Android & Java Frameworks: Introduction

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Learning Objectives in this Part of the Lesson

- Understand how software frameworks are used in Android & Java

Overview of Frameworks in Android

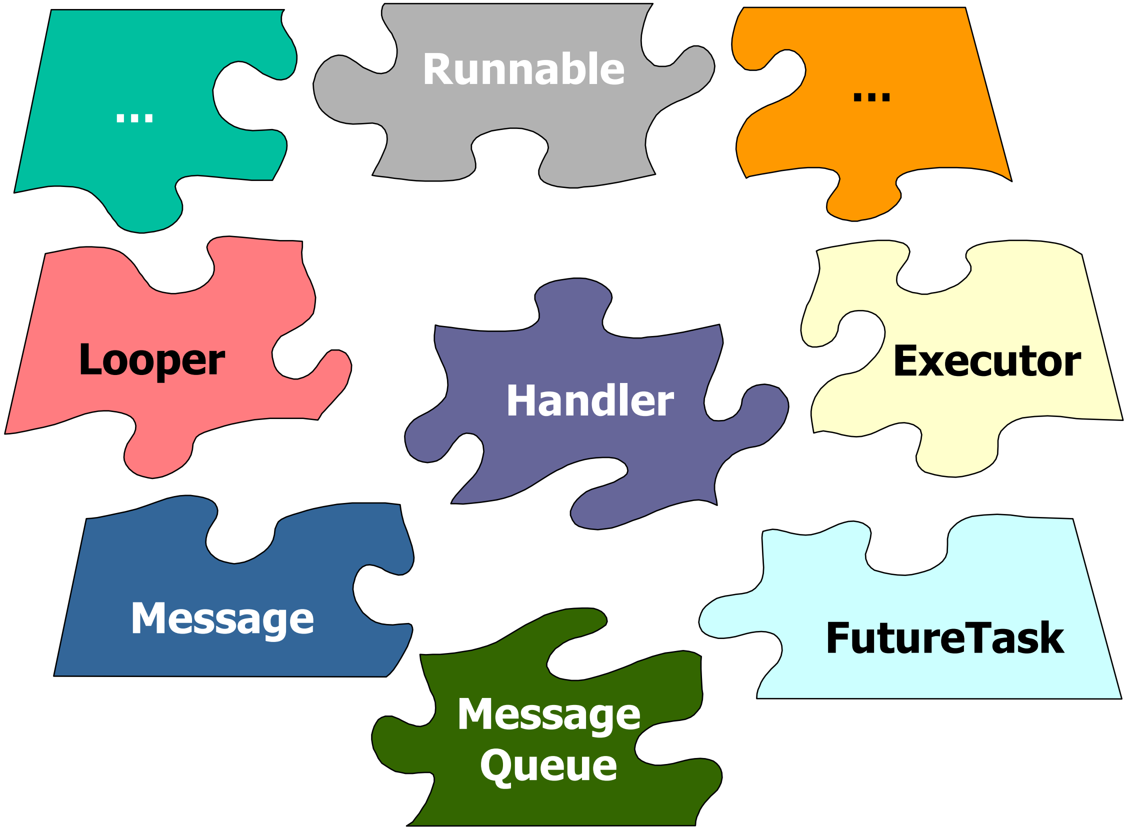
Overview of Frameworks in Android & Java

- A framework is an integrated set of components that provide a reusable architecture for a family of related apps

See www.dre.vanderbilt.edu/~schmidt/frameworks.html

Overview of Frameworks in Android & Java

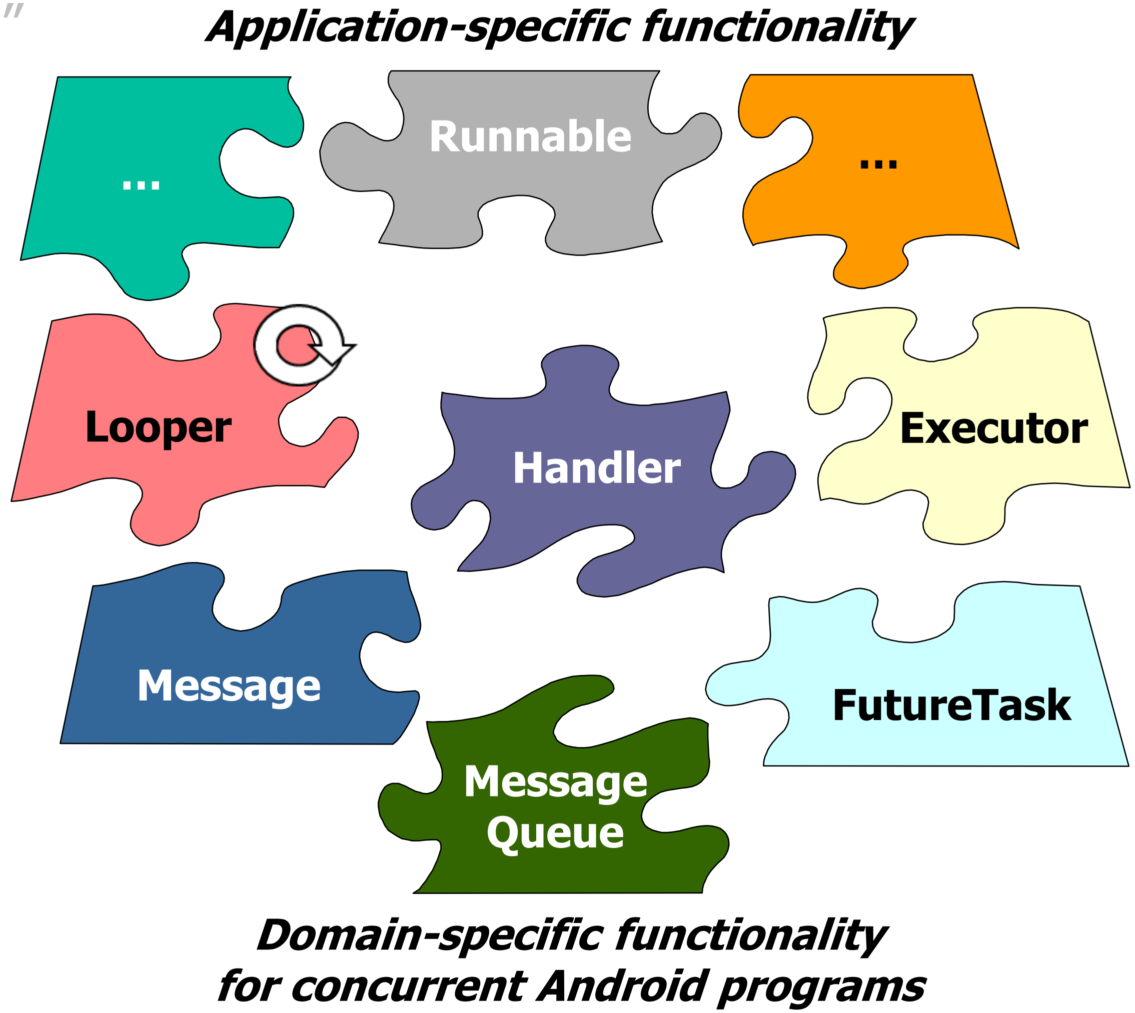
- A framework is an integrated set of components that provide a reusable architecture for a family of related apps & exhibits three key characteristics
  - Exhibit "inversion of control" (IoC) via callbacks



