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VIỆN CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG

Mobile Programing

Chapter 1. Android Introduction

Note

- This slide is based on Google Android code labs slides
- Original slides: https://drive.google.com/drive/folders/1eu-LXxiHocSktGYpG04PfE9Xmr_pBY5P

3.1 The Android Studio debugger

Contents

- All code has bugs
- Android Studio logging
- Android Studio debugger
- Working with breakpoints
- Changing variables
- Stepping through code

All Code Has Bugs

Bugs

- Incorrect or unexpected result, wrong values
- Crashes, exceptions, freezes, memory leaks
- Causes
  - Human Design or Implementation Error > Fix your code
  - Software fault, but in libraries > Work around limitation
  - Hardware fault or limitation -> Make it work with what's available

Origin of the term "bug" (it's not what you think)

Debugging

- Find and fix errors
- Correct unexpected and undesirable behavior

- Unit tests help identify bugs and prevent regression
- User testing helps identify interaction bugs

Android Studio debugging tools

Android Studio has tools that help you

- identify problems
- find where in the source code the problem is created
- so that you can fix it

Logging with Android Studio

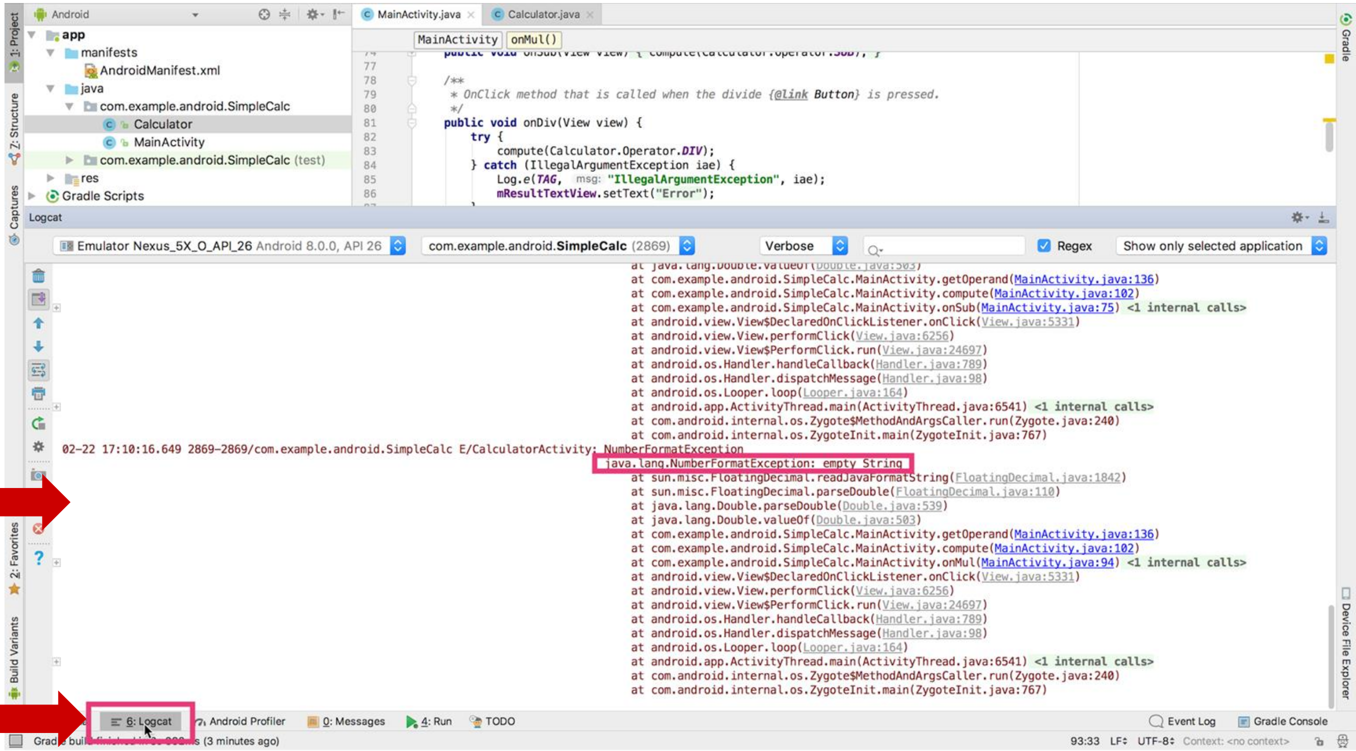
Add Log messages to your code

```
import android.util.Log;

// Use class variable with class name as tag
private static final String TAG =
    MainActivity.class.getSimpleName();

// Show message in Logcat pane of Android Studio
// Log.<log-level>(TAG, "Message");
Log.d(TAG, “Hello World”);
```

Open Logcat pane



```
public void onSub(View view) { compute(Calculator.Operator.SUB); }

/**
 * OnClick method that is called when the divide {@link Button} is pressed.
 */
public void onDiv(View view) {
    try {
        compute(Calculator.Operator.DIV);
    } catch (IllegalArgumentException iae) {
        Log.e(TAG,  msg: "IllegalArgumentException", iae);
        mResultTextView.setText("Error");
```

Emulator Nexus_5X_O_API_26 Android 8.0.0, API 26 | com.example.android.SimpleCalc (2869) | Verbose | ☑ Regex | Show only selected application

