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 and exhibits three key characteristics:

- Exhibit "inversion of control" (IoC) via callbacks

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

Domain-specific functionality for concurrent Android programs

- Looper
- Runnable
- Handler
- Executor
- FutureTask
- Message Queue
- Message
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
  - Provide semi-complete (portions of) apps

See [www.laputan.org/drc/drc.html](http://www.laputan.org/drc/drc.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
  • Integrated domain-specific structure & functionality
  • Provide semi-complete (portions of) apps

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

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.
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

```java
public void onClick(View v) {
    ...
}
```
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](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](http://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

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](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
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

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.

*Example Diagram*

- *Application Code*:
  - Register for event
  - Event occurs
  - Event occurs

- *Framework Code*:
  - Event occurs

*Note*
- *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

  ![Diagram](image)

  - e.g., dispatch lifecycle hook methods like `onCreate()`, `onStart()`, `onReceive()`, etc.
Overview of Frameworks in Android & Java

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  • A framework calls to app code when an event of interest occurs

\[\text{Application Code} \quad \text{Framework Code} \]

\[\text{Register for event} \quad \text{Event occurs} \quad \text{Event occurs} \]

\[\text{e.g., the app performs its processing in the context of framework thread(s)}\]
Overview of Frameworks in Android & Java

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  - Control returns to the framework after an app callback is done
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  • Control returns to the framework after an app callback is done
  • 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](http://www.sei.cmu.edu/reports/95tr021.pdf)
End of Android & Java Frameworks: Introduction