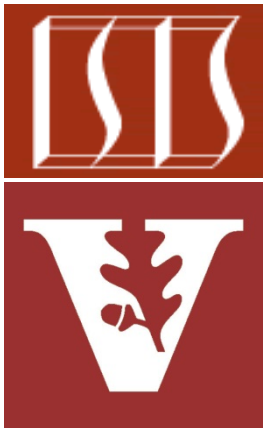


# Android Concurrency: Black-box & White-box Frameworks with AsyncTask



Douglas C. Schmidt

[d.schmidt@vanderbilt.edu](mailto:d.schmidt@vanderbilt.edu)

[www.dre.vanderbilt.edu/~schmidt](http://www.dre.vanderbilt.edu/~schmidt)

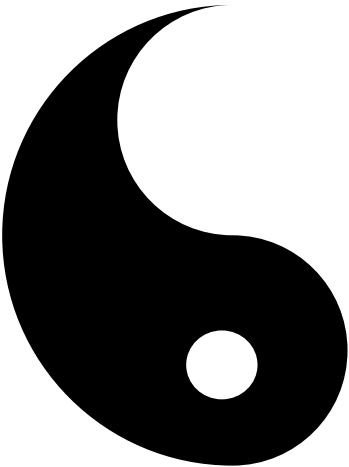
Institute for Software  
Integrated Systems  
Vanderbilt University  
Nashville, Tennessee, USA



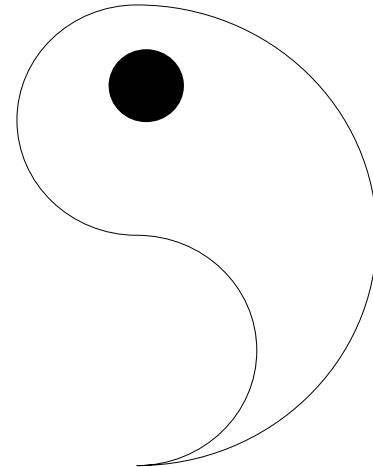
# Learning Objectives in this Part of the Module

- Understand what black-box & white-box framework techniques & patterns are & how AsyncTask implements both types of frameworks

Black-box



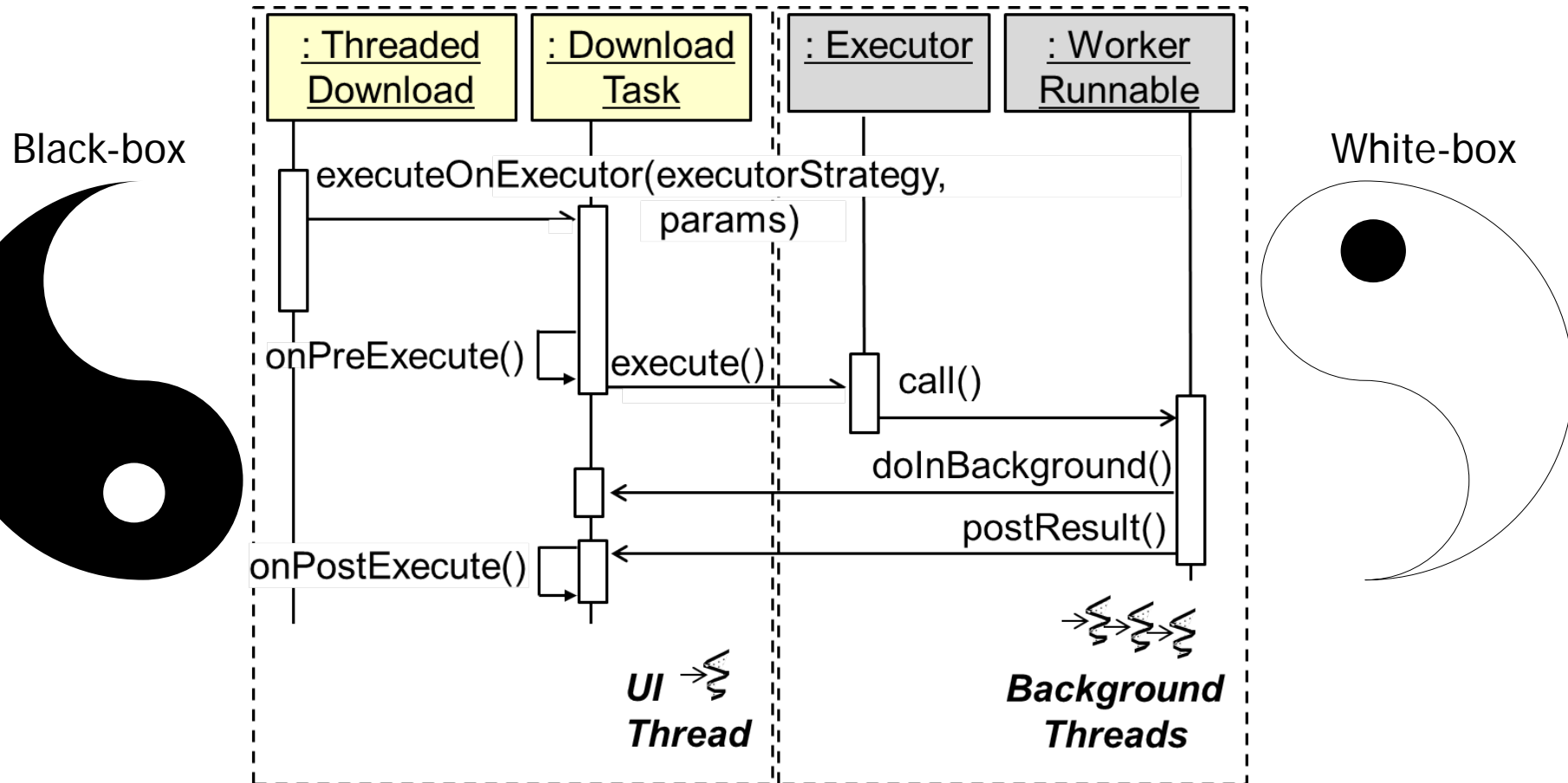
White-box



See [www.dre.vanderbilt.edu/~schmidt/PDF/DRC.pdf](http://www.dre.vanderbilt.edu/~schmidt/PDF/DRC.pdf)

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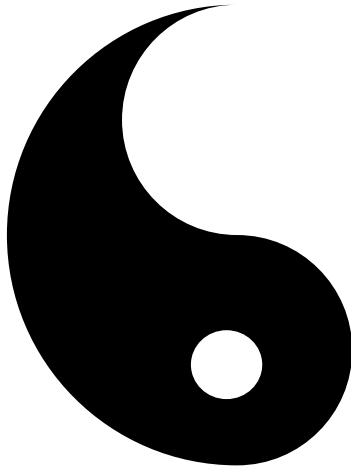
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# Common Types of Frameworks

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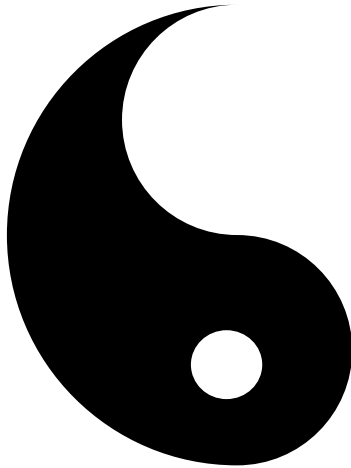
- **Black-box frameworks** only require understanding external interfaces of objects



# Common Types of Frameworks

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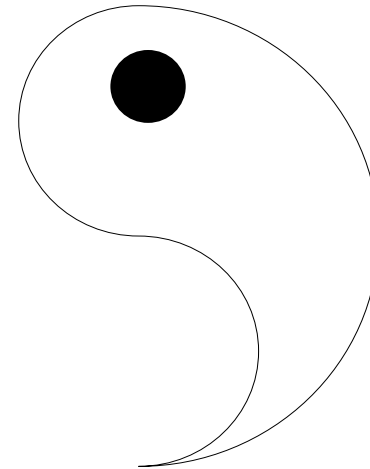
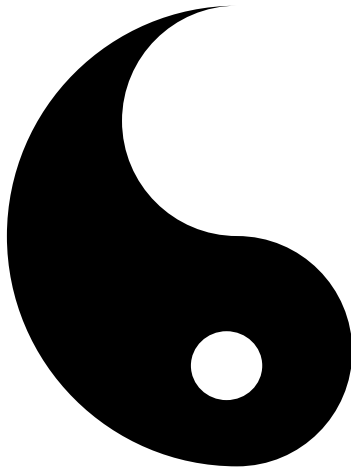
- **Black-box frameworks** only require understanding external interfaces of objects
  - Framework elements typically reused by parameterizing & assembling objects



# Common Types of Frameworks

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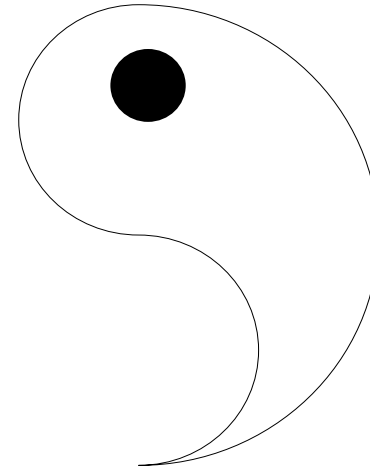
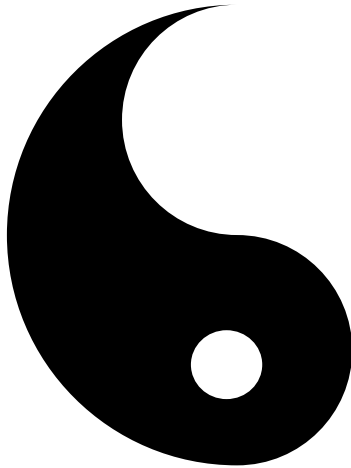
- **Black-box frameworks** only require understanding external interfaces of objects
- Framework elements typically reused by parameterizing & assembling objects
- **White-box frameworks** require understanding some parts of the framework implementation



# Common Types of Frameworks

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- **Black-box frameworks** only require understanding external interfaces of objects
  - Framework elements typically reused by parameterizing & assembling objects
- **White-box frameworks** require understanding some parts of the framework implementation
  - Framework elements typically reused by subclassing & overriding

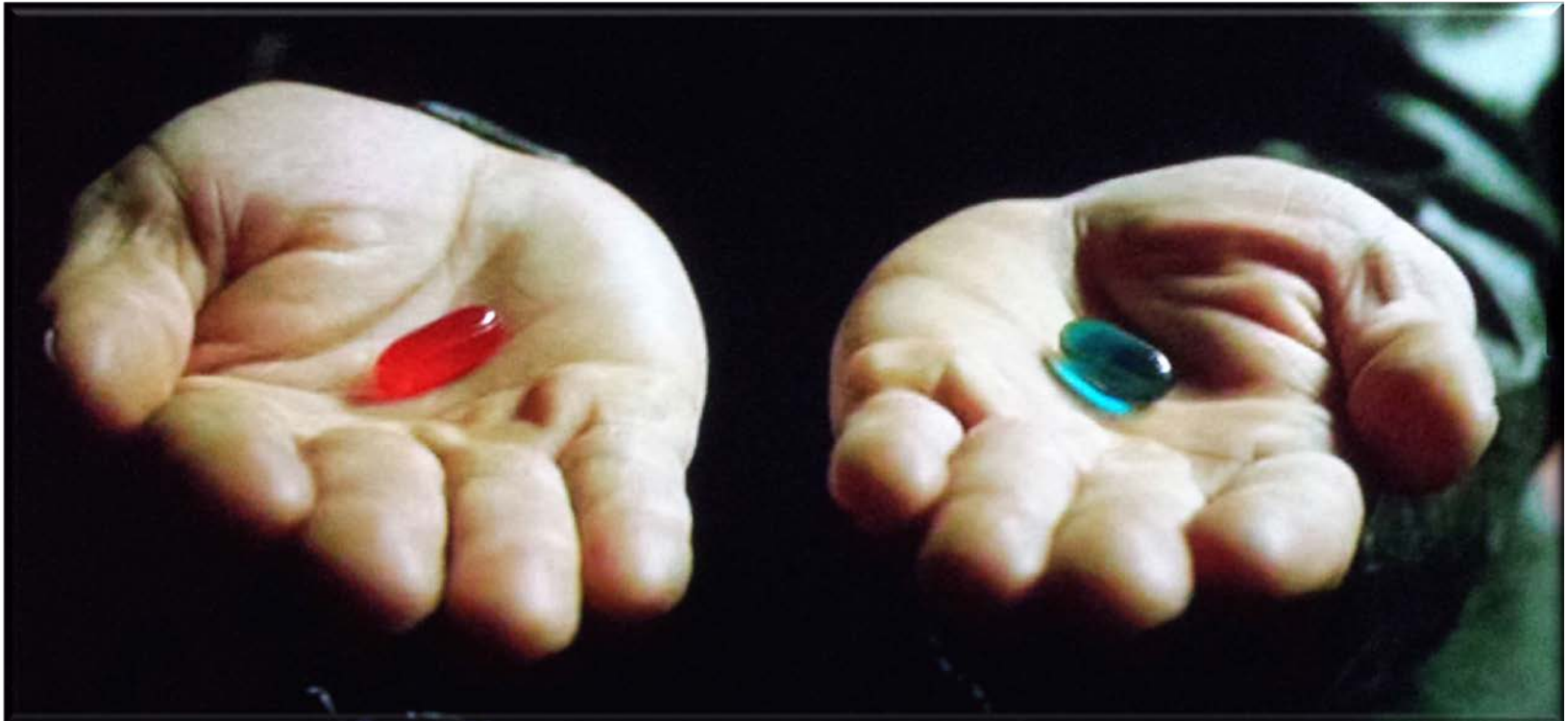




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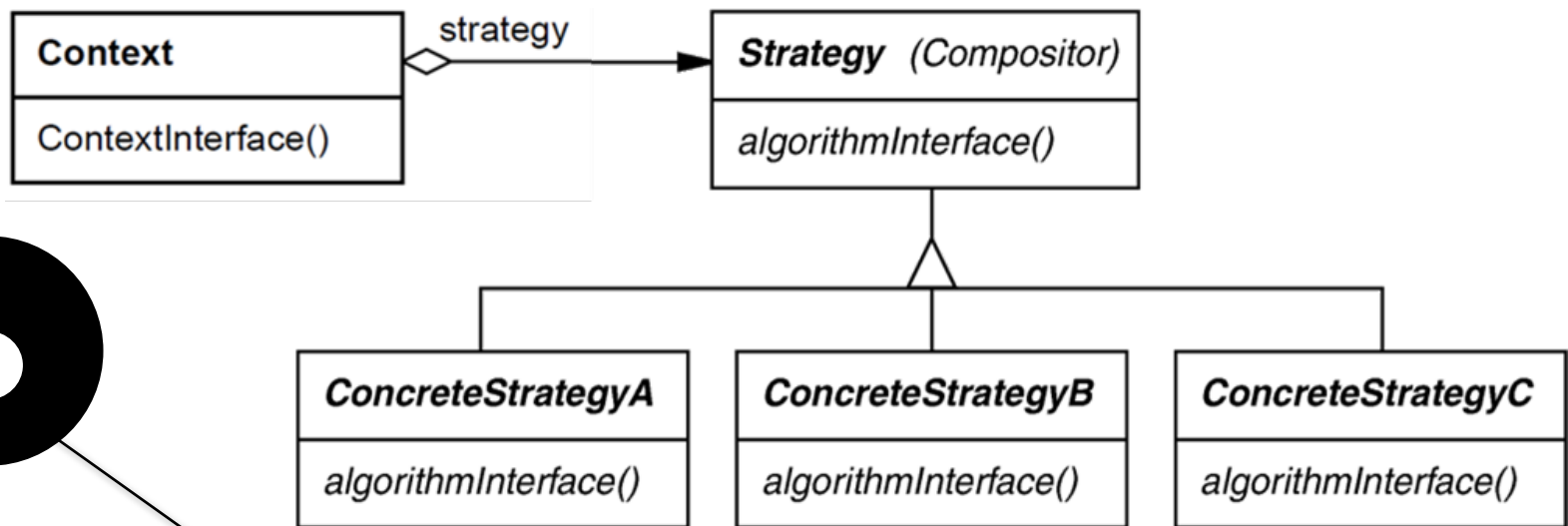
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- **Black-box frameworks** only require understanding external interfaces of objects
- **White-box frameworks** require understanding some parts of the framework implementation
- Each category of OO framework uses different sets of patterns



