Android Concurrency: The AsyncTask Framework (Part 2)

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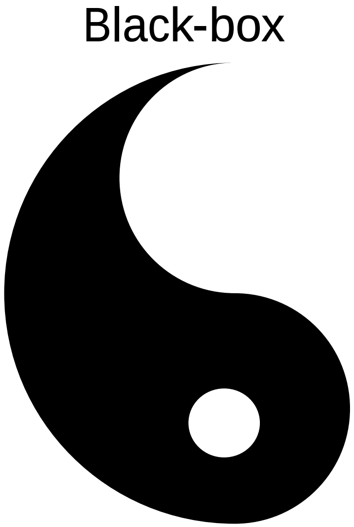
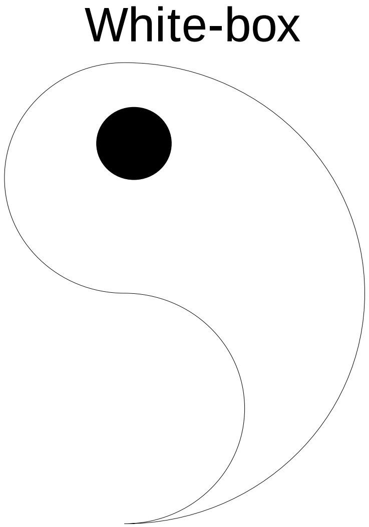
Learning Objectives in this Part of the Module

- Understand how the AsyncTask framework implements both white-box & black-box techniques & patterns





www.dre.vanderbilt.edu/~schmidt/PDF/DRC.pdf has more on frameworks

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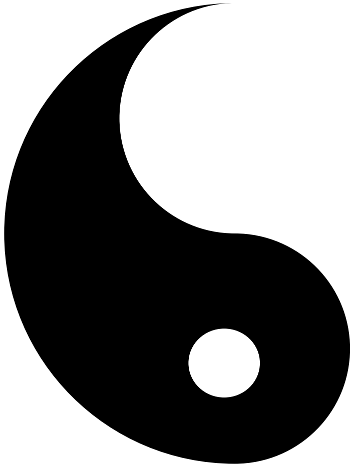
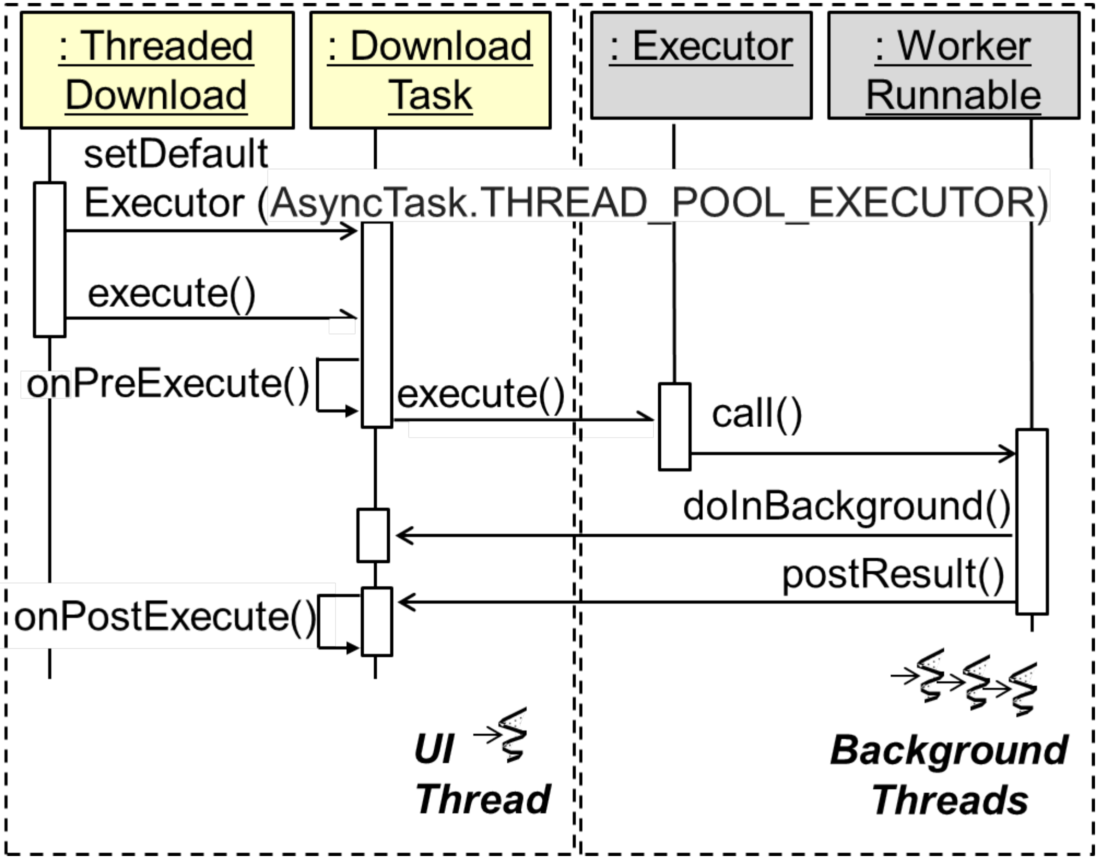
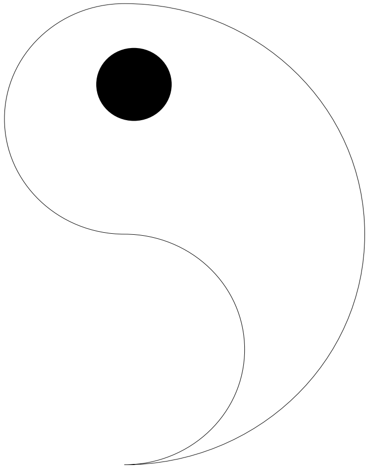
Black-box



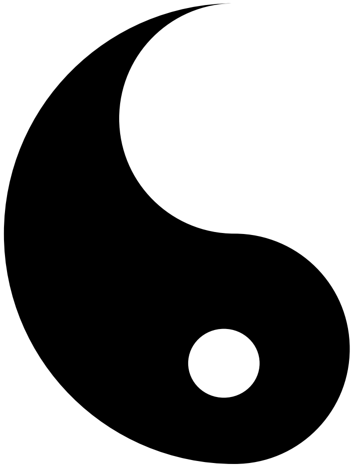


White-box



Common Types of Frameworks

- **Black-box frameworks** only require understanding external interfaces of objects



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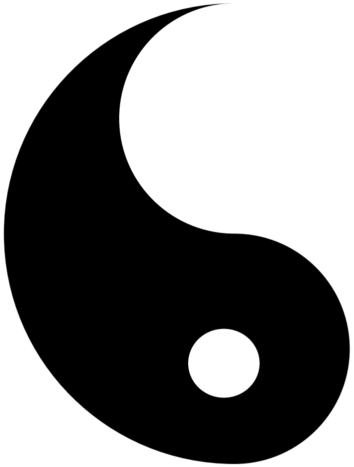
  - Framework elements typically reused by parameterizing & assembling objects



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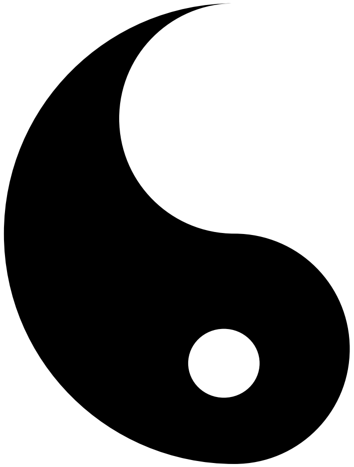
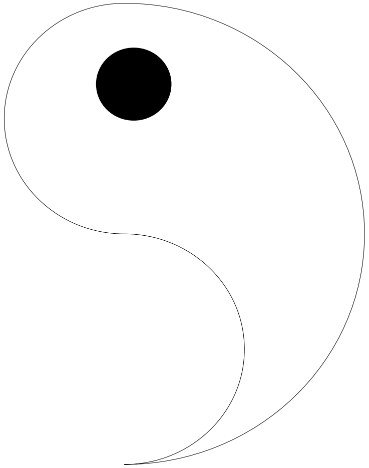


- **White-box frameworks** require understanding some parts of the framework implementation



Common Types of Frameworks

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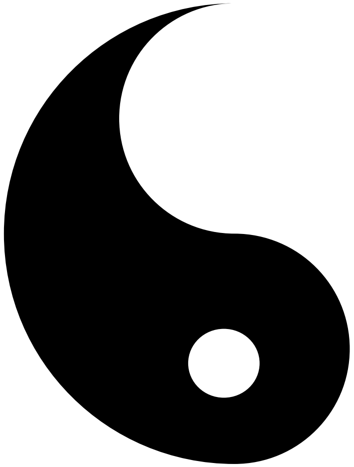
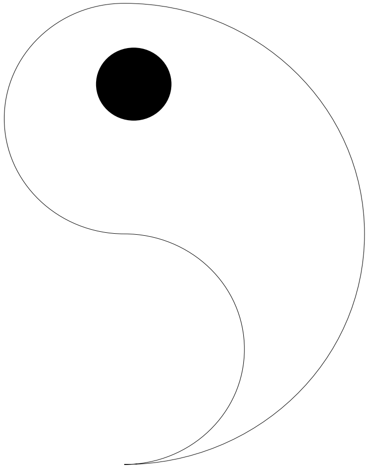
  - Framework elements typically reused by subclassing & overridding





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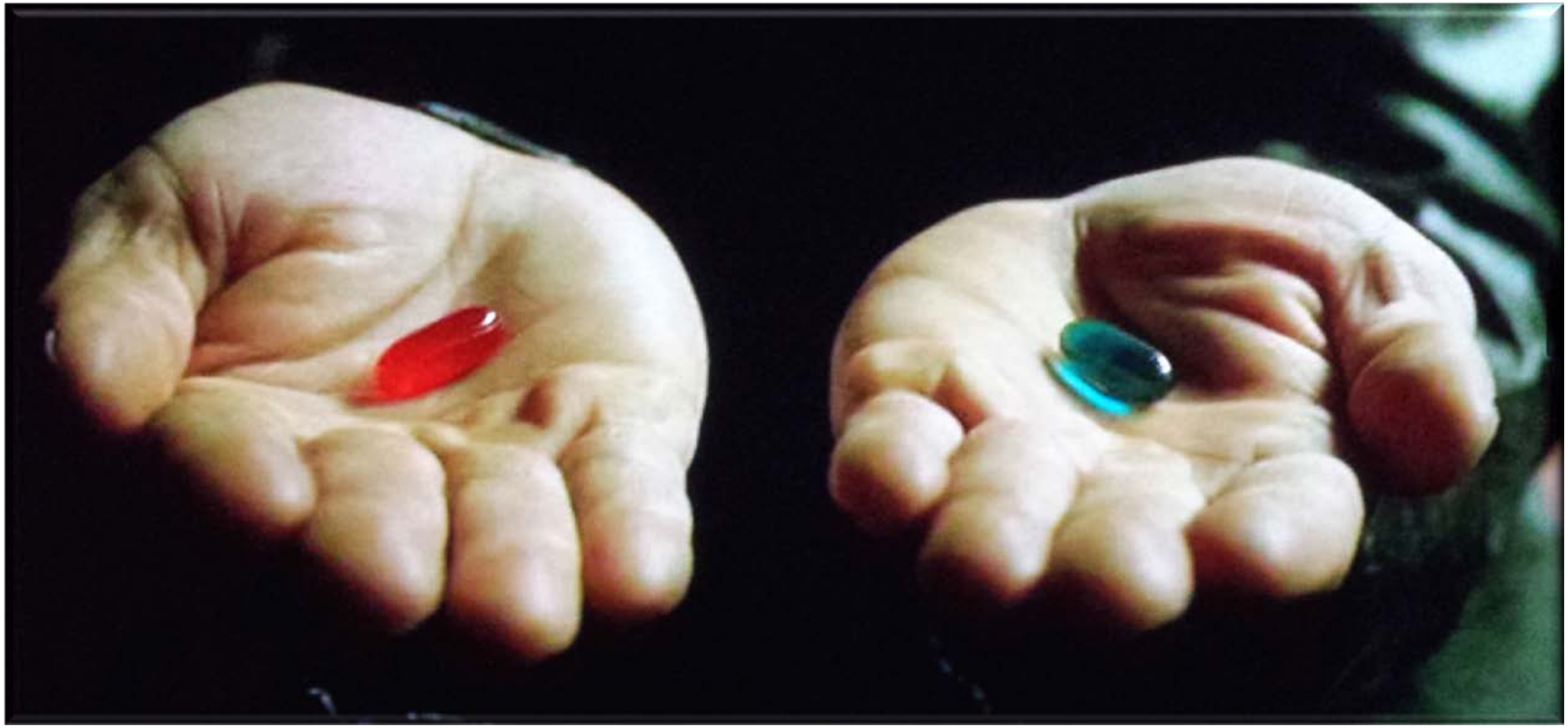
- Each category of OO framework uses different sets of patterns



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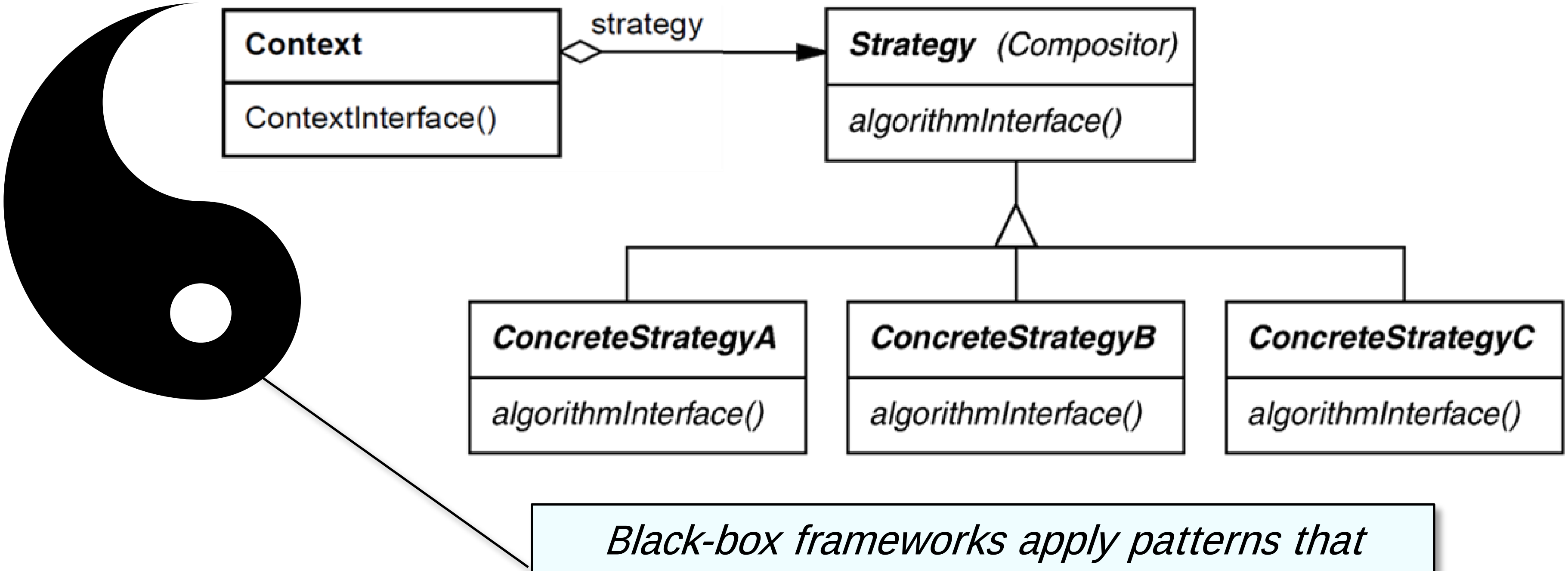

Black-box frameworks apply patterns that emphasize extensibility via object composition

en.wikipedia.org/wiki/Strategy_pattern & en.wikipedia.org/wiki/Decorator_pattern

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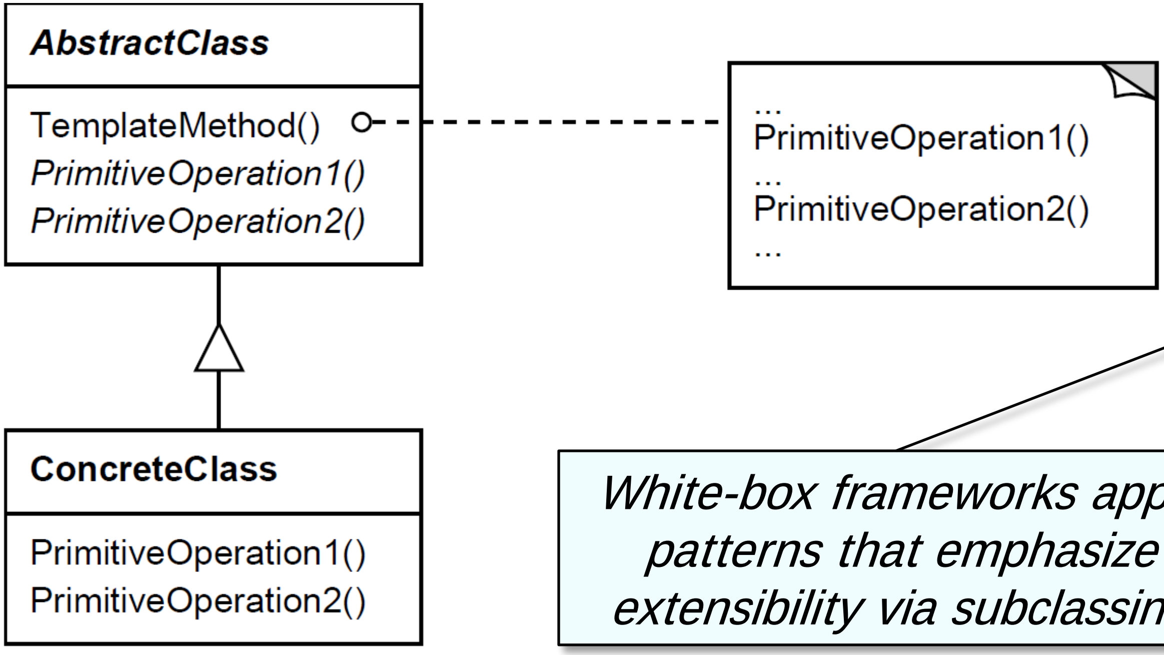

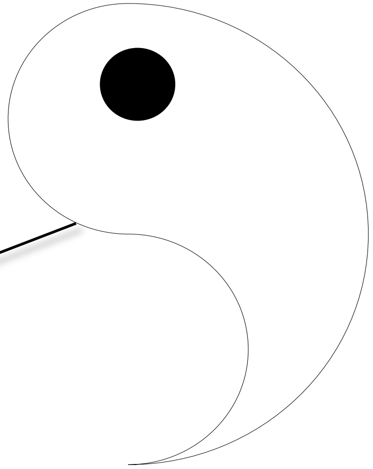

White-box frameworks apply patterns that emphasize extensibility via subclassing

en.wikipedia.org/wiki/Template_method & en.wikipedia.org/wiki/State_pattern

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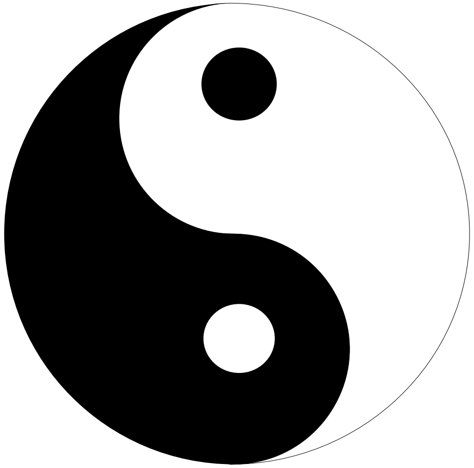

