

Overview of Java 8 Concurrent & Parallel Programming

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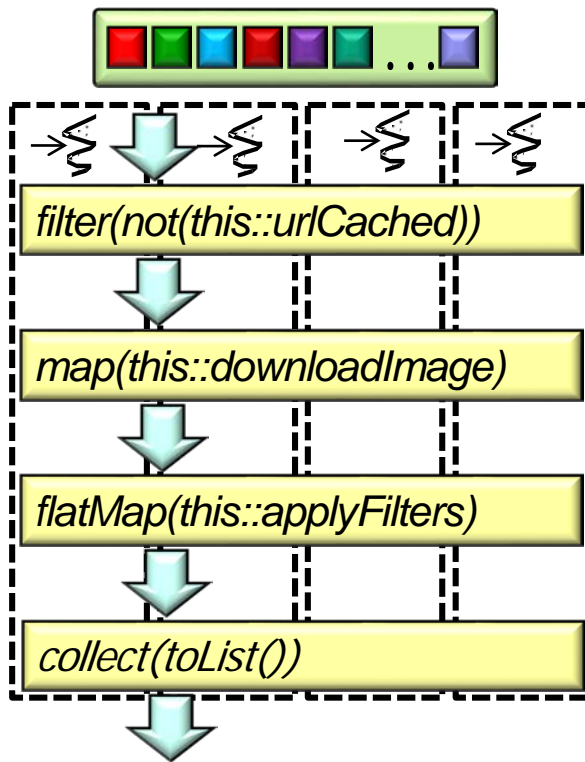


Learning Objectives in this Lesson

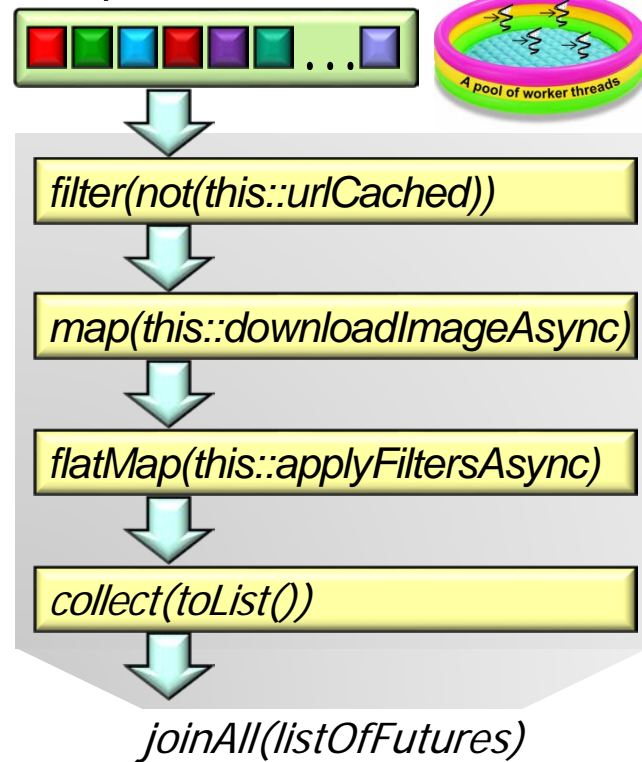
- Know what topics we'll cover



Parallel Streams



Completable Futures



Learning Objectives in this Lesson

- Know what topics we'll cover
- Learn where to find Java 8 & relevant IDEs



Learning Objectives in this Lesson

- Know what topics we'll cover
- Learn where to find Java 8 & relevant IDEs
- Be able to locate examples of Java 8 concurrent & parallel programs

USE THE
SOURCE LUKE!



Branch: master New pull request		Create new file	Upload files	Find file	Clone or download
douglasraigschmidt updates		Latest commit #67fd89 35 minutes ago			
BarrierTaskGang	Updates	10 months ago			
BuggyQueue	updates	a day ago			
BusySynchronizedQueue	updates	4 months ago			
DeadlockQueue	Refactored	3 years ago			
ExpressionTree	Updates	10 months ago			
Factorials	update	5 days ago			
ImageStreamGang	updates	22 days ago			
ImageTaskGangApplication	Updates	10 months ago			
Java8	update	3 days ago			
PalantirManagerApplication		7 months ago			
PingPongApplication		10 months ago			
PingPongWrong		3 years ago			
SearchStreamForkJoin		35 minutes ago			
SearchStreamGang		3 hours ago			
SearchStreamSplitter		37 minutes ago			
SearchTaskGang		4 months ago			
SimpleAtomicLong		2 years ago			
SimpleBlockingQueue	Updates	4 months ago			
SimpleSearchStream	update	6 days ago			
ThreadJoinTest	updates	22 days ago			
ThreadedDownloads	Updates	10 months ago			
UserOrDaemonExecutor	Refactored	3 years ago			
UserOrDaemonRunnable	Updates	2 years ago			
UserOrDaemonThread	Updates	10 months ago			
UserThreadInterrupted	Update	2 years ago			
.gitattributes	Committed	3 years ago			
.gitignore	Updates	10 months ago			
README.md	updates	21 days ago			

