G54MDP
Mobile Device Programming

Lecture 5 – Activities

Android Programming Model

- Component based model
  - Multiple application entry points
    - The point through which the system can “enter” the application
  - Not all are entry points for the user
  - Each exists as a logical independent unique entity

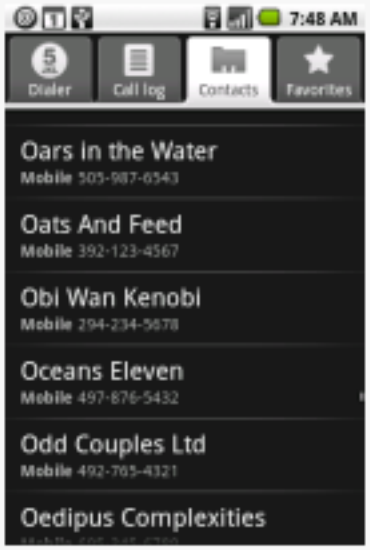
Android Components

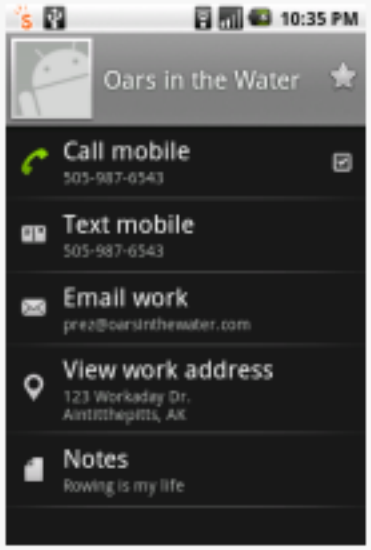
- Activities
  - UI components
- Services
  - Mechanism for doing something long-running in the background
- Broadcast Receivers
  - Respond to broadcast messages from the OS / other apps
- Content Providers
  - Make data available to / make use of data from other apps
  - No access to the file system
    - SD Card

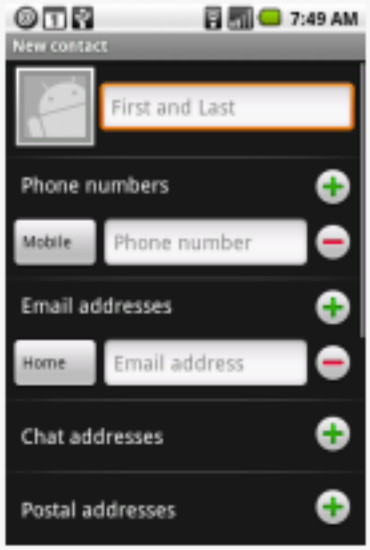
Activities

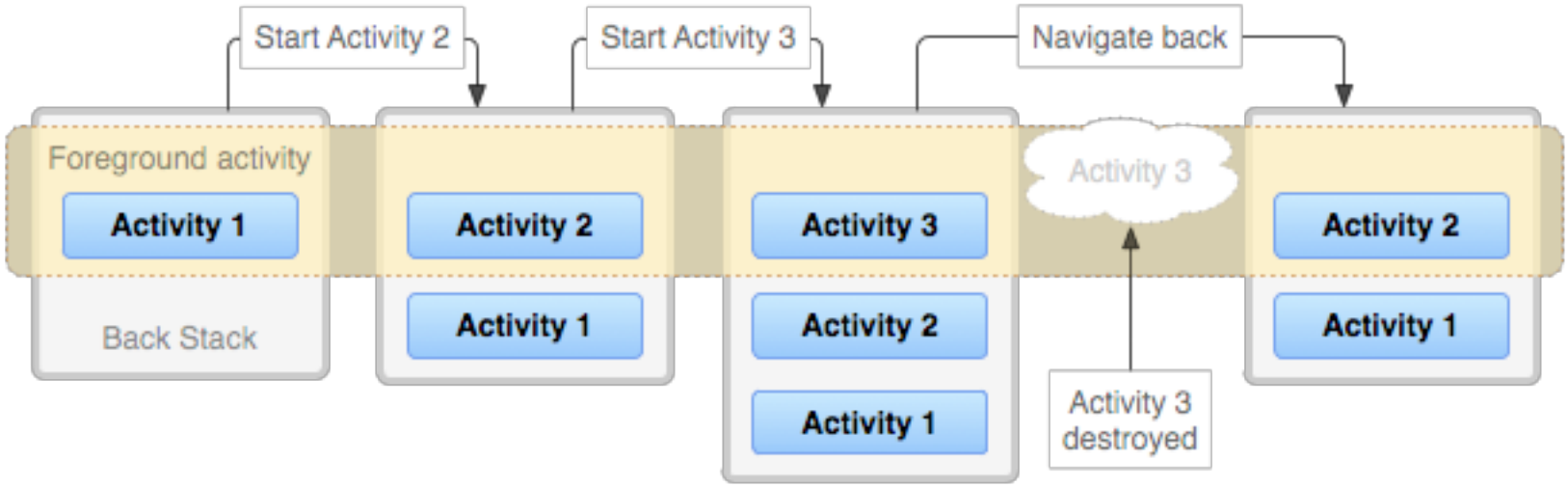
- Activities can start other activities
- Forms a stack of Activities — current activity is on the top
- An activity should be an **atomic** part of a particular task
- Multiple activities form a Task
  - Like…
  - A Task may span multiple applications
- Activities in a task move as a unit from foreground to background and vice versa