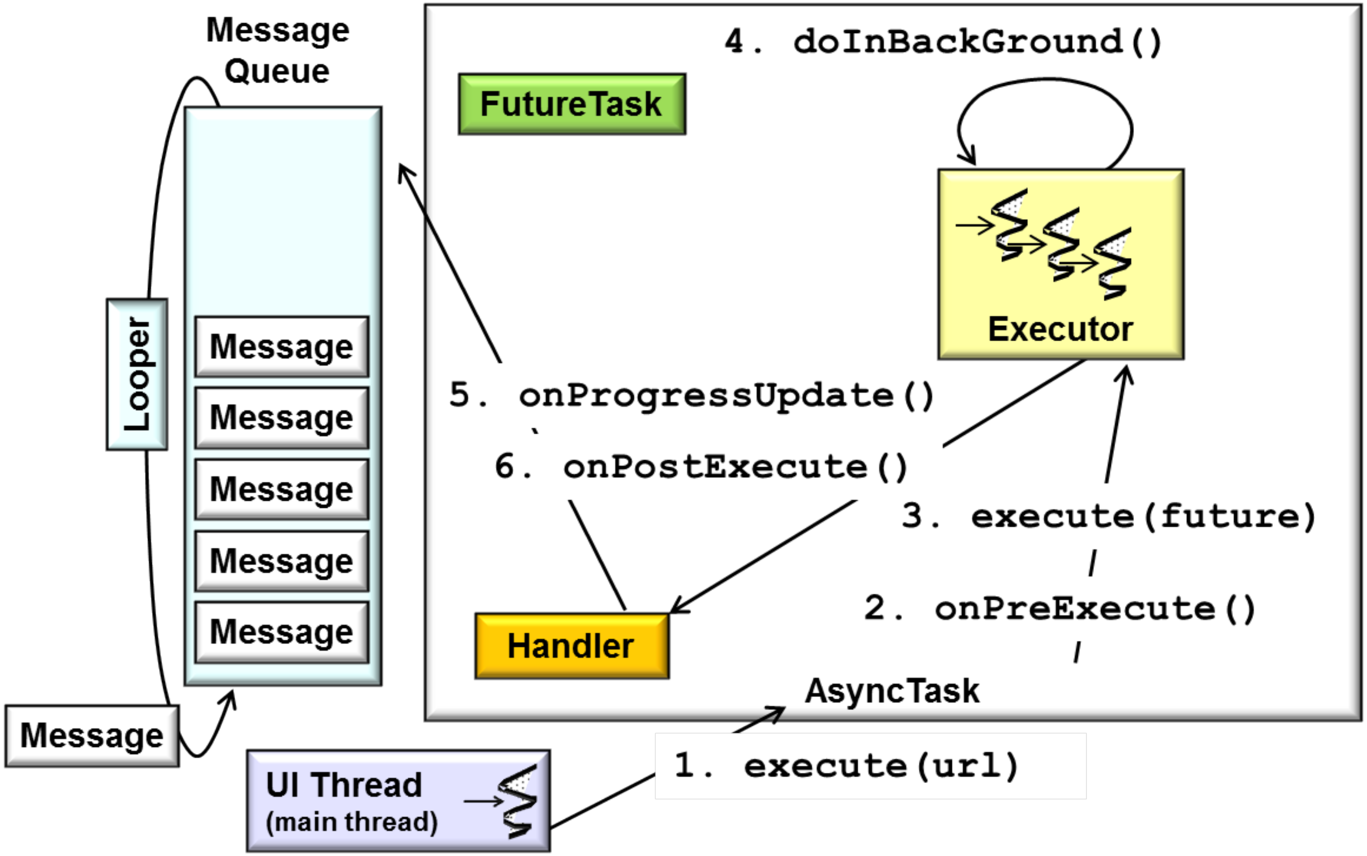

White-box Elements of the AsyncTask Framework

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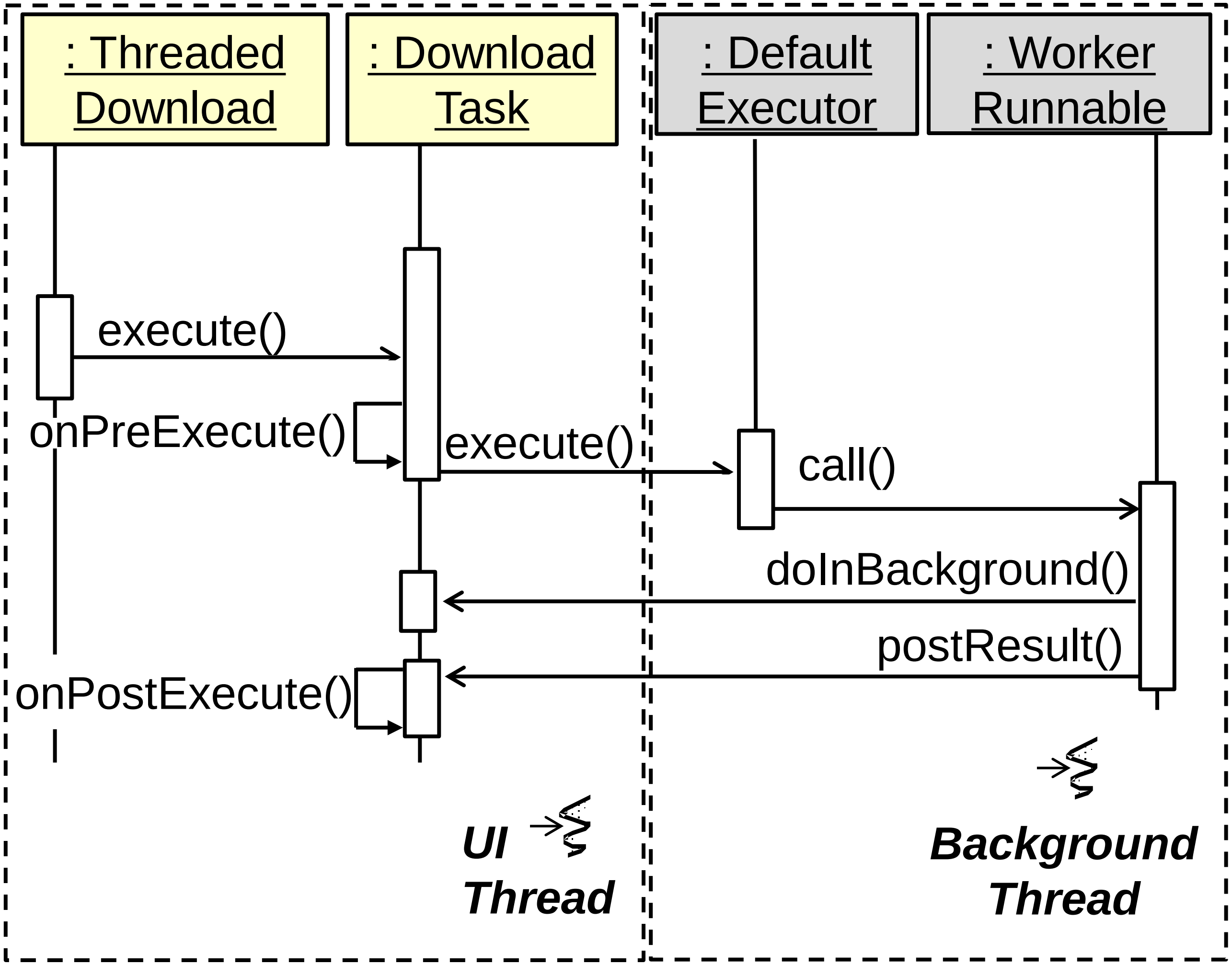

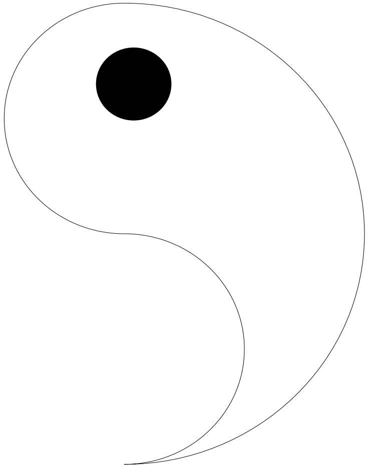

en.wikipedia.org/wiki/Template_method has info on *Template Method* pattern

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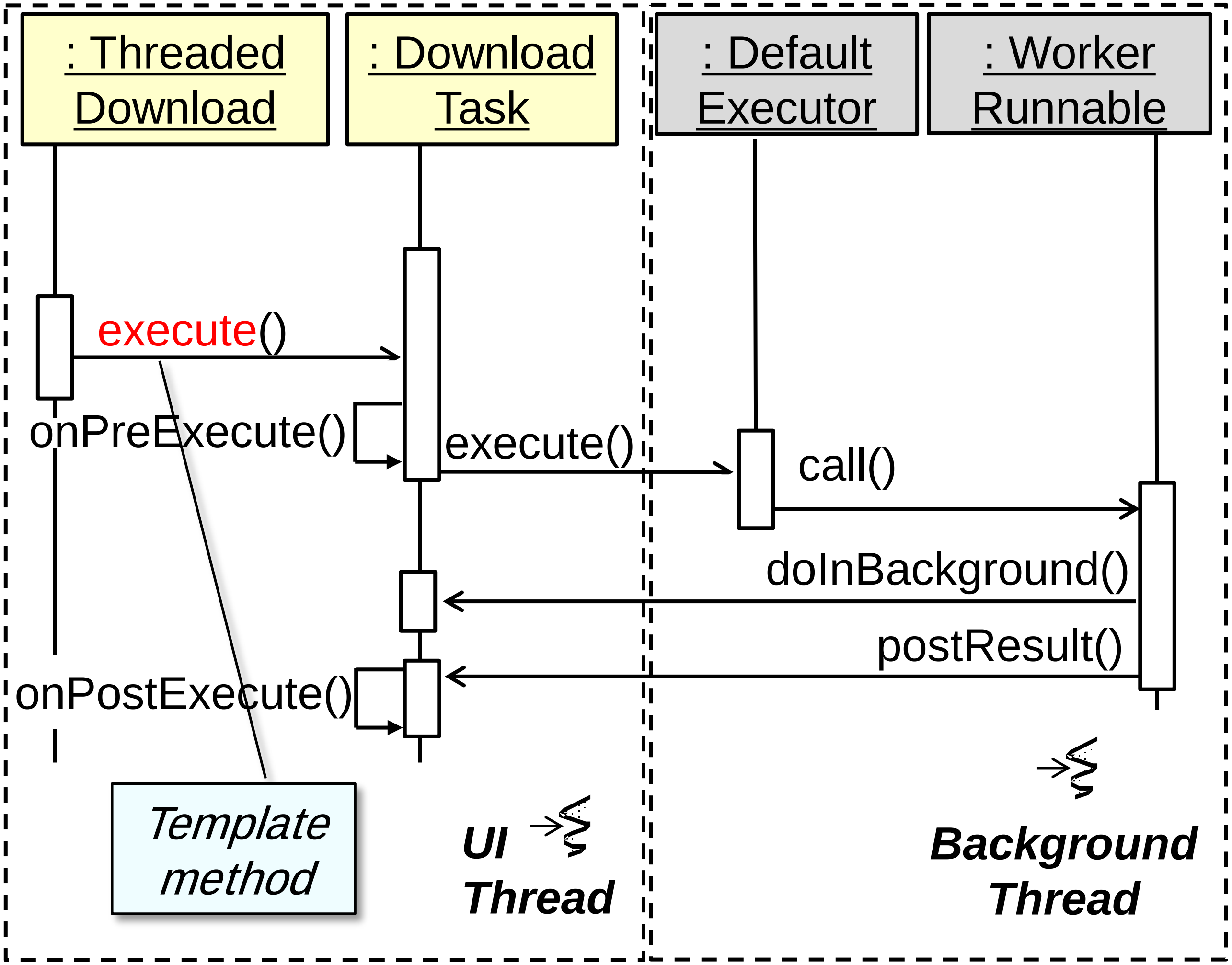
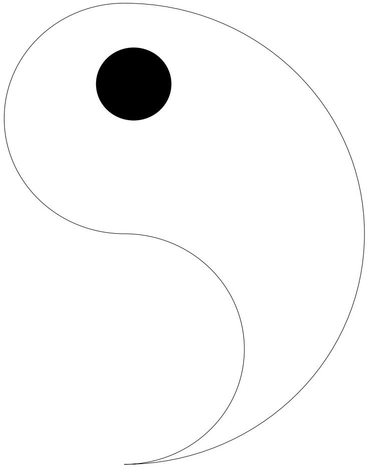
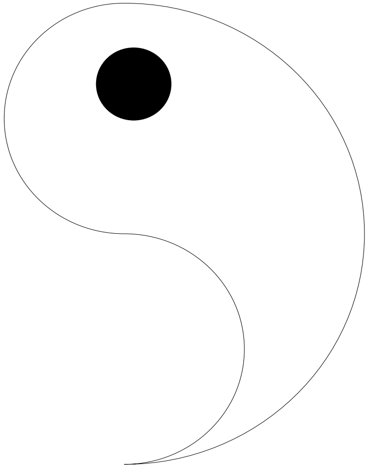


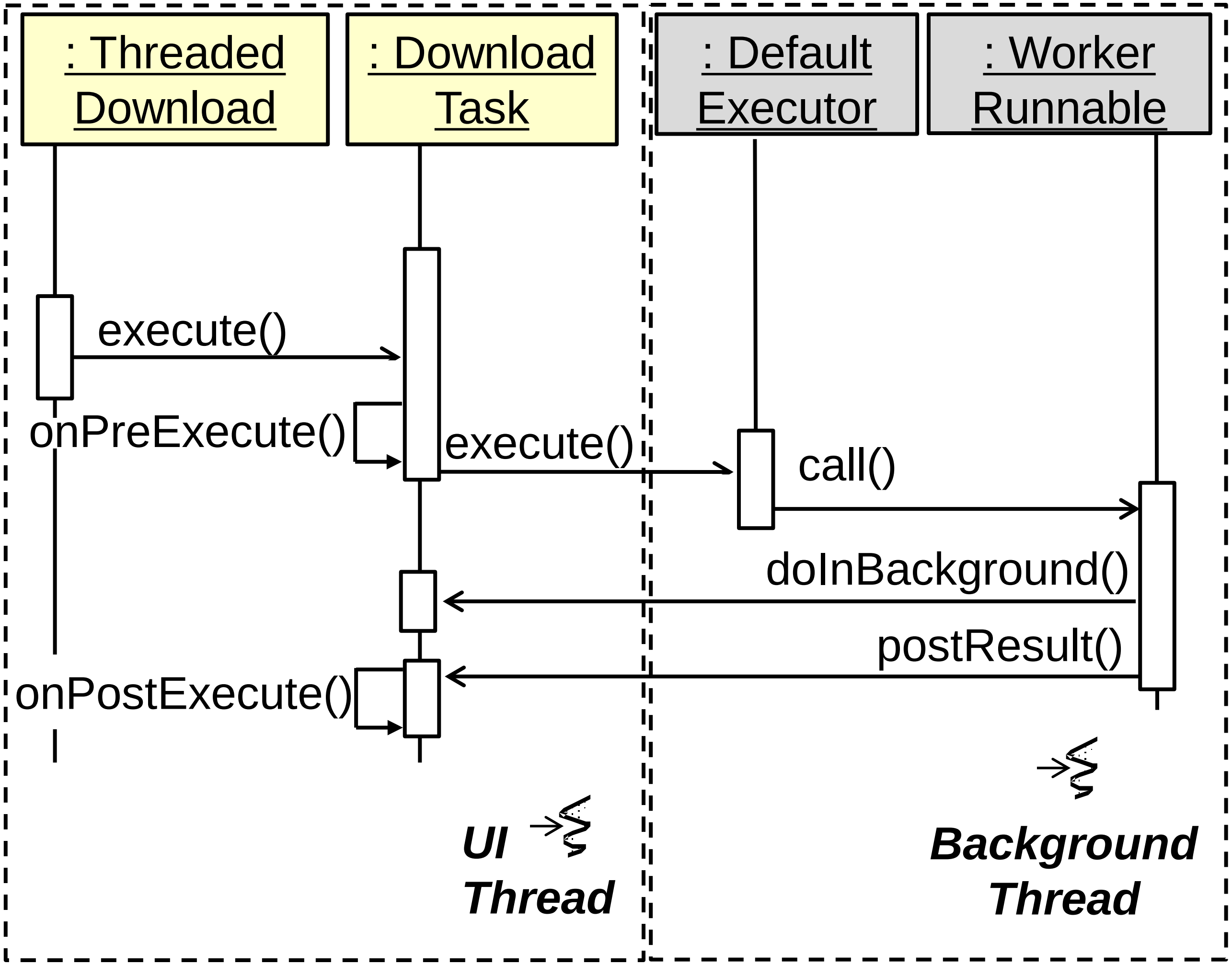


xp123.com/wwake/fw/ch12-bb.htm has more on framework design

White-box Elements of the AsyncTask Framework

- White-box framework elements enable long duration operations to interact with UI thread
- Framework dictates control flow via hook method callbacks





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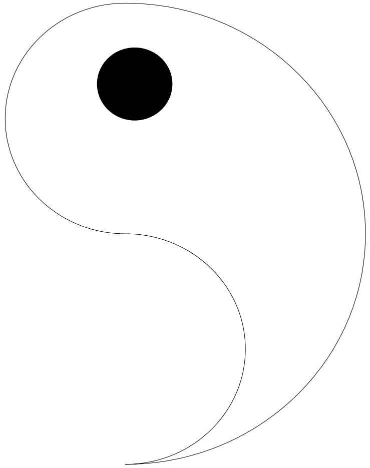