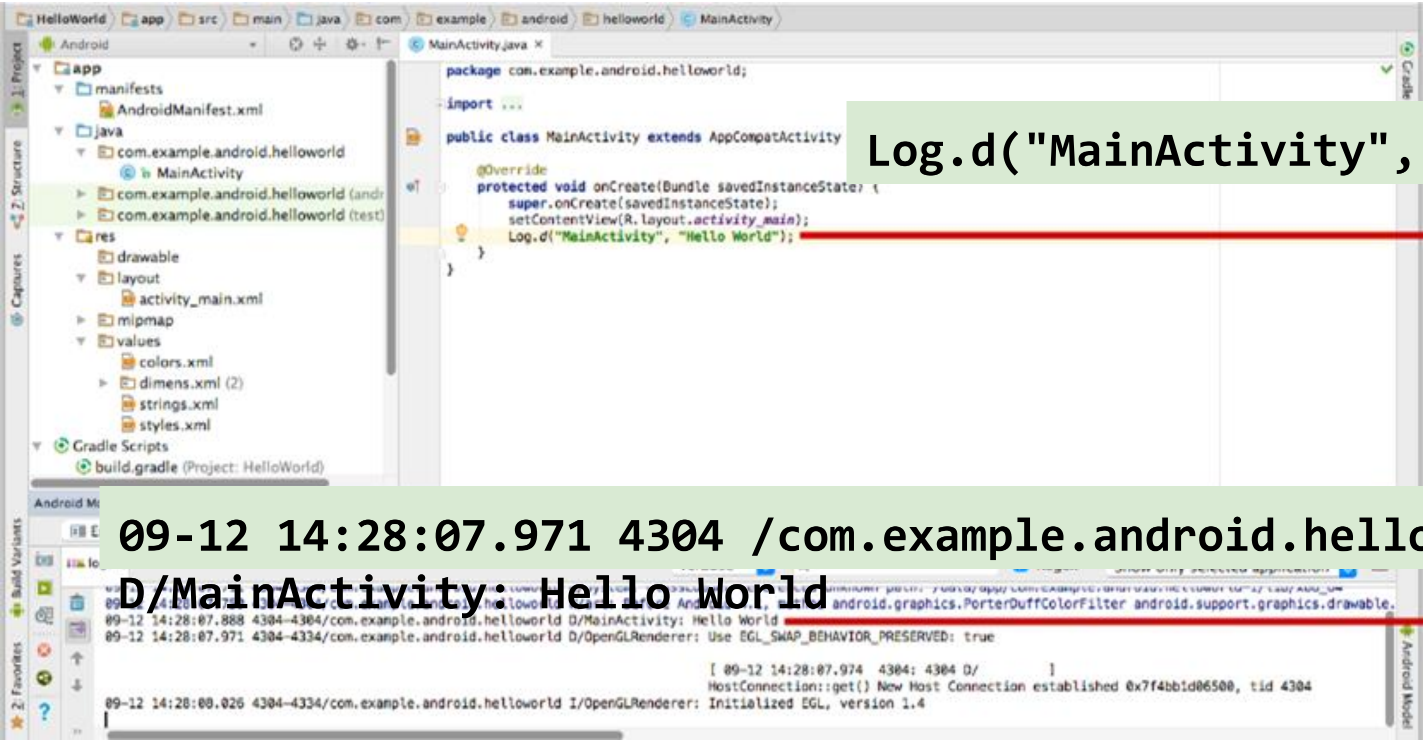
```
                                                              at java.lang.Double.valueOf(Double.java:503)
                                                              at com.example.android.SimpleCalc.MainActivity.getOperand(MainActivity.java:136)
                                                              at com.example.android.SimpleCalc.MainActivity.compute(MainActivity.java:102)
                                                              at com.example.android.SimpleCalc.MainActivity.onSub(MainActivity.java:75) <1 internal calls>
                                                              at android.view.View$DeclaredOnClickListener.onClick(View.java:5331)
                                                              at android.view.View.performClick(View.java:6256)
                                                              at android.view.View$PerformClick.run(View.java:24697)
                                                              at android.os.Handler.handleCallback(Handler.java:789)
                                                              at android.os.Handler.dispatchMessage(Handler.java:98)
                                                              at android.os.Looper.loop(Looper.java:164)
                                                              at android.app.ActivityThread.main(ActivityThread.java:6541) <1 internal calls>
                                                              at com.android.internal.os.Zygote$MethodAndArgsCaller.run(Zygote.java:240)
                                                              at com.android.internal.os.ZygoteInit.main(ZygoteInit.java:767)
02-22 17:10:16.649 2869-2869/com.example.android.SimpleCalc E/CalculatorActivity: NumberFormatException
                                                            java.lang.NumberFormatException: empty String
                                                              at sun.misc.FloatingDecimal.readJavaFormatString(FloatingDecimal.java:1842)
                                                              at sun.misc.FloatingDecimal.parseDouble(FloatingDecimal.java:110)
                                                              at java.lang.Double.parseDouble(Double.java:539)
                                                              at java.lang.Double.valueOf(Double.java:503)
                                                              at com.example.android.SimpleCalc.MainActivity.getOperand(MainActivity.java:136)
                                                              at com.example.android.SimpleCalc.MainActivity.compute(MainActivity.java:102)
                                                              at com.example.android.SimpleCalc.MainActivity.onMul(MainActivity.java:94) <1 internal calls>
                                                              at android.view.View$DeclaredOnClickListener.onClick(View.java:5331)
                                                              at android.view.View.performClick(View.java:6256)
                                                              at android.view.View$PerformClick.run(View.java:24697)
                                                              at android.os.Handler.handleCallback(Handler.java:789)
                                                              at android.os.Handler.dispatchMessage(Handler.java:98)
                                                              at android.os.Looper.loop(Looper.java:164)
                                                              at android.app.ActivityThread.main(ActivityThread.java:6541) <1 internal calls>
                                                              at com.android.internal.os.Zygote$MethodAndArgsCaller.run(Zygote.java:240)
                                                              at com.android.internal.os.ZygoteInit.main(ZygoteInit.java:767)
```