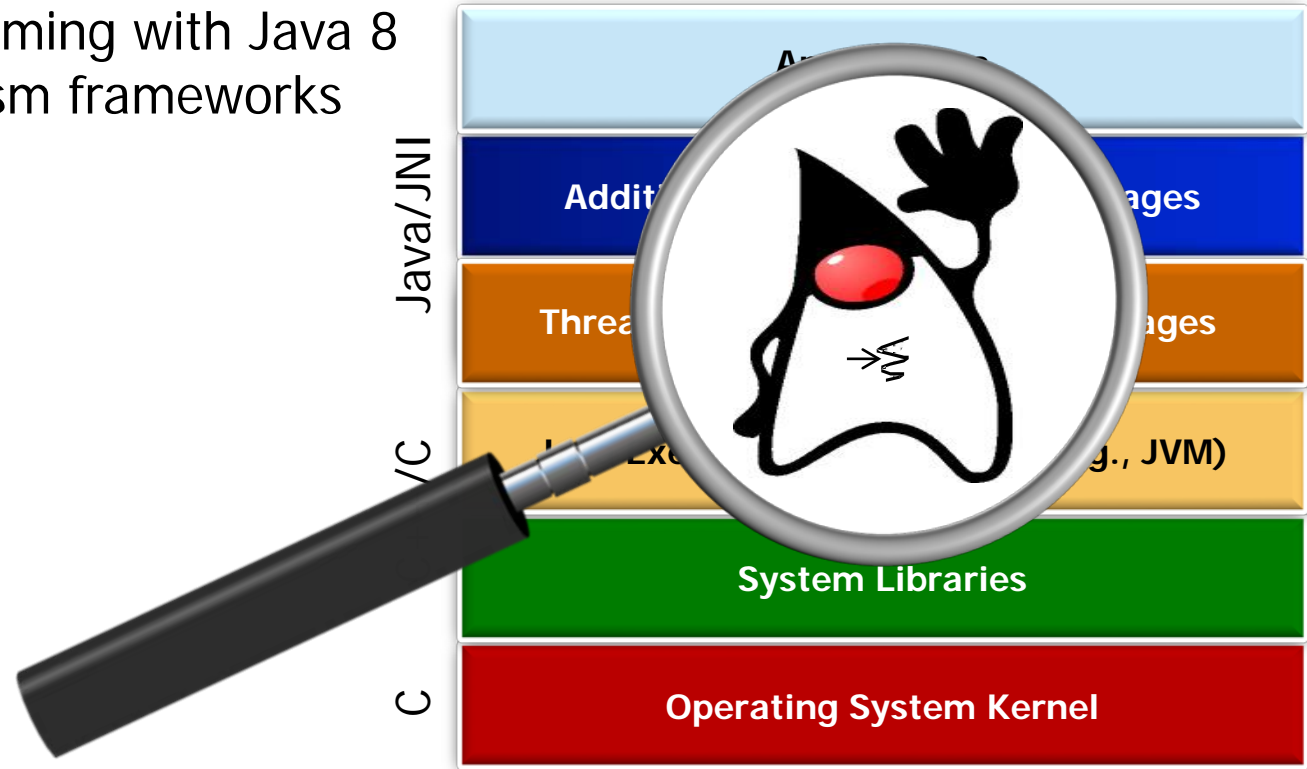
We'll review many of these examples, so feel free to clone or download this repo!

