

# System design document for Twirl

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**Author** Eric Arnebäck

This version overrides all previous versions.

## 1 Introduction

### 1.1 Design goals

The design should use MVC in a way that makes it easy to reuse the model when porting the game to other platforms. The physics engine should also be easily replaceable. The model should be testable.

### 1.2 Definitions, acronyms and abbreviations

(TODO: write definitions of terms here that we use throughout the document)

## 2 System design

### 2.1 Overview

The game uses a MVC model.

(TODO: describe the model)

#### 2.1.1 Entities

All the ancestor of all the entities is the abstract Entity class. But no entity used in the game directly extends Entity, they rather extends one of the classes CircleEntity, PolygonEntity, or RectangleEntity. Which one they chose to extend depends on their shapes. I.e., Obstacles are polygon-formed so they extend PolygonEntity.

#### 2.1.2 GameWorld

### 2.2 Software decomposition

#### 2.2.1 General

- controller, the controller classes.
- model, the entities of the app and the gameworld. There are also some package private classes in there for managing entities.
- model.powerup, the powerups of the game.
- model.resource, basically classes for mapping resources to file names. These resources are then loaded by displayed by the view. The classes for managing the high score list and localization strings are also here.
- model.physics, interfaces that describe the physics functionality that the model needs. These interfaces are then implemented by the view(TODO; mention somewhere in the beginning that the view handles the physics). There is also a vector class here that we nicked from box2d
- model.randomlevelgenerator, classes used for generating new, random levels in the game. The main class here is the RandomLevelGenerator, which is used by the model to generate the random levels.
- model.randomlevel.generator.sat, In randomly generated levels, we must ensure that entities are not placed on top of each other, and so we need some kind of collision handling. Box2D was too inflexible for this purpose, so we implemented collision handling from scratch using the Separating Axis Theorem. That theorem is basically implemented by this package.
- View, the view related classes.
- View.scene, Scenes are separate screens of viewing in AndEngine, for example, the high score list is one scene and the main menu is another scene. All the scenes of the game are stored here.
- View.entity, the views of all the entities are stored here.
- View.loading, utility classes for the loading scenes are stored here.
- View.andengine.entity, AndEngine also has a class called Entity. We needed to extend this Entity class a couple

- of times for some classes in the view, and these classes are stored here.
- View.resource, the resources that the model wishes to show to the user(sounds effects and images) are stored here, and of course shown by the view. As familiar, the paths to these resources can be found in the model.resource package.
  - View.loader, classes that simplify the loading of resources in AndEngine
  - view.opengl, AndEngine has no support for primitives like polygons and circles, so we had to implement that from scratch, using opengl. The classes that handle this are put in this package. Also, a class that draws a star background using opengl is also stored here.
  - View.physics, these classes expose the physics functionality from Box2D that we need. The interfaces in model.physics are also implemented here.

Package diagram. For each package an UML class diagram in appendix

### **2.2.2 Decomposition into subsystems**

We don't have any subsystems. Everything is handled in one, big system.

### **2.2.3 Layering**

The layering is as indicated in the Figure below . Higher layers are at the top of the figure.

### **2.2.4 Dependency analysis**

Dependencies are as shown in Figure. There are no circular dependencies.

(TODO: insert a Stan generated diagram below to show the laying and dependencies.)

### **2.3 Concurrency issues**

Practically all multithreading is handled by AndEngine. The only place where we use our own threads is during the loading scenes. There, on a worker thread game resources are loaded, and in the main thread a loading animation is shown. However, those are shown for a such a short period of time, plus they don't listen to any user input, so they should not pose and problems.