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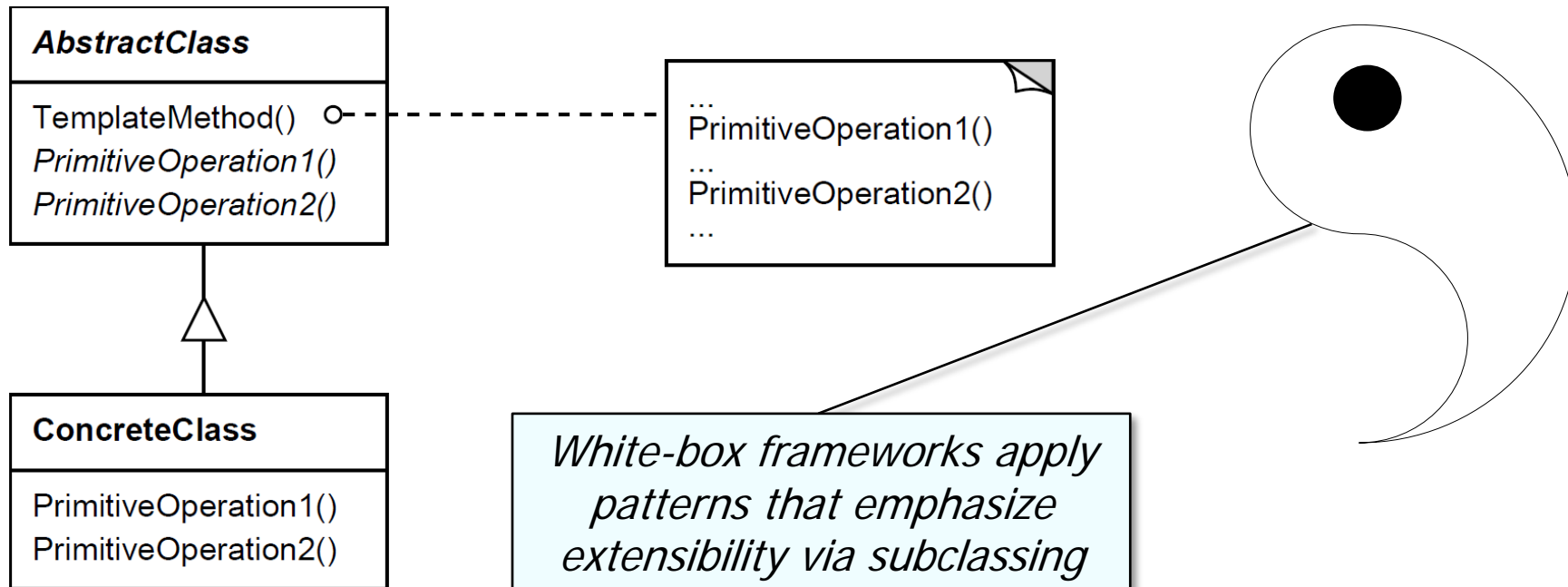


*Black-box frameworks apply patterns that emphasize extensibility via object composition*

See [en.wikipedia.org/wiki/Strategy\\_pattern](https://en.wikipedia.org/wiki/Strategy_pattern)  
& [en.wikipedia.org/wiki/Decorator\\_pattern](https://en.wikipedia.org/wiki/Decorator_pattern)

# Common Types of Frameworks

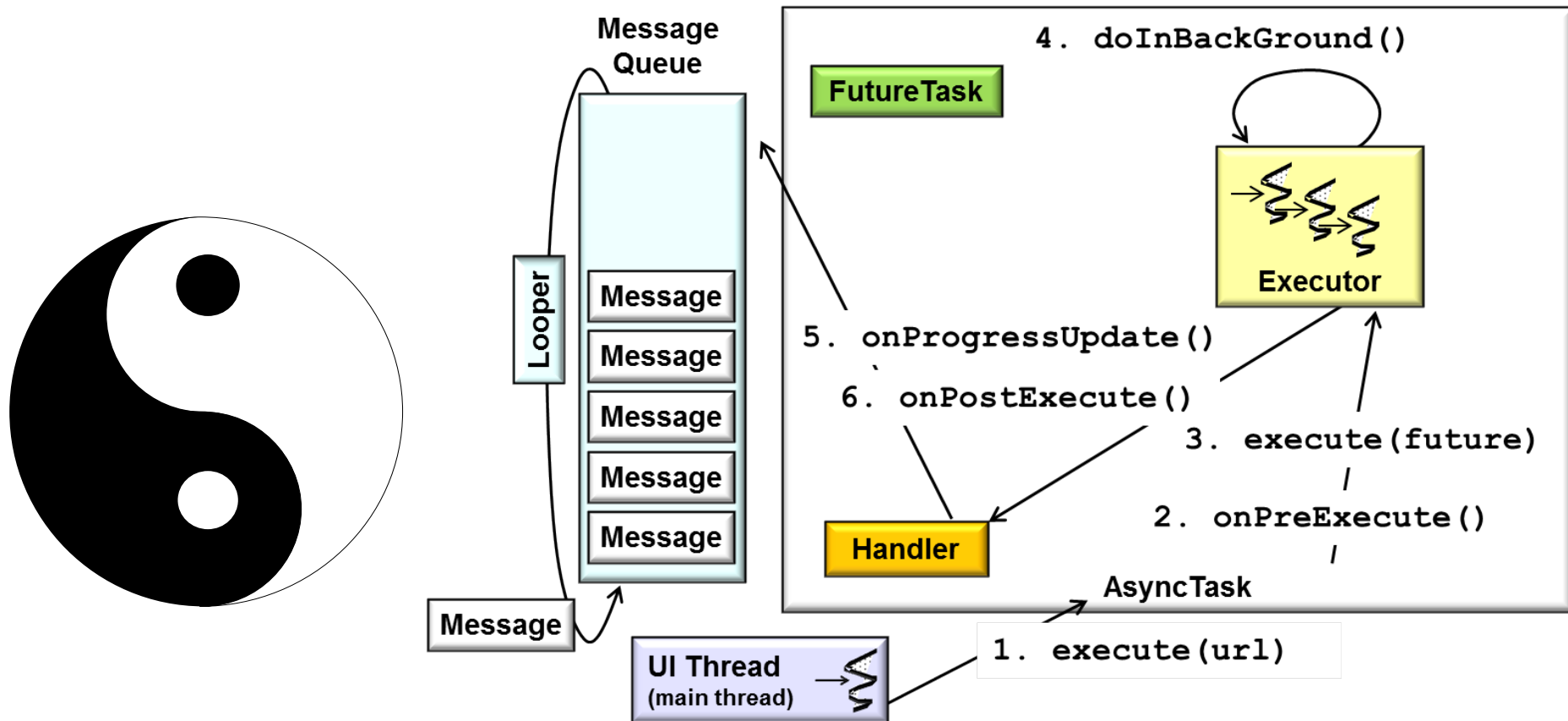
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See [en.wikipedia.org/wiki/Template\\_method](https://en.wikipedia.org/wiki/Template_method)  
& [en.wikipedia.org/wiki/State\\_pattern](https://en.wikipedia.org/wiki/State_pattern)

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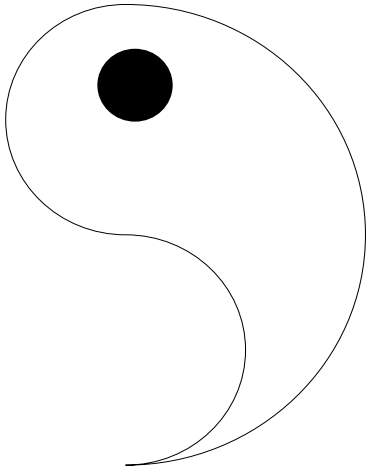
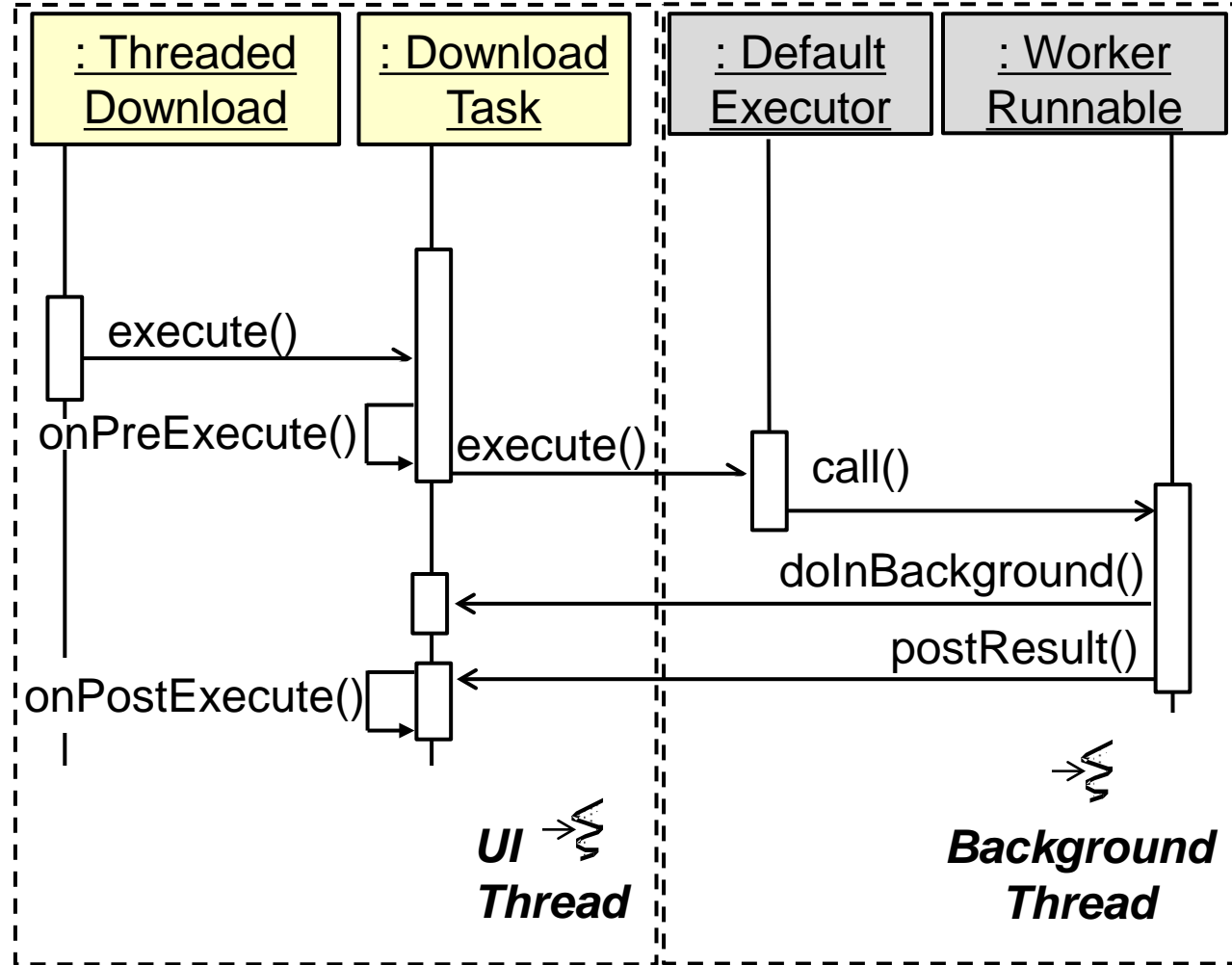
The Android AsyncTask's combines elements of both black-box & white-box frameworks

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# White-box Elements of the *AsyncTask* Framework

# White-box Elements of the AsyncTask Framework

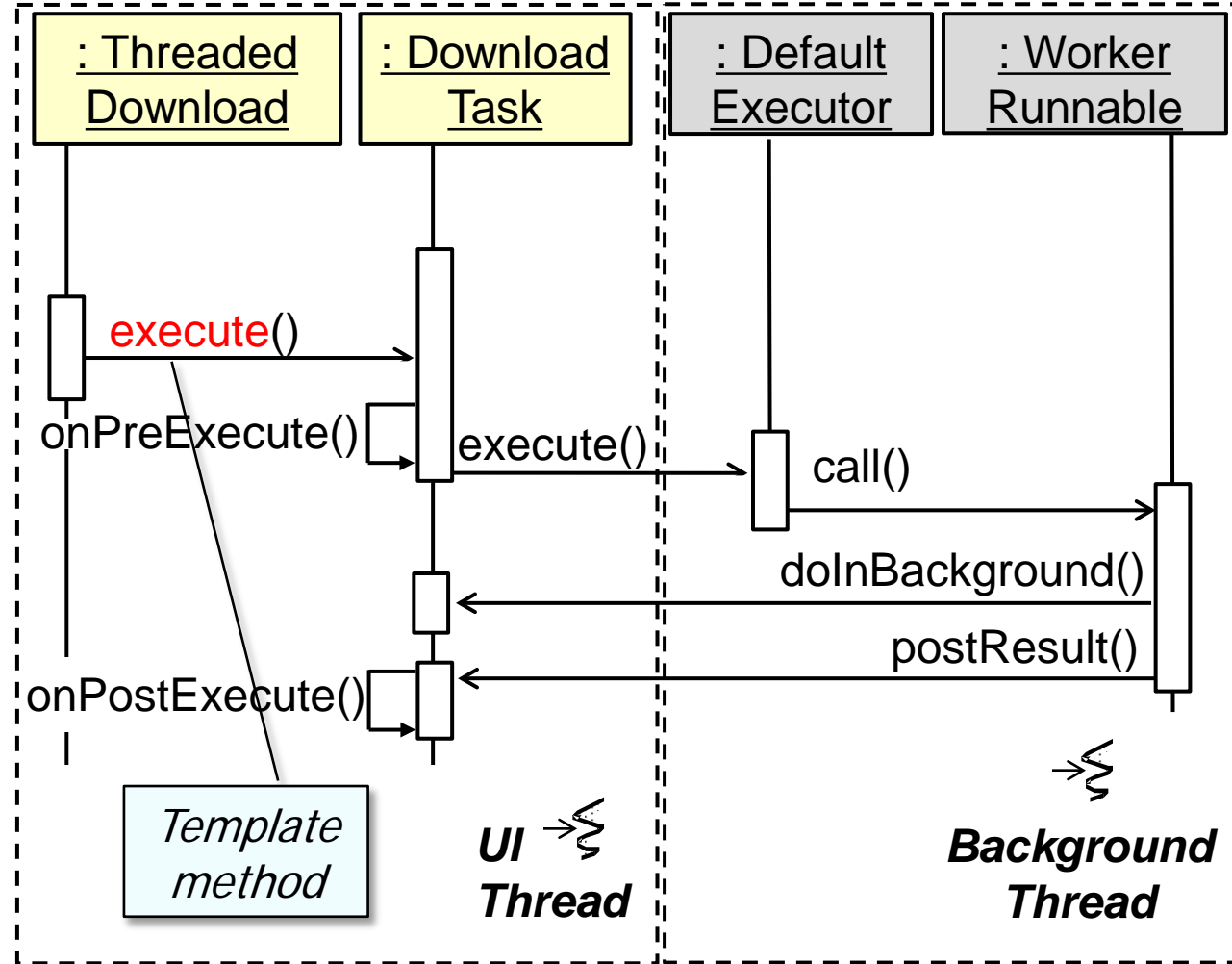
- White-box framework elements enable long duration operations to interact with UI thread



See [en.wikipedia.org/wiki/Template\\_method](http://en.wikipedia.org/wiki/Template_method)

