Mobile App Development

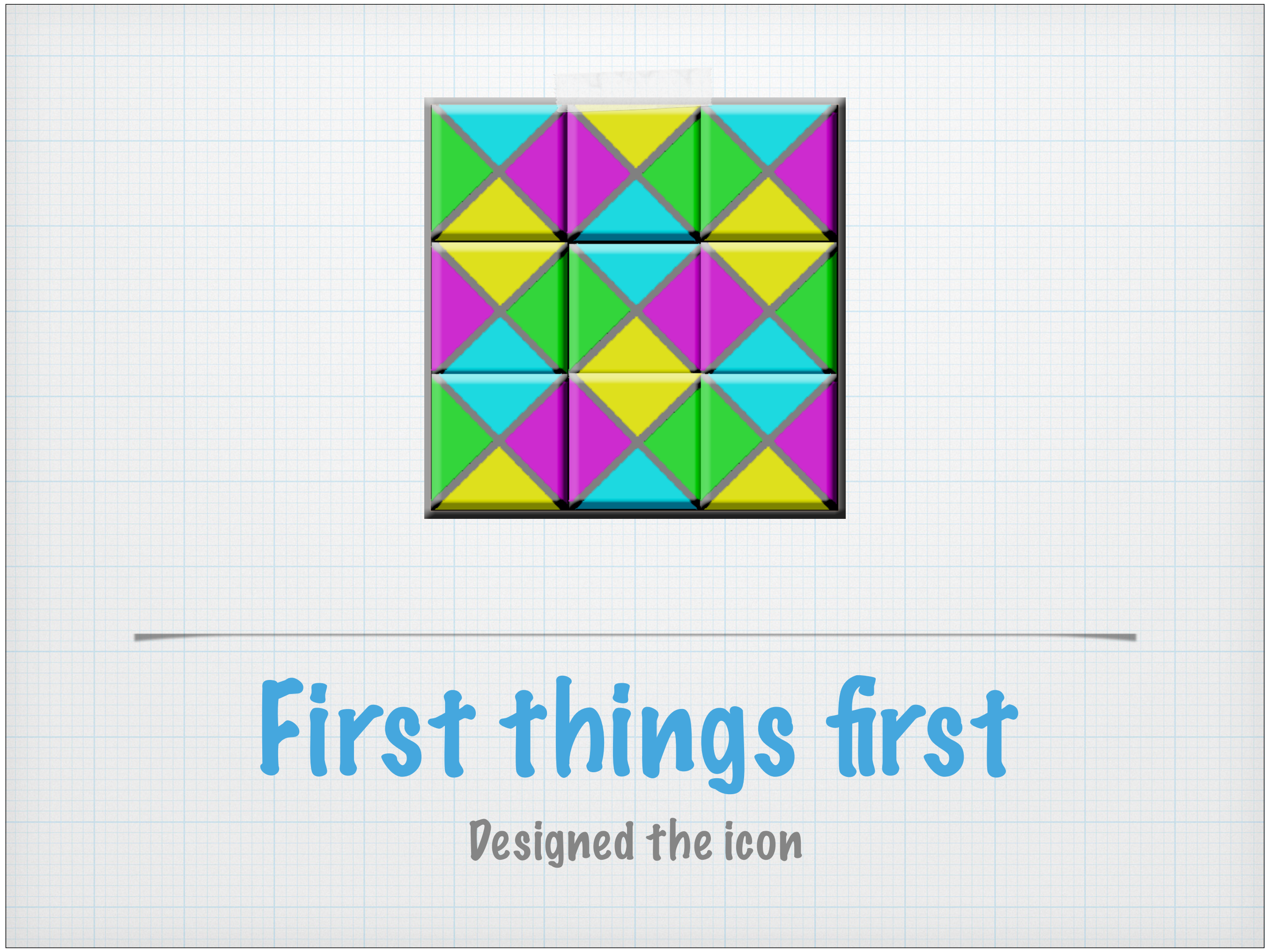
How I wrote an Android game

By Jon Tollefson

Simple game but with some challenge in its' play

Make use of Android features but will work on old phones

Picked tetravex



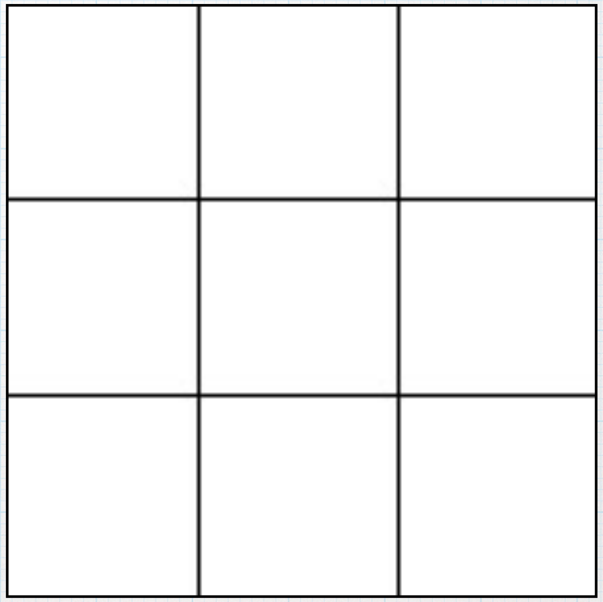
First things first

Designed the icon

Then come up with a cool name for it

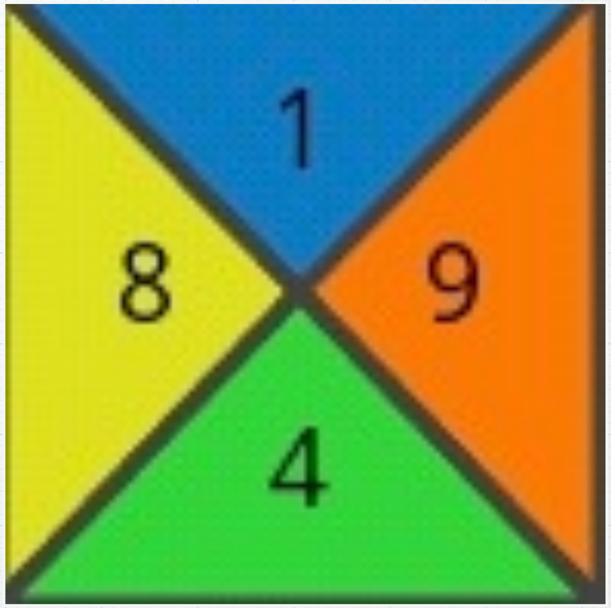
Game Setup

Set of squares arranged 2x2, 3x3, 4x4, etc



Game Setup

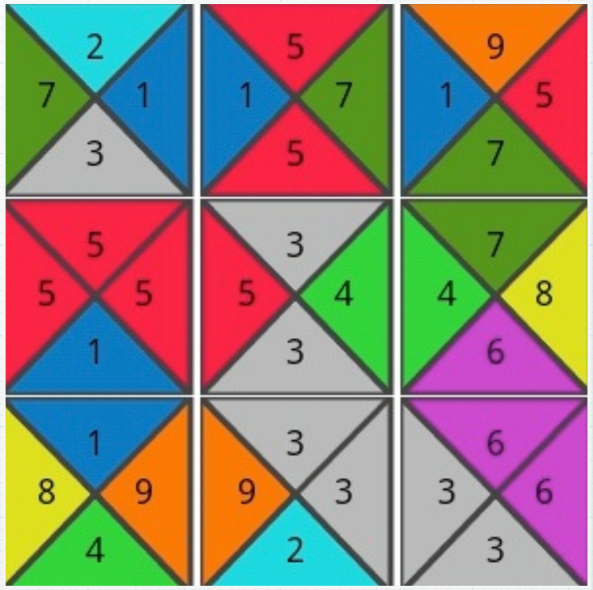
- The side of each square is assigned a number 1 to 9
- Each number is assigned an unique color



Goal

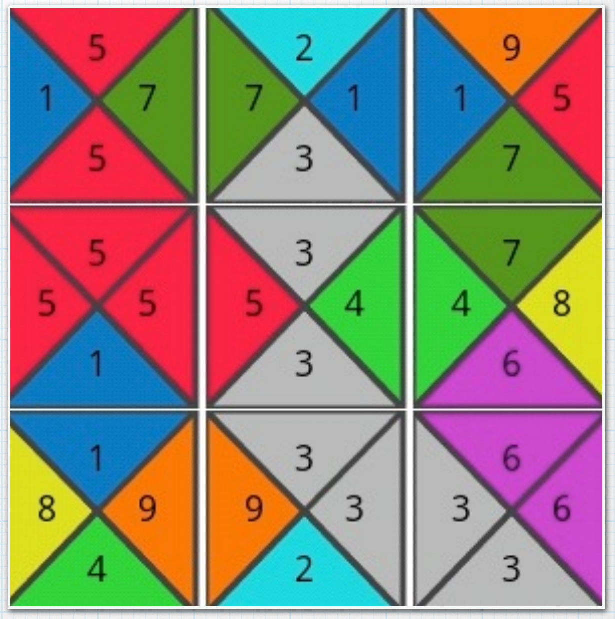
- Arrange the squares such that touching sides match