See en.wikipedia.org/wiki/Inversion_of_control & en.wikipedia.org/wiki/Callback_(computer_programming)

Overview of Frameworks in Android & Java

- A framework is an integrated set of components that provide a reusable architecture for a family of related apps & exhibits three key characteristics
  - Exhibit "inversion of control" (IoC) via callbacks
  - Integrated domain-specific structure & functionality



Application-specific functionality
…
Runnable
…
Looper
Handler
Executor
Message
FutureTask
Message Queue
Domain-specific functionality for concurrent Android programs

Overview of Frameworks in Android & Java

- A framework is an integrated set of components that provide a reusable architecture for a family of related apps & exhibits three key characteristics
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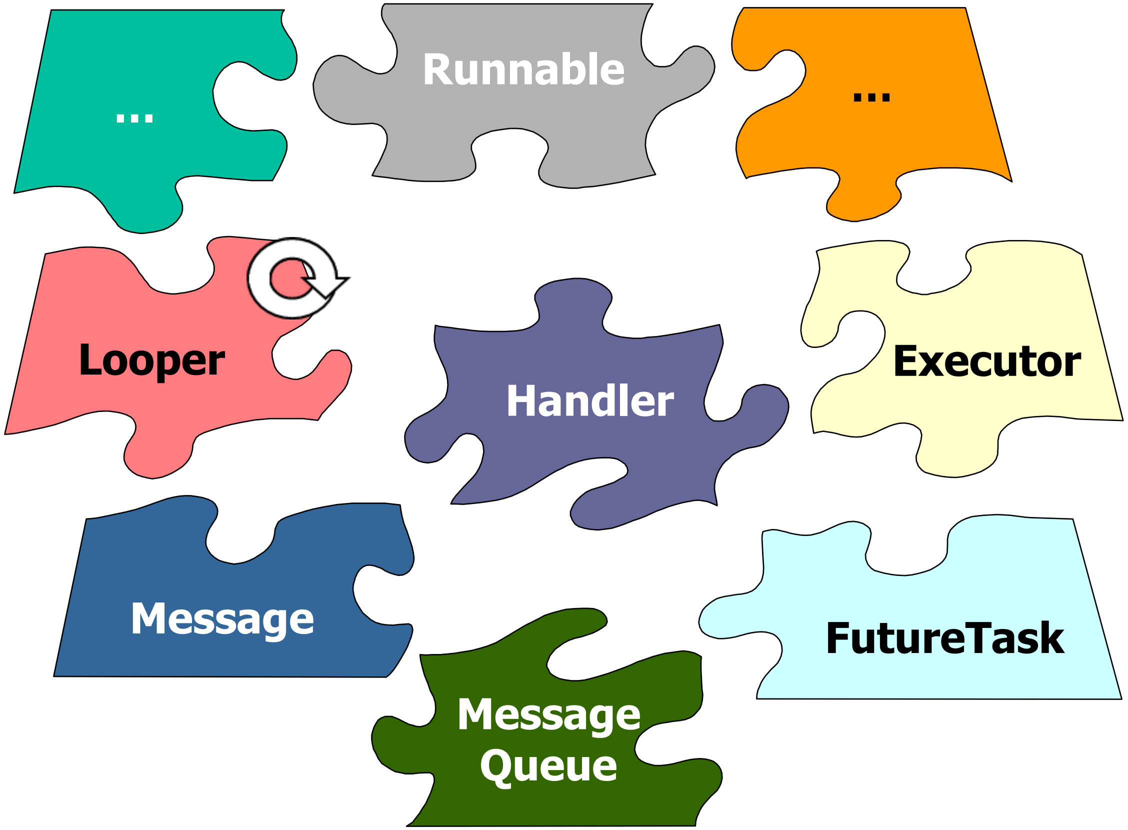
  - Integrated domain-specific structure & functionality
  - Provide semi-complete (portions of) apps

Application-specific functionality



Domain-specific functionality for concurrent Android programs

See www.laputan.org/drc/drc.html

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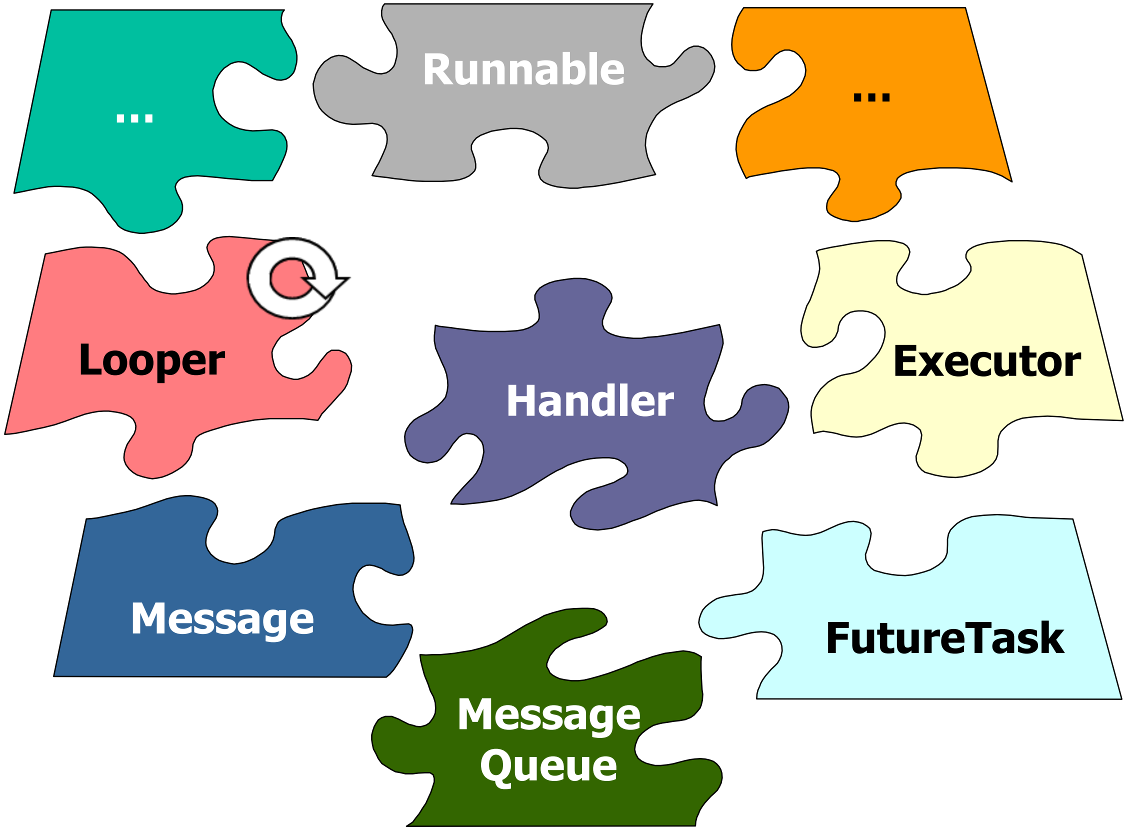
Application-specific functionality



