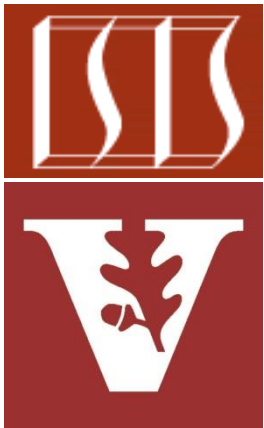


Android Concurrency Frameworks: Motivation



Douglas C. Schmidt

d.schmidt@vanderbilt.edu

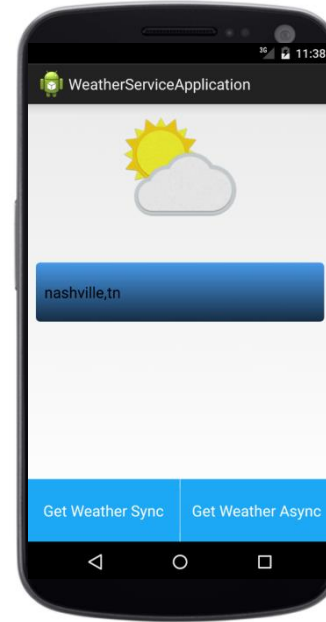
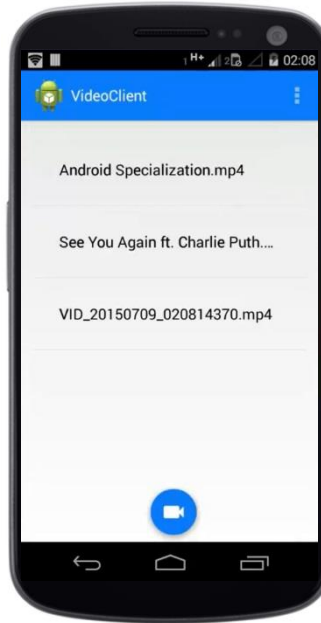
www.dre.vanderbilt.edu/~schmidt

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



Learning Objectives in this Part of the Lesson

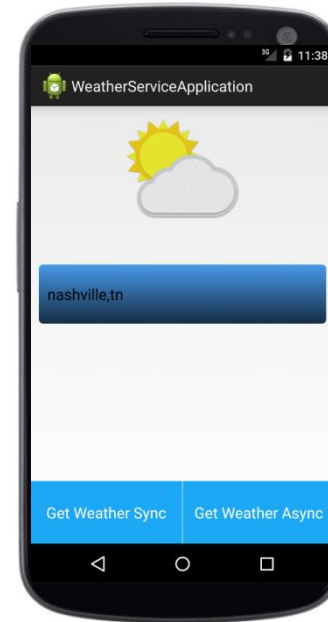
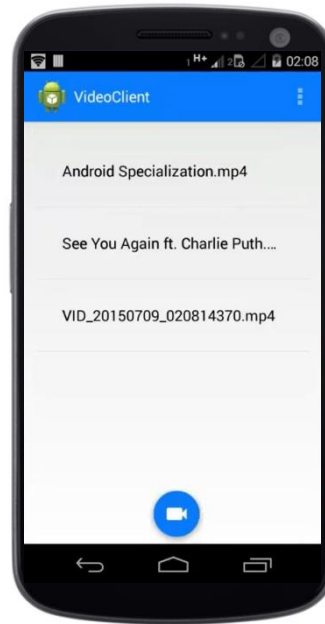
- Know the motivations for Android concurrency & its concurrency frameworks



Motivation for Android Concurrency

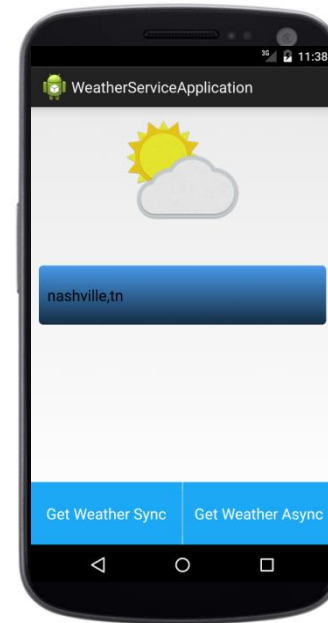
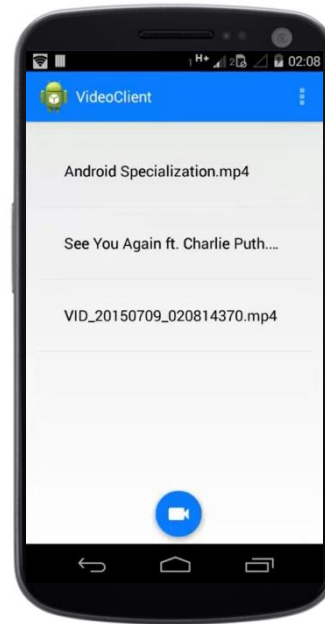
Motivation for Android Concurrency

- Many Android apps require and/or benefit from concurrency



Motivation for Android Concurrency

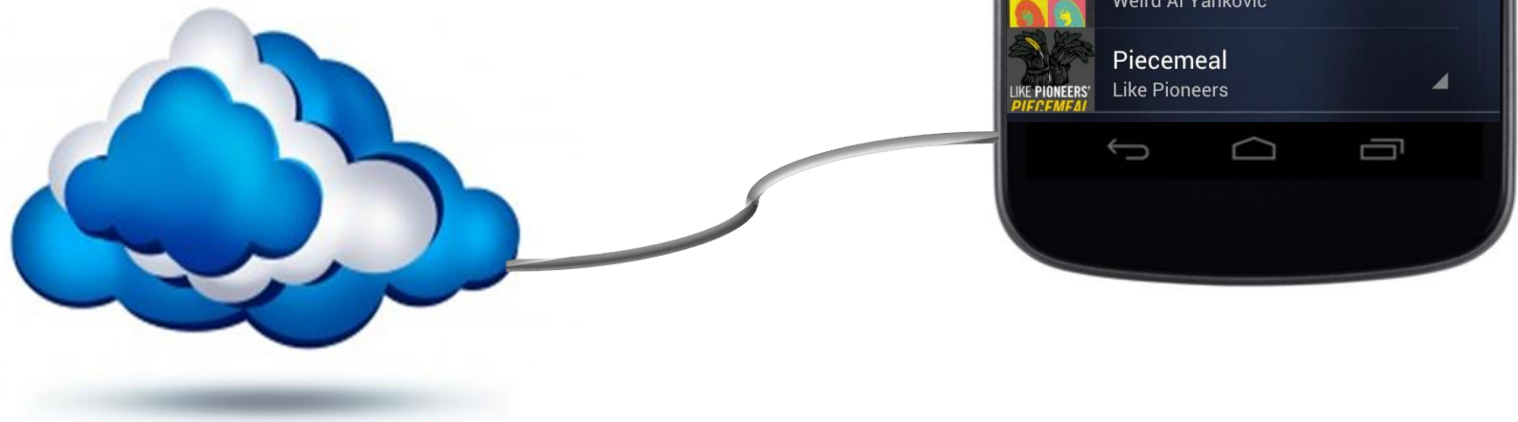
- Many Android apps require and/or benefit from concurrency
- These apps perform long-duration operations and/or access remote resources in the background