See www.github.com/douglasraigschmidt/LiveLessons

Overview of this Course

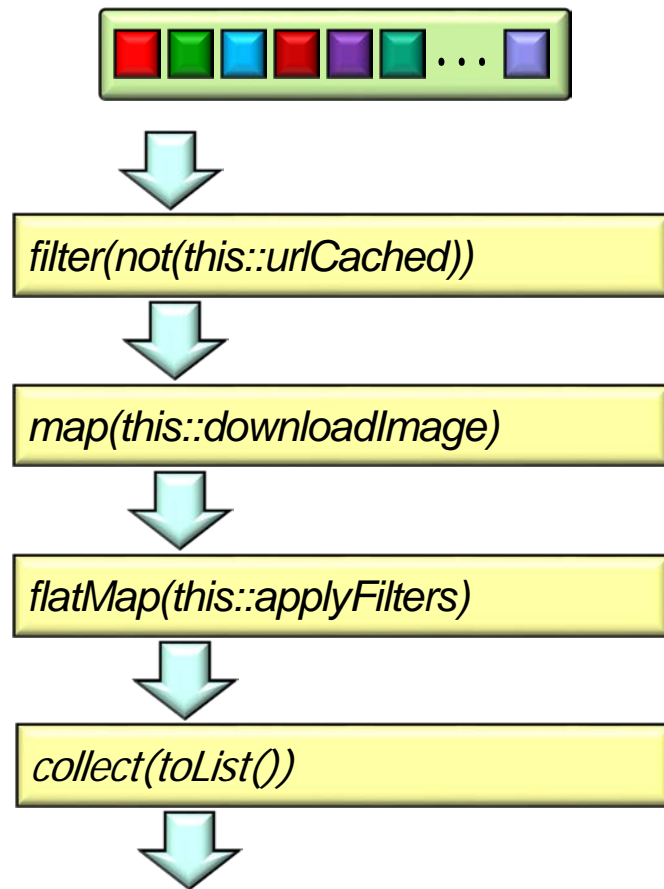
Overview of this Course

- We focus on programming with Java 8 concurrency/parallelism frameworks



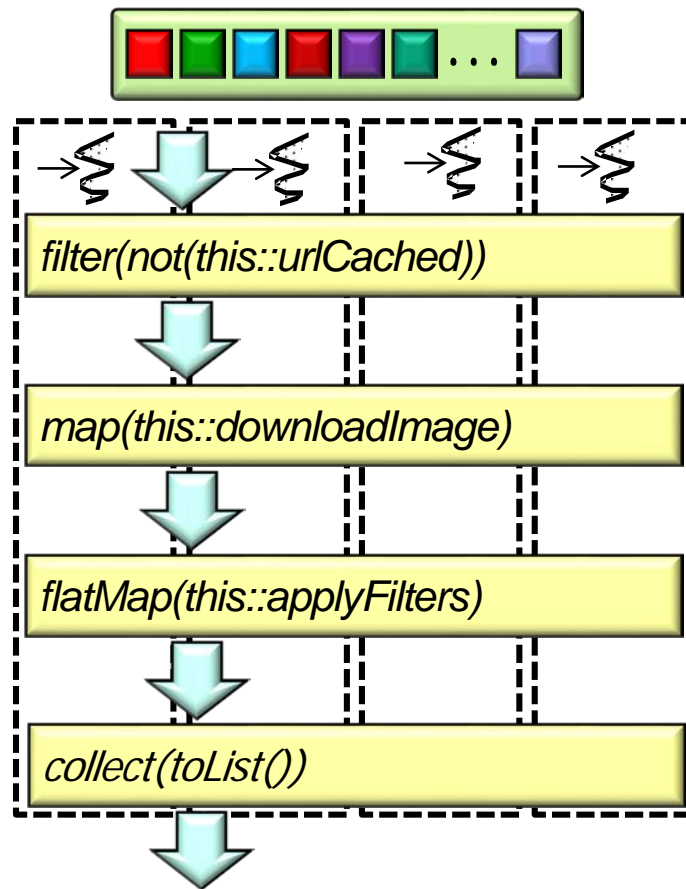
Overview of this Course

- We focus on programming with Java 8 concurrency/parallelism frameworks, e.g.
 - **Parallel streams**
 - Partition a stream into multiple substreams that run concurrently & combine into a “reduced” result