Grad… buil… s (3 minutes ago) | 93:33 LF: UTF-8: Context: <no context>

Logcat pane

Logcat tab

Inspect logging messages



```
package com.example.android.helloworld;

import ...

public class MainActivity extends AppCompatActivity

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        Log.d("MainActivity", "Hello World");
    }
}
```

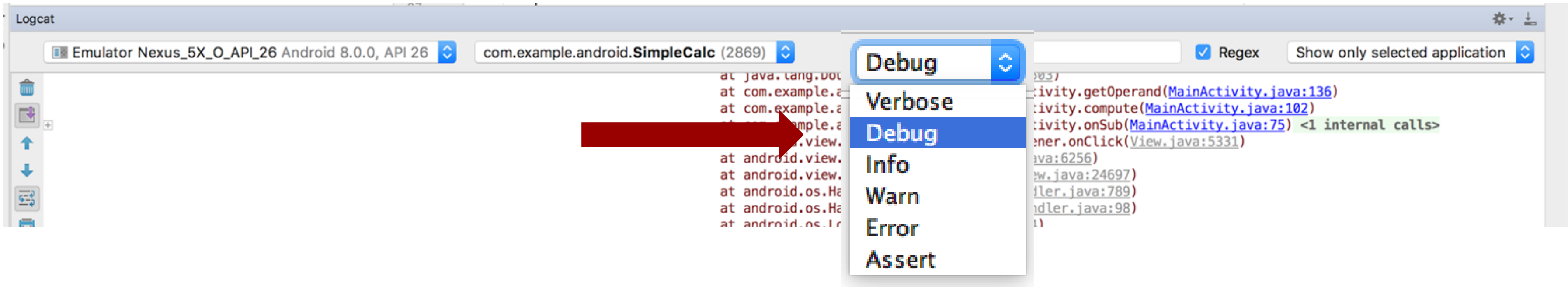
```
Log.d("MainActivity", "Hello World");
```

```
... android.graphics.PorterDuffColorFilter android.support.graphics.drawable.
09-12 14:28:07.888 4304-4304/com.example.android.helloworld D/MainActivity: Hello World
09-12 14:28:07.971 4304-4334/com.example.android.helloworld D/OpenGLRenderer: Use EGL_SWAP_BEHAVIOR_PRESERVED: true

                                                                              [ 09-12 14:28:07.974  4304: 4304 D/         ]
                                                                              HostConnection::get() New Host Connection established 0x7f4bb1d06500, tid 4304
09-12 14:28:08.026 4304-4334/com.example.android.helloworld I/OpenGLRenderer: Initialized EGL, version 1.4
```

```
09-12 14:28:07.971 4304 /com.example.android.helloworld
D/MainActivity: Hello World
```

Choose visible logging level



Emulator Nexus_5X_O_API_26 Android 8.0.0, API 26
com.example.android.SimpleCalc (2869)

Show only selected application

```
at java.lang.Dou                       303)
at com.example.a                       :ivity.getOperand(MainActivity.java:136)
at com.example.a                       :ivity.compute(MainActivity.java:102)
at com.example.a                       :ivity.onSub(MainActivity.java:75) <1 internal calls>
at          .view.                     ener.onClick(View.java:5331)
at android.view.                       ava:6256)
at android.view.                       ew.java:24697)
at android.os.Ha                       ller.java:789)
at android.os.Ha                       ndler.java:98)
at android.os.Lo                       1)
```

