Components, Activity Lifecycle and Intents

CE881: Mobile and Social Application Programming

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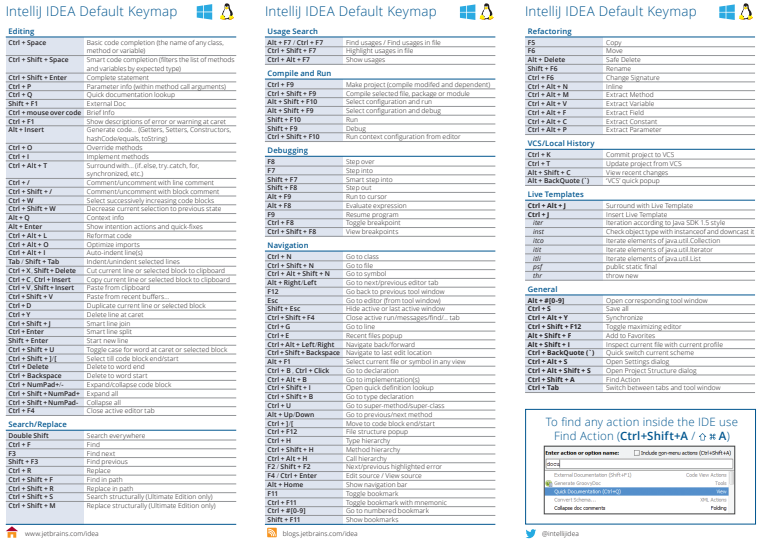
January 23, 2015

Movies, Books and Websites

- Theme: "The Enterprise"
- Movies
  - Office Space
  - Clerks
  - Up in the air
- Businessweek

Keyboard propaganda (1)



IntelliJ IDEA Default Keymap

Editing

Ctrl + Space	Basic code completion (the name of any class, method or variable)
Ctrl + Shift + Space	Smart code completion (filters the list of methods and variables by expected type)
Ctrl + Shift + Enter	Complete statement
Ctrl + P	Parameter info (within method call arguments)
Ctrl + Q	Quick documentation lookup
Shift + F1	External Doc
Ctrl + mouse over code	Brief Info
Ctrl + F1	Show descriptions of error or warning at caret
Alt + Insert	Generate code... (Getters, Setters, Constructors, hashCode/equals, toString)
Ctrl + O	Override methods
Ctrl + I	Implement methods
Ctrl + Alt + T	Surround with... (if..else, try..catch, for, synchronized, etc.)
Ctrl + /	Comment/uncomment with line comment
Ctrl + Shift + /	Comment/uncomment with block comment
Ctrl + W	Select successively increasing code blocks
Ctrl + Shift + W	Decrease current selection to previous state
Alt + Q	Context info
Alt + Enter	Show intention actions and quick-fixes
Ctrl + Alt + L	Reformat code
Ctrl + Alt + O	Optimize imports
Ctrl + Alt + I	Auto-indent line(s)
Tab / Shift + Tab	Indent/unindent selected lines
Ctrl + X, Shift + Delete	Cut current line or selected block to clipboard
Ctrl + C, Ctrl + Insert	Copy current line or selected block to clipboard
Ctrl + V, Shift + Insert	Paste from clipboard
Ctrl + Shift + V	Paste from recent buffers...
Ctrl + D	Duplicate current line or selected block
Ctrl + Y	Delete line at caret
Ctrl + Shift + J	Smart line join
Ctrl + Enter	Smart line split
Shift + Enter	Start new line
Ctrl + Shift + U	Toggle case for word at caret or selected block
Ctrl + Shift +]/[	Select till code block end/start
Ctrl + Delete	Delete to word end
Ctrl + Backspace	Delete to word start
Ctrl + NumPad+/-	Expand/collapse code block
Ctrl + Shift + NumPad+	Expand all
Ctrl + Shift + NumPad-	Collapse all
Ctrl + F4	Close active editor tab

Search/Replace

Double Shift	Search everywhere
Ctrl + F	Find
F3	Find next
Shift + F3	Find previous
Ctrl + R	Replace
Ctrl + Shift + F	Find in path
Ctrl + Shift + R	Replace in path
Ctrl + Shift + S	Search structurally (Ultimate Edition only)
Ctrl + Shift + M	Replace structurally (Ultimate Edition only)

www.jetbrains.com/idea

IntelliJ IDEA Default Keymap

Usage Search

Alt + F7 / Ctrl + F7	Find usages / Find usages in file
Ctrl + Shift + F7	Highlight usages in file
Ctrl + Alt + F7	Show usages