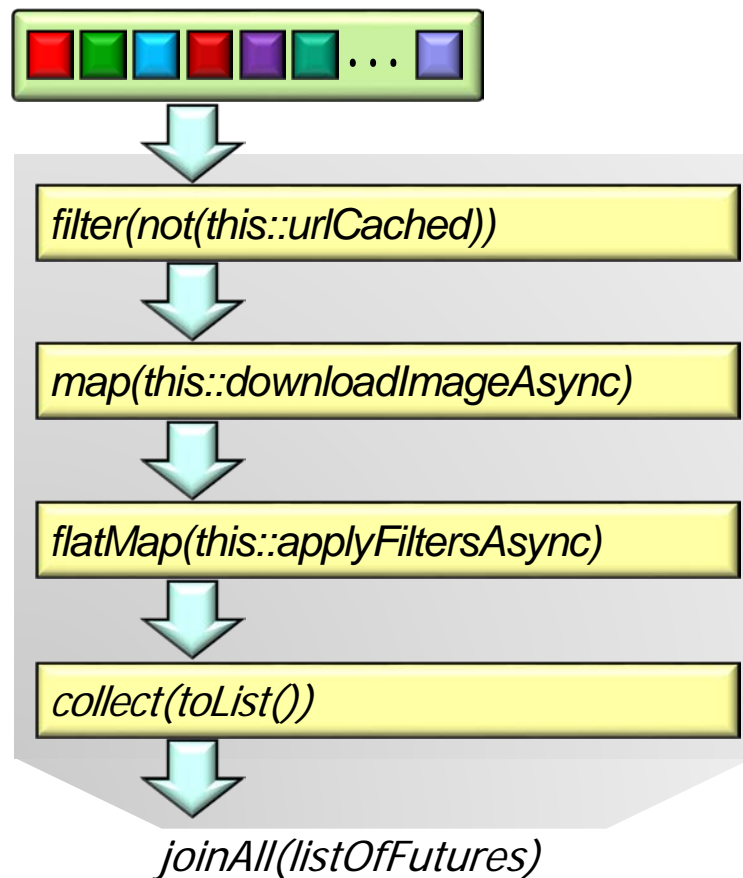
Overview of this Course

- We focus on programming with Java 8 concurrency/parallelism frameworks, e.g.
 - **Parallel streams**
 - Partition a stream into multiple substreams that run concurrently & combine into a “reduced” result
 - Chunks of data in a parallel stream can be mapped to multiple threads (& cores)



Overview of this Course

- We focus on programming with Java 8 concurrency/parallelism frameworks, e.g.
 - **Parallel streams**
 - **Completable futures**
 - Support dependent functions that trigger upon completion of asynchronous operations



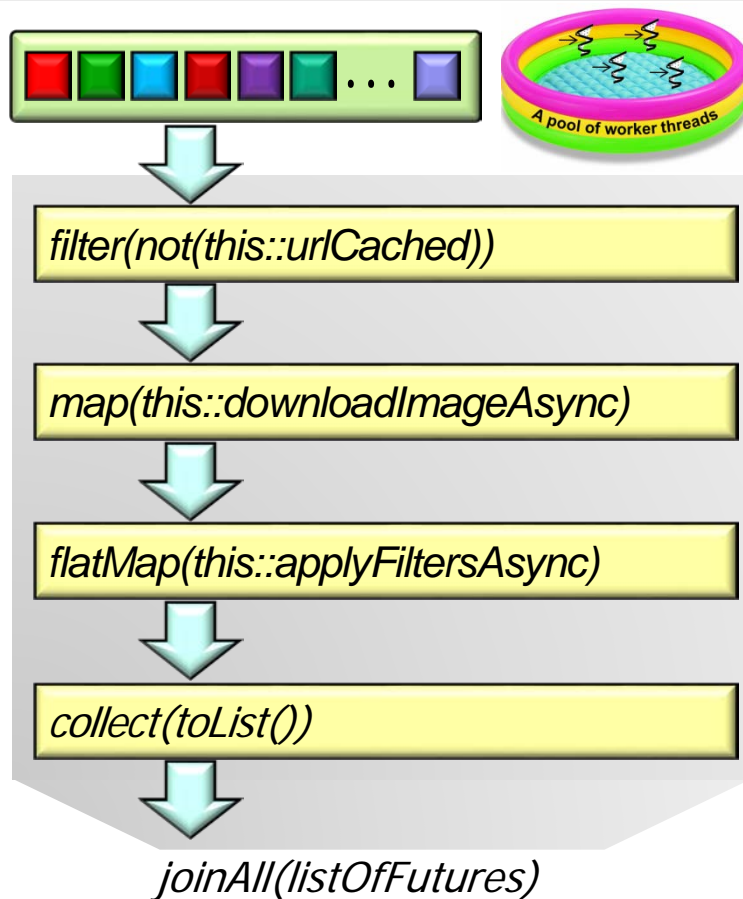
Overview of this Course

- We focus on programming with Java 8 concurrency/parallelism frameworks, e.g.

- **Parallel streams**

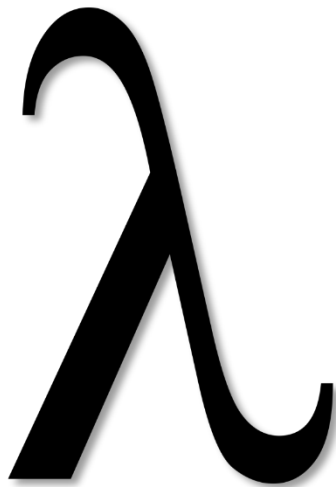
- **Completable futures**

- Support dependent functions that trigger upon completion of asynchronous operations
- Can be used in conjunction with thread pools to run asynchronous operations concurrently



Overview of this Course

- We also briefly cover Java 8 functional programming concepts & features
 - e.g., lambda expressions, method references, & functional interfaces



These features are the foundation for Java 8's concurrency/parallelism frameworks

