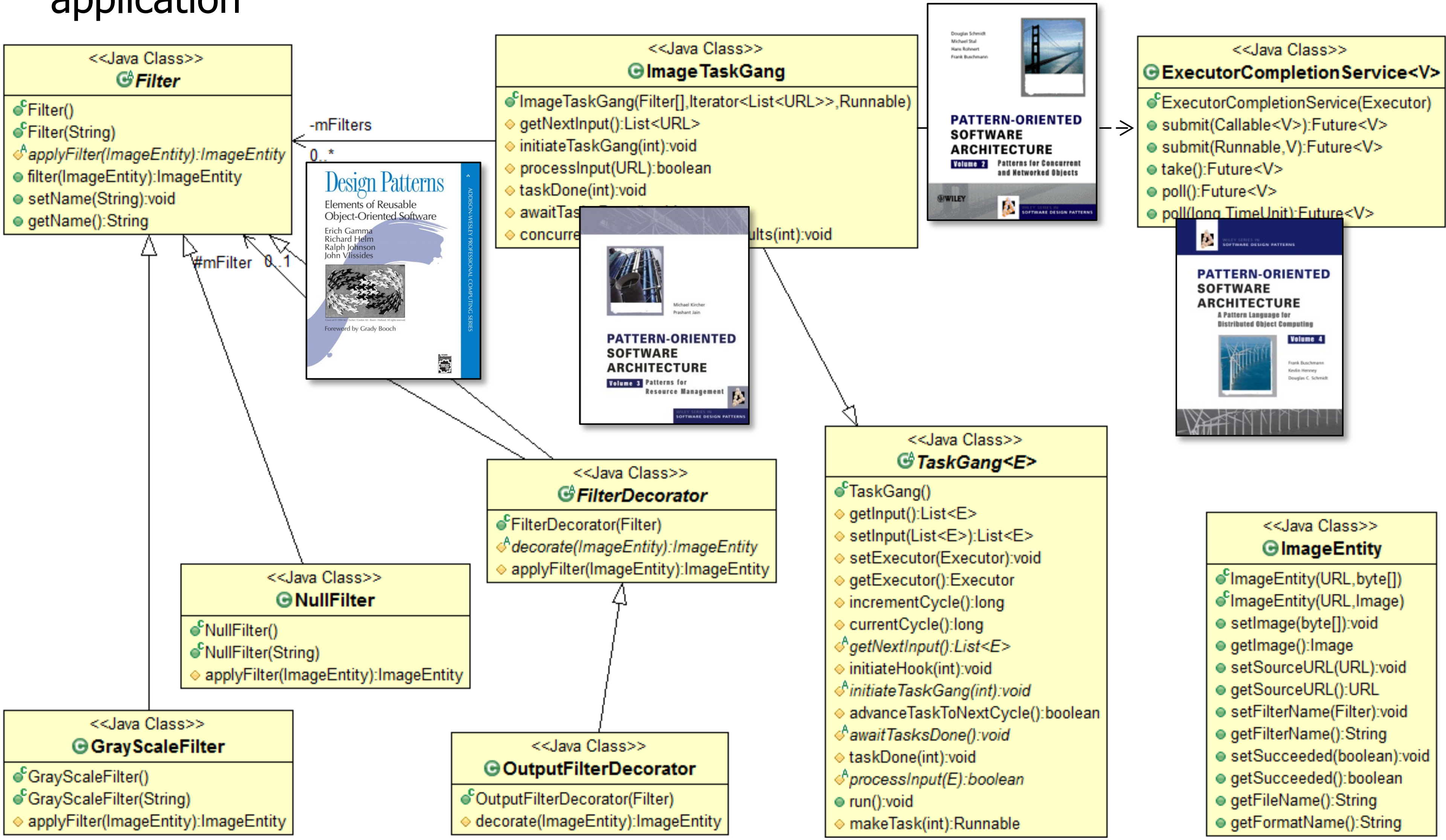
Pattern-Oriented Software Architecture of the ImageTask Gang Application

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

Institute for Software
Integrated Systems
Vanderbilt University
Nashville, Tennessee, USA

Learning Objectives in this Part of the Lesson

- Understand the pattern-oriented software architecture of ImageTaskGang application



<<Java Class>>
Filter

- Filter()
- Filter(String)
- *applyFilter(ImageEntity):ImageEntity*
- filter(ImageEntity):ImageEntity
- setName(String):void
- getName():String

<<Java Class>>
ImageTaskGang

- ImageTaskGang(Filter[],Iterator<List<URL>>,Runnable)
- getNextInput():List<URL>
- initiateTaskGang(int):void
- processInput(URL):boolean
- taskDone(int):void
- awaitTas
- concurre lts(int):void

<<Java Class>>
ExecutorCompletionService<V>

- ExecutorCompletionService(Executor)
- submit(Callable<V>):Future<V>
- submit(Runnable,V):Future<V>
- take():Future<V>
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- getExecutor():Executor
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- currentCycle():long
- *getNextInput():List<E>*
- initiateHook(int):void
- *initiateTaskGang(int):void*
- advanceTaskToNextCycle():boolean
- *awaitTasksDone():void*
- taskDone(int):void
- *processInput(E):boolean*
- run():void
- makeTask(int):Runnable

<<Java Class>>
NullFilter

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- applyFilter(ImageEntity):ImageEntity

<<Java Class>>
ImageEntity

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- ImageEntity(URL,Image)
- setImage(byte[]):void
- getImage():Image
- setSourceURL(URL):void
- getSourceURL():URL
- setFilterName(Filter):void
- getFilterName():String
- setSucceeded(boolean):void
- getSucceeded():boolean
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<<Java Class>>
OutputFilterDecorator

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-mFilters
0..*
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Design Patterns
Elements of Reusable Object-Oriented Software
Erich Gamma
Richard Helm
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Foreword by Grady Booch
ADDISON-WESLEY PROFESSIONAL COMPUTING SERIES
PATTERN-ORIENTED SOFTWARE ARCHITECTURE
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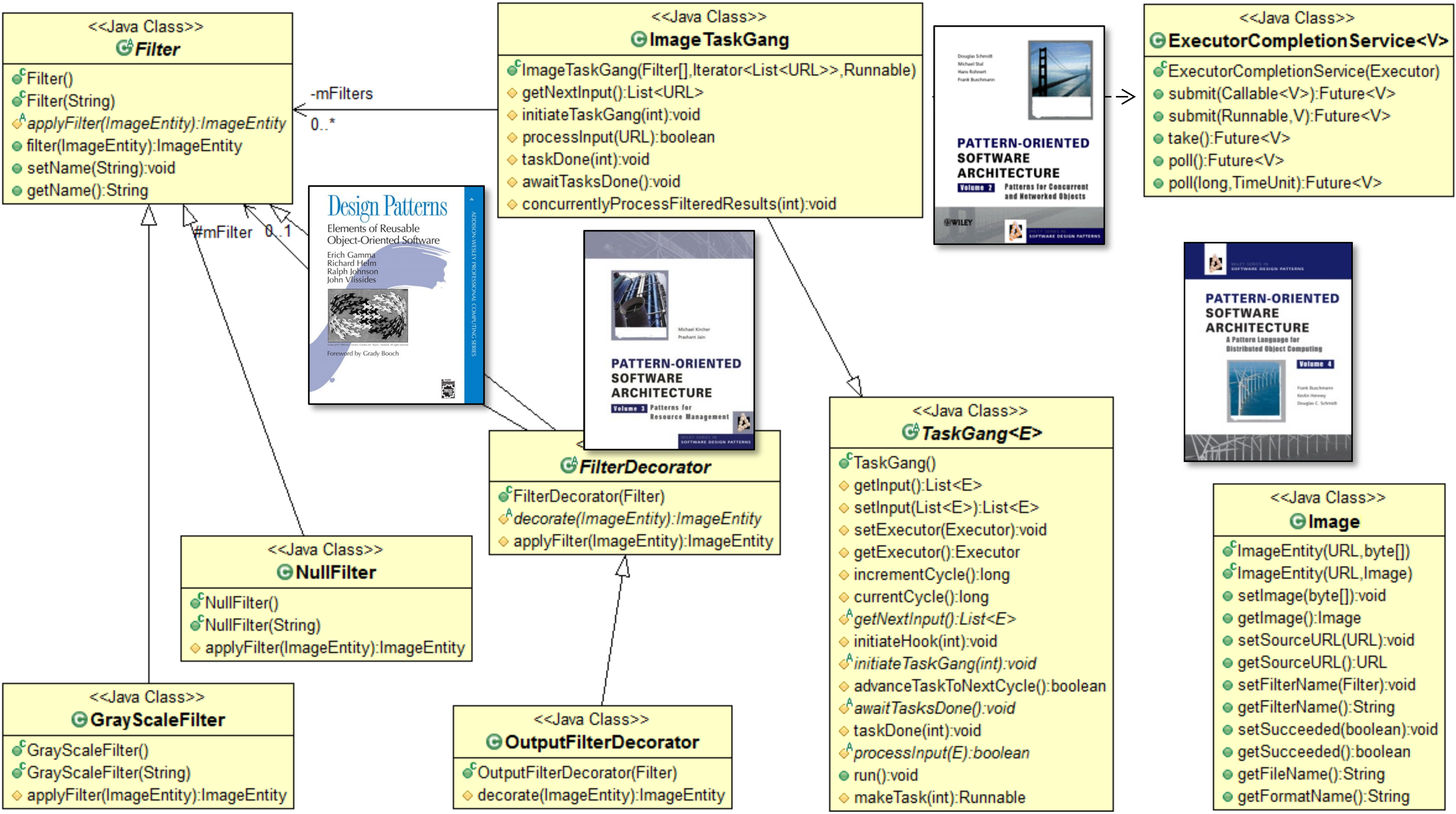
See github.com/douglascraigschmidt/LiveLessons/tree/master/ImageTaskGang

