Advanced Programming 2 - Android

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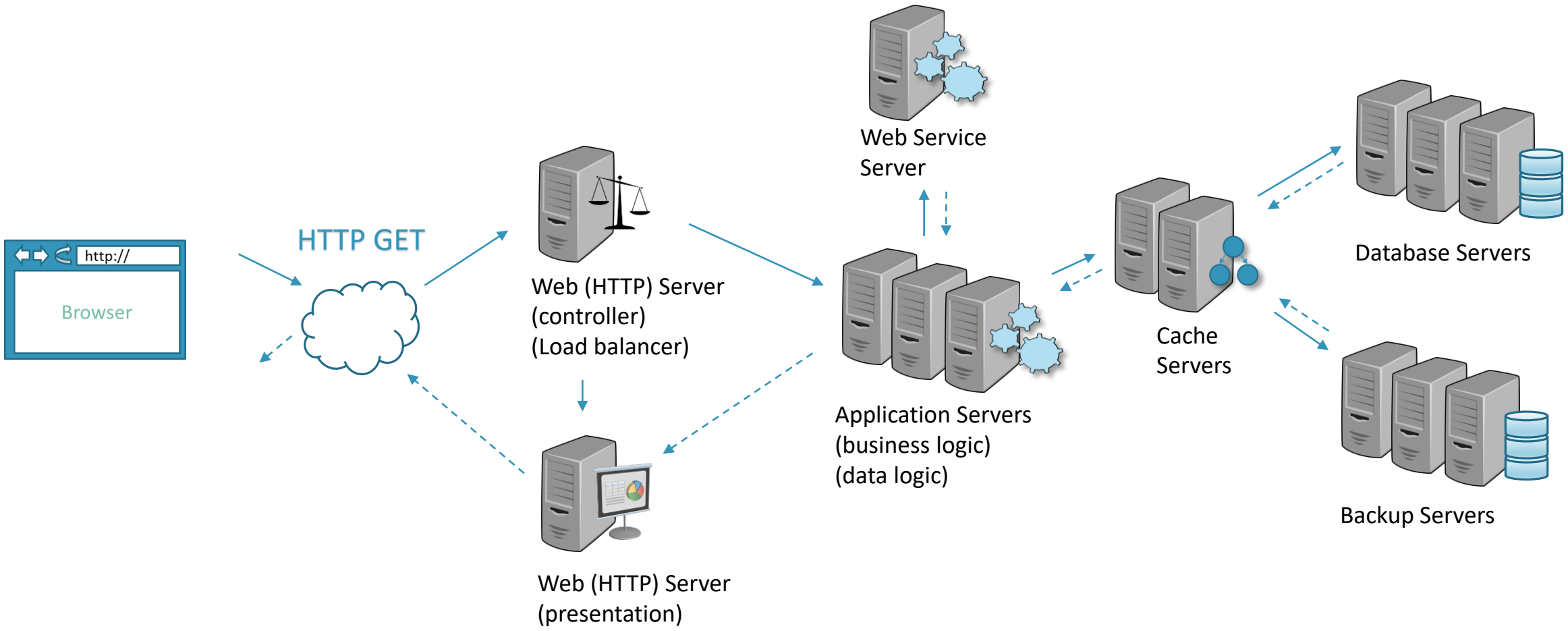
2016

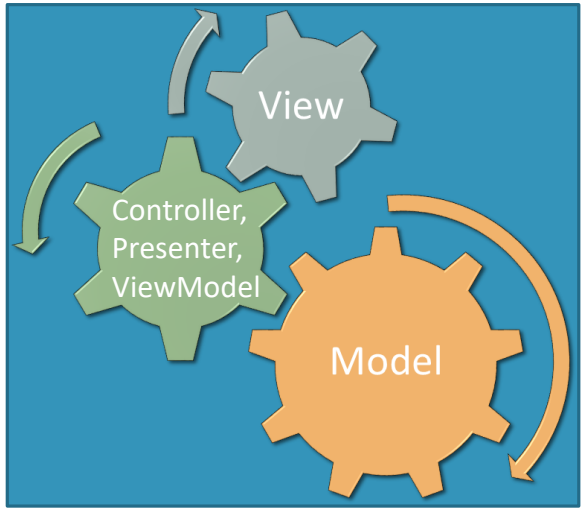
Our Enterprise

Client Side:

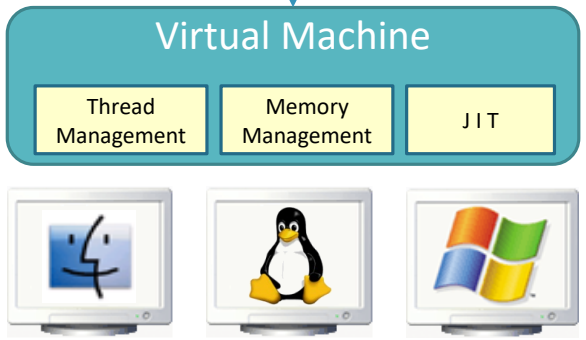


Our Enterprise

Client Source Code



Input



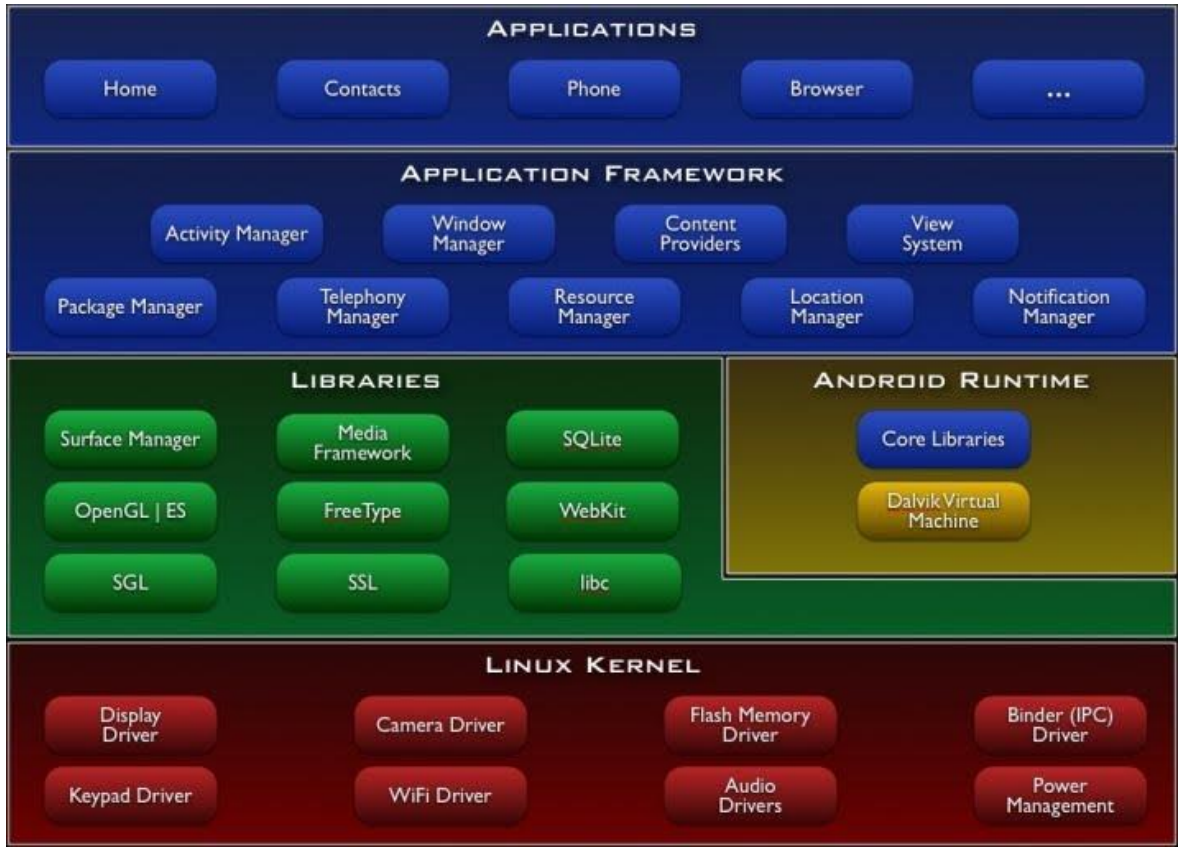
Client Side:

HTTP GET

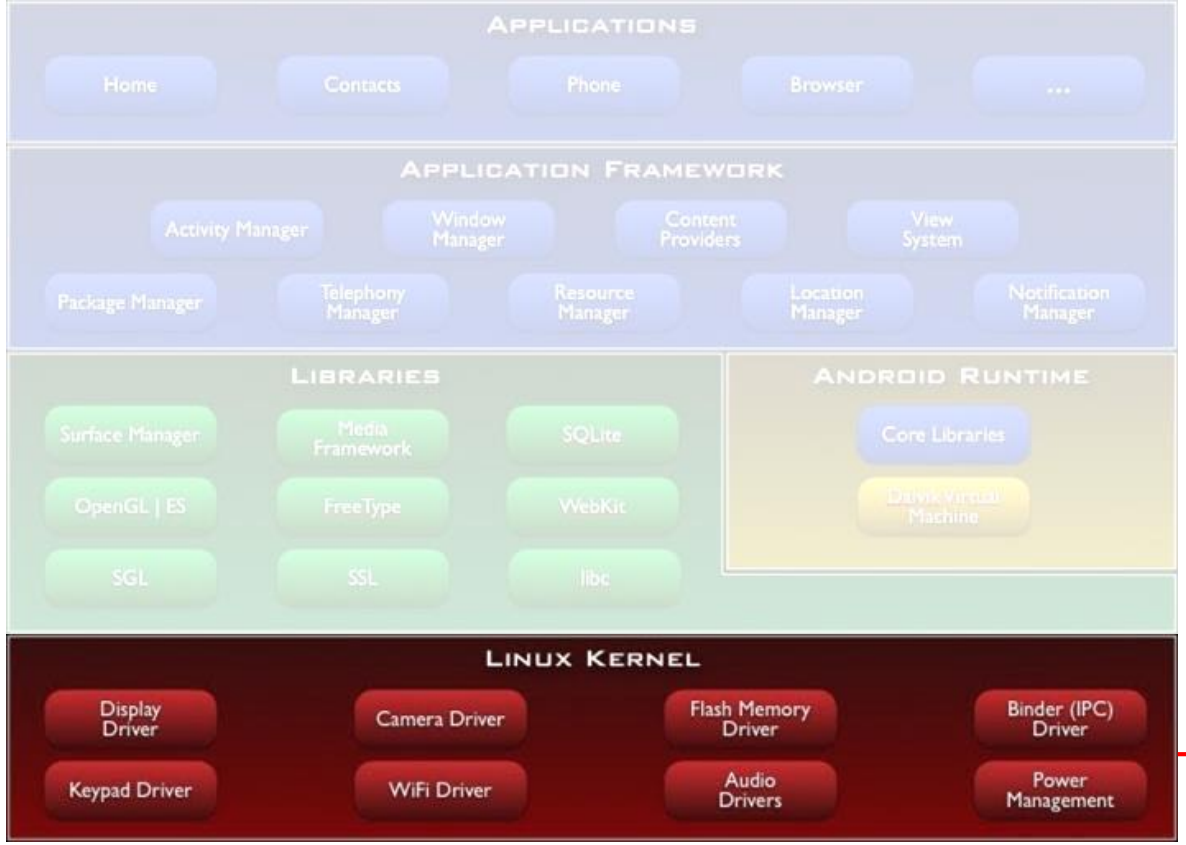
Today’s Lesson…

android

Android Architecture

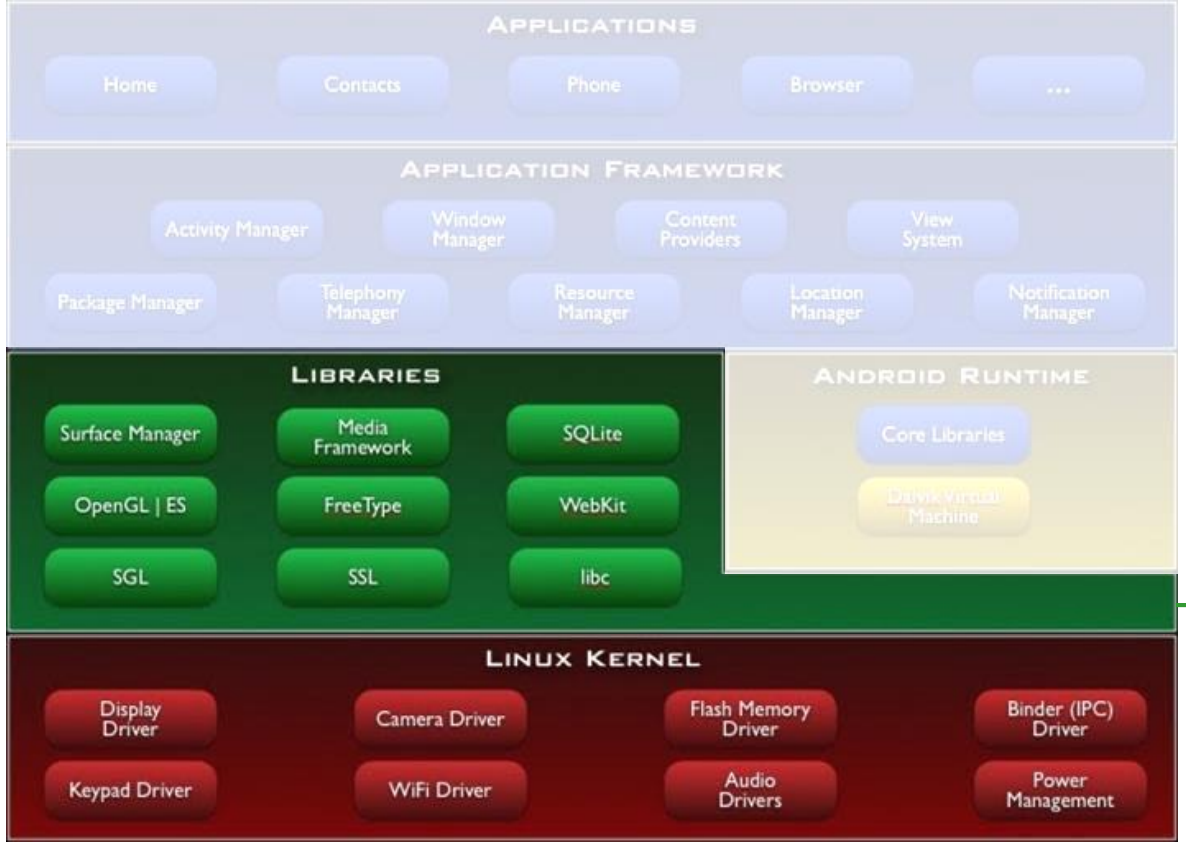


Android Architecture



- Based on Linux Kernel
- Hardware Abstraction Layer (HAL)
- Provides:
  - memory management
  - process management
  - networking

Android Architecture



- Native Libraries
  - written in C/C++, interfaced by Java

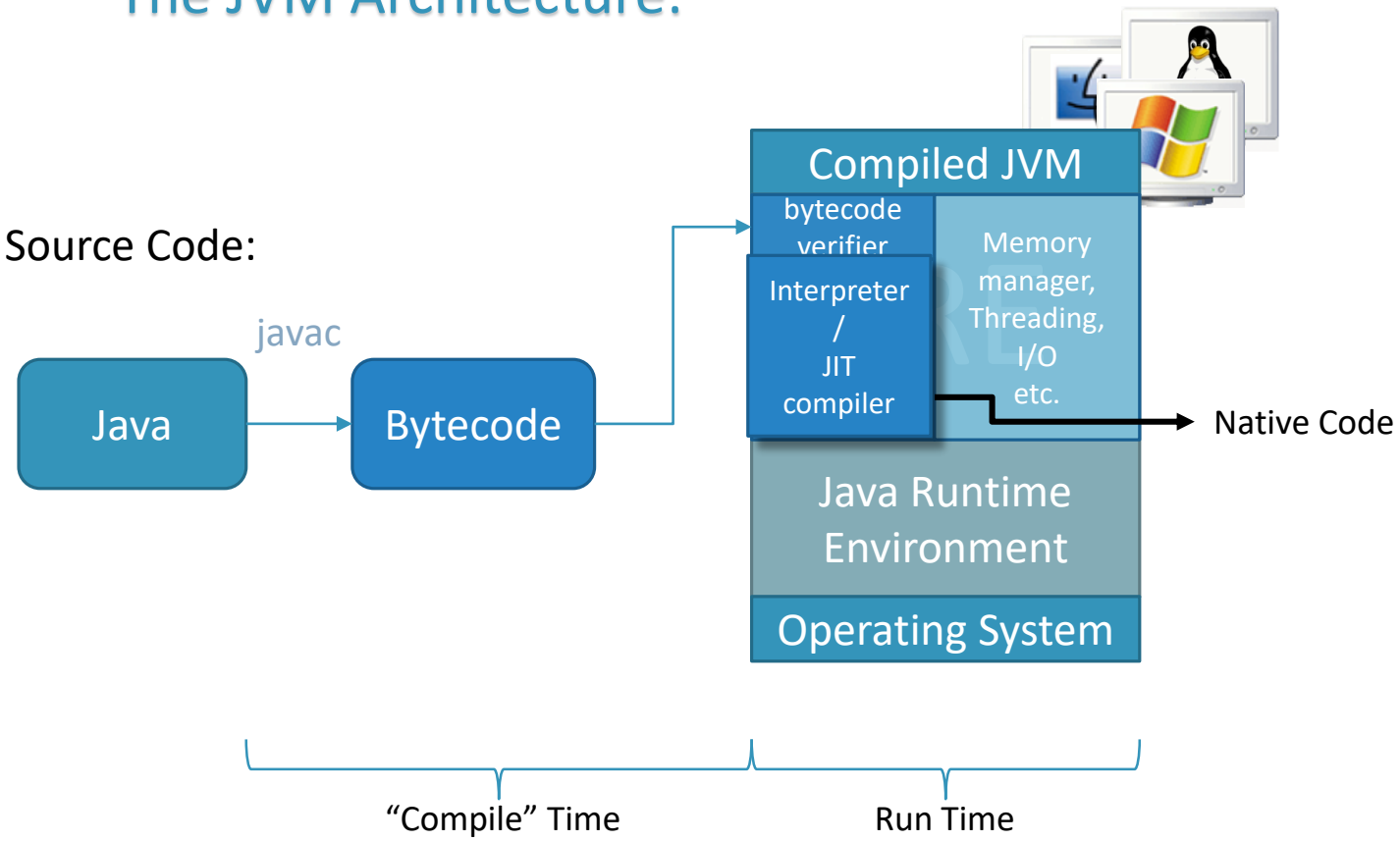
Overview:

- libc
- open-source web browser engine
- SQLite database (storage and sharing app data)
- Play and record audio and video
- SSL internet security
- Surface Manager (display / touch)
- etc

Android Architecture

Android Architecture

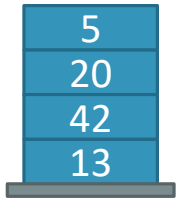
The JVM Architecture:



The JVM is a ***stack based machine***

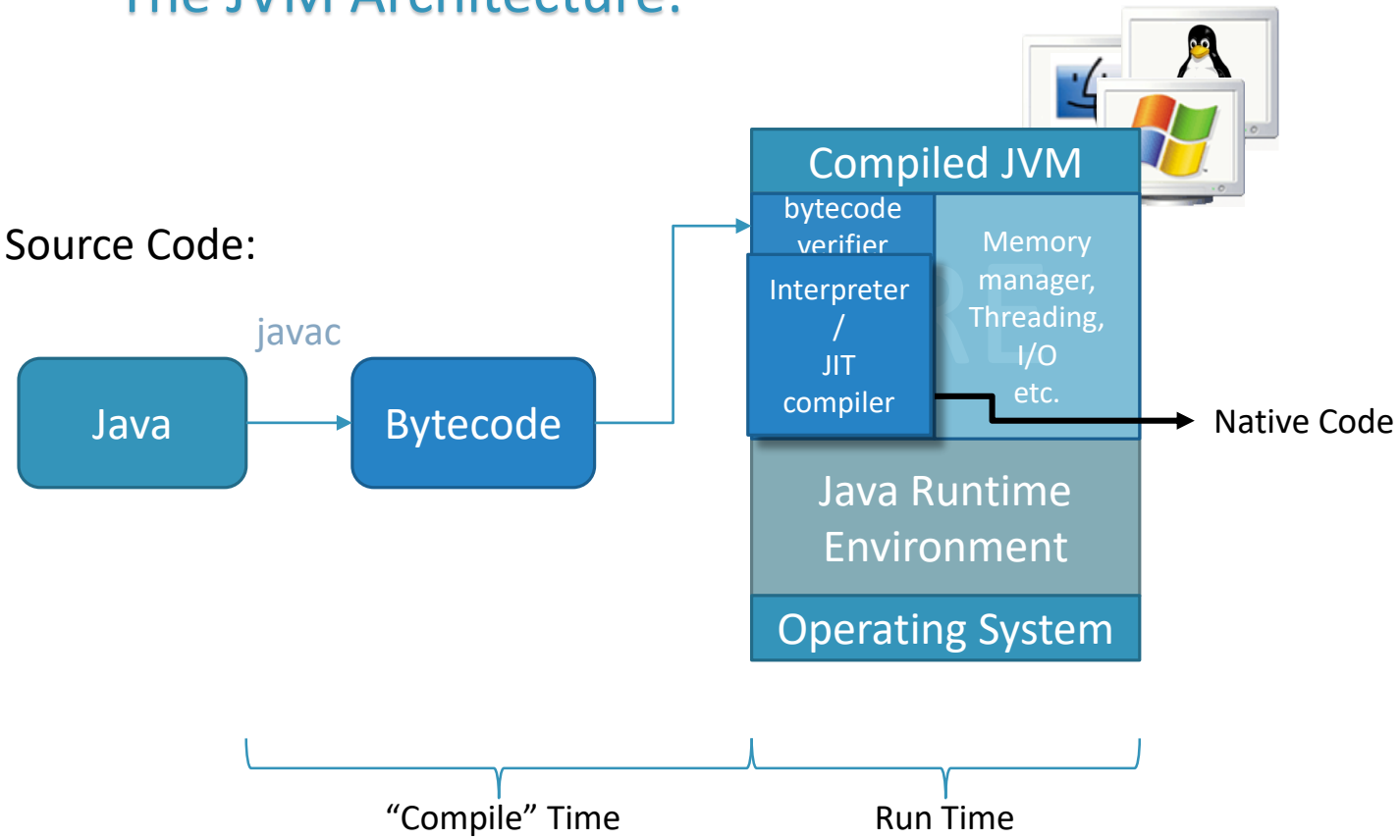
An instruction "5+20" translates to:

1. POP 5
2. POP 20
3. ADD 5, 20, result
4. PUSH result



Android Architecture

The JVM Architecture:



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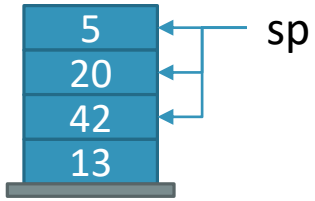


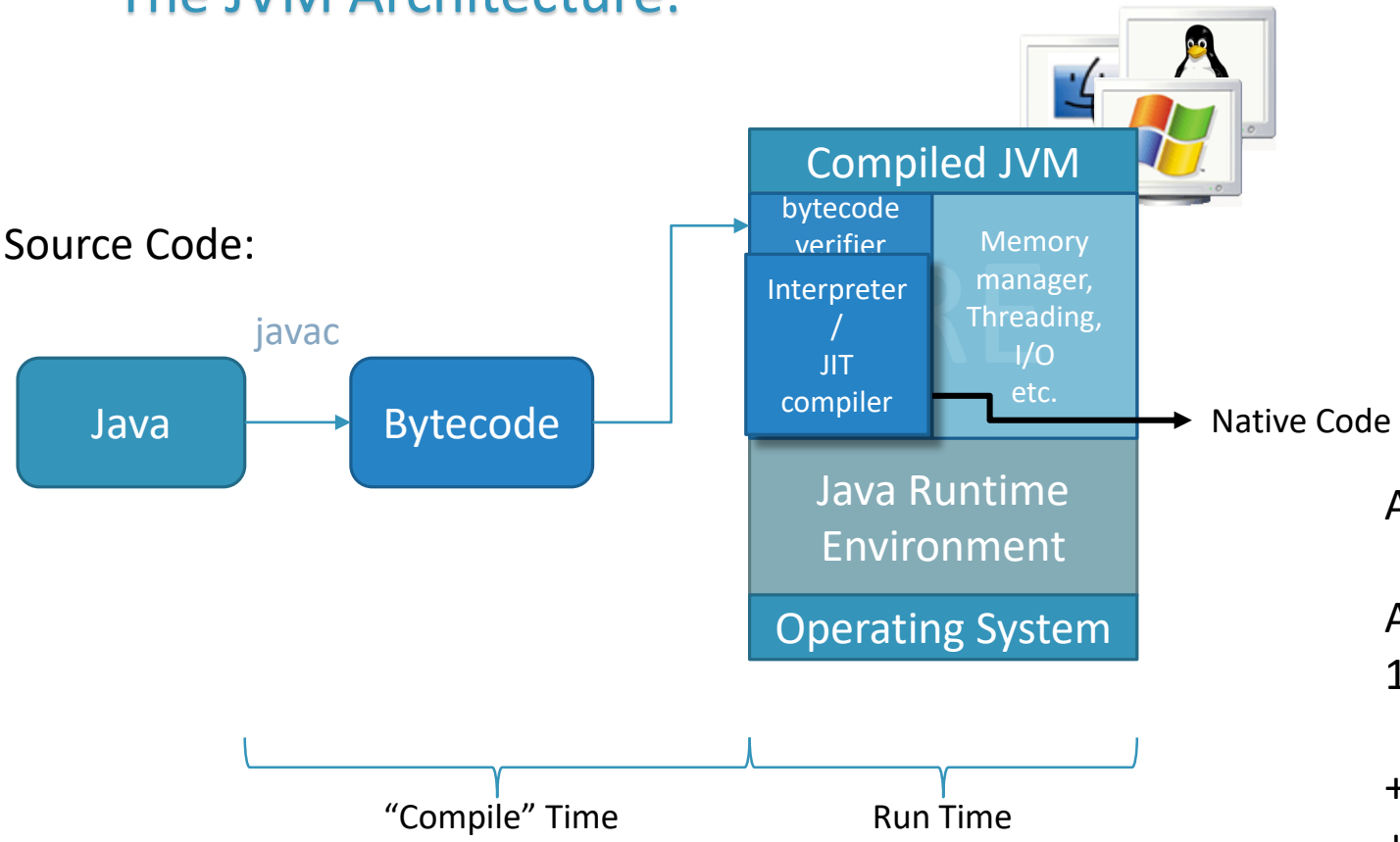
Android Architecture

Register based

Ongoing debate which is better…

The JVM Architecture:

Source Code:



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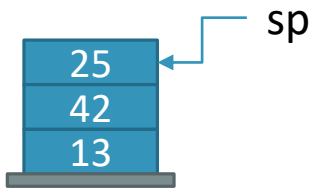


Another architecture ***register based machine***

An instruction "5+20" translates to:

1. ADD R1, R2, R3

+ Less instructions!
+ Possible optimizations!
- An instruction is more complex

Android Architecture

The Dalvik VM Architecture:

Source Code:

Java → javac → Bytecode (.class) → dx → Dalvik Executable (.dex / .odex)

Register-based

Dalvik VM
- bytecode verifier
- Interpreter / JIT compiler
- Memory manager, Threading, I/O etc.

→ Native Code

Android Runtime Environment

Android

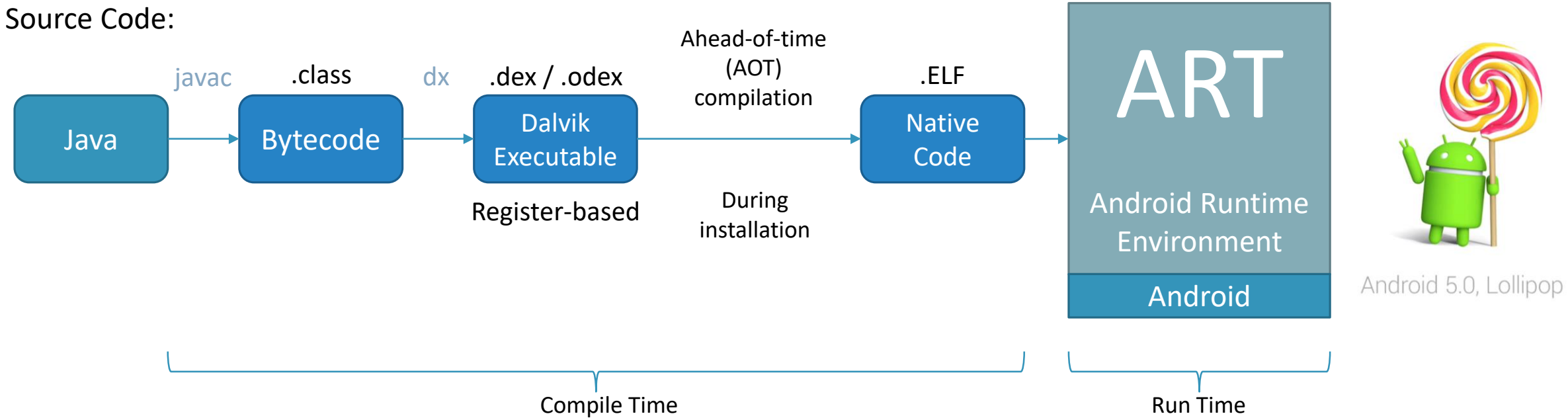
"Compile" Time

Run Time

Android 4.4 KitKat

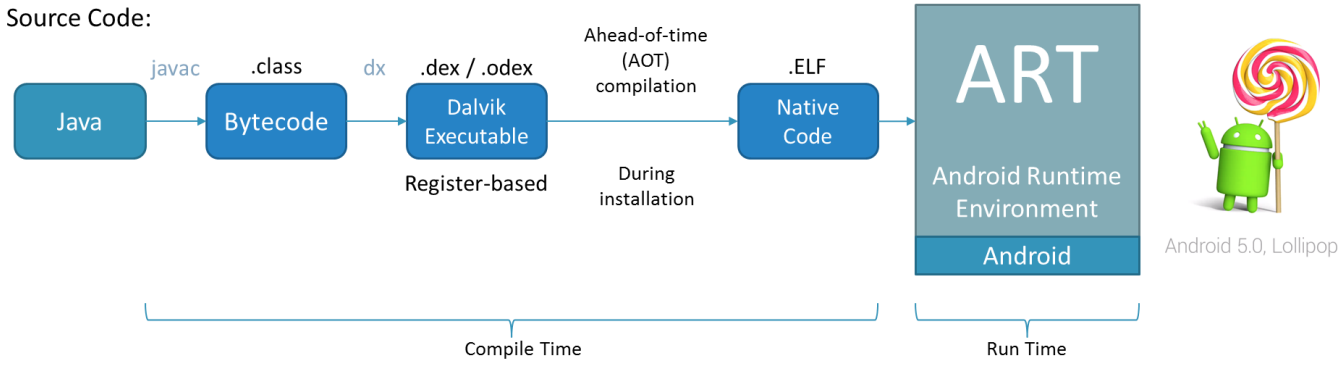
Android Architecture

The ~~Dalvik VM~~ Android Runtime (ART) Architecture:



Android Architecture

The ~~Dalvik VM~~ Android Runtime (ART) Architecture:



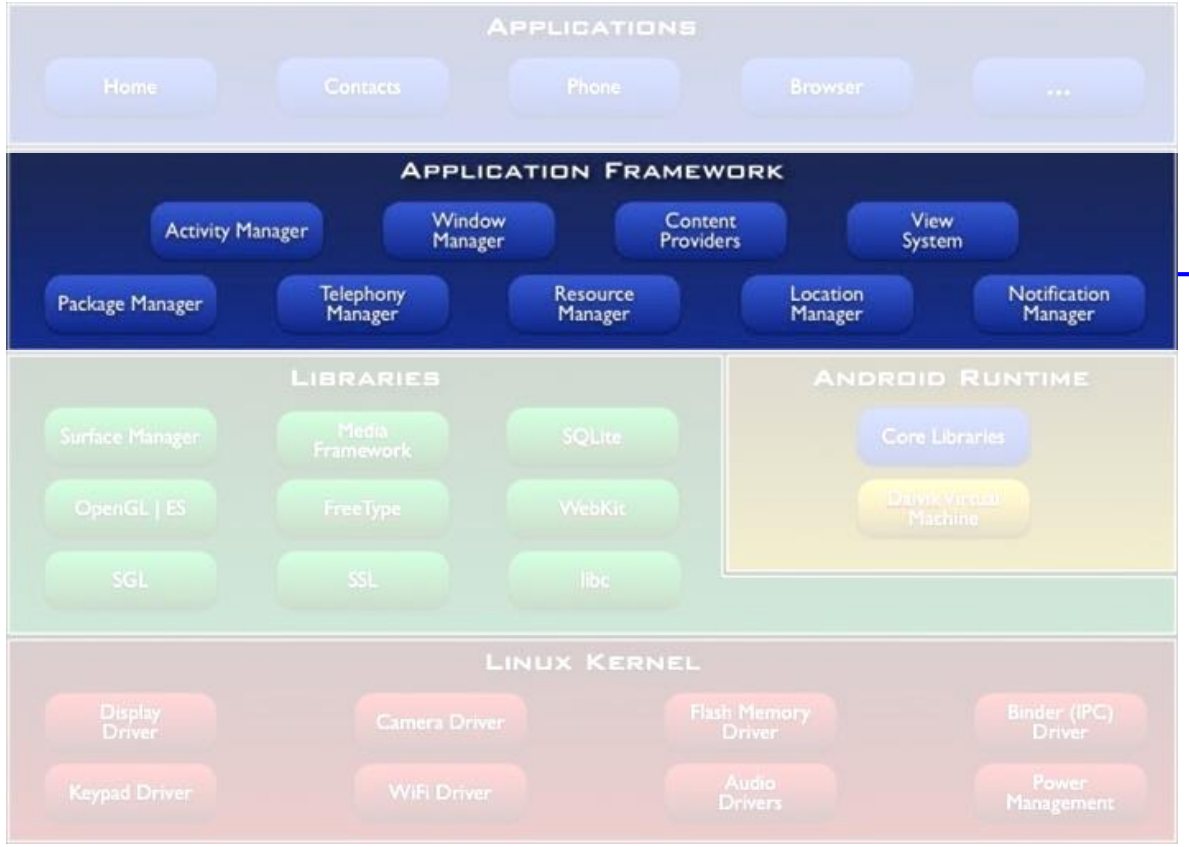
- More time of installation
- More storage for compiled code

+ Faster load!
+ Faster runtime! (no interpretation / JIT overhead)
+ Less RAM usage (no JIT code cache)
+ Less CPU usage (you run the app, not the interpreter)
+ Less power consumption (better for battery life)

At the same time, ART brings improvements in

- Performance
- Garbage collection
- Application debugging and profiling

Android Architecture



Application Framework:

- Written entirely in Java
- The framework for writing apps

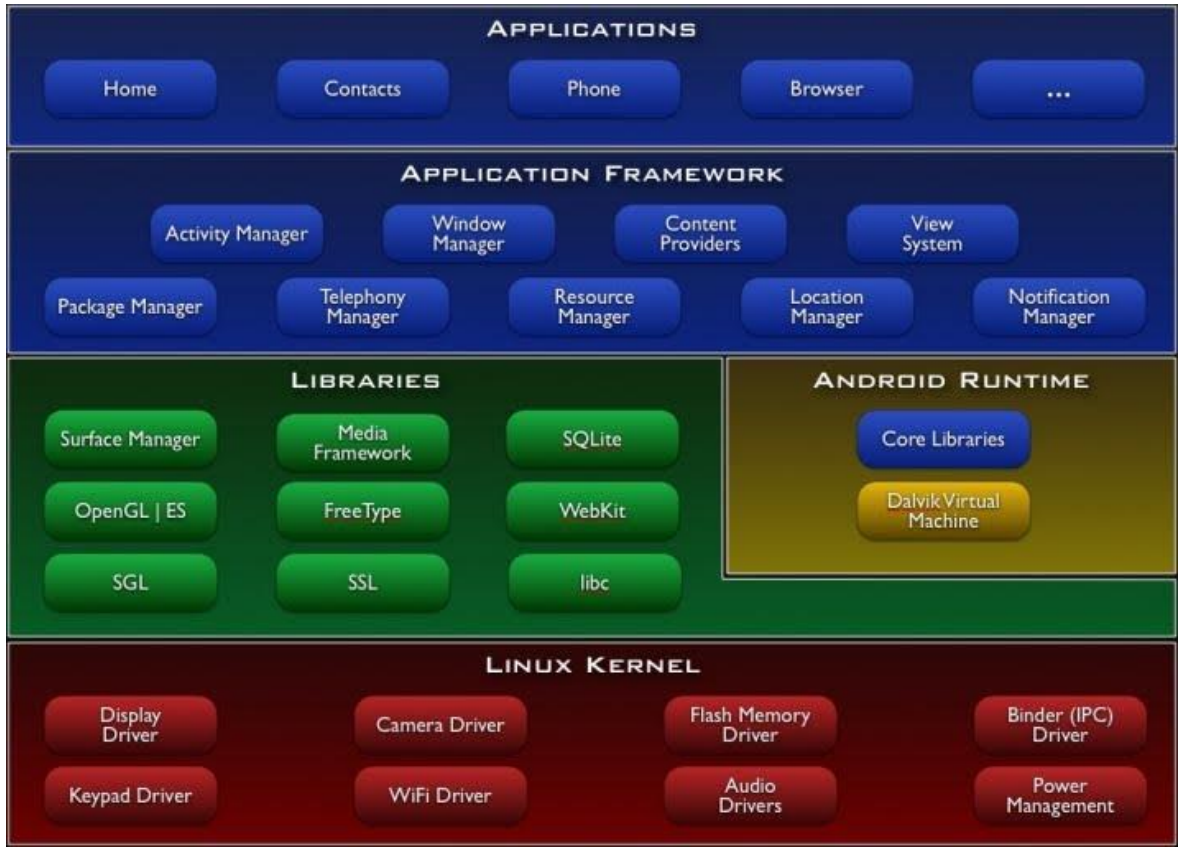
Overview:

- Activity manager – managing the life cycle of apps
- Package manager – managing installed apps
- Content providers – allows apps to share data

Android Architecture

- The (high-level) apps
- Android is shipped with existing apps
- In this layer we write our apps
- Java

Android Architecture



Android app building blocks

- **Activities**
  - A single screen with a user interface
  - An app is made of several independent activates (e.g., inbox, compose mail)
  - Apps can use the activities of other apps (e.g., a camera app may compose an email and share a picture)
  - Implemented as a subclass of Activity

- **Services**
  - A component that runs in the background to perform long-running operations (e.g., play music)
  - No user interface
  - An activity can invoke services
  - Implemented as a subclass of Service

Android app building blocks

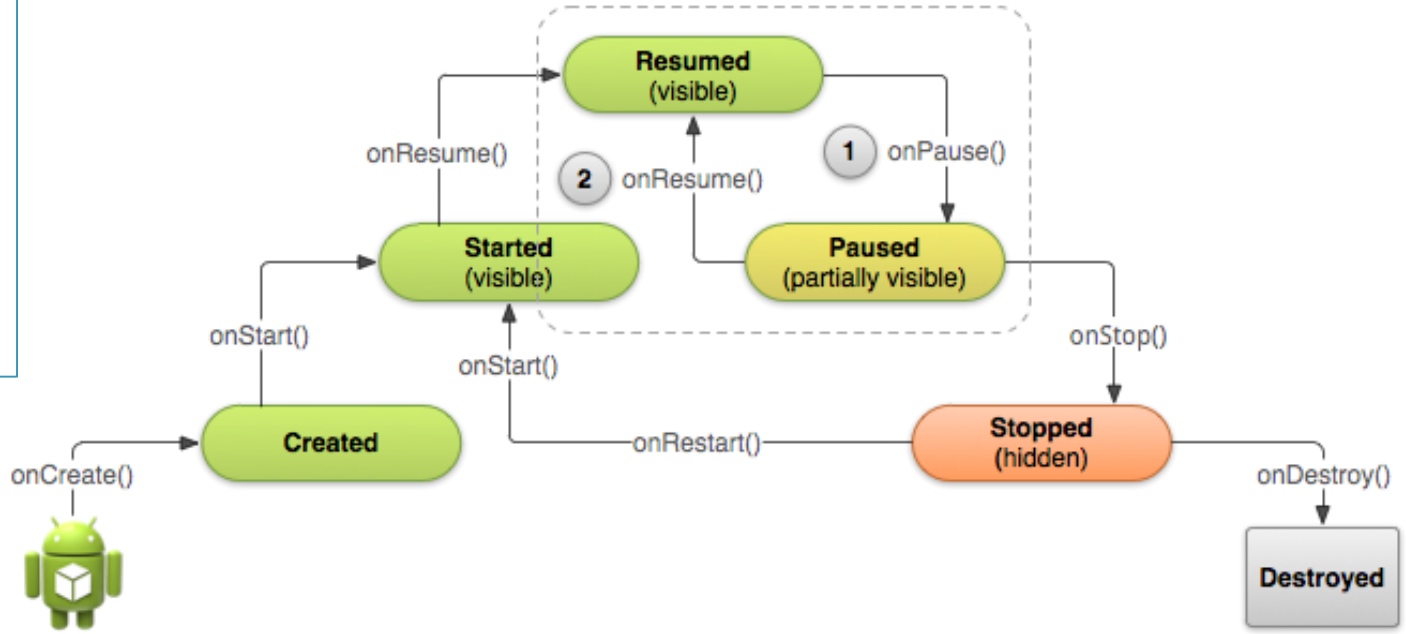
- **Content providers**
  - Manages a shared set of app data (e.g., contact list)
  - Anywhere you can access: file system, SQLite database, or on the web
  - Authorized apps can access and even change the shared data
  - Implemented as a subclass of ContentProvider