Overview of this Course

- All Java 8 concurrent & parallel examples we cover are available on github

douglasraigschmidt updates		Latest commit a67Fd89 38 minutes ago
BarrierTaskGang	Updates	10 months ago
BuggyQueue	updates	a day ago
BusySynchronizedQueue	updates	4 months ago
DeadlockQueue	Refactored	3 years ago
ExpressionTree	Updates	10 months ago
Factorials	update	5 days ago
ImageStreamGang	updates	22 days ago
ImageTaskGangApplication	Updates	10 months ago
Java8	update	3 days ago
PalantiriManagerApplication	Updates	7 months ago
PingPongApplication	Updates	10 months ago
PingPongWrong	Refactored	3 years ago
SearchStreamForkJoin	updates	38 minutes ago

See www.github.com/douglasraigschmidt/LiveLessons

Overview of this Course

- Examples we don't cover in this course are covered in my LiveLessons course

Introduction

Java Concurrency LiveLessons 2nd Edition

Doug Schmidt

Addison-Wesley

livelessons video instruction from technology experts

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douglasraigschmidt updates

- BarrierTaskGang
- BuggyQueue
- BusySynchronizedQueue
- DeadlockQueue
- ExpressionTree
- Factorials
- ImageStreamGang
- ImageTaskGangApplication
- Java8
- PalantiriManagerApplication
- PingPongApplication
- PingPongWrong
- SearchStreamForkJoin

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

Overview of this Course

- My website has *lots* more information on concurrent & parallel programming



Digital Learning Offerings

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- [Pattern-Oriented Software Architecture](#) (POSA)

[Vanderbilt University Courses](#)

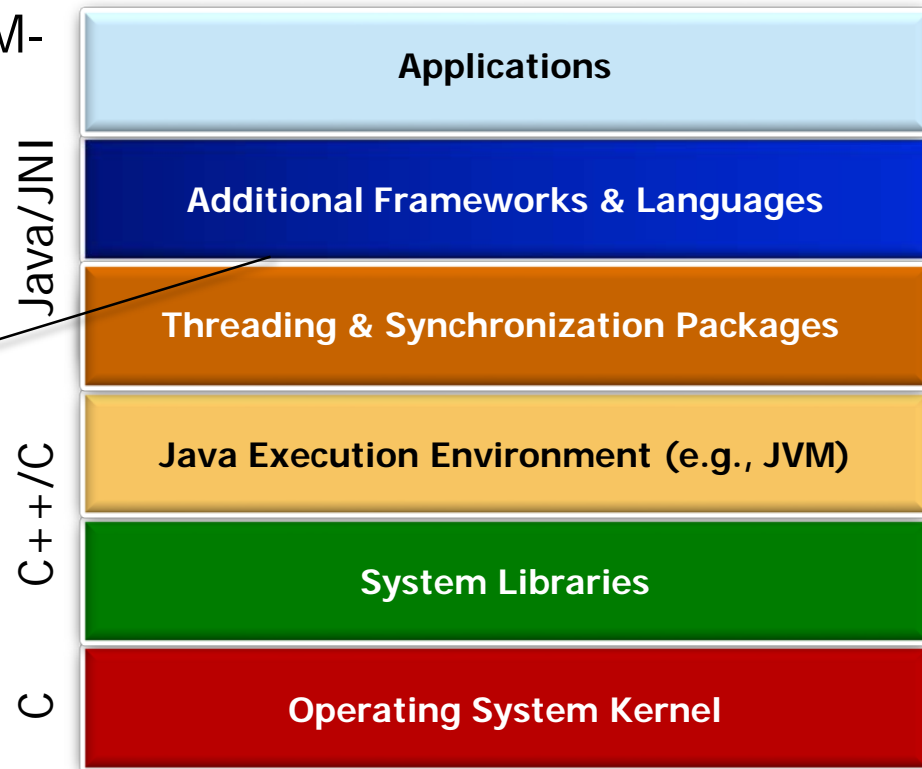
- [Playlist](#) from my [YouTube Channel](#) videos from [CS 892: Concurrent Java Programming with Android](#)
- [Playlist](#) from my [YouTube Channel](#) videos from [CS 251: Intermediate Software Design with Java](#)
- [Playlist](#) from my [YouTube Channel](#) videos from [CS 282: Concurrent Java Network Programming in Android](#)
- [Playlist](#) from my [YouTube Channel](#) videos from [CS 251: Intermediate Software Design with C++](#)
- [Playlist](#) from my [YouTube Channel](#) videos from [CS 282: Systems Programming for Android](#)