Pattern-Oriented Software Architecture of the Image TaskGang Application

Overview of Pattern-Oriented Framework Solution

- "Gang-of-Four" & POSA patterns enhance the framework-based solution



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WILEY SERIES IN SOFTWARE DESIGN PATTERNS

Patterns enhance application & framework reusability, flexibility, portability, & performance

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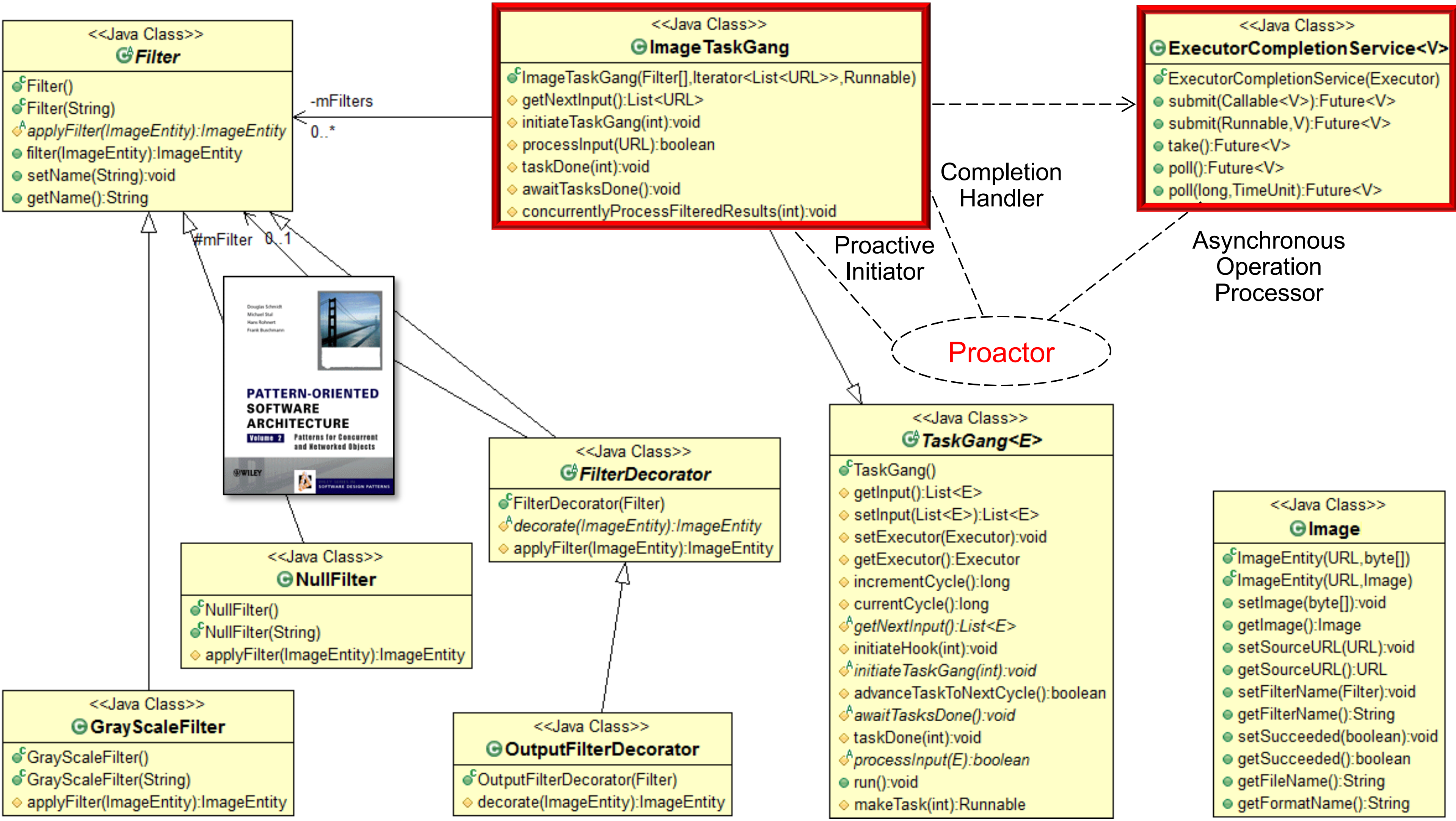

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Completion Handler
Proactive Initiator
Asynchronous Operation Processor
Proactor
Douglas Schmidt
Michael Stal
Hans Rohnert
Frank Buschmann
PATTERN-ORIENTED SOFTWARE ARCHITECTURE
Volume 2
Patterns for Concurrent and Networked Objects
WILEY
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Proactor allows concurrent applications to efficiently process service requests & responses asynchronously

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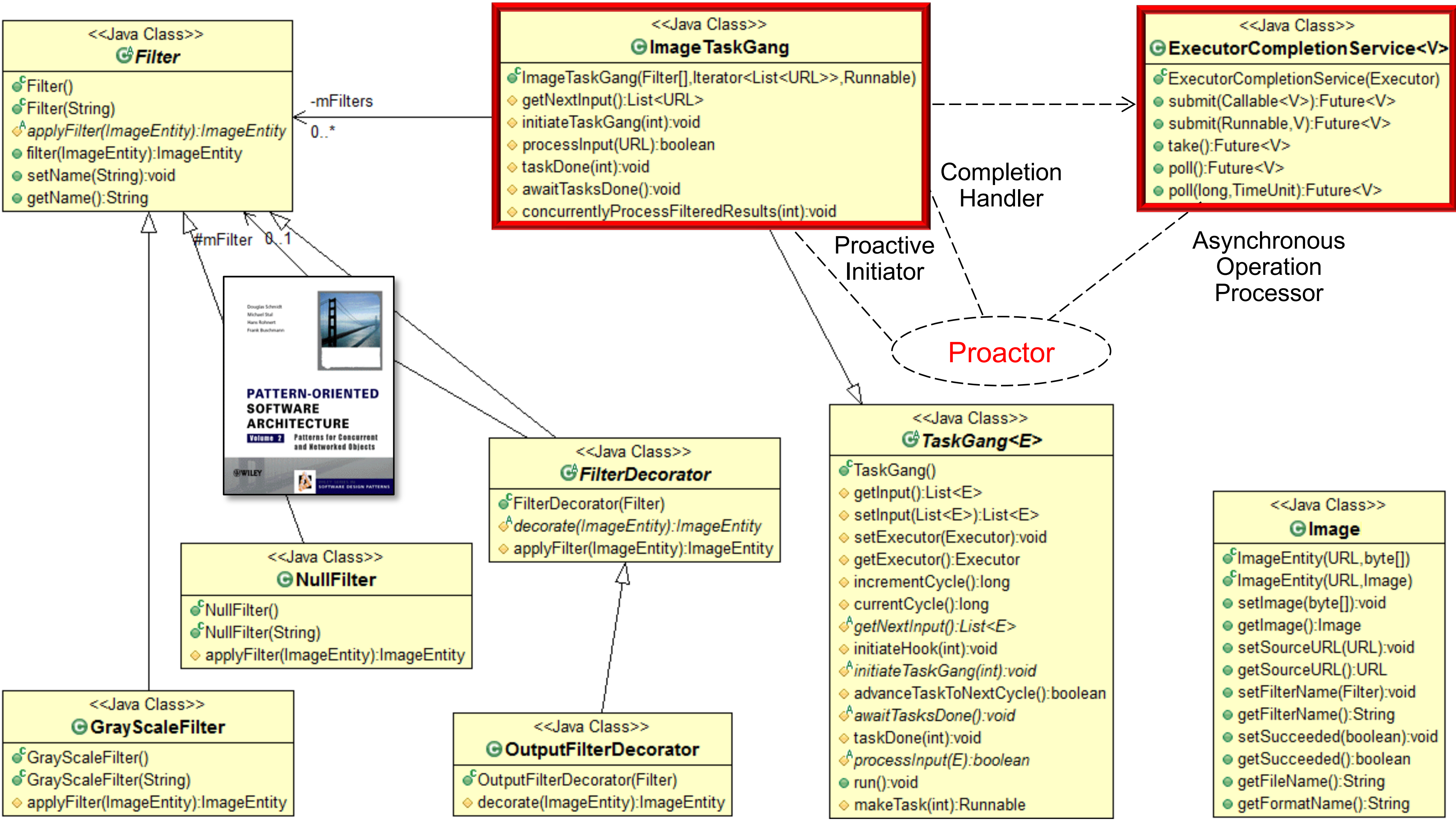

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Completion
Handler

Proactive
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Asynchronous
Operation
Processor

Proactor

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See en.wikipedia.org/wiki/Proactor_pattern