- **Broadcast receivers**
  - A component that responds to system-wide broadcast announcements
  - Screen has turned off, battery is low, a picture is captured, etc.
  - Apps can also initiate broadcasts (e.g., download is complete)
  - No UI, status bar notifications
  - Implemented as a subclass of BroadcastReceiver

Activity Life Cycle

```java
public class Activity extends ApplicationContext {

    protected void onCreate(Bundle savedInstanceState);

    protected void onStart();

    protected void onRestart();

    protected void onResume();

    protected void onPause();

    protected void onStop();

    protected void onDestroy();
}
```

Your Activity



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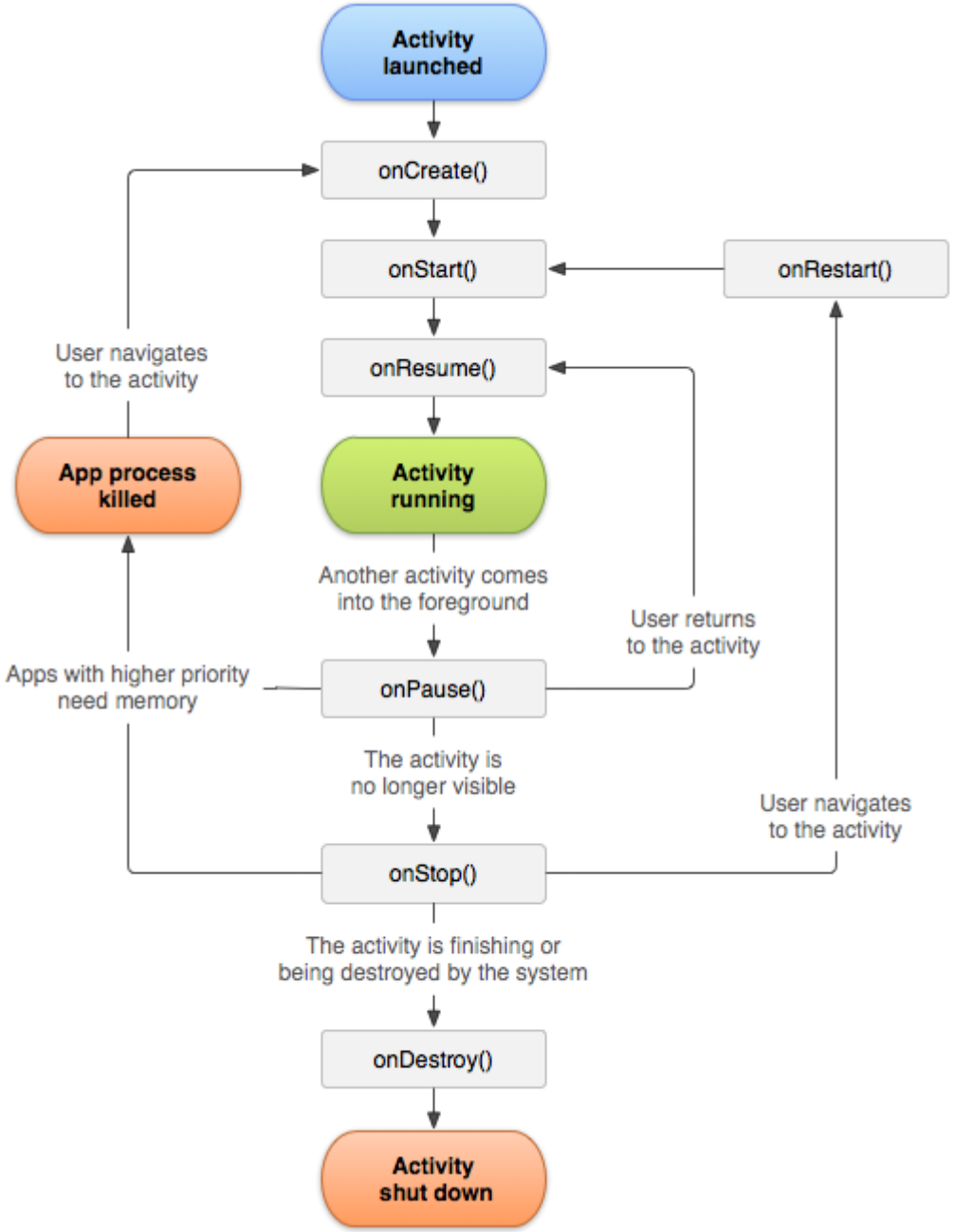
Your Activity



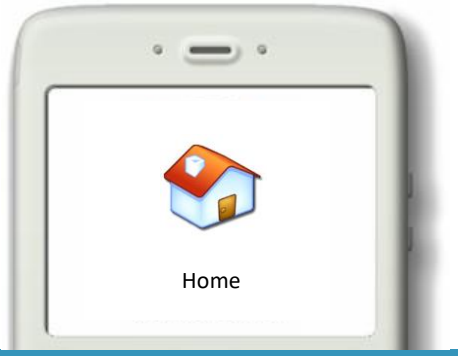
Activity Life Cycle

System process
Activity Manager

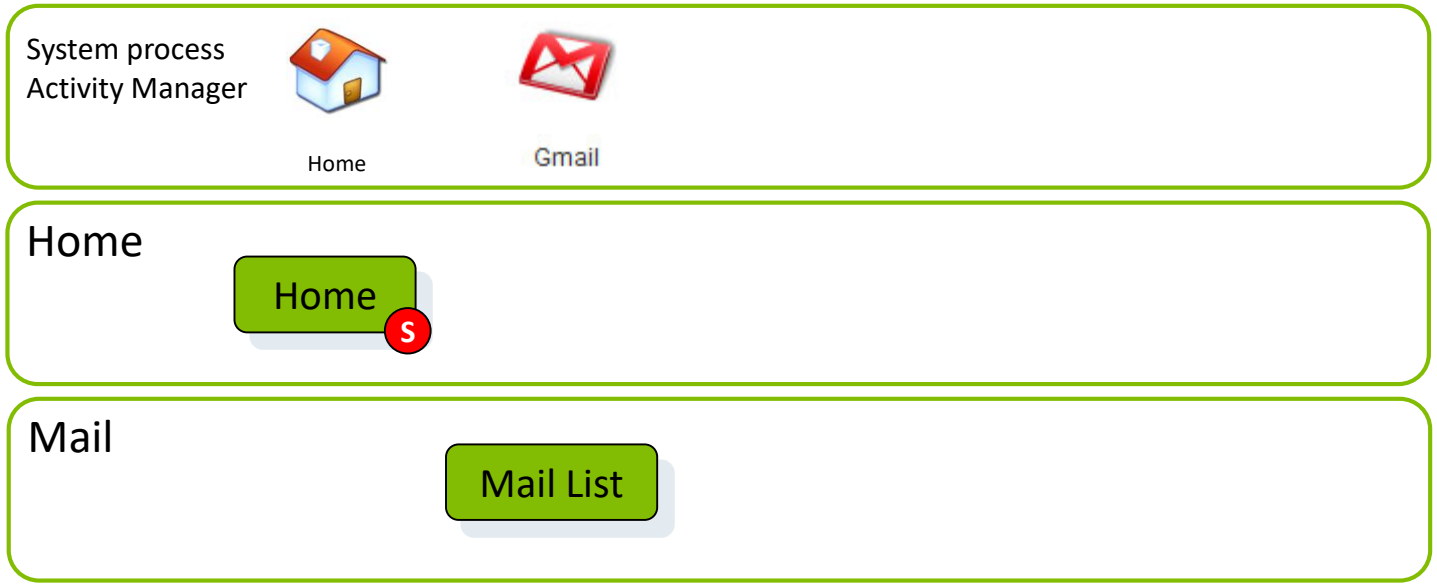
Home

Home

Home



Activity Life Cycle



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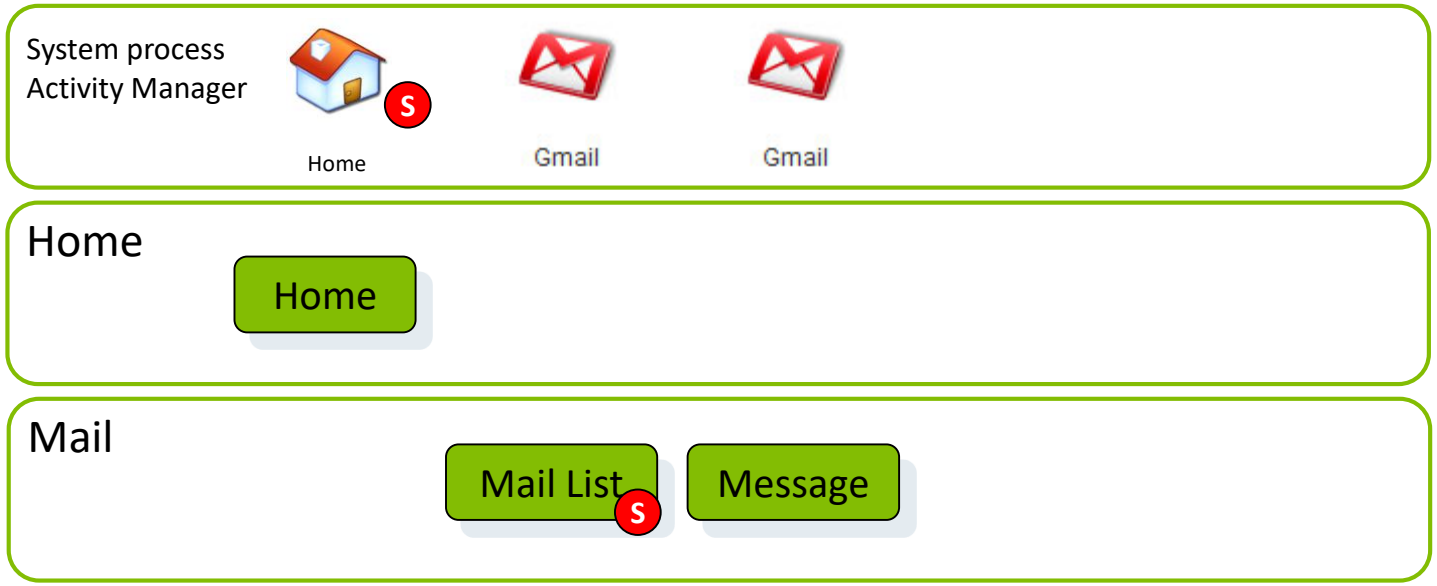