- Not allowed to rotate squares



Solved Puzzle

Sample Only

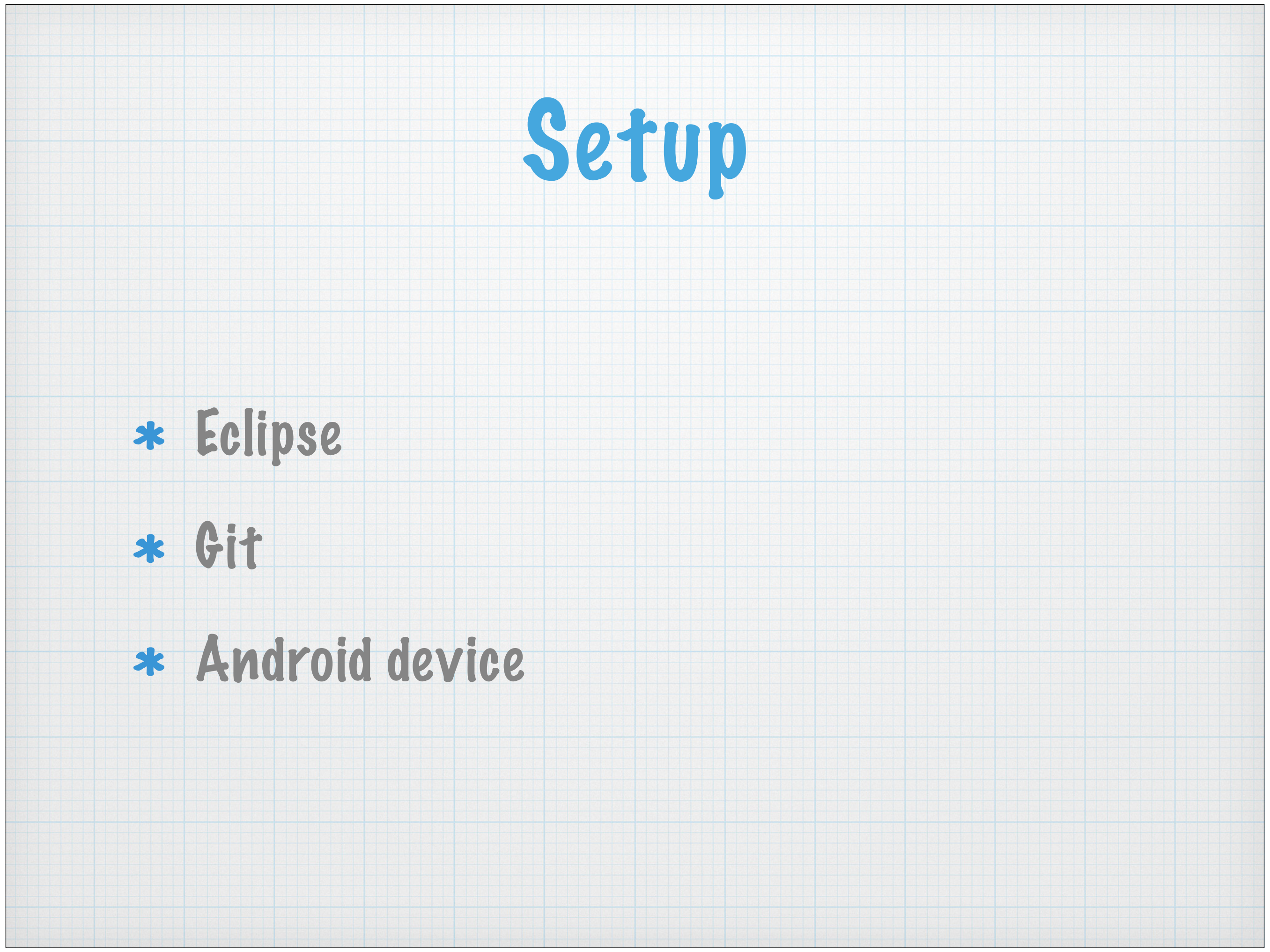


“Well, why didn't you list that among our assets in the first place.”

-Wesley from Princess Bride

Assets

- Know java and have been programming for years
- Have computer, USB cable and Android device
- "Android Programming: The Big Nerd Ranch Guide"



Setup

- Eclipse
- Git
- Android device

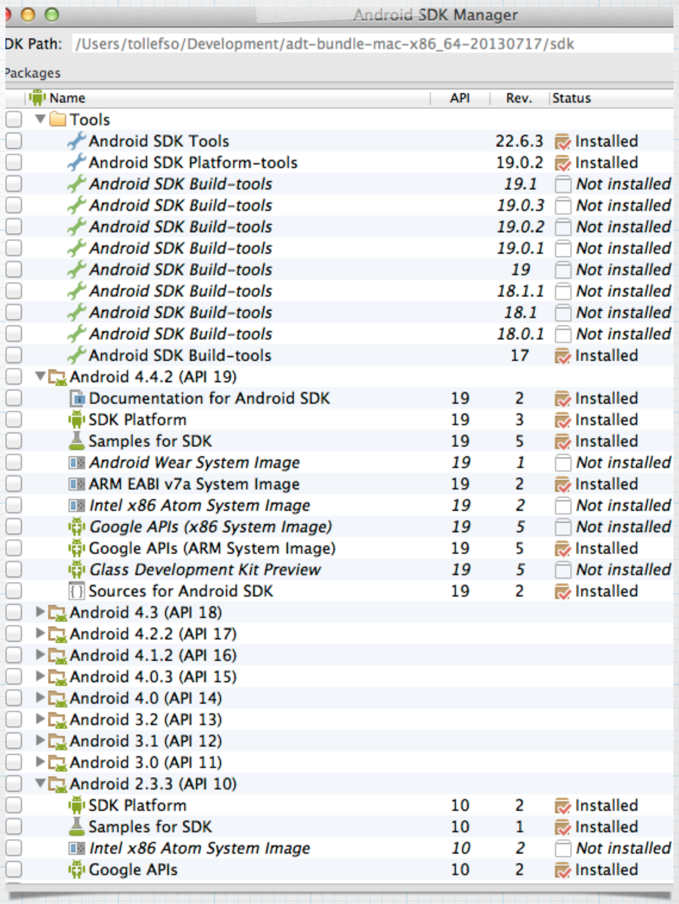
Android Studio IDE is an alternative

Eclipse Setup

- Android SDK
- Virtual machines
- New project

Android SDKs

Install API's for versions we want to support.



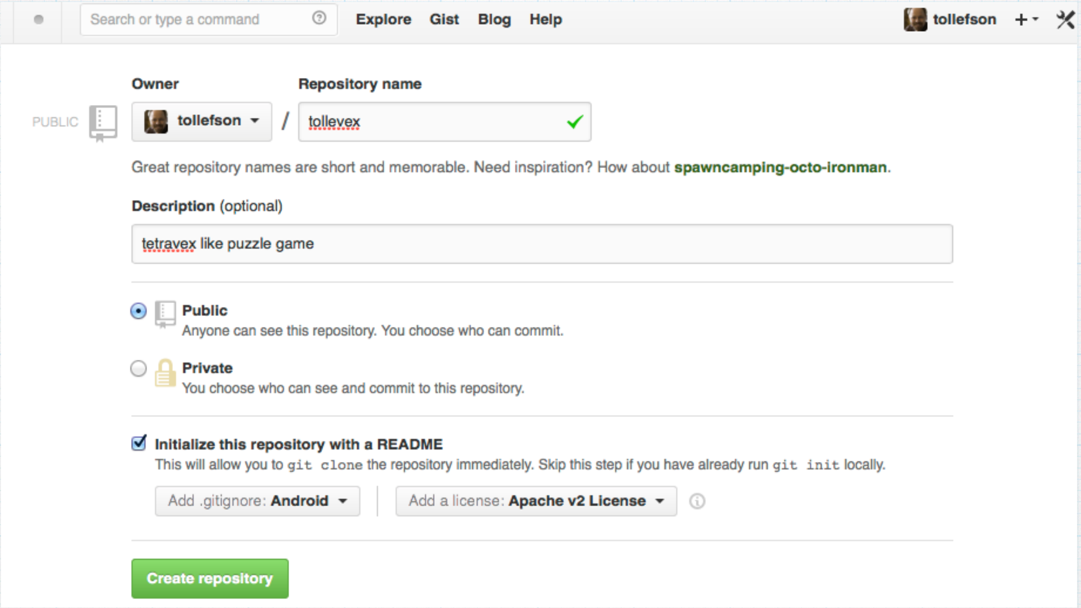
Android SDK Manager

DK Path: /Users/tollefso/Development/adt-bundle-mac-x86_64-20130717/sdk

Packages

Name	API	Rev.	Status
□ ▼ Tools			
□ Android SDK Tools		22.6.3	☑ Installed
□ Android SDK Platform-tools		19.0.2	☑ Installed
□ *Android SDK Build-tools*		*19.1*	□ *Not installed*
□ *Android SDK Build-tools*		*19.0.3*	□ *Not installed*
□ *Android SDK Build-tools*		*19.0.2*	□ *Not installed*
□ *Android SDK Build-tools*		*19.0.1*	□ *Not installed*
□ *Android SDK Build-tools*		*19*	□ *Not installed*
□ *Android SDK Build-tools*		*18.1.1*	□ *Not installed*
□ *Android SDK Build-tools*		*18.1*	□ *Not installed*
□ *Android SDK Build-tools*		*18.0.1*	□ *Not installed*
□ Android SDK Build-tools		17	☑ Installed
□ ▼ Android 4.4.2 (API 19)			
□ Documentation for Android SDK	19	2	☑ Installed
□ SDK Platform	19	3	☑ Installed
□ Samples for SDK	19	5	☑ Installed
□ *Android Wear System Image*	*19*	*1*	□ *Not installed*
□ ARM EABI v7a System Image	19	2	☑ Installed
□ *Intel x86 Atom System Image*	*19*	*2*	□ *Not installed*
□ *Google APIs (x86 System Image)*	*19*	*5*	□ *Not installed*
□ Google APIs (ARM System Image)	19	5	☑ Installed
□ *Glass Development Kit Preview*	*19*	*5*	□ *Not installed*
□ Sources for Android SDK	19	2	☑ Installed
□ ▶ Android 4.3 (API 18)			
□ ▶ Android 4.2.2 (API 17)			
□ ▶ Android 4.1.2 (API 16)			
□ ▶ Android 4.0.3 (API 15)			
□ ▶ Android 4.0 (API 14)			
□ ▶ Android 3.2 (API 13)			
□ ▶ Android 3.1 (API 12)			
□ ▶ Android 3.0 (API 11)			
□ ▼ Android 2.3.3 (API 10)			
□ SDK Platform	10	2	☑ Installed
□ Samples for SDK	10	1	☑ Installed
□ *Intel x86 Atom System Image*	*10*	*2*	□ *Not installed*
□ Google APIs	10	2	☑ Installed

Android Support Library is installed too - but doesn't show up on screen shot.