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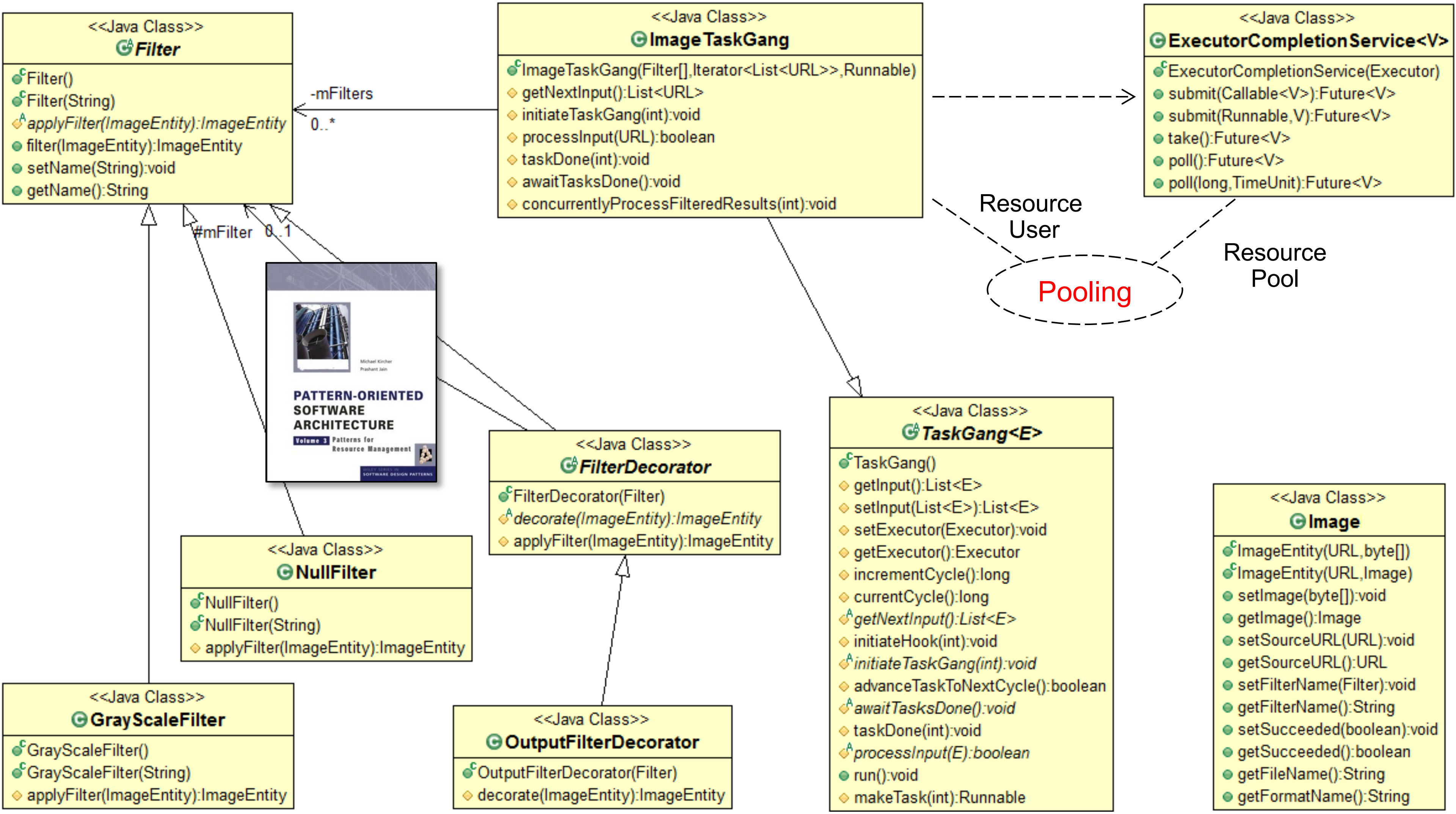

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-mFilters
0..*
#mFilter
0..1
Resource User
Resource Pool
Pooling
Michael Kircher
Prashant Jain
PATTERN-ORIENTED SOFTWARE ARCHITECTURE
Volume 3 Patterns for Resource Management
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Pooling manages multiple worker threads & optimizes their acquisition & release

Overview of Pattern-Oriented Framework Solution

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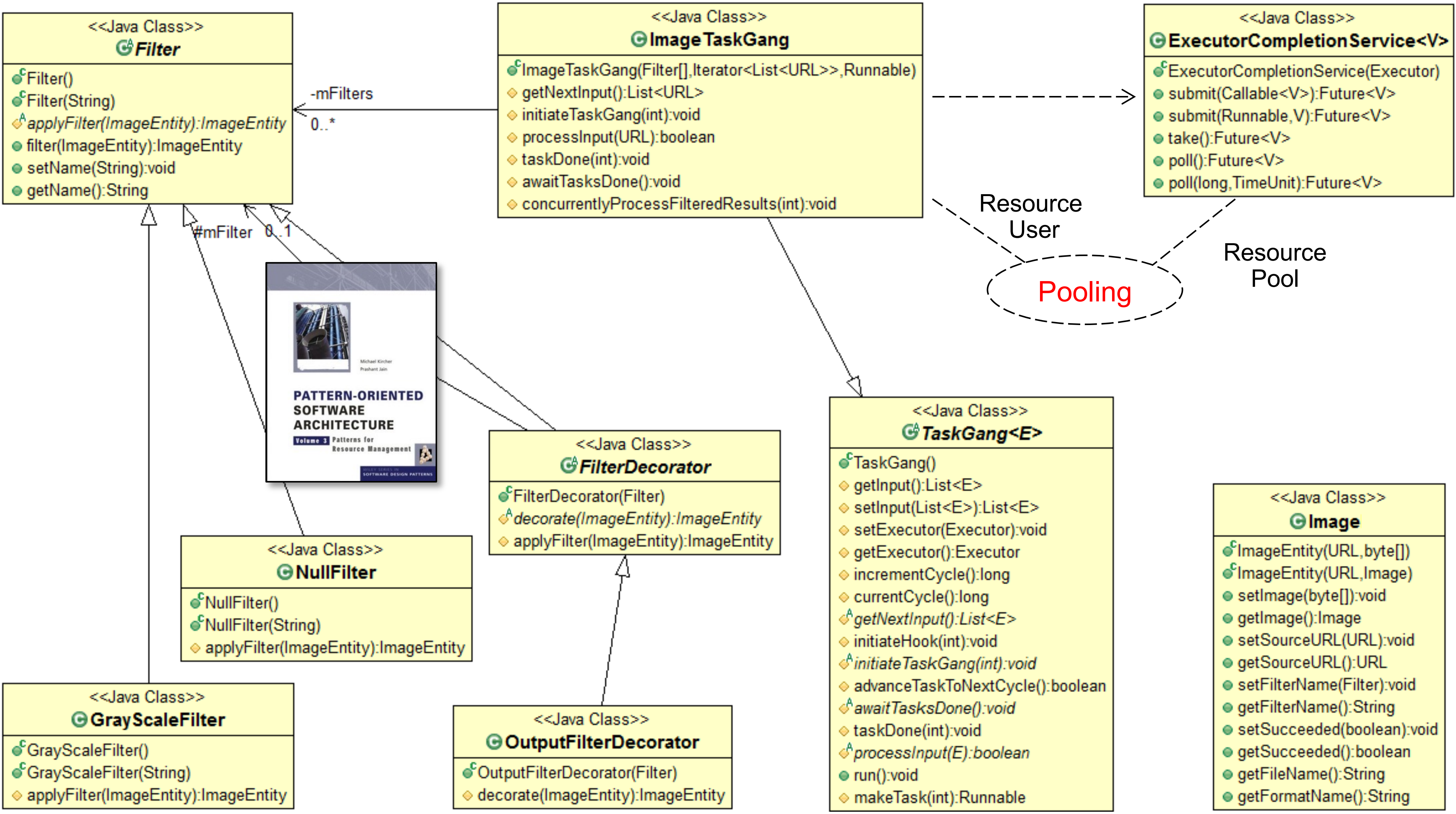

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Resource User

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See kircher-schwanninger.de/michael/publications/Pooling.pdf