Domain-specific functionality for concurrent Android programs

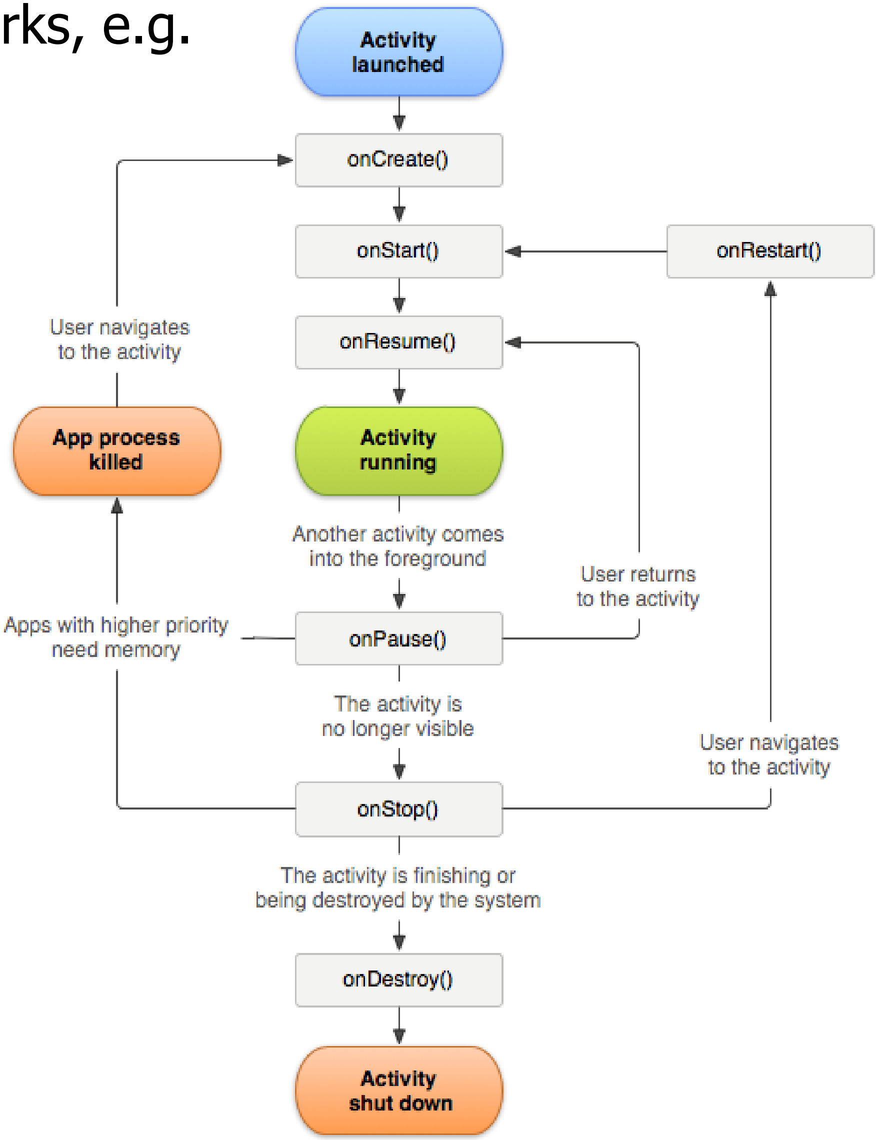
See next part of lesson on "*Android & Java Frameworks: Key Characteristics*"

Overview of Frameworks in Android & Java

- Android & Java provide many frameworks

Overview of Frameworks in Android & Java

- Android & Java provide many frameworks, e.g.
  - **Android**
    - Android's Activity framework manages lifecycle hook methods dispatched in the UI thread

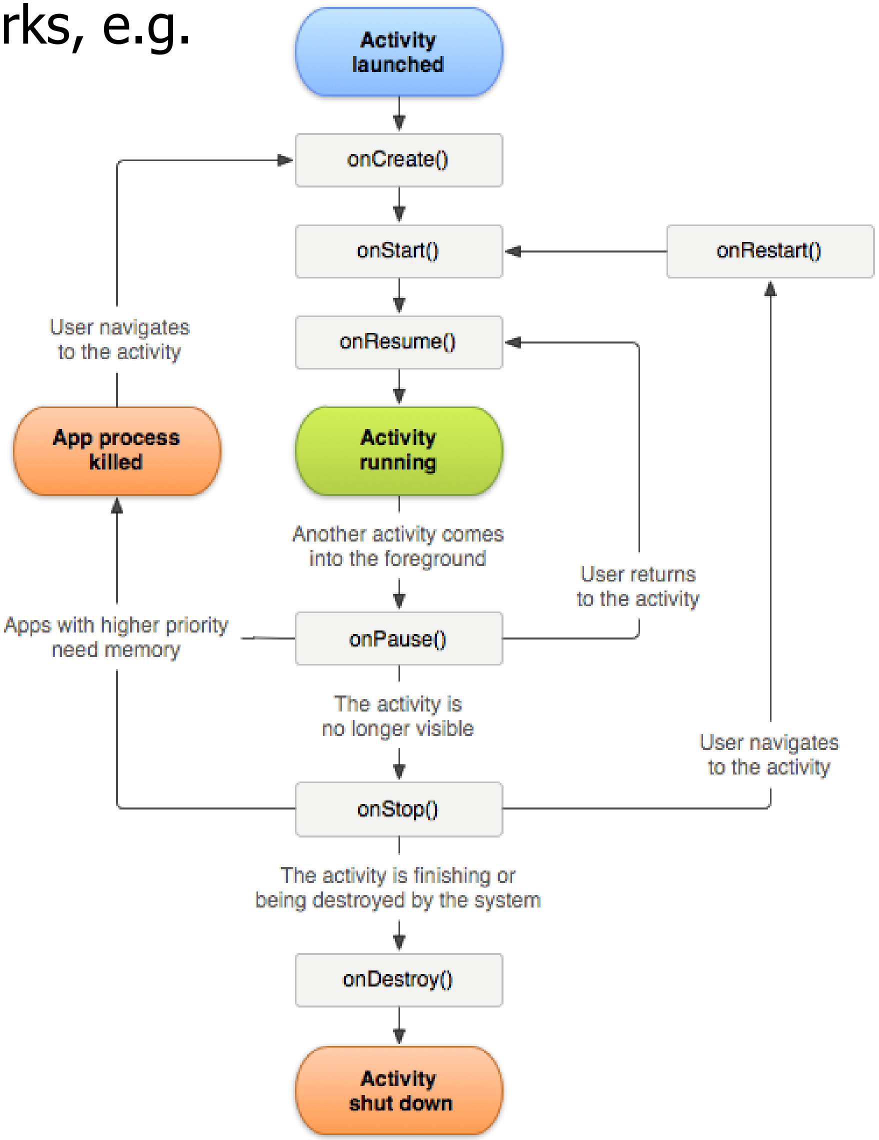


Activity launched
onCreate()
onStart()
onRestart()
onResume()
User navigates to the activity
App process killed
Activity running
Another activity comes into the foreground
User returns to the activity
Apps with higher priority need memory
onPause()
The activity is no longer visible
User navigates to the activity
onStop()
The activity is finishing or being destroyed by the system
onDestroy()
Activity shut down

