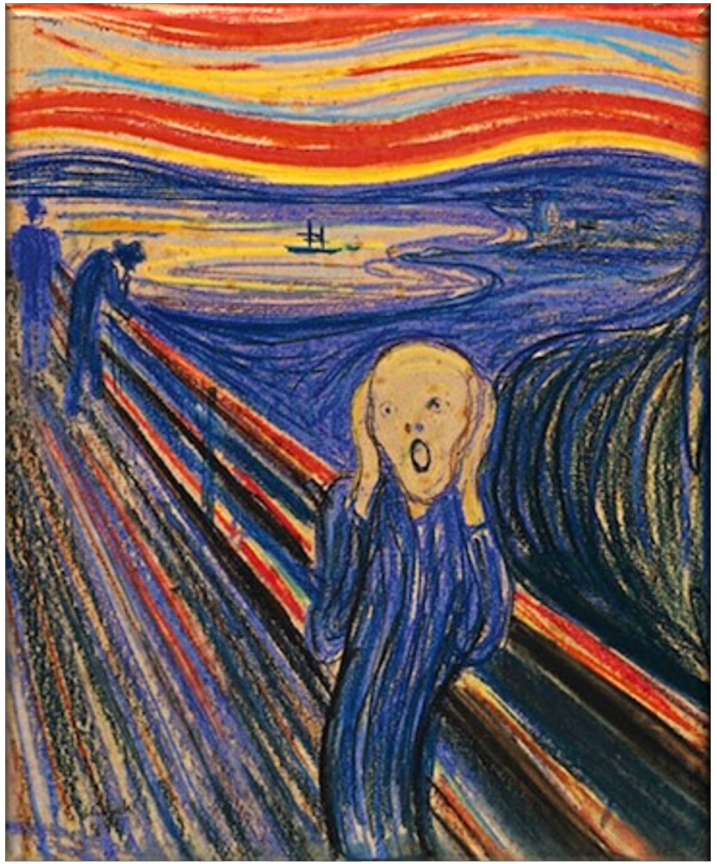
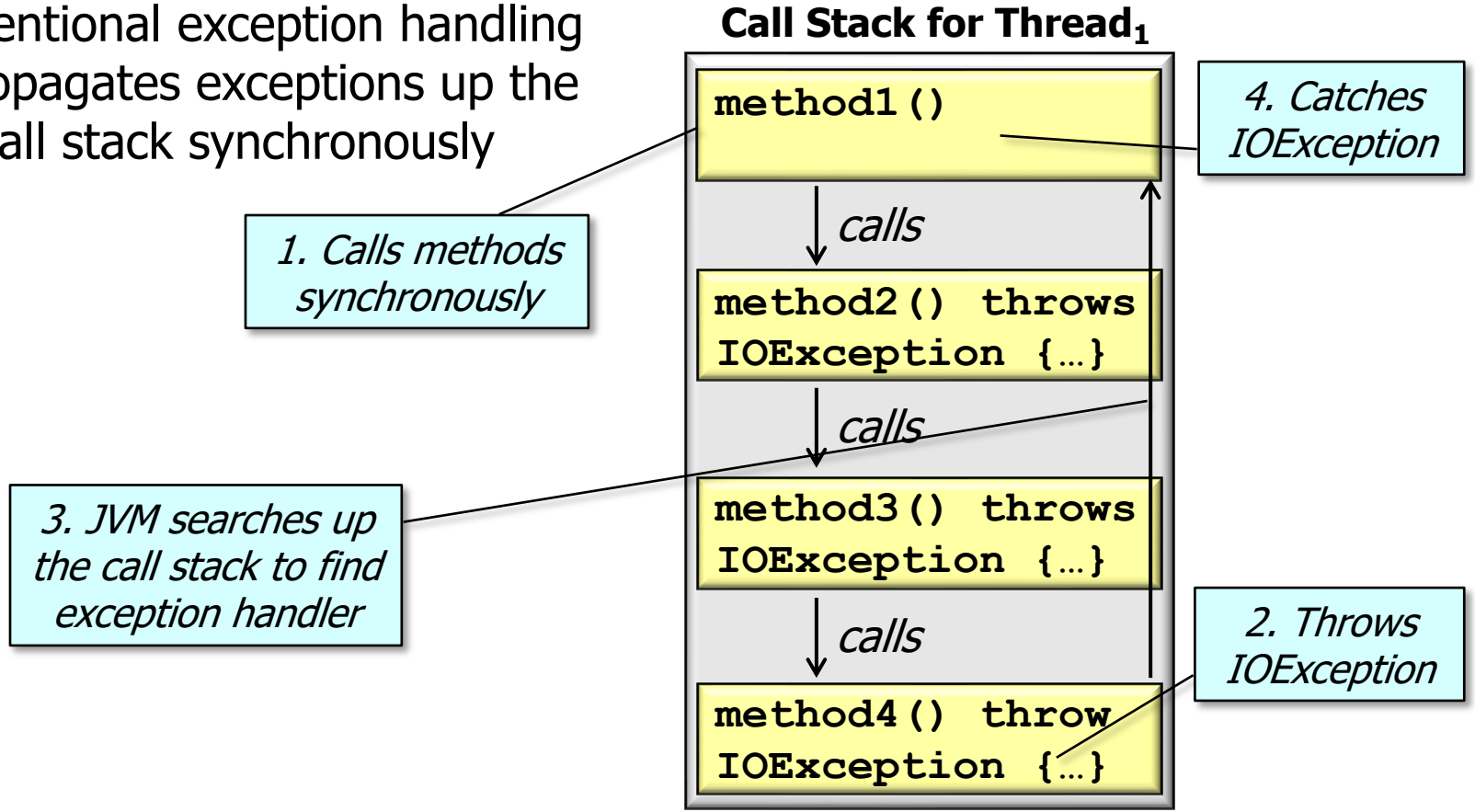
- Exception handling is more complex for asynchronous computations than for synchronous computations