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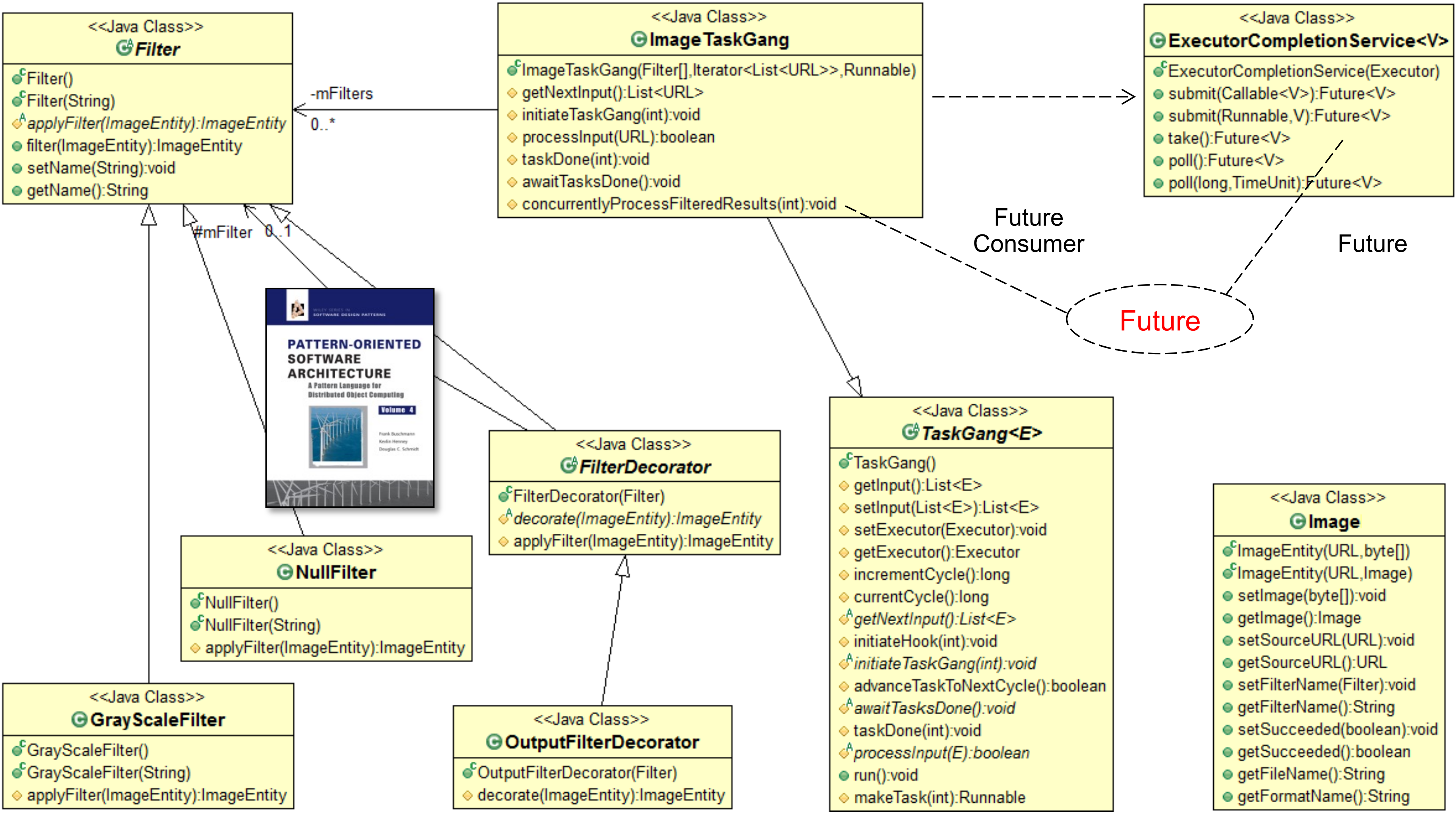

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Future Consumer
Future
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Volume 4
Frank Buschmann
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Future provides a proxy for a result that may not be available yet, allowing a program to continue execution without blocking until the result is needed

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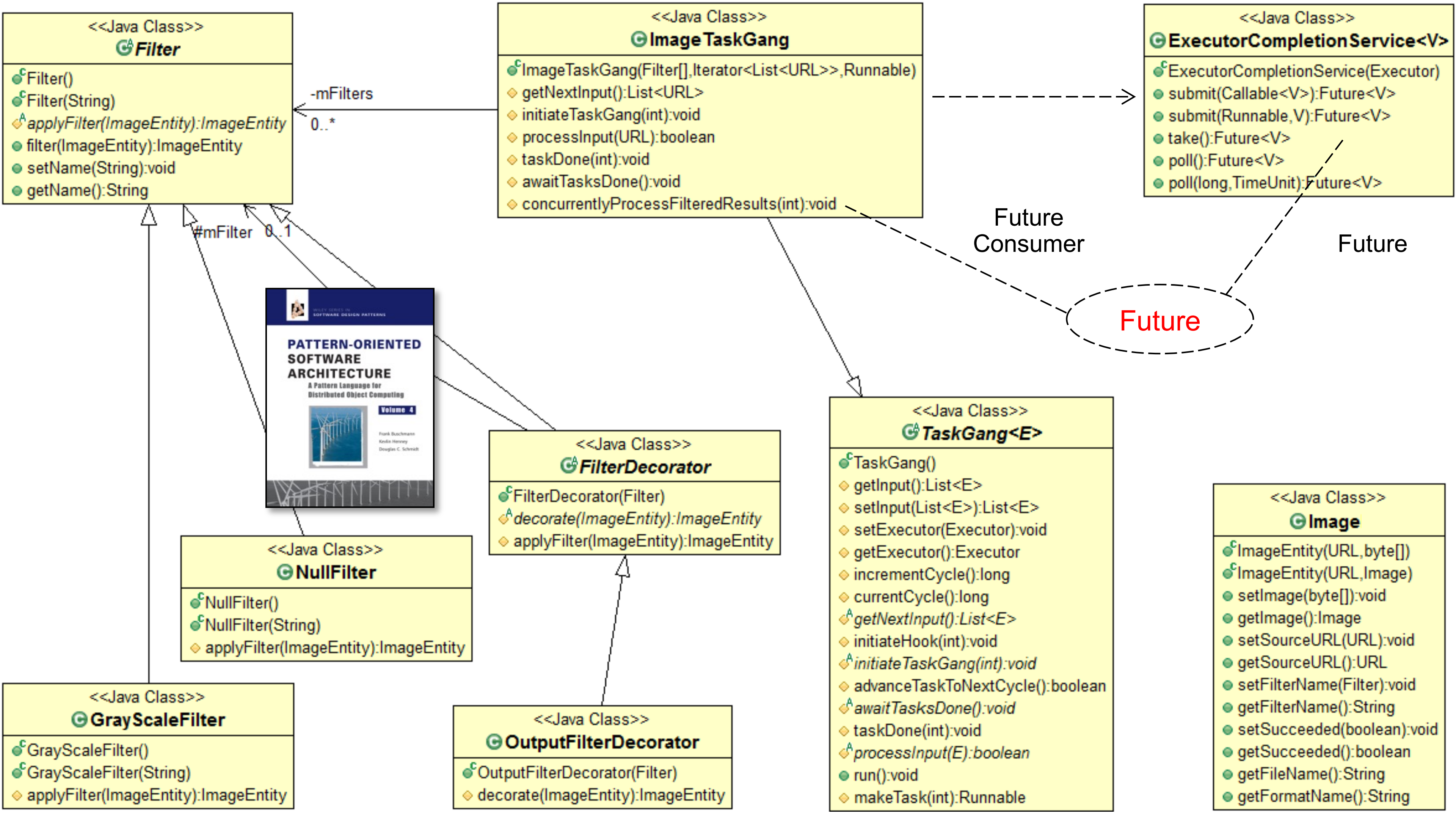

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See en.wikipedia.org/wiki/Futures_and_promises

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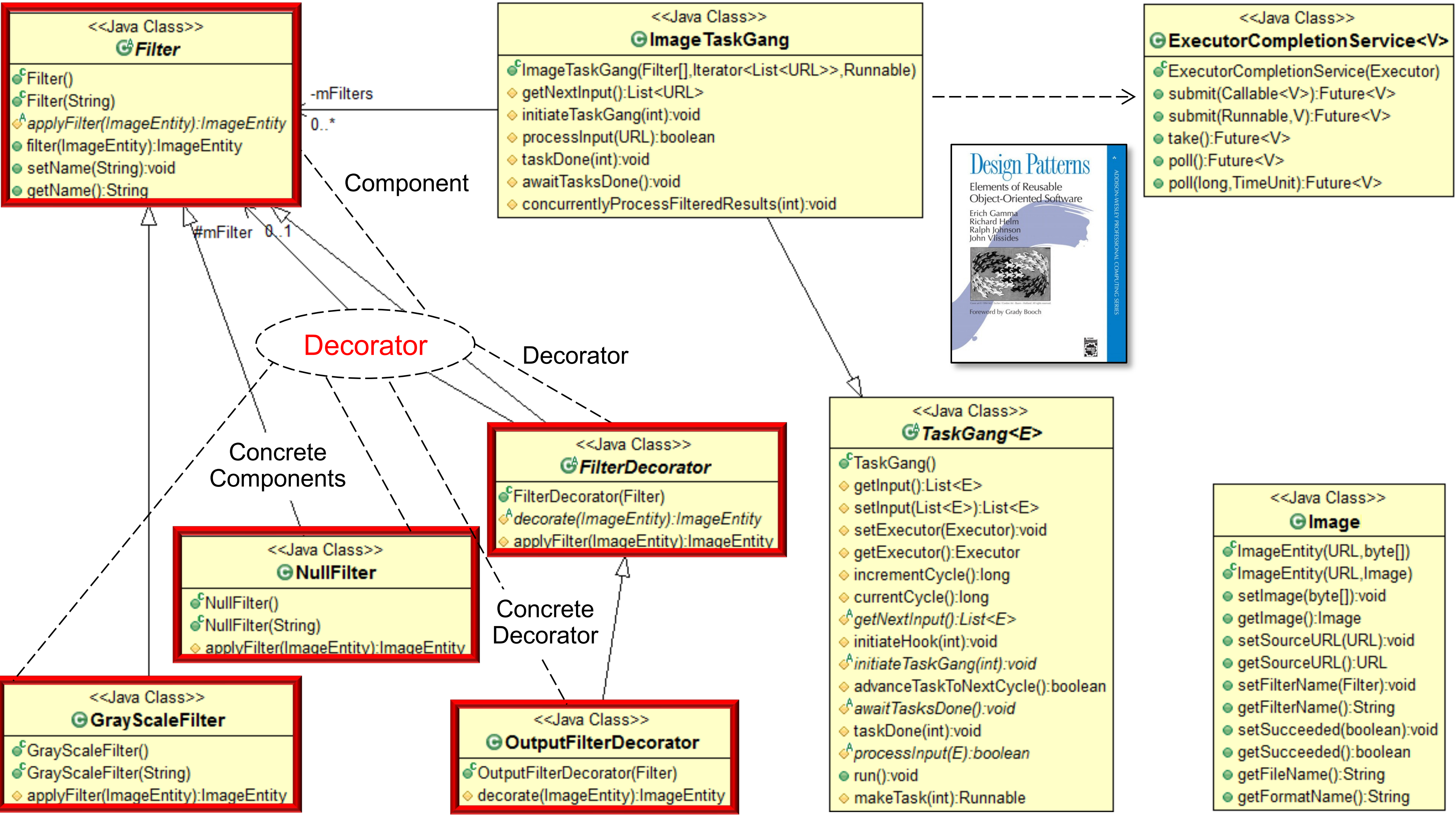