Compile and Run

Ctrl + F9	Make project (compile modified and dependent)
Ctrl + Shift + F9	Compile selected file, package or module
Alt + Shift + F10	Select configuration and run
Alt + Shift + F9	Select configuration and debug
Shift + F10	Run
Shift + F9	Debug
Ctrl + Shift + F10	Run context configuration from editor

Debugging

F8	Step over
F7	Step into
Shift + F7	Smart step into
Shift + F8	Step out
Alt + F9	Run to cursor
Alt + F8	Evaluate expression
F9	Resume program
Ctrl + F8	Toggle breakpoint
Ctrl + Shift + F8	View breakpoints

Navigation

Ctrl + N	Go to class
Ctrl + Shift + N	Go to file
Ctrl + Alt + Shift + N	Go to symbol
Alt + Right/Left	Go to next/previous editor tab
F12	Go back to previous tool window
Esc	Go to editor (from tool window)
Shift + Esc	Hide active or last active window
Ctrl + Shift + F4	Close active run/messages/find/... tab
Ctrl + G	Go to line
Ctrl + E	Recent files popup
Ctrl + Alt + Left/Right	Navigate back/forward
Ctrl + Shift + Backspace	Navigate to last edit location
Alt + F1	Select current file or symbol in any view
Ctrl + B, Ctrl + Click	Go to declaration
Ctrl + Alt + B	Go to implementation(s)
Ctrl + Shift + I	Open quick definition lookup
Ctrl + Shift + B	Go to type declaration
Ctrl + U	Go to super-method/super-class
Alt + Up/Down	Go to previous/next method
Ctrl +]/[	Move to code block end/start
Ctrl + F12	File structure popup
Ctrl + H	Type hierarchy
Ctrl + Shift + H	Method hierarchy
Ctrl + Alt + H	Call hierarchy
F2 / Shift + F2	Next/previous highlighted error
F4 / Ctrl + Enter	Edit source / View source
Alt + Home	Show navigation bar
F11	Toggle bookmark
Ctrl + F11	Toggle bookmark with mnemonic
Ctrl + #[0-9]	Go to numbered bookmark
Shift + F11	Show bookmarks

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IntelliJ IDEA Default Keymap

Refactoring

F5	Copy
F6	Move
Alt + Delete	Safe Delete
Shift + F6	Rename
Ctrl + F6	Change Signature
Ctrl + Alt + N	Inline
Ctrl + Alt + M	Extract Method
Ctrl + Alt + V	Extract Variable
Ctrl + Alt + F	Extract Field
Ctrl + Alt + C	Extract Constant
Ctrl + Alt + P	Extract Parameter

VCS/Local History

Ctrl + K	Commit project to VCS
Ctrl + T	Update project from VCS
Alt + Shift + C	View recent changes
Alt + BackQuote (`)	'VCS' quick popup

Live Templates

Ctrl + Alt + J	Surround with Live Template
Ctrl + J	Insert Live Template
iter	Iteration according to Java SDK 1.5 style
inst	Check object type with instanceof and downcast it
itco	Iterate elements of java.util.Collection
itit	Iterate elements of java.util.Iterator
itli	Iterate elements of java.util.List
psf	public static final
thr	throw new

General

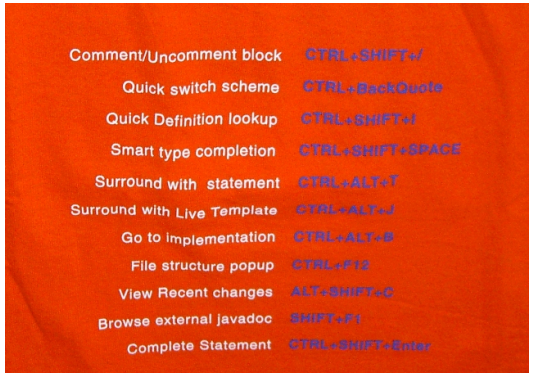
Alt + #[0-9]	Open corresponding tool window
Ctrl + S	Save all
Ctrl + Alt + Y	Synchronize
Ctrl + Shift + F12	Toggle maximizing editor
Alt + Shift + F	Add to Favorites
Alt + Shift + I	Inspect current file with current profile
Ctrl + BackQuote (`)	Quick switch current scheme
Ctrl + Alt + S	Open Settings dialog
Ctrl + Alt + Shift + S	Open Project Structure dialog
Ctrl + Shift + A	Find Action
Ctrl + Tab	Switch between tabs and tool window

