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MVC and Android

Slides originally by Ken Wong

MVC Framework

Who is in Control?

- Class library reuse
  - application developers:
    - write the main body of the application
    - reuse library code by calling it

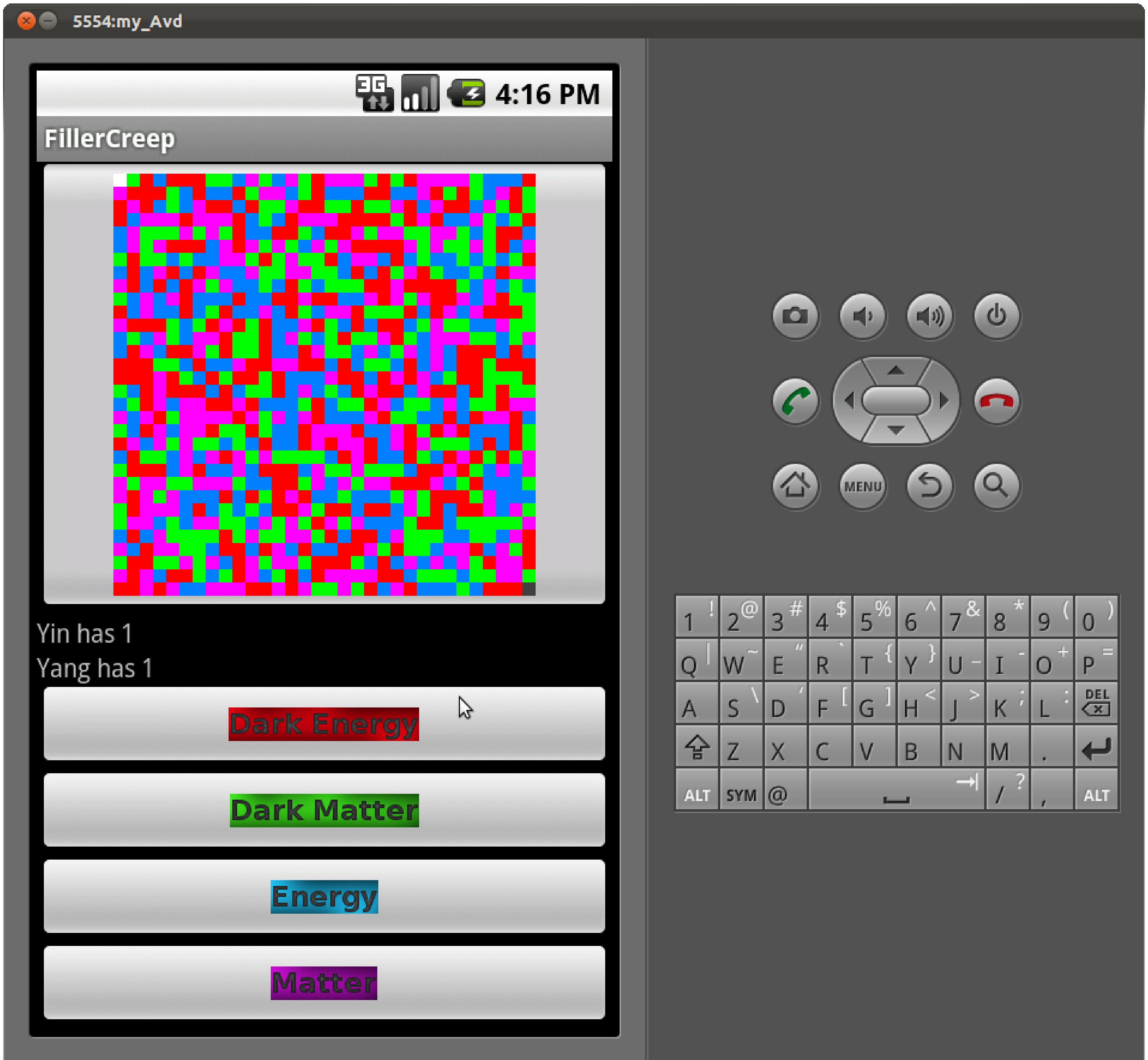
- Framework reuse
  - application developers:
    - reuse the main body of the application
    - write code that the framework calls
    - reuse library code by calling it