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- NullFilter(String)
- applyFilter(ImageEntity):ImageEntity

<<Java Class>>
GrayScaleFilter
- GrayScaleFilter()
- GrayScaleFilter(String)
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<<Java Class>>
OutputFilterDecorator
- OutputFilterDecorator(Filter)
- decorate(ImageEntity):ImageEntity

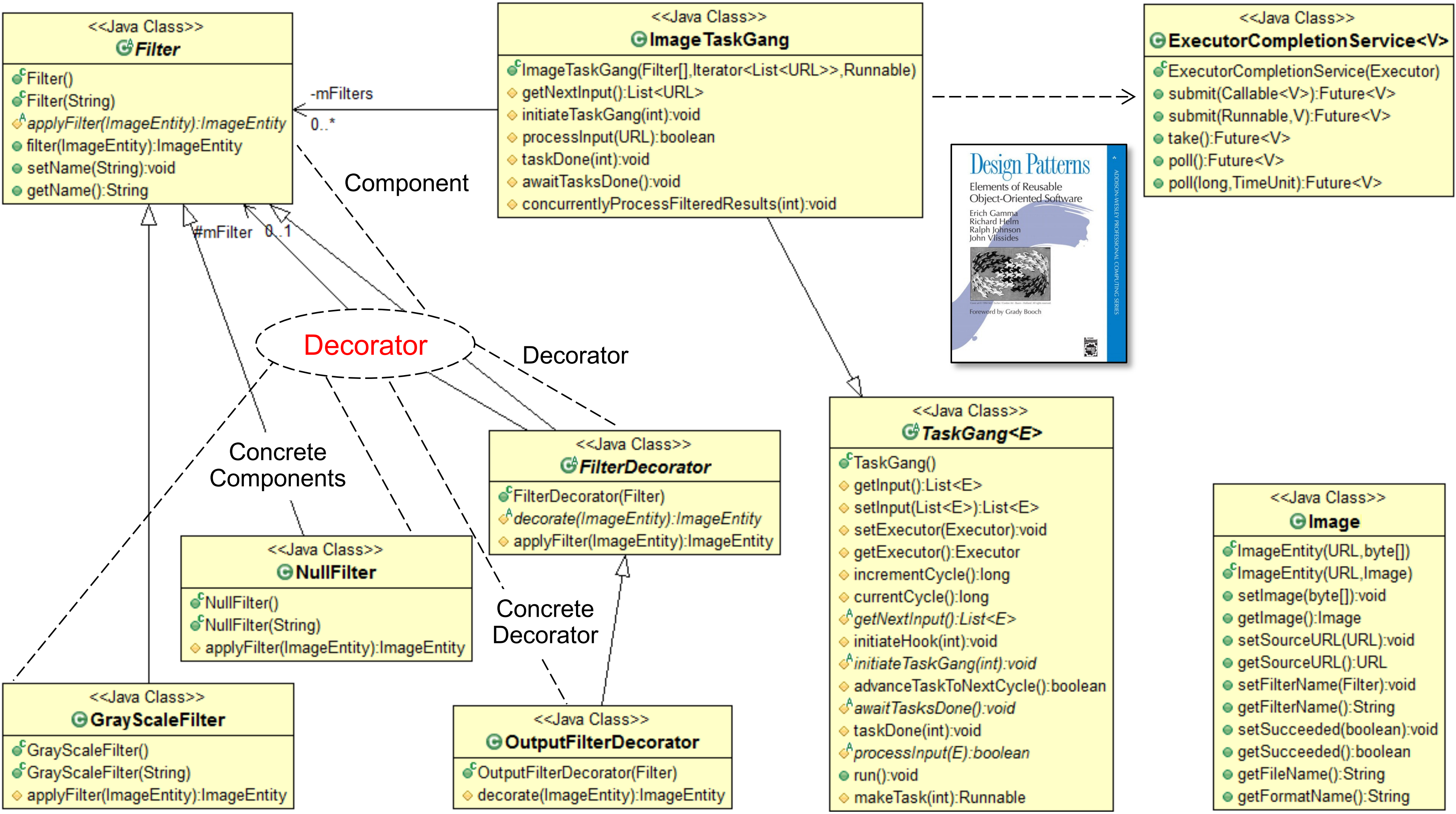
<<Java Class>>
TaskGang<E>
- TaskGang()
- getInput():List<E>
- setInput(List<E>):List<E>
- setExecutor(Executor):void
- getExecutor():Executor
- incrementCycle():long
- currentCycle():long
- *getNextInput():List<E>*
- initiateHook(int):void
- *initiateTaskGang(int):void*
- advanceTaskToNextCycle():boolean
- *awaitTasksDone():void*
- taskDone(int):void
- *processInput(E):boolean*
- run():void
- makeTask(int):Runnable

<<Java Class>>
Image
- ImageEntity(URL,byte[])
- ImageEntity(URL,Image)
- setImage(byte[]):void
- getImage():Image
- setSourceURL(URL):void
- getSourceURL():URL
- setFilterName(Filter):void
- getFilterName():String
- setSucceeded(boolean):void
- getSucceeded():boolean
- getFileName():String
- getFormatName():String

Decorator allows behavior to be added to an individual object transparently, without affecting the behavior of other object's from the same class

Overview of Pattern-Oriented Framework Solution

- “Gang-of-Four” & POSA patterns enhance the framework-based solution



<<Java Class>>
Filter

- Filter()
- Filter(String)
- *applyFilter(ImageEntity):ImageEntity*
- filter(ImageEntity):ImageEntity
- setName(String):void
- getName():String

<<Java Class>>
ImageTaskGang

- ImageTaskGang(Filter[],Iterator<List<URL>>,Runnable)
- getNextInput():List<URL>
- initiateTaskGang(int):void
- processInput(URL):boolean
- taskDone(int):void
- awaitTasksDone():void
- concurrentlyProcessFilteredResults(int):void

<<Java Class>>
ExecutorCompletionService<V>

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See en.wikipedia.org/wiki/Decorator_pattern

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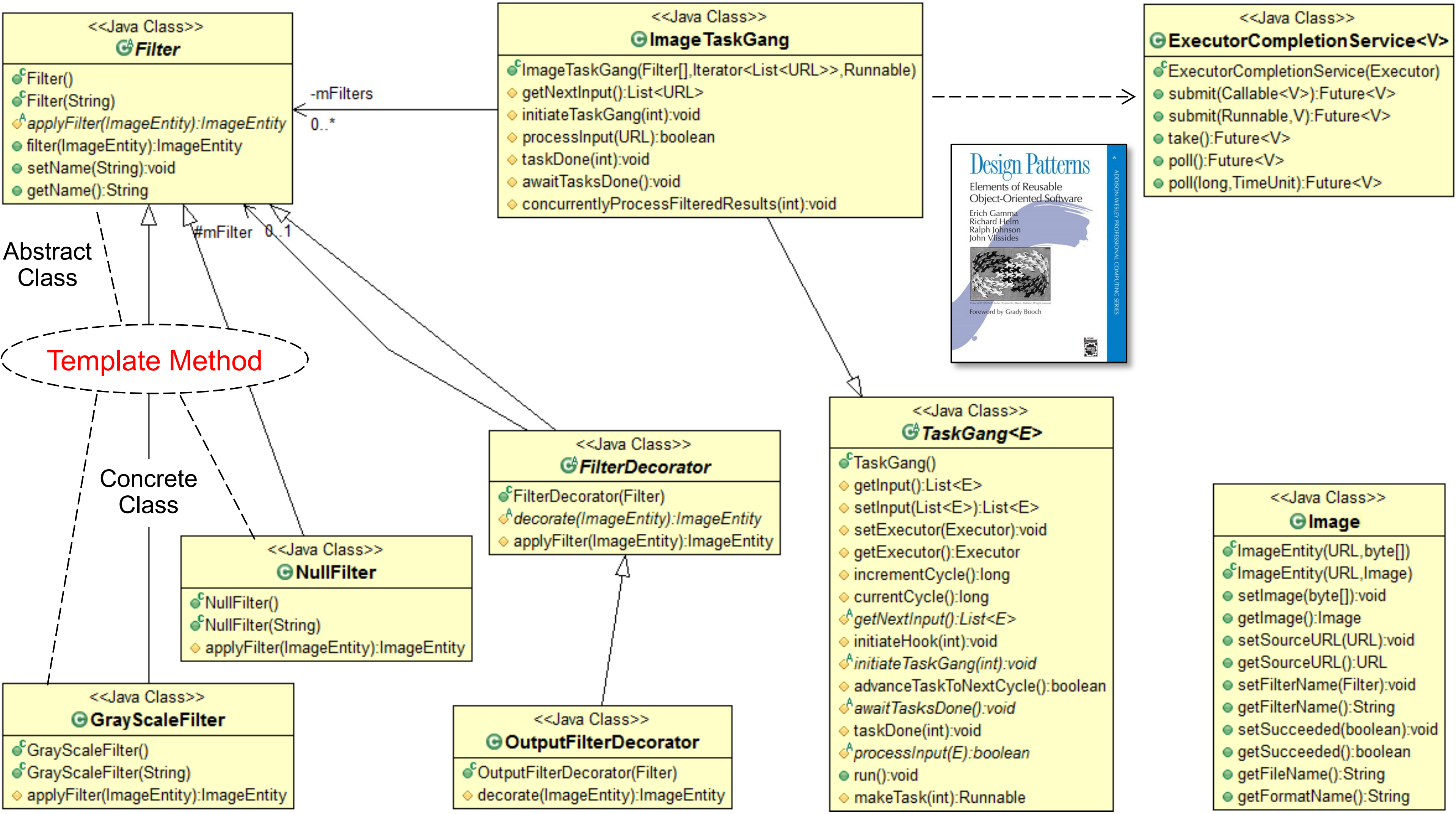

