Android Concurrency Frameworks:
Structure & Functionality

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Learning Objectives in this Part of the Lesson

• Know the motivations for Android concurrency & concurrency frameworks
• Recognize the two types of Android concurrency frameworks
• Understand the structure & functionality of Android’s concurrency frameworks
Elements of Android Concurrency Frameworks
Android’s concurrency frameworks are built using reusable classes & interfaces.
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces

We focus on classes/interfaces used to write concurrent Android programs
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces

We’ll also outline the implementation of Android’s concurrency frameworks
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces

**Looper**
- Run a message loop for a thread

```java
public static void loop() {
    final Looper me = myLooper();
    MessageQueue queue = me.mQueue;
    ...
    for (;;) {
        Message msg = queue.next();
        ...
        msg.target.
        dispatchMessage(msg);
        ...
    }
    ...
}
```

See developer.android.com/reference/android/os/Looper.html
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - **Looper**
  - **MessageQueue**
    - Holds the list of messages to be dispatched by a looper

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    - Messages aren’t added directly to a message queue, but rather via handler objects associated with the looper
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - **Looper**
  - **MessageQueue**
    - Holds the list of messages to be dispatched by a looper
      - Messages aren’t added directly to a message queue, but rather via handler objects associated with the looper
      - The looper blocks on the message queue until the next message is available
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - Looper
  - MessageQueue
  - Message
    - Contains data & type information that can be sent to a handler via a message queue

See developer.android.com/reference/android/os/Message.html
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - Looper
  - MessageQueue
  - Message
  - Handler
    - Send/process messages & runnables in the message queue associated with a thread’s looper

Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - Looper
  - MessageQueue
  - Message
  - Handler
    - Send/process messages & runnables in the message queue associated with a thread’s looper
    - Plays the roles of a proxy for client thread & of a target adapter for dispatching in another thread

See en.wikipedia.org/wiki/Proxy_pattern & en.wikipedia.org/wiki/Adapter_pattern
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - Looper
  - MessageQueue
  - Message
  - Handler
  - Runnable
    - Represents a command that can be executed

Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - Looper
  - MessageQueue
  - Message
  - Handler
- **Runnable**
  - Represents a command that can be executed
    - This command is often run in a thread different than it was created in

See [www.dre.vanderbilt.edu/~schmidt/PDF/CommandProcessor.pdf](http://www.dre.vanderbilt.edu/~schmidt/PDF/CommandProcessor.pdf)
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - Looper
  - MessageQueue
  - Message
  - Handler
  - Runnable

These classes are used by both the HaMeR & AsyncTask concurrency frameworks

The HaMeR framework exposes some classes to app developers directly, whereas the AsyncTask framework shields app developers from these classes
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - Looper
  - MessageQueue
  - Message
  - Handler
  - Runnable

Some classes are just used by the AsyncTask concurrency framework
Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - Looper
  - MessageQueue
  - Message
  - Handler
  - Runnable
- **FutureTask**
  - Can be used to
    - Start & cancel a computation that runs asynchronously
    - Query to see if a computation is done
    - Retrieve the result of the computation

Elements of Android Concurrency Frameworks

- Android’s concurrency frameworks are built using reusable classes & interfaces
  - Looper
  - MessageQueue
  - Message
  - Handler
  - Runnable
  - FutureTask

- **Executor framework**
  - Execute submitted runnable tasks either
    - Sequentially in one thread (in the background) or
    - Concurrently in a thread pool

See developer.android.com/reference/java/util/concurrent/Executor.html
Elements of Android Concurrency Frameworks

- These framework elements are used by Android’s application frameworks & packaged 3rd-party applications

See source.android.com
End of Android Concurrency Frameworks: Structure & Functionality