Framework

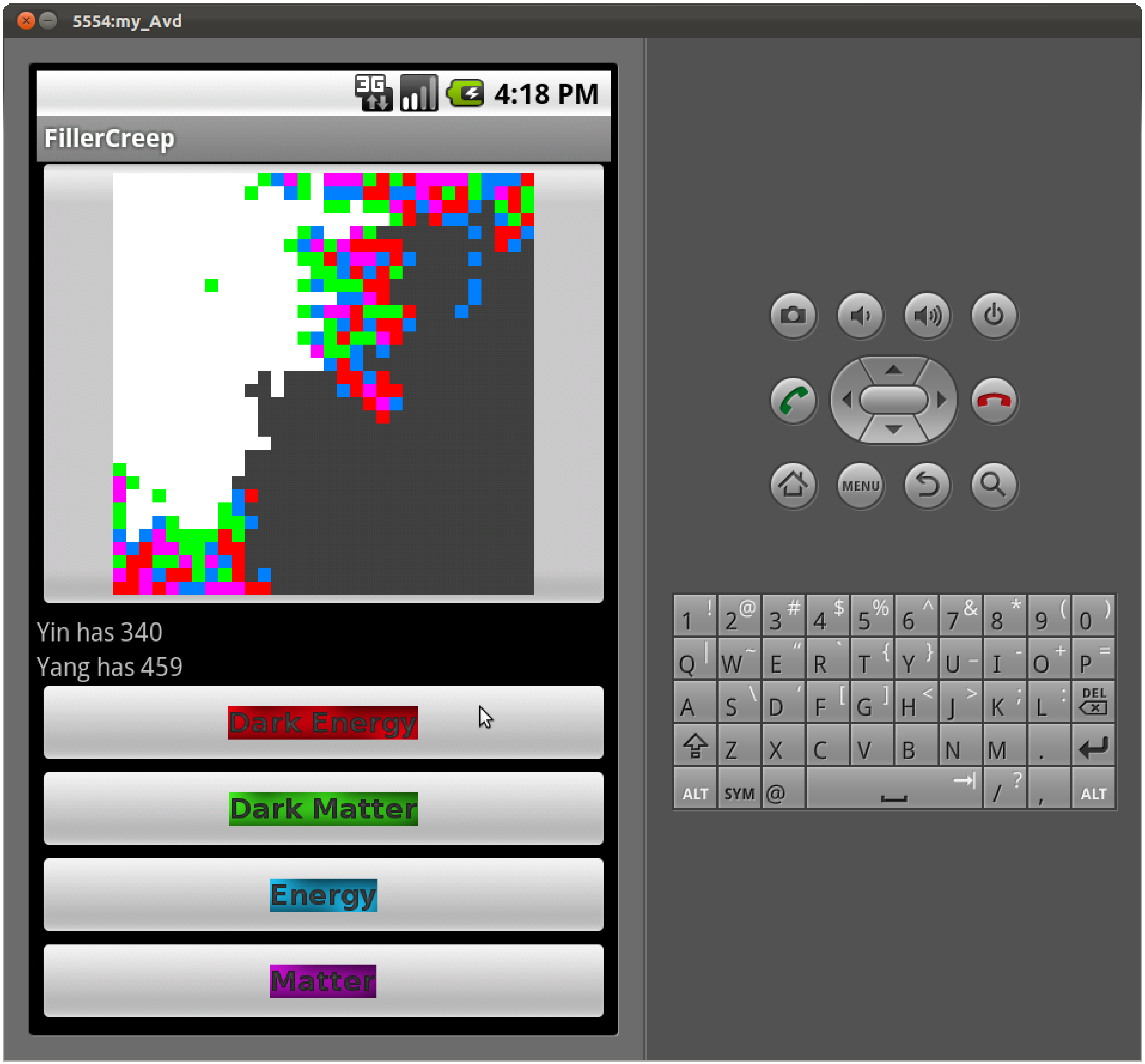
- Separation of concerns:
  - framework
    - skeletal application code
    - general superclasses and interfaces
  - your “customizations”
    - specific subclasses and implementations

Exercise

- Design an MVC framework for building interactive applications.