To find any action inside the IDE use Find Action (**Ctrl+Shift+A** / ⇧ ⌘ A)

@intellijidea

Keyboard propaganda (2)

- Learn how to touch type
- Ctrl+Shift+A (Meta - search for shortcut/action)
- Ctrl+B (Go to declaration)
- Ctrl+U (Go to superclass)
- Ctrl+J (Insert template)



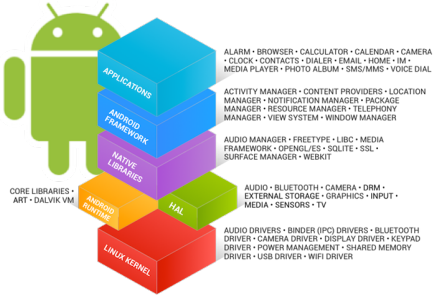
http://stackoverflow.com/questions/294167/what-are-the-most-useful-intellij-idea-keyboard-

Apps

- Great enterprise Apps
  - Expensify
  - Google now
  - Linkedin
  - Audio Memos
  - Insightly

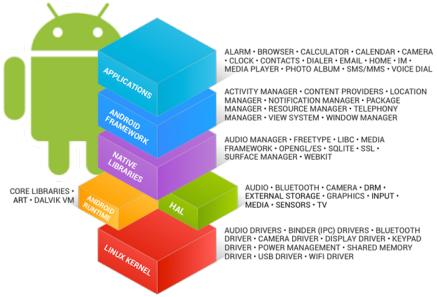
Android: The Big picture

- Android is (almost) a version of linux
- A software stack
  - Open source: http://source.android.com/
  - Hacked Kernel
  - Standard libaries



Android: The java stack

- JVM - Dalvik or ART (5.0)
- Moved recently to “Ahead of time compilation” from JIT



What happens when an app is launched?

- Android creates a new user
- User is unknown to the application
- A virtual machine is spawned
- "Princple of least privilege"
- Why take all these measures?

App components

- Four different kinds of components
  - **Activities**
    - Single Screen
  - **Services**
    - Background process
  - **Broadcast receivers**
    - Route, present to status bar
  - *Content providers*
    - Databases

Intents

- With the exception of content providers, all components exchange messages
  - These messages are called *intents*
  - Think of them as asynchronous method calls
- Why not direct method calls? Why exchange messages?

Design decisions

- Interoperability
  - You can start other app components
    - e.g, Take pictures, record sound, check battery
    - No need for run-time linking
- Security
  - Allows the platform to control access
- Robustness
  - One application crush shouldn't impact the system

Manifest file

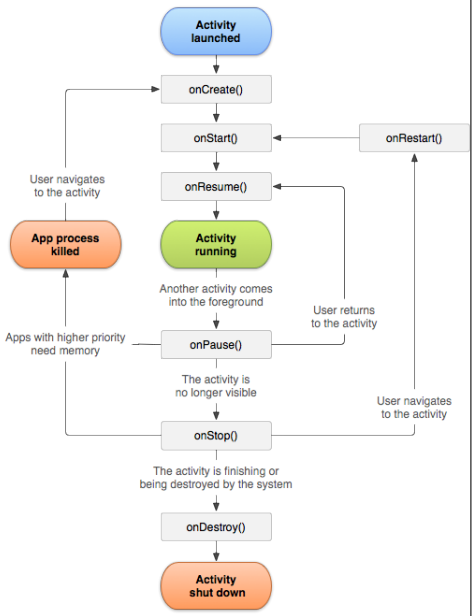
- **AndroidManifest.xml**
- All components have to be registered there
- http://developer.android.com/guide/topics/manifest/manifest-intro.html
- Android also picks up component information from here
- Other apps can make use of our components