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- awaitTasksDone():void
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- getFilterName():String
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Template Method defines the skeleton of an algorithm in a method, deferring certain steps to subclass methods

Overview of Pattern-Oriented Framework Solution

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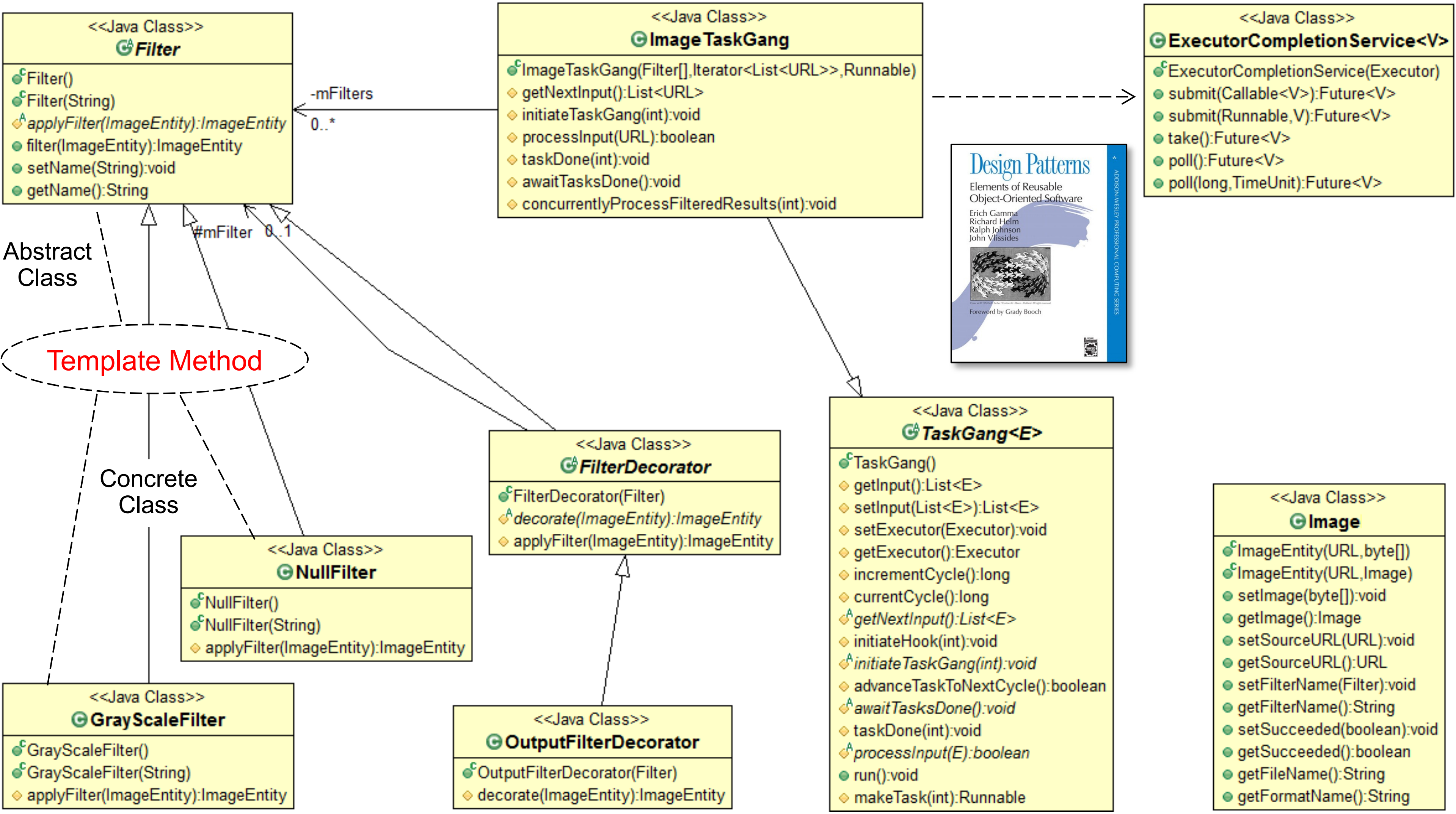

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<<Java Class>>
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ImageTaskGang(Filter[],Iterator<List<URL>>,Runnable)
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<<Java Class>>
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setFilterName(Filter):void
getFilterName():String
setSucceeded(boolean):void
getSucceeded():boolean
getFileName():String
getFormatName():String