Often (but not always), apps interact with servers that reside in the cloud

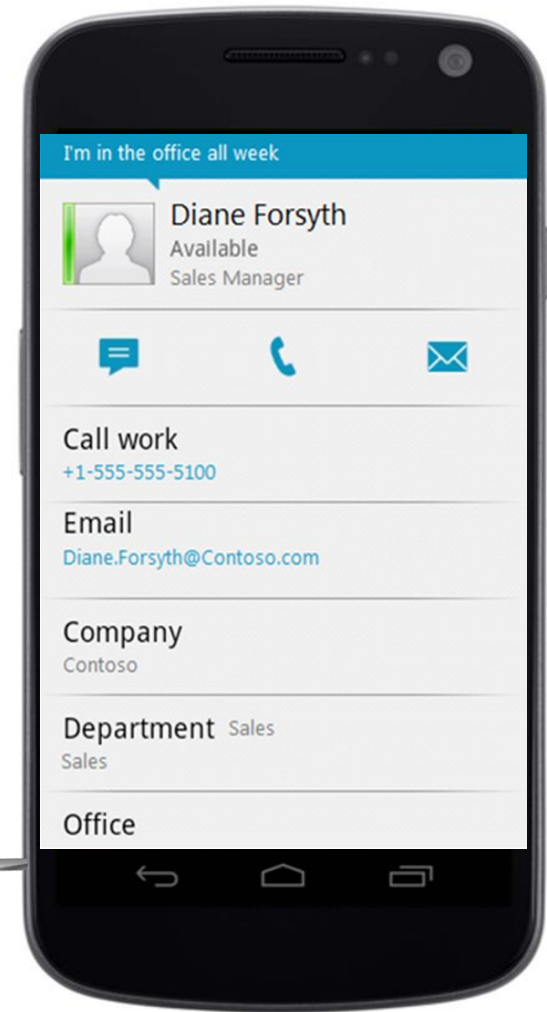
Motivation for Android Concurrency

- Many Android apps require and/or benefit from concurrency
 - These apps perform long-duration operations and/or access remote resources in the background, e.g.
 - Play multimedia content on a device
 - e.g., music or videos



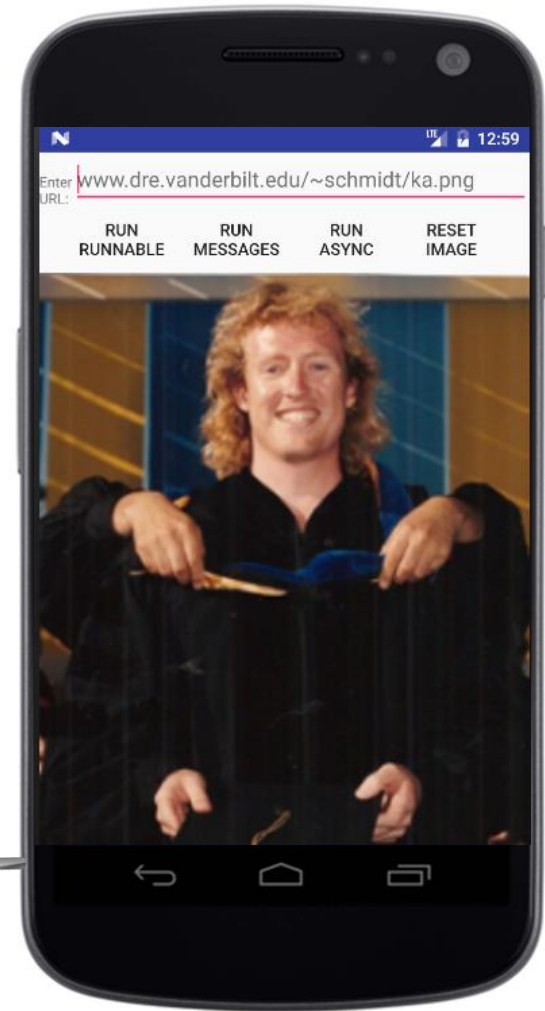
Motivation for Android Concurrency

- Many Android apps require and/or benefit from concurrency
 - These apps perform long-duration operations and/or access remote resources in the background, e.g.
 - Play multimedia content on a device
 - Synchronize contents of phone databases with cloud servers
 - e.g., email, contacts, calendar, MMS/SMS, etc.