See developer.android.com/training/multiple-threads/communicate-ui.html

Overview of Frameworks in Android & Java

- Android & Java provide many frameworks, e.g.
  - **Android**
    - Android's Activity framework manages lifecycle hook methods dispatched in the UI thread
      - e.g., onCreate(), onStart(), onStop(), onDestroy(), etc.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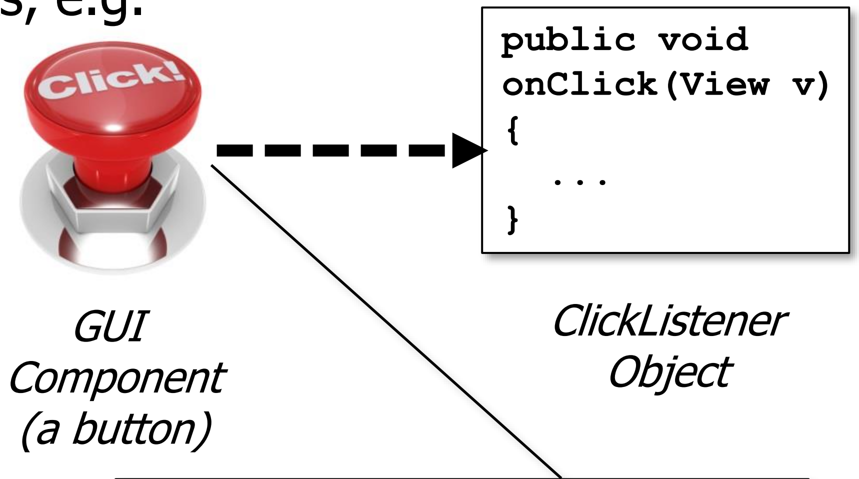
See developer.android.com/training/basics/activity-lifecycle

Overview of Frameworks in Android & Java

- Android & Java provide many frameworks, e.g.
  - **Android**
    - Android's Activity framework manages lifecycle hook methods dispatched in the UI thread
    - A listener for button clicks is called back by Android's GUI framework

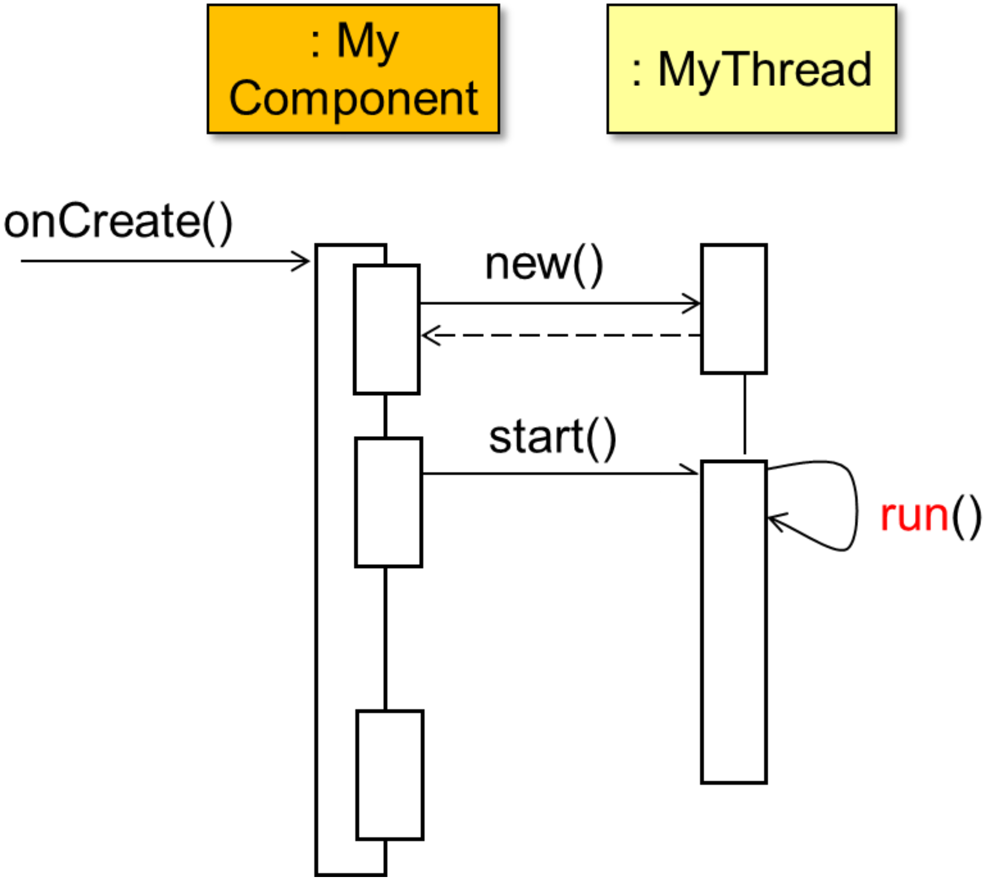


```
public void
onClick(View v)
{
   ...
}
```

A GUI component sending an event to its registered listener

Overview of Frameworks in Android & Java

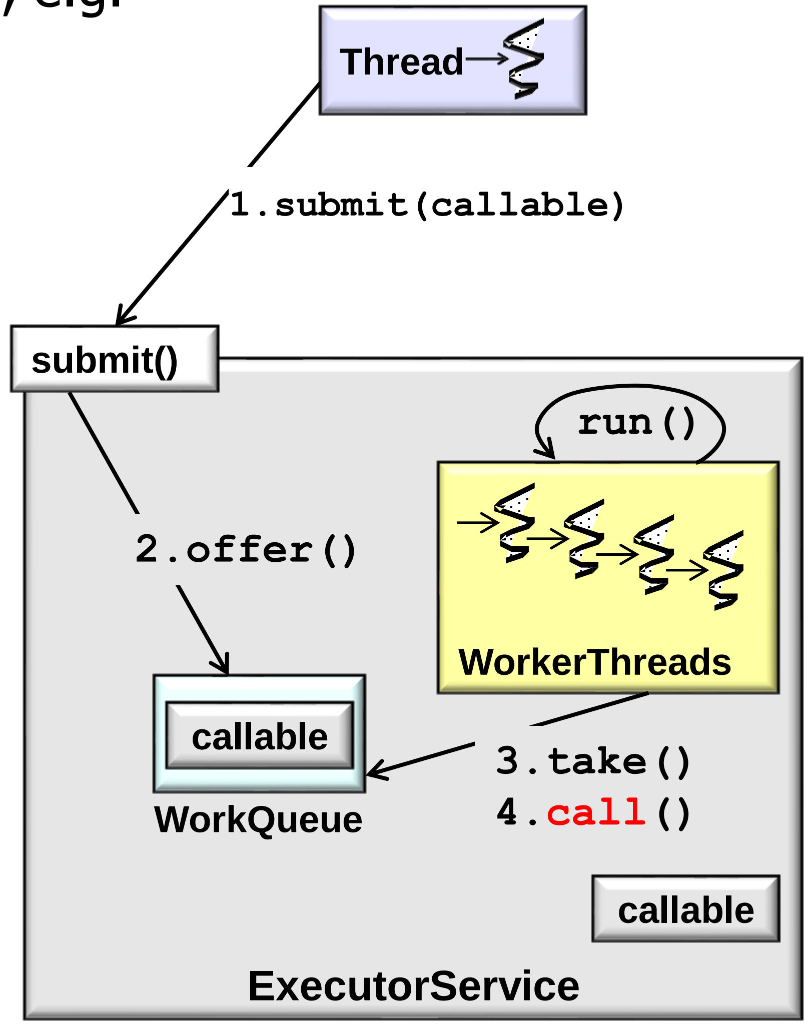
- Android & Java provide many frameworks, e.g.
  - Android
  - **Java**
    - A thread invokes the run() hook method of a runnable