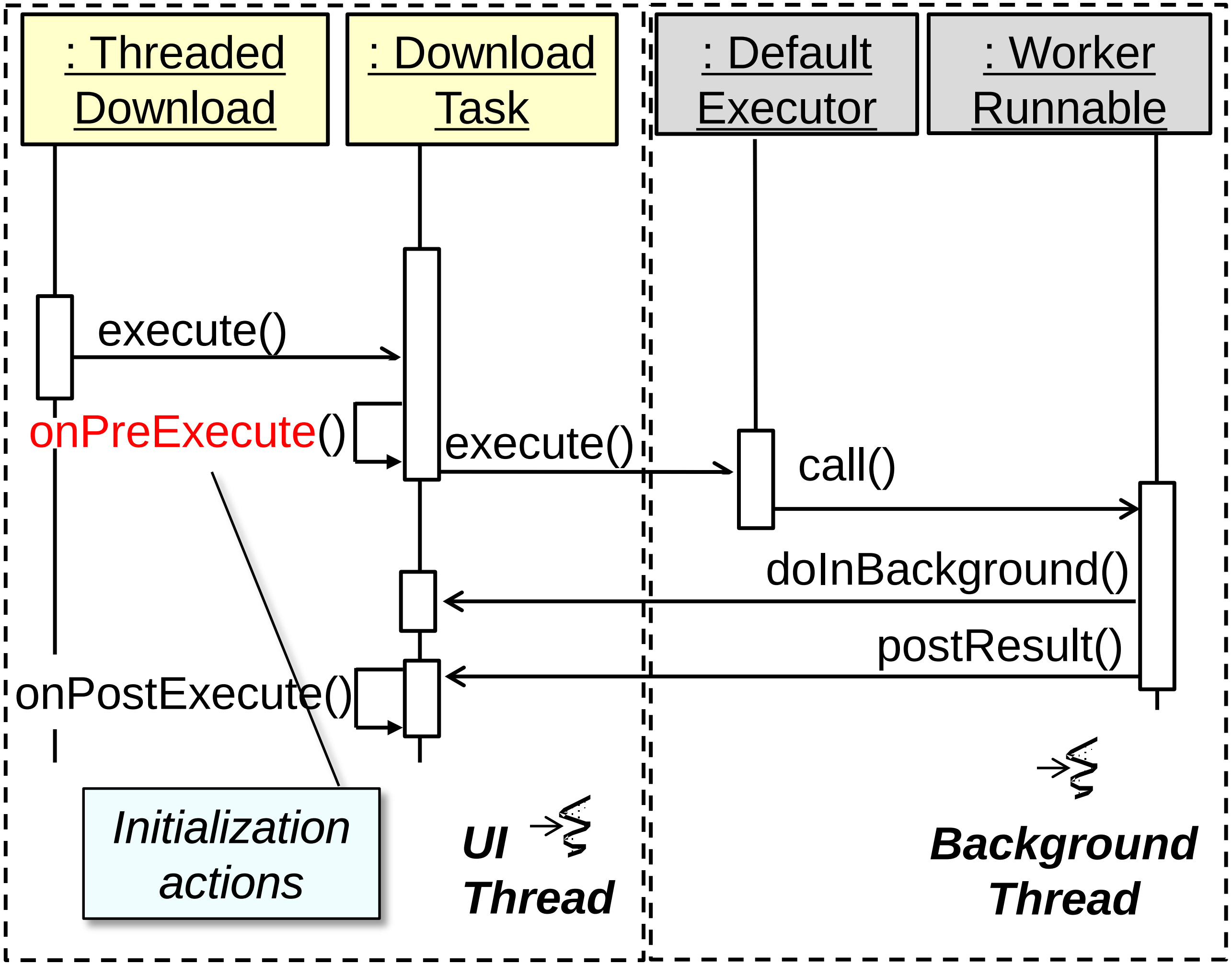

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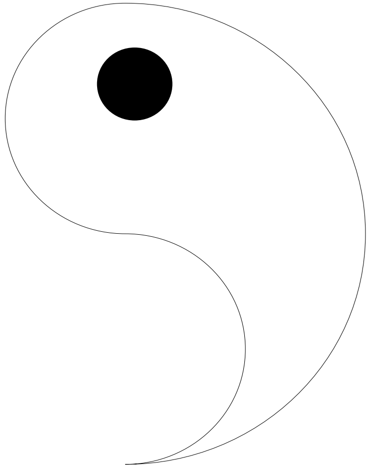

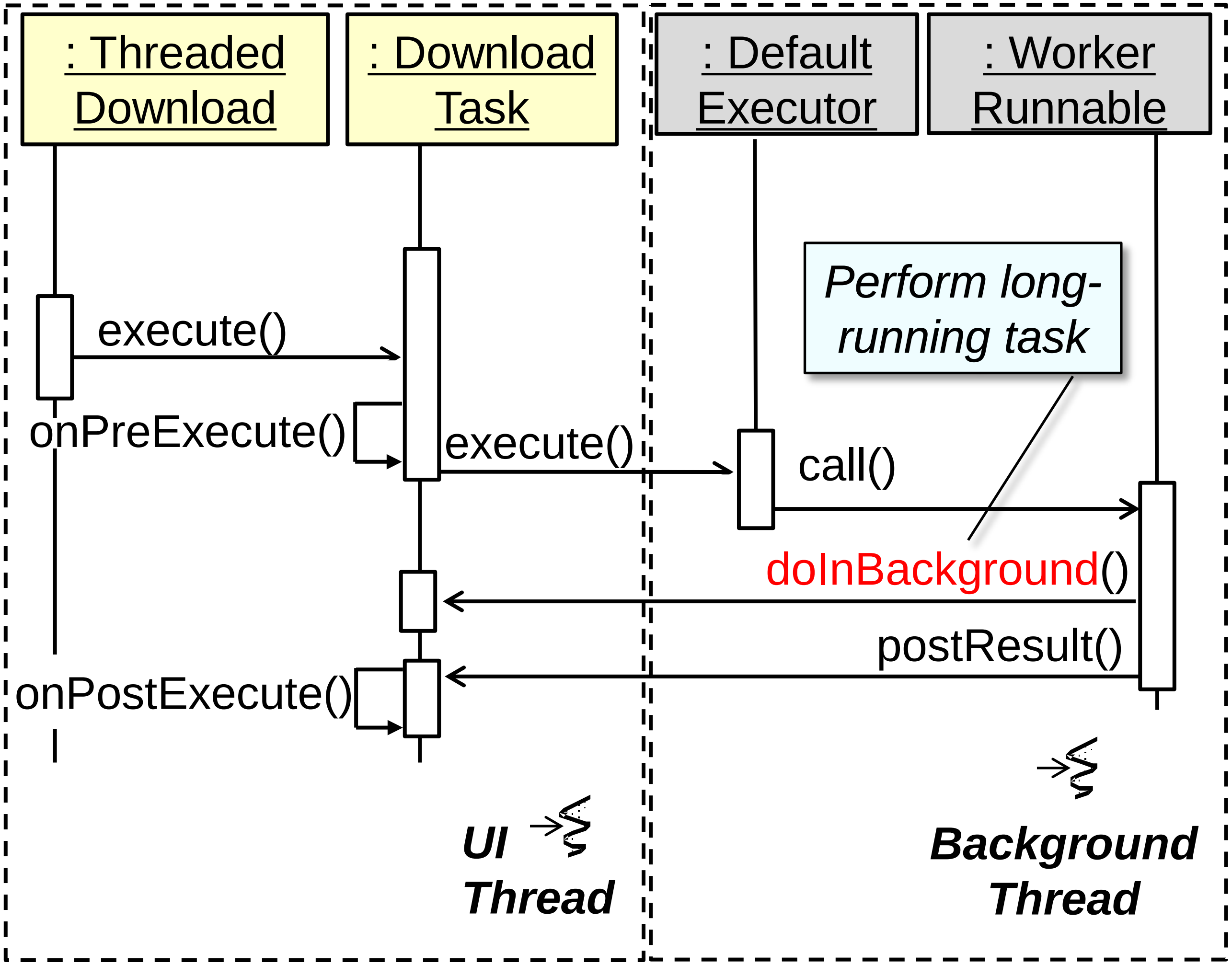

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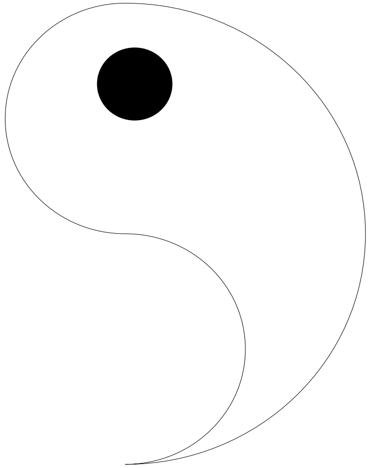

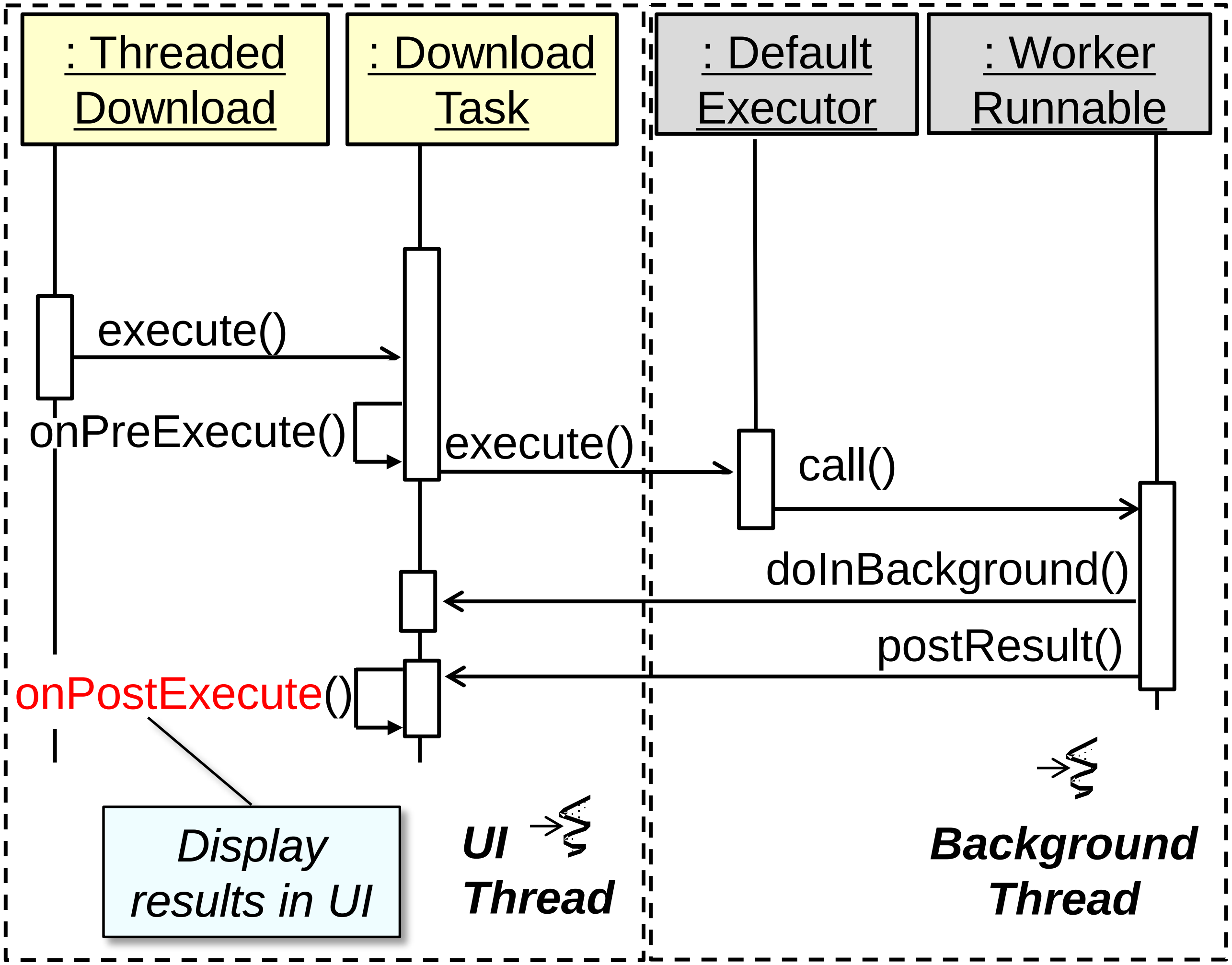

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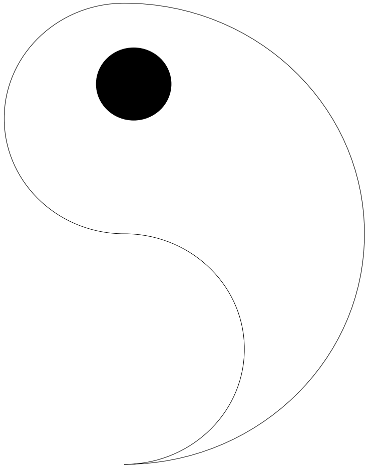

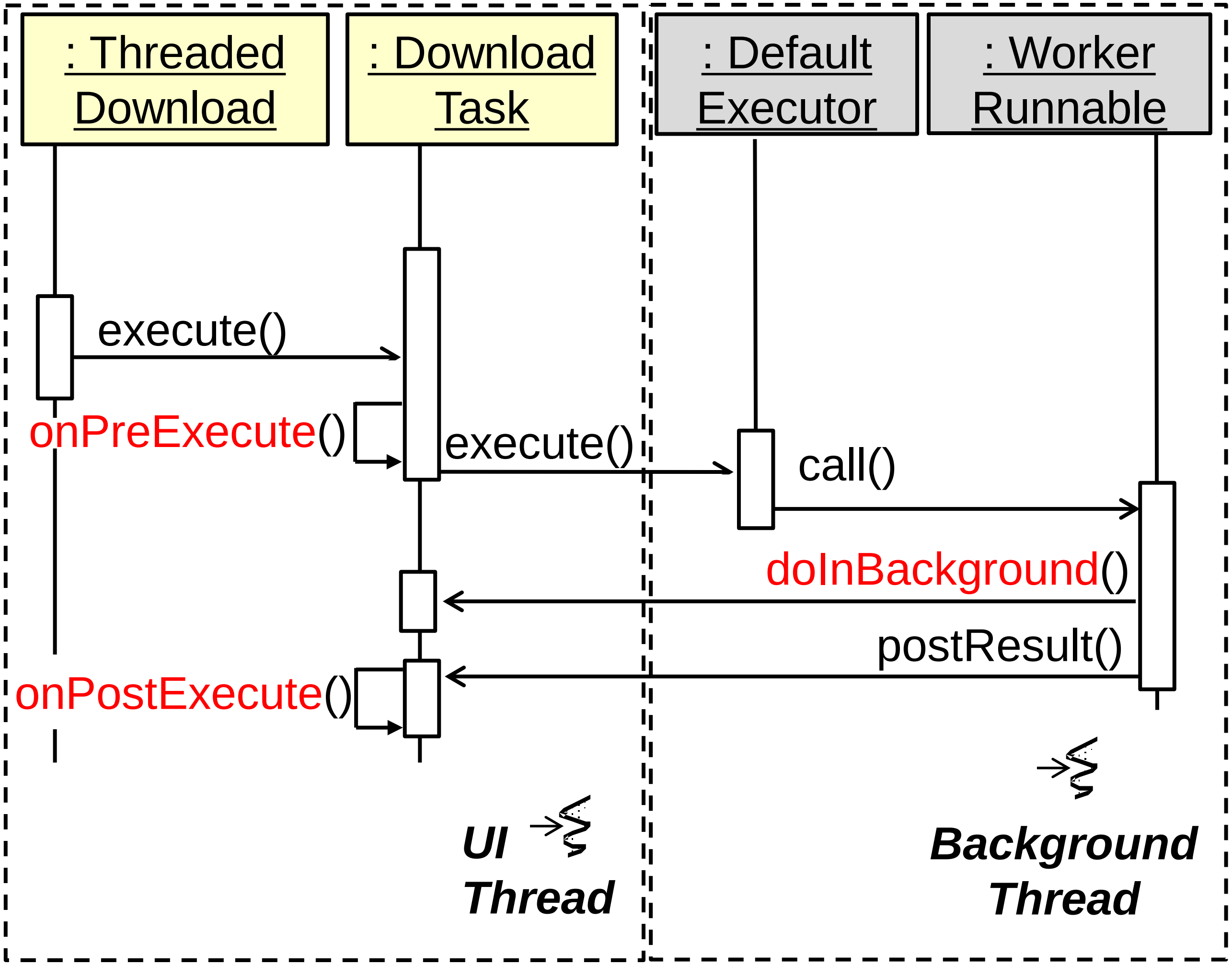

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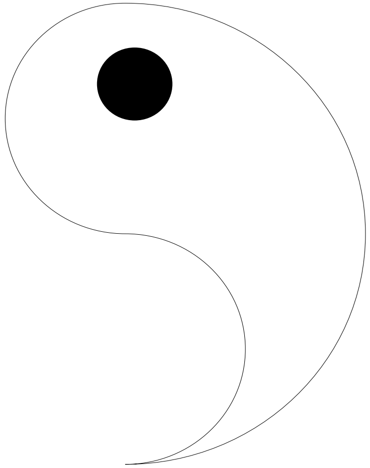