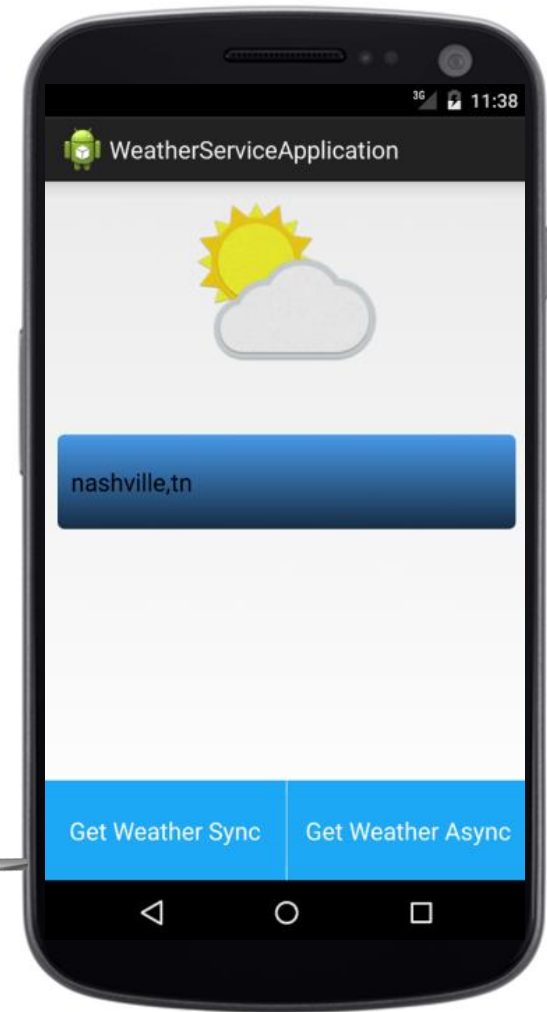
Motivation for Android Concurrency

- Many Android apps require and/or benefit from concurrency
 - These apps perform long-duration operations and/or access remote resources in the background, e.g.
 - Play multimedia content on a device
 - Synchronize contents of phone databases with cloud servers
 - Download & store images



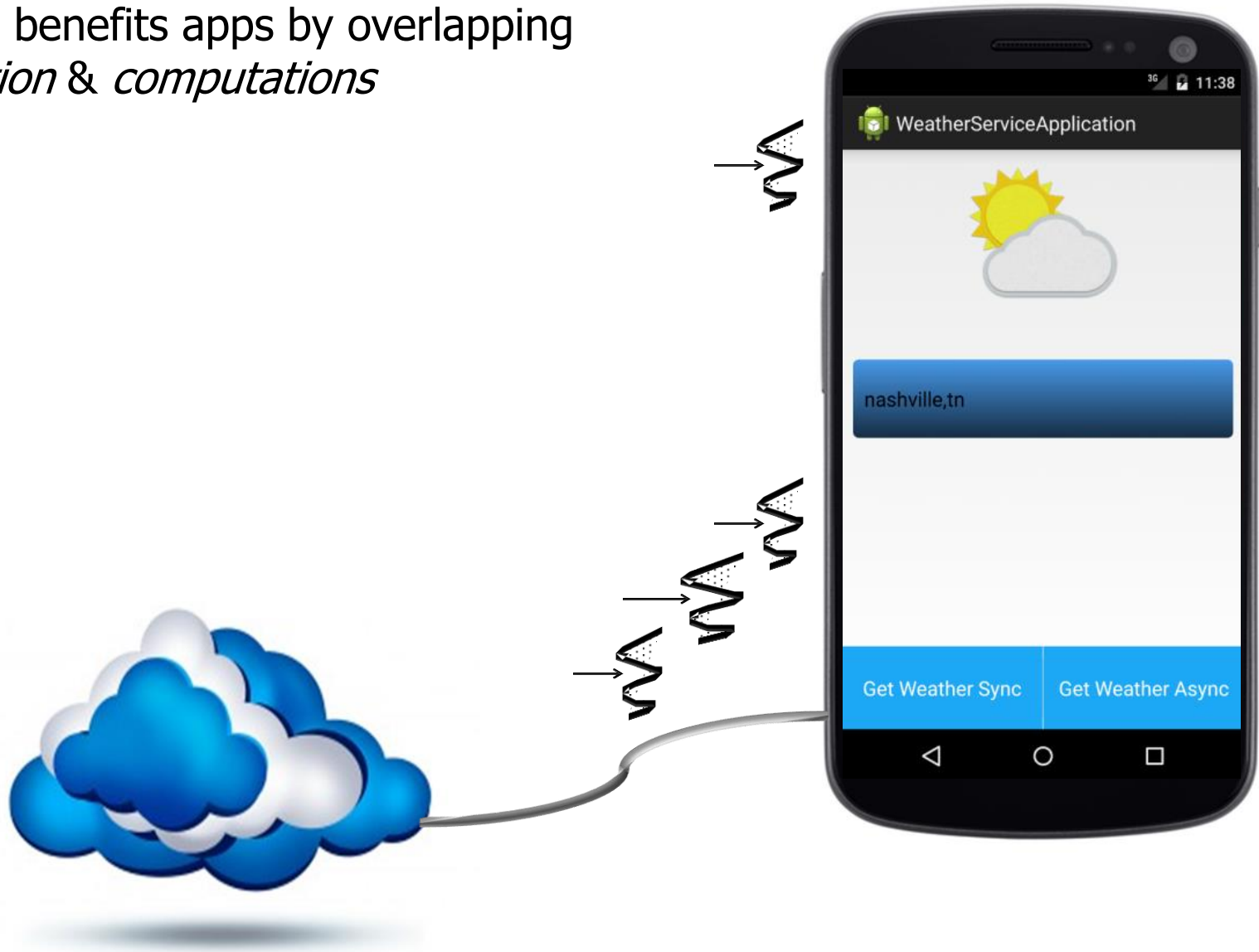
Motivation for Android Concurrency

- Many Android apps require and/or benefit from concurrency
 - These apps perform long-duration operations and/or access remote resources in the background, e.g.
 - Play multimedia content on a device
 - Synchronize contents of phone databases with cloud servers
 - Download & store images
 - Access web services