Activity Subclasses

- Let's see some

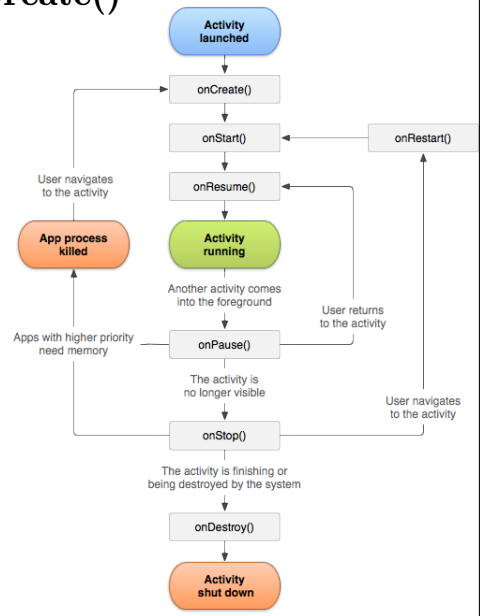
Activity Lifecycle

- Most important component type
- Controls the application flow
- Initiates intents
- Delegates to other activities



Activity Lifecycle: **OnCreate()**

- Activity on the foreground of the screen
- First thing called
- Called when screen is rotated
- Called when there is a language change

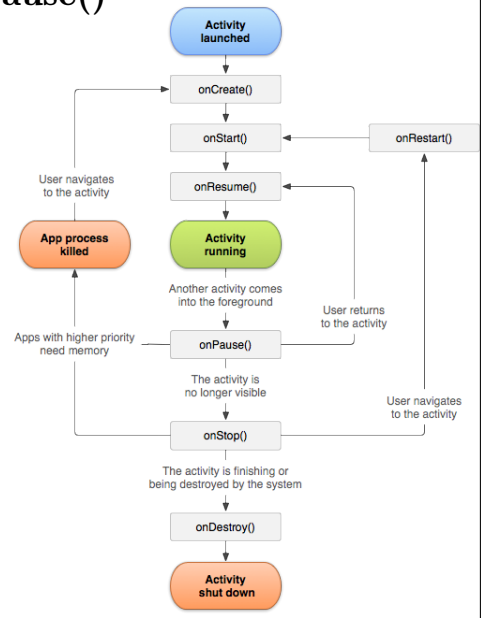


Activity Lifecycle: **onCreate()**

```
public void onCreate(Bundle savedInstanceState)
{
    // What are we missing here?
}
```

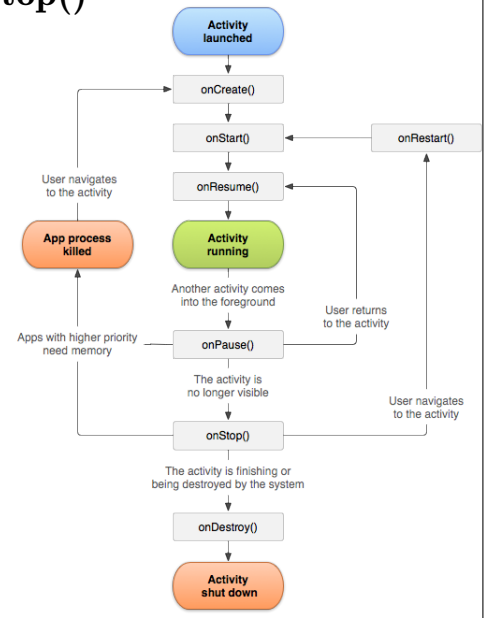

Activity Lifecycle: **OnPause()**

- Called when user brings another window up
- Application has to be visible
- State *might* be lost, if device low in memory