Owner: tollefson / Repository name: tollevex ✓

PUBLIC

Great repository names are short and memorable. Need inspiration? How about **spawncamping-octo-ironman**.

Description (optional)

tetravex like puzzle game

● **Public**
Anyone can see this repository. You choose who can commit.

○ **Private**
You choose who can see and commit to this repository.

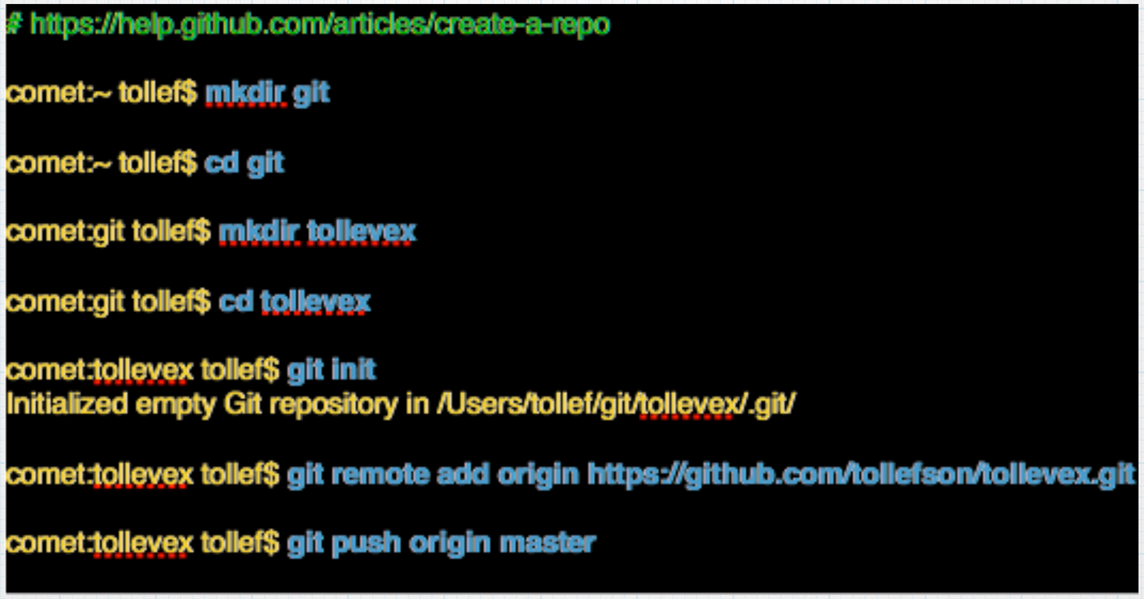
☑ **Initialize this repository with a README**
This will allow you to `git clone` the repository immediately. Skip this step if you have already run `git init` locally.

Add .gitignore: **Android**

Add a license: **Apache v2 License**

Git Setup

Creating a repository on github



```
# https://help.github.com/articles/create-a-repo

comet:~ tollef$ mkdir git

comet:~ tollef$ cd git

comet:git tollef$ mkdir tollevex

comet:git tollef$ cd tollevex

comet:tollevex tollef$ git init
Initialized empty Git repository in /Users/tollef/git/tollevex/.git/

comet:tollevex tollef$ git remote add origin https://github.com/tollefson/tollevex.git

comet:tollevex tollef$ git push origin master
```

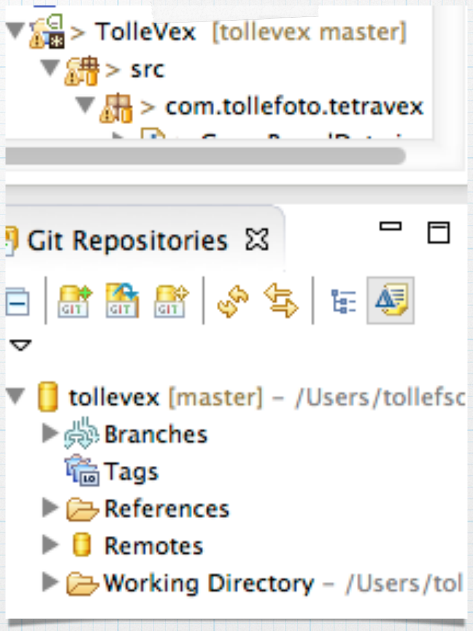
Git Setup

Creating Local Repository

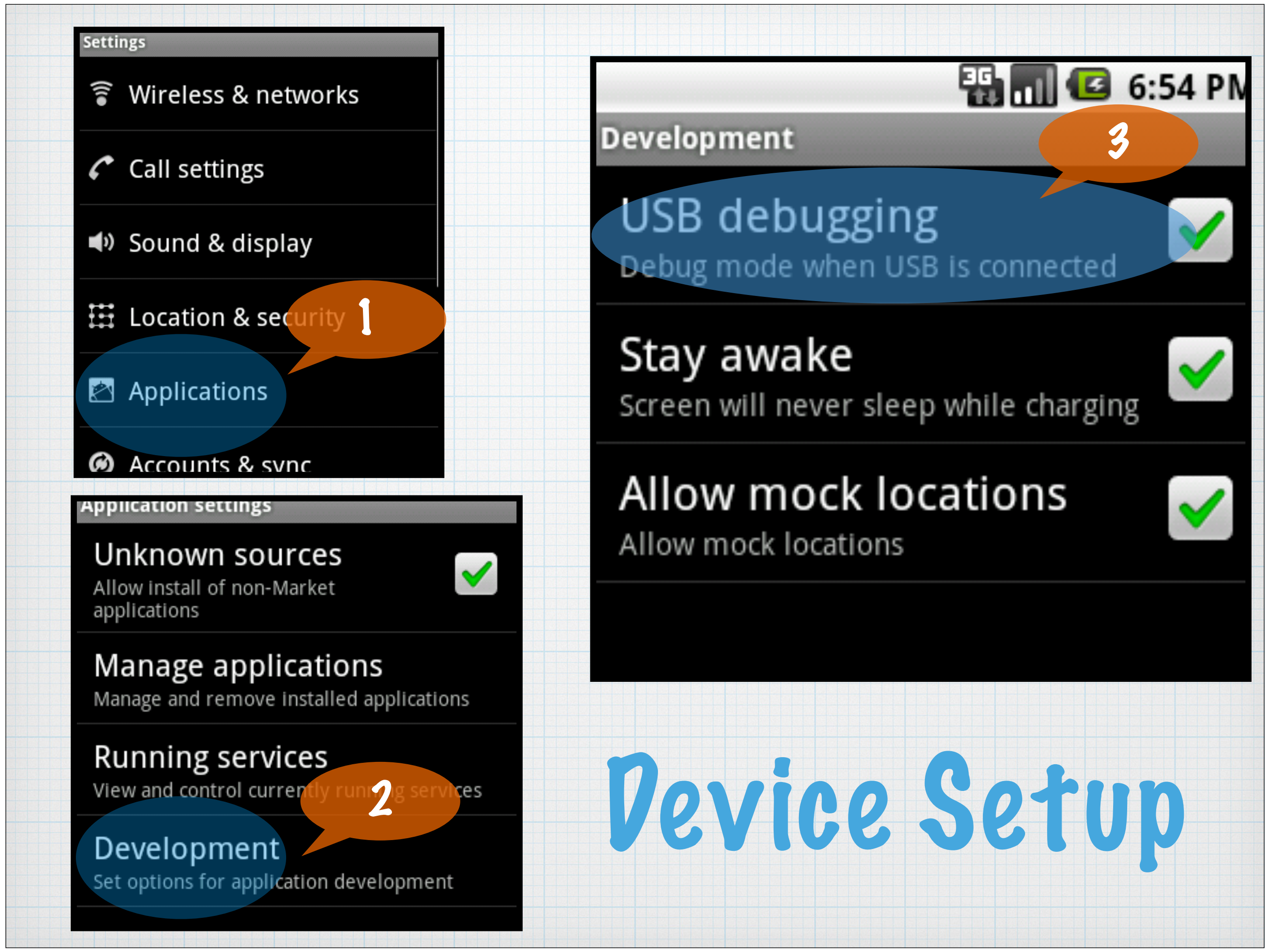
Creating local repo and hooking it to the remote repository.

EGit

- Eclipse plugin for git
- http://www.eclipse.org/egit/



> TolleVex [tollevex master]
> src
> com.tollefoto.tetravex
Git Repositories
tollevex [master] – /Users/tollefsc
Branches
Tags
References
Remotes
Working Directory – /Users/tol



Device Setup

Settings

- Wireless & networks
- Call settings
- Sound & display
- Location & security
- Applications
- Accounts & sync

Application settings

- Unknown sources ☑
  Allow install of non-Market applications
- Manage applications
  Manage and remove installed applications
- Running services
  View and control currently running services
- Development
  Set options for application development

Development

- USB debugging ☑
  Debug mode when USB is connected
- Stay awake ☑
  Screen will never sleep while charging
- Allow mock locations ☑
  Allow mock locations

The exact location of USB debugging could vary based on Android version, but it is the key setting to allow you to test your application on your device.