Displays logs with levels at this level or higher

Log Levels

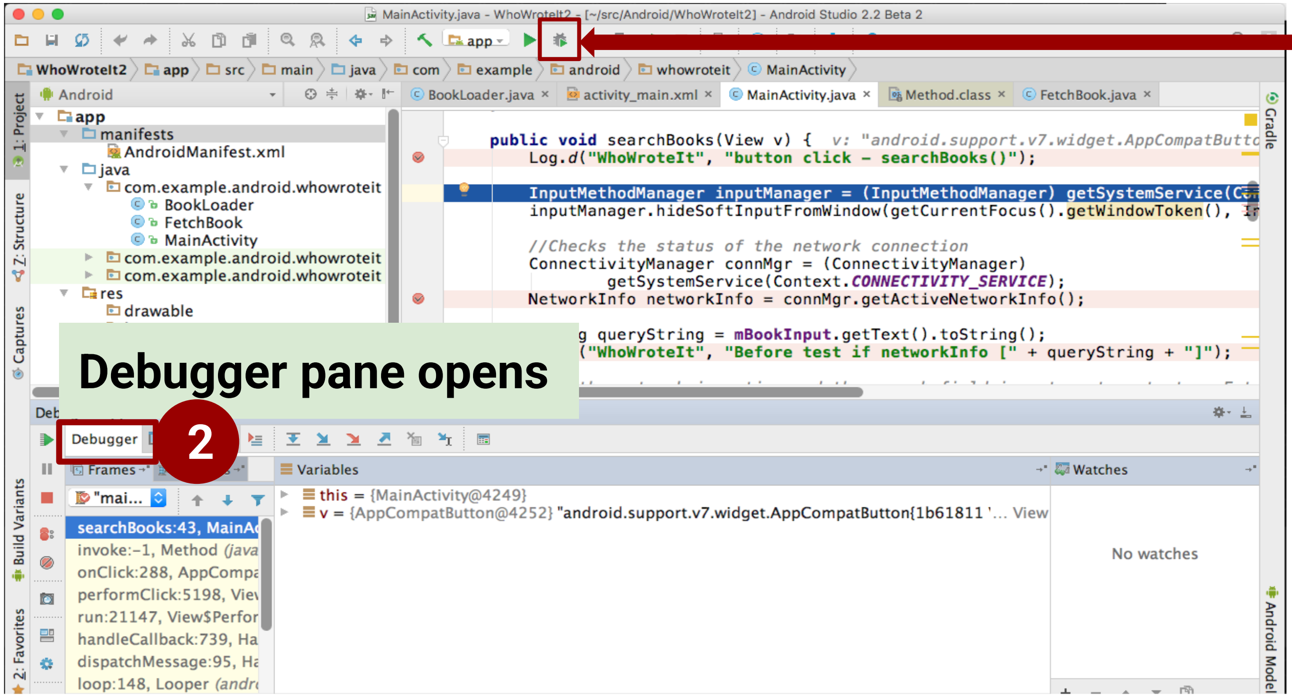
- **Verbose** - All verbose log statements and comprehensive system
- **Debug** - All debug logs, variable values, debugging notes
- **Info** - Status info, such as database connection
- **Warning** - Unexpected behavior, non-fatal issues
- **Error** - Serious error conditions, exceptions, crashes only

Debugging with Android Studio

What you can do

- Run in debug mode with attached debugger
- Set and configure breakpoints
- Halt execution at breakpoints
- Inspect execution stack frames and variable values
- Change variable values
- Step through code line by line
- Pause and resume a running program

Run in debug mode



MainActivity.java - WhoWroteIt2 - [~/src/Android/WhoWroteIt2] - Android Studio 2.2 Beta 2

```
    public void searchBooks(View v) {  v: "android.support.v7.widget.AppCompatButto
        Log.d("WhoWroteIt", "button click - searchBooks()");

        InputMethodManager inputManager = (InputMethodManager) getSystemService(Co
        inputManager.hideSoftInputFromWindow(getCurrentFocus().getWindowToken(), In

        //Checks the status of the network connection
        ConnectivityManager connMgr = (ConnectivityManager)
                getSystemService(Context.CONNECTIVITY_SERVICE);
        NetworkInfo networkInfo = connMgr.getActiveNetworkInfo();

                        g queryString = mBookInput.getText().toString();
                        ("WhoWroteIt", "Before test if networkInfo [" + queryString + "]");
```

```
searchBooks:43, MainAc
invoke:-1, Method (java
onClick:288, AppCompa
performClick:5198, View
run:21147, View$Perfor
handleCallback:739, Ha
dispatchMessage:95, Ha
loop:148, Looper (andro
```

```
this = {MainActivity@4249}
v = {AppCompatButton@4252} "android.support.v7.widget.AppCompatButton{1b61811 '... View
```