7:48 AM
Dialer
Call log
Contacts
Favorites
1
2 ABC
3 DEF
4 GHI
5 JKL
6 MNO
7 PQRS
8 TUV
9 WXYZ
*
0 +
#


7:48 AM
Dialer
Call log
Contacts
Favorites
Oars in the Water
Mobile 505-987-6543
Oats And Feed
Mobile 392-123-4567
Obi Wan Kenobi
Mobile 294-234-5678
Oceans Eleven
Mobile 497-876-5432
Odd Couples Ltd
Mobile 492-765-4321
Oedipus Complexities

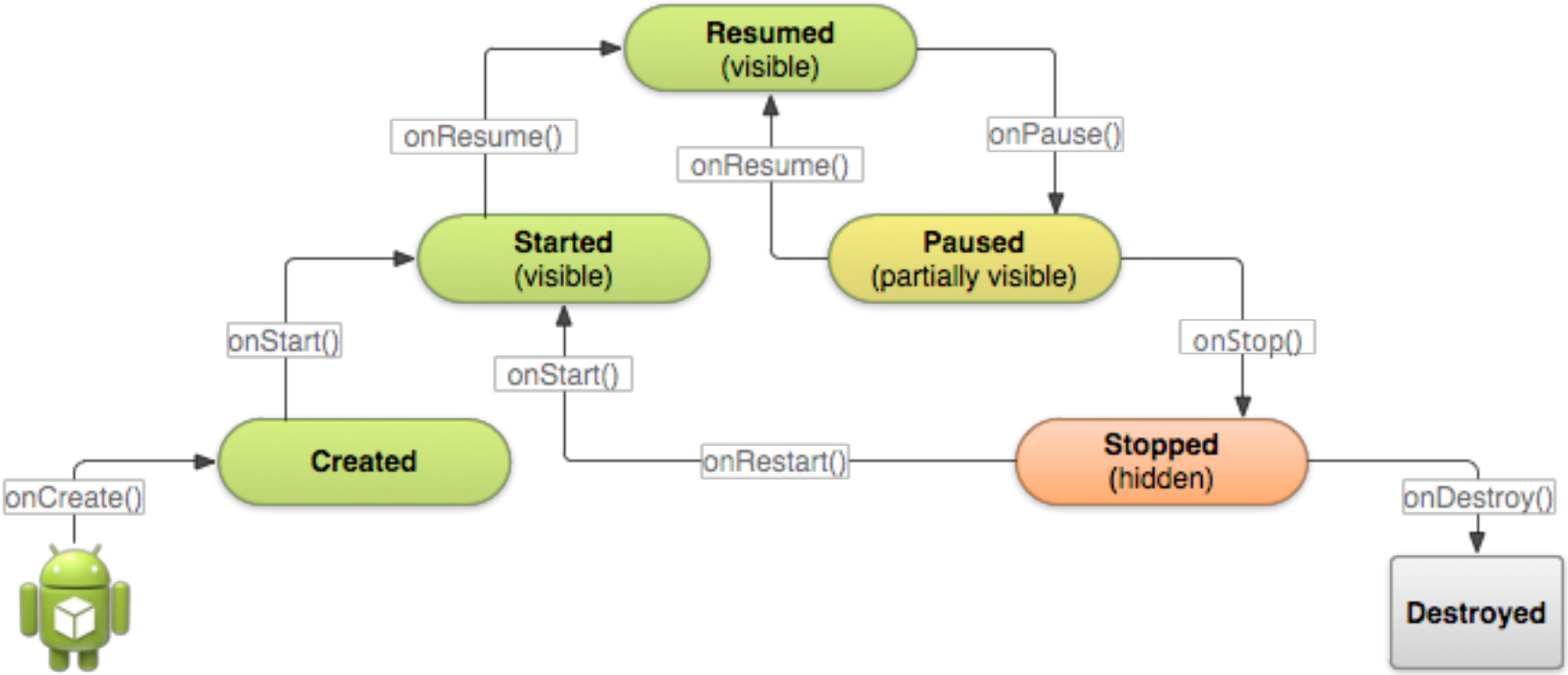

10:35 PM
Oars in the Water
Call mobile
505-987-6543
Text mobile
505-987-6543
Email work
Email address
View work address
123 Workaday Dr.
Notes
Rowing is my life


7:49 AM
New contact
First and Last
Phone numbers
Mobile
Phone number
Email addresses
Home
Email address
Chat addresses
Postal addresses


Start Activity 2
Start Activity 3
Navigate back
Foreground activity
Activity 1
Back Stack
Activity 2
Activity 1
Activity 3
Activity 2
Activity 1
Activity 3
Activity 3 destroyed
Activity 2
Activity 1

Activity Lifecycle

- Essentially three states
  - Active
    - in the foreground
  - Paused
    - still visible, but not top
  - Stopped