Motivation for Android Concurrency

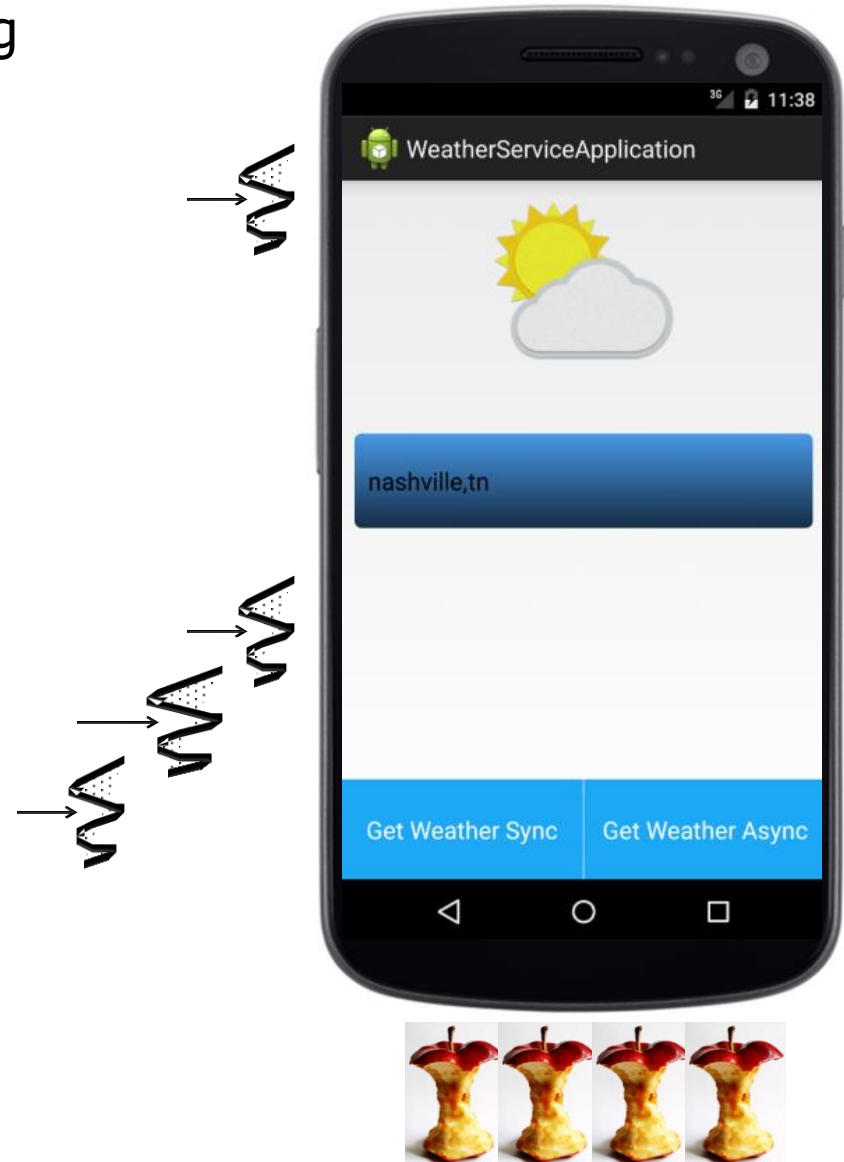
- Concurrency benefits apps by overlapping *communication* & *computations*



See earlier lessons on "*Motivation for Concurrency*"

Motivation for Android Concurrency

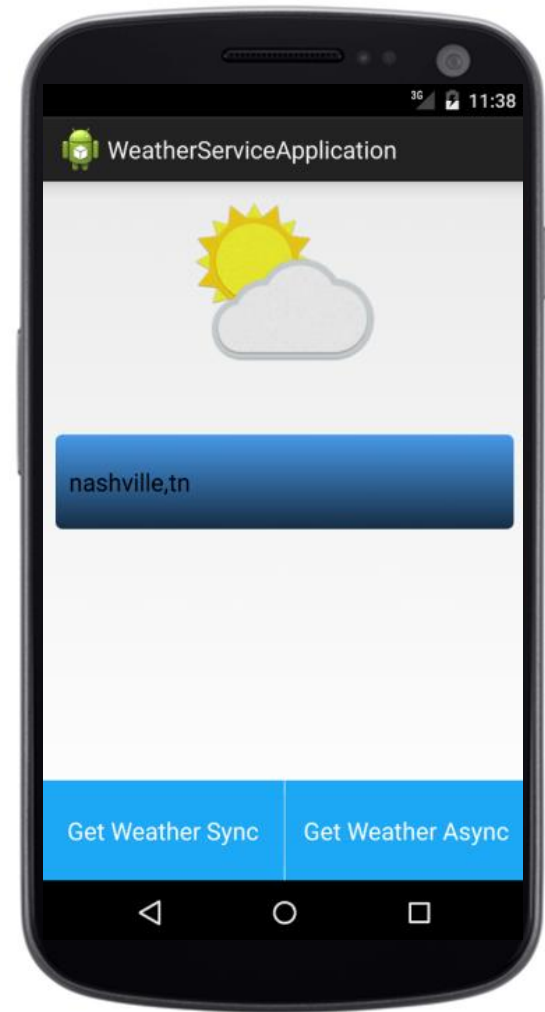
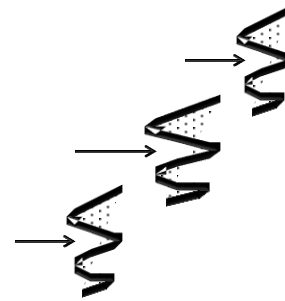
- Concurrency benefits apps by overlapping *communication* & *computations*, e.g.
- Increase performance via multi-core parallelism



See developer.qualcomm.com/blog/multi-threading-android-apps-multi-core-processors-part-1-2