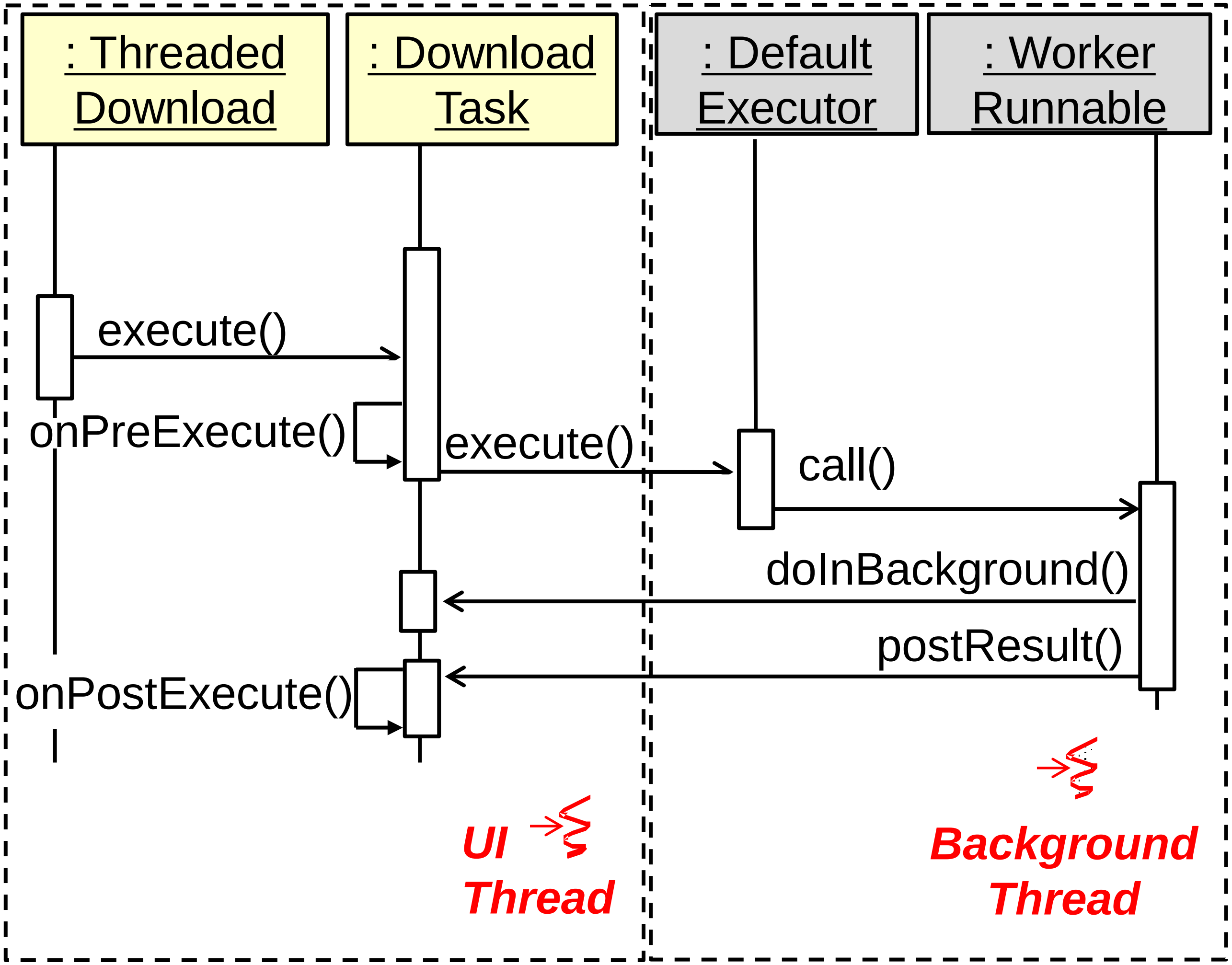

This *Template Method* variant allows hook methods to run in different threads

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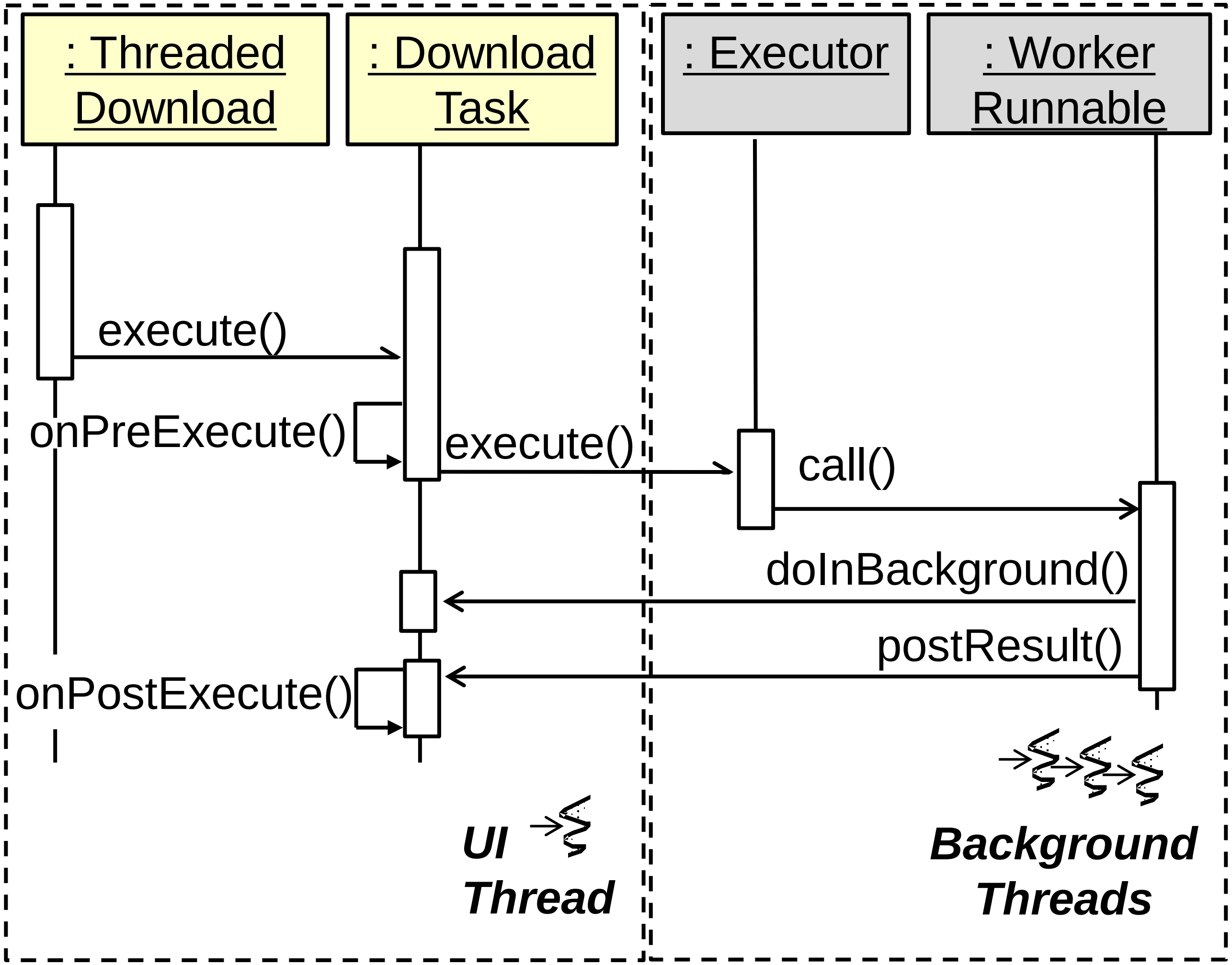

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Black-box Elements of the AsyncTask Framework

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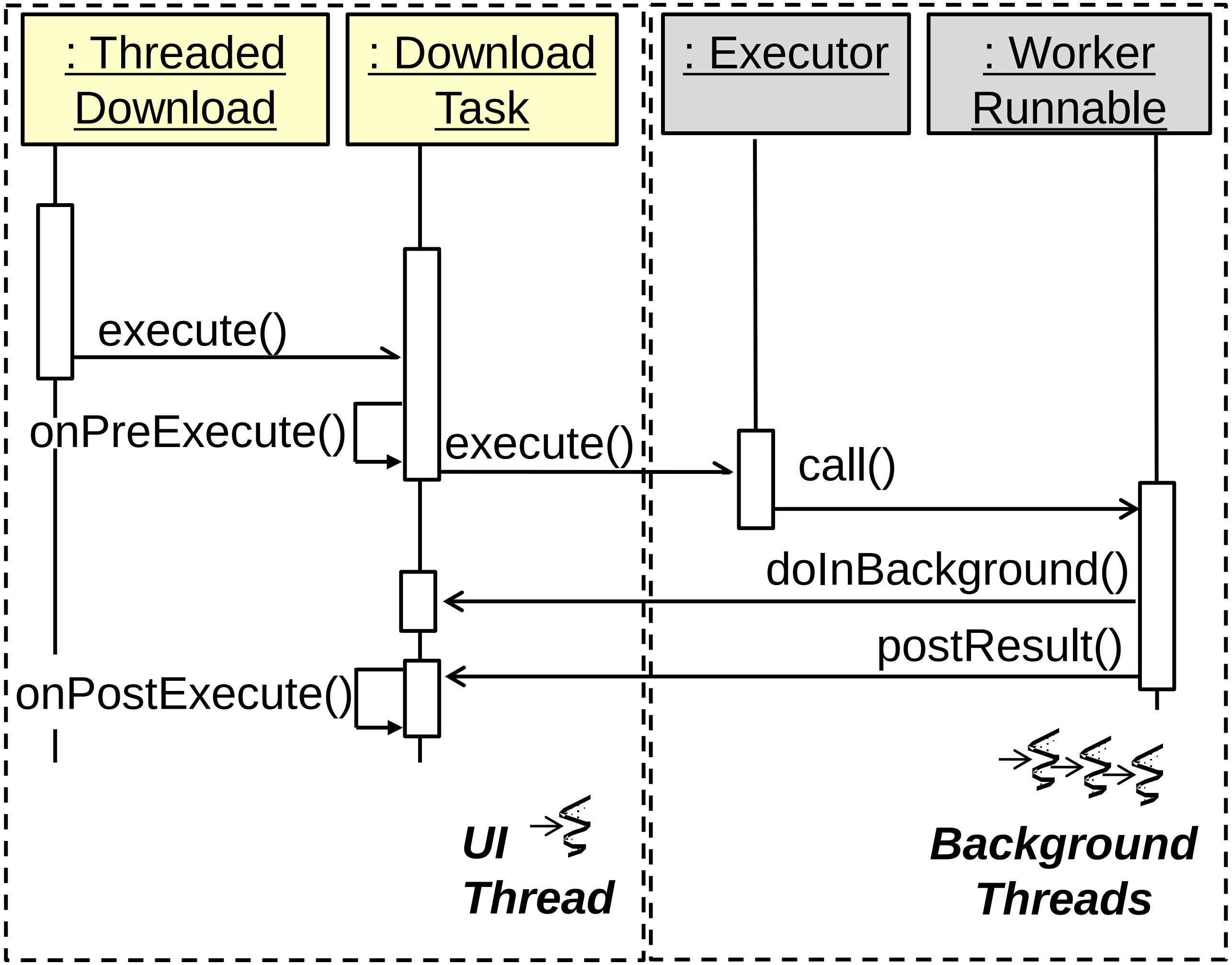

developer.android.com/reference/android/os/AsyncTask.html has more info

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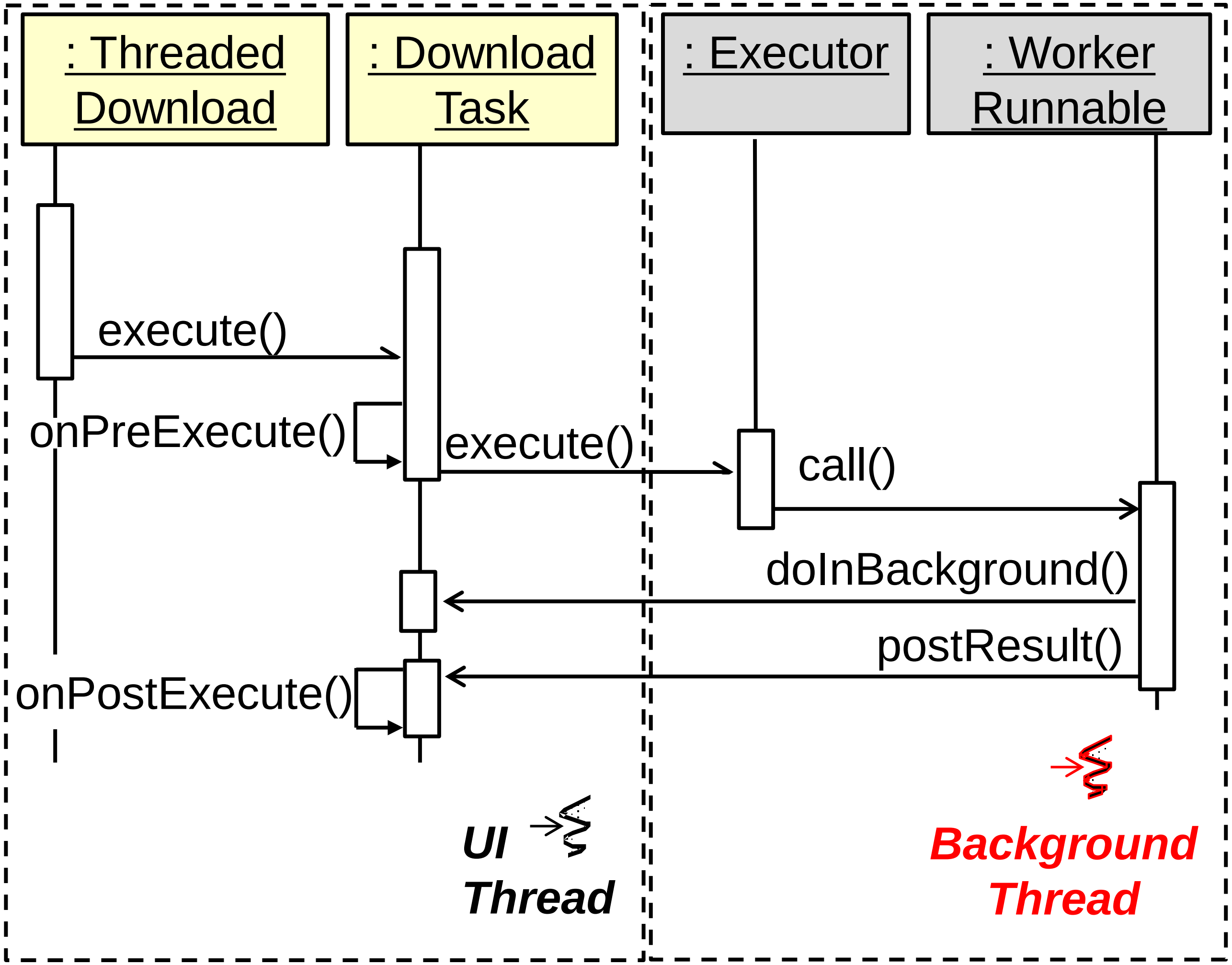

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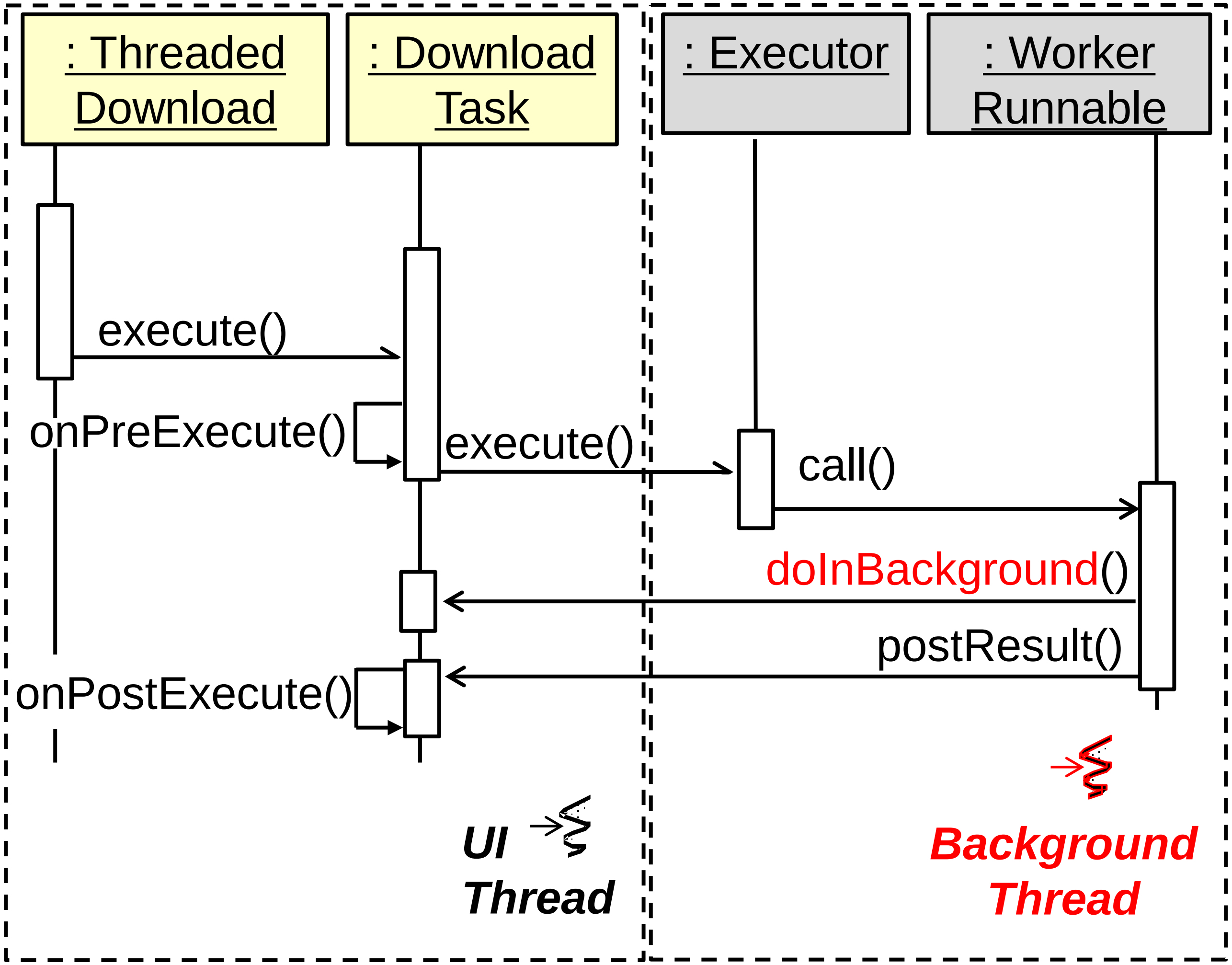
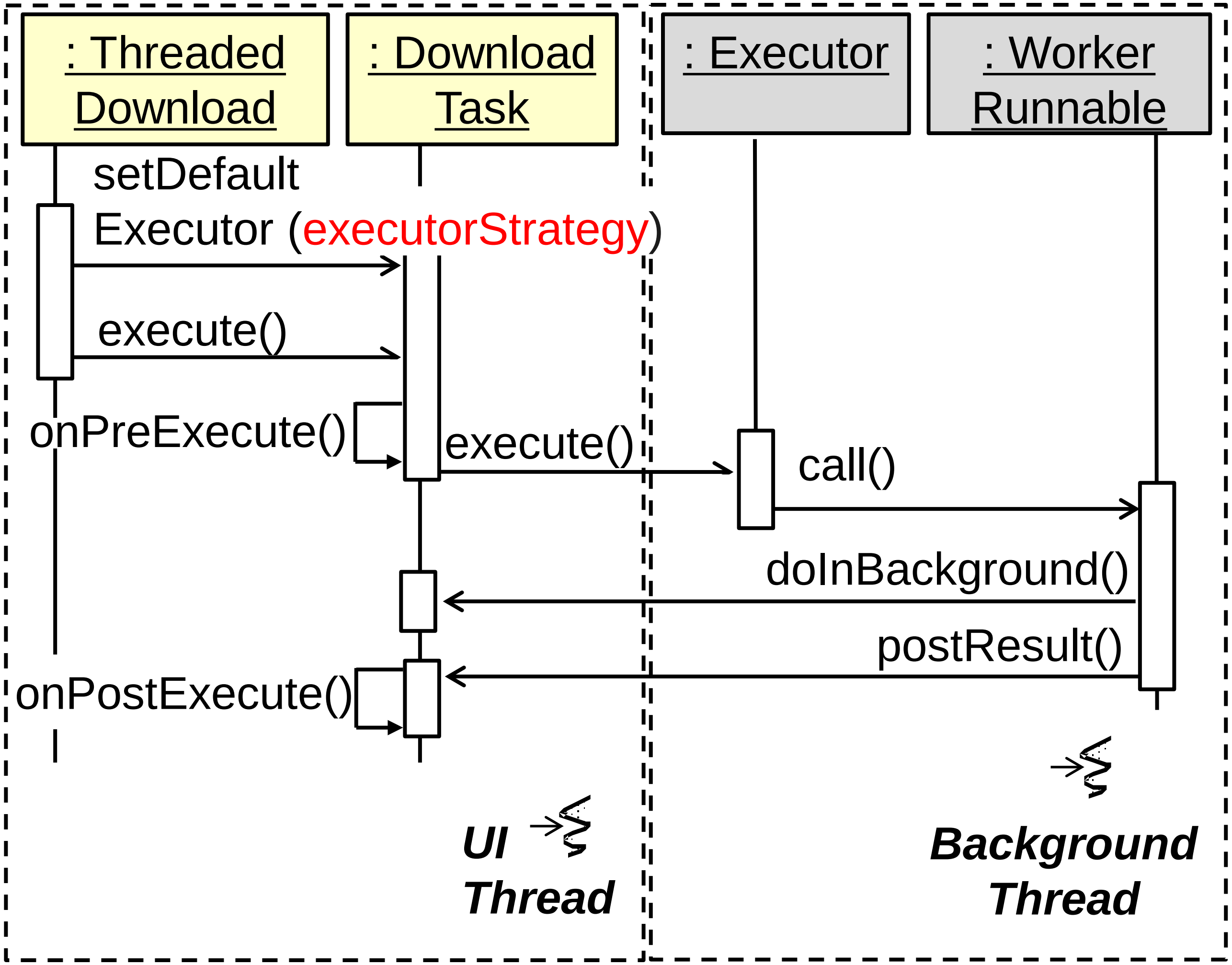


Black-box Elements of the AsyncTask Framework

- Black-box framework elements control the background thread(s)
- AsyncTask can be configured via a # of Executor strategies