See www.dre.vanderbilt.edu/~schmidt/DigitalLearning

Overview of this Course

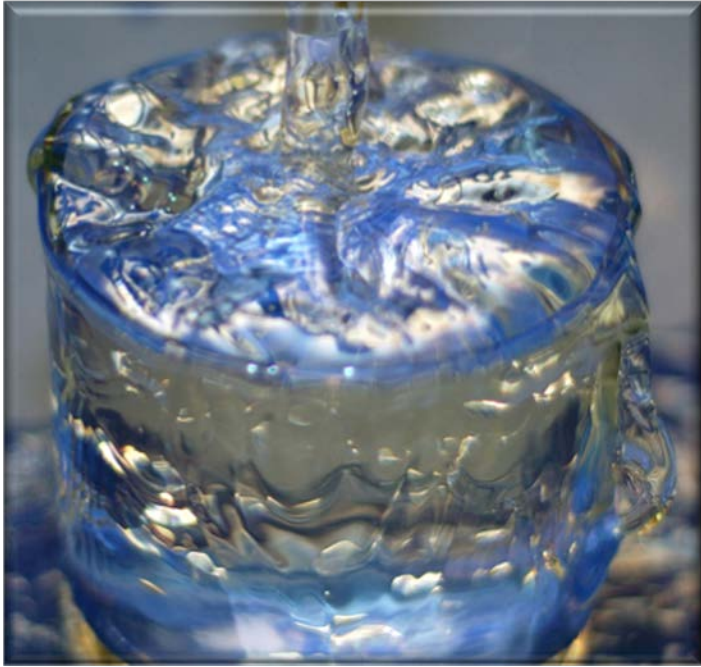
- There are also other Java-based & JVM-related frameworks & languages for concurrency & parallelism

*e.g., RxJava, Android, Java 9
Flow APIs, Scala, Kotlin, etc.*



Overview of this Course

- There are also other Java-based & JVM-related frameworks & languages for concurrency & parallelism



Java/JNI

C++/C

C

Applications

Additional Frameworks & Languages

Threading & Synchronization Packages

Java Execution Environment (e.g., JVM)

System Libraries

Operating System Kernel

Very interesting, but beyond the scope of this course!

Accessing Java 8 Features & Functionality

Accessing Java 8 Features & Functionality

- The Java 8 (& beyond) runtime environment (JRE) supports Java 8 features



The screenshot shows the Oracle Java SE Downloads page. At the top, there are tabs for Overview, Downloads, Documentation, Community, Technologies, and Training. The main heading is "Java SE Downloads". Below this, there are two download options: "Java Platform (JDK) 8u101 / 8u102" and "NetBeans with JDK 8", each with a "DOWNLOAD" button. Below these, there is a section for "Java Platform, Standard Edition" with a heading "Java SE 8u101 / 8u102". The text in this section states: "Java SE 8u101 includes important security fixes. Oracle strongly recommends that all Java SE 8 users upgrade to this release. Java SE 8u102 is a patch-set update, including all of 8u101 plus additional features (described in the release notes)." and includes a "Learn more" link. To the left of the download buttons, there is a list of links: "Installation Instructions", "Release Notes", "Oracle License", "Java SE Products", "Third Party Licenses", "Certified System Configurations", "Readme Files", and "JDK ReadMe". To the right of the list, there are three download buttons: "JDK DOWNLOAD", "Server JRE DOWNLOAD", and "JRE DOWNLOAD".



See docs.oracle.com/javase/8/docs/technotes/guides/install/install_overview.html

Accessing Java 8 Features & Functionality

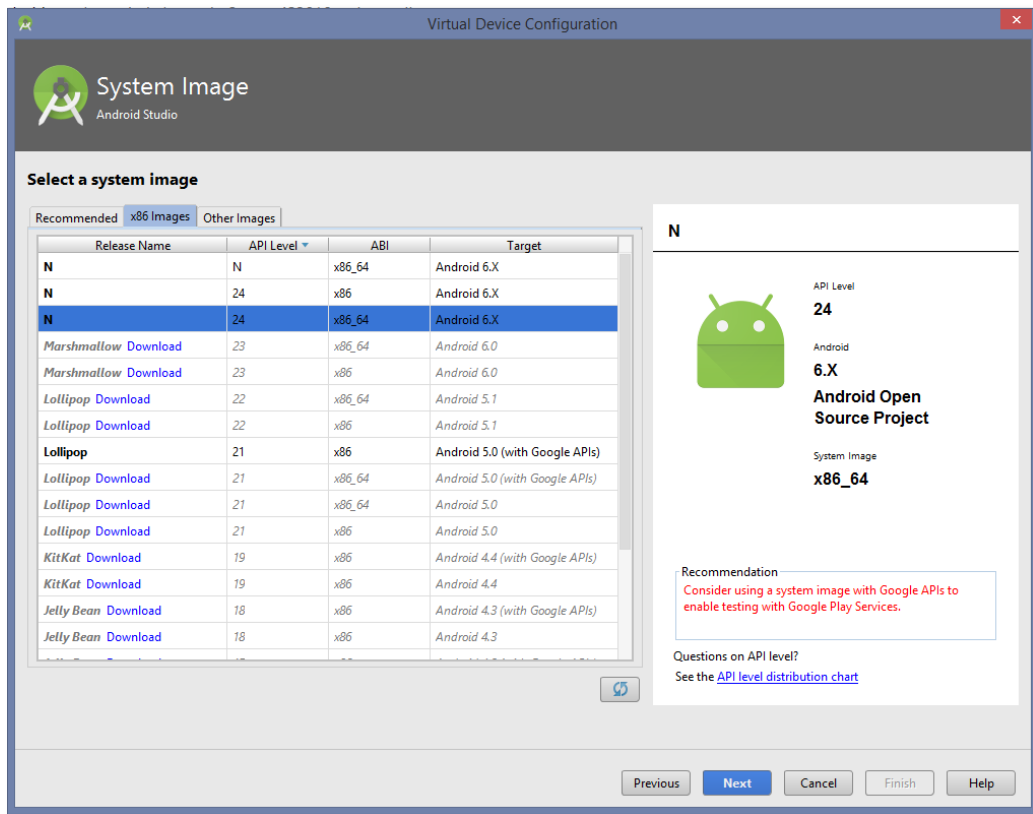
- The Java 8 (& beyond) runtime environment (JRE) supports Java 8 features
 - IntelliJ & Eclipse are popular Java 8 IDEs