Motivation for Android Concurrency

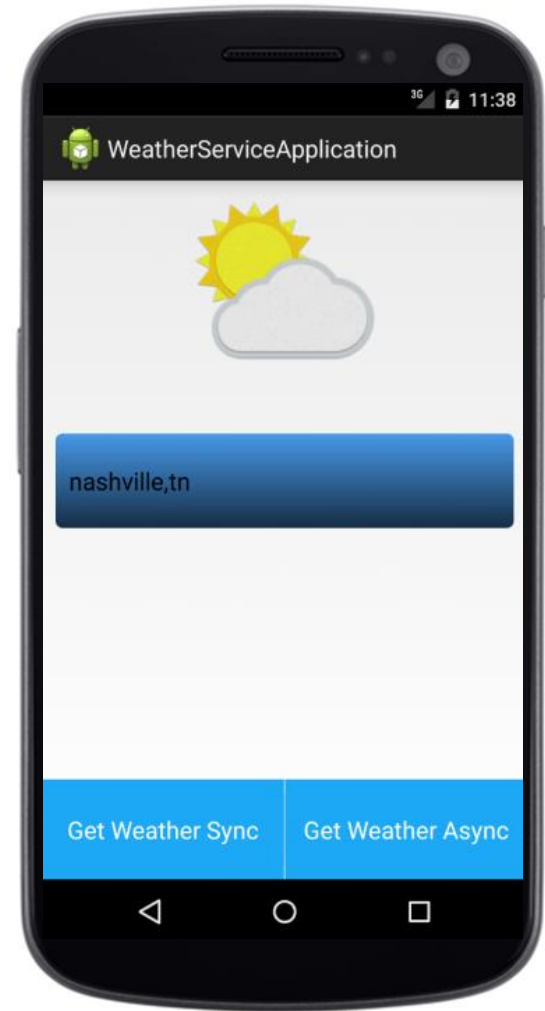
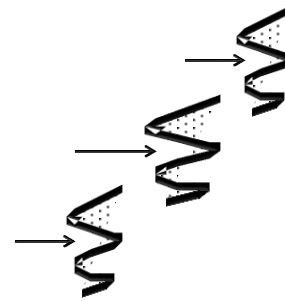
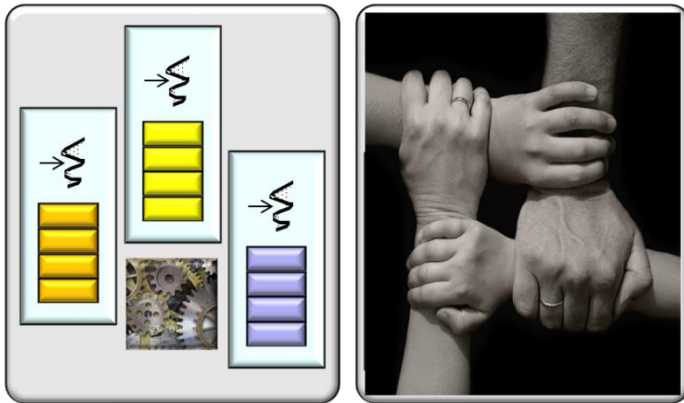
- Concurrency benefits apps by overlapping *communication & computations*, e.g.
 - Increase performance via multi-core parallelism
- Improve responsiveness by running long-duration operations in background thread(s)



See developer.android.com/training/articles/perf-anr.html

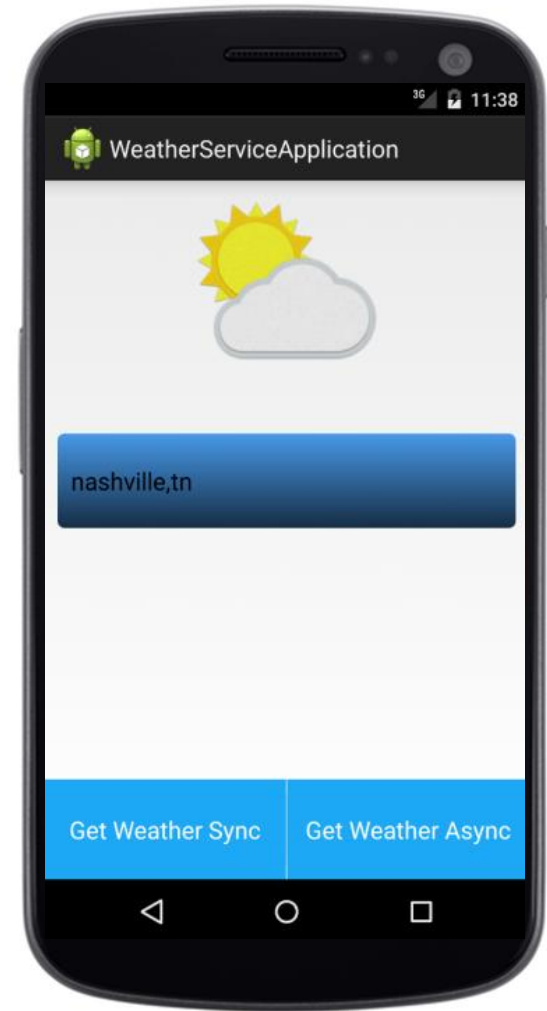
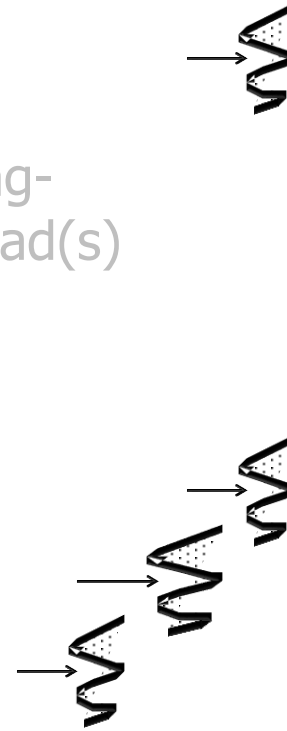
Motivation for Android Concurrency

- Concurrency benefits apps by overlapping *communication & computations*, e.g.
 - Increase performance via multi-core parallelism
 - Improve responsiveness by running long-duration operations in background thread(s)
 - Simplify program structure by allowing threads to block synchronously



Motivation for Android Concurrency

- Concurrency benefits apps by overlapping *communication & computations*, e.g.
 - Increase performance via multi-core parallelism
 - Improve responsiveness by running long-duration operations in background thread(s)
 - Simplify program structure by allowing threads to block synchronously
 - Can yield more natural control flow & collaboration within an app