    - obscured by another activity
- If paused or stopped, the system can drop the Activity from memory
  - Stopped activities are suspended in memory
    - Consume no processing resources
  - Inactive activities are destroyed if memory is required
    - Oldest first


Resumed
(visible)
onResume()
onResume()
onPause()
Started
(visible)
Paused
(partially visible)
onStart()
onStart()
onStop()
Created
onRestart()
Stopped
(hidden)
onCreate()
onDestroy()
Destroyed

Android UI

- An Activity has a window associated with it
- Usually full screen
  - Can hover over another activity
  - Can be transparent
- Within the window there is a hierarchy of View objects
- Set with setContentView()
- Usually specified via an XML resource
  - /res/layout/mylayout.xml

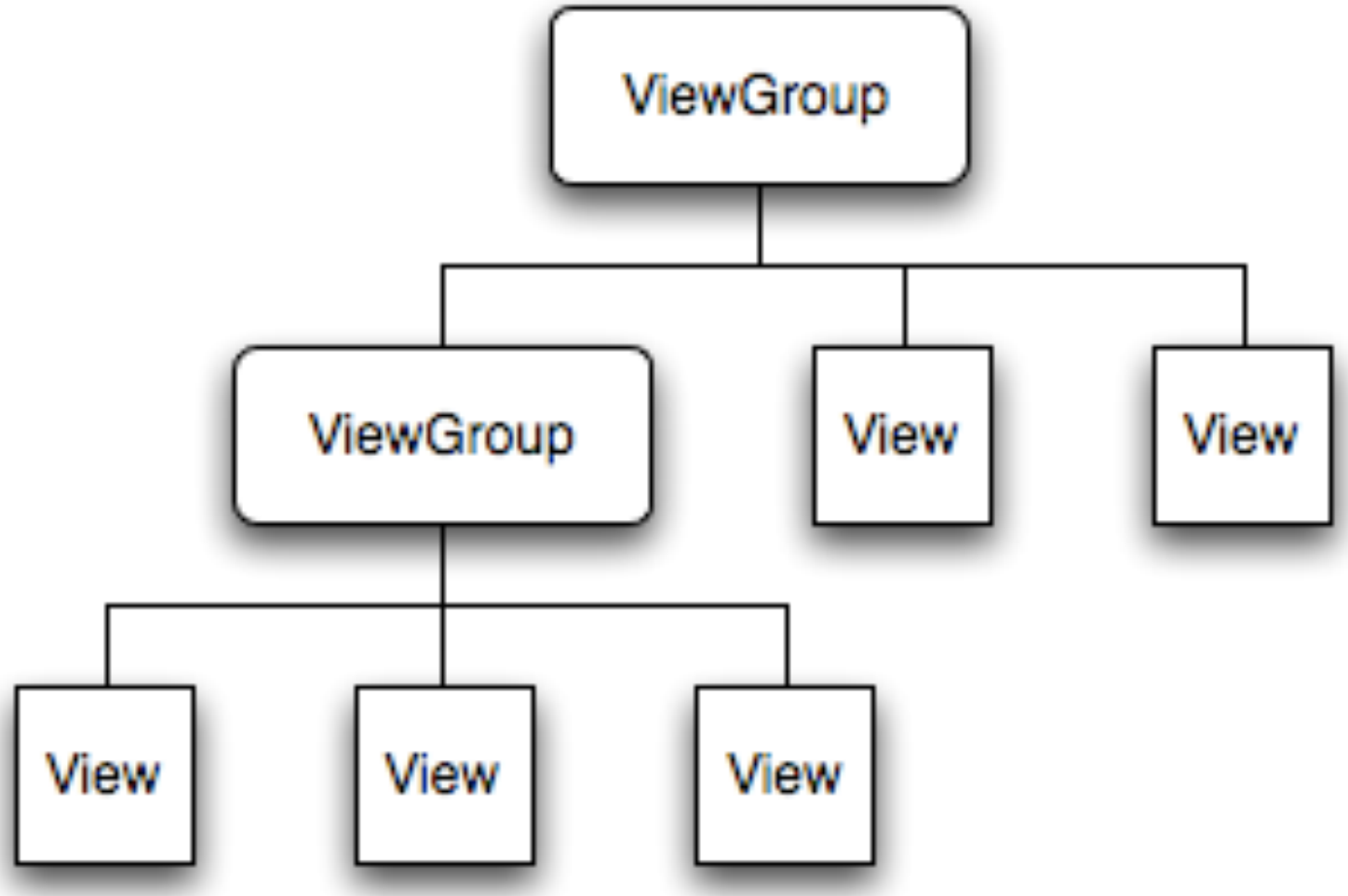
```java
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
```

```xml
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    tools:context=".MainActivity" >

    <TextView
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="@string/hello_world" />
```