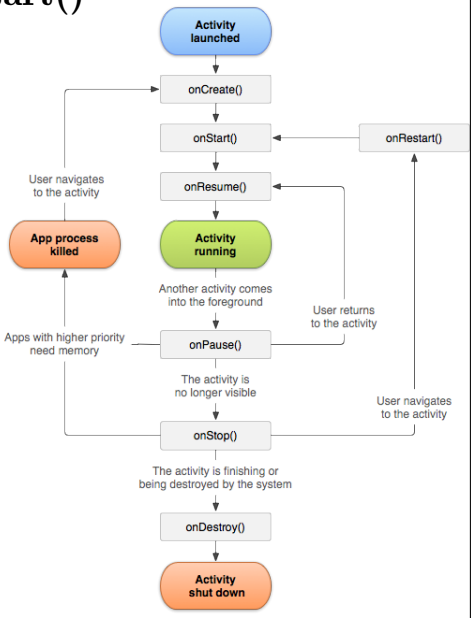
Activity Lifecycle: **OnStop()**

- Activity no longer visible
- All state lost, must be persisted somewhere



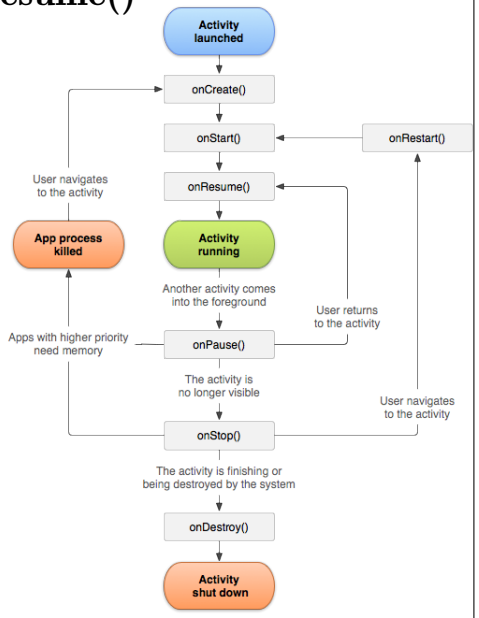
Activity Lifecycle: **OnStart()**

- Called after **onCreate()** and when user brings activity to the foreground
- When activity is brought to the foreground



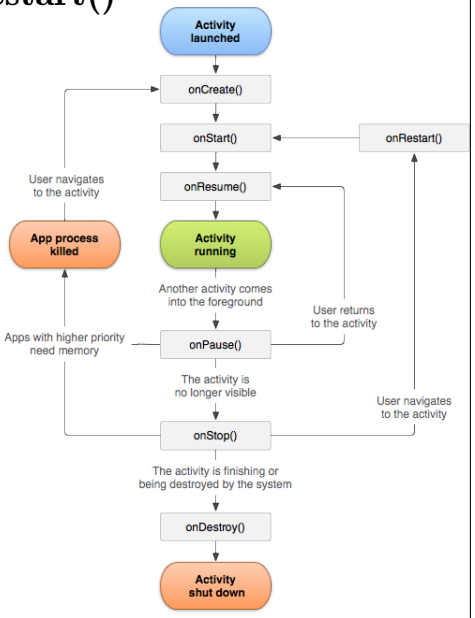
Activity Lifecycle: **OnResume()**

- The opposite of **onPause()**



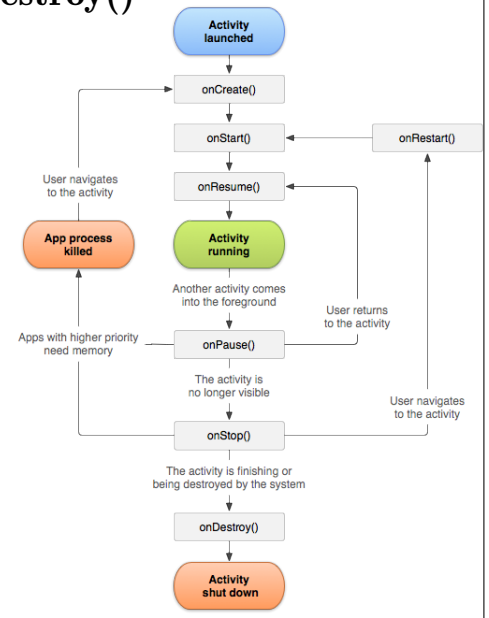
Activity Lifecycle: **onRestart()**

- Calls **onStart()**



Activity Lifecycle: **onDestroy()**

- Final exit
- Clean up happens automatically
- But if you have spawned any threads, you might have to kill them
- Might not be called at all!
- Don't save state here



Screen Orientation

- Each time the screen is rotated, the current activity is destroyed, and then re-created
- Predefined onCreate() method retrieves state of any View components (i.e. components that sub-class View; this eases the job of the programmer)
- Rationale:
  - Typically a new layout may be needed, involving new resource allocation
  - Cleanest solution: always destroy and re-create
  - Note: apps can specify to always operate in a particular orientation