See blog.lightstreamer.com/2014/07/exception-handling-in-asynchronous-java.html

Synchronous vs. Asynchronous Exception Handling

- The conventional exception handling model propagates exceptions up the runtime call stack synchronously

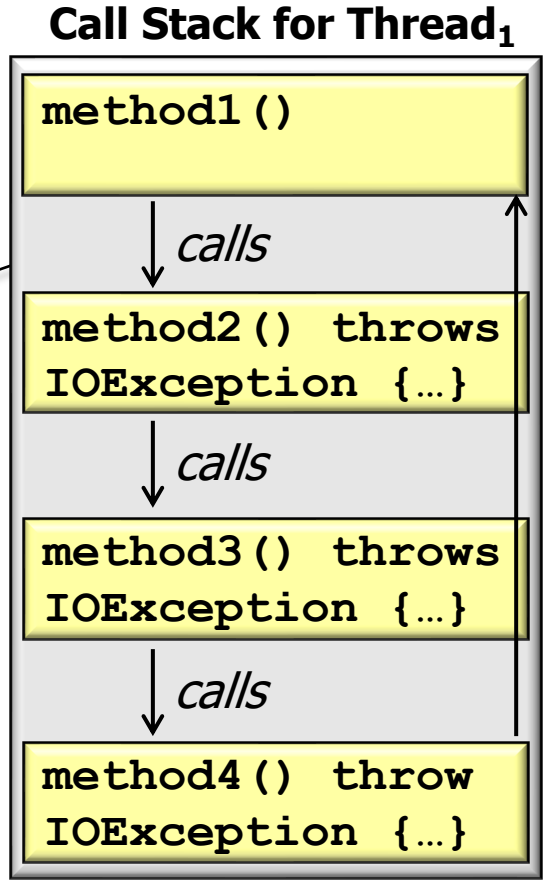


See en.wikipedia.org/wiki/Exception_handling

Synchronous vs. Asynchronous Exception Handling

- The conventional exception handling model propagates exceptions up the runtime call stack synchronously

Therefore, the thread that calls a method is the same thread that can handle any exception that is thrown