See www.eclipse.org/downloads & www.jetbrains.com/idea/download

Accessing Java 8 Features & Functionality

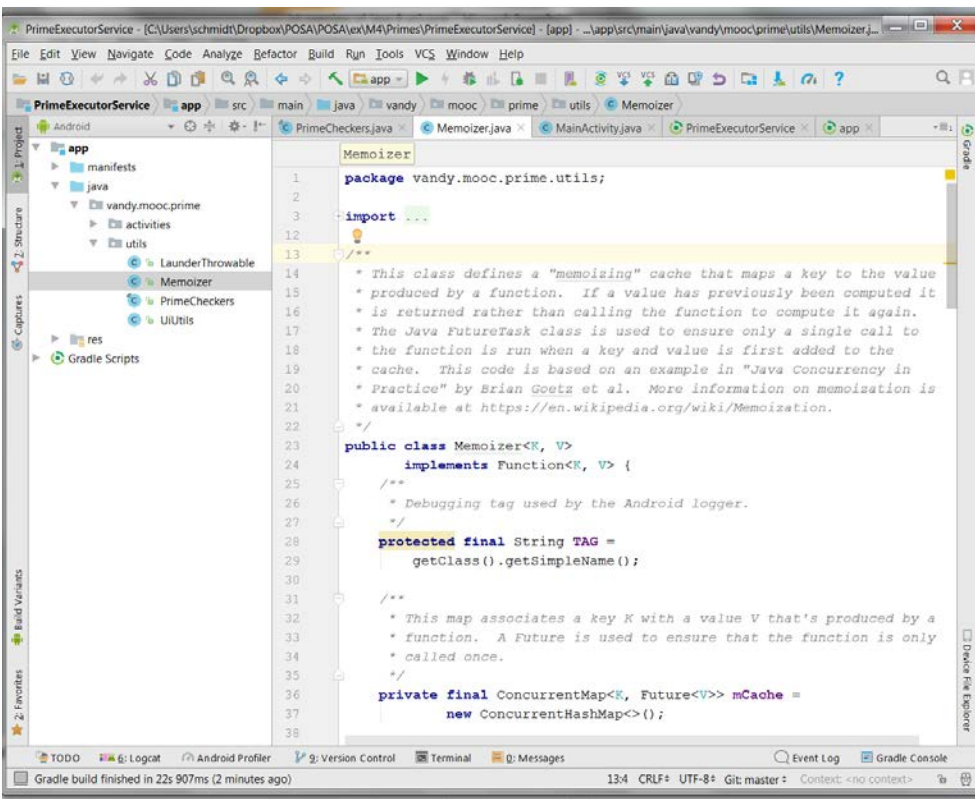
- The Java 8 (& beyond) runtime environment (JRE) supports Java 8 features
 - IntelliJ & Eclipse are popular Java 8 IDEs
- Most Java 8 features are supported by Android API level 24 (& beyond)



See android-developers.googleblog.com/2017/03/future-of-java-8-language-feature.html