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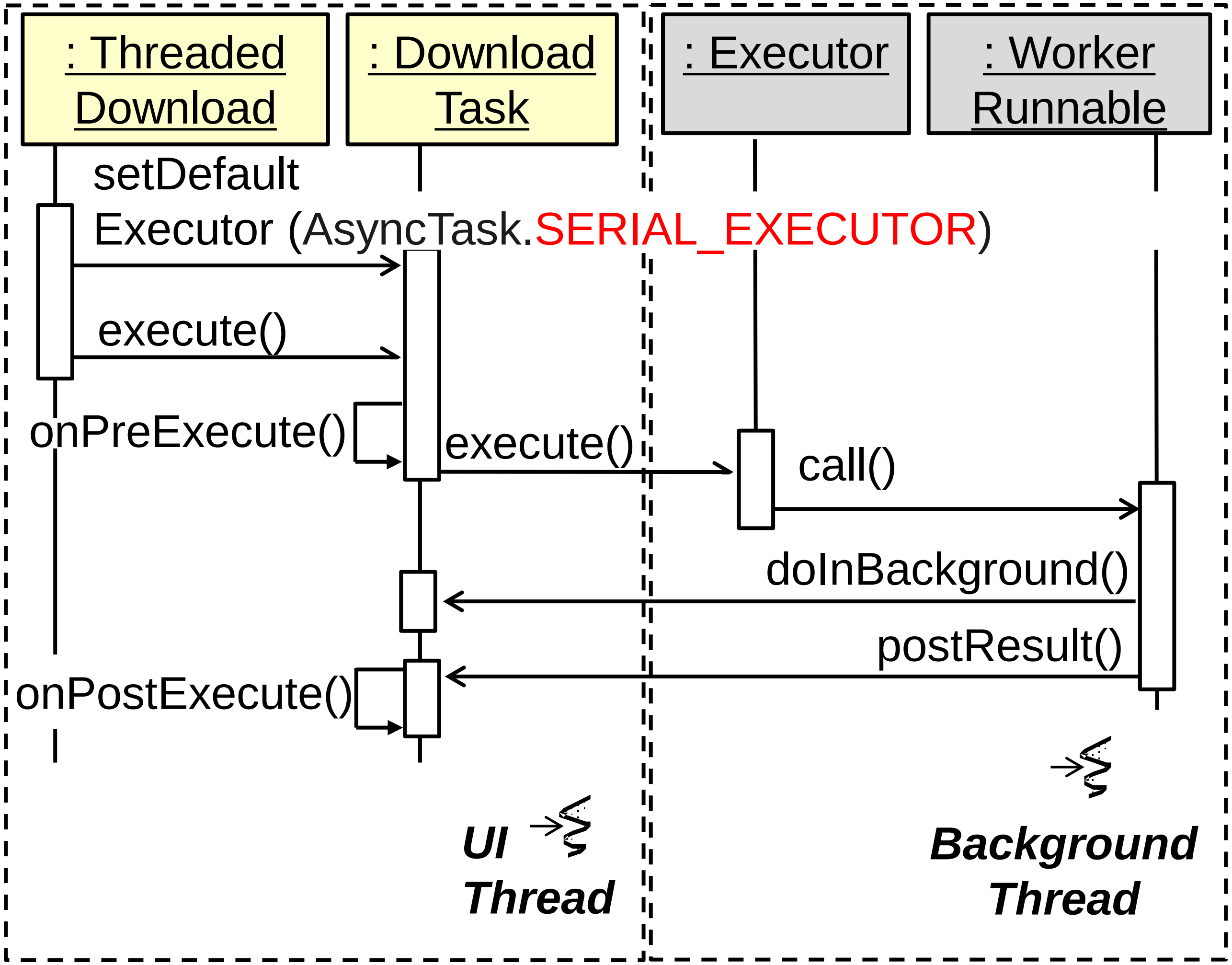

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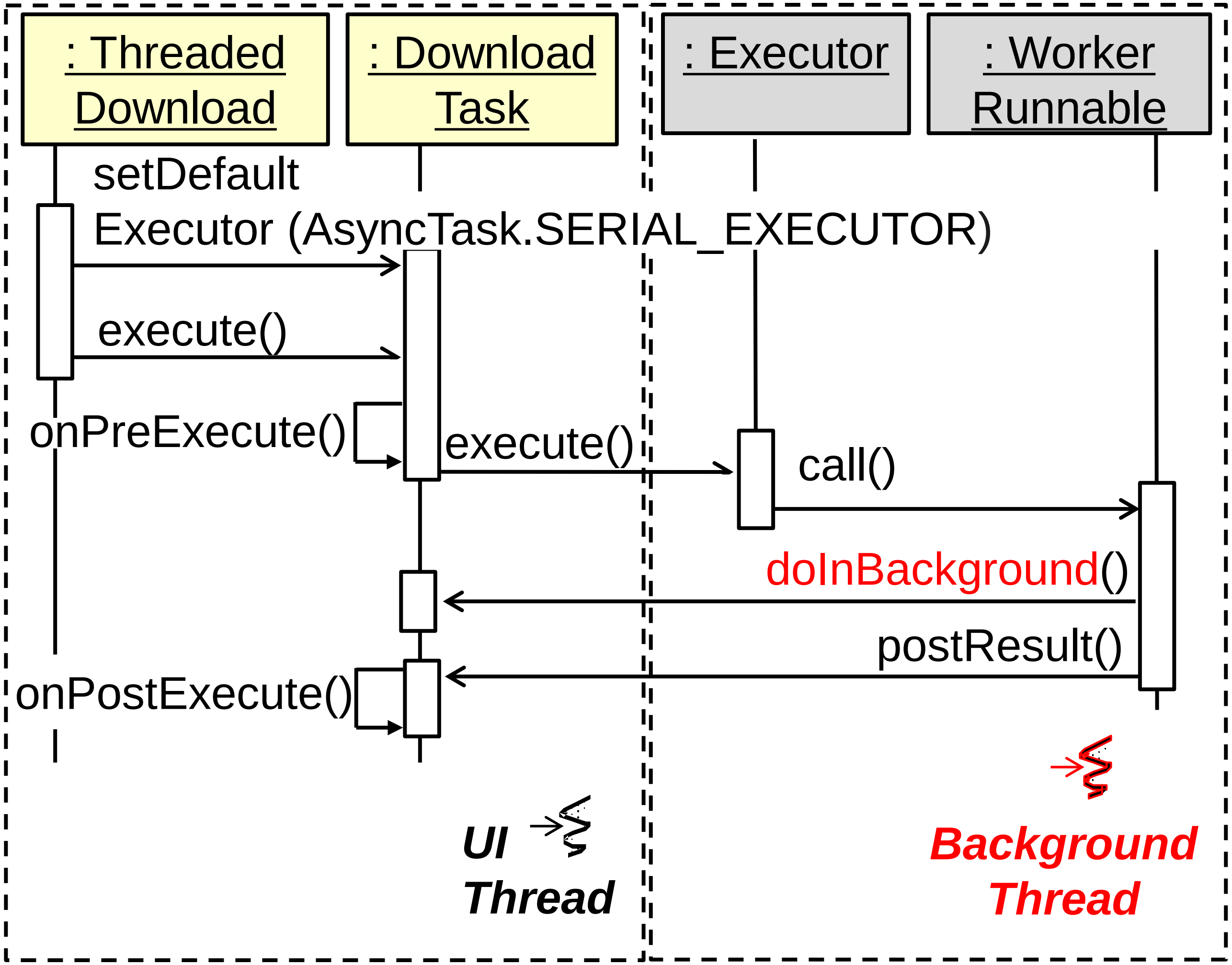

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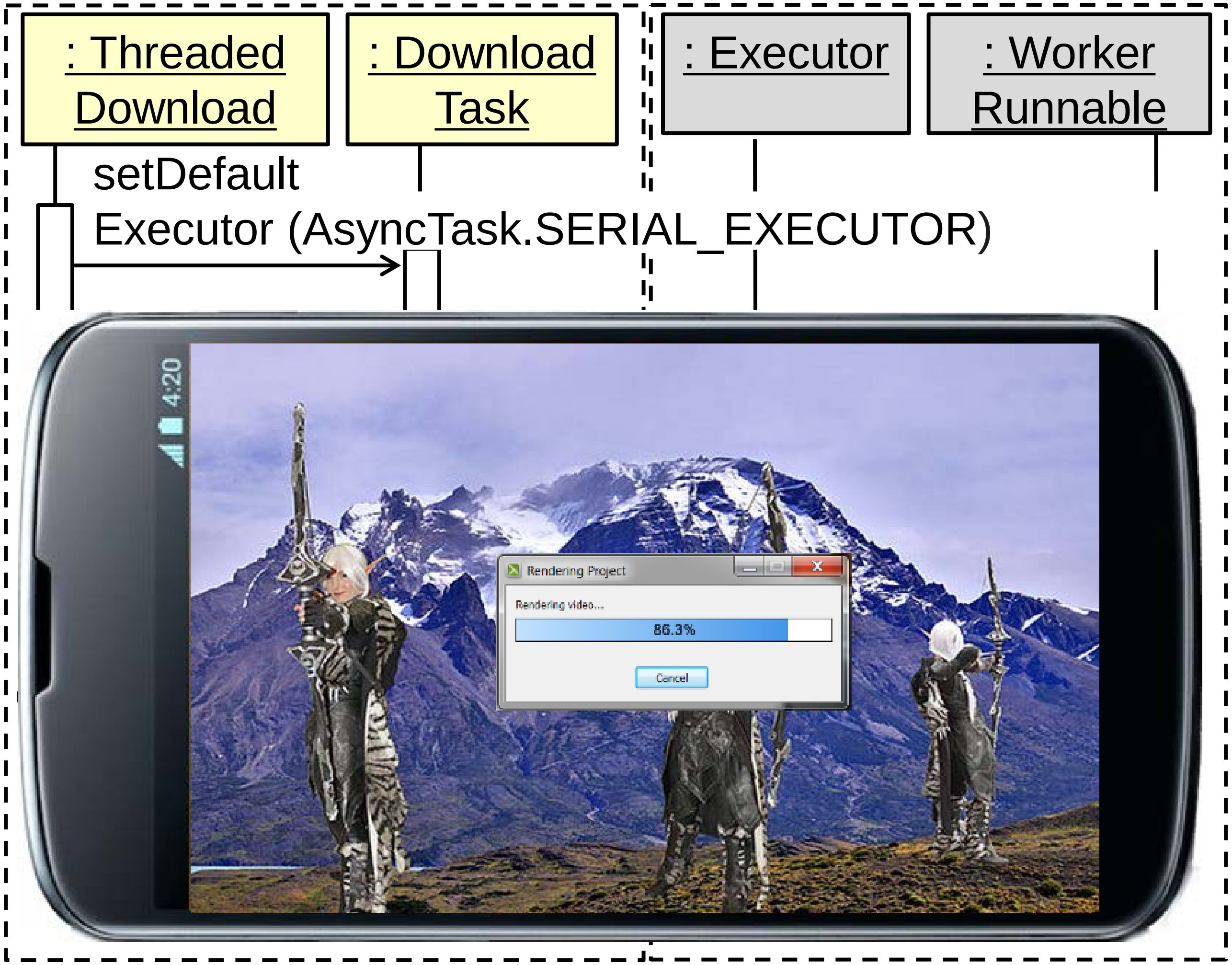

: Threaded Download

: Download Task

: Executor

: Worker Runnable

setDefault Executor (AsyncTask.SERIAL_EXECUTOR)

Some applications need to run async tasks in parallel instead of serially

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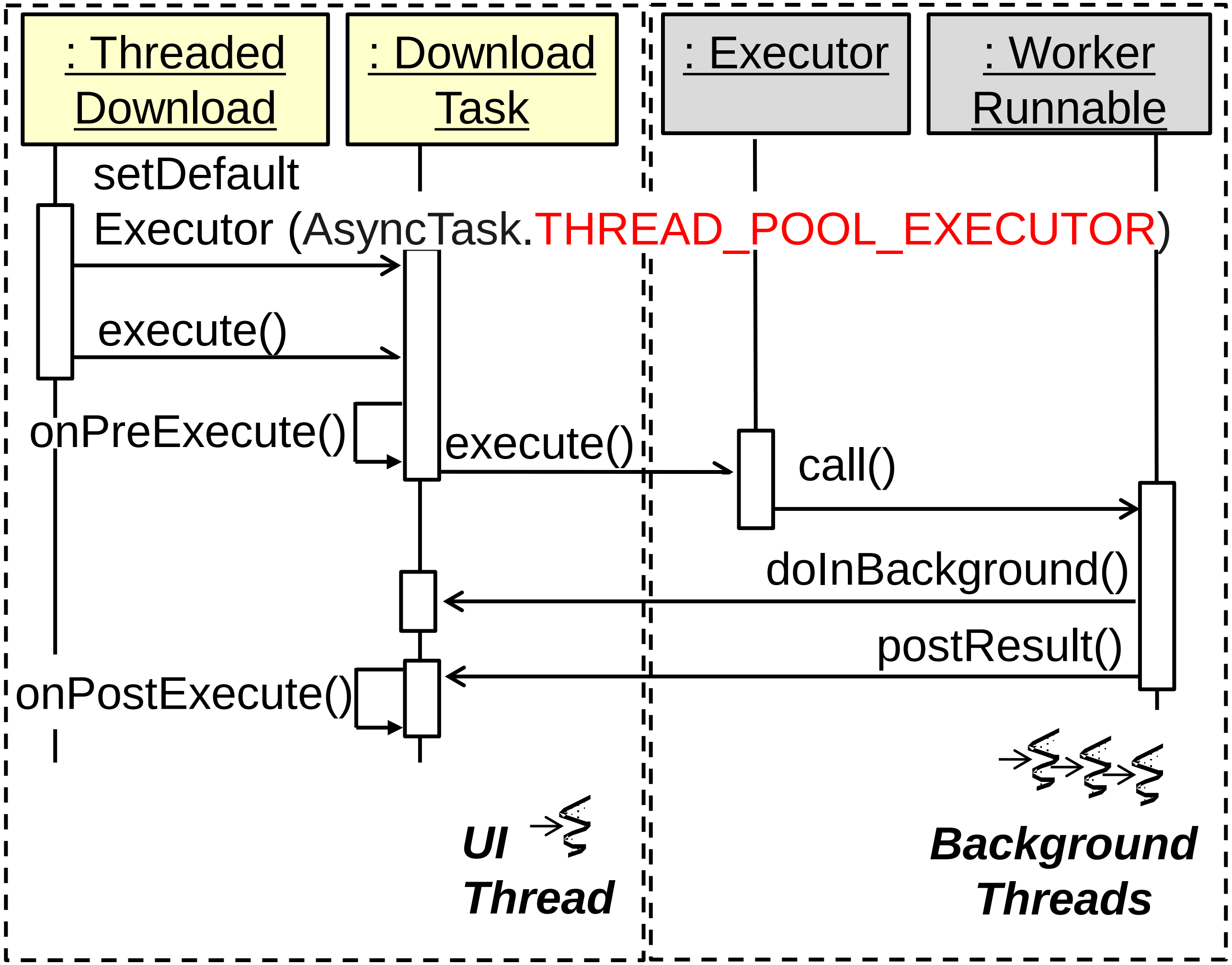

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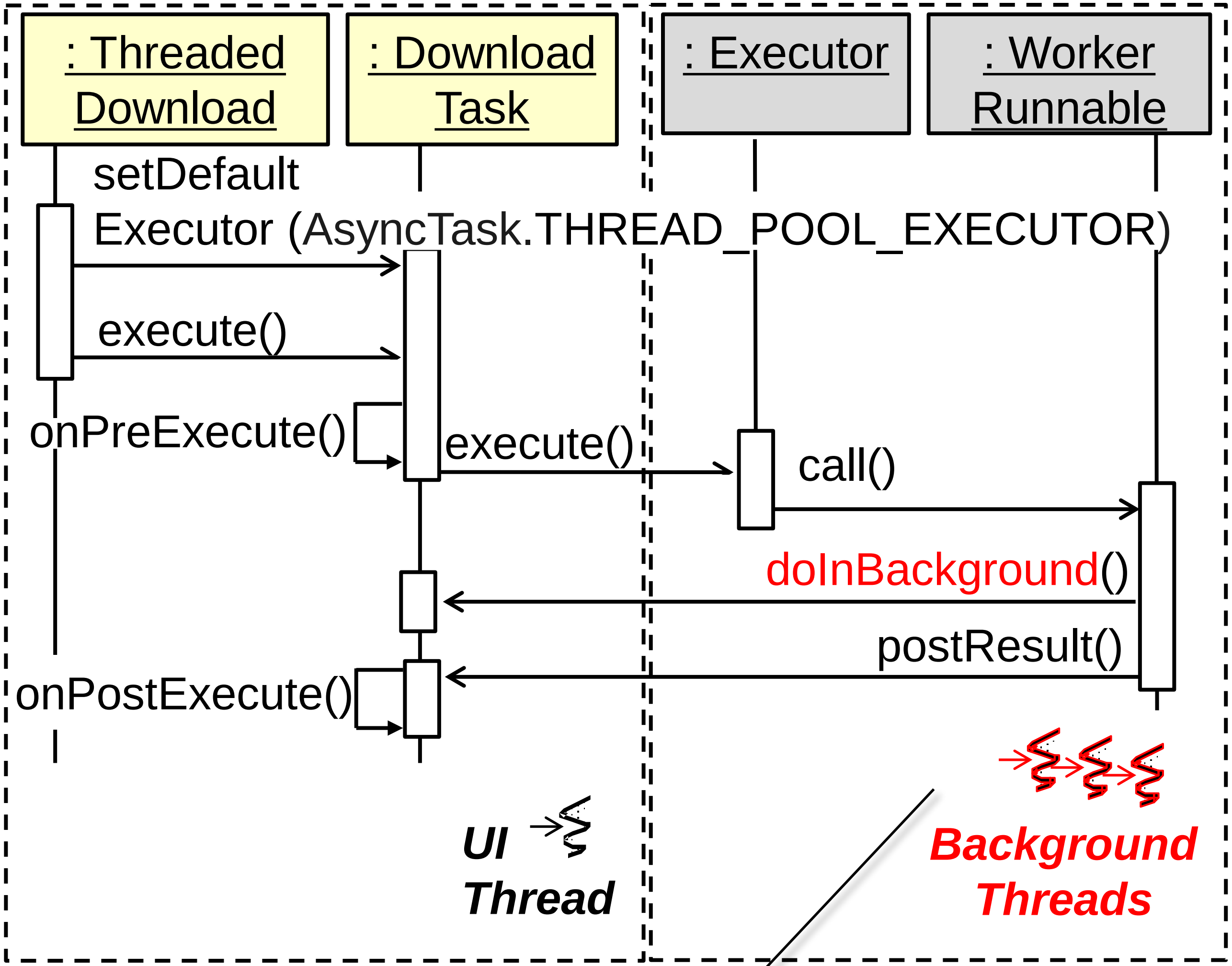

Allows multiple long duration tasks to run in parallel within a process

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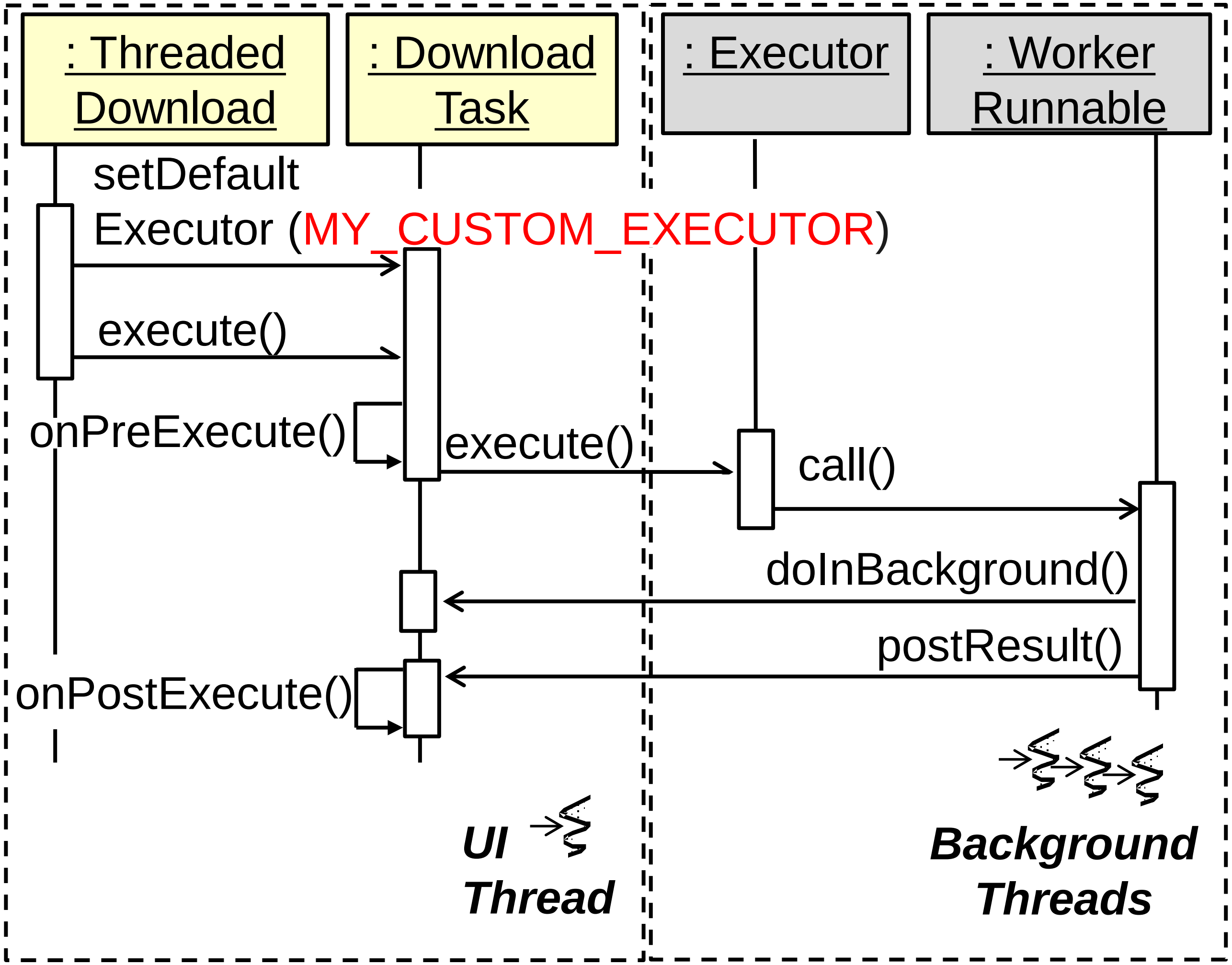