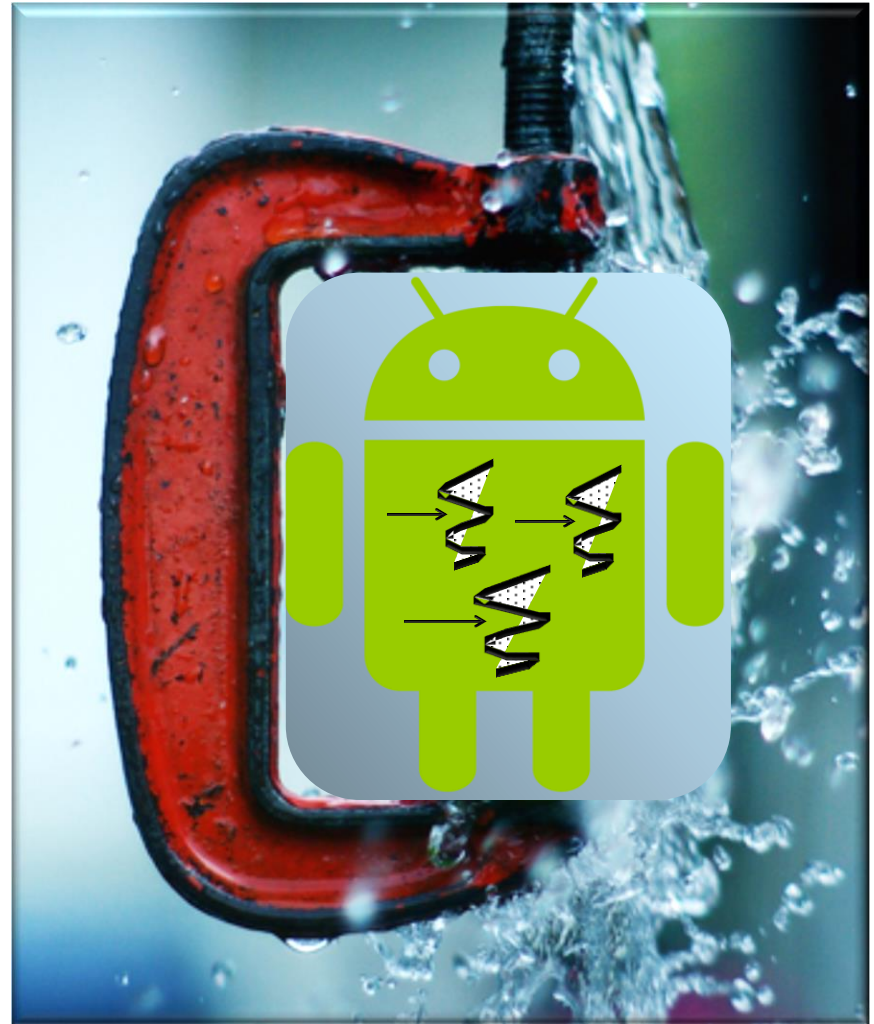


See en.wikipedia.org/wiki/Control_flow

Motivating Android's Concurrency Frameworks

Motivating Android Concurrency Frameworks

- Android's concurrency frameworks also address design constraints

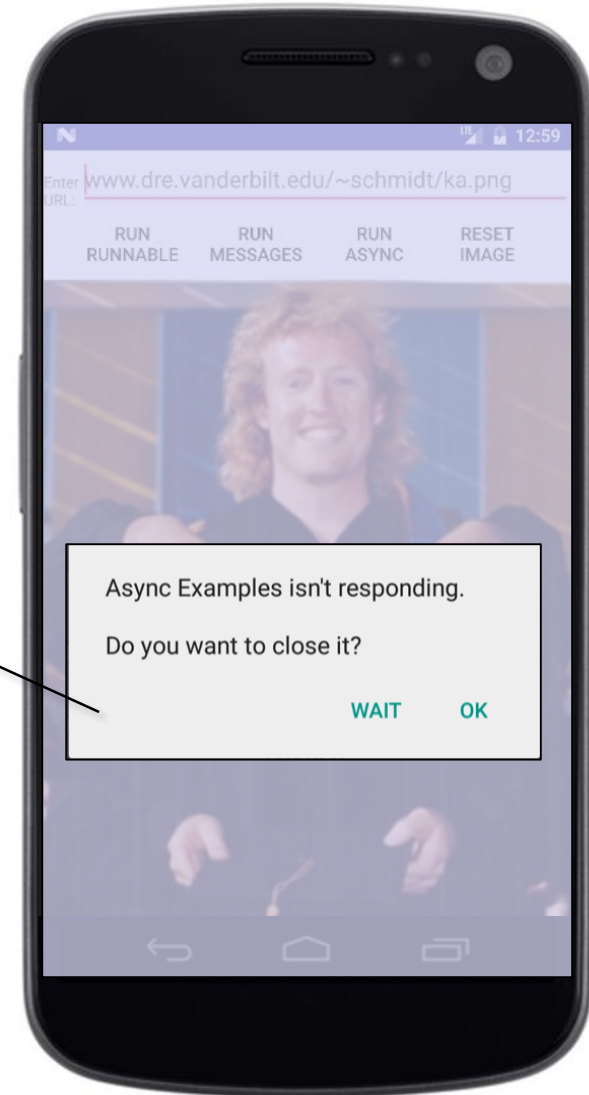


See developer.android.com/guide/components/processes-and-threads.html#Threads

Motivating Android Concurrency Frameworks

- Android's concurrency frameworks also address design constraints, e.g.
 - "ANR" dialog is generated if the UI thread blocks too long

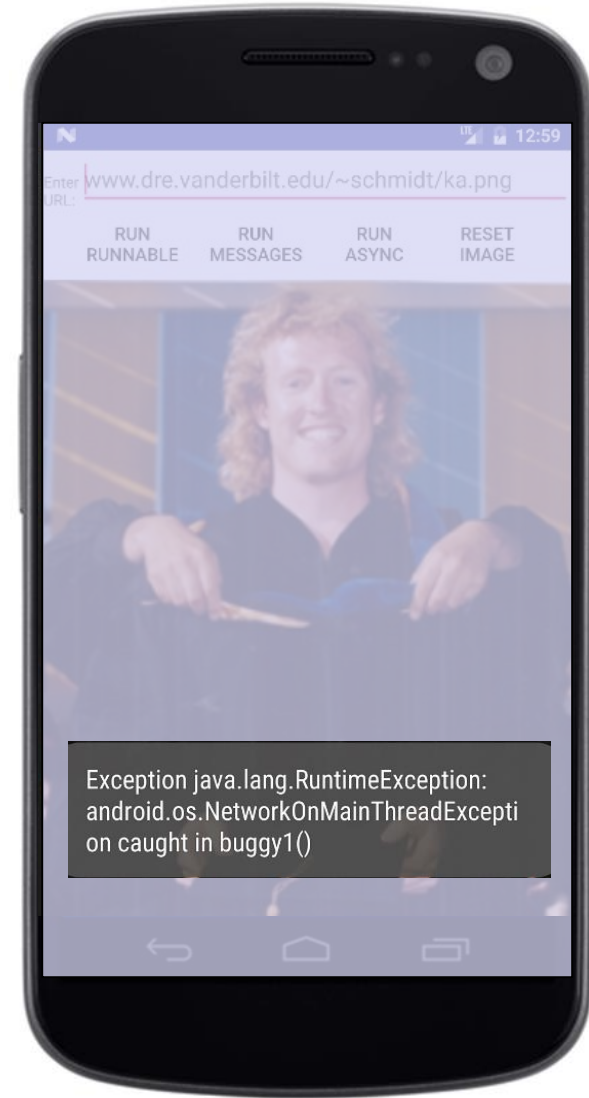
The UI thread can't block for more than several seconds, so it can't be used for long-duration operations