Managing State Between Orientation Changes

Tips for State Management

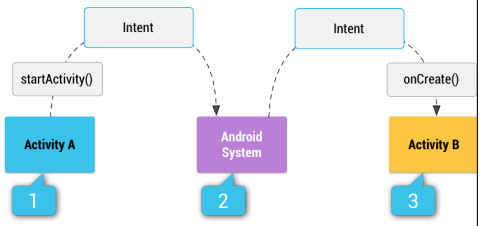
- Save any important information frequently or immediately
  - Mobile device: the battery could die any time!
- Override **onPause** to save useful permanent state
- You should also use **onSaveInstanceState(Bundle)** to save transient state

Starting a new activity

- Define a class that sub-classes Activity
- Add some GUI control to invoke it from the parent activity
- Listen for the relevant event, then launch a new Intent
- This will indirectly call the new Activity's method:
  - **onCreate(Bundle savedInstance)**
- The new activity will start and enter then Resumed state via the call graph shown previously

Pretty pictures

- Looks like this
- Using messages



Intents

- "An intent is an abstract description of an operation to be performed." (developer.android.com)
- A bit like a method call
- Two flavours: explicit and implicit
  - An explicit Intent specifies exactly which Activity should be started
  - An implicit Intent is more declarative: it explains what the Activity should do
  - The system will then search for Activities that match by checking the Intent filters
  - Example: opening a Web Page (more on this later)

Example

- The following example adds an Activity to provide information about an App
  - A menu item called "About" is added to the options menu
  - We listen for onOptionItemSelected events within the main activity
  - Create an Intent, then call startActivity with the Intent as an argument
  - When the user has finished reading the HTML page, the back button can be used to return to the main app
  - This behaviour is automatic use of the ""back stack"; no need to program it

AboutActivity

- Simple example uses a hard-coded HTML file name; import statements are omitted
- Uses a WebView to display an HTML page specified in loadUrl method)

```
public class AboutActivity extends Activity {
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        WebView wb = new WebView(this);
        wb.loadUrl(
        "http://www.google.com");
        setContentView(wb);
    }
}
```


Updating the AndroidManifest.xml

```
<application android:label="@string/app_name">
  <activity android:name="MyActivity"
            android:label="@string/app_name">
    <intent-filter>
       <action
         android:name="android.intent.action.MAIN"/>
       <category
         android:name="android.intent.category.LAUNCHER"/>
    </intent-filter>
  </activity>

  <activity android:name="AboutActivity" />

</application>
```

Explicit calling

```
Intent intent = new Intent(this, AboutActivity.class);
startActivity(newAct);
```


Add the menu / launching Intent

```
public boolean onCreateOptionsMenu(Menu menu) {
    menu.add("About");
    return true;
}

public boolean onOptionsItemSelected(MenuItem item) {
    if (item.getTitle().equals("About")) {
        Intent intent =
            new Intent(this, AboutActivity.class);
        startActivity(intent);
        return true;
    }
    return super.onOptionsItemSelected(item);
}
```


Quick Discussion

Anyone notice something non-ideal about this line of code?

menu.add(“About”);

What’s wrong, and how would you fix it?

Implicit intent?

- Instead of specifying exactly which Activity class should handle the intent, can instead specify an action e.g. via a URL

```
Intent intent = new Intent(Intent.ACTION_VIEW);

intent.setData(Uri.parse("http://www.google.com"));

startActivity(intent);
```

Another example, google maps

```
Intent intent = new Intent(Intent.ACTION_VIEW);
intent.setData(Uri.parse("geo:" + 42.516845 +
    "," + -70.898503));
startActivity(intent);
```


Intent filters

- Each activity can declare filters

```
<intent-filter>
 <action android:name="android.intent.action.ACTION_VIEW"/>
 <category android:name="android.intent.category.DEFAULT"/>
 <data android:mimeType="text/html"/>
</intent-filter>
```


Filter creation

- How can we call our activity implicitly ?
- Where should we add this filter in our case ?

Overall

- Android Stack
- App lifecycle, and which state transition methods to override in order to save and re-create state
- Explicit and implicit intents