Yin has 1
Yang has 1



Yin has 340
Yang has 459

Filler Creep Game

- The universe is filled with stuff
- You (Yin) fight Yang for the fundamental stuff that forms the universe.
- You can only consume what you touch
- You will beat Yang if you consume more than Yang.
- 4 kinds of stuff: energy, matter, dark matter and dark energy (I guess you're some of space)
- https://github.com/abramhindle/FillerCreepForAndroid

Filler Creep Game

- We're going to use MVC
- Model
  - The universe and game rules
- Views
  - Text View, Graphical View
- Controller
  - Game interaction rules
  - Access to model
  -

The Generic Model

```
public class FModel<V extends FView> {
   private ArrayList<V> views;
   public FModel() {
      views = new ArrayList<V>();
   }
   public void addView(V view) {
      if (! views.contains(view)) {
         views.add(view);
      }
   }
   public void deleteView(V view) {
      views.remove( view );
   }
   public void notifyViews() {
      for (V view : views) {
         view.update( this );
      }
   }
}
```

The Generic View

```
public interface FView<M> {
  public void update( M model);
}
```

The Less Than Generic Controller

```
// The purpose is to decouple the Views
// from the Model and save them from
// changes made to the model
public interface FController {
   public boolean isGameOver();
   public int[] getScores();
   public int whichPlayerNumberWins();
   public Player[] getPlayers();
   public Bitmap getMapBitmap();
   public void playRound(FundamentalStuff
choice);
   public String [] getGameScoreStrings();

}
```