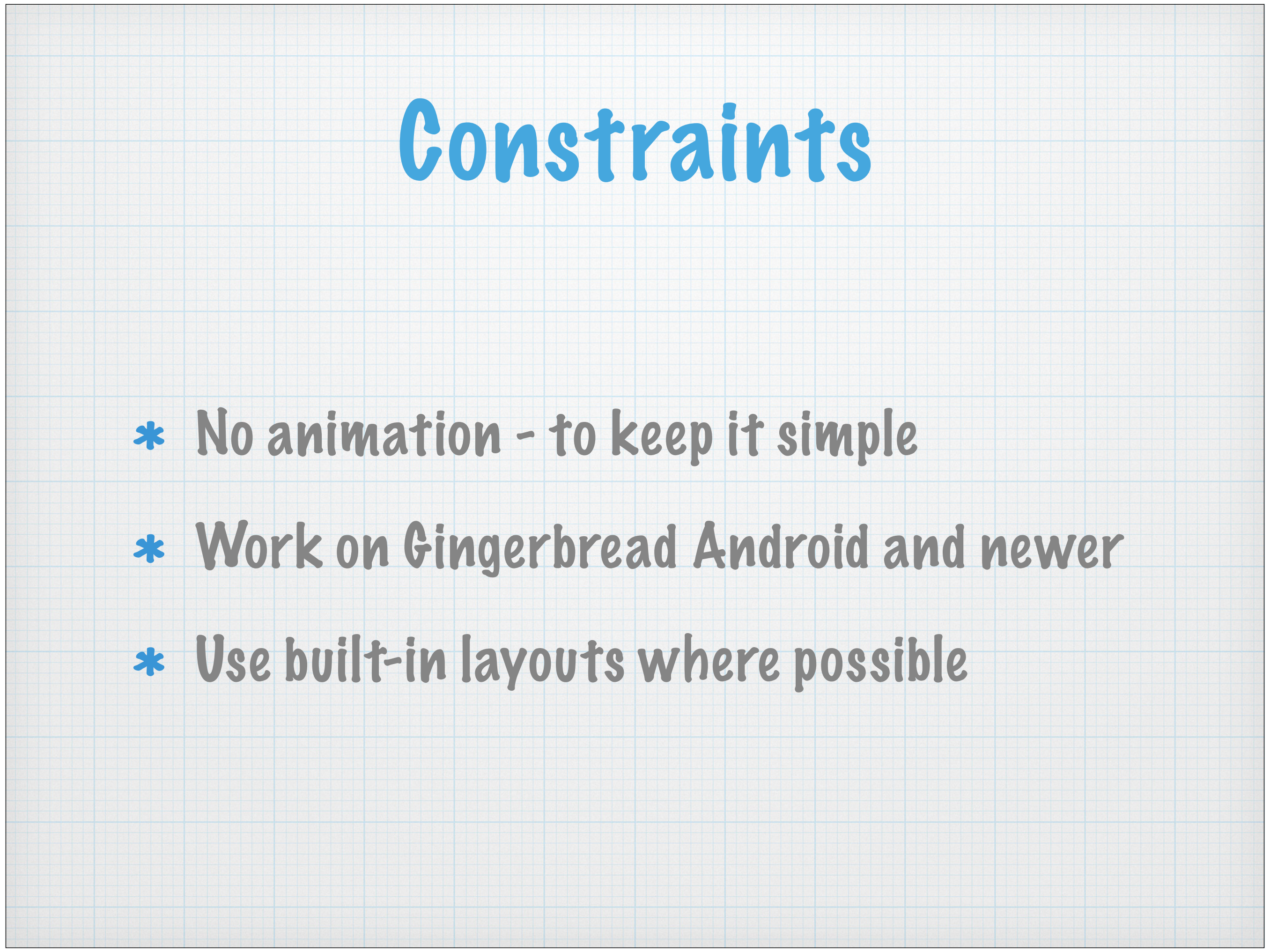
May also need a device driver setup on the computer (for Windows).

The Competition

- Other apps for the same game
  - https://play.google.com/store/search?q=tetravex&c=apps

There are numerous other free versions - not sure if they any are ad free or not.

Also you can find the source code for other versions of tetravex.



Constraints

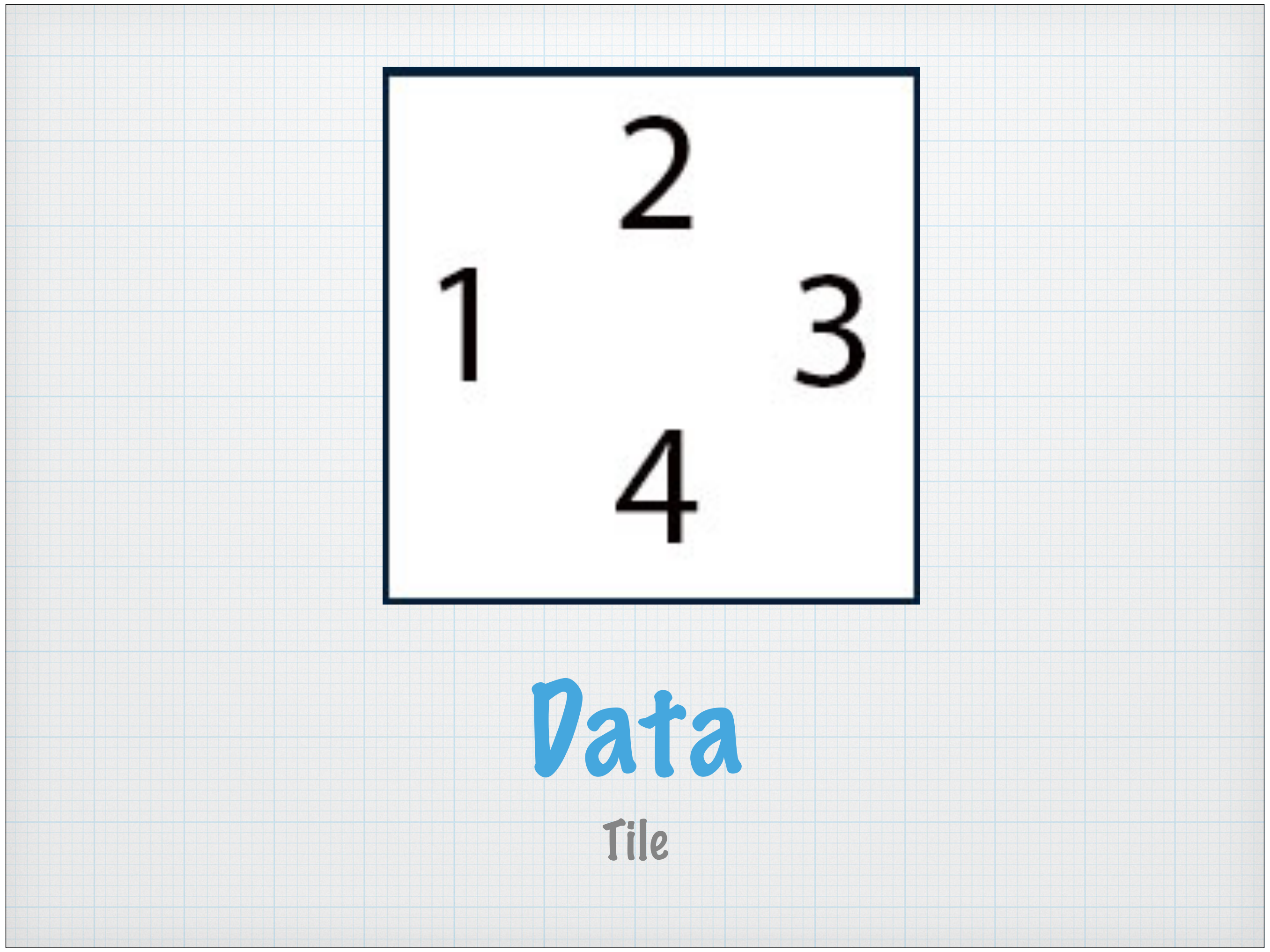
- No animation - to keep it simple
- Work on Gingerbread Android and newer
- Use built-in layouts where possible