<<Java Class>>
NullFilter

NullFilter()
NullFilter(String)
applyFilter(ImageEntity):ImageEntity

<<Java Class>>
GrayScaleFilter

GrayScaleFilter()
GrayScaleFilter(String)
applyFilter(ImageEntity):ImageEntity

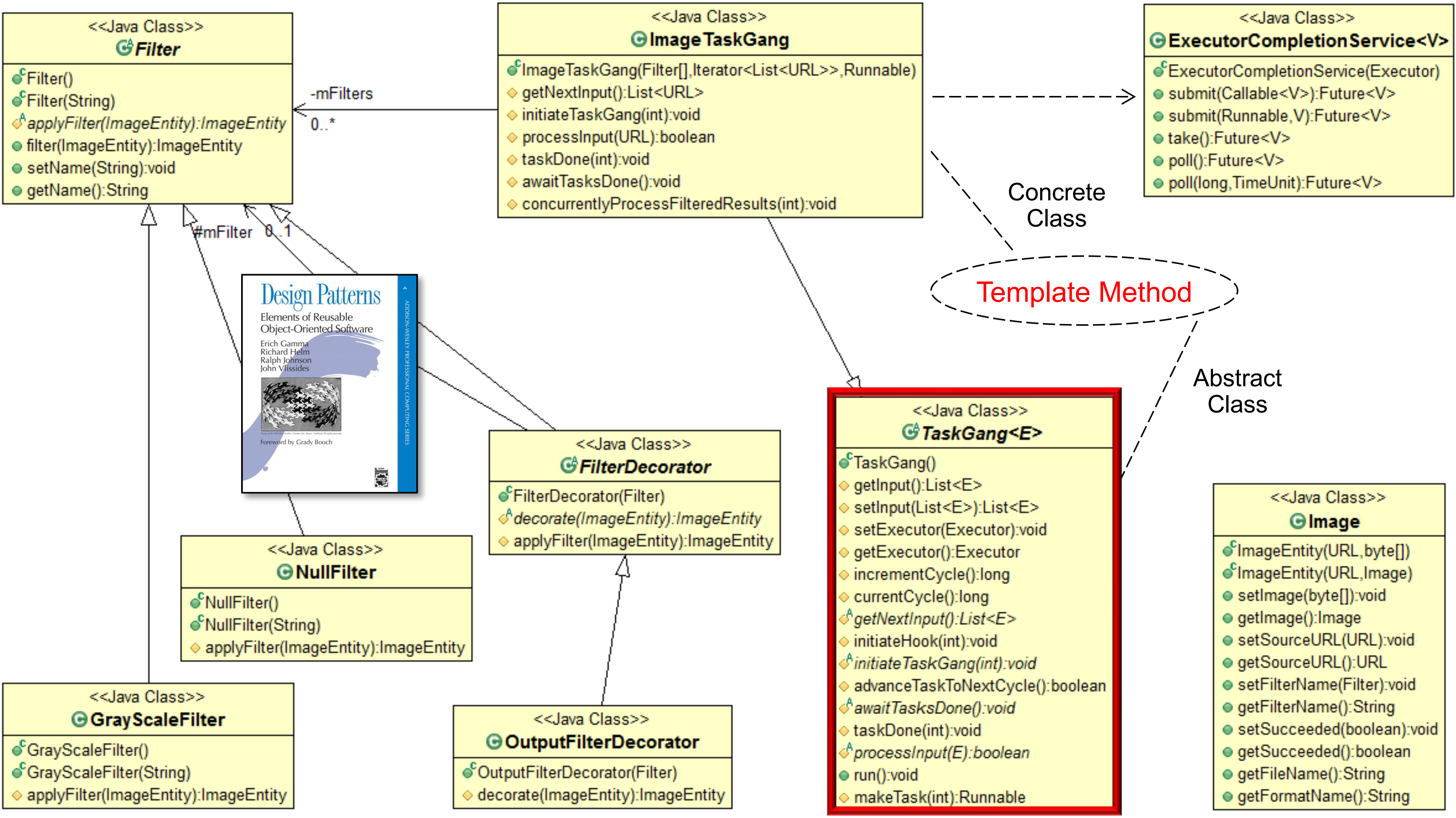
<<Java Class>>
OutputFilterDecorator

OutputFilterDecorator(Filter)
decorate(ImageEntity):ImageEntity

See en.wikipedia.org/wiki/Template_method_pattern

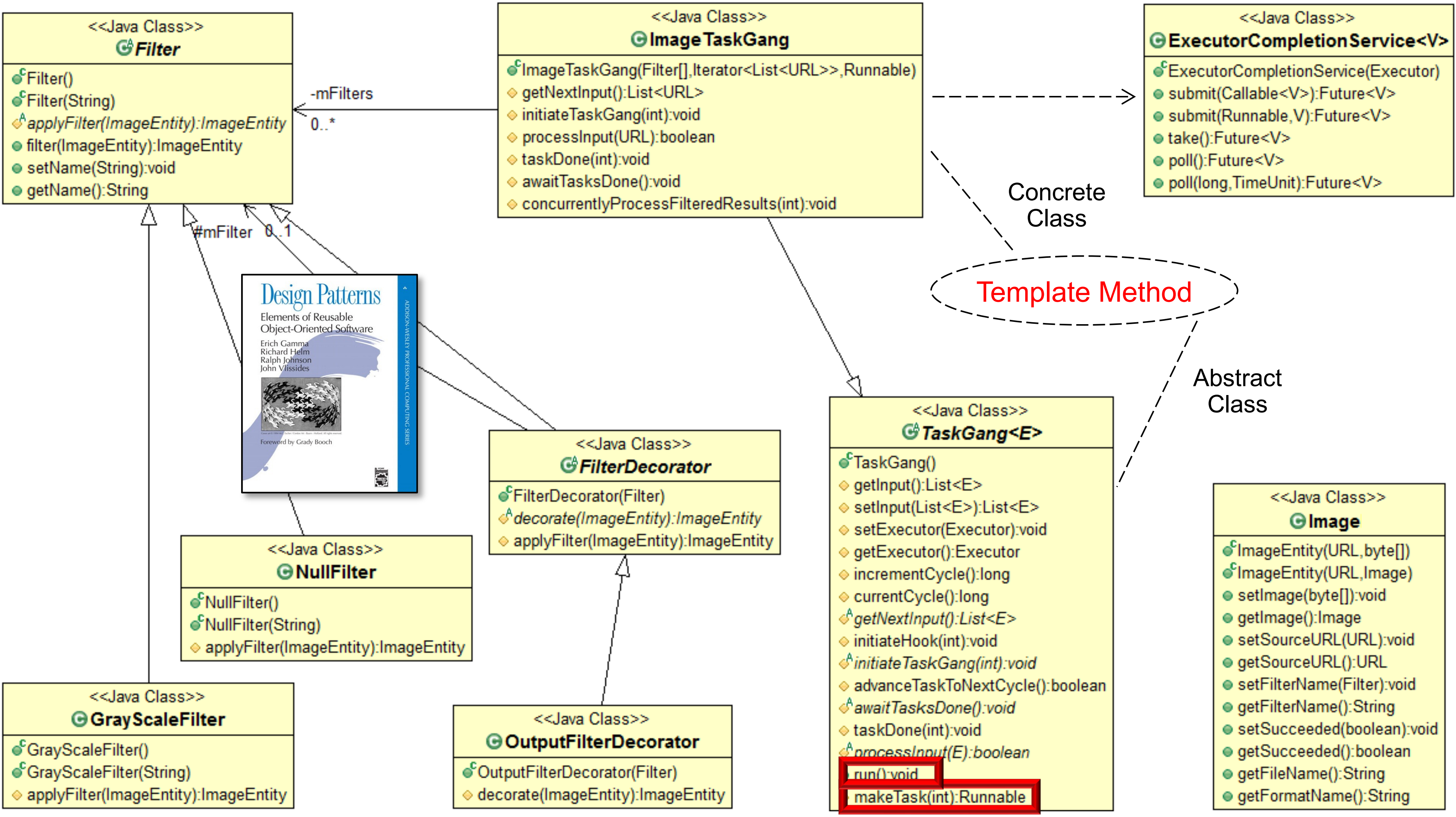
Overview of Pattern-Oriented Framework Solution

- "Gang-of-Four" & POSA patterns enhance the framework-based solution



Overview of Pattern-Oriented Framework Solution

- "Gang-of-Four" & POSA patterns enhance the framework-based solution



<<Java Class>>
Filter
- Filter()
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- filter(ImageEntity):ImageEntity
- setName(String):void
- getName():String

<<Java Class>>
ImageTaskGang
- ImageTaskGang(Filter[],Iterator<List<URL>>,Runnable)
- getNextInput():List<URL>
- initiateTaskGang(int):void
- processInput(URL):boolean
- taskDone(int):void
- awaitTasksDone():void
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<<Java Class>>
ExecutorCompletionService<V>
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- poll(long,TimeUnit):Future<V>

-mFilters

0..*

#mFilter

0..1

Concrete Class

Template Method

Abstract Class

<<Java Class>>
FilterDecorator
- FilterDecorator(Filter)
- *decorate(ImageEntity):ImageEntity*
- applyFilter(ImageEntity):ImageEntity

<<Java Class>>
NullFilter
- NullFilter()
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GrayScaleFilter
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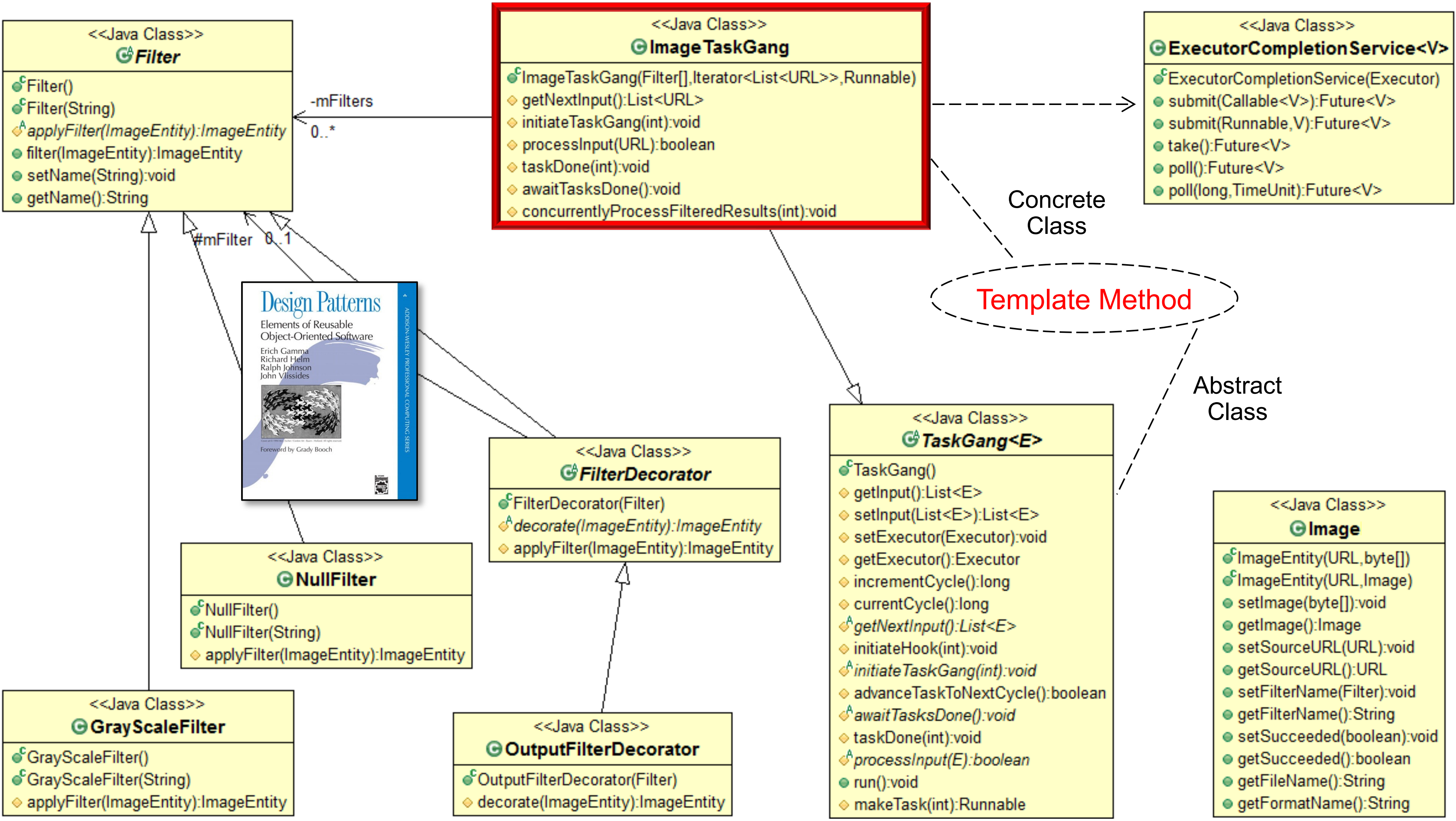
Design Patterns
Elements of Reusable Object-Oriented Software
Erich Gamma
Richard Helm
Ralph Johnson
John Vlissides
Foreword by Grady Booch
ADDISON-WESLEY PROFESSIONAL COMPUTING SERIES