# White-box Elements of the AsyncTask Framework

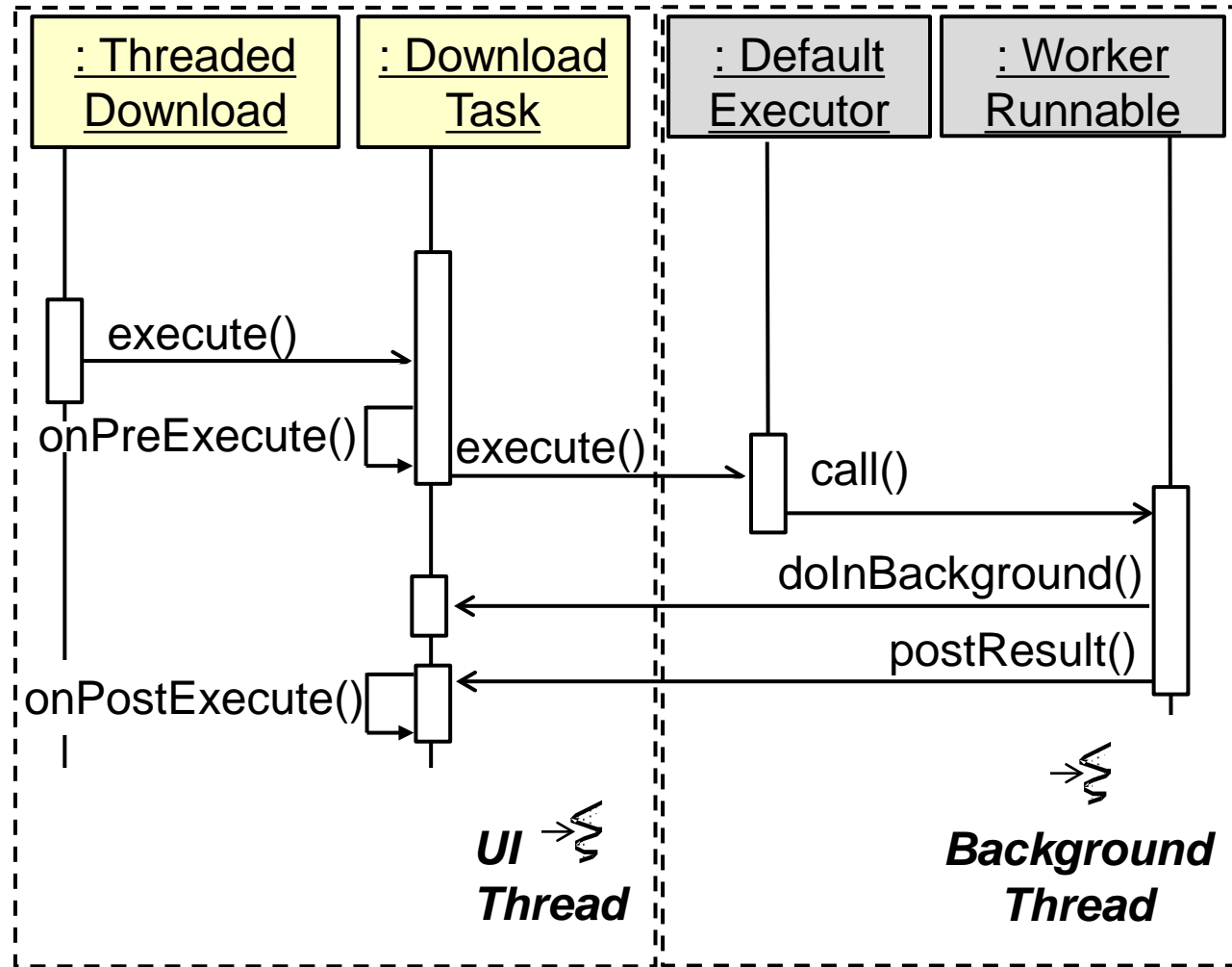
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See [xp123.com/wwake/fw/ch12-bb.htm](http://xp123.com/wwake/fw/ch12-bb.htm)  
for more on framework design

# White-box Elements of the AsyncTask Framework

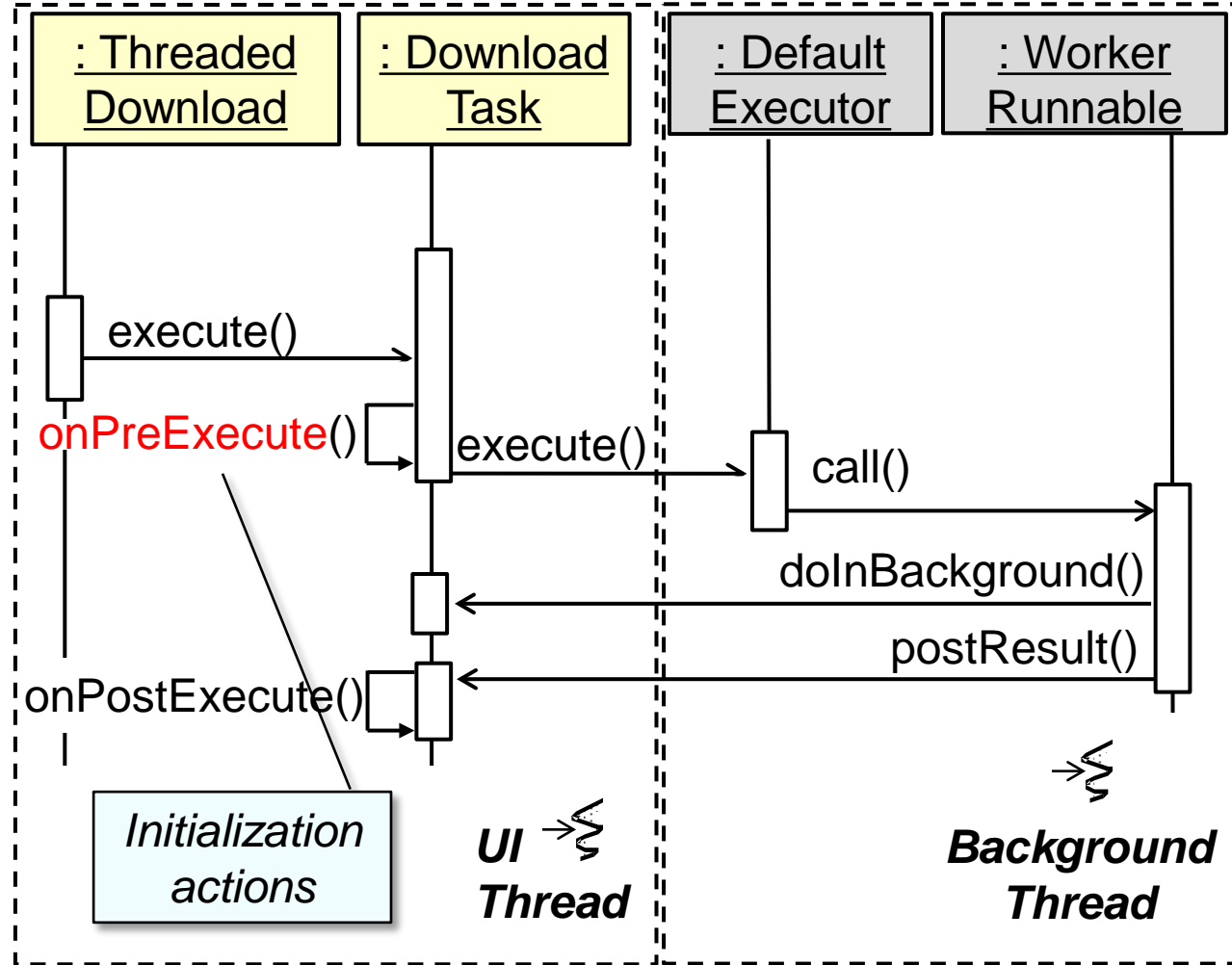
- White-box framework elements enable long duration operations to interact with UI thread
- Framework dictates control flow via hook method callbacks