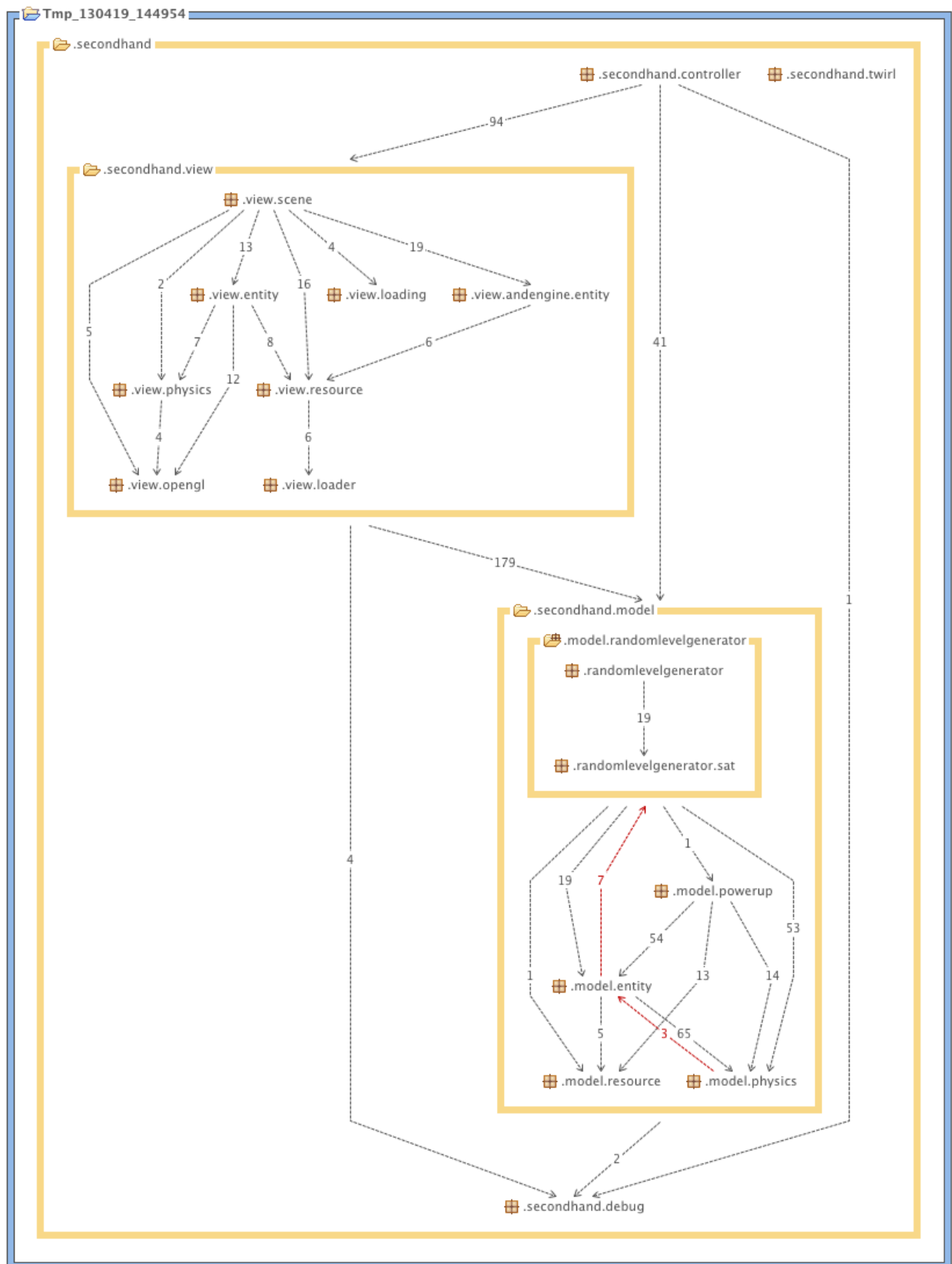


Figure: Package structure

## 2.4 Persistent data management

- Localization files for the localizable text of the app will be stored using XML, using the system for localization offered by the android OS, using strings.xml files. See <http://developer.android.com/guide/topics/resources/localization.html>

- The high score list is stored using a flat ASCII-based format. See the appendix

## 2.5 Access control and security

NA.

## 2.6 Boundary conditions

The app is launched like any other android app, by clicking on the icon. It is exited by pressing the back button. By pressing on the home button the application will freeze and wait for the user to proceed playing when he/she reenters the app.

## 3 References

(TODO: Cite important design sources here. Ie, mvc. Not anything related to code details!)

## APPENDIX

### Class diagrams for packages

(insert class diagram of the mode.entity package here)

- Entity, the base class that all entities extend from
- CircleEntity, circle-formed entities derive from this class
- PolygonEntity, polygon-formed entities derive from this class
- RectangleEntity, rectangle-formed entities derive from this class
- BlackHole, all types of black holes(enemy and player) derive from this class. Has functionality for eating other entities.
- Enemy, an enemy, AI-controlled, black hole
- Player, a player-controlled black hole.
- Obstacle, an uneatable, polyformed-formed, obstacle in the game,
- Planet, an eatable planet in the game.
- IPowerUp, interface that all powerups classes implements.
- CollisionResolver, helper-class responsible for resolving potential collisions between entities.
- EntityManager, manages all the entities in a list, and is responsible for updating them every frame, and makes sure that removed entities are removed from the world.
- GameWorld, the world in which the game takes place. Responsible for transitioning to the next level. Uses RandomLevelGenerator to create the next level, and EntityManager for managing all the entities of the world.

### File Formats

The format for storing the high score list is a simple ASCII-format simple. A list of 3 persons is stored as follows:

```
Sven
100
Sonny
50
Ronny
10
```

So name and score is separated by a newline character. And the separate entries are too separated by a newline character. The file is assumed to be sorted, so the first name found is first in the high score list.