View Hierarchy

- Types of View subclasses
  - Those that display something
  - Those that do something (Widgets)
  - And ViewGroups which layout a collection of subviews
- Various layout types available — can specify in the XML resource


ViewGroup
ViewGroup
View
View
View
View
View

ViewGroups - Layouts

- FrameLayout
  - Simplest, contains a single object
- LinearLayout
  - Aligns all children in a single direction, based on the orientation attribute
- TableLayout
  - Positions children into rows and columns
- RelativeLayout
  - Lets the child views specify their position relative to the parent view or to each other
- ScrollView
  - A vertically scrolling view, like FrameLayout only contains a single element (e.g. a LinearLayout)

Views - Widgets

- A child View that the user can (optionally) interact with
  - Button (a button)
  - EditText (text entry)
  - CalendarViewer (a calendar widget)
  - ImageView (displays an image)
  - …
- Handle appropriate UI events
  - In code, register setOnClickListener()
  - In XML layout, set android:onClick parameter
- Properties / parameters
  - Set via XML at build-time
  - Equivalent set / get methods for modifying at run-time

    android:text="@string/hello_world" />

    .getText(...), .setText(…)

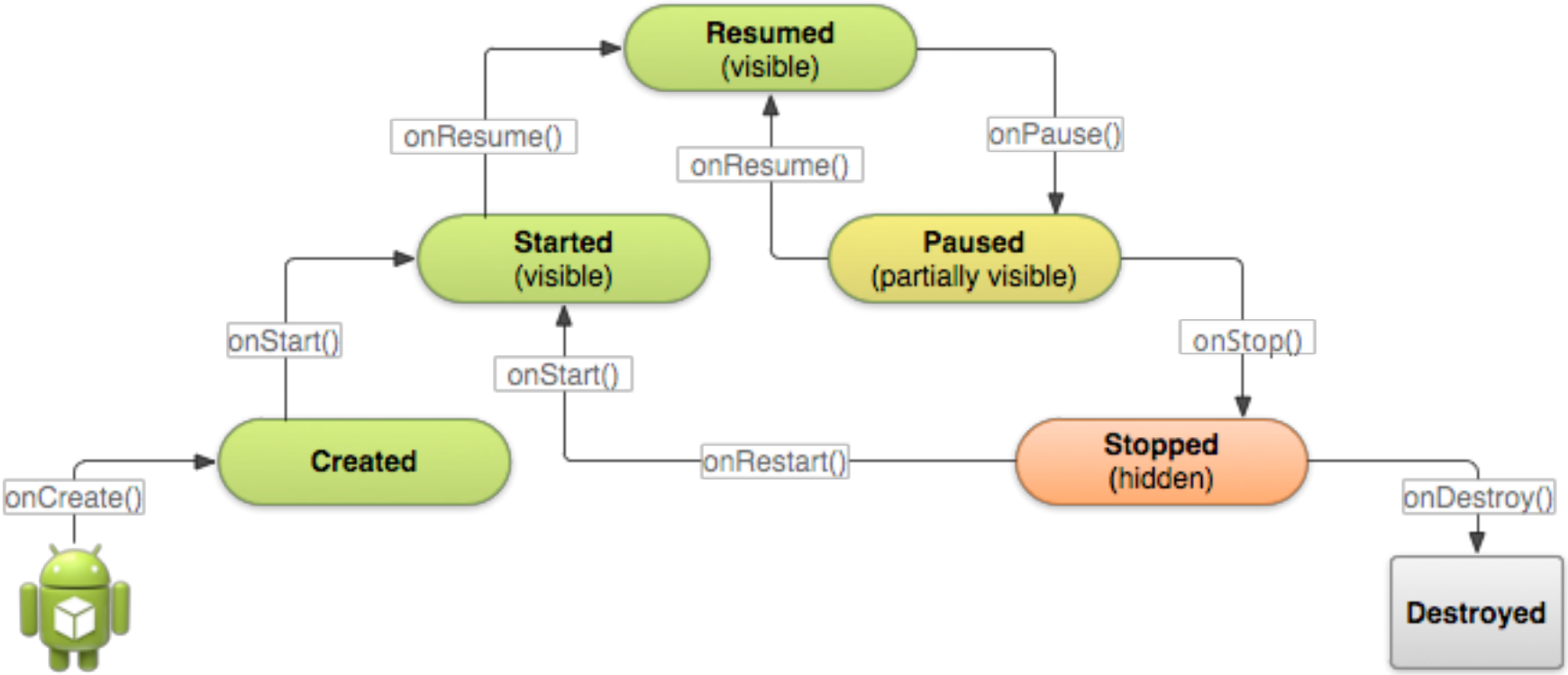
Views - Parameters

- Parameters specify the details of particular Views
  - Width, height
    - Generally **not** in terms of absolute pixels
    - Relative to parent, percentages, offsets, margins
      - android:layout_width="match_parent”
      - android:layout_height="wrap_content"
  - ID
    - Used to generate a Java member variable we can refer to programmatically
      - android:id="@+id/my_button"
  - Methods
    - Used to automatically bind UI events to code
      - android:onClick=“myMethod”