The Application

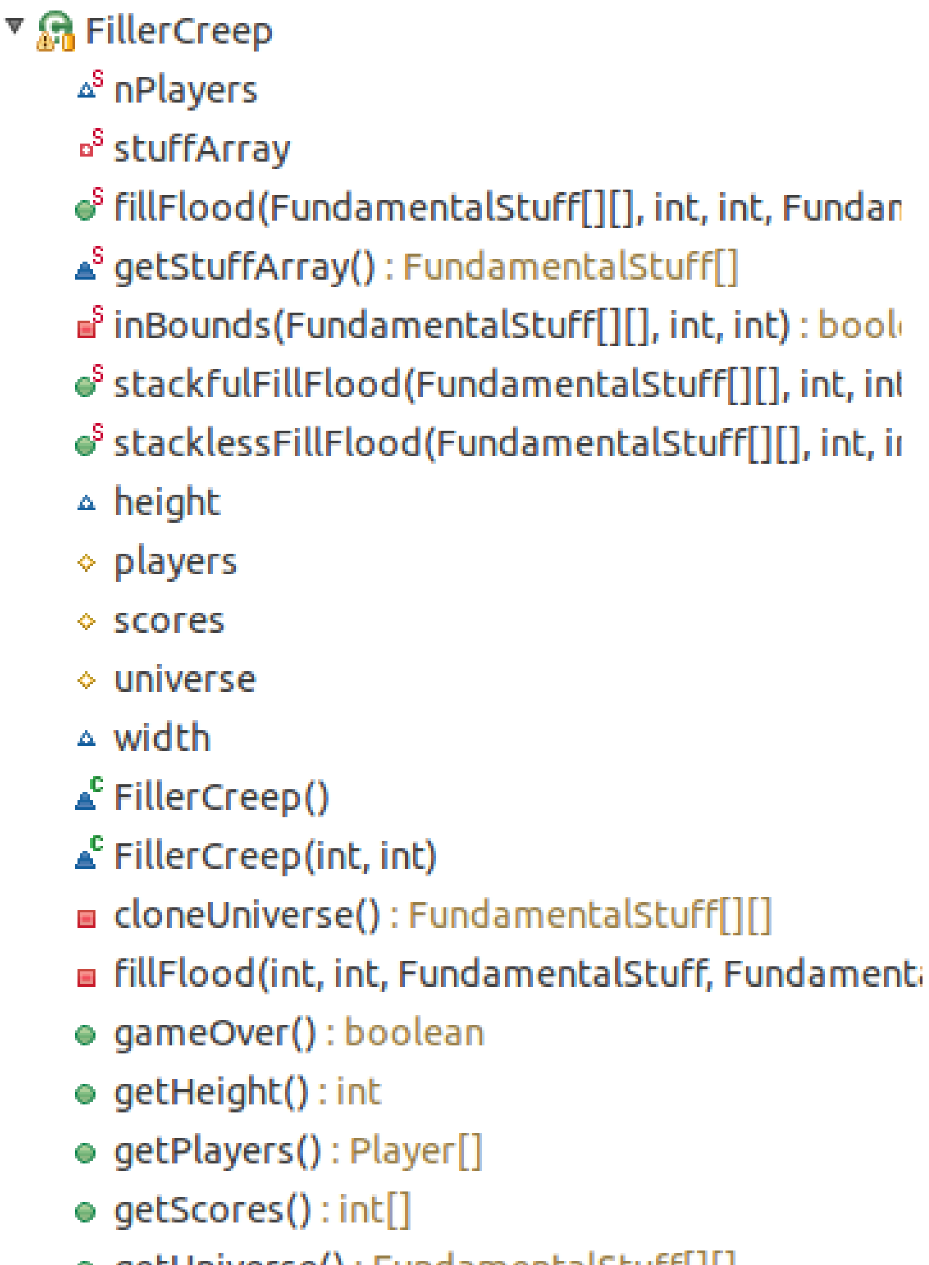
```
public class FillerCreepApplication extends Application {
    // Singleton
    transient private static FillerCreep fillerCreep = null;

    static FillerCreep getFillerCreep() {
        if (fillerCreep == null) {
            fillerCreep = new FillerCreep();
        }
        return fillerCreep;
    }
    // Singleton
    transient private static GameController gameController = null;

    public static GameController getGameController() {
        if (gameController == null) {
            gameController = new GameController(getFillerCreep());
        }
        return gameController;
    }

    @Override
    public void onCreate() {
        super.onCreate();
    }
}
```

The Application

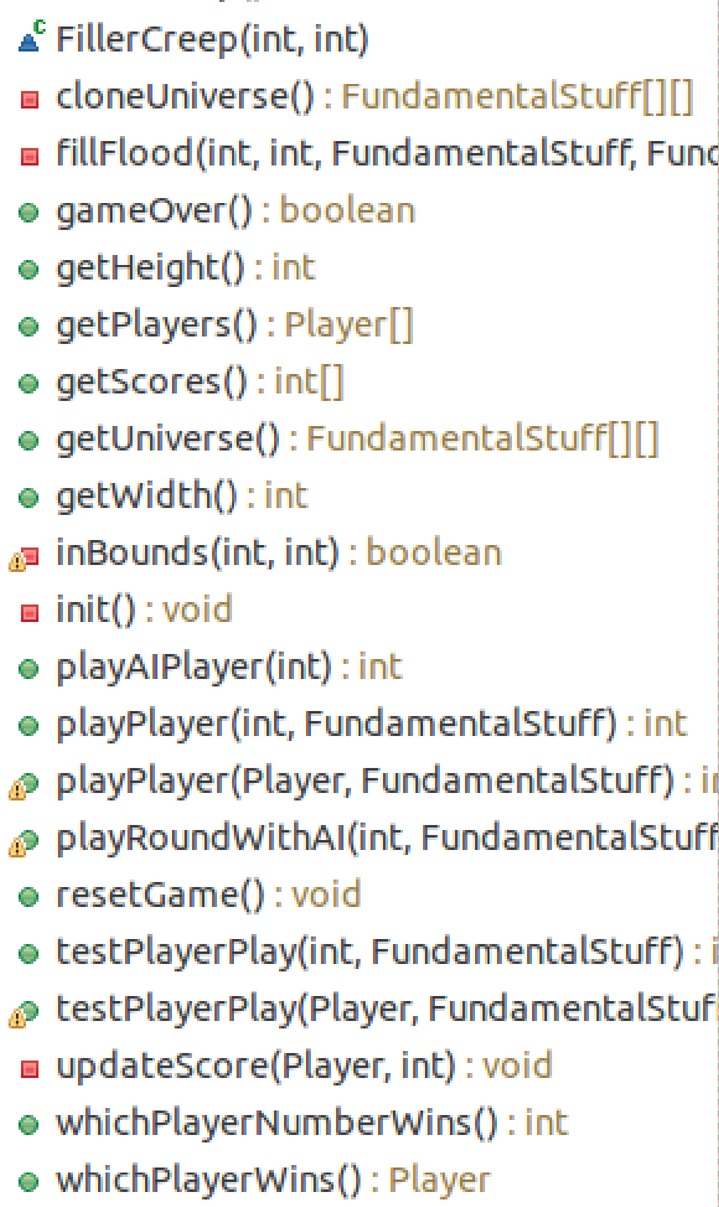
- The application in Android allows us to save local state in memory without communicating through intents.
- We have our singletons here. We will forget them if the application terminates.
- Need to add the application class name in the android.xml

```
<application
    android:name="FillerCreepApplication"
    android:icon="@drawable/ic_launcher"
    android:label="@string/app_name" >
```