No watches

Debugger pane opens

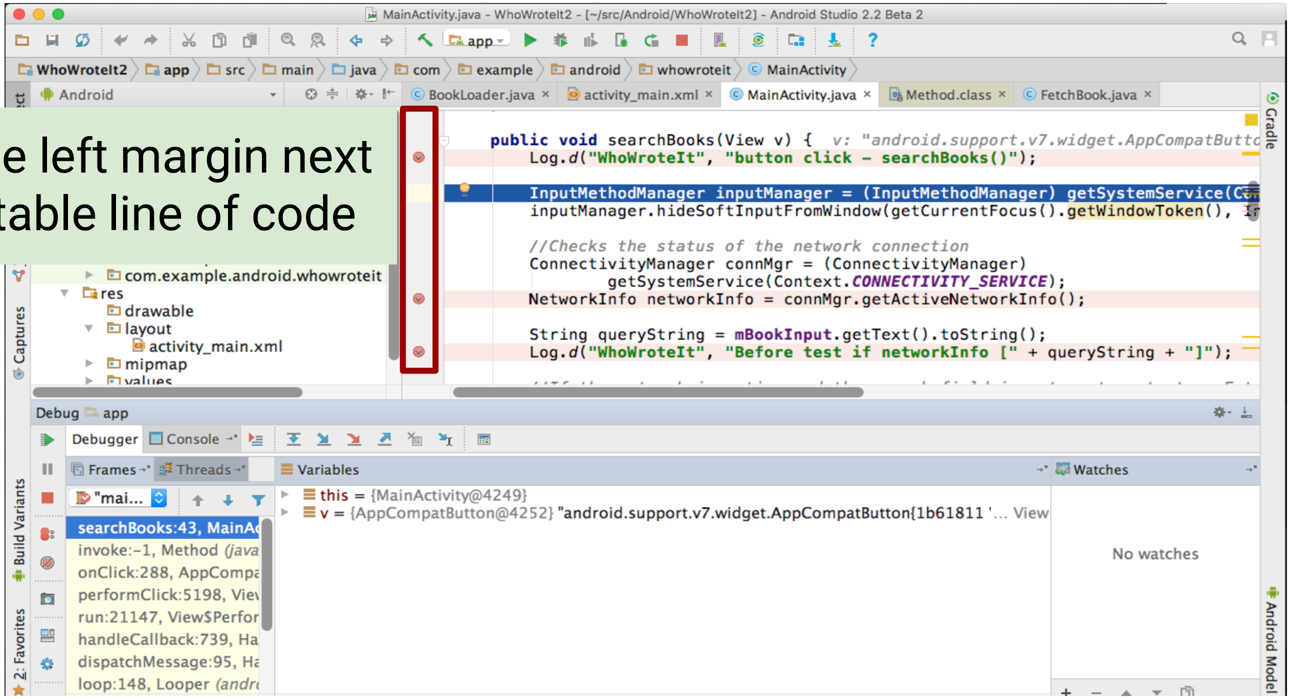
2

1

Menu:

Run > Debug 'your app'

Set breakpoints



```
public void searchBooks(View v) {  v: "android.support.v7.widget.AppCompatButto
    Log.d("WhoWroteIt", "button click - searchBooks()");

    InputMethodManager inputManager = (InputMethodManager) getSystemService(Co
    inputManager.hideSoftInputFromWindow(getCurrentFocus().getWindowToken(), In

    //Checks the status of the network connection
    ConnectivityManager connMgr = (ConnectivityManager)
            getSystemService(Context.CONNECTIVITY_SERVICE);
    NetworkInfo networkInfo = connMgr.getActiveNetworkInfo();

    String queryString = mBookInput.getText().toString();
    Log.d("WhoWroteIt", "Before test if networkInfo [" + queryString + "]");
```

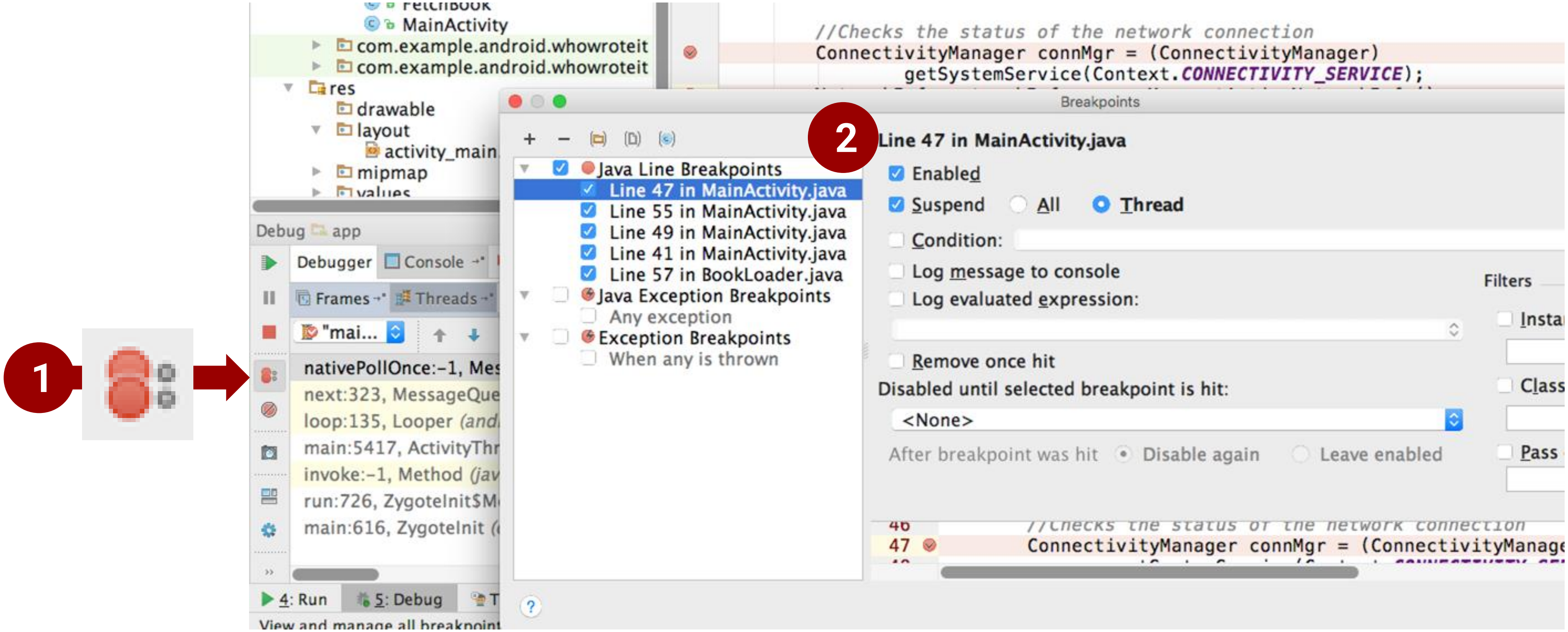
```
searchBooks:43, MainAc
invoke:-1, Method (java
onClick:288, AppCompa
performClick:5198, View
run:21147, View$Perfor
handleCallback:739, Ha
dispatchMessage:95, Ha
loop:148, Looper (andro
```

```
this = {MainActivity@4249}
v = {AppCompatButton@4252} "android.support.v7.widget.AppCompatButton{1b61811 '... View
```