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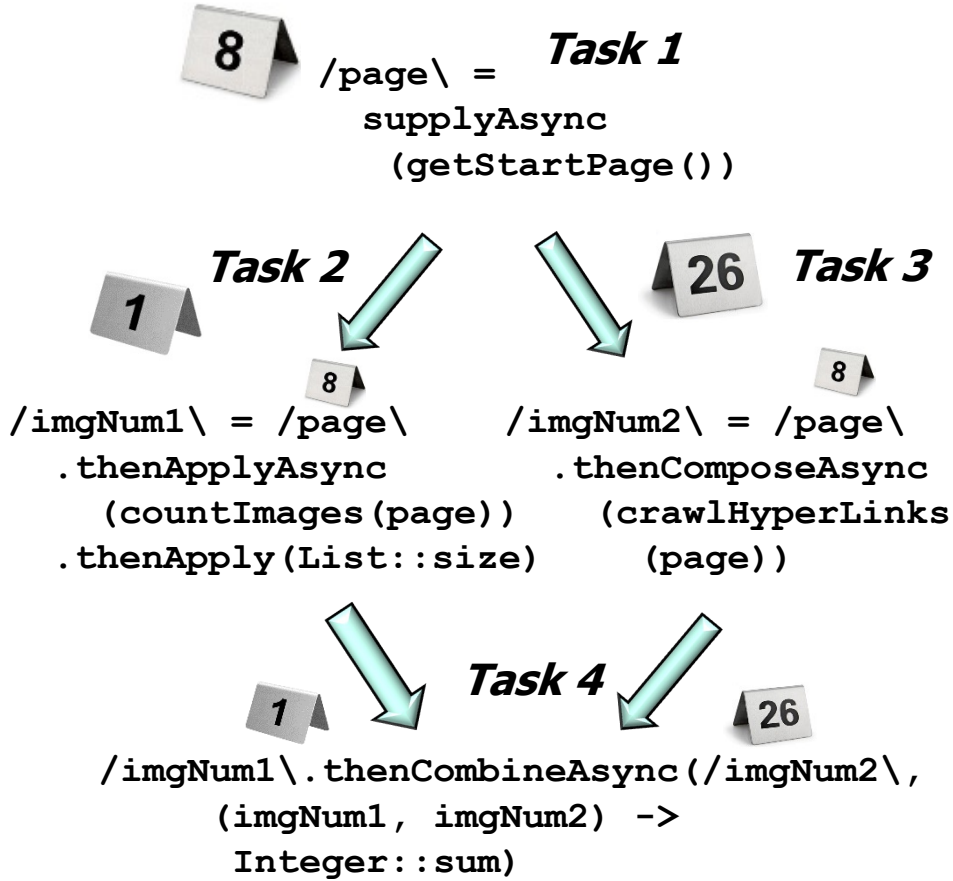
Synchronous vs. Asynchronous Exception Handling

- In contrast, completable futures that run asynchronously don't conform to the conventional call stack model



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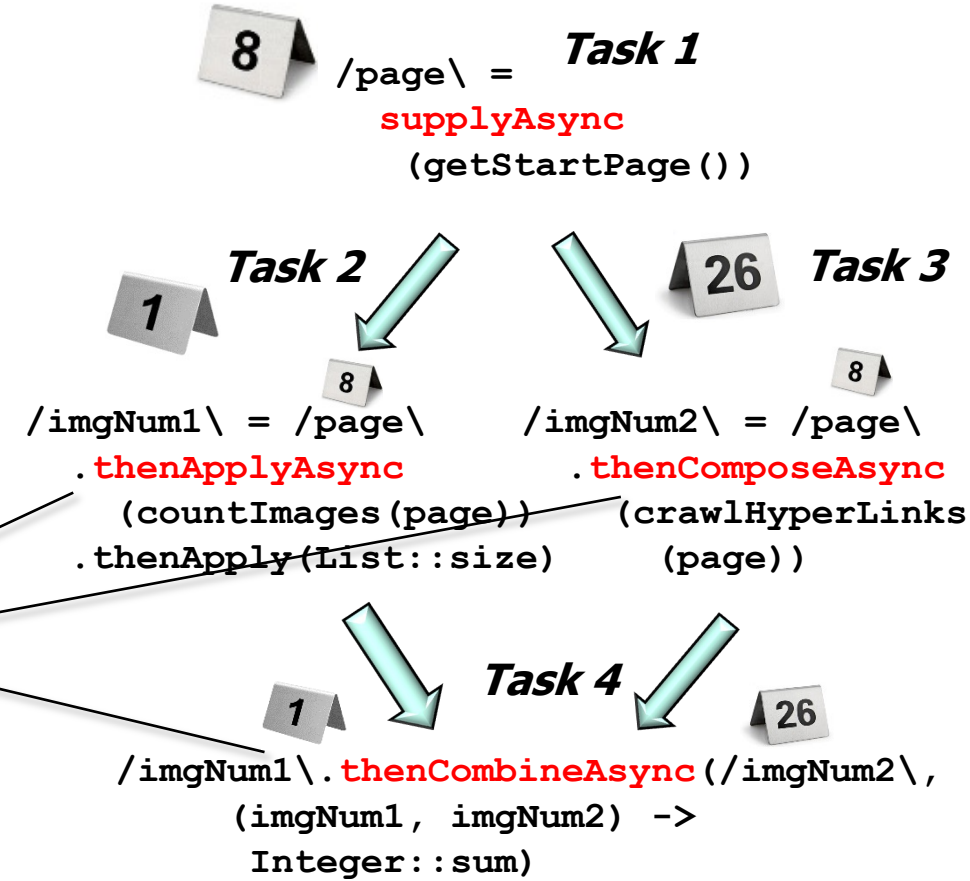

Completion stage methods can thus run in different worker threads than the thread where a method call originates!