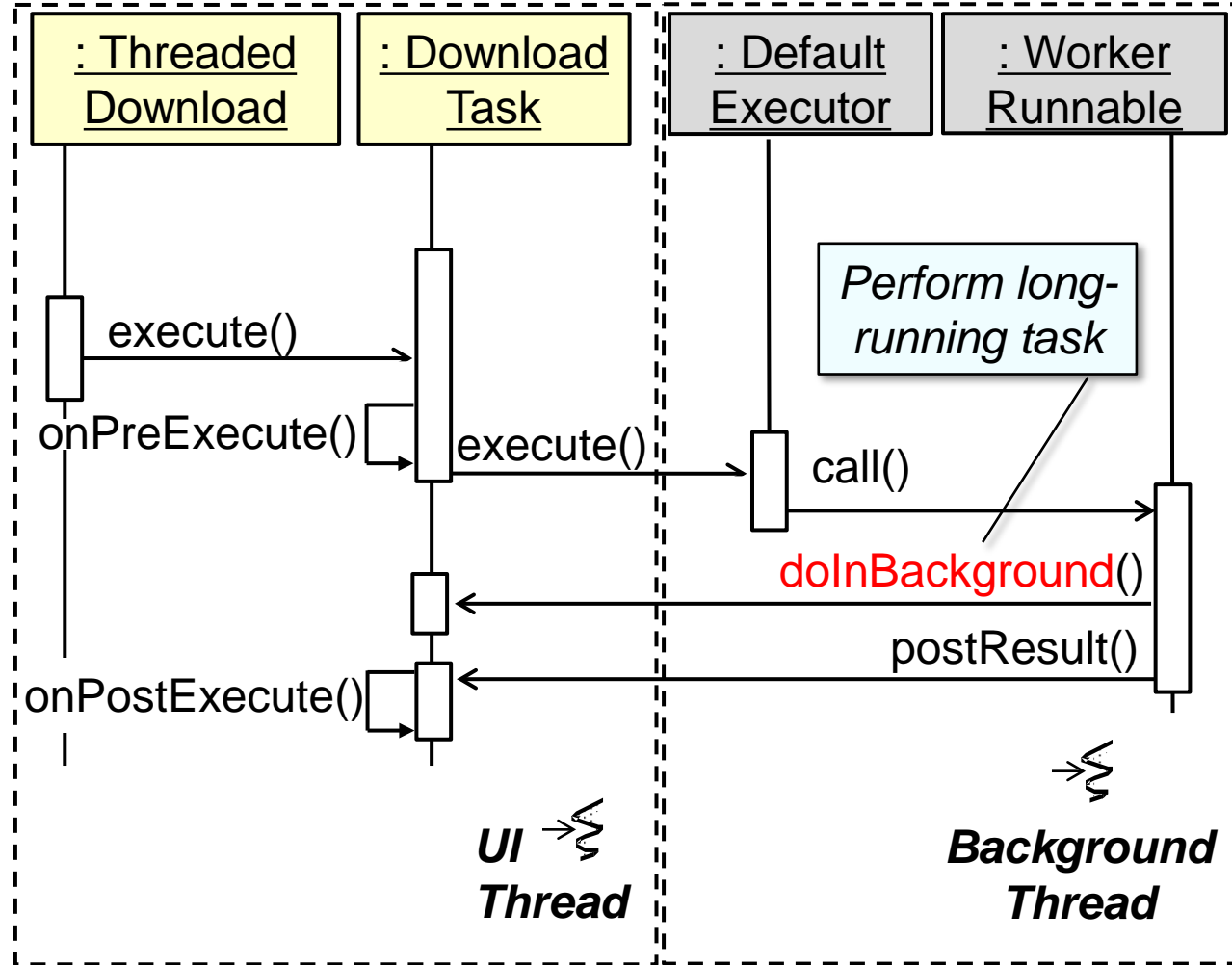
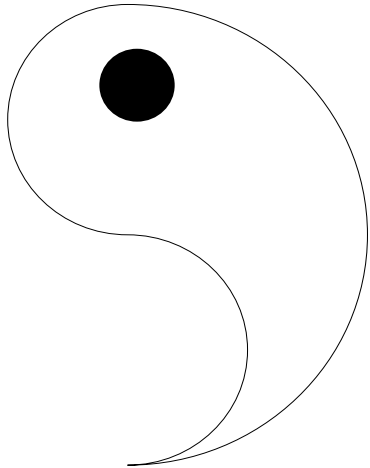
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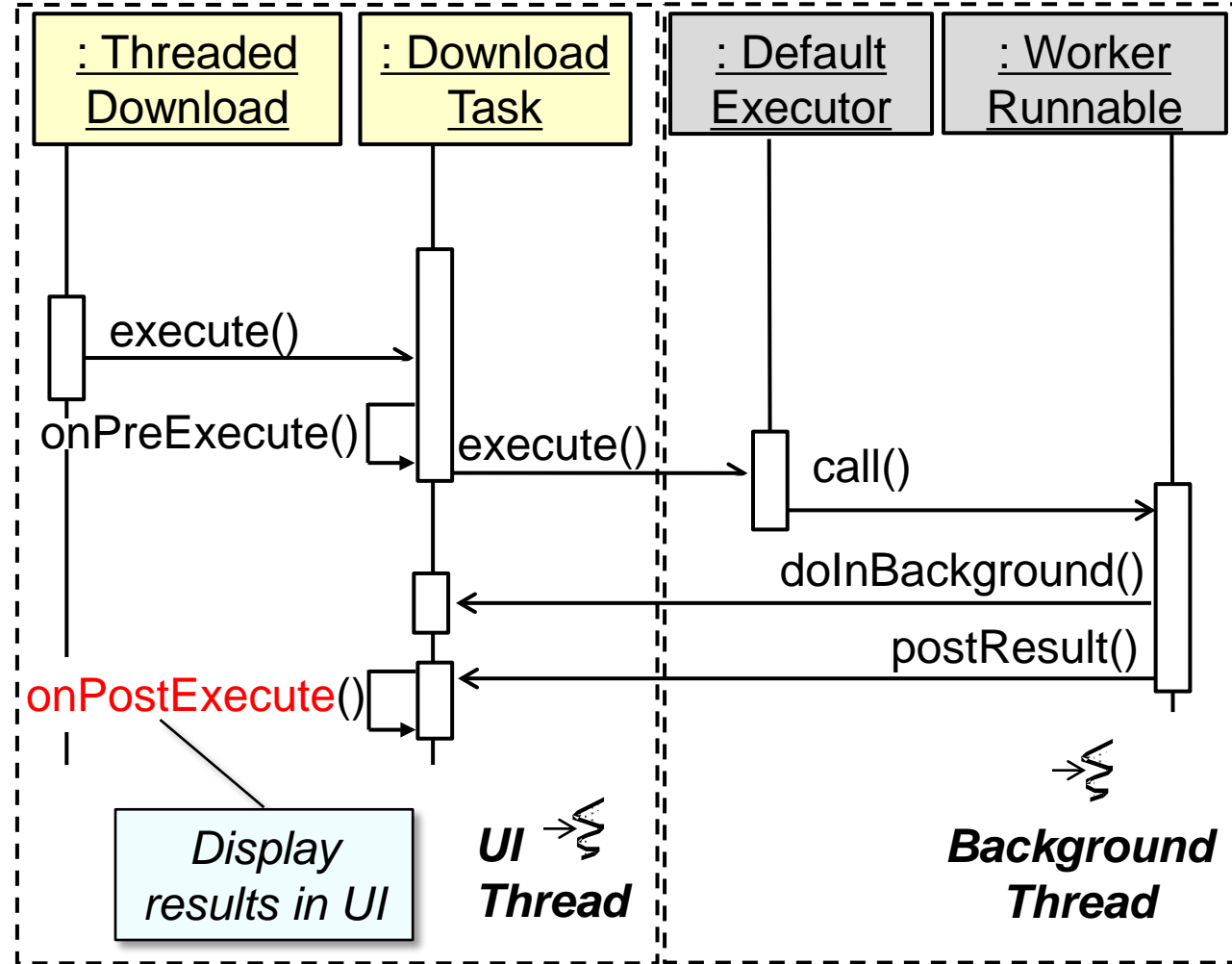
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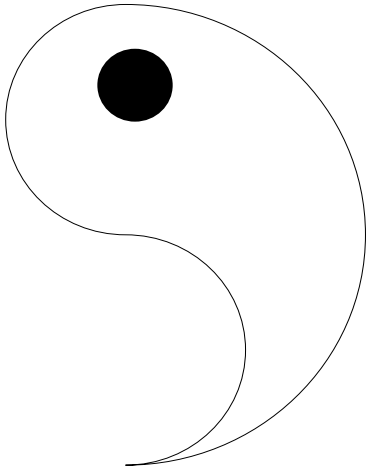
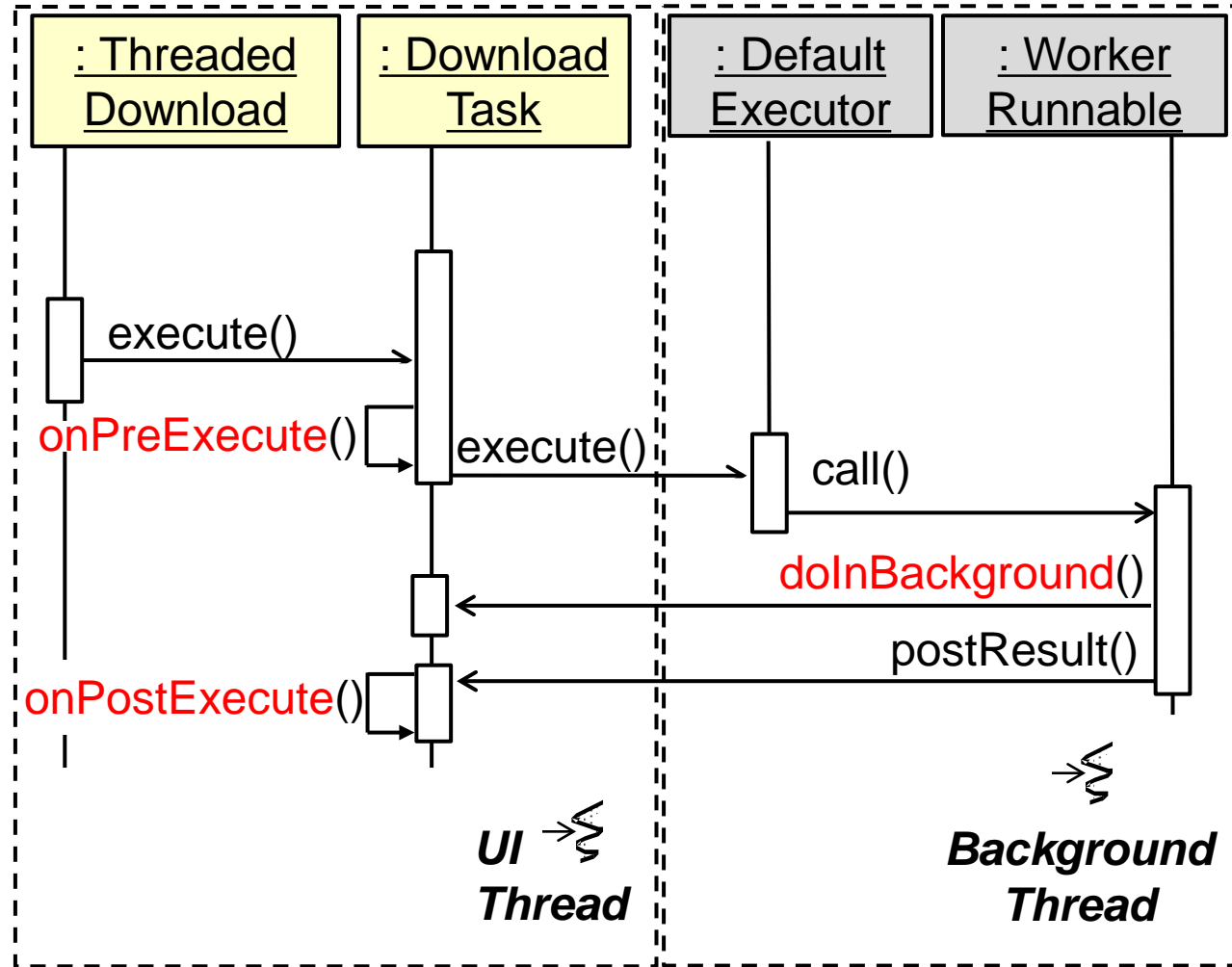
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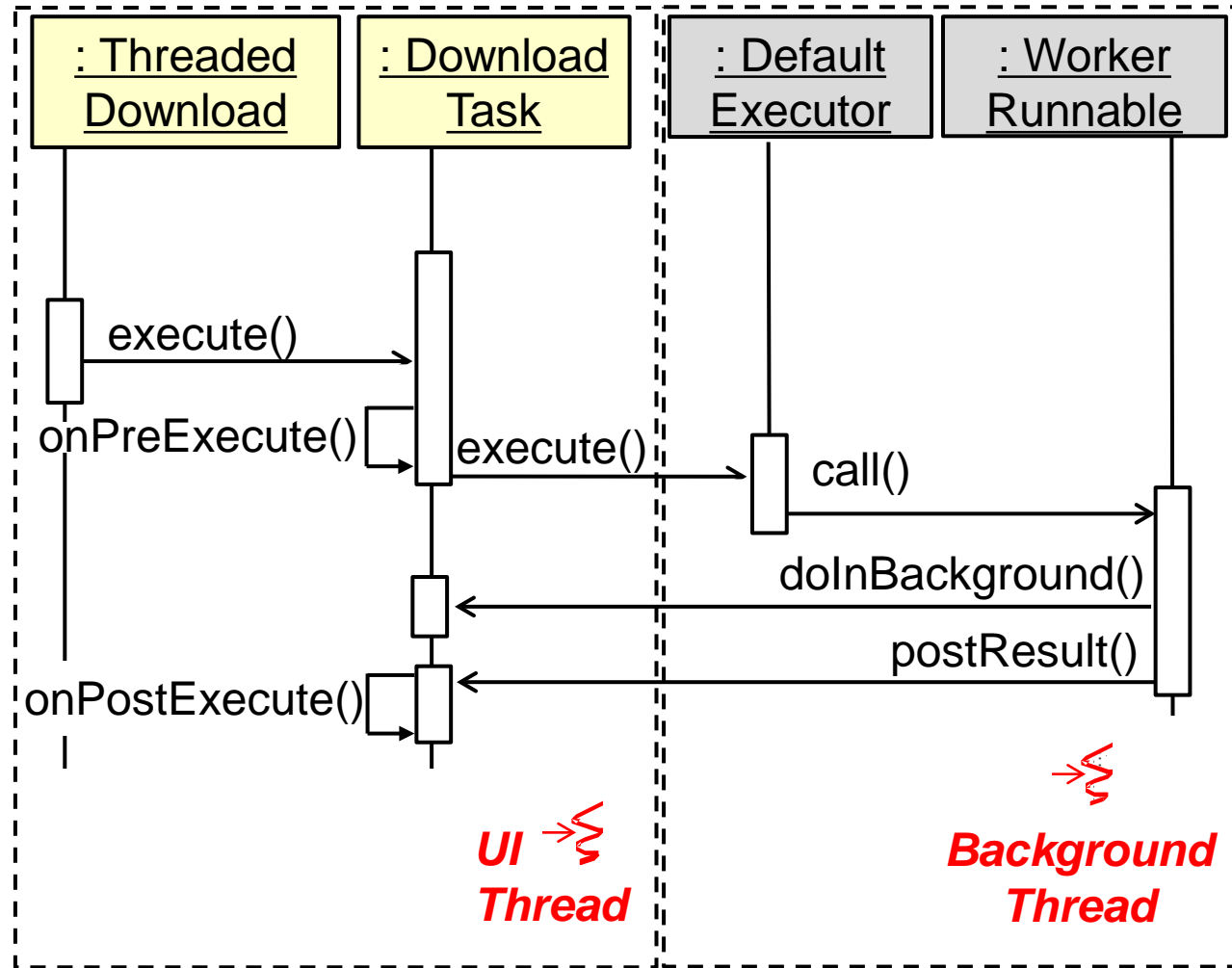
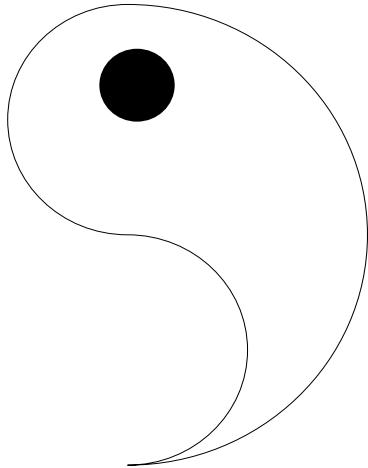
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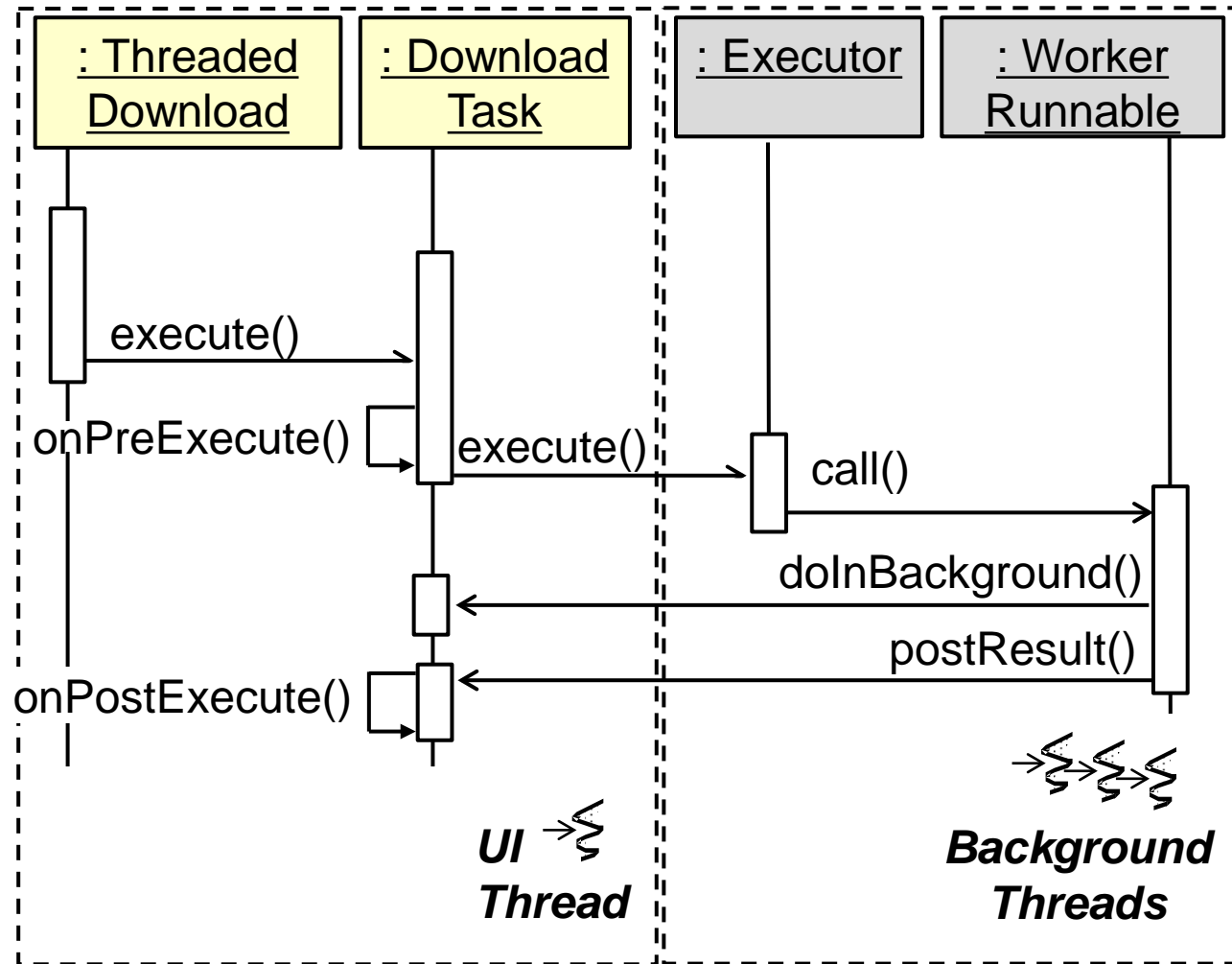
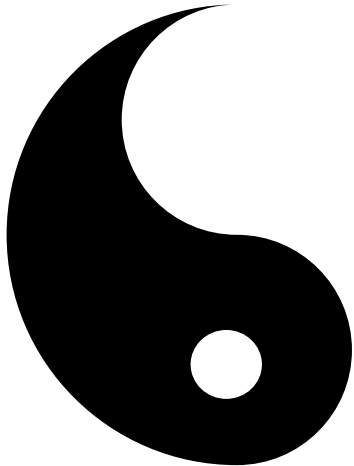
This *Template Method* variant allows hook methods to run in different threads

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# Black-box Elements of the *AsyncTask* Framework

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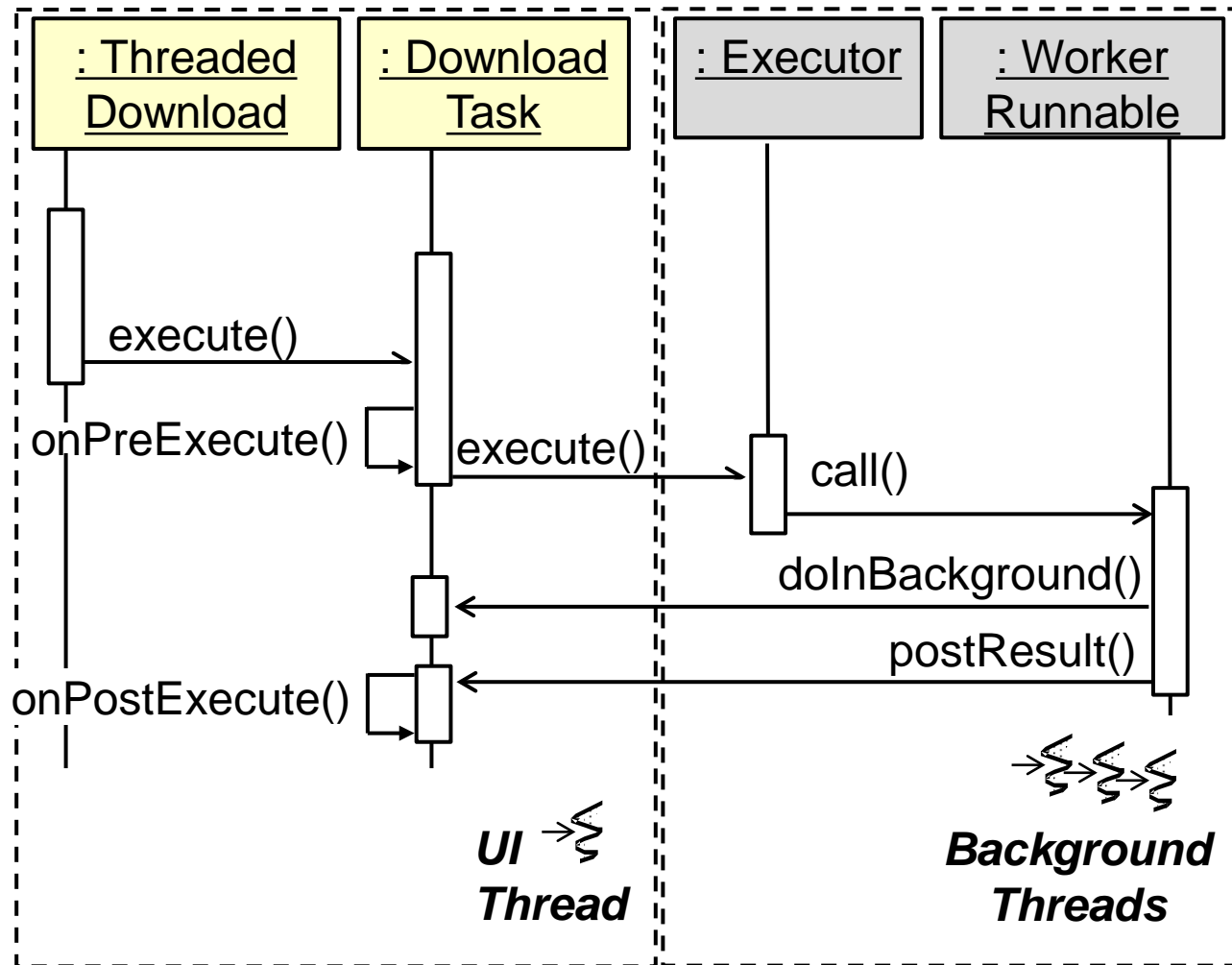
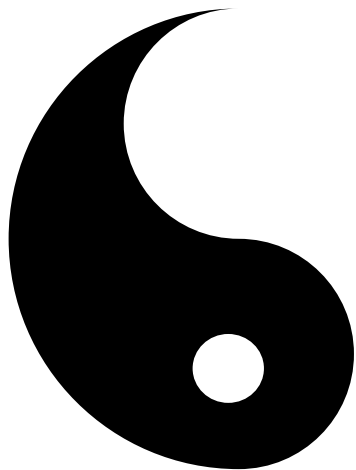
- Black-box framework elements control the background thread(s)



See [en.wikipedia.org/wiki/Strategy\\_pattern](http://en.wikipedia.org/wiki/Strategy_pattern)