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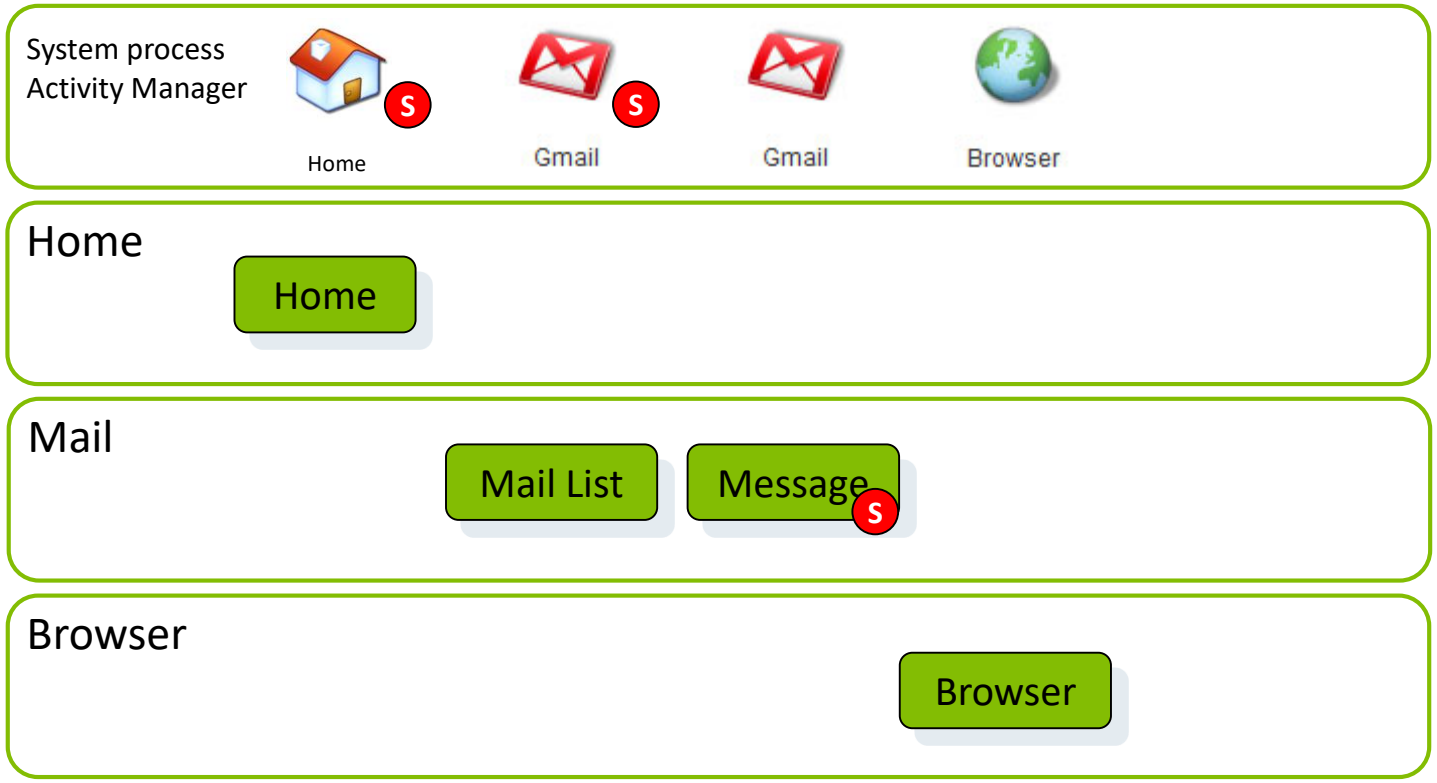

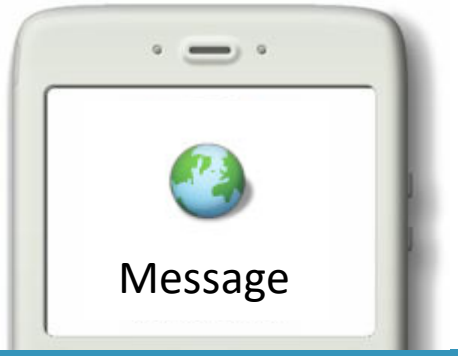

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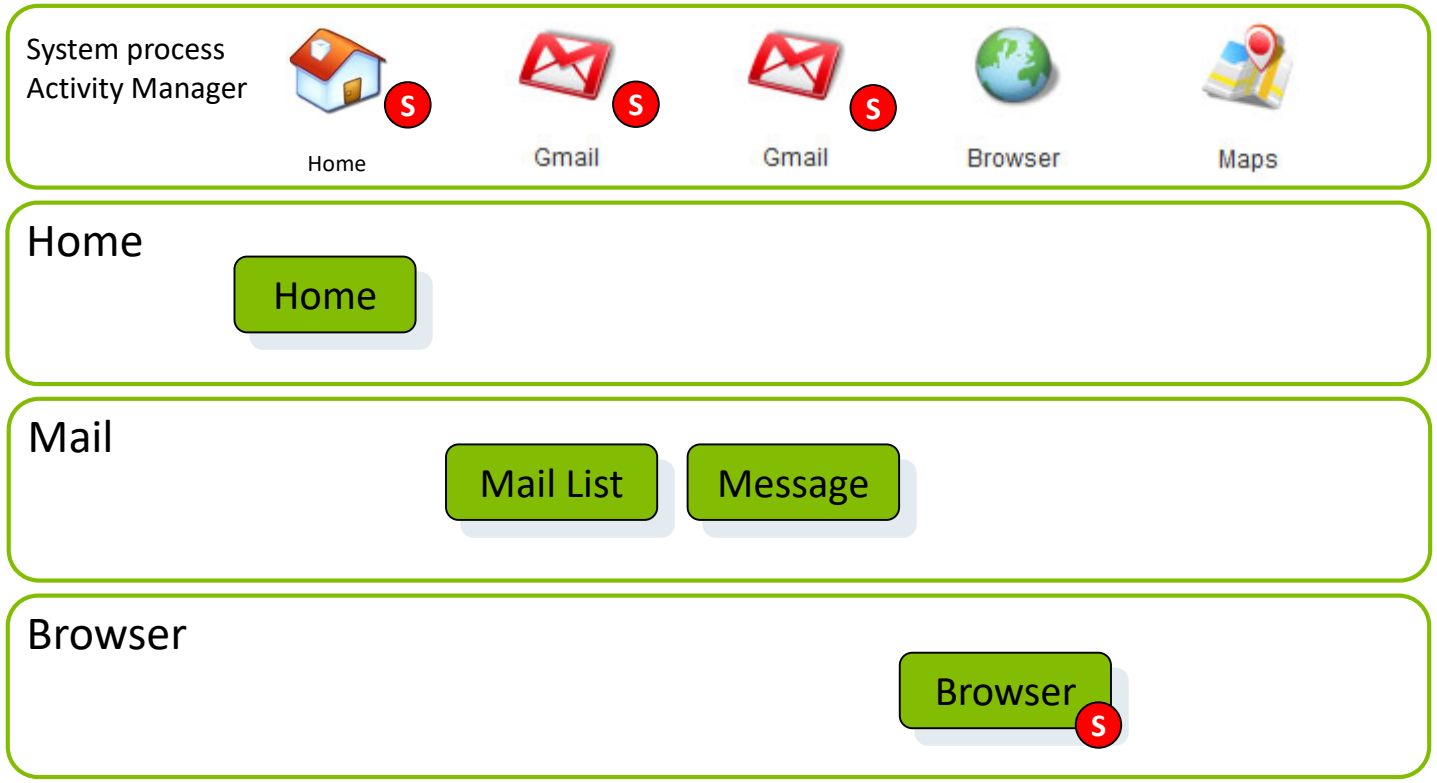

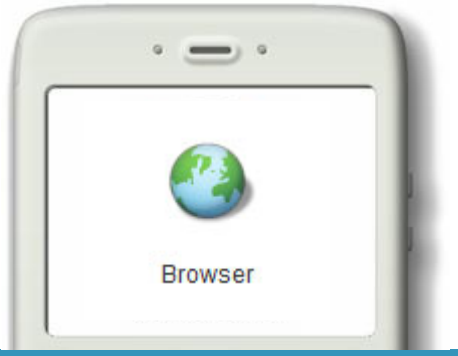

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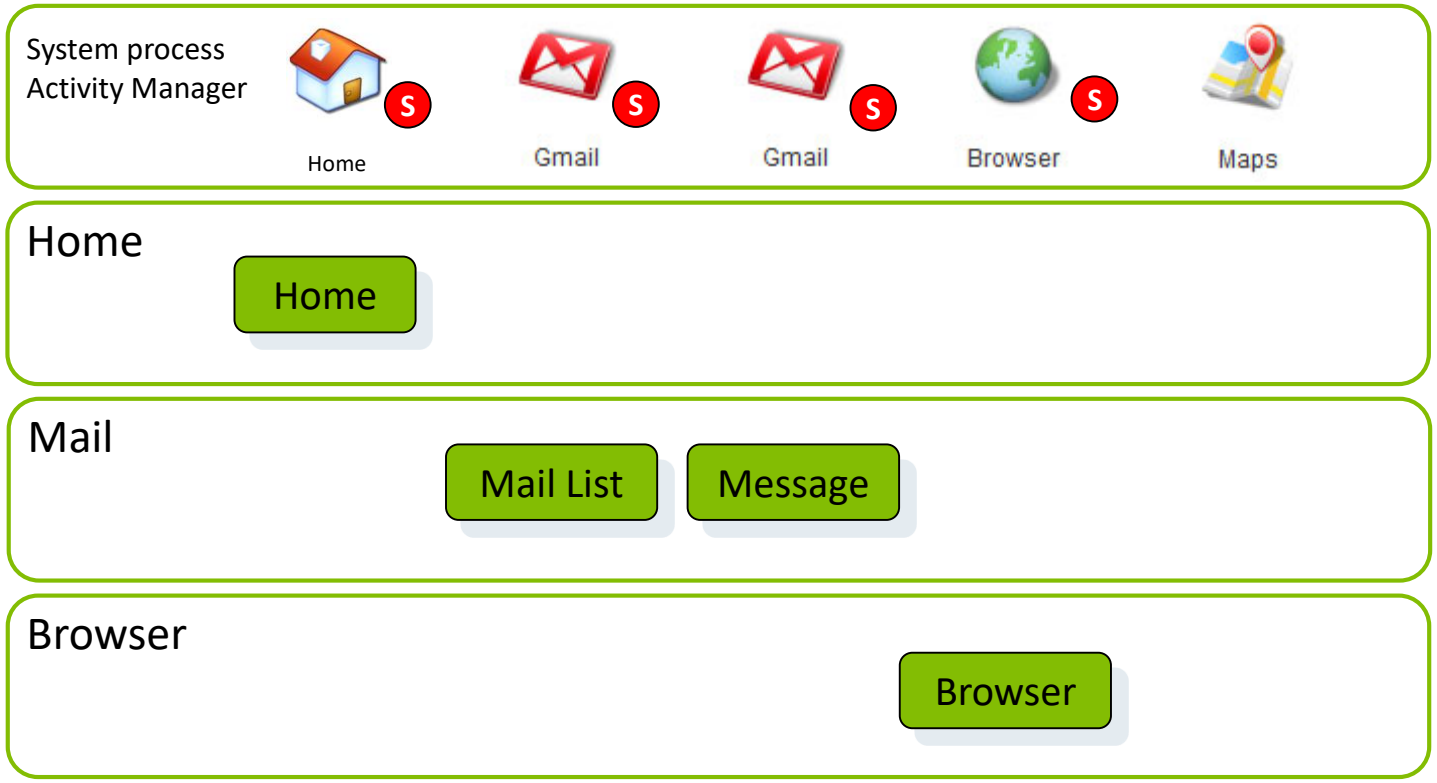