Our Model



```
FillerCreep
  nPlayers
  stuffArray
  fillFlood(FundamentalStuff[][], int, int, Fundan
  getStuffArray() : FundamentalStuff[]
  inBounds(FundamentalStuff[][], int, int) : bool
  stackfulFillFlood(FundamentalStuff[][], int, int
  stacklessFillFlood(FundamentalStuff[][], int, i
  height
  players
  scores
  universe
  width
  FillerCreep()
  FillerCreep(int, int)
  cloneUniverse() : FundamentalStuff[][]
  fillFlood(int, int, FundamentalStuff, Fundament
  gameOver() : boolean
  getHeight() : int
  getPlayers() : Player[]
  getScores() : int[]
```



```
FillerCreep(int, int)
cloneUniverse() : FundamentalStuff[][]
fillFlood(int, int, FundamentalStuff, Func
gameOver() : boolean
getHeight() : int
getPlayers() : Player[]
getScores() : int[]
getUniverse() : FundamentalStuff[][]
getWidth() : int
inBounds(int, int) : boolean
init() : void
playAIPlayer(int) : int
playPlayer(int, FundamentalStuff) : int
playPlayer(Player, FundamentalStuff) : i
playRoundWithAI(int, FundamentalStuff
resetGame() : void
testPlayerPlay(int, FundamentalStuff) : i
testPlayerPlay(Player, FundamentalStuf
updateScore(Player, int) : void
whichPlayerNumberWins() : int
whichPlayerWins() : Player
```

An example View

```
public class FillerCreepGraphicalViewActivity extends Activity implements
        FView<FillerCreep> {
    /** Called when the activity is first created. */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.graphicalview);
        ImageButton button = (ImageButton) findViewById(R.id.maingraphicalview);
        OnClickListener listener = new OnClickListener() {
            public void onClick(View v) {
                finish();
            }
        };
        button.setOnClickListener(listener);

        FillerCreep fc = FillerCreepApplication.getFillerCreep();
        fc.addView(this);

        updateMap();
    }

    @Override
    public void onDestroy() {
        super.onDestroy();
        FillerCreep fc = FillerCreepApplication.getFillerCreep();
        fc.deleteView(this);
    }

    public void update(FillerCreep fillerCreep) {
        updateMap();
    }

    public void updateMap() {
        ImageButton button = (ImageButton) findViewById(R.id.maingraphicalview);
        GameController gc = FillerCreepApplication.getGameController();
        Bitmap bitmap = gc.getMapBitmap();
        button.setImageBitmap(bitmap);

    }
}
```