# Black-box Elements of the AsyncTask Framework

- Black-box framework elements control the background thread(s)
- Default concurrency model has changed

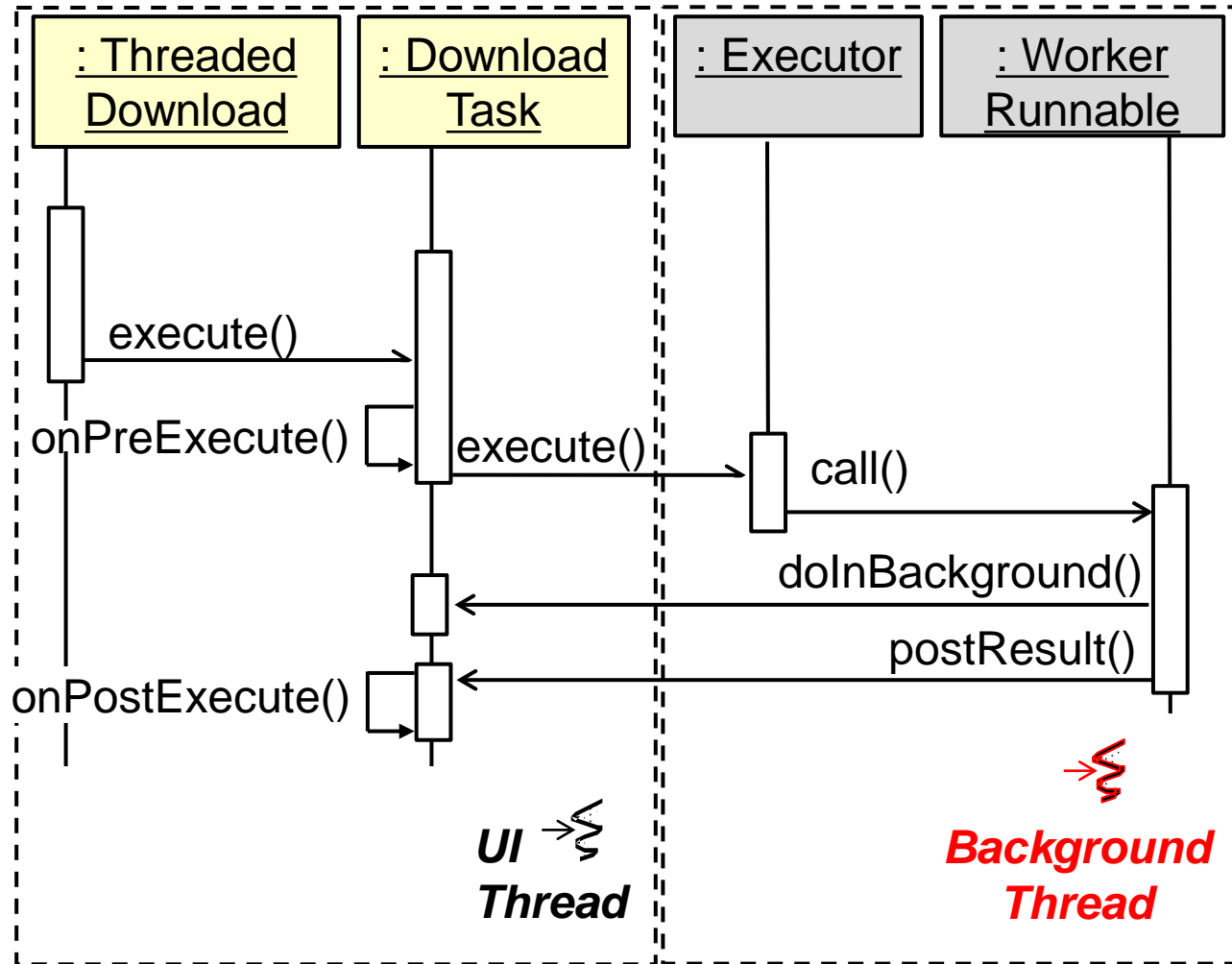
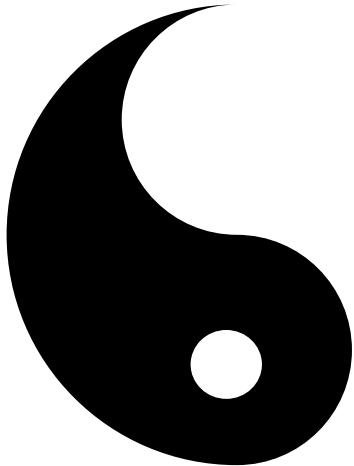


See [developer.android.com/reference/  
android/os/AsyncTask.html](http://developer.android.com/reference/android/os/AsyncTask.html)



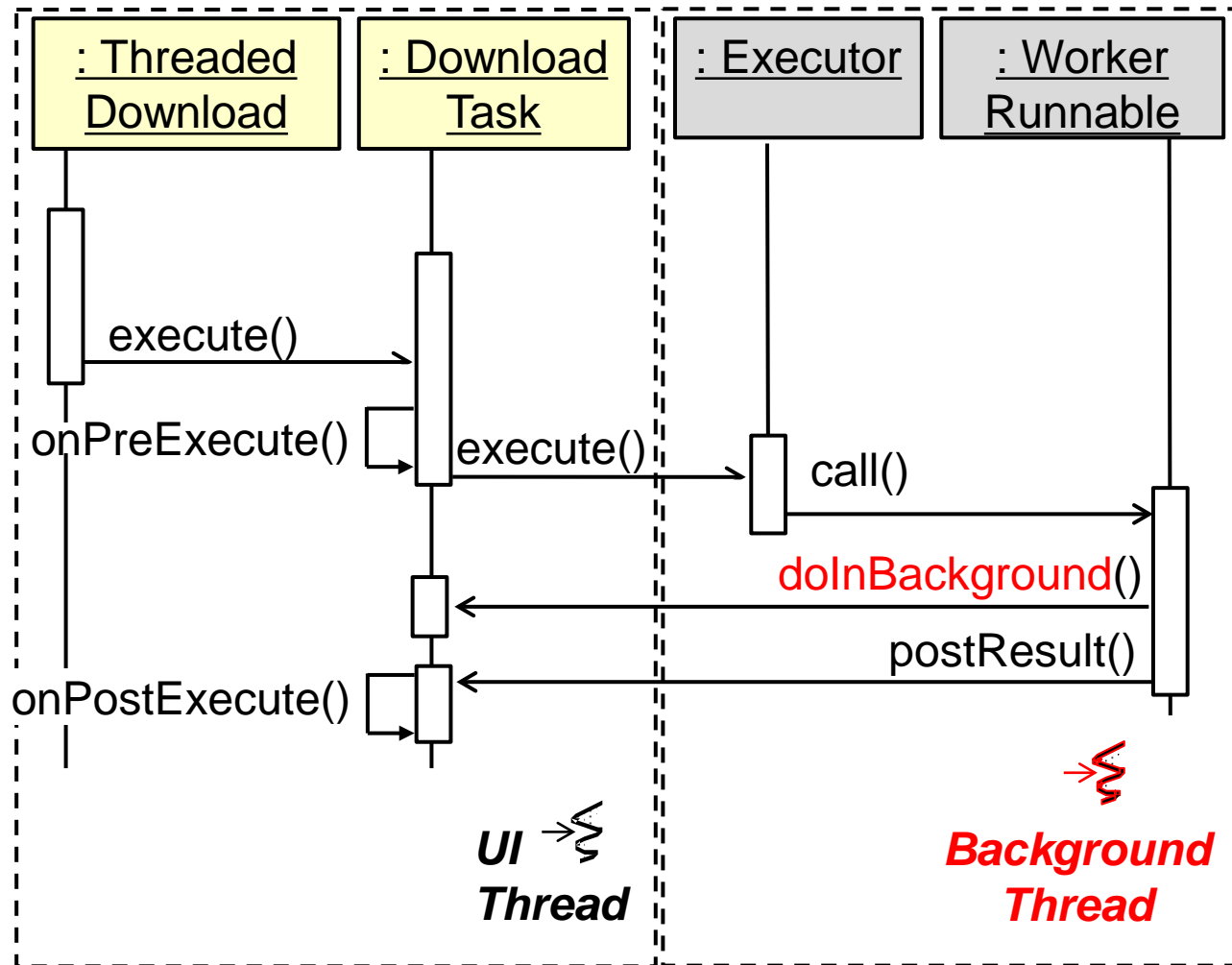
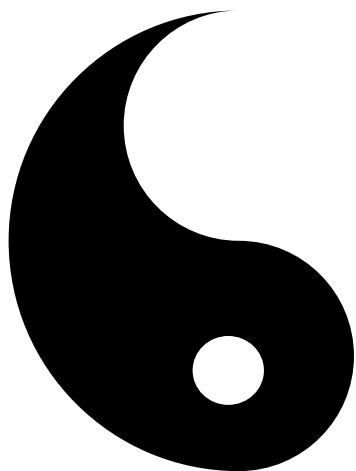
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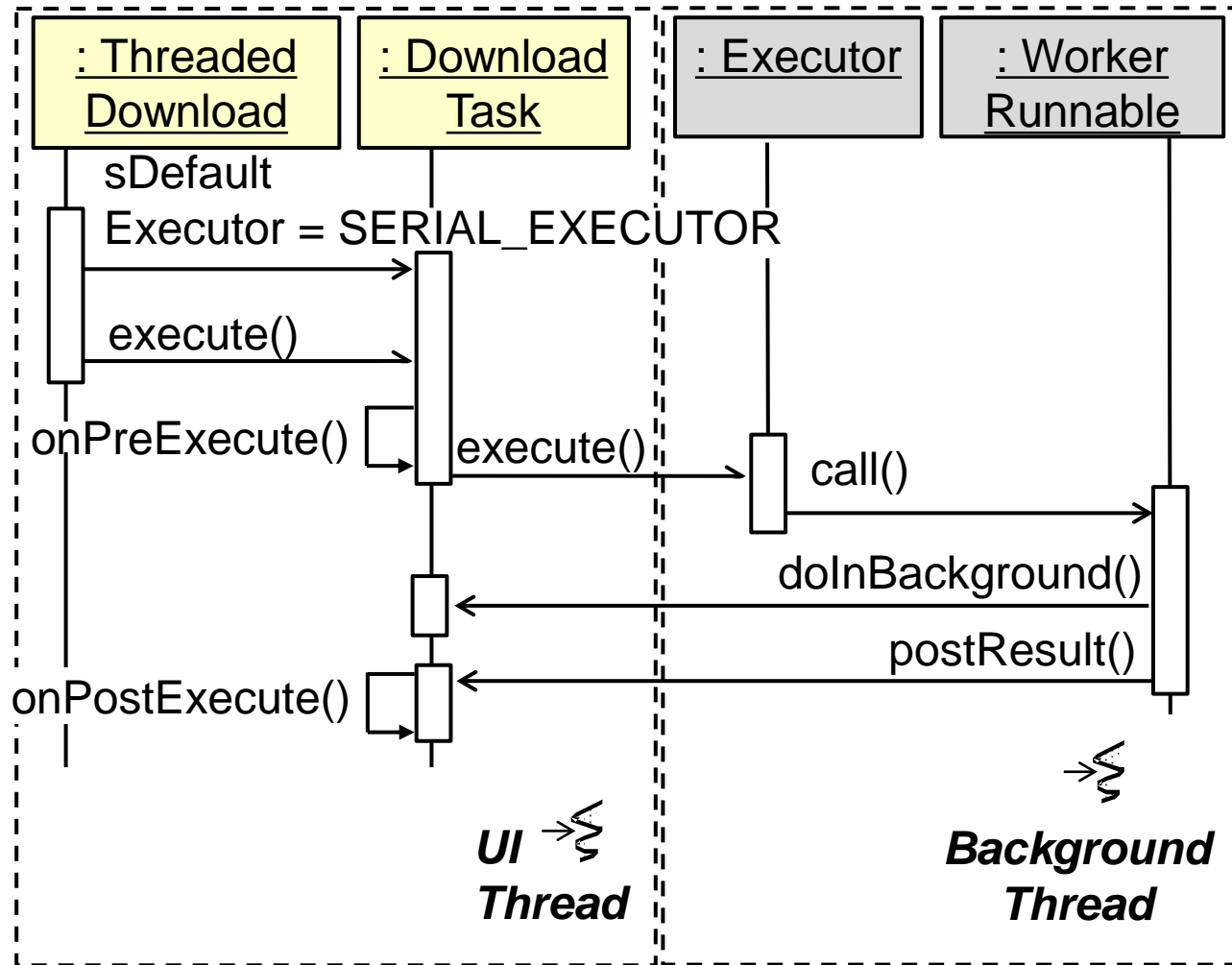
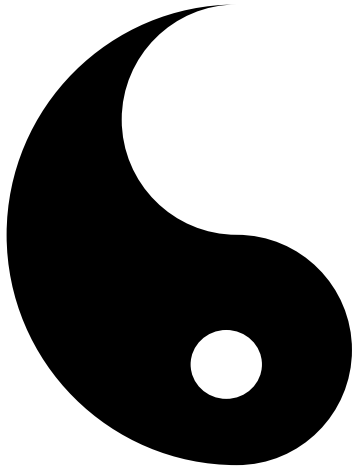
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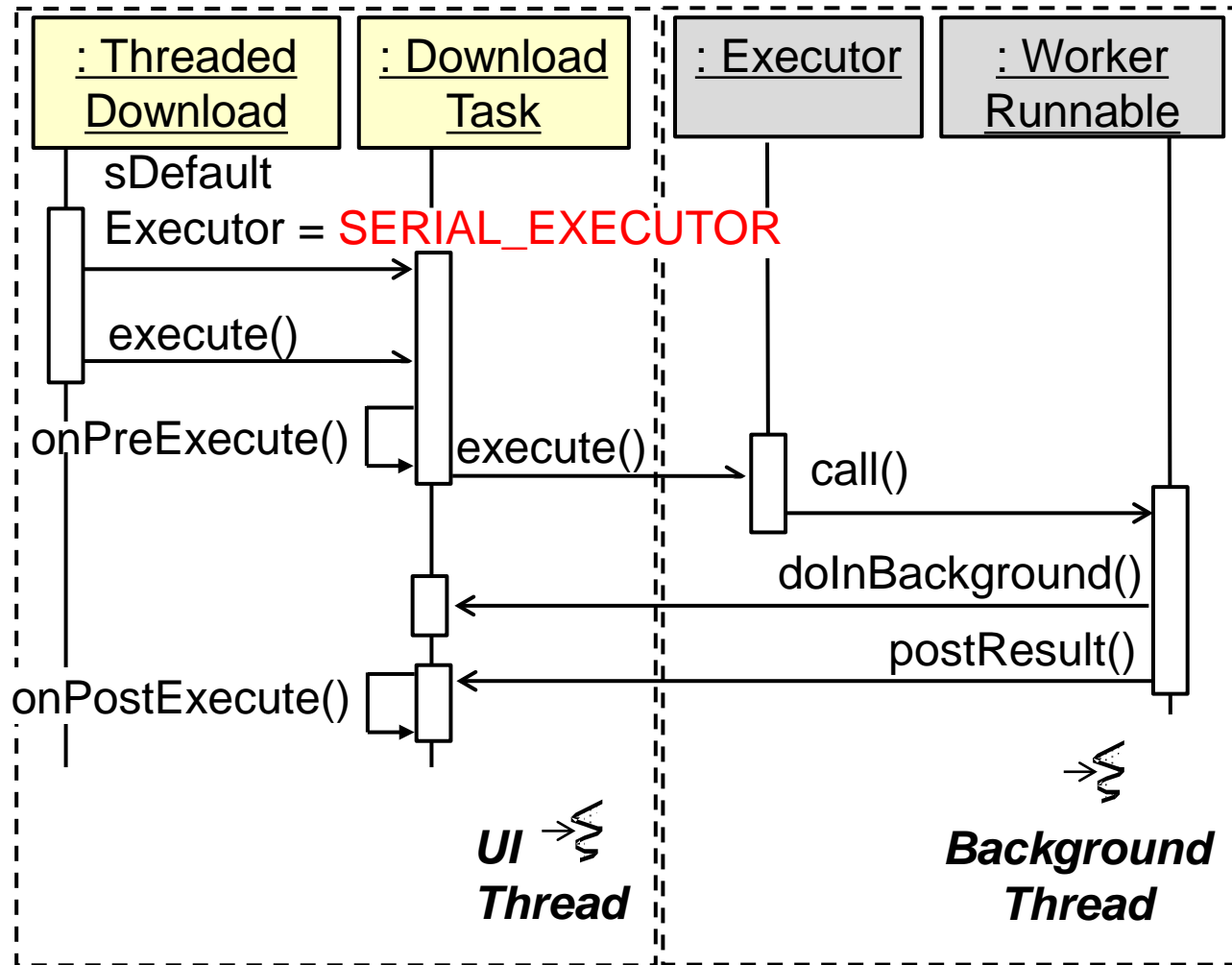
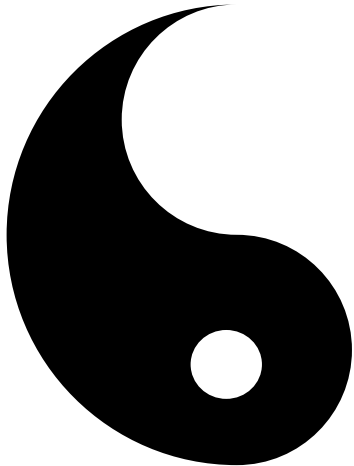
- Black-box framework elements control the background thread(s)
- AsyncTask can be configured via a # of Executor strategies