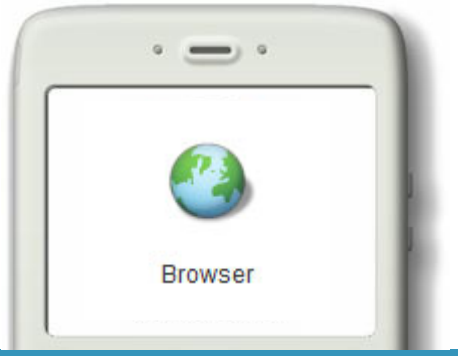

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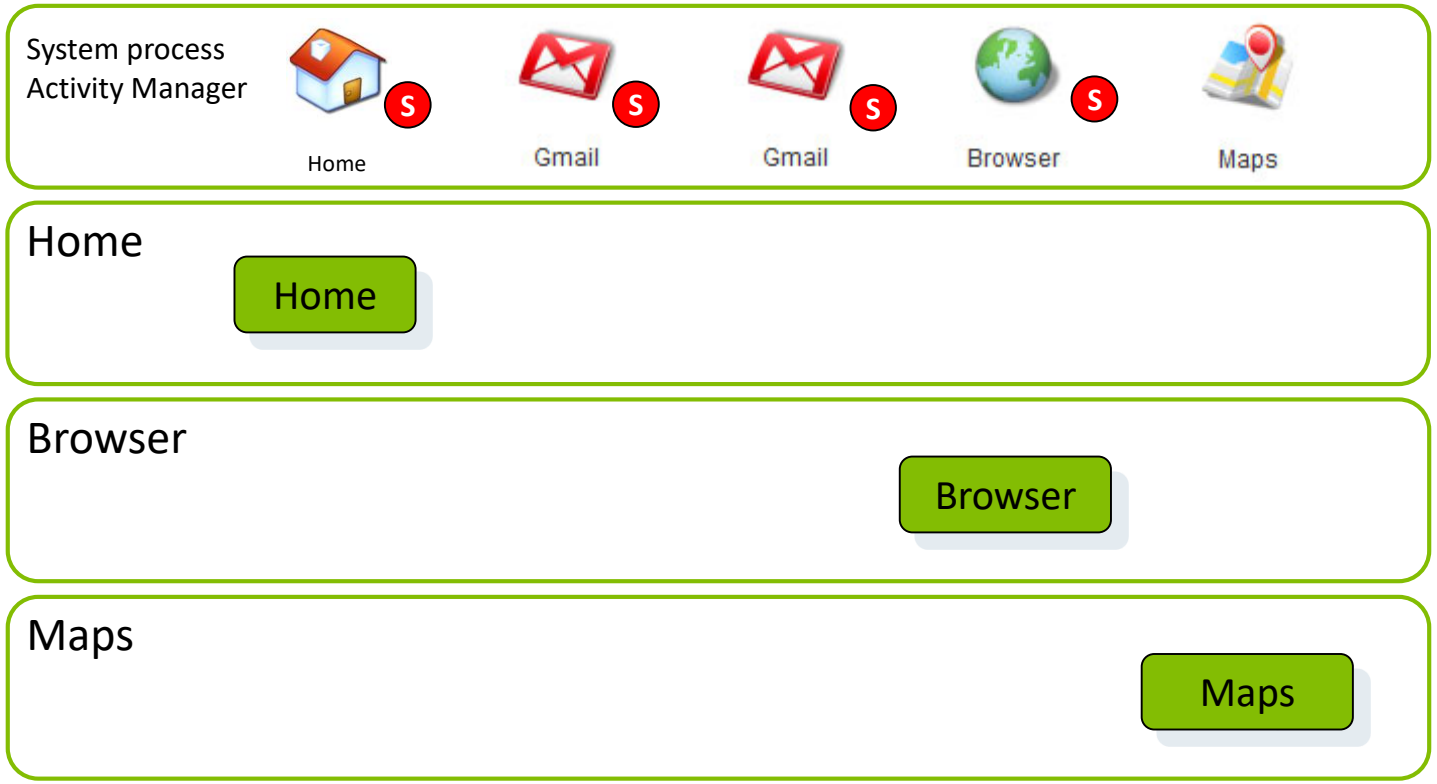

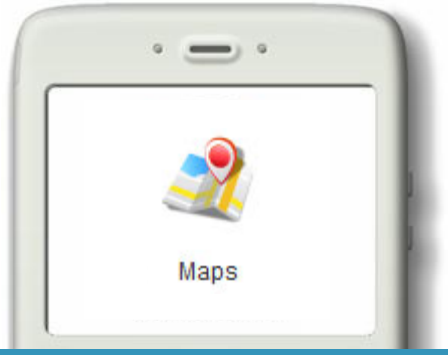

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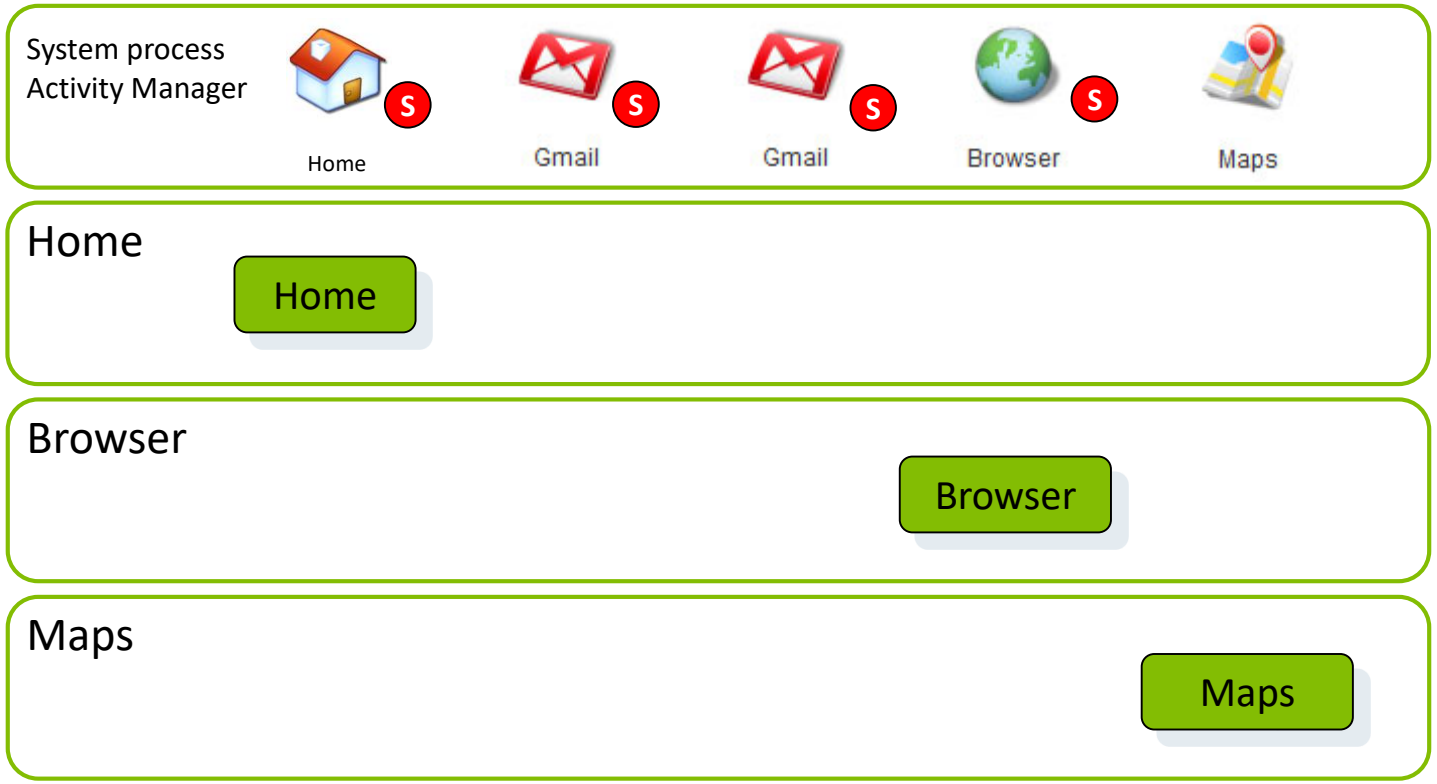