An example View

```
public class FillerCreepGraphicalViewActivity extends Activity implements FView<FillerCreep> {
    /** Called when the activity is first created. */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.graphicalview);
        ImageButton button = (ImageButton) findViewById(R.id.maingraphicalview);
        OnClickListener listener = new OnClickListener() {
            public void onClick(View v) {
                finish();
            }
        };
        button.setOnClickListener(listener);

        FillerCreep fc = FillerCreepApplication.getFillerCreep();
        fc.addView(this);

        updateMap();
    }

    @Override
    public void onDestroy() {
        super.onDestroy();
        FillerCreep fc = FillerCreepApplication.getFillerCreep();
        fc.deleteView(this);
    }

    public void update(FillerCreep fillerCreep) {
        updateMap();
    }

    public void updateMap() {
        ImageButton button = (ImageButton) findViewById(R.id.maingraphicalview);
        GameController gc = FillerCreepApplication.getGameController();
        Bitmap bitmap = gc.getMapBitmap();
        button.setImageBitmap(bitmap);

    }
}
```

Example View/Controller

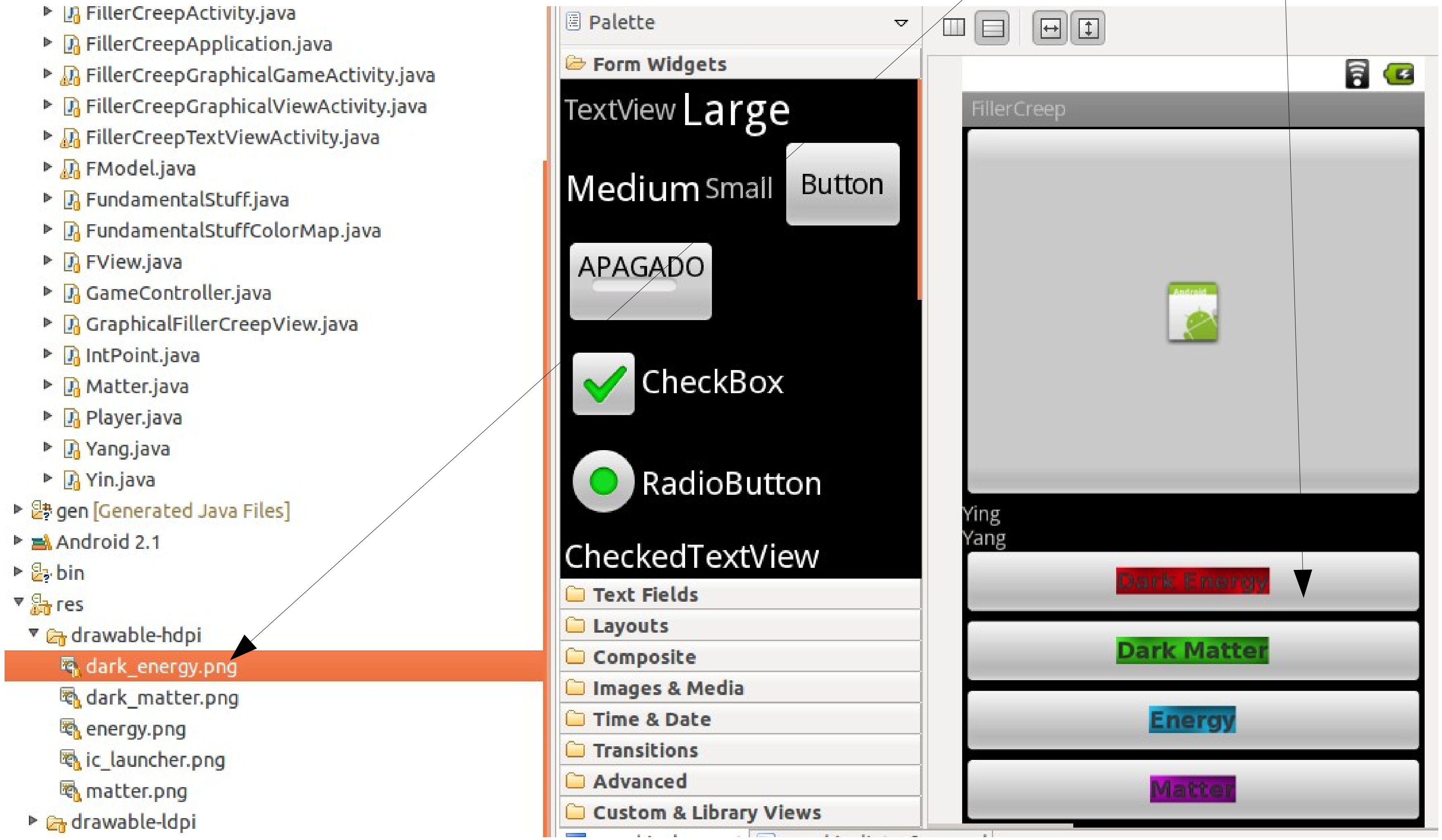
```
public class FillerCreepTextViewActivity extends Activity implements
        FView<FillerCreep> {
    /** Called when the activity is first created. */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.textinterface);

        Button button = (Button) findViewById(R.id.textdarkenergy);
        button.setOnClickListener(new OnClickListener() {
            @Override
            public void onClick(View arg0) {
                play(new DarkEnergy());
            }
        });
        ...
        updateScores();
        FillerCreep fc = FillerCreepApplication.getFillerCreep();
        fc.addView(this);
    }
    public void update(FillerCreep fillerCreep) {
        updateScores();
    }
    @Override
    public void onDestroy() {
        super.onDestroy();
        FillerCreep fc = FillerCreepApplication.getFillerCreep();
        fc.deleteView(this);
    }
    void play(FundamentalStuff choice) {
        GameController gc = FillerCreepApplication.getGameController();
        gc.playRound(choice);
    }
    void updateScores() {
        TextView score1 = (TextView) findViewById(R.id.textyin);
        TextView score2 = (TextView) findViewById(R.id.textyang);
        TextView[] tscores = new TextView[] { score1, score2 };
        GameController gc = FillerCreepApplication.getGameController();
        String[] scores = gc.getGameScoreStrings();
        for (int i = 0; i < tscores.length; i++) {
            tscores[i].setText(scores[i]);
        }
```