See suryanarayanjena.wordpress.com/async-methods-in-completablefuture

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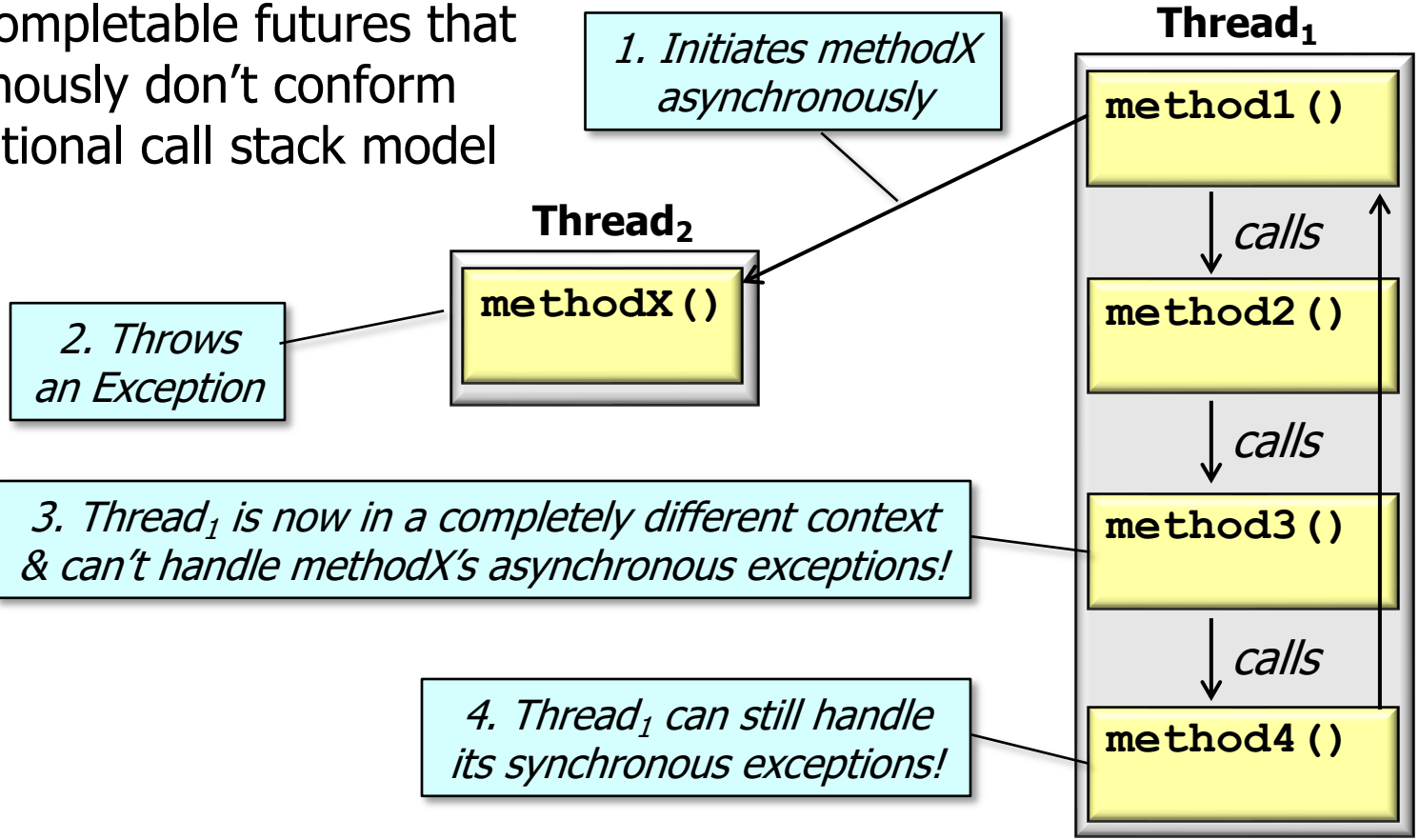

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Overview of Handling Exceptions in Completion Stages