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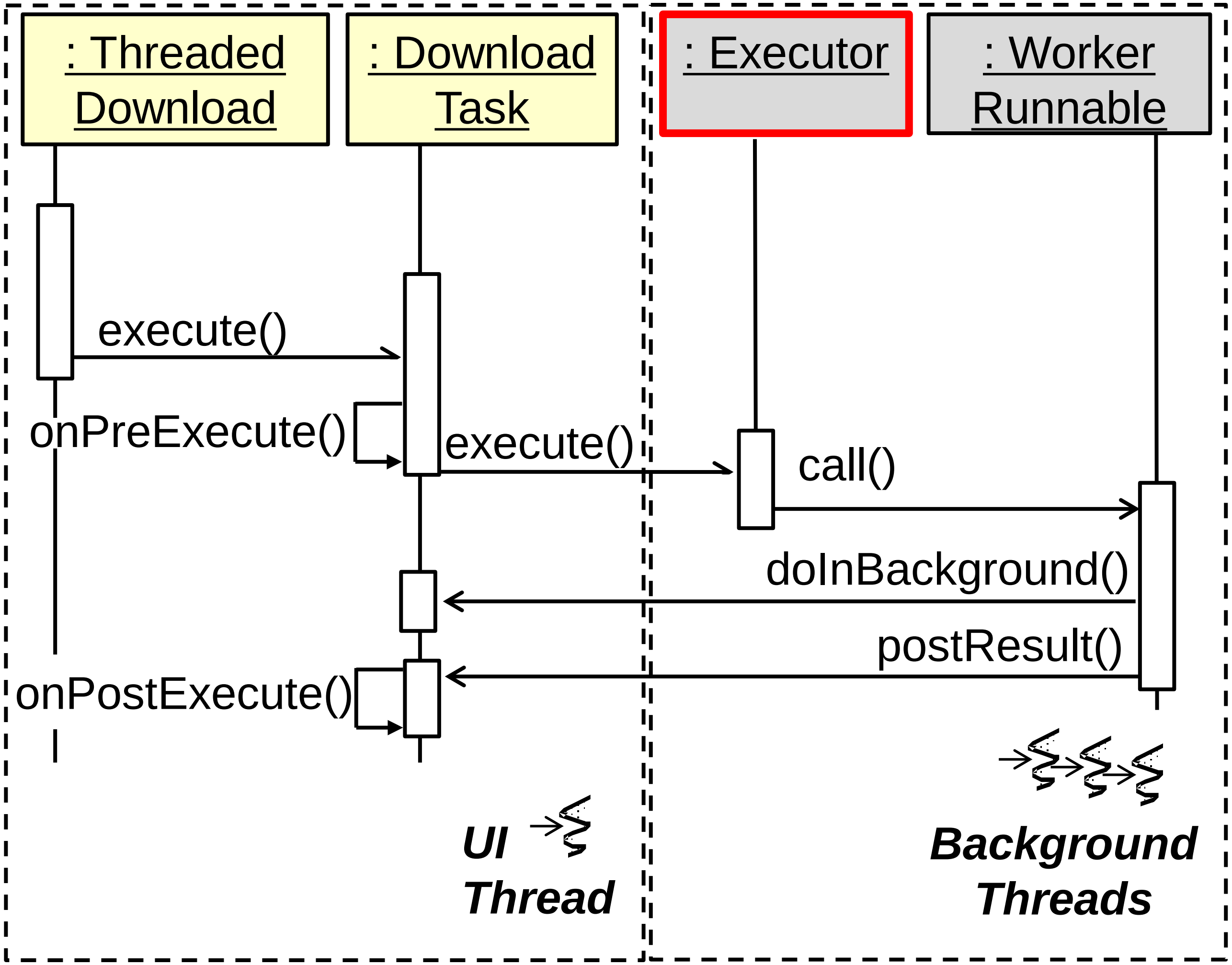

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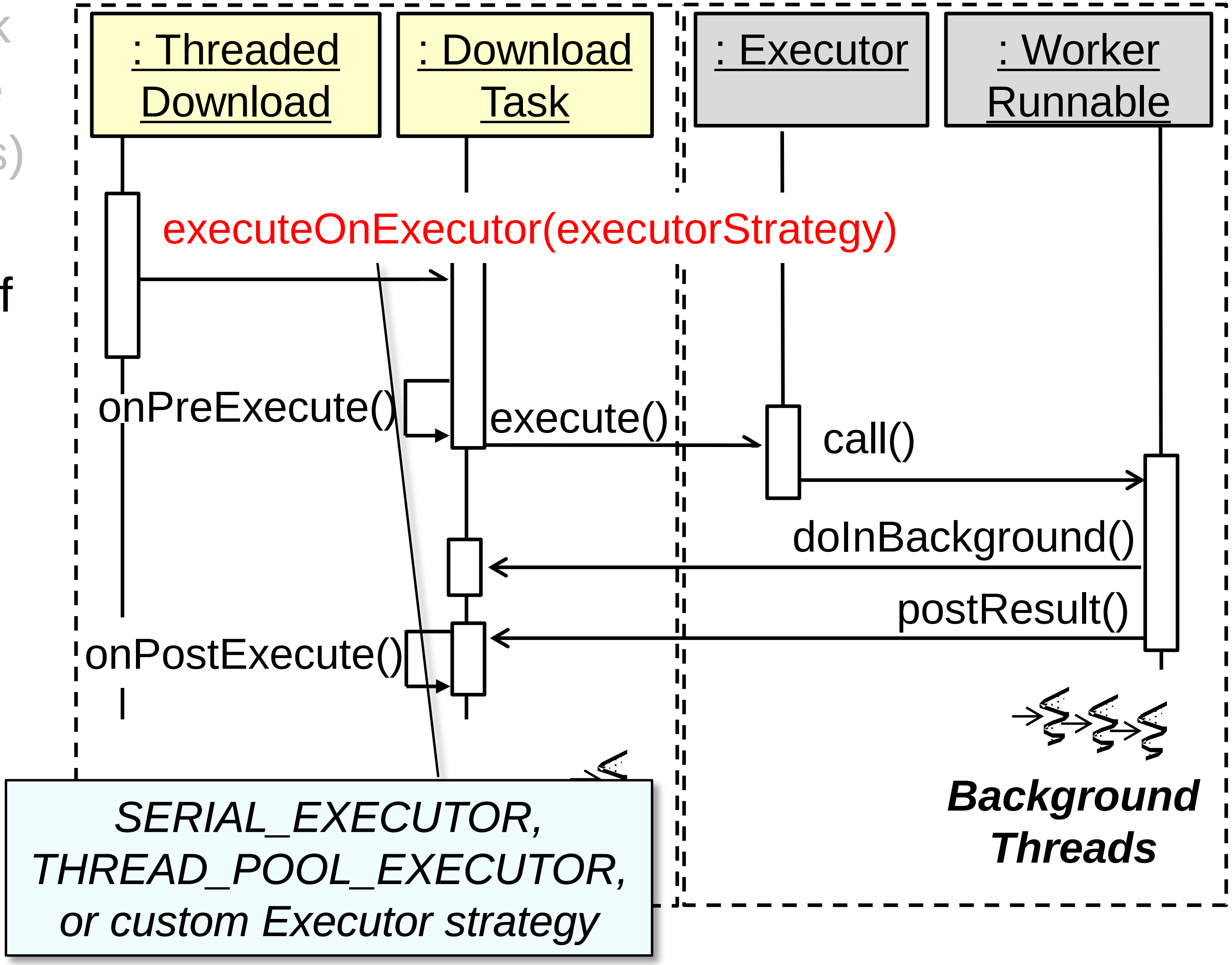

SERIAL_EXECUTOR, THREAD_POOL_EXECUTOR, or custom Executor strategy

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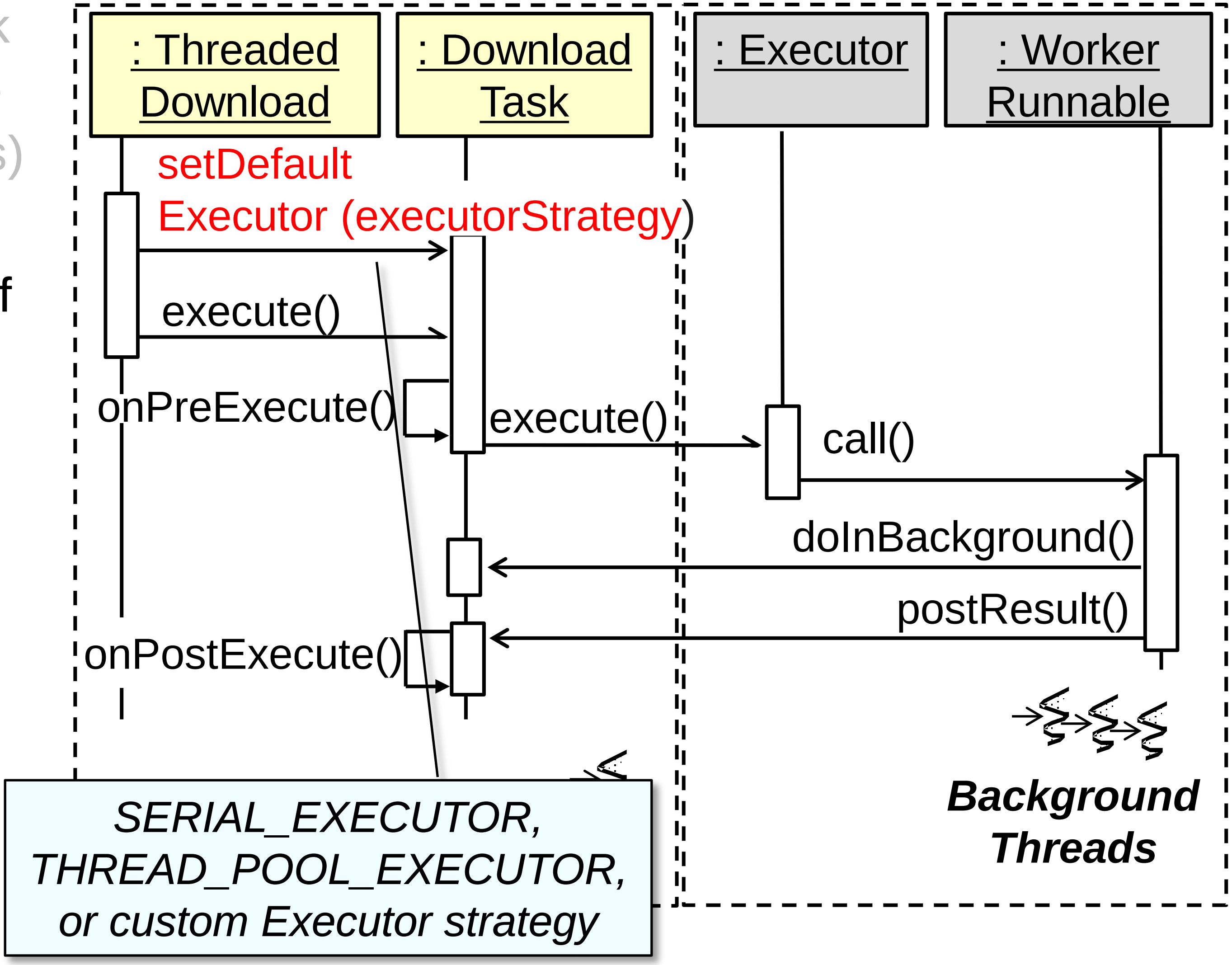

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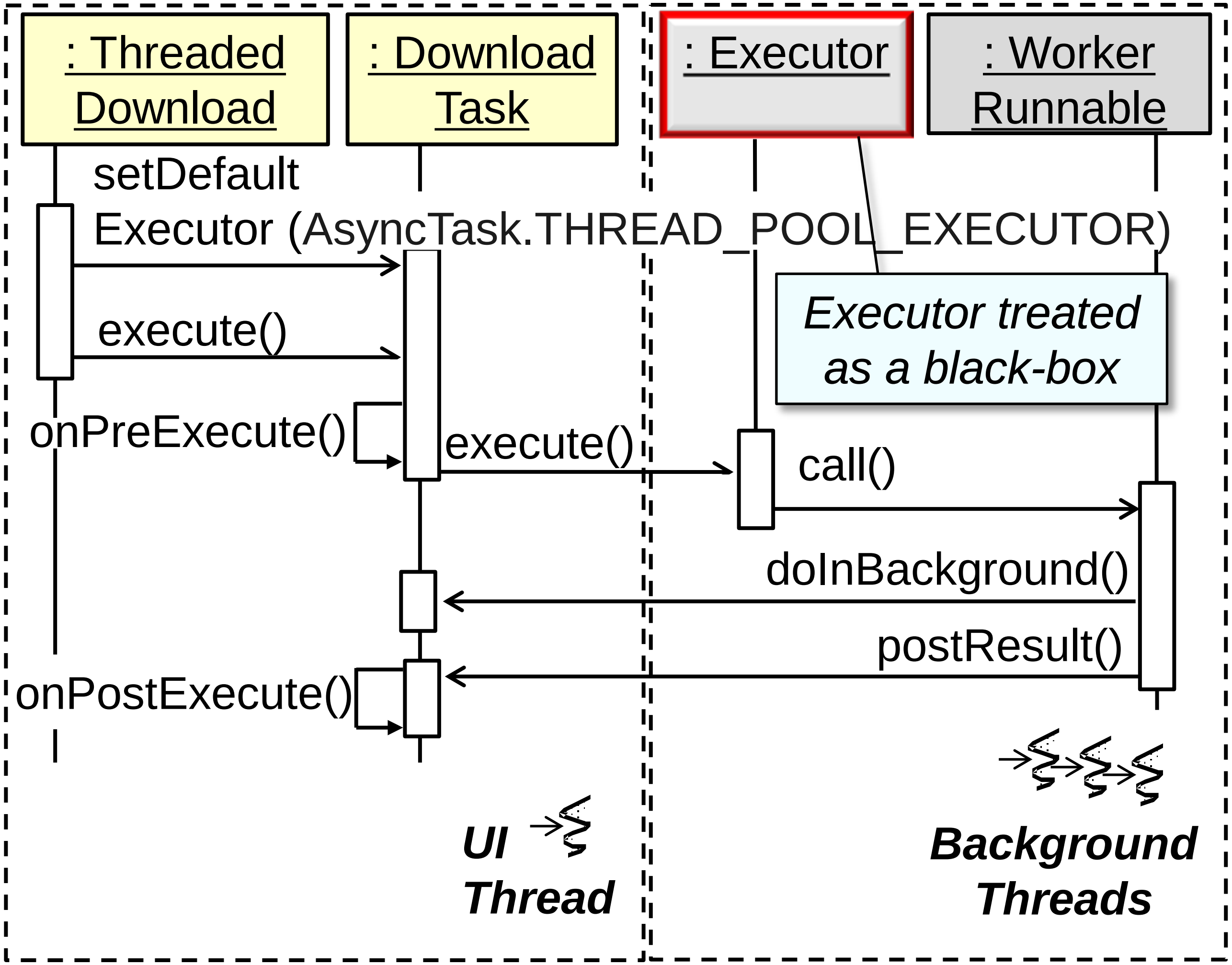

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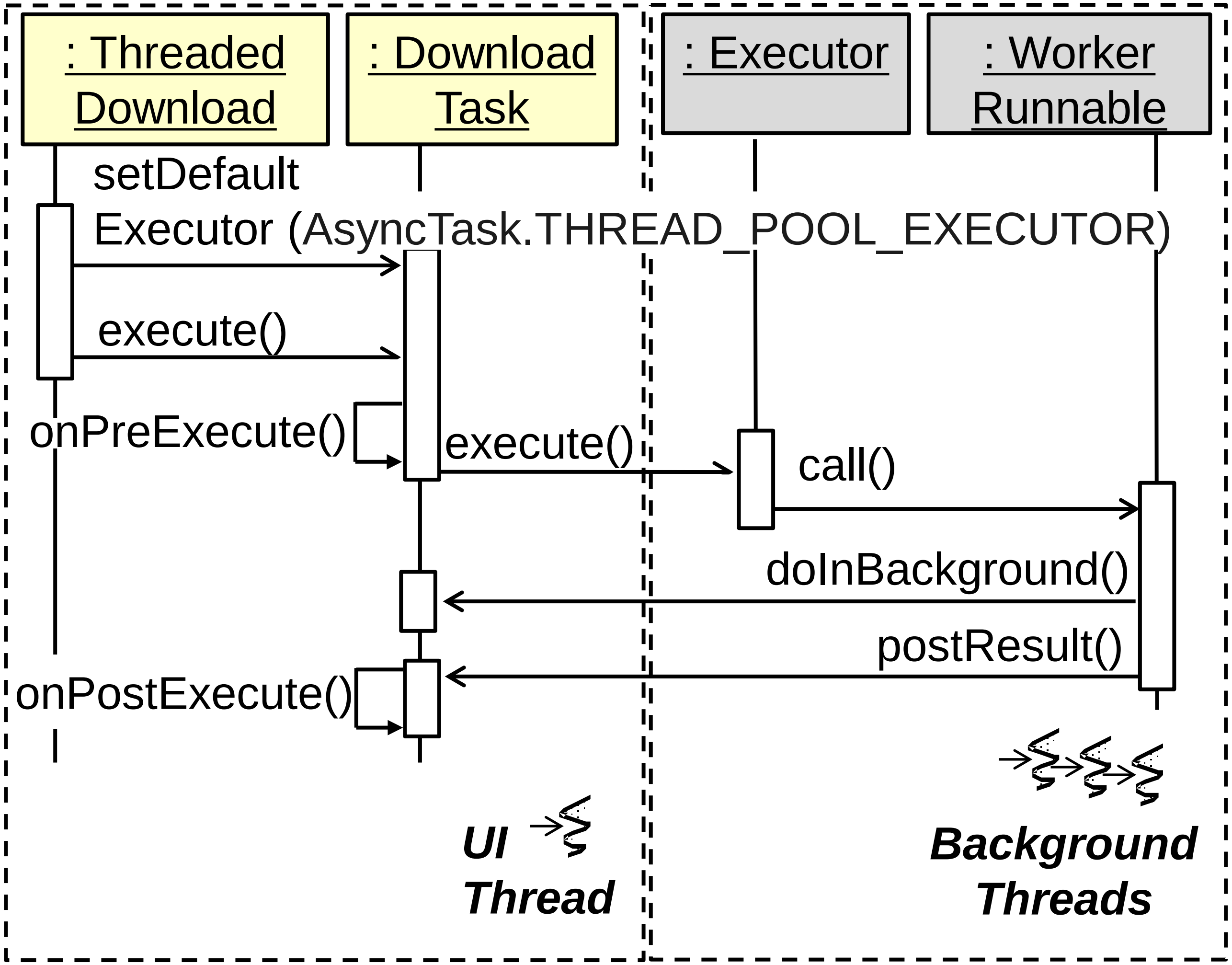