See docs.oracle.com/javase/tutorial/essential/concurrency/runthread.html

Overview of Frameworks in Android & Java

- Android & Java provide many frameworks, e.g.
  - Android
  - **Java**
    - A thread invokes the run() hook method of a runnable
    - The ExecutorService invokes the call() hook method of a callable



See docs.oracle.com/javase/tutorial/essential/concurrency/executors.html

Overview of Frameworks in Android & Java

- *All* Android apps run inside one or more software frameworks

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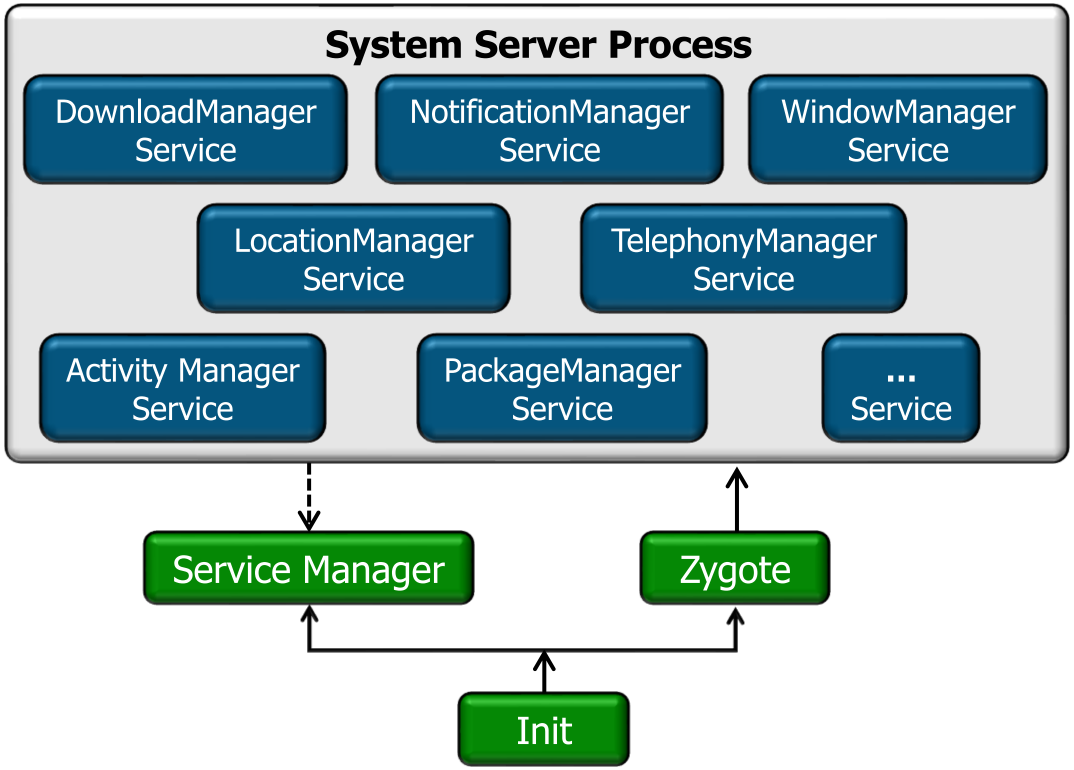


System Server Process

DownloadManager Service

NotificationManager Service

WindowManager Service

LocationManager Service

TelephonyManager Service

Activity Manager Service

PackageManager Service

... Service

Service Manager

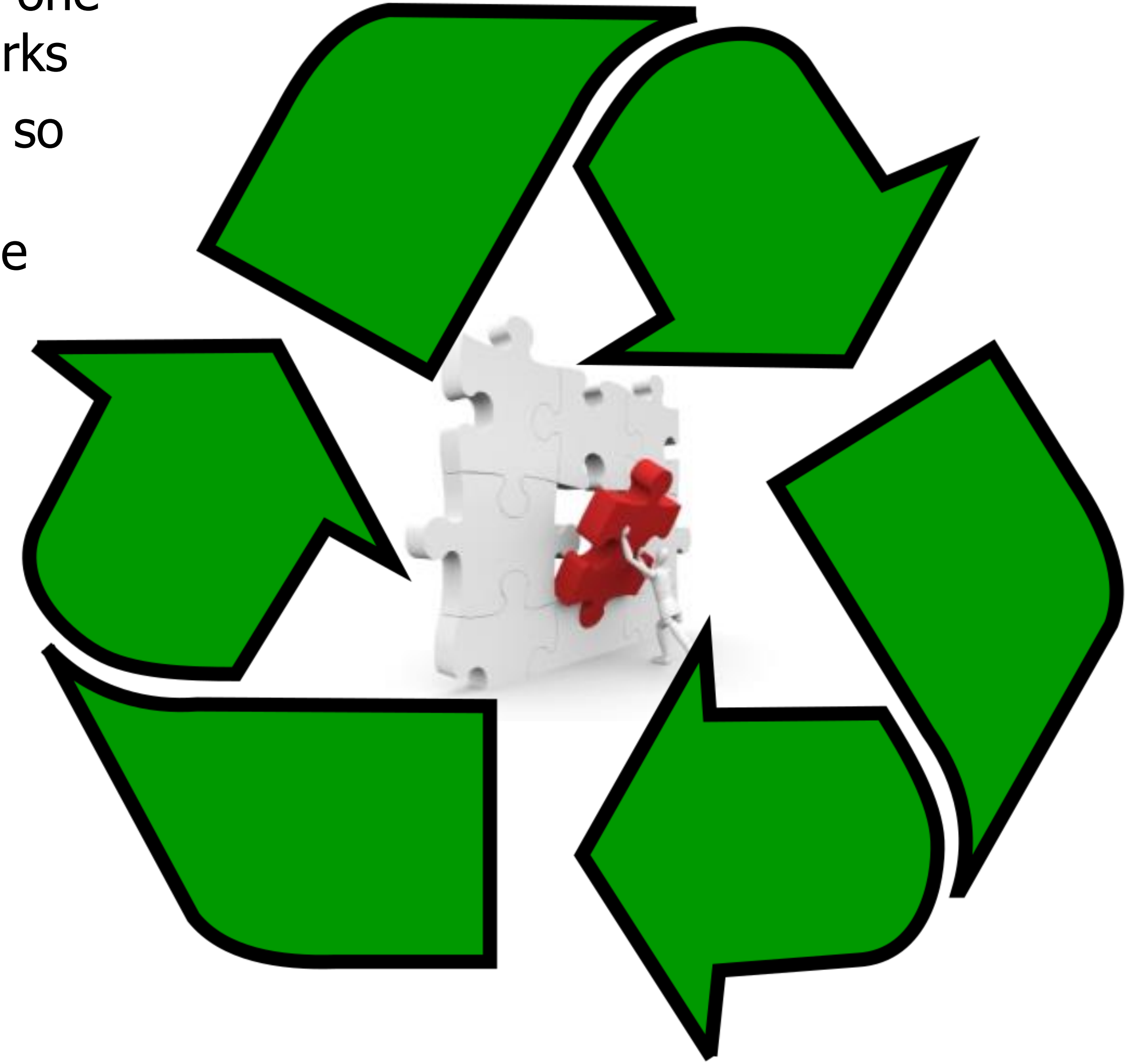
Zygote

Init

Your mobile apps must use multiple Android frameworks

Overview of Frameworks in Android & Java

- *All* Android apps run inside one or more software frameworks
  - The motivation for using so many frameworks is to enhance systematic reuse