No watches

Click in the left margin next to executable line of code

Edit breakpoint properties



```
//Checks the status of the network connection
ConnectivityManager connMgr = (ConnectivityManager)
        getSystemService(Context.CONNECTIVITY_SERVICE);
```

```
nativePollOnce:-1, Mes
next:323, MessageQue
loop:135, Looper (and
main:5417, ActivityThr
invoke:-1, Method (jav
run:726, ZygoteInit$M
main:616, ZygoteInit (
```

View and manage all breakpoint

- ☑ Java Line Breakpoints
  - ☑ Line 47 in MainActivity.java
  - ☑ Line 55 in MainActivity.java
  - ☑ Line 49 in MainActivity.java
  - ☑ Line 41 in MainActivity.java
  - ☑ Line 57 in BookLoader.java
- □ Java Exception Breakpoints
  - □ Any exception
- □ Exception Breakpoints
  - □ When any is thrown

Line 47 in MainActivity.java

☑ Enabled

☑ Suspend ○ All ● Thread

□ Condition:

□ Log message to console

□ Log evaluated expression:

□ Remove once hit

Disabled until selected breakpoint is hit:

<None>

After breakpoint was hit ● Disable again ○ Leave enabled

□ Insta

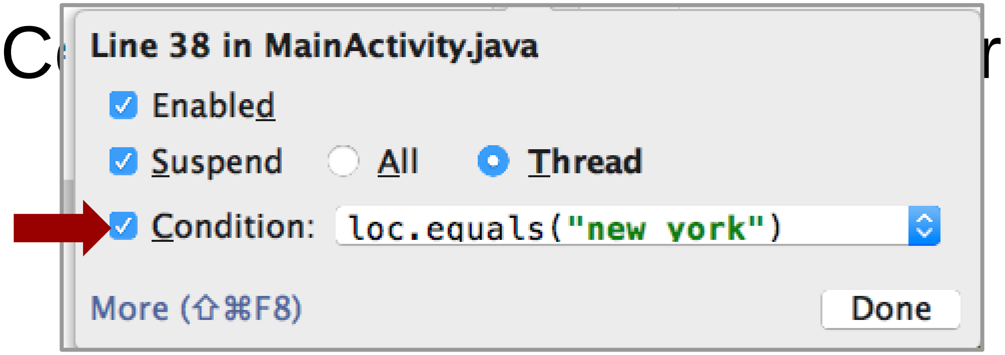
□ Class

□ Pass

```
46        //Checks the status of the network connection
47        ConnectivityManager connMgr = (ConnectivityManage
```

Make breakpoints conditional

- In properties dialog or right -click existing breakpoint
- Any Java expression that returns a boolean
- C rite conditions