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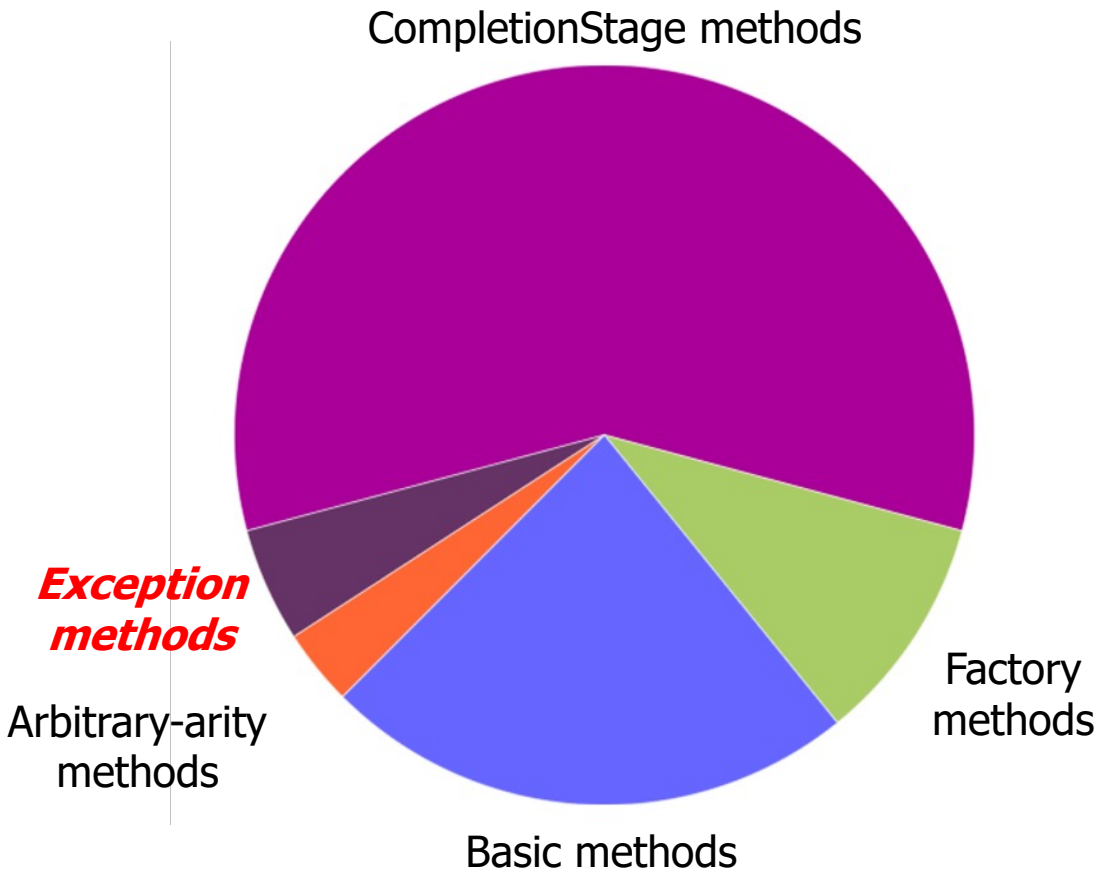
- Completion stage methods handle runtime exceptions that occur asynchronously



See www.jesperdj.com/2015/09/26/the-future-is-completable-in-java-8

Overview of Handling Exceptions in Completion Stages

- Completion stage methods handle runtime exceptions that occur asynchronously

Methods	Params	Returns	Behavior
when Complete (Async)	Bi Consumer	Completable Future with result of earlier stage or throws exception	Handle outcome of a stage, whether a result value or an exception
handle (Async)	Bi Function	Completable Future with result of BiFunction	Handle outcome of a stage & return new value
exceptionally (Async)	Function	Completable Future<T>	When exception occurs, replace exception with result value

Help make programs more *resilient* by handling erroneous computations gracefully

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These methods run in the invoking thread or the same thread as previous stage

The thread that executes these methods depends on various runtime factors

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**Async() variants run in some thread pool*

See blog.krecan.net/2013/12/25/completablefutures-why-to-use-async-methods

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Added in Java 12

See www.logicbig.com/tutorials/core-java-tutorial/java-12-changes/completion-stage-new-methods.html

Overview of Handling Exceptions in Completion Stages

- Completion stage methods handle runtime exceptions that occur asynchronously
  - Summary of capabilities

Item	handle()	whenComplete()	exceptionally()
Access to success?	Yes	Yes	No
Access to failure?	Yes	Yes	Yes
Can recover from failure?	Yes	No	Yes
Can transform result from `T` to `U`?	Yes	No	No
Trigger when success?	Yes	Yes	No
Trigger when failure?	Yes	Yes	Yes
Has an async version?	Yes	Yes	Yes (Java 12)

See mincong.io/2020/05/30/exception-handling-in-completable-future

End of Advanced Java CompletableFuture Features: Handling Runtime Exceptions (Part 1)