See [developer.android.com/reference/java/util/concurrent/Executor.html](http://developer.android.com/reference/java/util/concurrent/Executor.html)

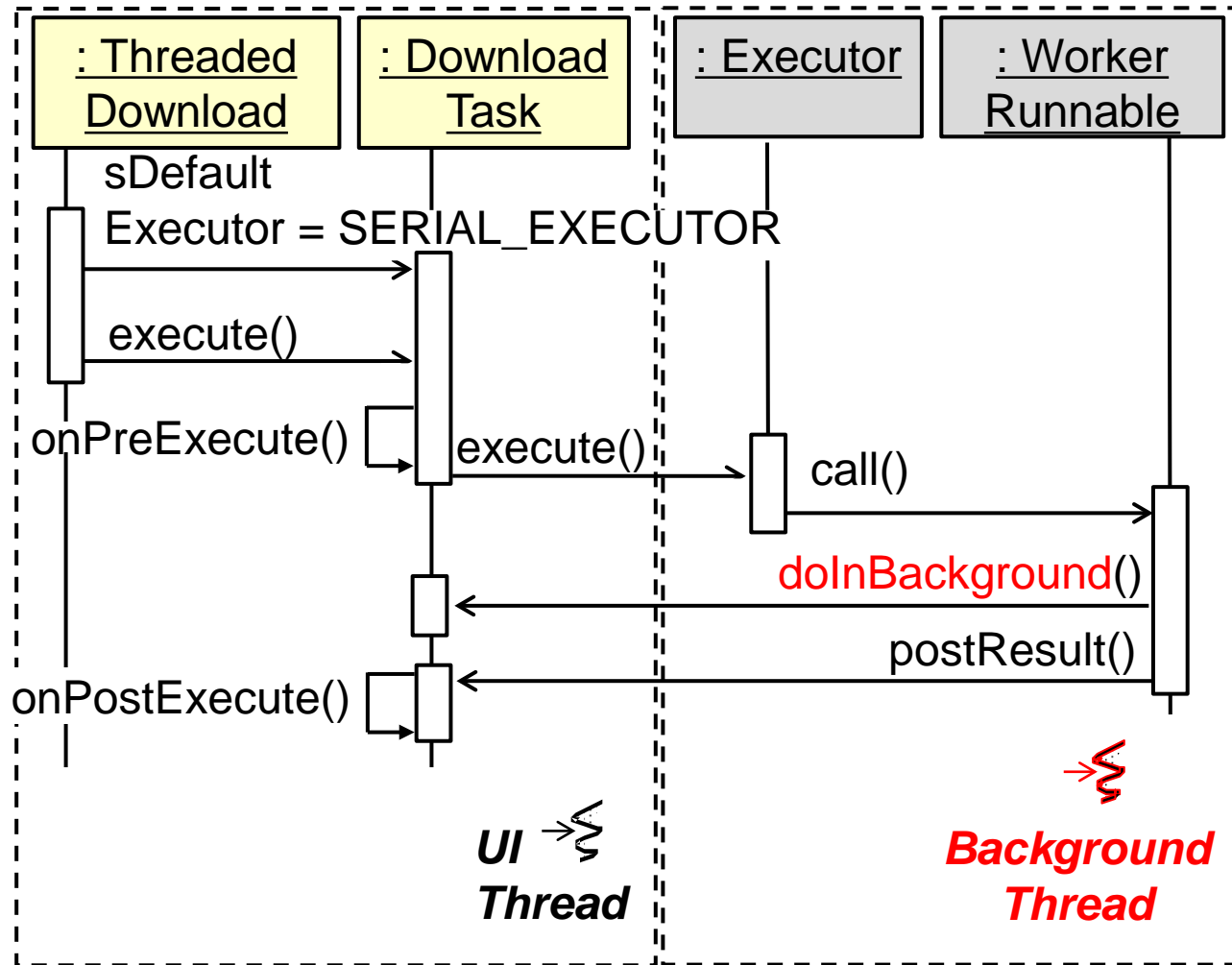
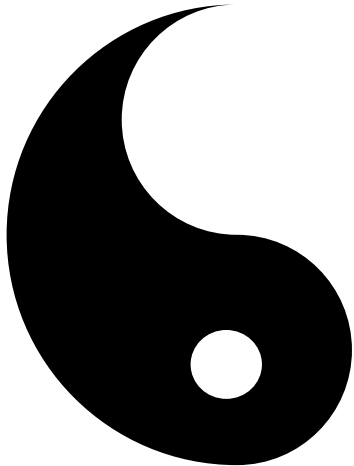
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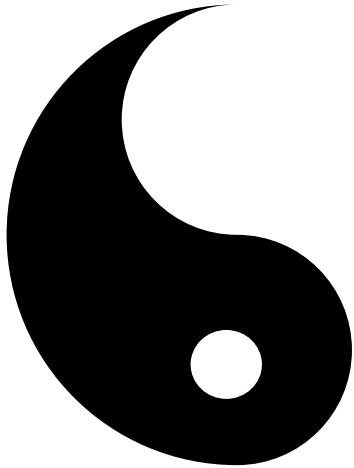
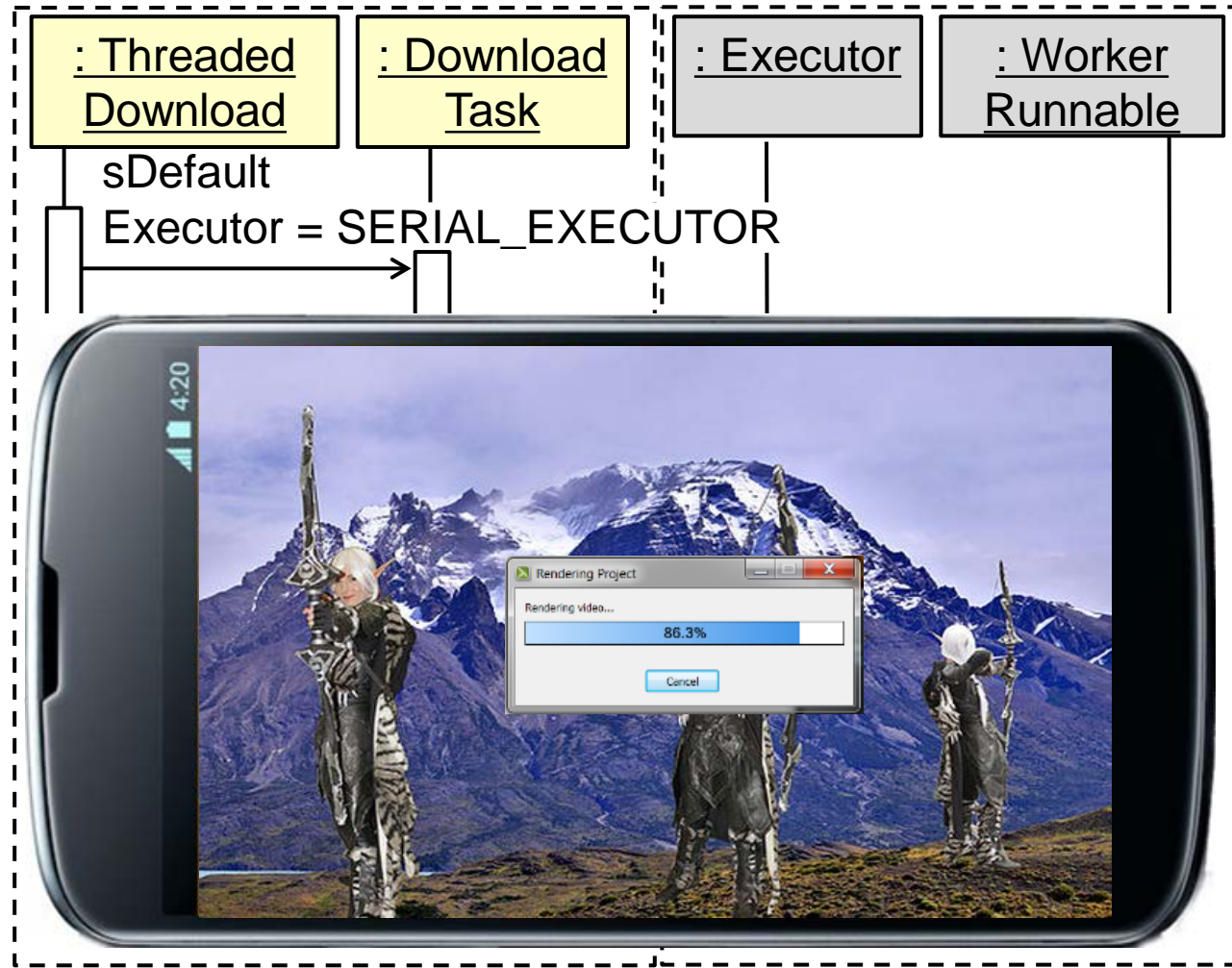
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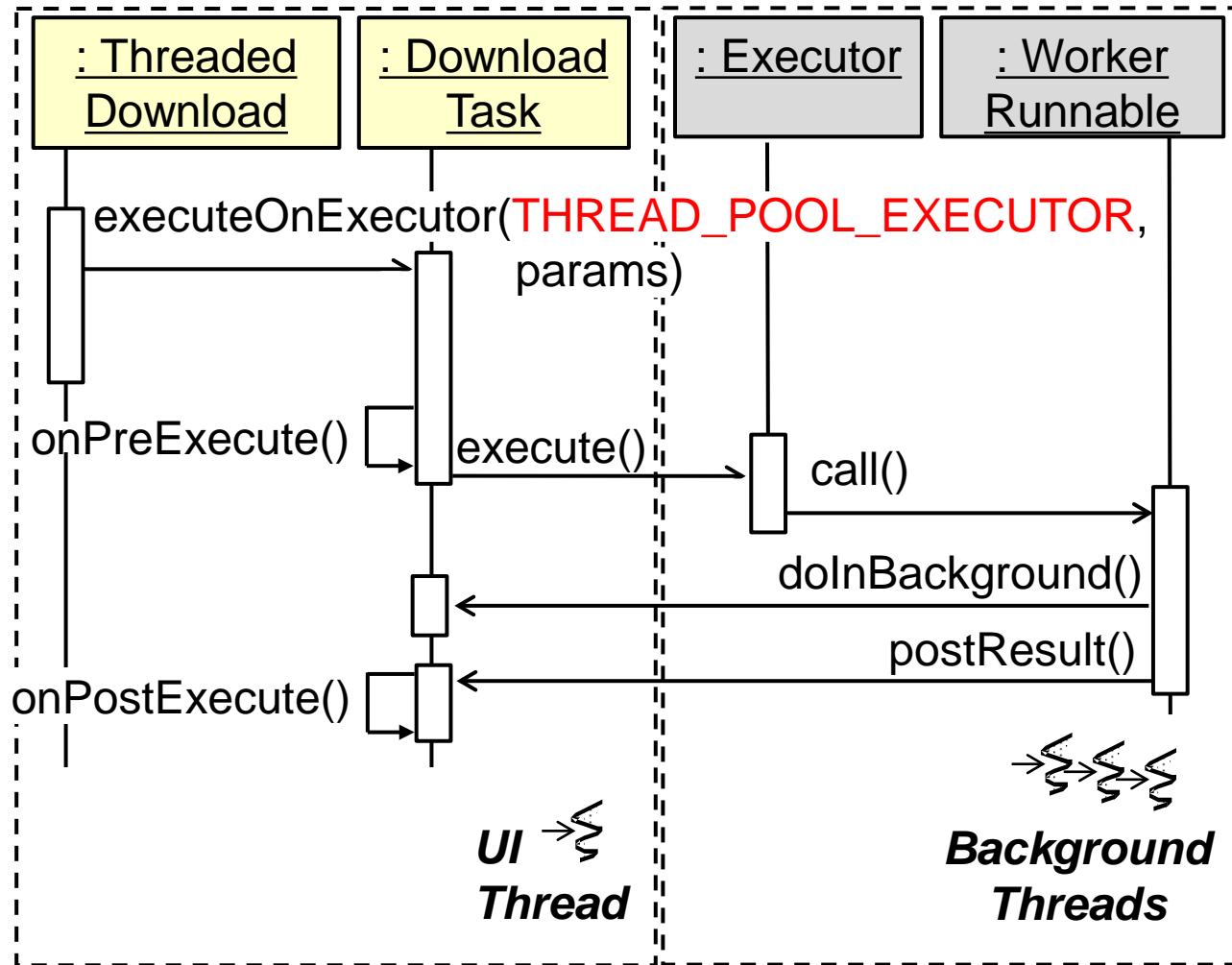
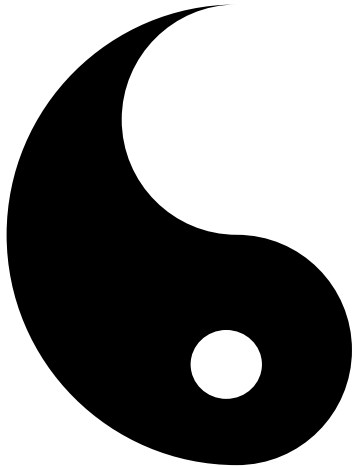
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Some applications need to run AsyncTask objects in parallel instead of serially