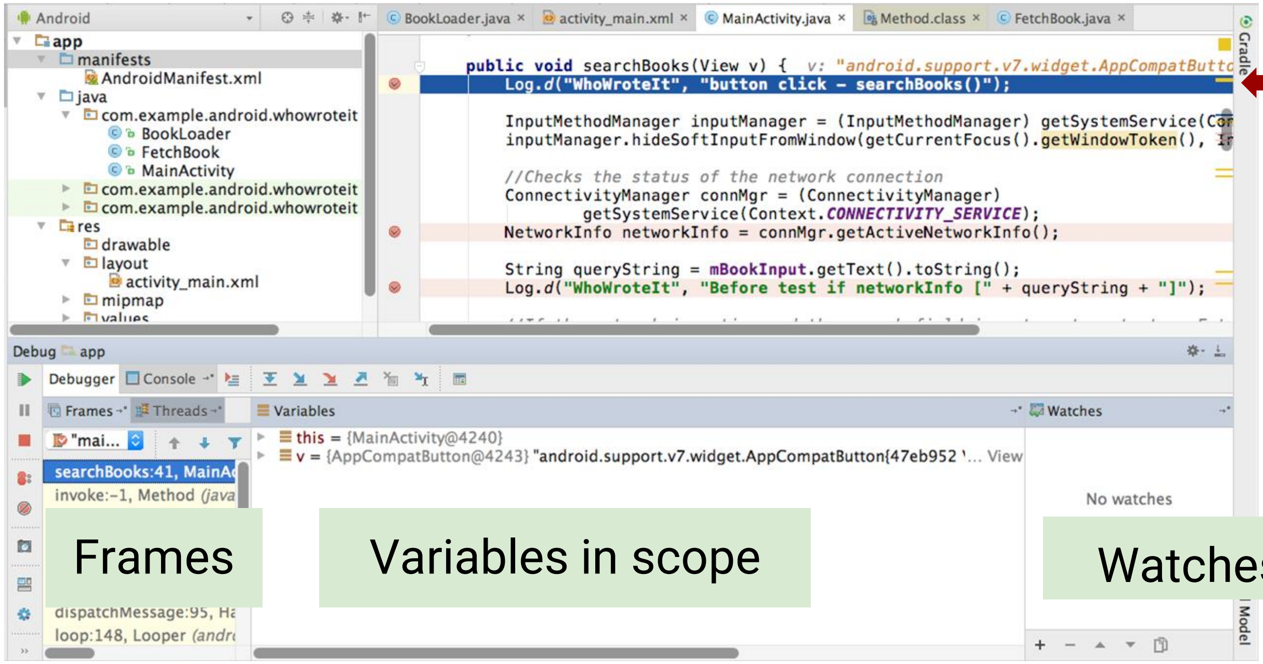
Line 38 in MainActivity.java

☑ Enabled

☑ Suspend ○ All ● Thread

☑ Condition: `loc.equals("new york")`

Run until app stops at breakpoint



```
    public void searchBooks(View v) {  v: "android.support.v7.widget.AppCompatButto
        Log.d("WhoWroteIt", "button click - searchBooks()");

        InputMethodManager inputManager = (InputMethodManager) getSystemService(Cor
        inputManager.hideSoftInputFromWindow(getCurrentFocus().getWindowToken(), Ir

        //Checks the status of the network connection
        ConnectivityManager connMgr = (ConnectivityManager)
                getSystemService(Context.CONNECTIVITY_SERVICE);
        NetworkInfo networkInfo = connMgr.getActiveNetworkInfo();

        String queryString = mBookInput.getText().toString();
        Log.d("WhoWroteIt", "Before test if networkInfo [" + queryString + "]");
```

```
searchBooks:41, MainAc
invoke:-1, Method (java
dispatchMessage:95, Ha
loop:148, Looper (andr
```

```
this = {MainActivity@4240}
v = {AppCompatButton@4243} "android.support.v7.widget.AppCompatButton{47eb952 '... View
```

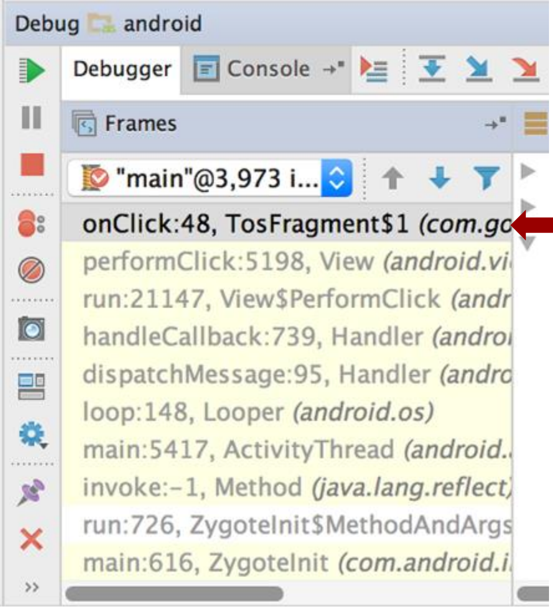
First Breakpoint

Frames

Variables in scope

Watches (C/C++)

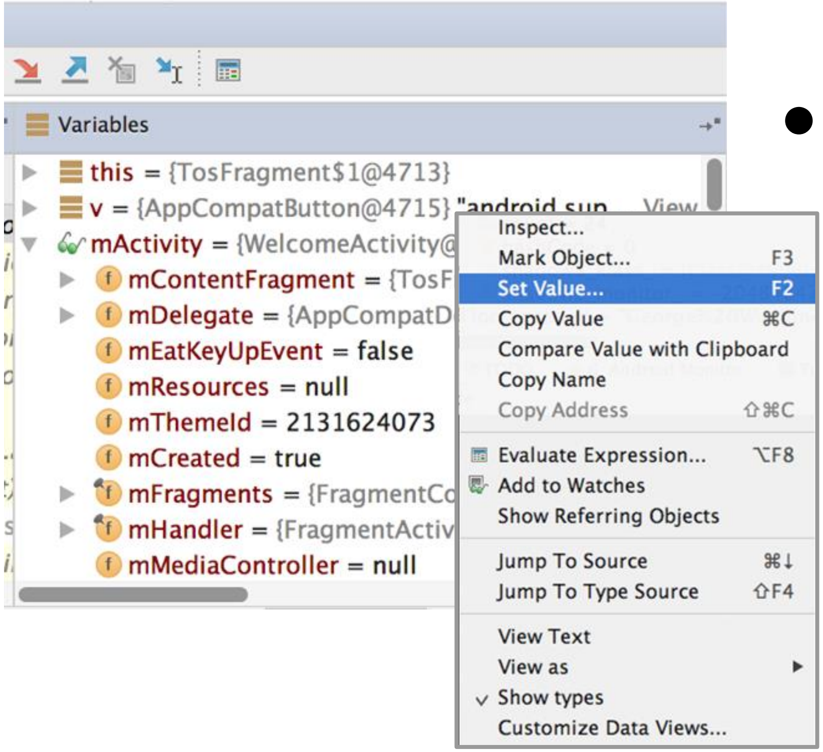
Inspect frames



```
onClick:48, TosFragment$1 (com.go
performClick:5198, View (android.vi
run:21147, View$PerformClick (andr
handleCallback:739, Handler (andro
dispatchMessage:95, Handler (andro
loop:148, Looper (android.os)
main:5417, ActivityThread (android.
invoke:-1, Method (java.lang.reflect
run:726, ZygoteInit$MethodAndArgs
main:616, ZygoteInit (com.android.i
```