See developer.android.com/training/articles/perf-anr.html

Motivating Android Concurrency Frameworks

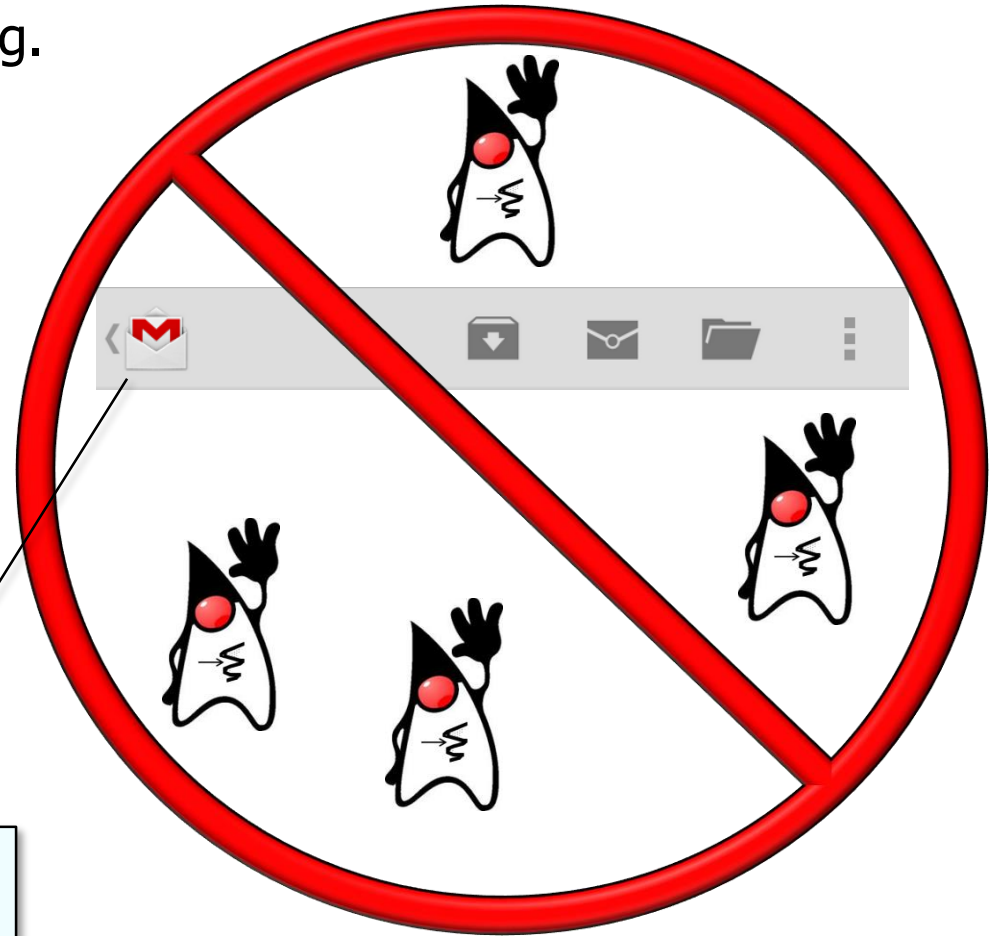
- Android's concurrency frameworks also address design constraints, e.g.
 - "ANR" dialog is generated if the UI thread blocks too long
- Network calls are disallowed on the UI thread by default



See blog.vogella.com/2012/02/22/android-strictmode-networkonmainthreadexception

Motivating Android Concurrency Frameworks

- Android's concurrency frameworks also address design constraints, e.g.
 - "ANR" dialog is generated if the UI thread blocks too long
 - Network calls are disallowed on the UI thread by default
 - Non-UI threads can't access UI toolkit components directly

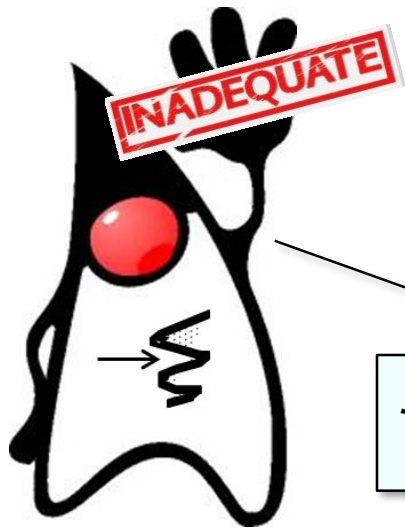


*UI toolkit components
aren't thread-safe*

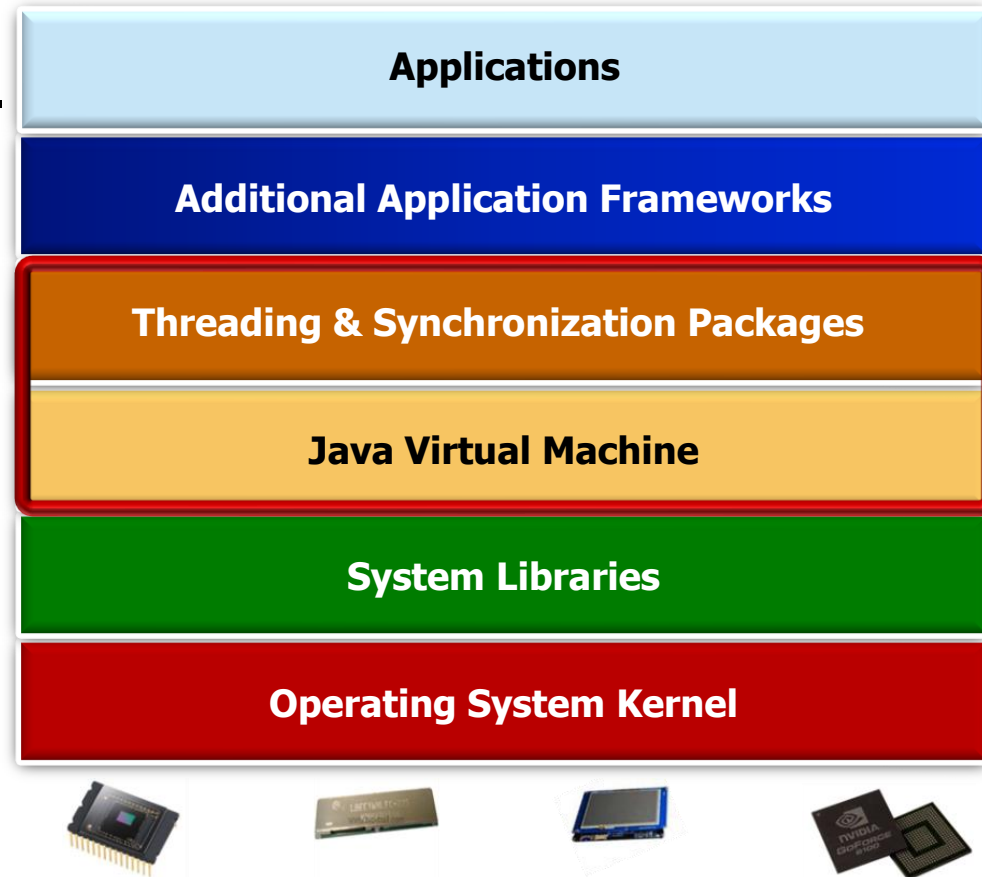
See android-developers.blogspot.com/2009/05/painless-threading.html