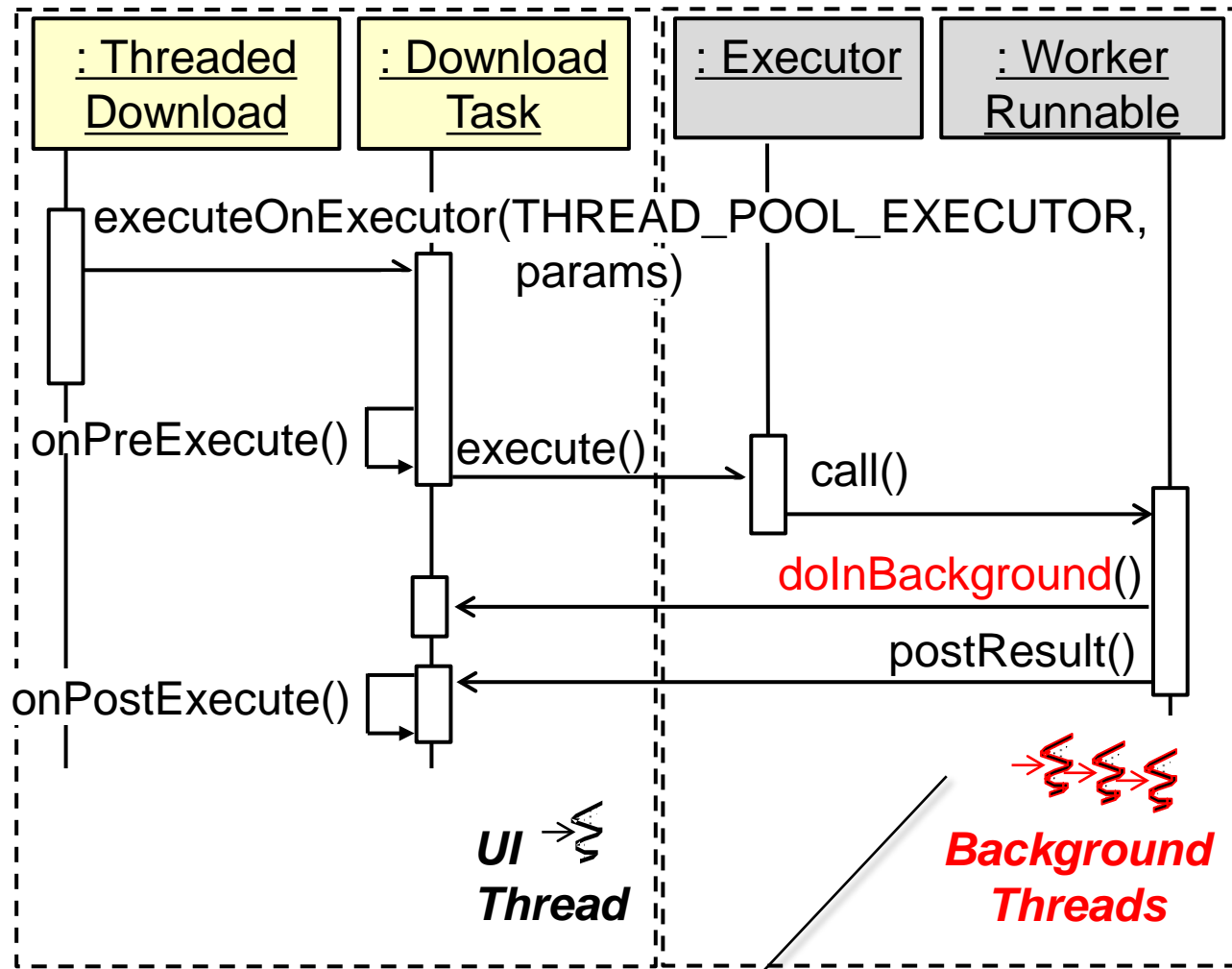
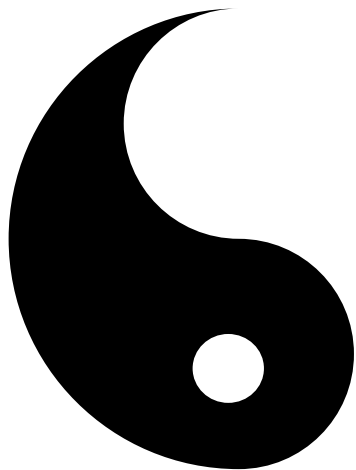
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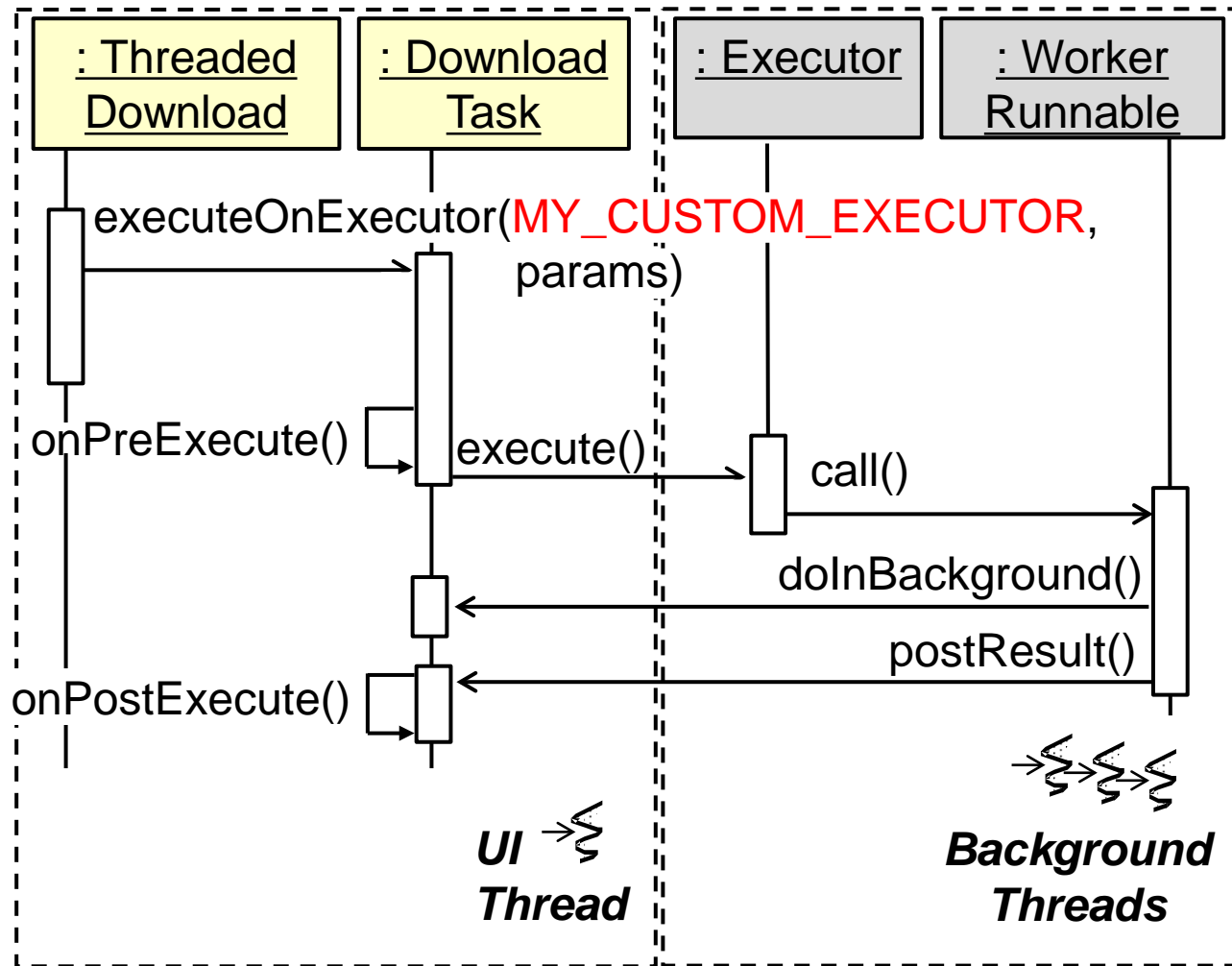
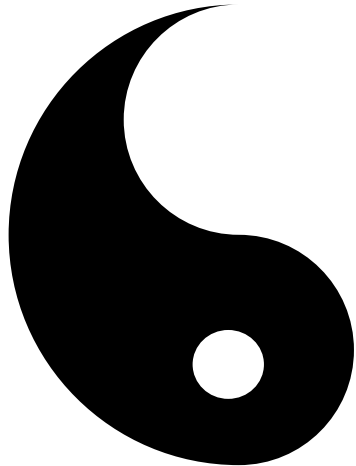


*Allows multiple long duration tasks to run in parallel within a process*



# Black-box Elements of the AsyncTask Framework

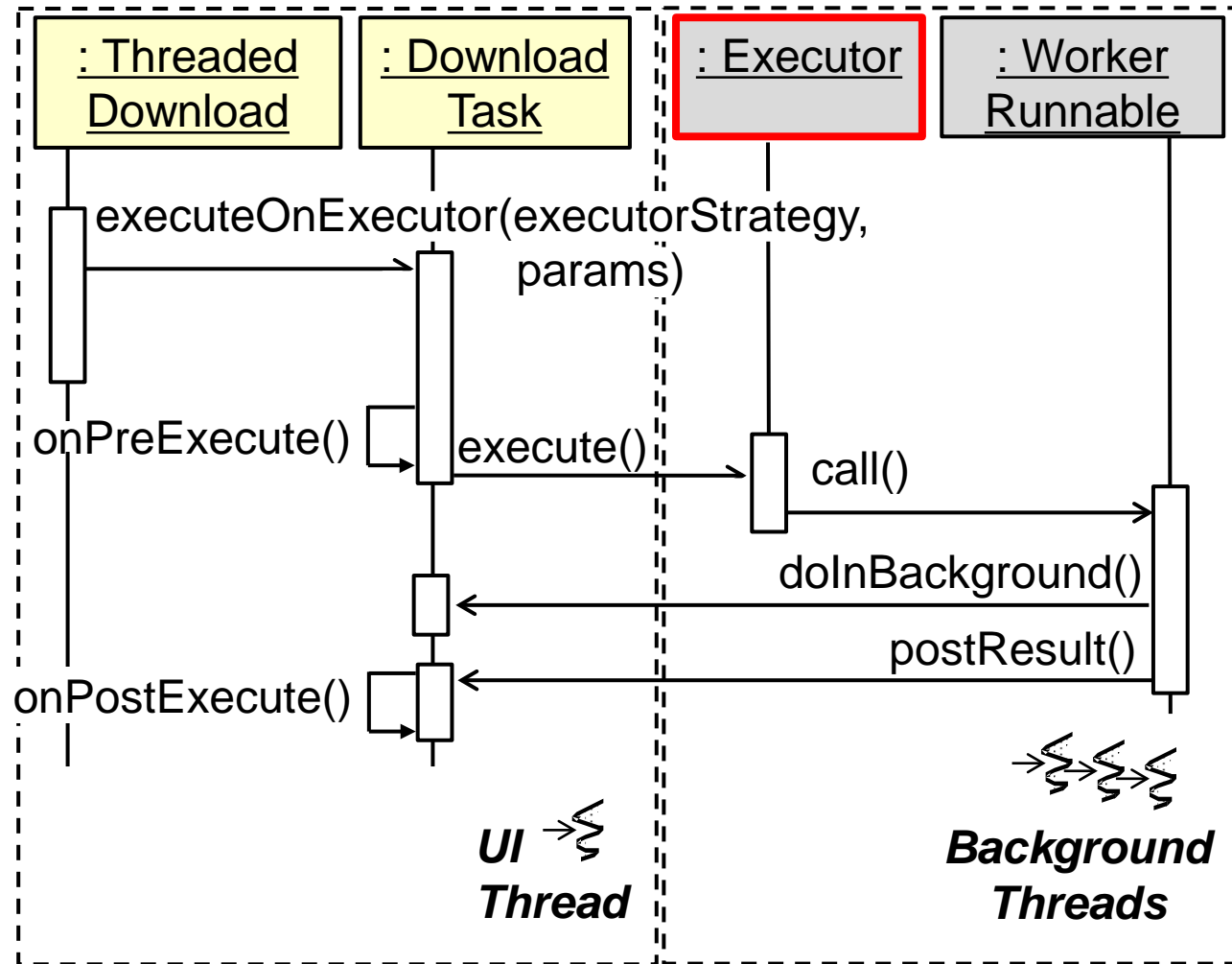
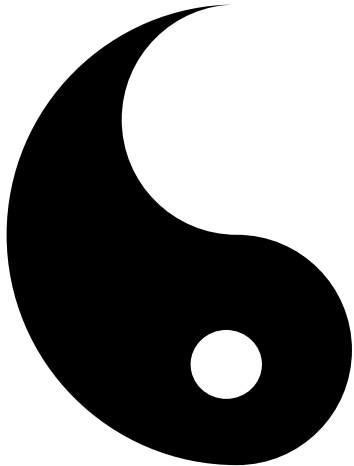
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See [developer.android.com/reference/java/util/concurrent/ExecutorService.html](http://developer.android.com/reference/java/util/concurrent/ExecutorService.html)