A. 1. No drag and drop 2. maximize square size with showing only one board

Select square and then select other square to exchange with -instead

B. phone I had had Gingerbread(2.3.7) and so did the nook that I wanted it to work on

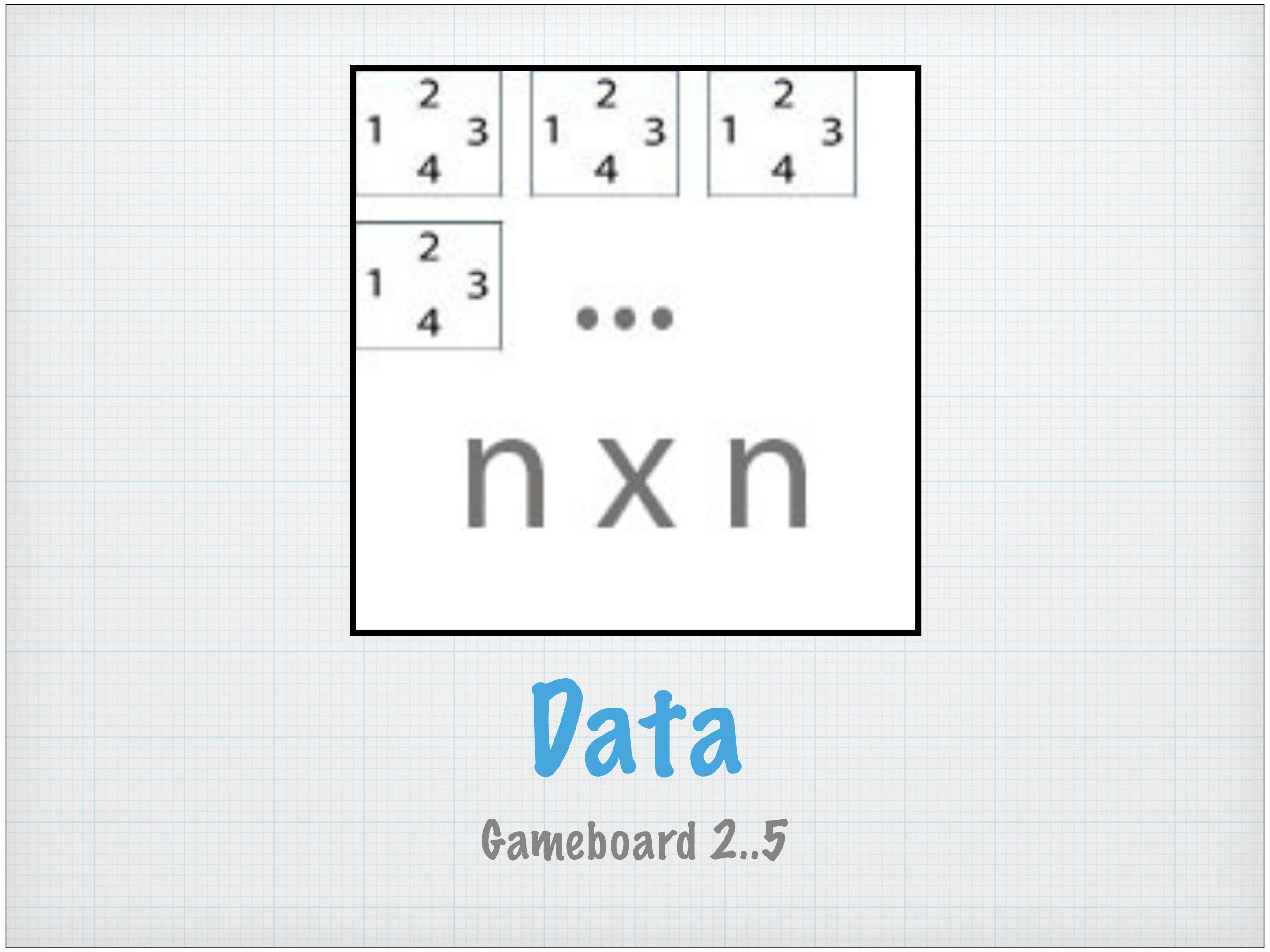
C. Get it up and going as soon as possible- gratification helps drive it further and I would have something to demo



Data

Tile

4 numbers associated with left, right, top and bottom



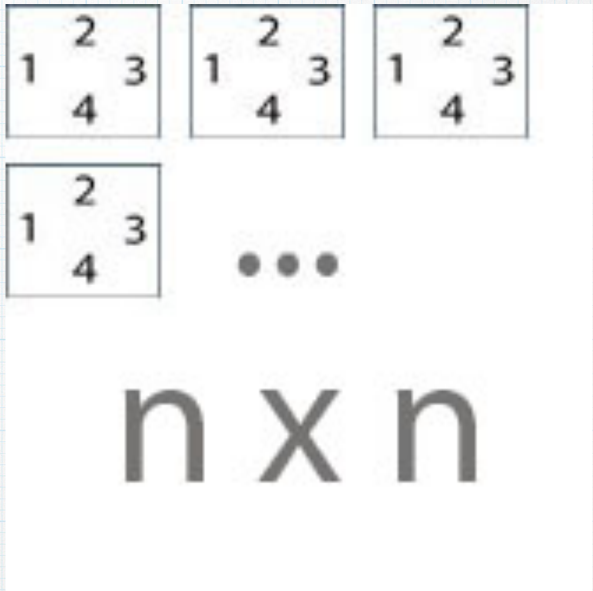
Data

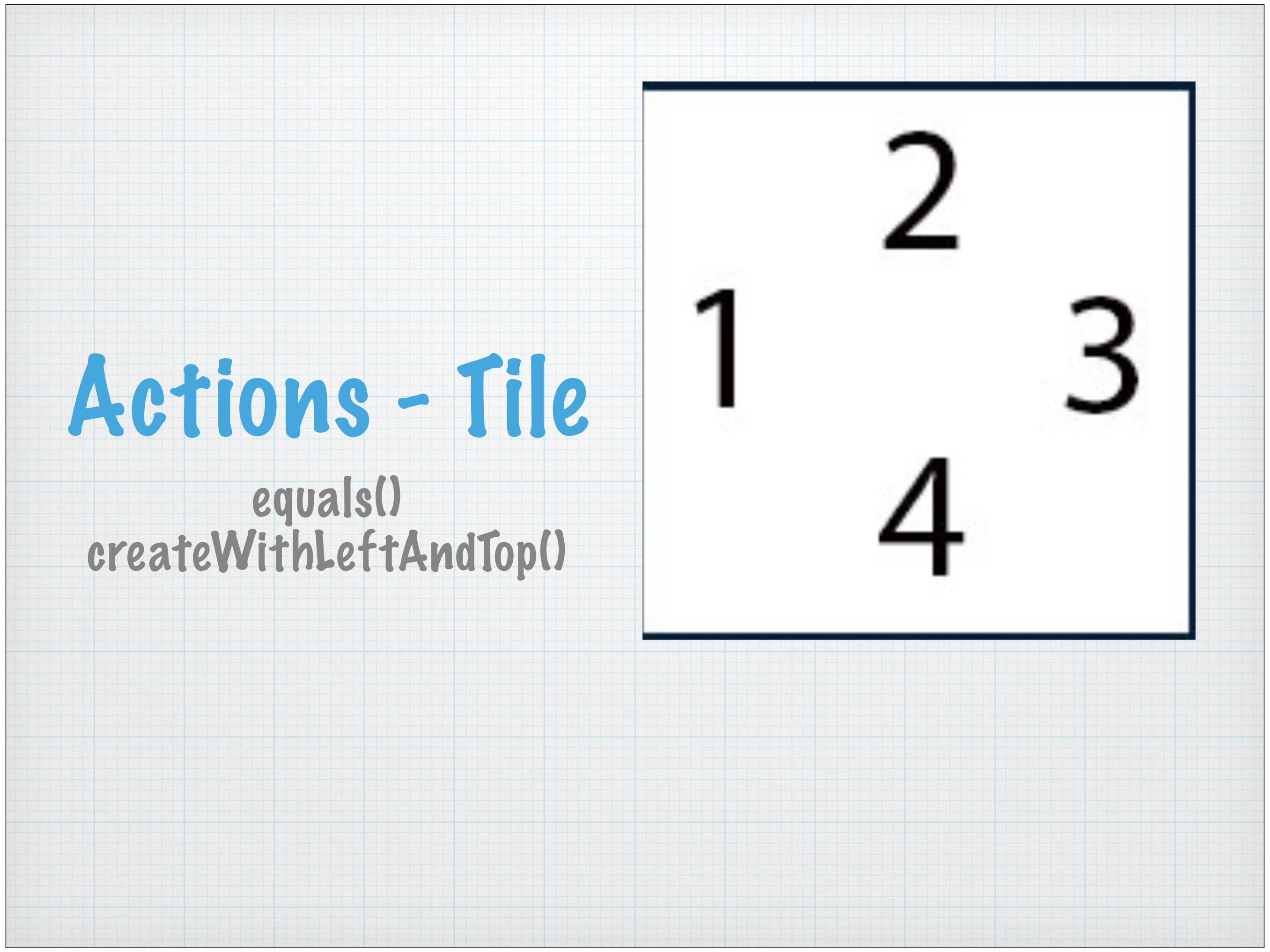
Gameboard 2..5

Some people have done up to 6 but I found that it got small to read on a phone.

Actions - Gameboard

init()
scramble()
isWinner()
swap()