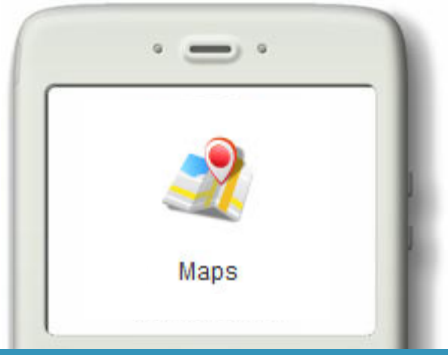

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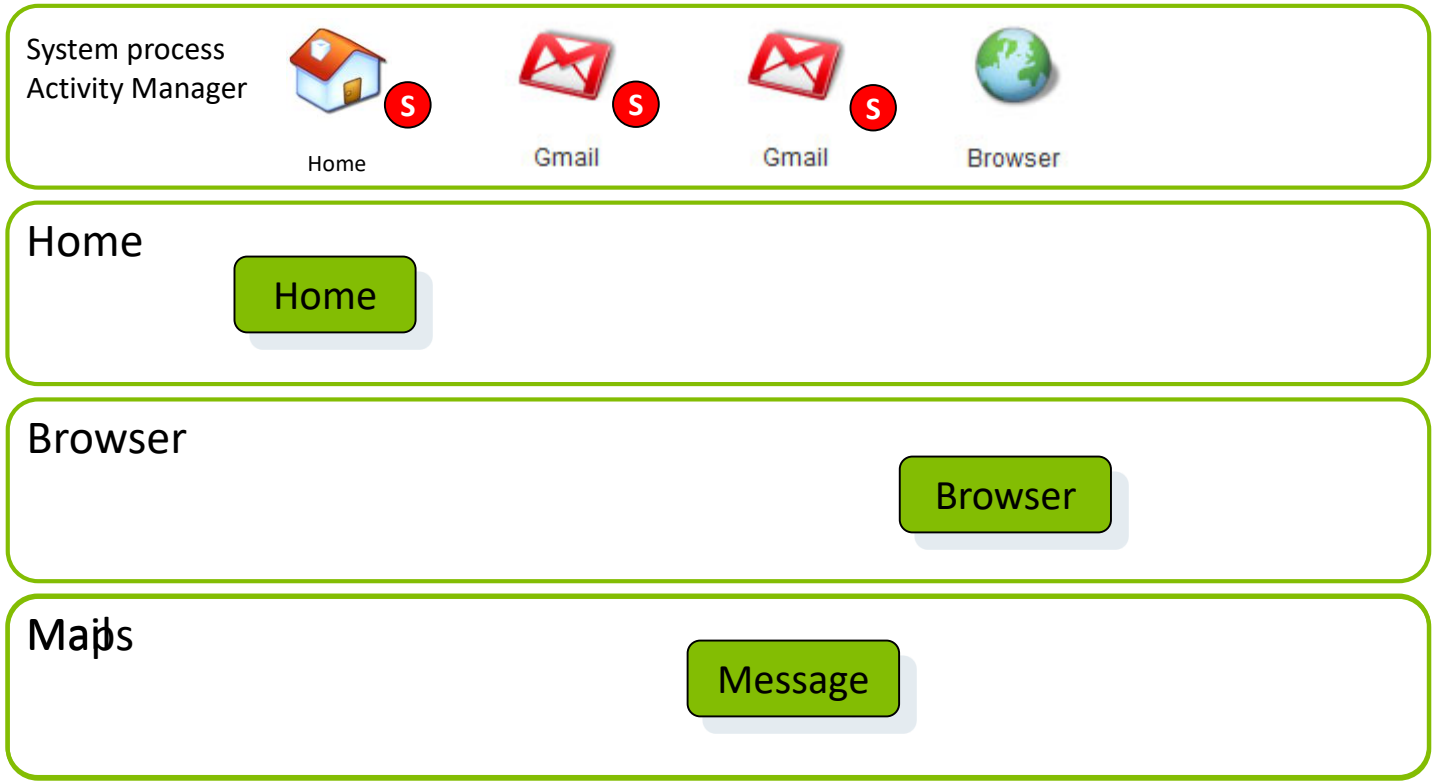

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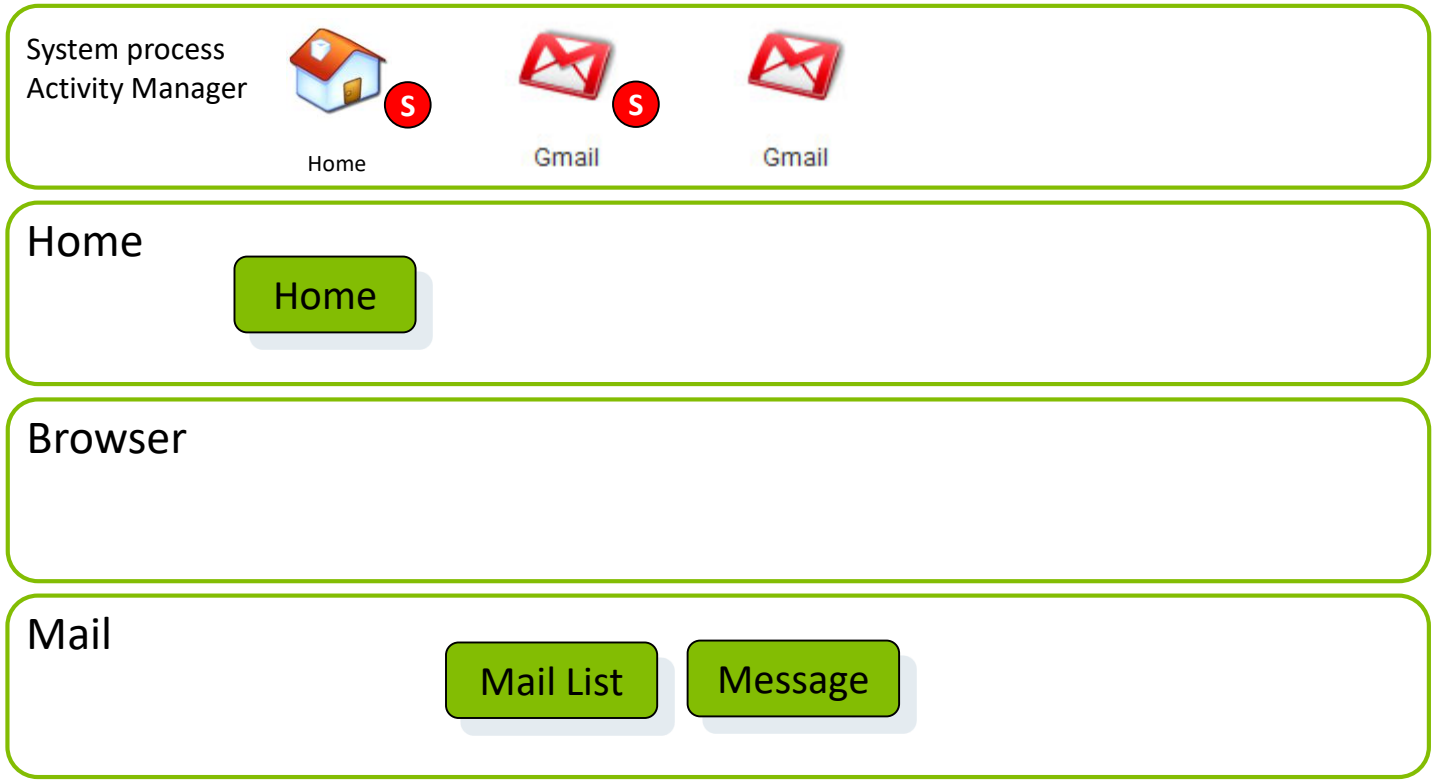


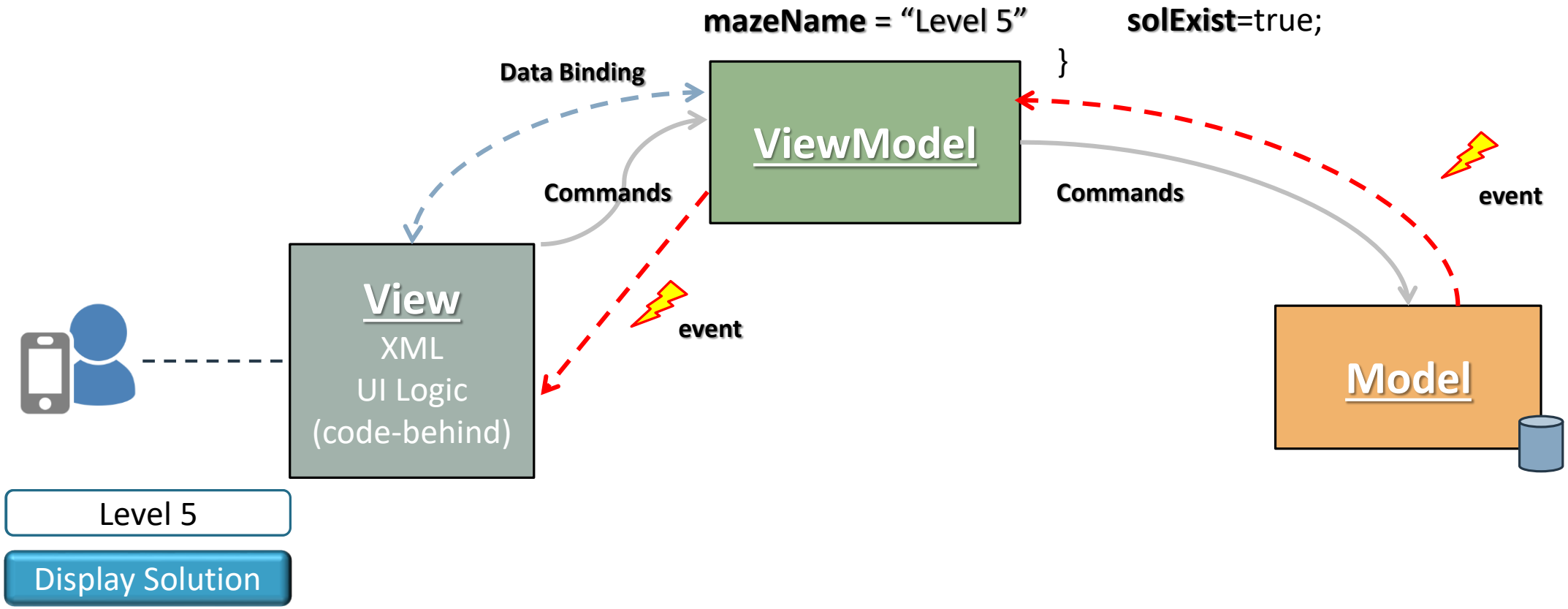
MVVM in Android

EXAMPLE

The MVVM Architecture

Data Binding Library

```
if(model.soltionExist(mazeName)){
    sol=model.getSolution(mazeName);
    solExist=true;
}
```



View with binding to the ViewModel

```
1.<layout xmlns:android="http://schemas.android.com/apk/res/android">
2.
3.   <data>
4.       <variable
5.           name="viewModel"
6.           type="myPackage.MyViewModel"/>
7.   </data>
8.
9.   <LinearLayout ... />
10.       <EditText
11.           style="@style/EditText"
12.           android:text="@{viewModel.mazeName}"
13.           android:onEditorAction="@{viewModel.onE
14.
15.         <Button
16.           style="@style/ButtonSignIn"
17.           android:enabled="@{viewModel.solExist}"
18.           android:onClick="@{viewModel.onDisplays
19.   </LinearLayout>
20.</layout>
```

```
// in the ViewModel class
public boolean onEditorAction(   @NonNull final TextView textView,
                                 final int actionId,
                                 @Nullable final KeyEvent event) {

    if (actionId == EditorInfo.IME_ACTION_DONE ||
        event.getKeyCode() == KeyEvent.KEYCODE_ENTER) {

        // mazeName = textView.getText();
        if(model.soltionExist(mazeName)){
            sol=model.getSolution(mazeName);
            solExist=true;
        }
    }
    return solExist;
}
```