See en.wikipedia.org/wiki/Code_reuse#Systematic_software_reuse

Overview of Frameworks in Android & Java

- *All* Android apps run inside one or more software frameworks
  - The motivation for using so many frameworks is to enhance systematic reuse
  - Apps (& app developers) thus don't need to "reinvent the wheel"

See en.wikipedia.org/wiki/Reinventing_the_wheel

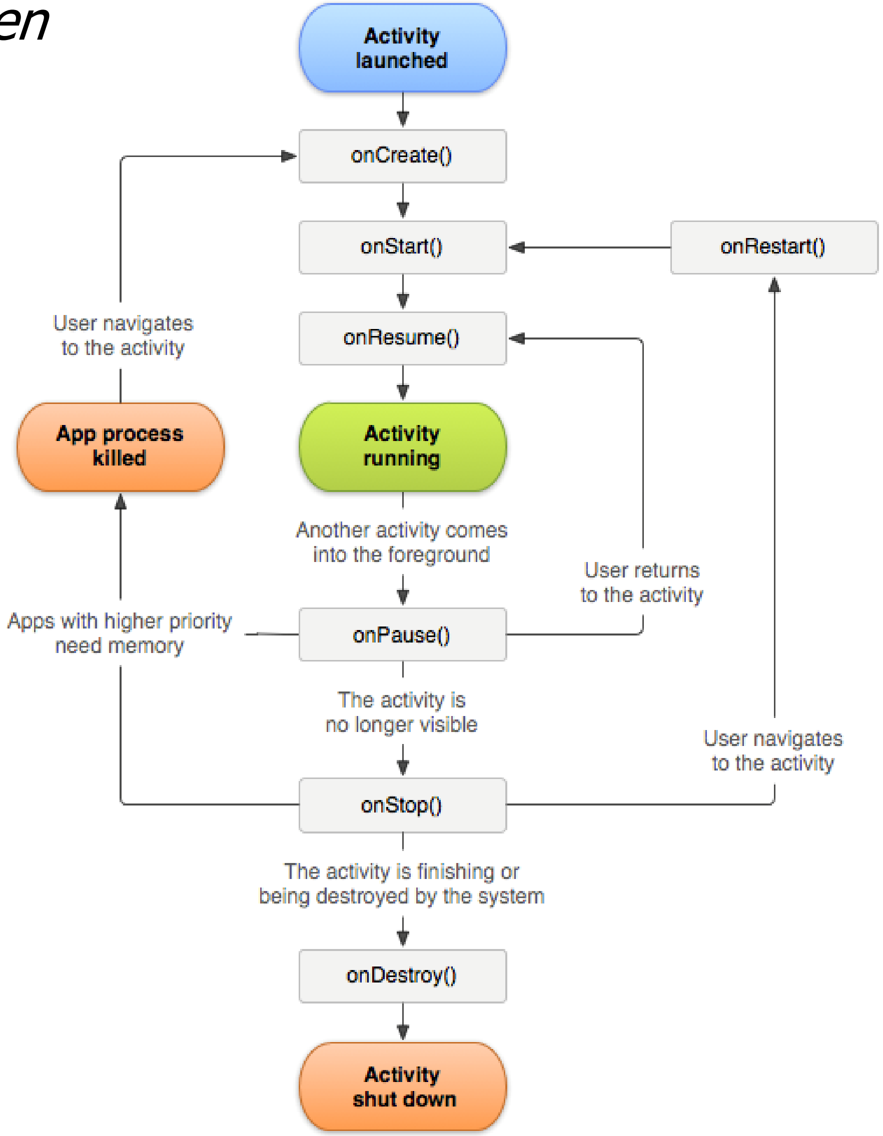
Overview of Frameworks in Android & Java

- Android frameworks use an *event-driven programming model* to integrate app classes into them

See en.wikipedia.org/wiki/Event-driven_programming

Overview of Frameworks in Android & Java

- Android frameworks use an *event-driven programming model* to integrate app classes into them
  - In this programming paradigm, the flow of the program is determined by events, e.g.
    - User actions (button presses, gestures, etc.)
    - Sensor inputs/outputs
    - Messages from other threads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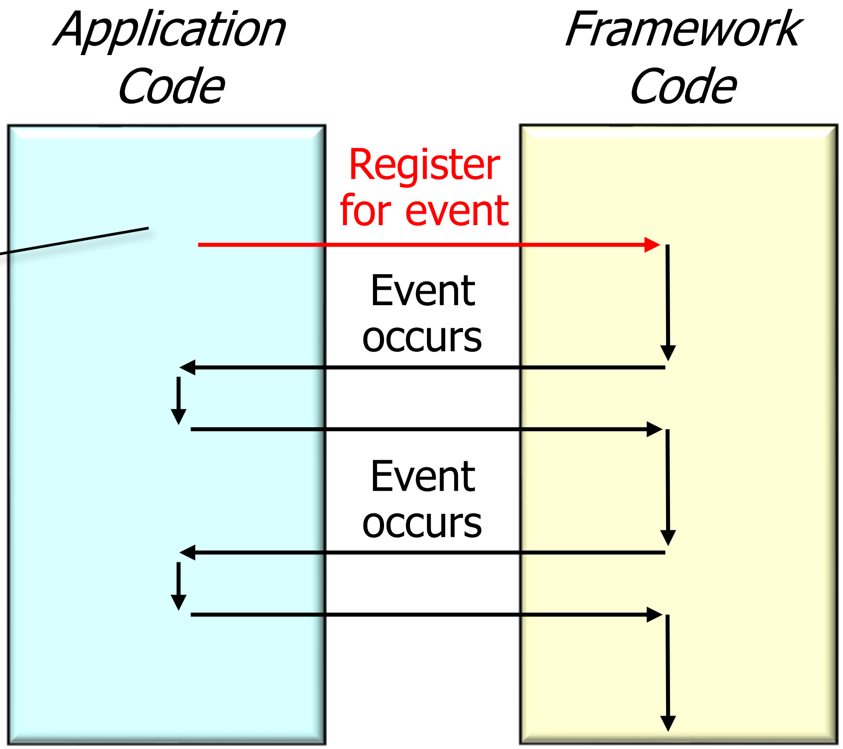
See en.wikipedia.org/wiki/Event-driven_programming