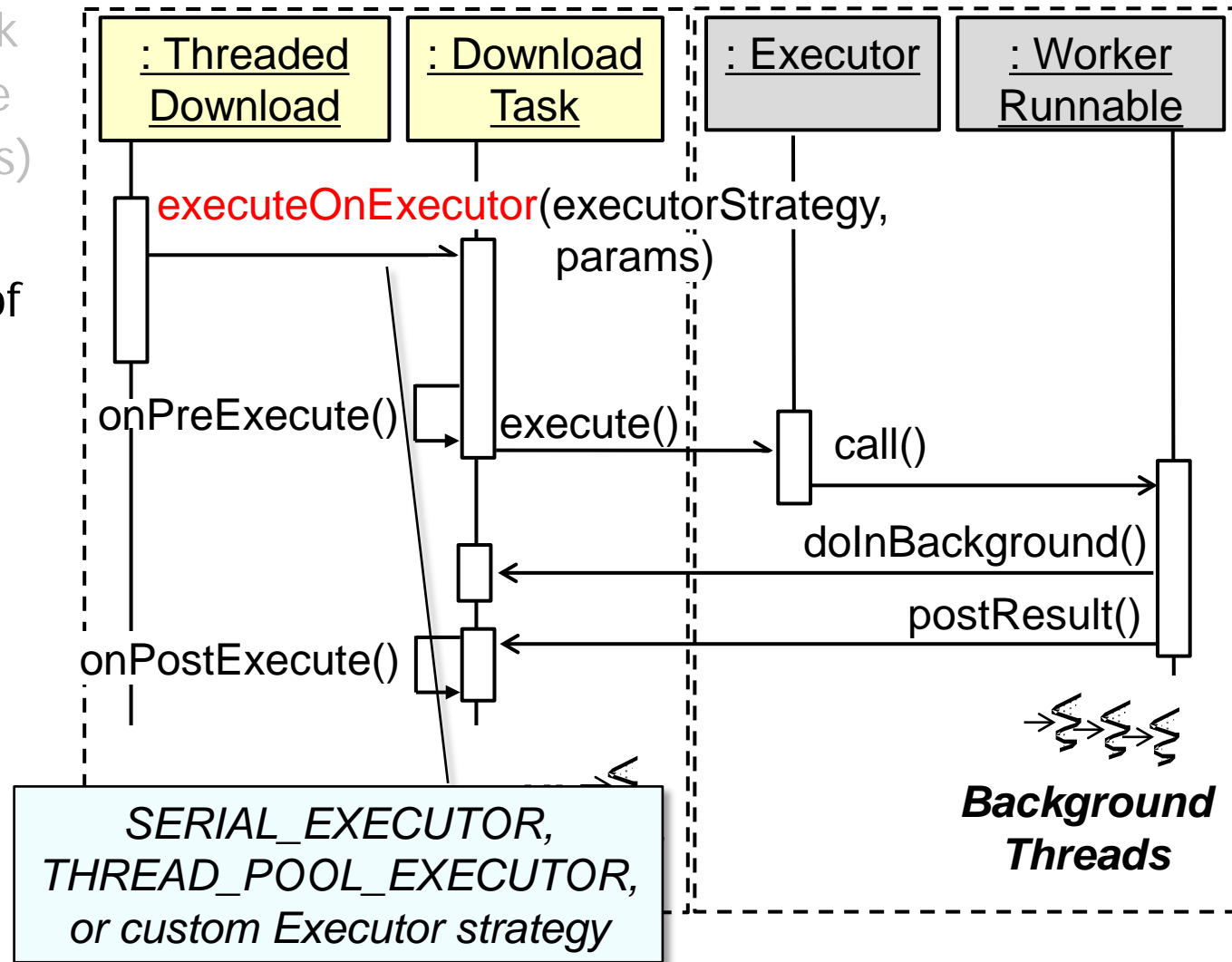
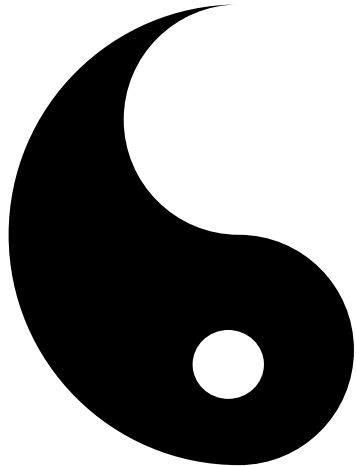
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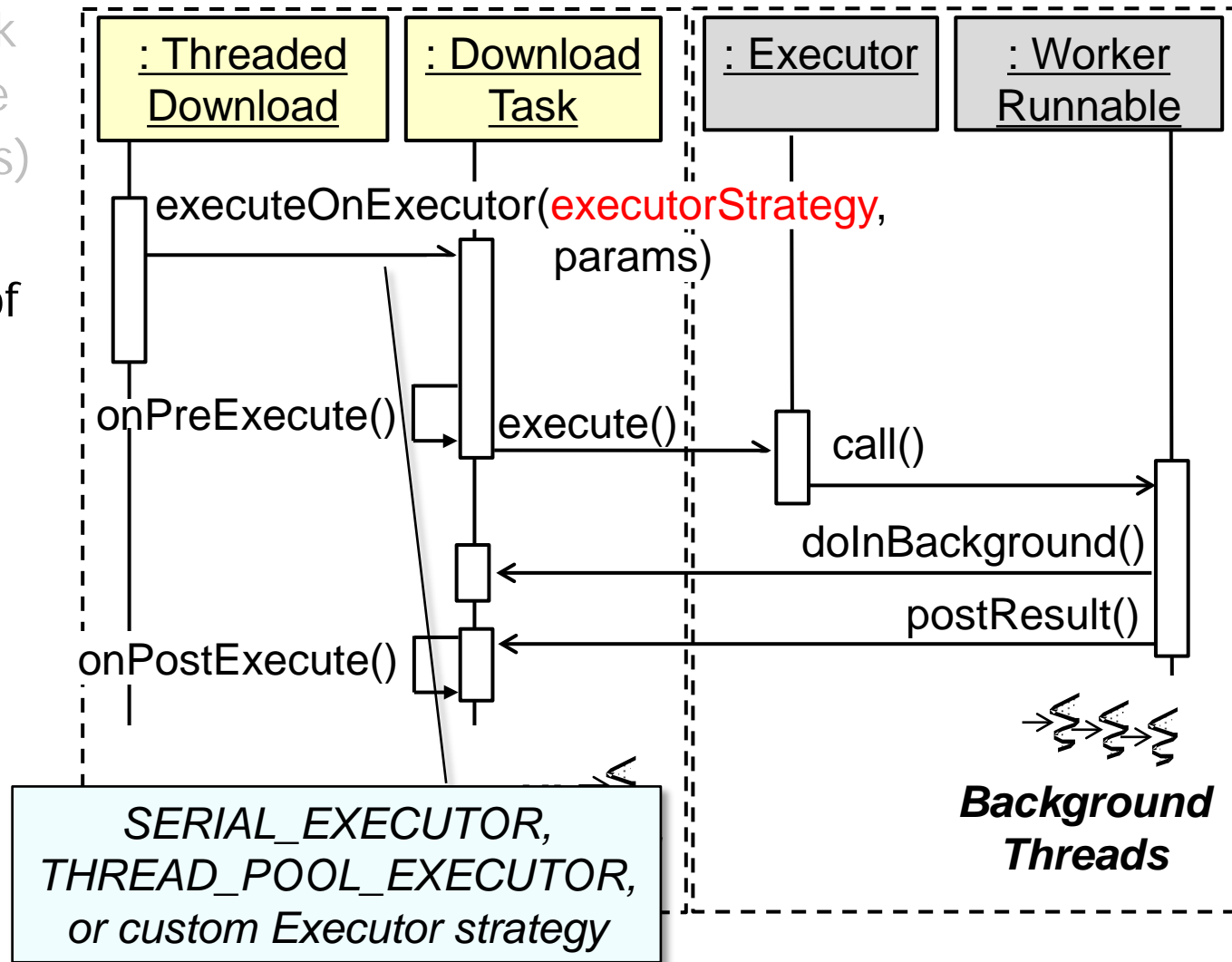
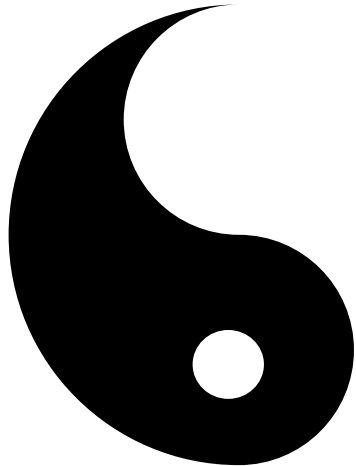
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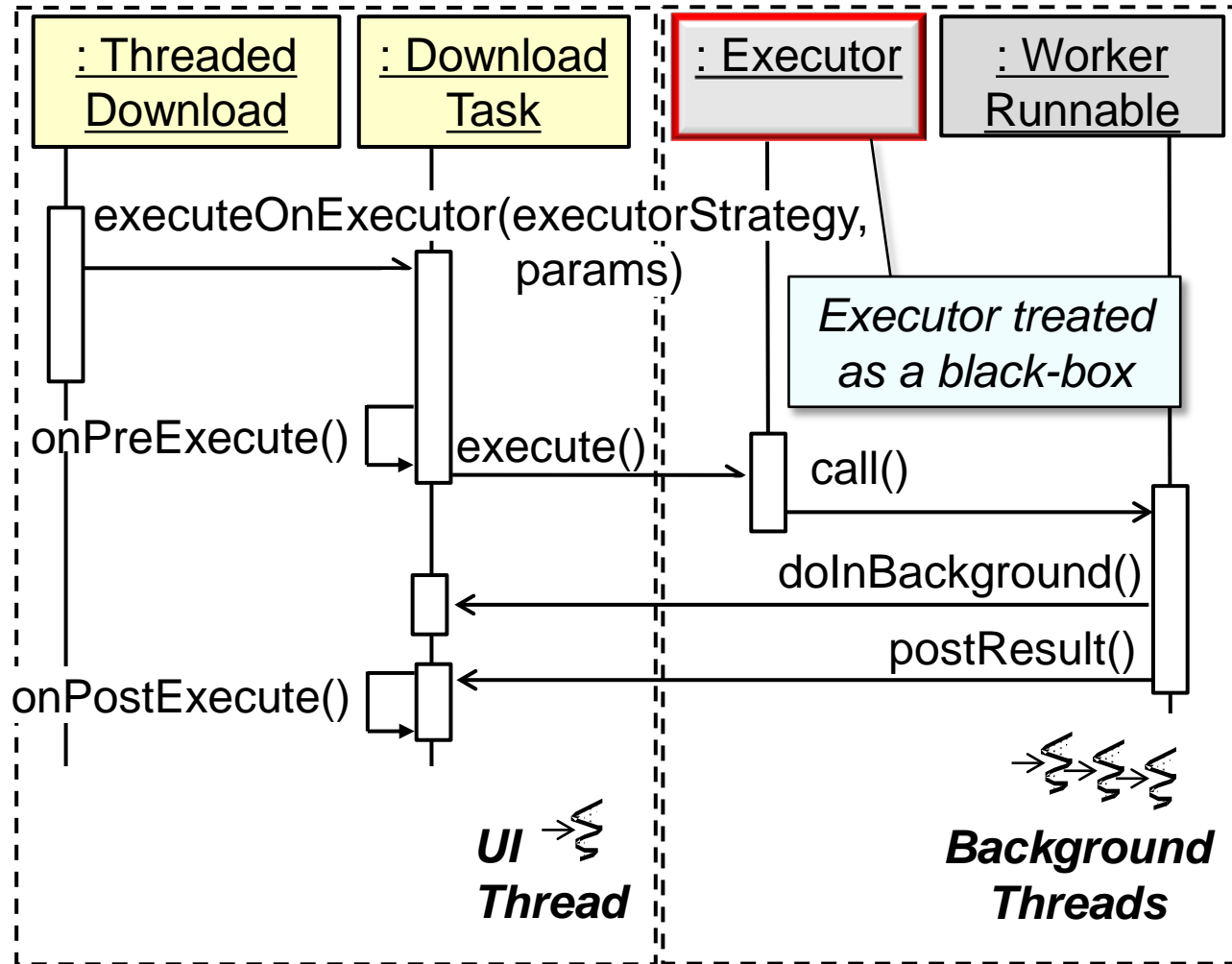
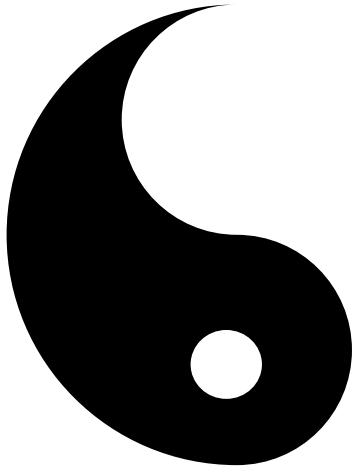
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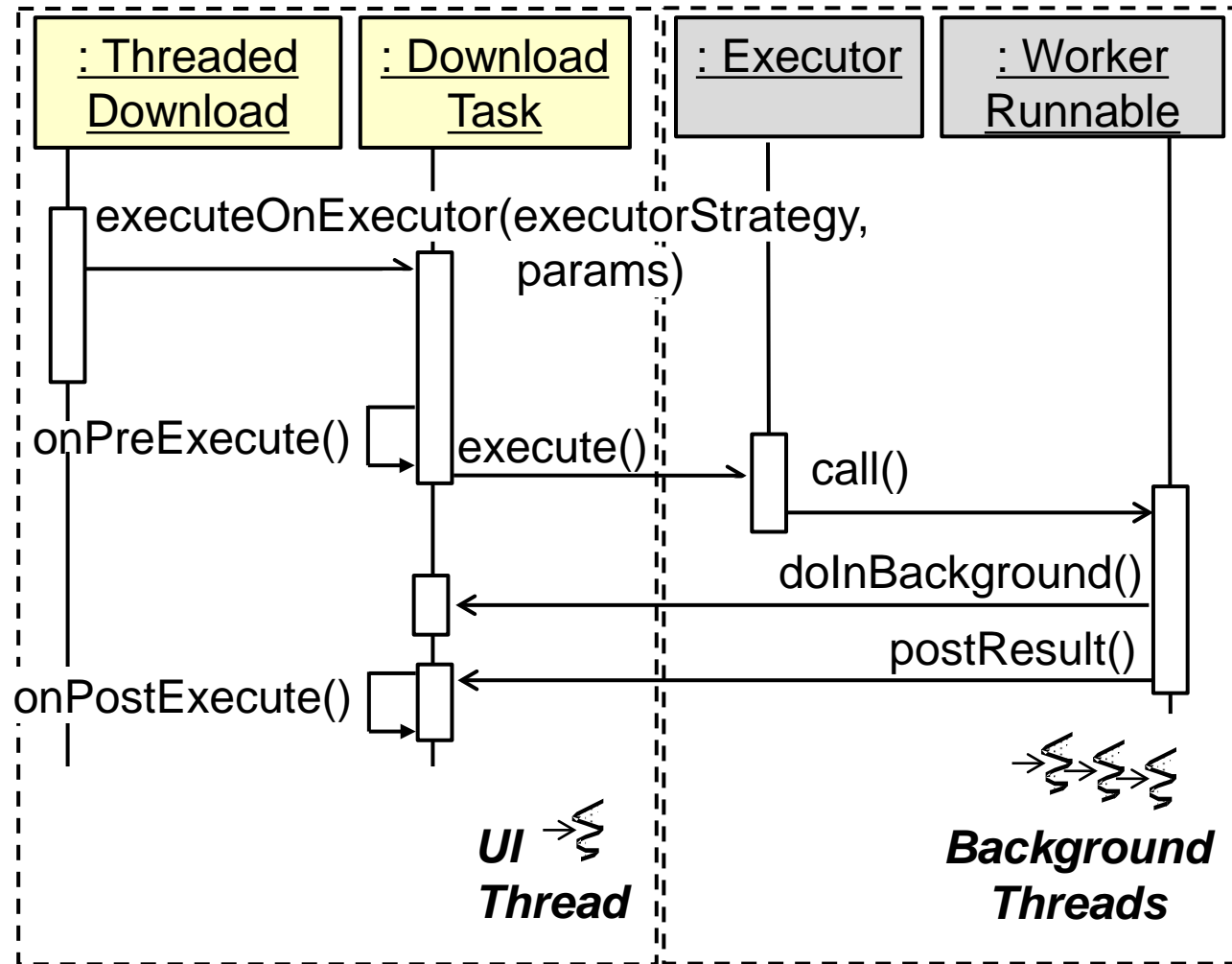
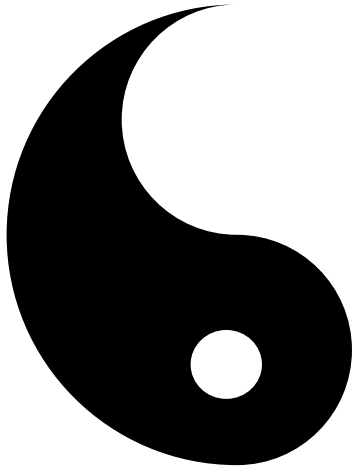
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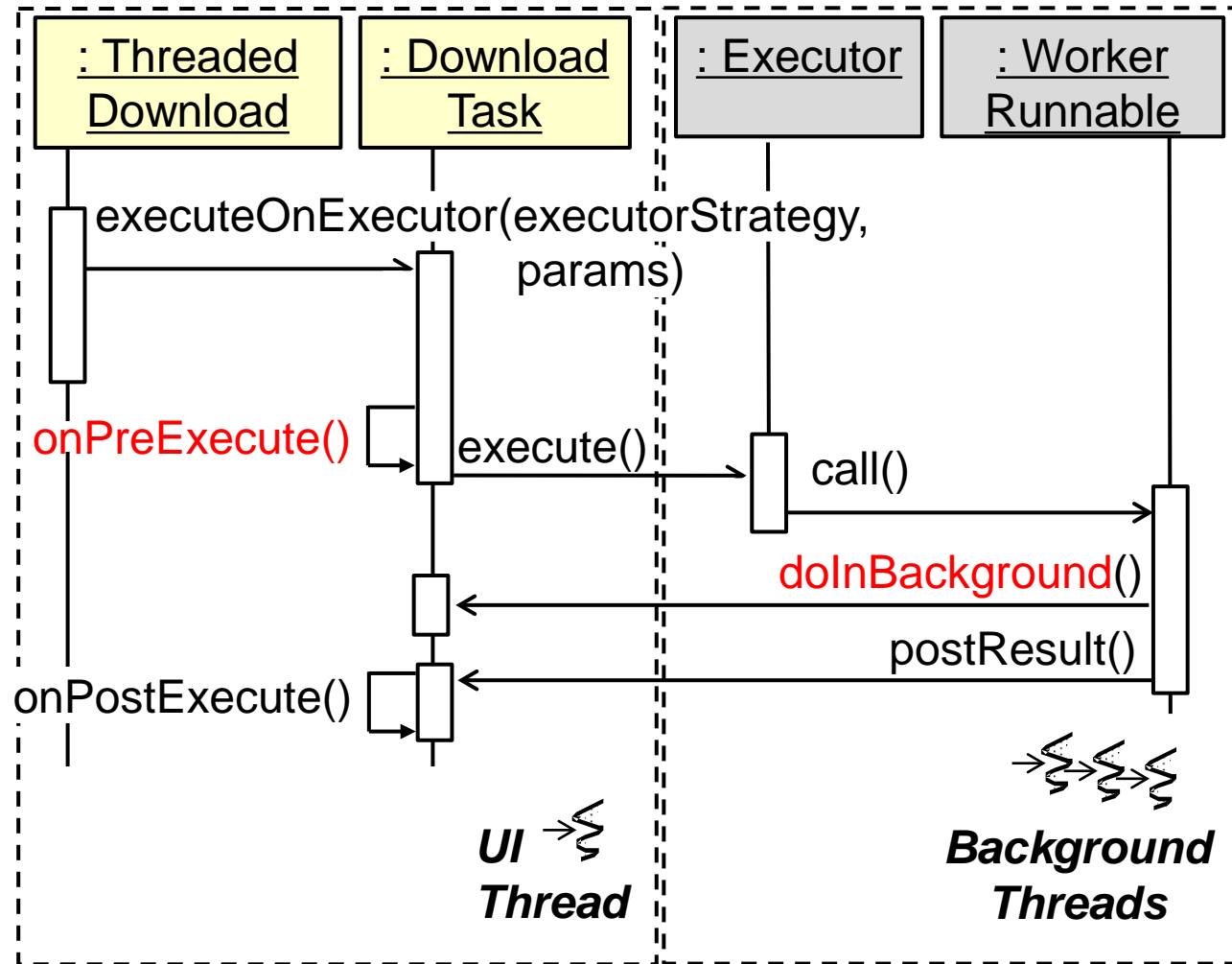
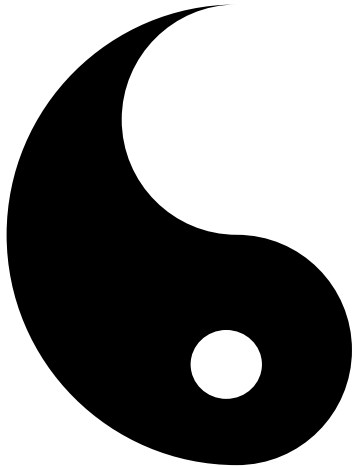
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- Black-box framework elements control the background thread(s)
- AsyncTask can be configured via a # of Executor strategies
- Frameworks ensures some thread safety



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