Overview of Pattern-Oriented Framework Solution

- "Gang-of-Four" & POSA patterns enhance the framework-based solution



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<<Java Class>>
Filter
Filter()
Filter(String)
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filter(ImageEntity):ImageEntity
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ImageTaskGang
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taskDone(int):void
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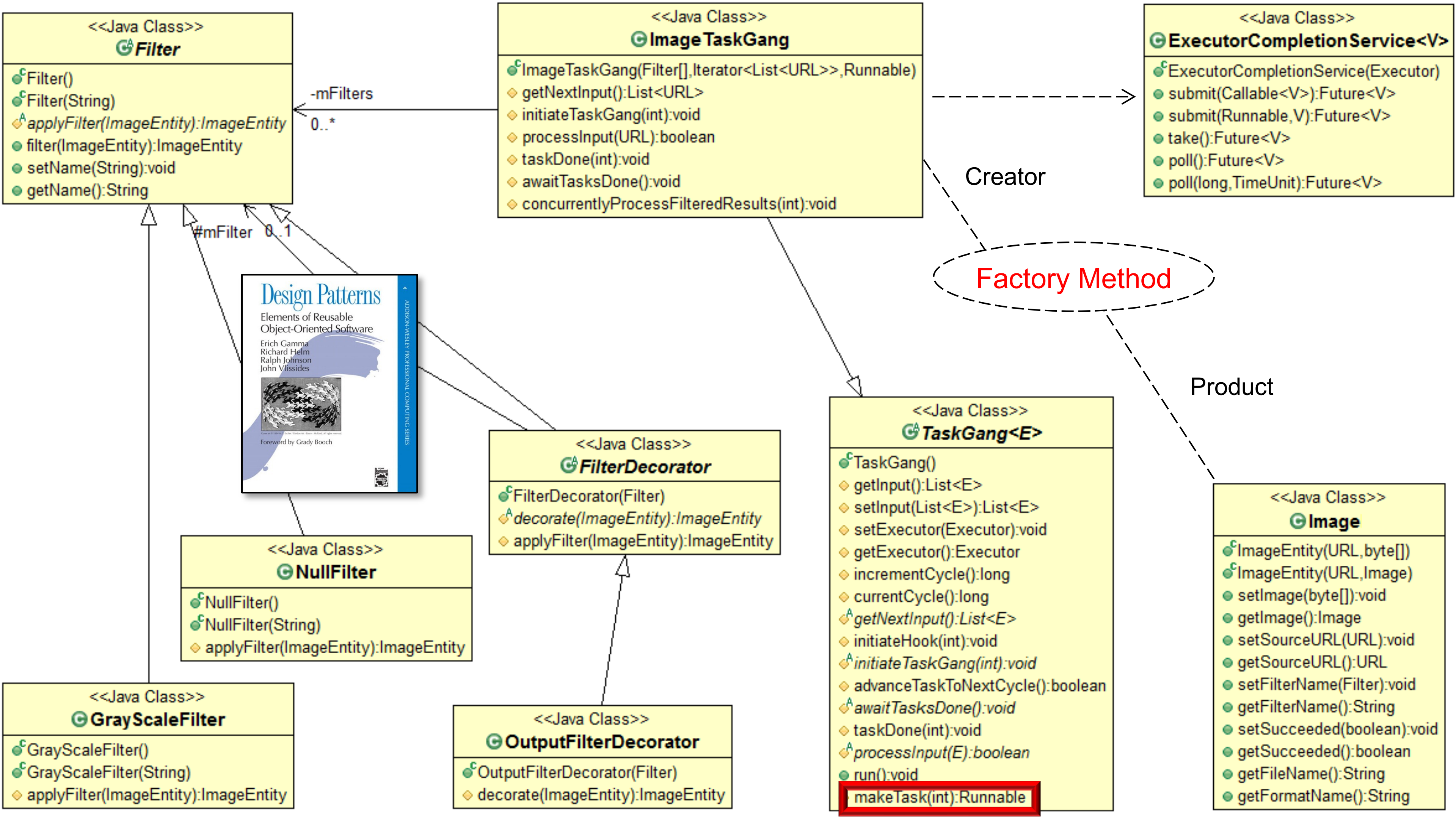
```

Overview of Pattern-Oriented Framework Solution

- "Gang-of-Four" & POSA patterns enhance the framework-based solution



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Factory Method defines an interface for creating objects, but let subclasses to decide which class to instantiate

Overview of Pattern-Oriented Framework Solution

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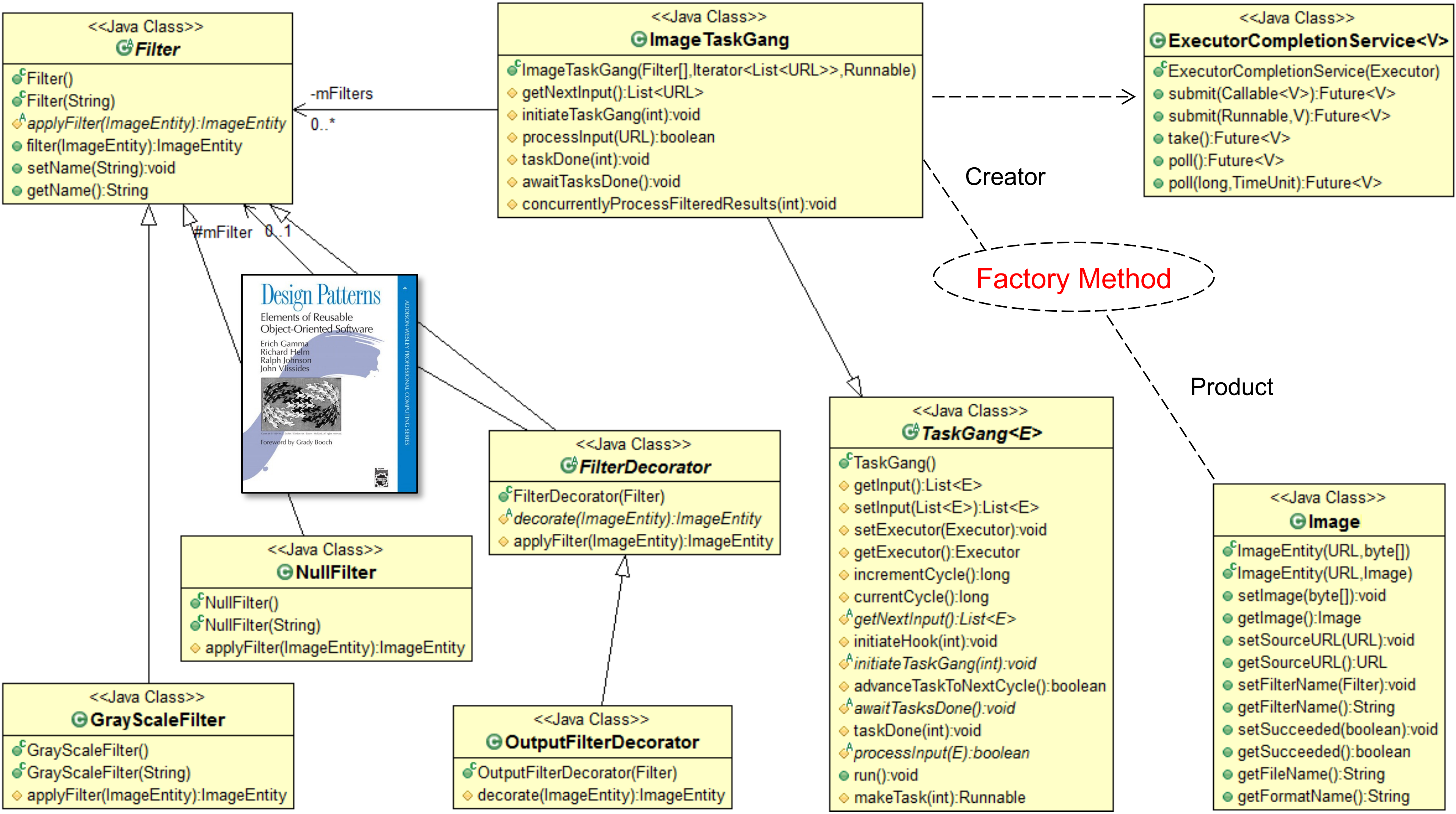

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See en.wikipedia.org/wiki/Factory_method_pattern

End of Pattern-Oriented Software Architecture of the ImageTaskGang Application