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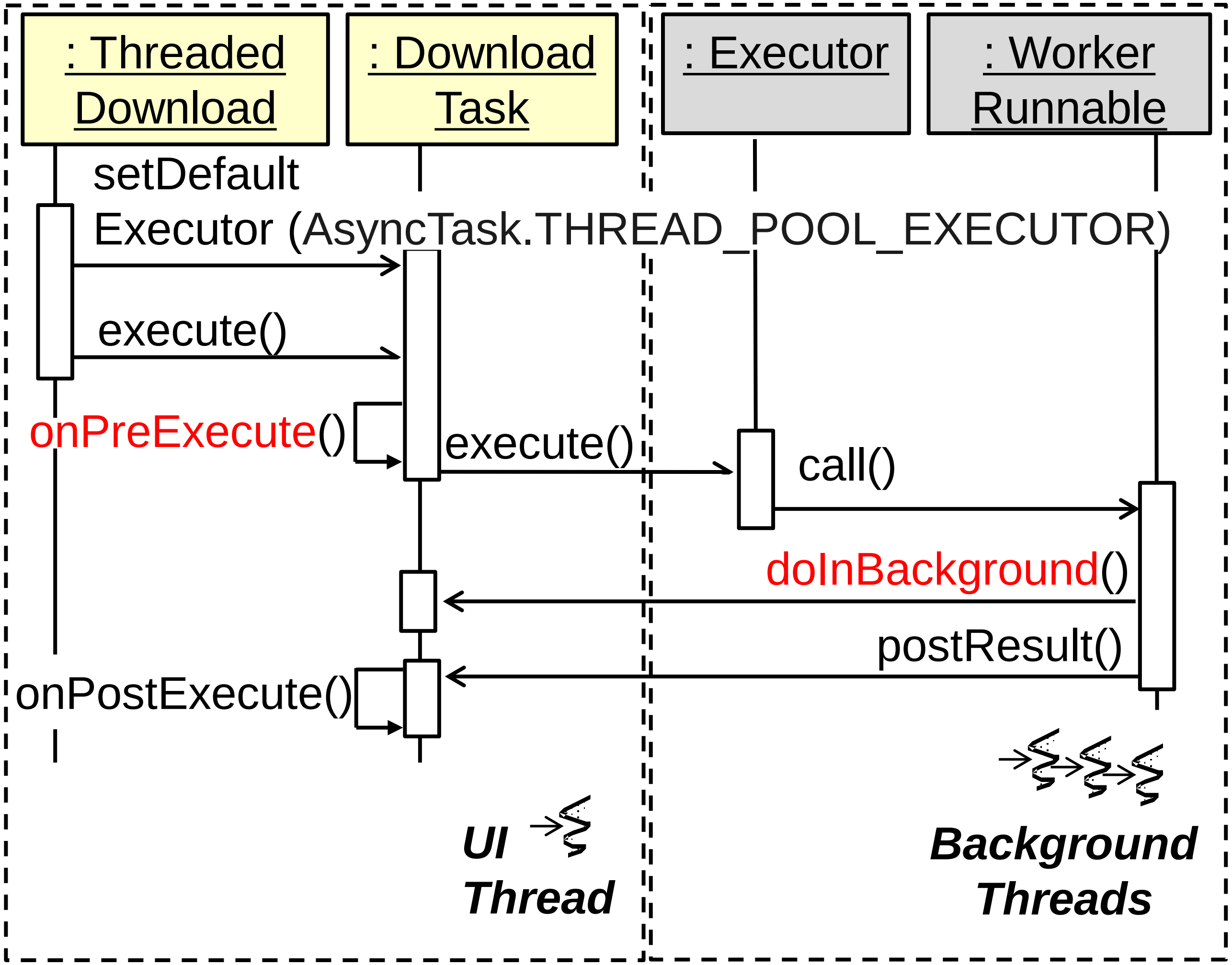

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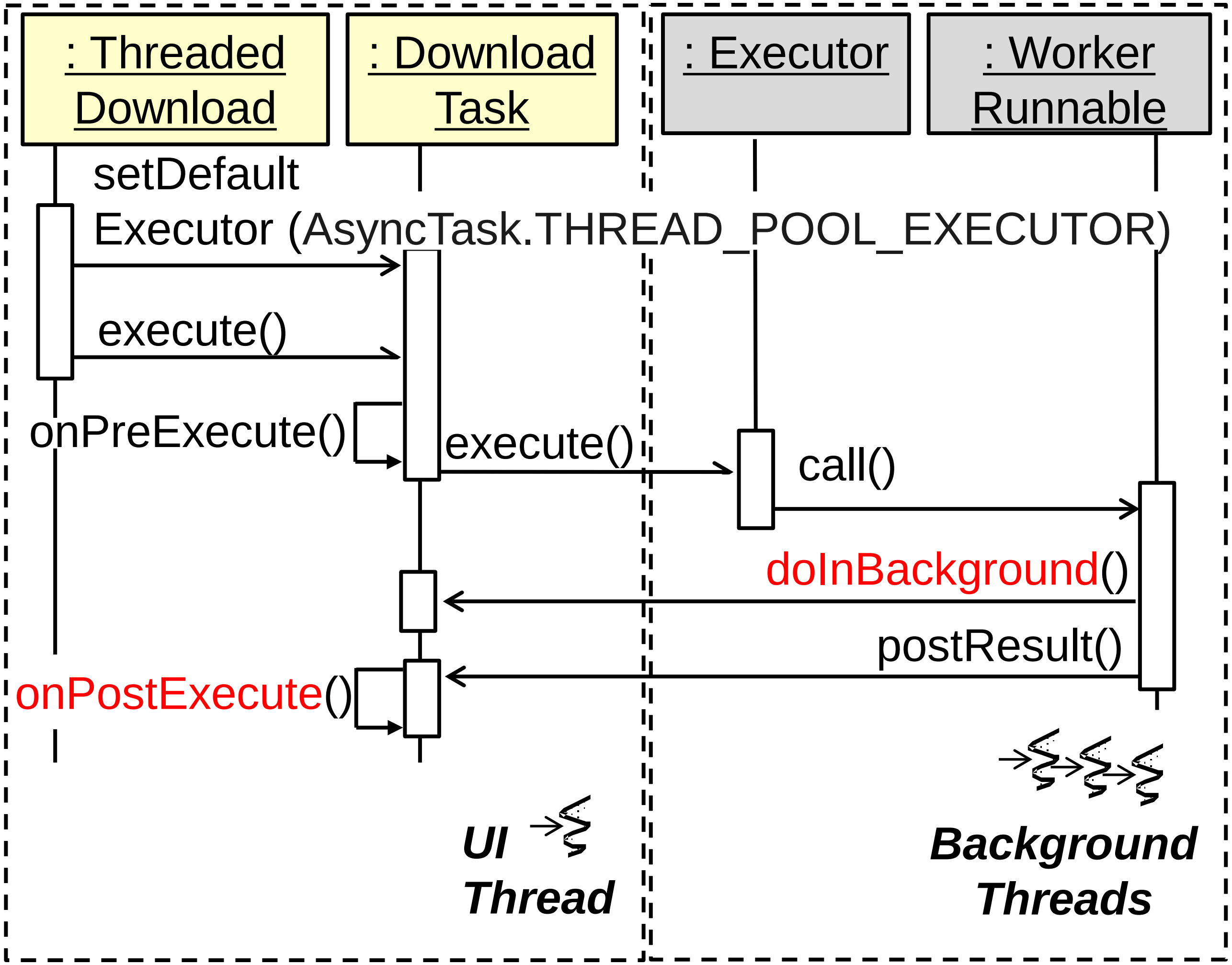

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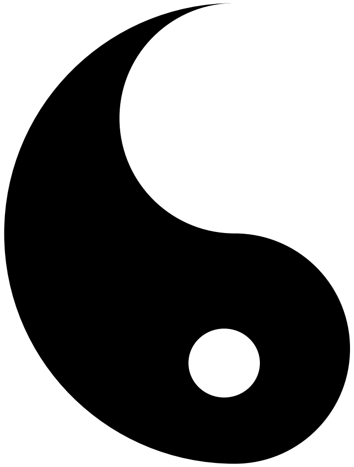
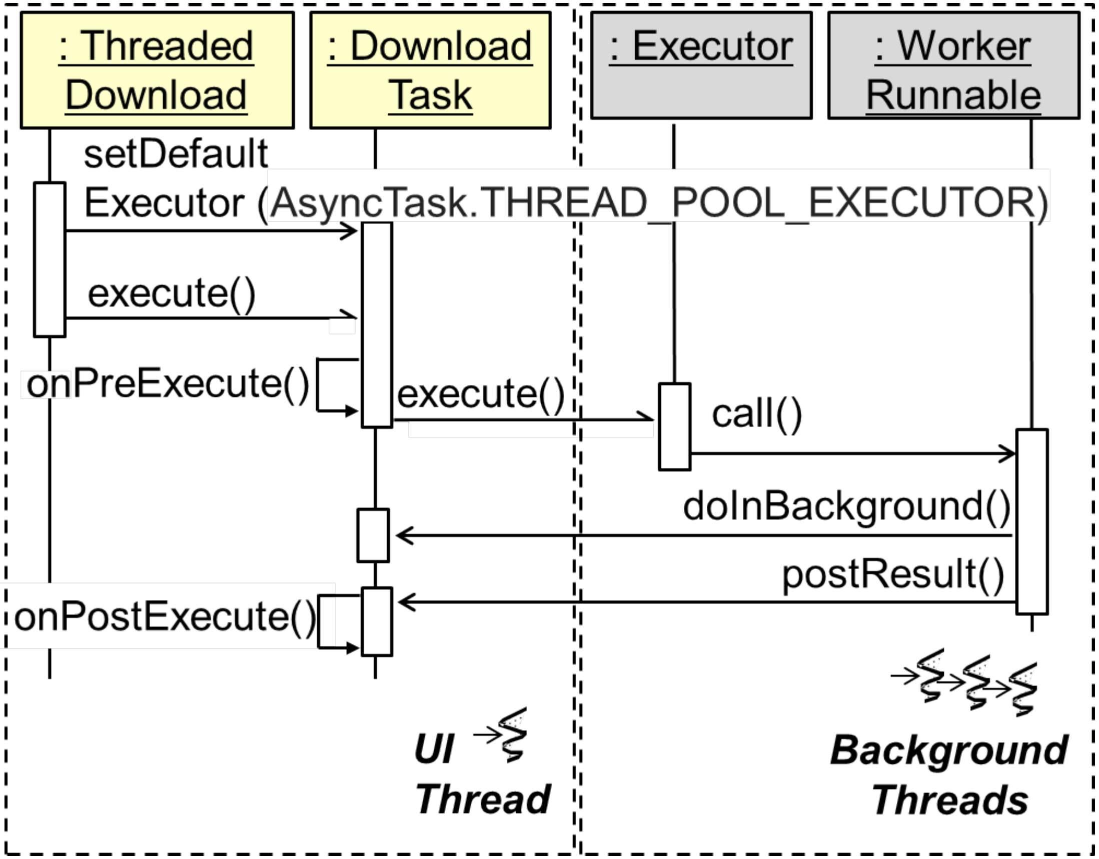
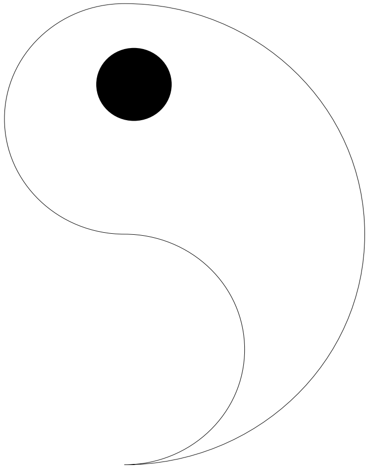




White-box



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- There are trade-offs between each approach
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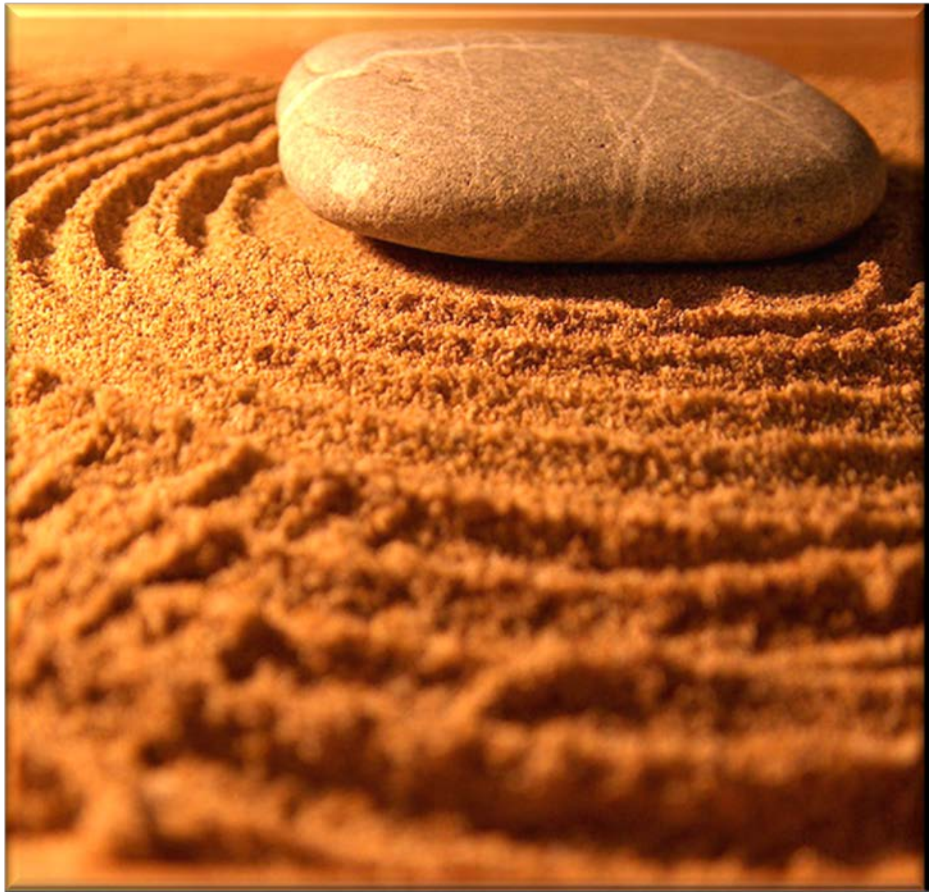

en.wikipedia.org/wiki/Plug-in_(computing) has more on plug-ins

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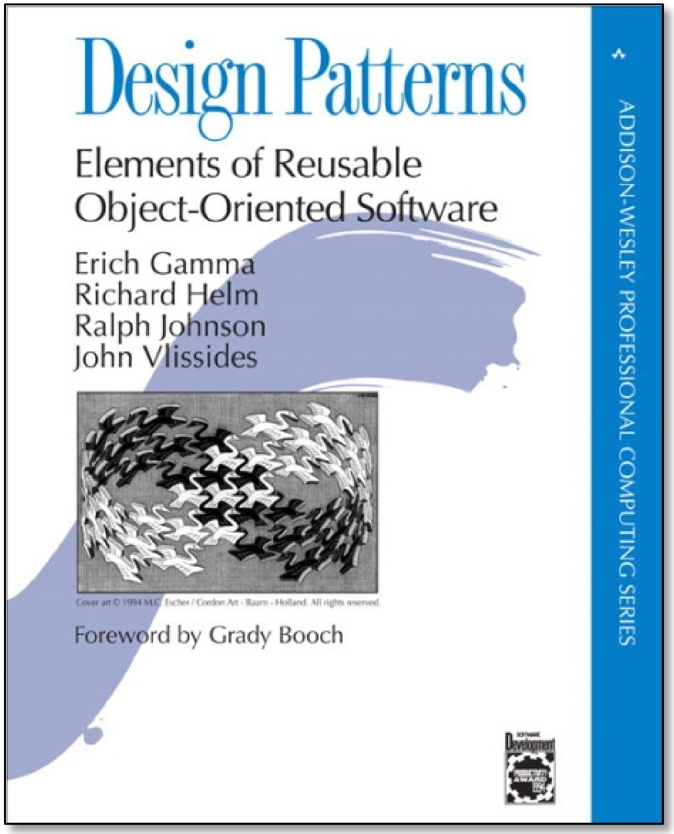
- AsyncTask uses several GoF patterns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Erich Gamma
Richard Helm
Ralph Johnson
John Vlissides
Foreword by Grady Booch
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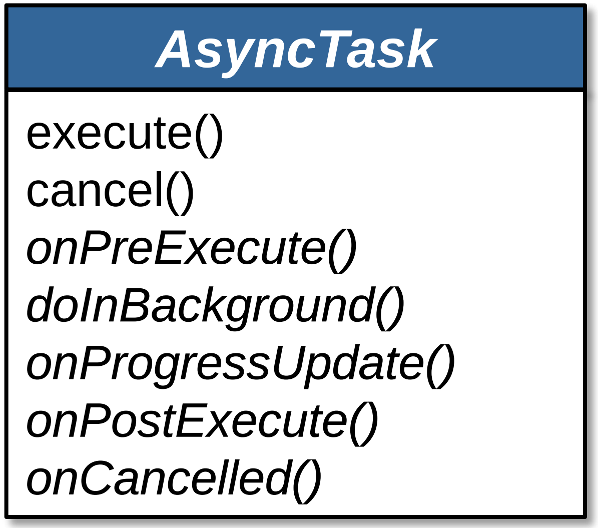
- AsyncTask uses several GoF patterns
  - *Template Method* is used for its white-box capabilities

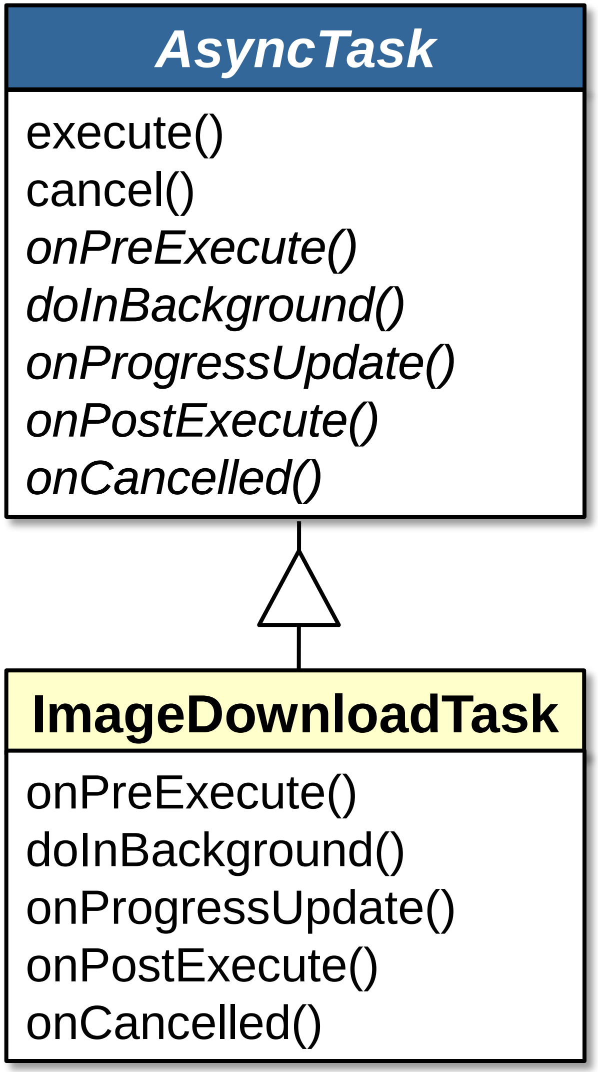


AsyncTask

execute()
cancel()
onPreExecute()
doInBackground()
onProgressUpdate()
onPostExecute()
onCancelled()