Overview of Frameworks in Android & Java

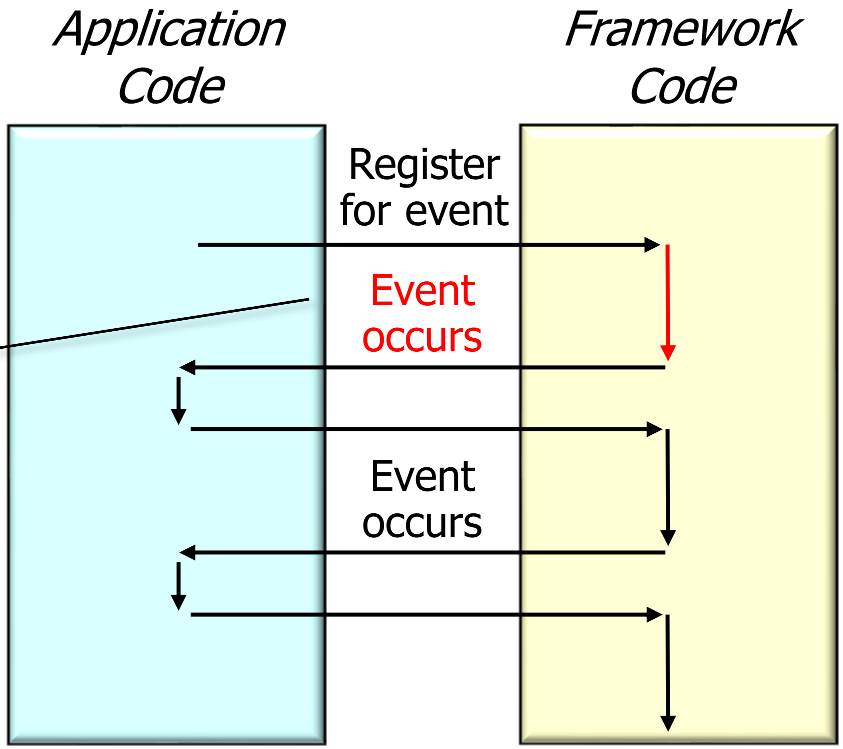
- The control flow in framework-driven Android apps traverses between the framework(s) & the app classes

e.g., create an activity, service, and/or broadcast receiver



Overview of Frameworks in Android & Java

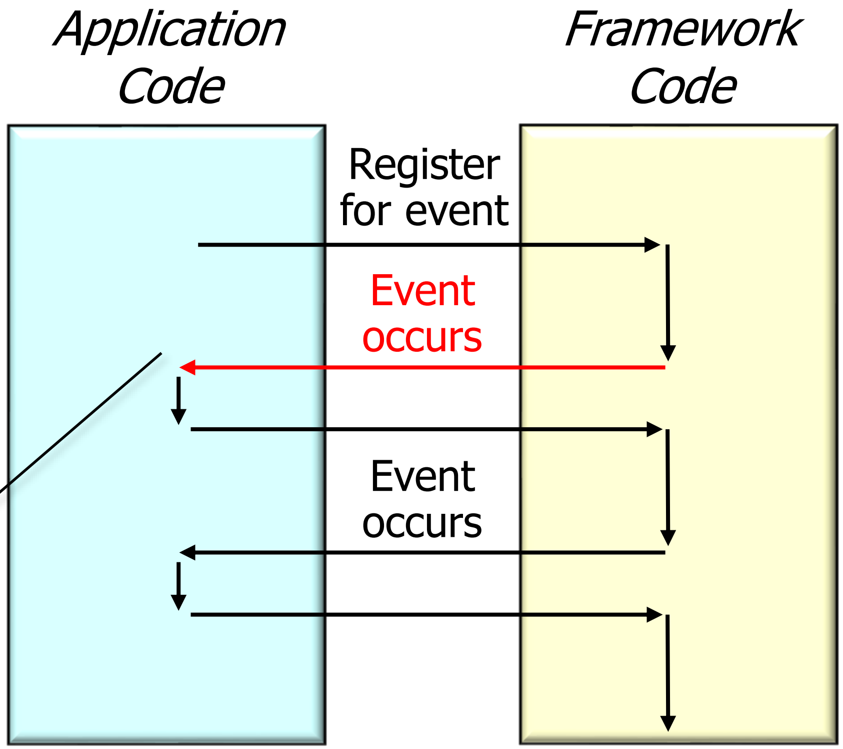
- The control flow in framework-driven Android apps traverses between the framework(s) & the app classes



e.g., a message occurs that triggers a lifecycle event

Overview of Frameworks in Android & Java

- The control flow in framework-driven Android apps traverses between the framework(s) & the app classes
  - A framework calls to app code when an event of interest occurs



e.g., dispatch lifecycle hook methods like onCreate(), onStart(), onReceive(), etc.

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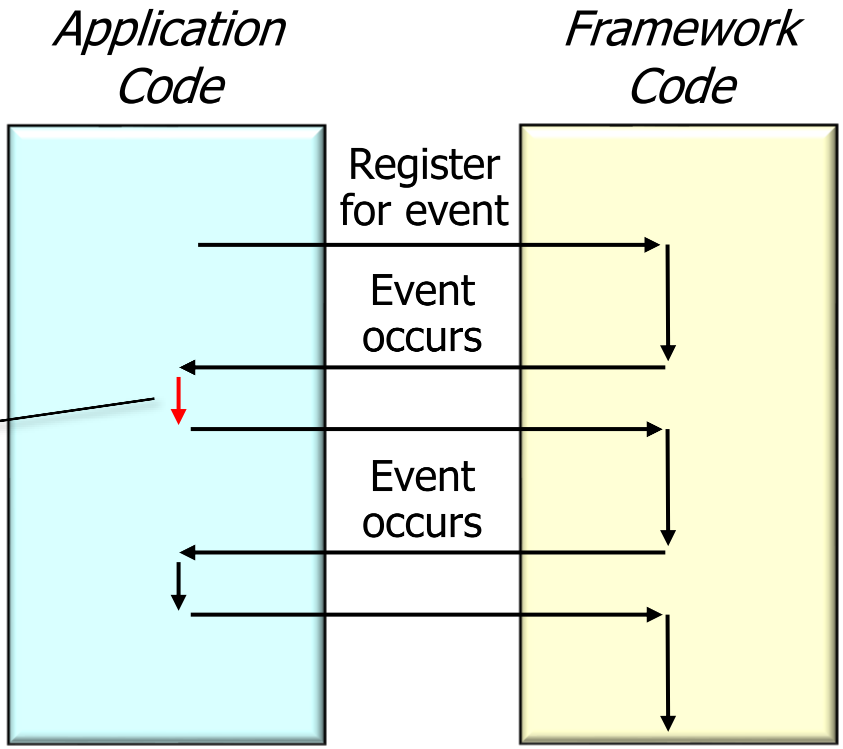
e.g., the app performs its processing in the context of framework thread(s)



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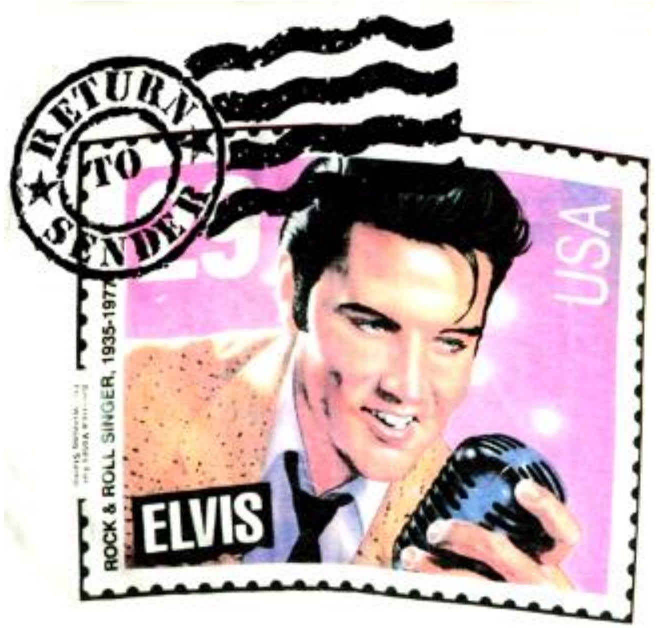