Accessing Java 8 Features & Functionality

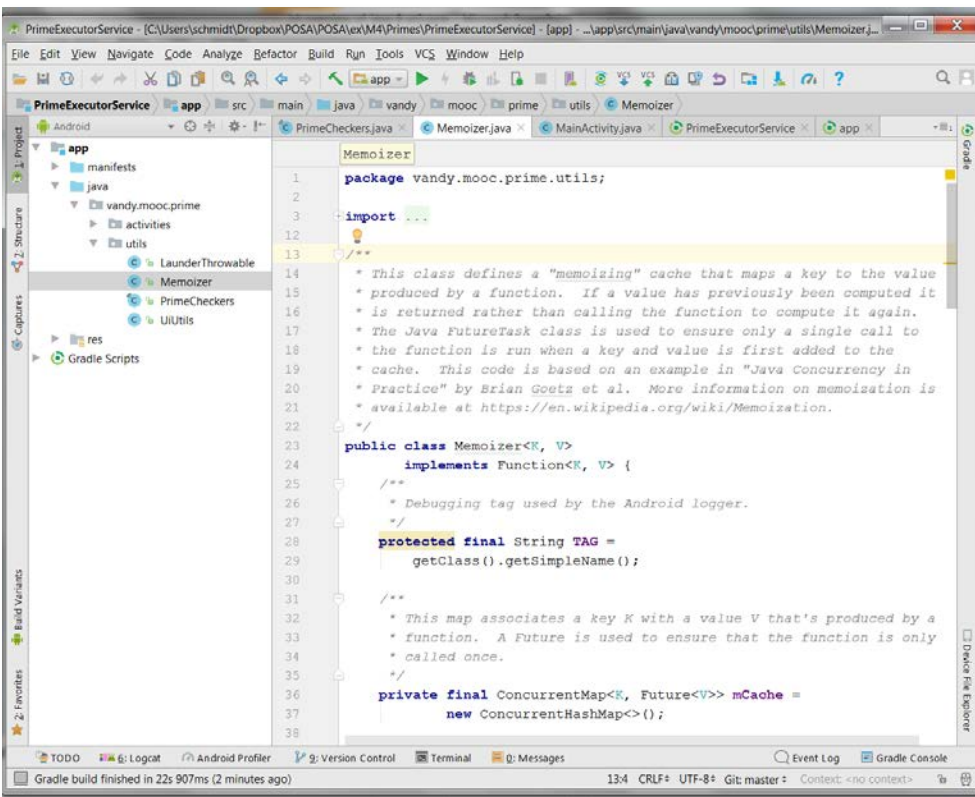
- The Java 8 (& beyond) runtime environment (JRE) supports Java 8 features
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- Most Java 8 features are supported by Android API level 24 (& beyond)
- A subset of Java 8 features are available in earlier Android releases, as well



See android-developers.googleblog.com/2017/04/java-8-language-features-support-update.html

Accessing Java 8 Features & Functionality

- The Java 8 (& beyond) runtime environment (JRE) supports Java 8 features
 - IntelliJ & Eclipse are popular Java 8 IDEs
- Most Java 8 features are supported by Android API level 24 (& beyond)
 - A subset of Java 8 features are available in earlier Android releases, as well
- Make sure to get Android Studio 2.4 or later!



See developer.android.com/studio/preview/features/java8-support.html

Accessing Java 8 Features & Functionality

- Java 8 source code is available online
 - For browsing
greppcode.com/file/repository.greppcode.com/java/root/jdk/openjdk/8-b132/java
 - For downloading
jdk8.java.net/download.html



The screenshot shows the Java.net website. At the top, the Java logo and 'Java.net' text are followed by the tagline 'The Source for Java Technology Collaboration'. On the right, there are links for 'Login', 'Register', and 'Help'. A sidebar on the left lists 'JDK 8' resources: 'Downloads', 'Feedback Forum', 'OpenJDK', and 'Planet JDK'. The main content area is titled 'JDK 8 Project' with the subtitle 'Building the next generation of the JDK platform'. Below this, there are two columns. The left column is titled 'JDK 8 snapshot builds' and lists links for 'Download 8u40 early access snapshot builds', 'Source code (instructions)', 'Official Java SE 8 Reference Implementations', and 'Early Access Build Test Results (instructions)'. The right column is titled 'We Want Contributions!' and contains text about contributing to the platform. At the bottom, there is a 'Feedback' section with instructions on how to provide feedback and report bugs.

Java.net The Source for Java Technology Collaboration

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JDK 8

- Downloads
- Feedback Forum
- OpenJDK
- Planet JDK

JDK 8 Project

Building the next generation of the JDK platform

JDK 8 snapshot builds

- [Download 8u40 early access snapshot builds](#)
- [Source code \(instructions\)](#)
- [Official Java SE 8 Reference Implementations](#)
- [Early Access Build Test Results \(instructions\)](#)

We Want Contributions!

Frustrated with a bug that never got fixed? Have a great idea for improving the Java SE platform? See [how to contribute](#) for information on making contributions to the platform.

Feedback

Please use the [Project Feedback](#) forum if you have suggestions for or encounter issues using JDK 8.

If you find bugs in a release, please submit them using the usual [Java SE bug reporting channels](#), not with the Issue tracker accompanying this project. Be sure to include complete version information from the output of the `java -version` command.

End of Course Overview