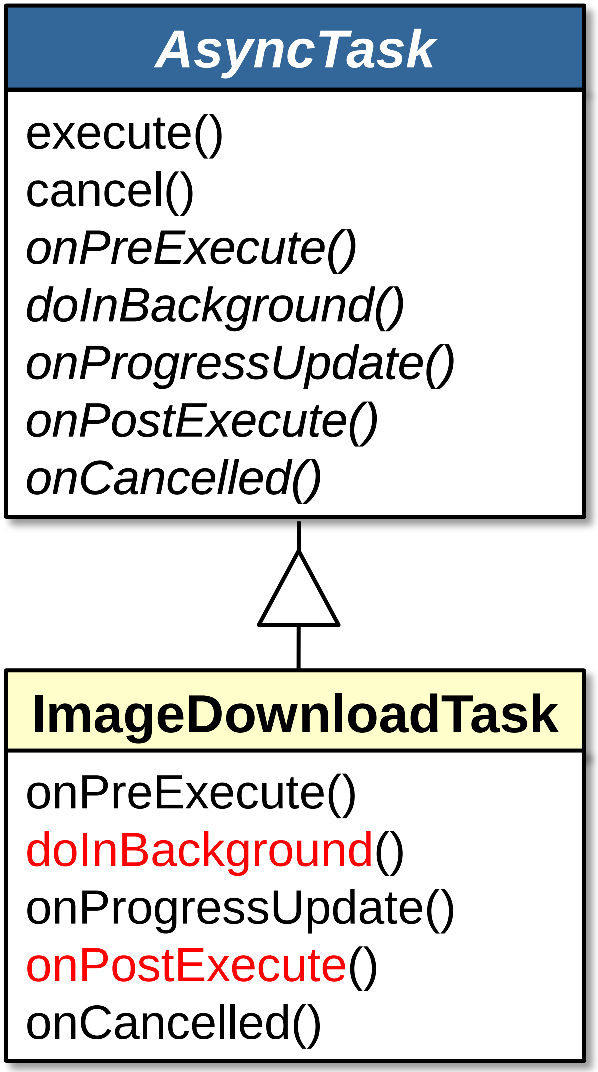
Summary

- AsyncTask is a black-box & white-box framework
- There are trade-offs between each approach
- AsyncTask uses several GoF patterns
  - *Template Method* is used for its white-box capabilities



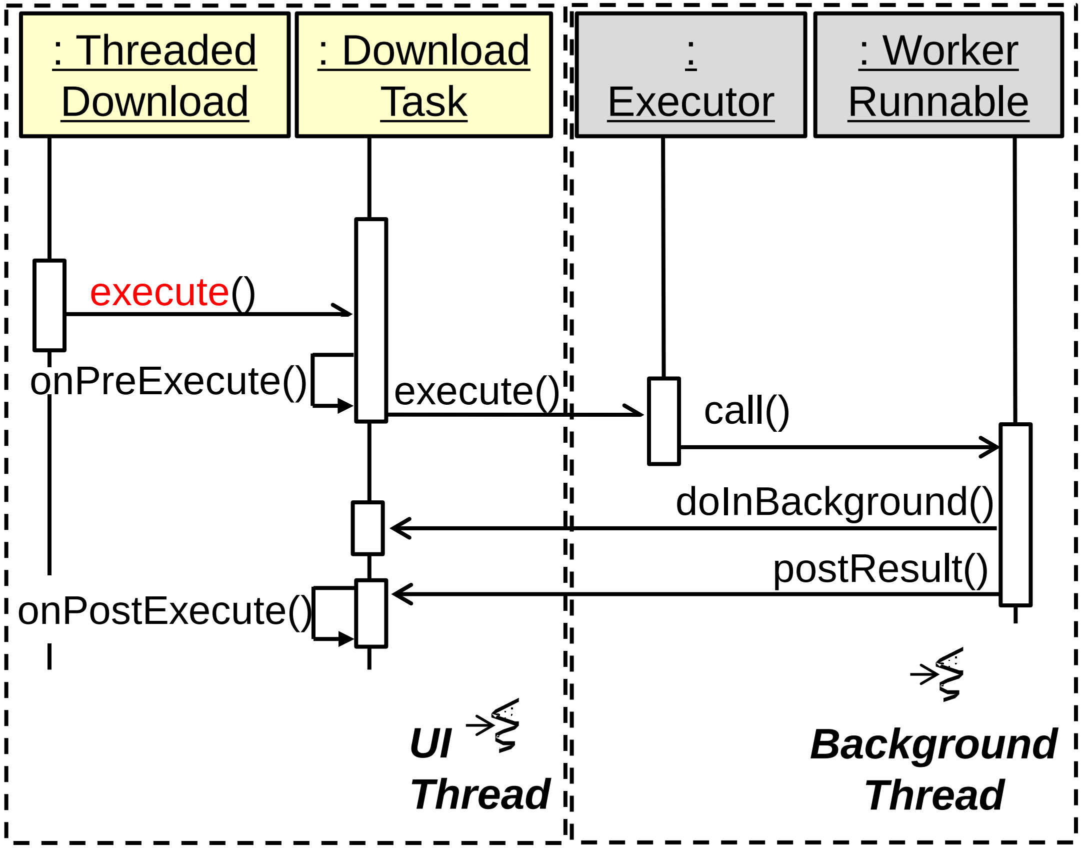
Summary

- AsyncTask is a black-box & white-box framework
- There are trade-offs between each approach
- AsyncTask uses several GoF patterns
  - *Template Method* is used for its white-box capabilities



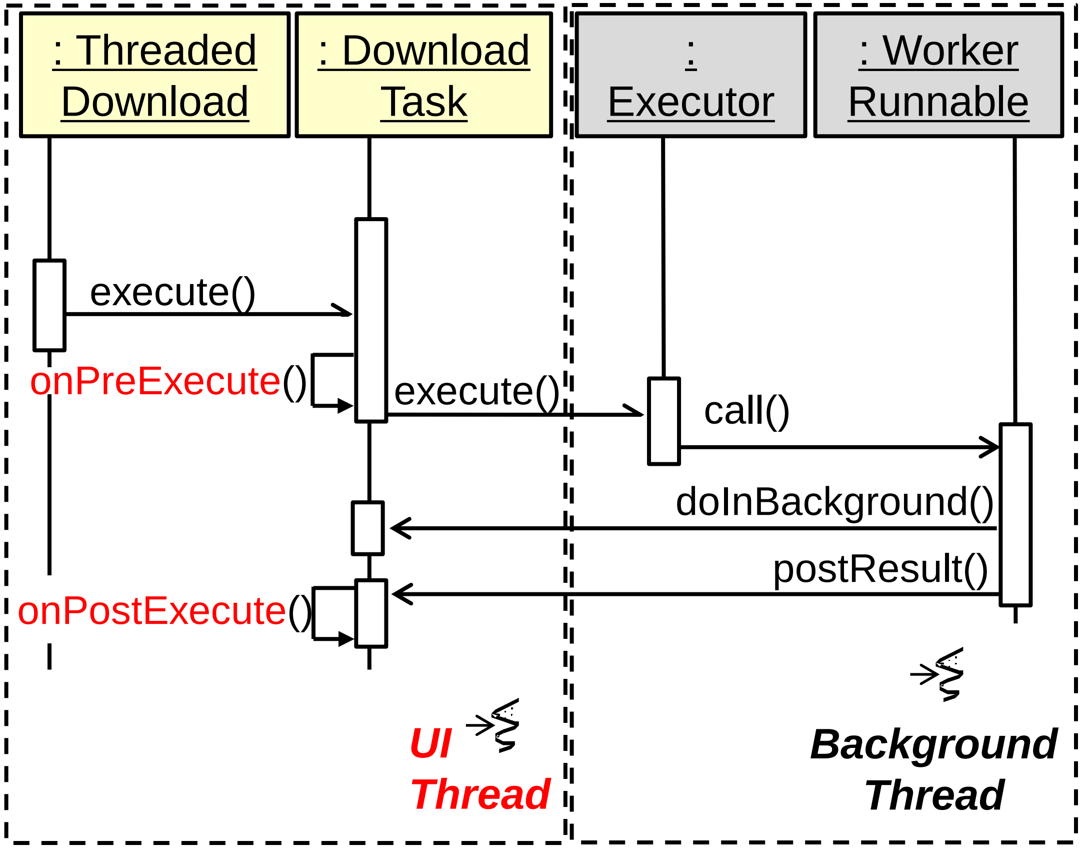
Summary

- AsyncTask is a black-box & white-box framework
- There are trade-offs between each approach
- AsyncTask uses several GoF patterns
  - *Template Method* is used for its white-box capabilities



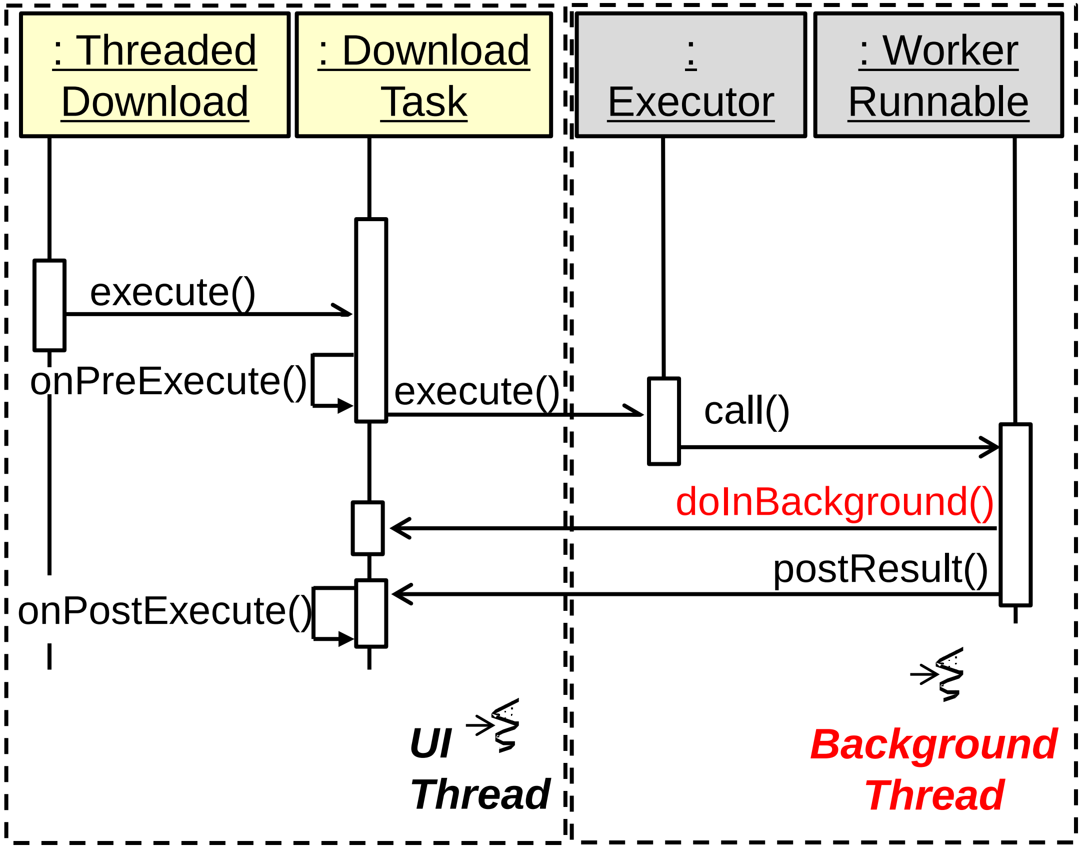
Summary

- AsyncTask is a black-box & white-box framework
- There are trade-offs between each approach
- AsyncTask uses several GoF patterns
  - *Template Method* is used for its white-box capabilities



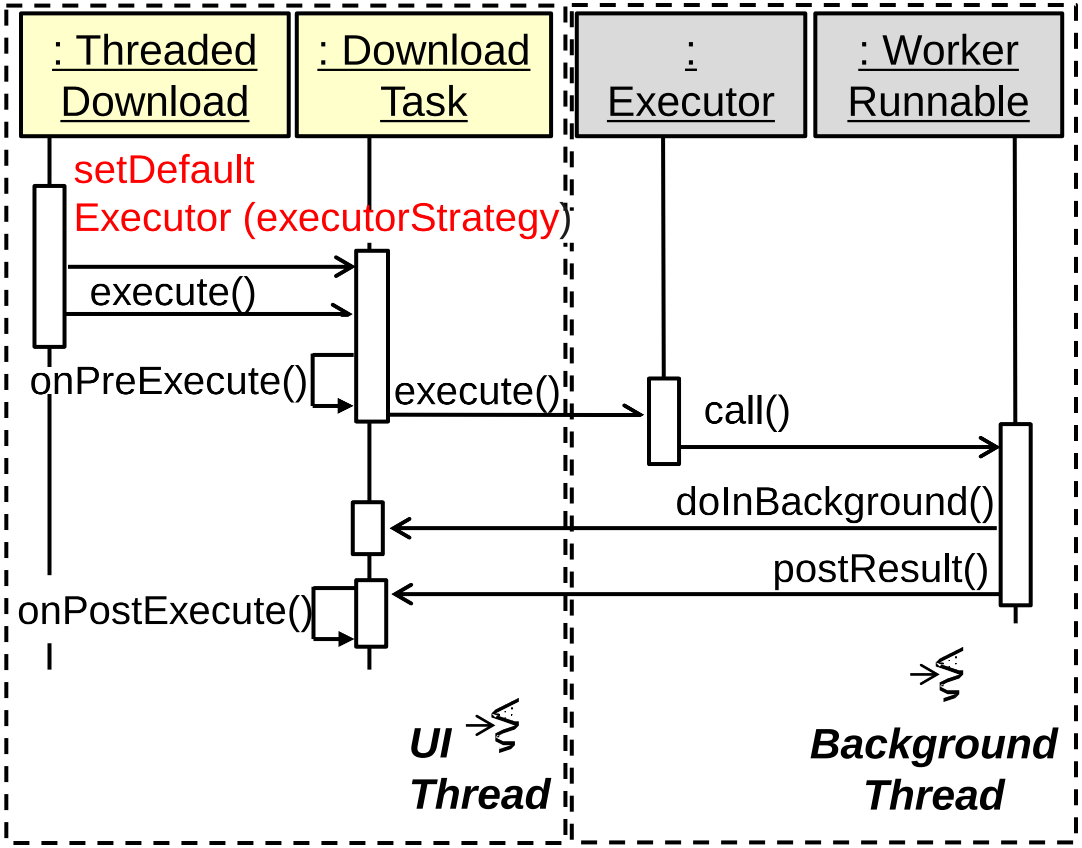
Summary

- AsyncTask is a black-box & white-box framework
- There are trade-offs between each approach
- AsyncTask uses several GoF patterns
  - *Template Method* is used for its white-box capabilities



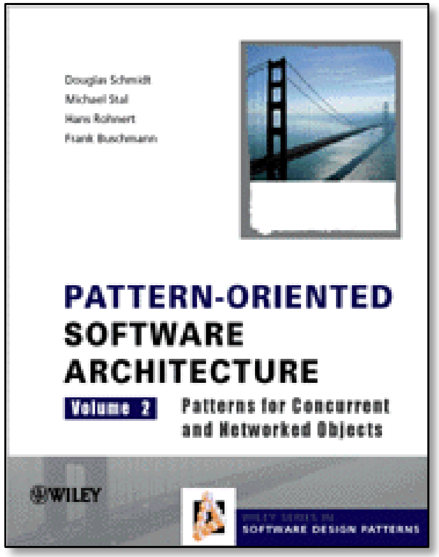
Summary

- AsyncTask is a black-box & white-box framework
- There are trade-offs between each approach
- AsyncTask uses several GoF patterns
  - *Template Method* is used for its white-box capabilities
  - *Strategy* is used for its black-box capabilities



Summary

- AsyncTask is a black-box & white-box framework
- There are trade-offs between each approach
- AsyncTask uses several GoF patterns
- It also uses the POSA2 *Half-Sync/Half-Async* pattern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Michael Stal
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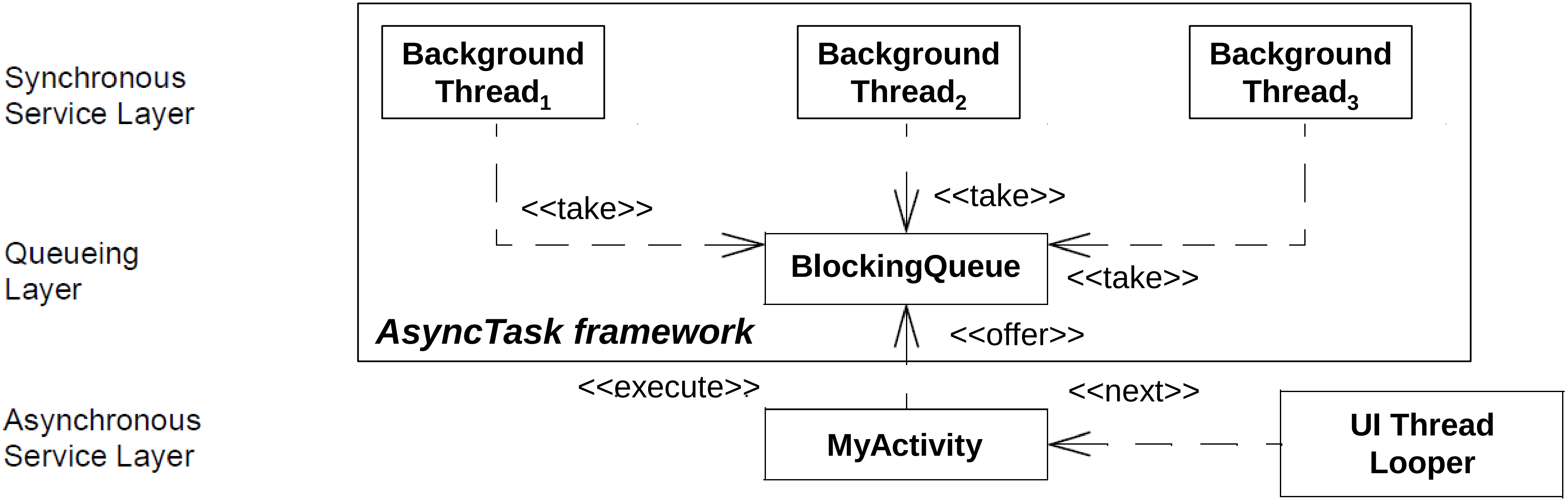
Synchronous Service Layer

Queueing Layer

Asynchronous Service Layer

Background Thread$_1$

Background Thread$_2$

Background Thread$_3$

<<take>>

<<take>>

<<take>>

BlockingQueue

AsyncTask framework

<<offer>>

<<execute>>

<<next>>

MyActivity

UI Thread Looper

See upcoming parts on “The *Half-Sync/Half-Async* Pattern”