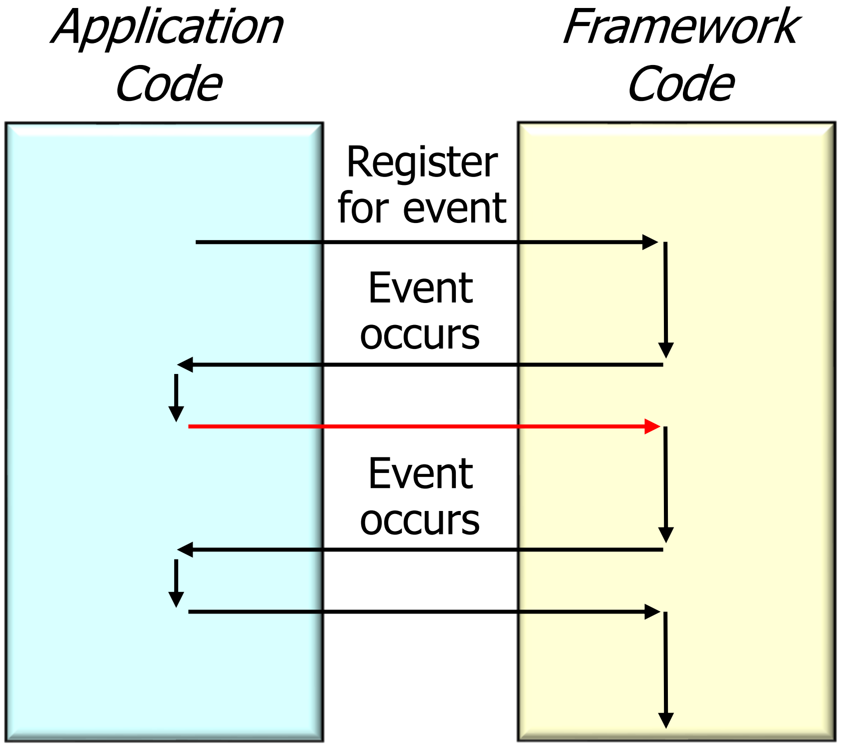

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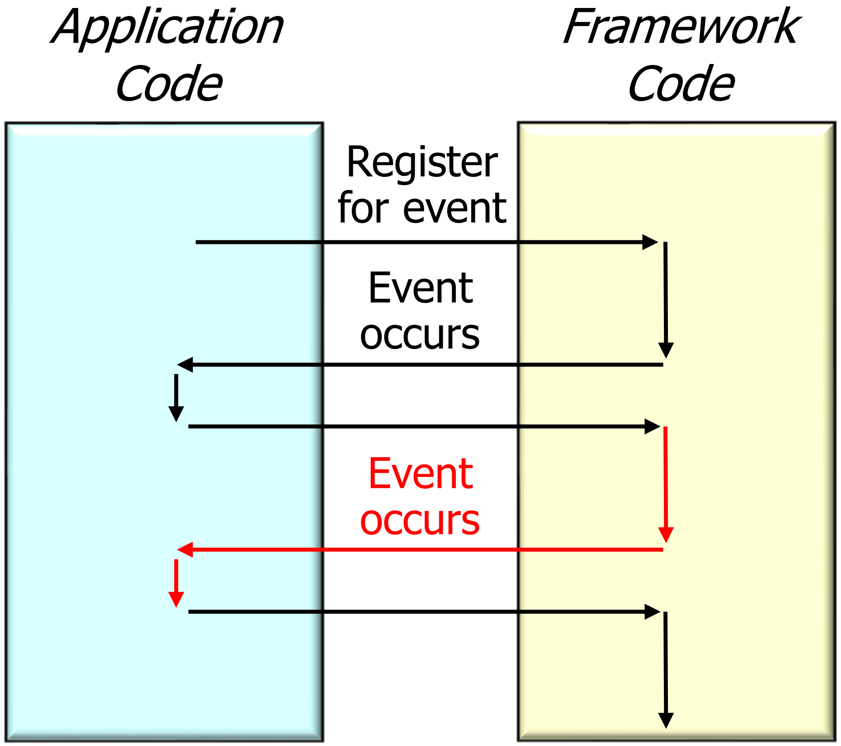
  - Lather, rinse, repeat until app is done …



See en.wikipedia.org/wiki/Lather,_rinse,_repeat

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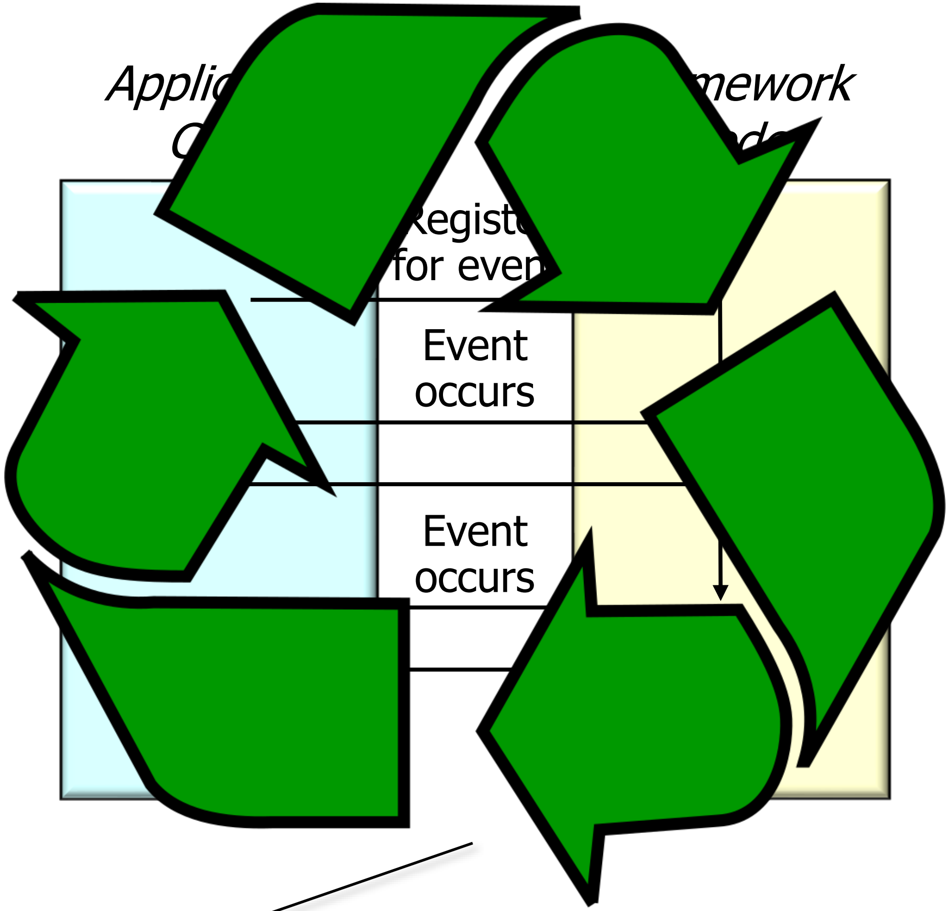

Separating concerns this way helps enhance systematic software reuse & improve various quality attributes

See www.sei.cmu.edu/reports/95tr021.pdf

End of Android & Java Frameworks: Introduction