Manipulating Views

- We can alter the view hierarchy programmatically as the application runs
- ViewGroup provides methods
  - To add addView()
    - Need to either keep a reference to it or call setId() on the view so we can find it later
    - Or use references generated from layout XML for existing views
  - Or to remove removeView() children
    - Can add new buttons, layouts as required

Let’s have a look…


Resumed
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Paused
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onStart()
onStop()
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Stopped
(hidden)
onCreate()
onDestroy()
Destroyed

Saving State

- Shouldn't rely on an Activity storing UI state
  - E.g. rotating the device
    - Destroys and recreates the activity
  - If you need to keep it, save it
- Before onStop() is called, Android will call onSaveInstanceState()
  - To restore the **UI** to its previous state on restore
  - This allows you to save any **UI state** into a Bundle object
    - When the Activity is recreated, the Bundle is passed to onCreate() and onRestoreInstanceState()
    - Giving the Activity chance to restore its state
  - Save **other state** to more persistent storage
    - SQLite database / user preferences
    - More on this later

Saving UI State

- Bundle
  - A collection of key/value pairs
  - Key
    - Unique String identifier
  - Value
    - A primitive value
    - A Serializable / Parcelable object
      - Writing and reading a complex class
      - More on this later on (IPC)
  - i.e. myBundle.putInt(“myInteger”, 5);
  - … int i = myBundle.getInt(“myInteger”);

Let’s have a look…

References

- http://developer.android.com/guide/topics/ui/declaring-layout.html

- http://developer.android.com/guide/topics/ui/controls.html