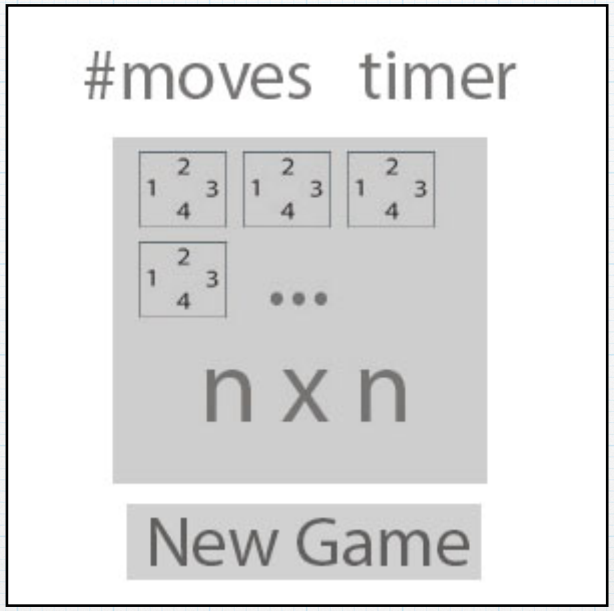




Actions - Tile

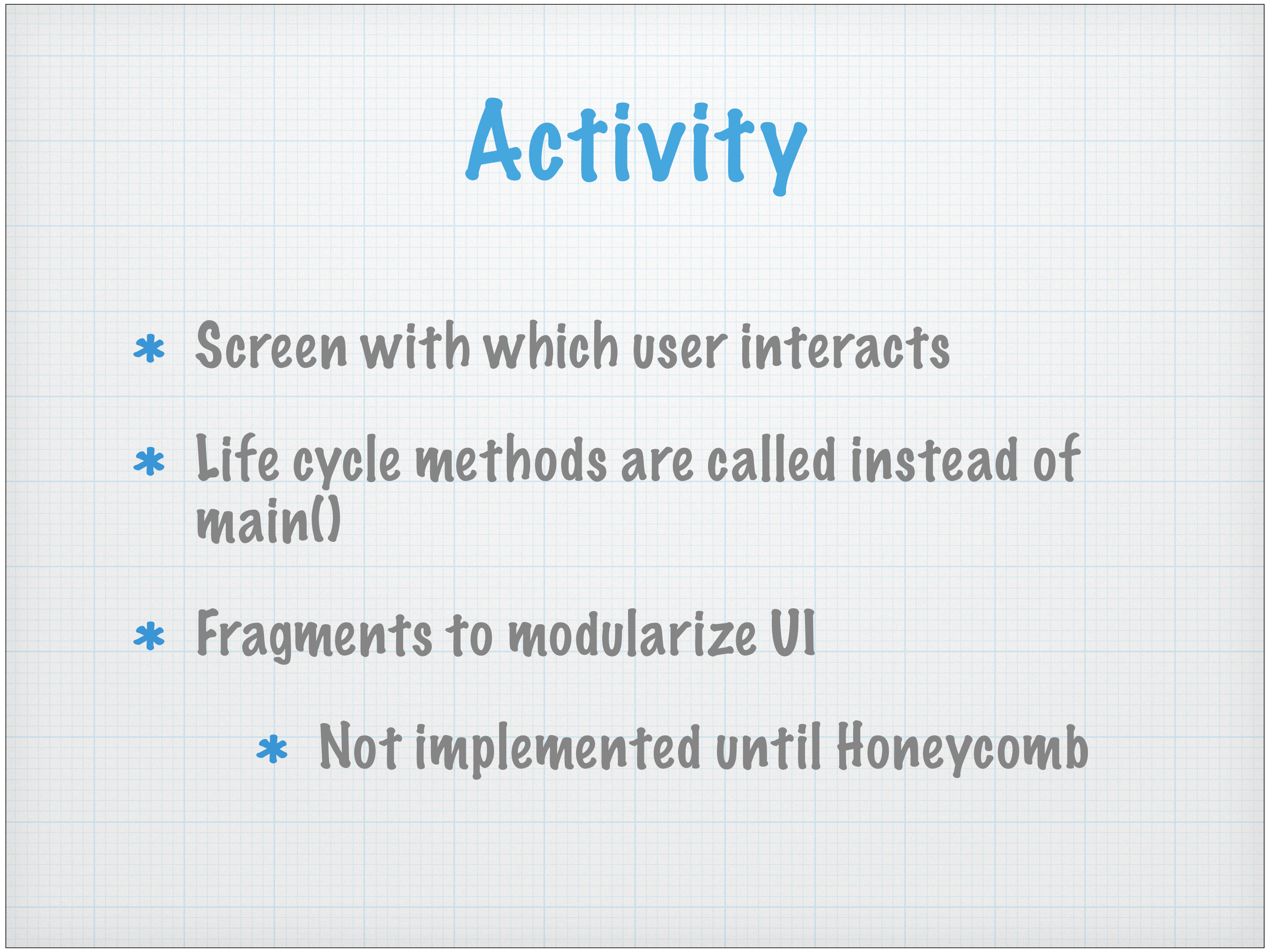
equals()
createWithLeftAndTop()

will need to generate random numbers between 1 and 9



Tollevex Layout

Settings menu to set board size, option to display moves and timer.

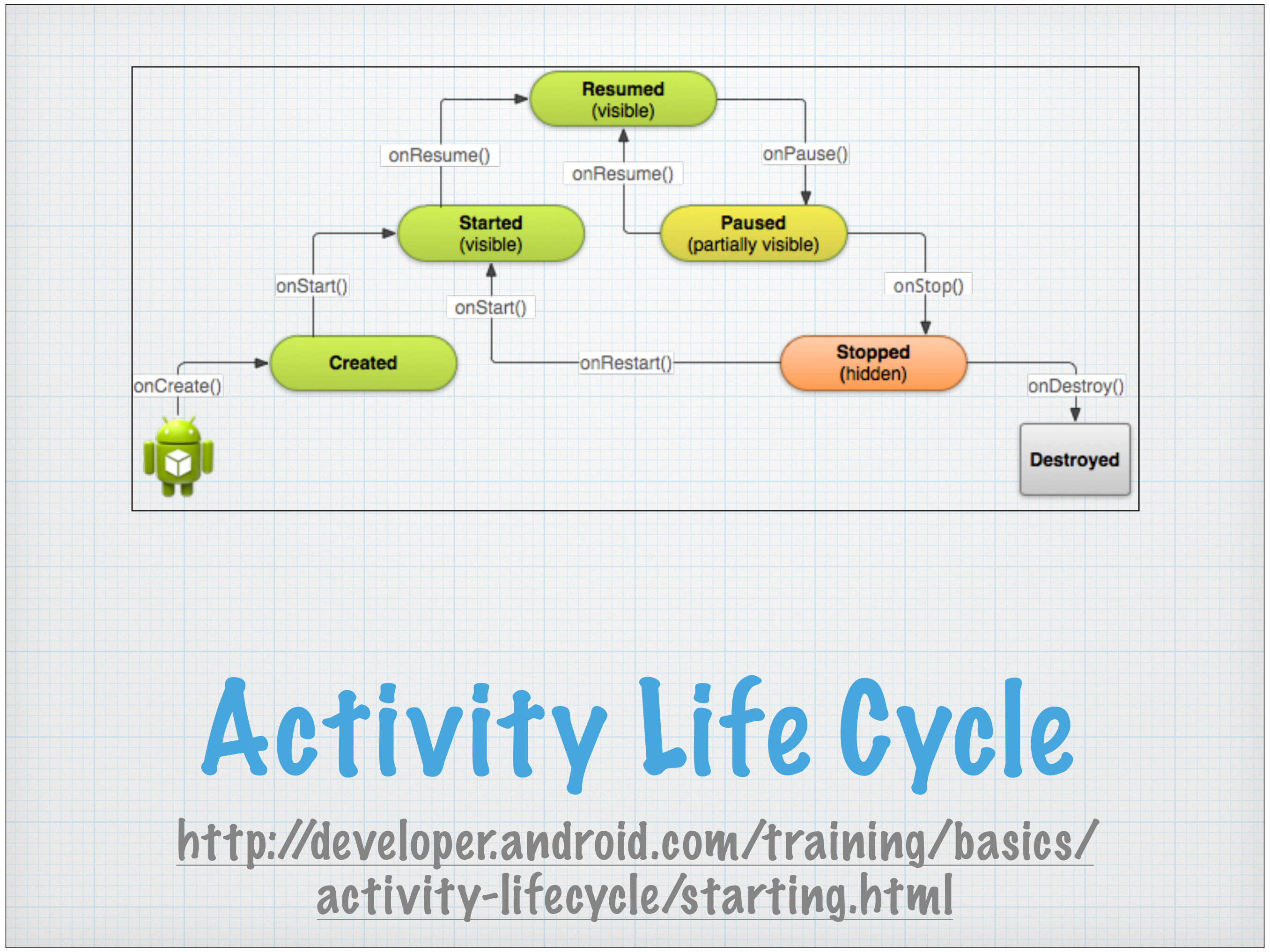


Activity

- Screen with which user interacts
- Life cycle methods are called instead of main()
- Fragments to modularize UI
  - Not implemented until Honeycomb

Fragments have their own life cycle

Fragments are available for earlier Android versions from the Android Support Library



Activity Life Cycle

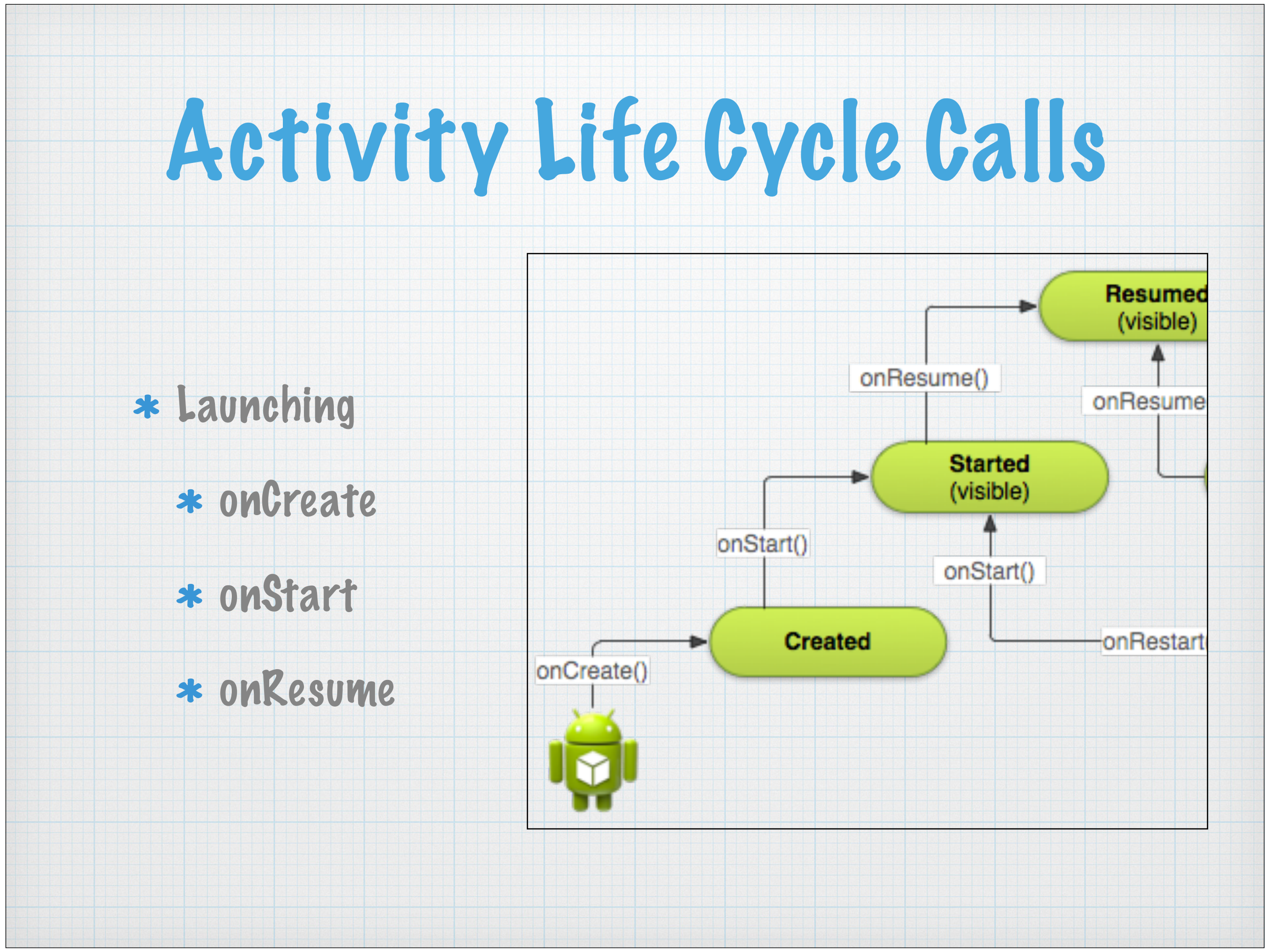
http://developer.android.com/training/basics/activity-lifecycle/starting.html