Motivating Android Concurrency Frameworks

- Android's concurrency frameworks also address design constraints, e.g.
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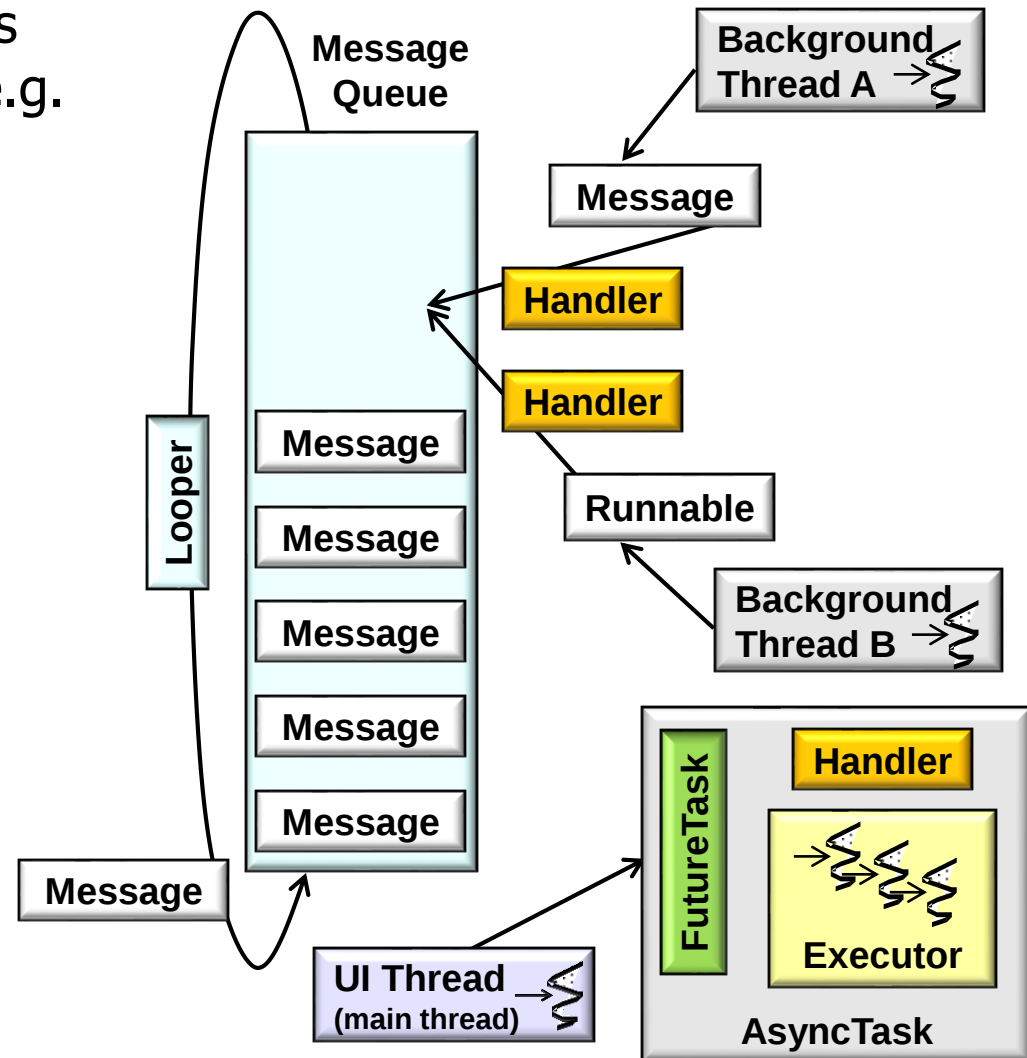
Java concurrency mechanisms alone cannot address these constraints!!



See www.dre.vanderbilt.edu/~schmidt/LiveLessons/CPIJava

Motivating Android Concurrency Frameworks

- Android's concurrency frameworks also address design constraints, e.g.
 - "ANR" dialog is generated if the UI thread blocks too long
 - Network calls are disallowed on the UI thread by default
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Android concurrency frameworks address these design constraints

See developer.android.com/guide/components/processes-and-threads.html#WorkerThreads

Motivating Android Concurrency Frameworks

- The “Buggy Downloader” app motivates the need for Android’s concurrency frameworks



See github.com/douglasraigschmidt/POSA/tree/master/ex/M4/BuggyDownloader

Motivating Android Concurrency Frameworks

- The “Buggy Downloader” app motivates the need for Android’s concurrency frameworks
- “Buggy1” throws an exception since the image is downloaded in the UI thread



Motivating Android Concurrency Frameworks

- The “Buggy Downloader” app motivates the need for Android’s concurrency frameworks
 - “Buggy1” throws an exception since the image is downloaded in the UI thread
 - “Buggy2” throws an exception since a UI component is accessed via a background thread



End of Android Concurrency Frameworks: Motivation