Top frame is where execution is halted in your code

Inspect and edit variables



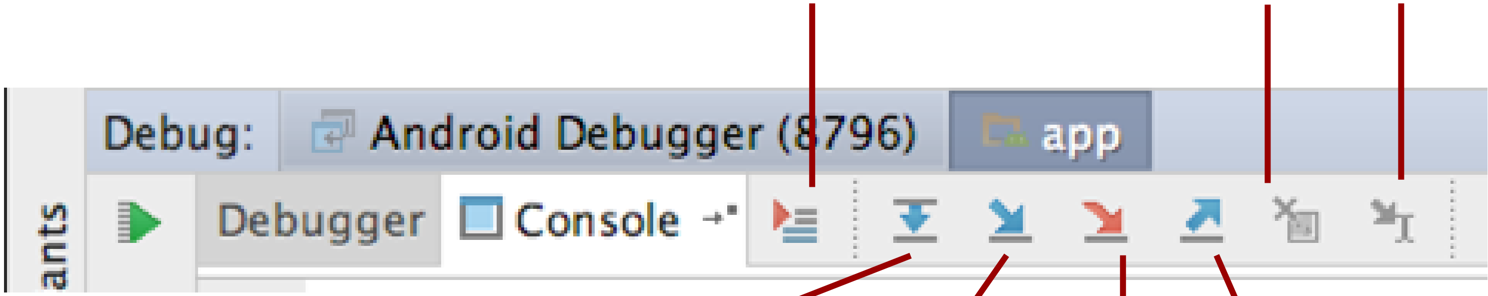
```
▶ this = {TosFragment$1@4713}
▶ v = {AppCompatButton@4715} "android.sup... View
▼ mActivity = {WelcomeActivity@
    ▶ mContentFragment = {TosF
    ▶ mDelegate = {AppCompatD
      mEatKeyUpEvent = false
      mResources = null
      mThemeId = 2131624073
      mCreated = true
    ▶ mFragments = {FragmentCo
    ▶ mHandler = {FragmentActiv
      mMediaController = null
```

- Right-click on variable for menu

Basic Stepping Commands

Step Over	F8	Step to the next line in current file
Step Into	F7	Step to the next executed line
Force Step Into	⇧F7	Step into a method in a class that you wouldn't normally step into, like a standard JDK class
Step Out	⇧F8	Step to first executed line after returning from current method
Run to Cursor	⌥F9	Run to the line where the cursor is in the file

Stepping through code



Show execution point

Drop frame

Run to cursor

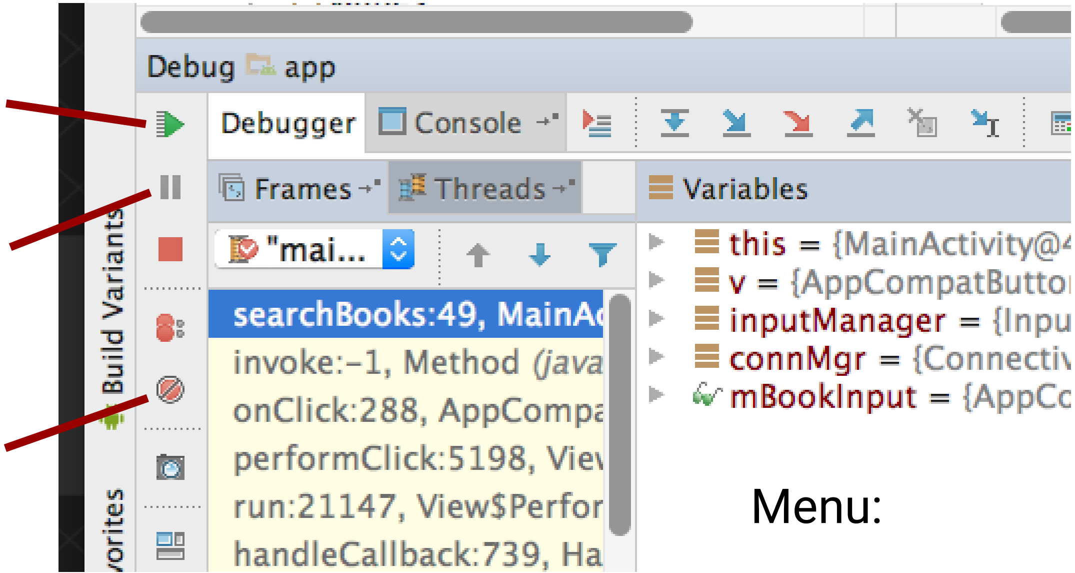
Step over

Step into

Step out

Force step into

Resume and Pause



"mai...

searchBooks:49, MainAc
invoke:-1, Method (java
onClick:288, AppCompa
performClick:5198, View
run:21147, View$Perfor
handleCallback:739, Ha

this = {MainActivity@4
v = {AppCompatButto
inputManager = {Inpu
connMgr = {Connectiv
mBookInput = {AppCo

Resume

Pause

Mute all breakpoints

Menu:

Run->Pause Program…
Run->Resume Program…

Learn more

- Debug Your App (Android Studio User Guide)
- Debugging and Testing in Android Studio (video)

What's Next?

- Concept Chapter: 3.1 The Android Studio debugger
- Practical: 3.1 The debugger

END