Created and Started are transient

Resumed is the ‘running’ state

Paused - may be partially visible but is not in foreground and doesn’t get user input

Stopped - hidden but still has it’s member variables



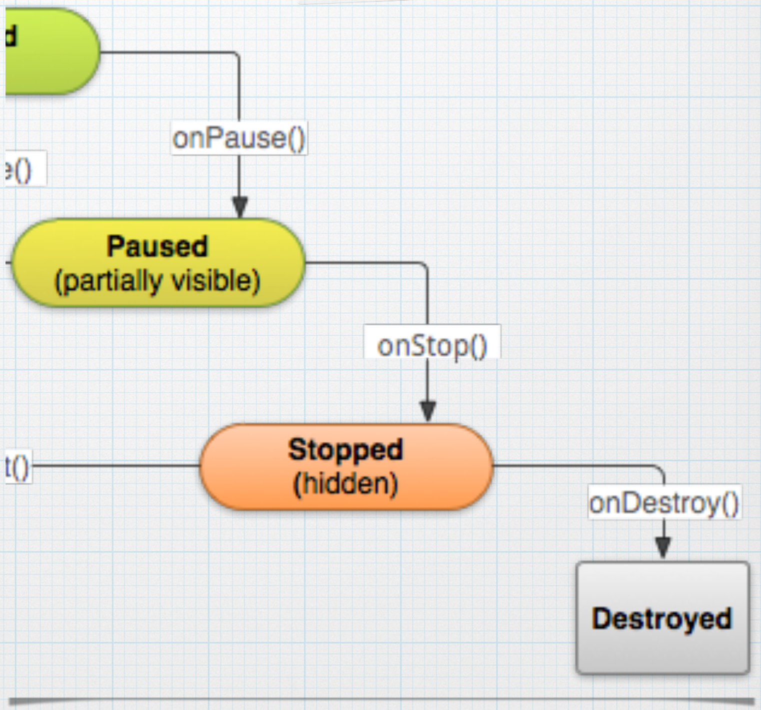
Activity Life Cycle Calls

- Launching
  - onCreate
  - onStart
  - onResume

I instrumented the life cycle calls to see when they are called.