Each Activity Must Be Declared!

```
From AndroidManifest.xml
        <activity
            android:name=".FillerCreepActivity"
            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=".FillerCreepTextViewActivity"
            android:label="@string/app_name" >
            <intent-filter>
            </intent-filter>
        </activity>
        <activity
            android:name=".FillerCreepGraphicalViewActivity"
            android:label="@string/app_name" >
            <intent-filter>
            </intent-filter>
        </activity>
        <activity
            android:name=".FillerCreepGraphicalGameActivity"
            android:label="@string/app_name" >
            <intent-filter>
            </intent-filter>
        </activity>
```

ImageButtons!

```
<ImageButton
    android:id="@+id/gamedarkenergy"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:src="@drawable/dark_energy"
    android:text="@string/darkenergy" />
```



```
▸ FillerCreepActivity.java
▸ FillerCreepApplication.java
▸ FillerCreepGraphicalGameActivity.java
▸ FillerCreepGraphicalViewActivity.java
▸ FillerCreepTextViewActivity.java
▸ FModel.java
▸ FundamentalStuff.java
▸ FundamentalStuffColorMap.java
▸ FView.java
▸ GameController.java
▸ GraphicalFillerCreepView.java
▸ IntPoint.java
▸ Matter.java
▸ Player.java
▸ Yang.java
▸ Yin.java
▸ gen [Generated Java Files]
▸ Android 2.1
▸ bin
▾ res
  ▾ drawable-hdpi
      dark_energy.png
      dark_matter.png
      energy.png
      ic_launcher.png
      matter.png
  ▸ drawable-ldpi
```

Exercise

- Design an MVC framework for building interactive applications.