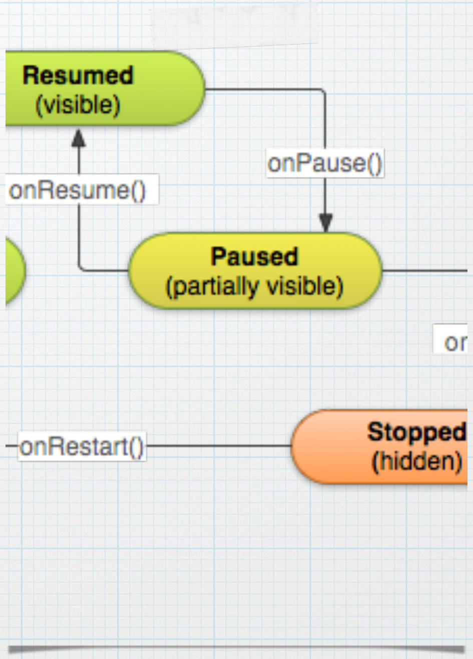
Activity Life Cycle Calls

- Backbutton
  - onPause
  - onStop
  - onDestroy



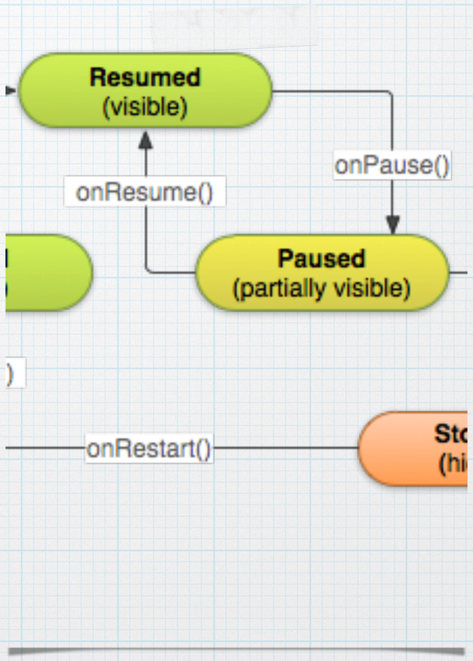
Activity Life Cycle Calls

- Power button
  - onPause



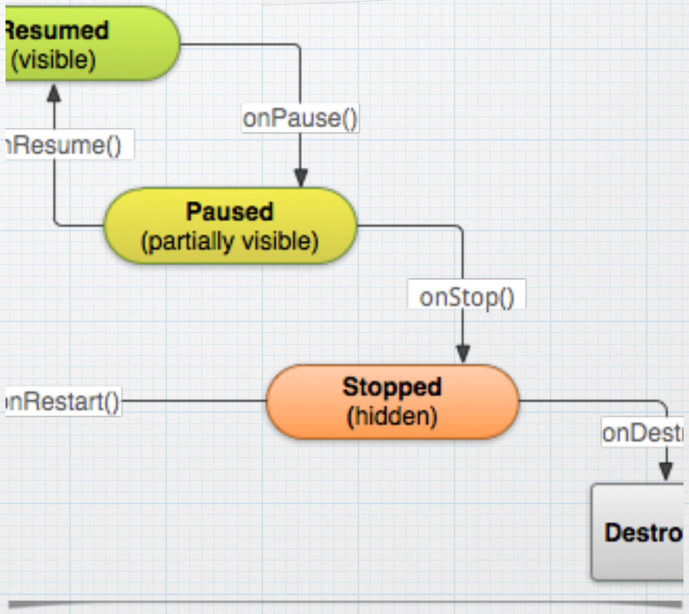
Activity Life Cycle Calls

- Power button Again
  - onResume



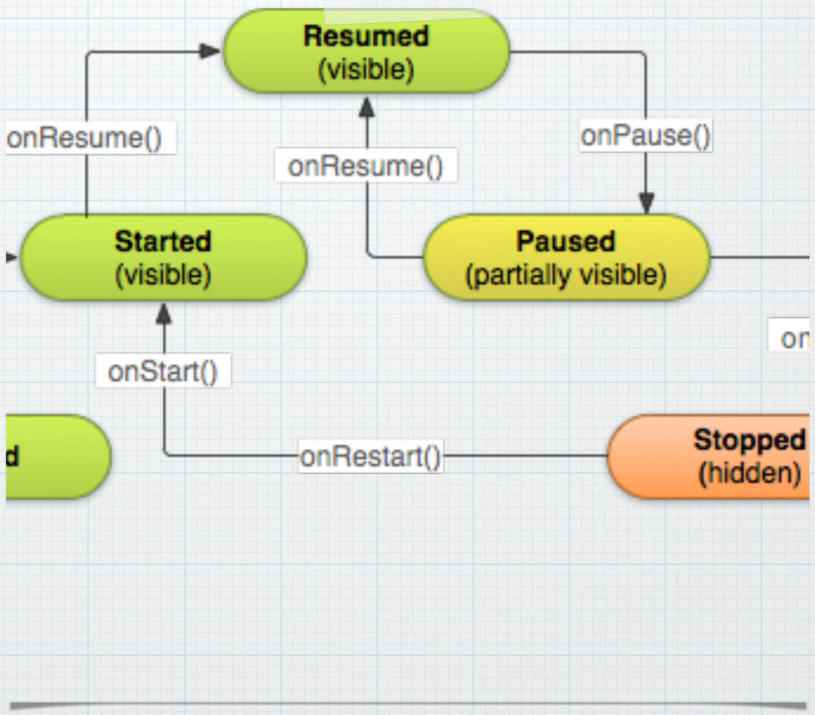
Activity Life Cycle Calls

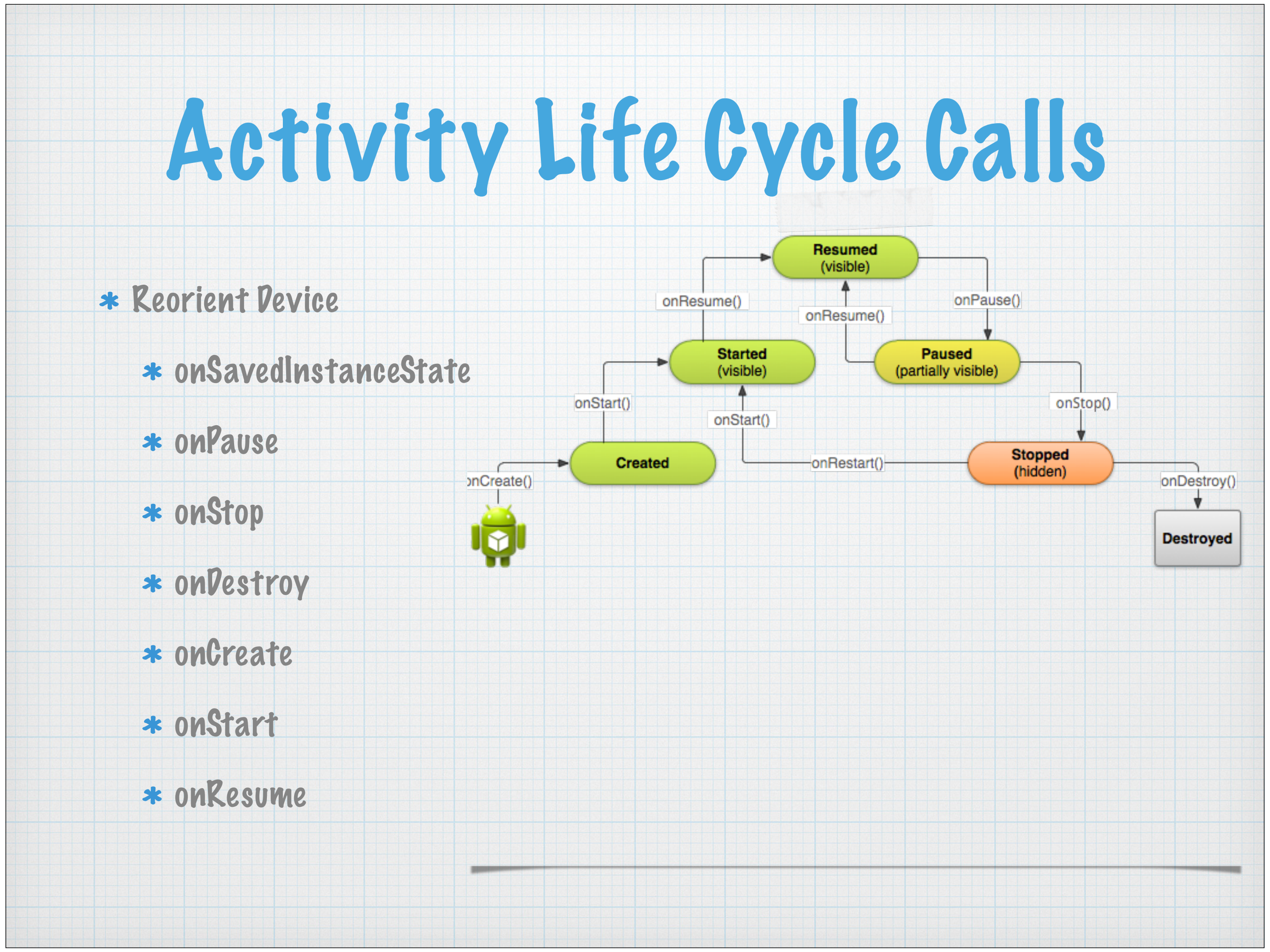
- Home Button
  - onPause
  - onStop



Activity Life Cycle Calls

- Relaunch
  - onStart
  - onResume





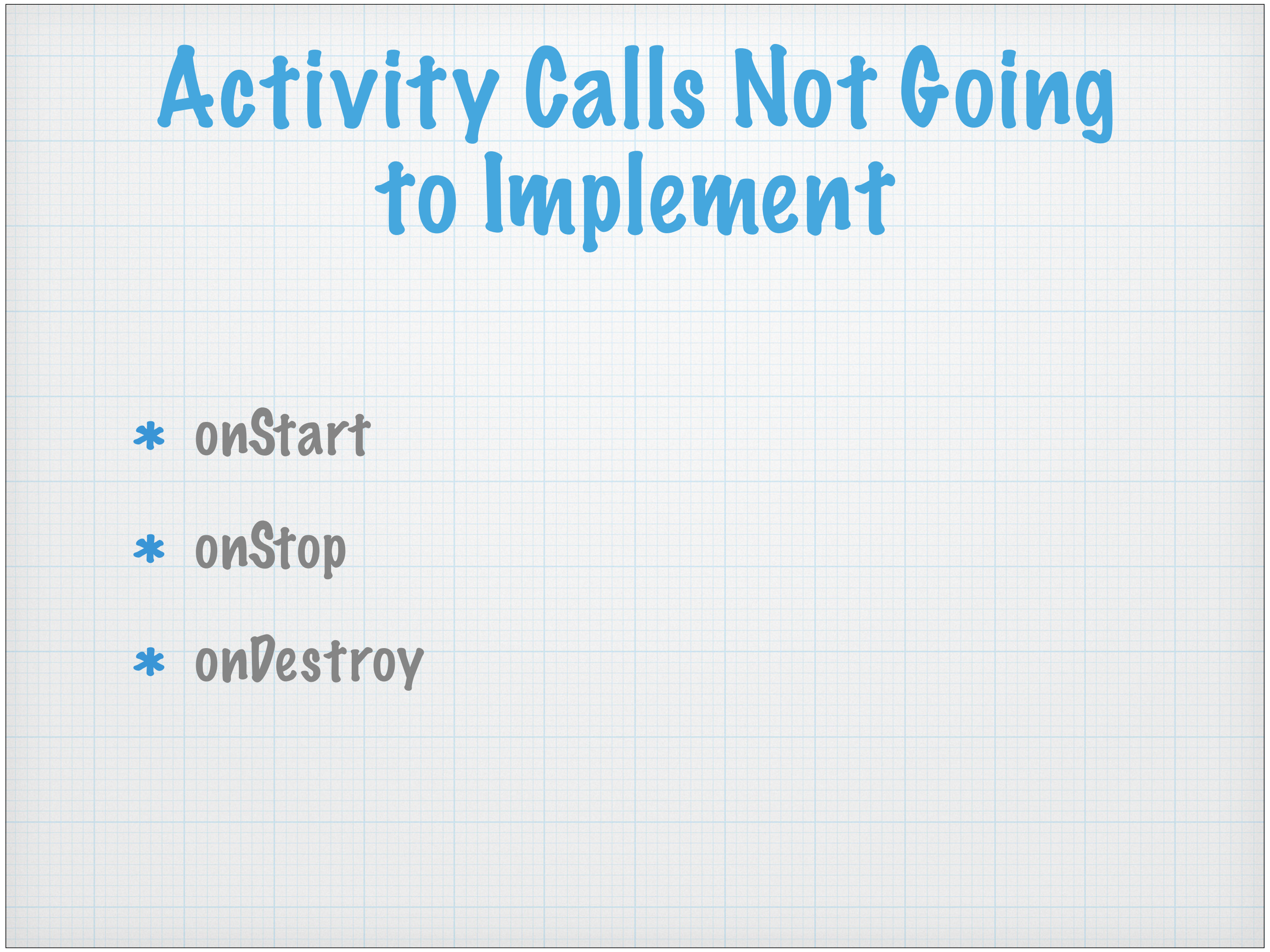
Activity Life Cycle Calls

- Reorient Device
  - onSavedInstanceState
  - onPause
  - onStop
  - onDestroy
  - onCreate
  - onStart
  - onResume

No guarantee that onSavedInstanceState will be called - e.g. when back button is pressed

Activity Calls to Implement

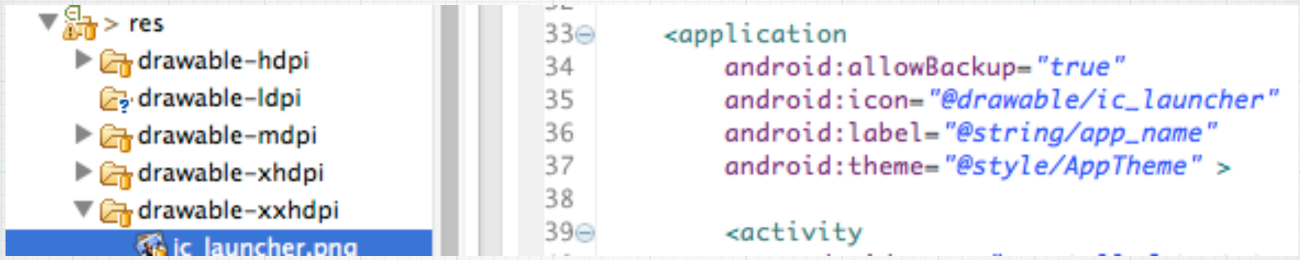
- onCreate
- onResume
- onPause



Activity Calls Not Going to Implement

- onStart
- onStop
- onDestroy

the other activity calls seem to handle the cases we need



```
▼ > res
  ▶ drawable-hdpi
    drawable-ldpi
  ▶ drawable-mdpi
  ▶ drawable-xhdpi
  ▼ drawable-xxhdpi
      ic_launcher.png
```

```xml
    <application
        android:allowBackup="true"
        android:icon="@drawable/ic_launcher"
        android:label="@string/app_name"
        android:theme="@style/AppTheme" >

        <activity
```

Icon Installment

Resource referenced in AndroidManifest.xml

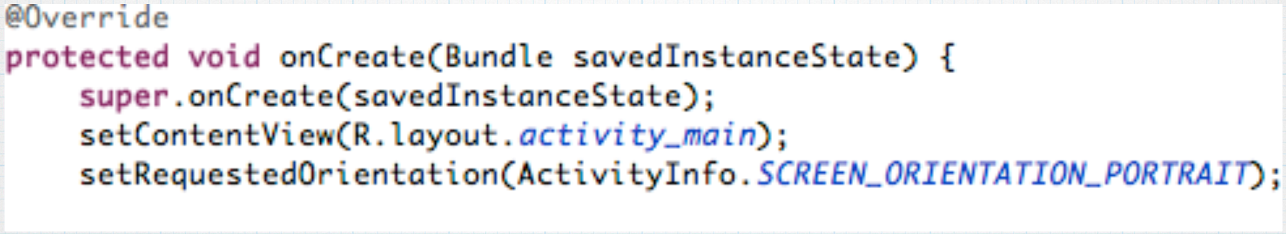
prefix icons with ic_ so that they alphabetize together

launcher icons must be 48 x 48 for smallest to 144x144 for xxhdpi

google play icons must be 512x512

start with 864x864 makes it easier to scale down

http://developer.android.com/design/style/iconography.html



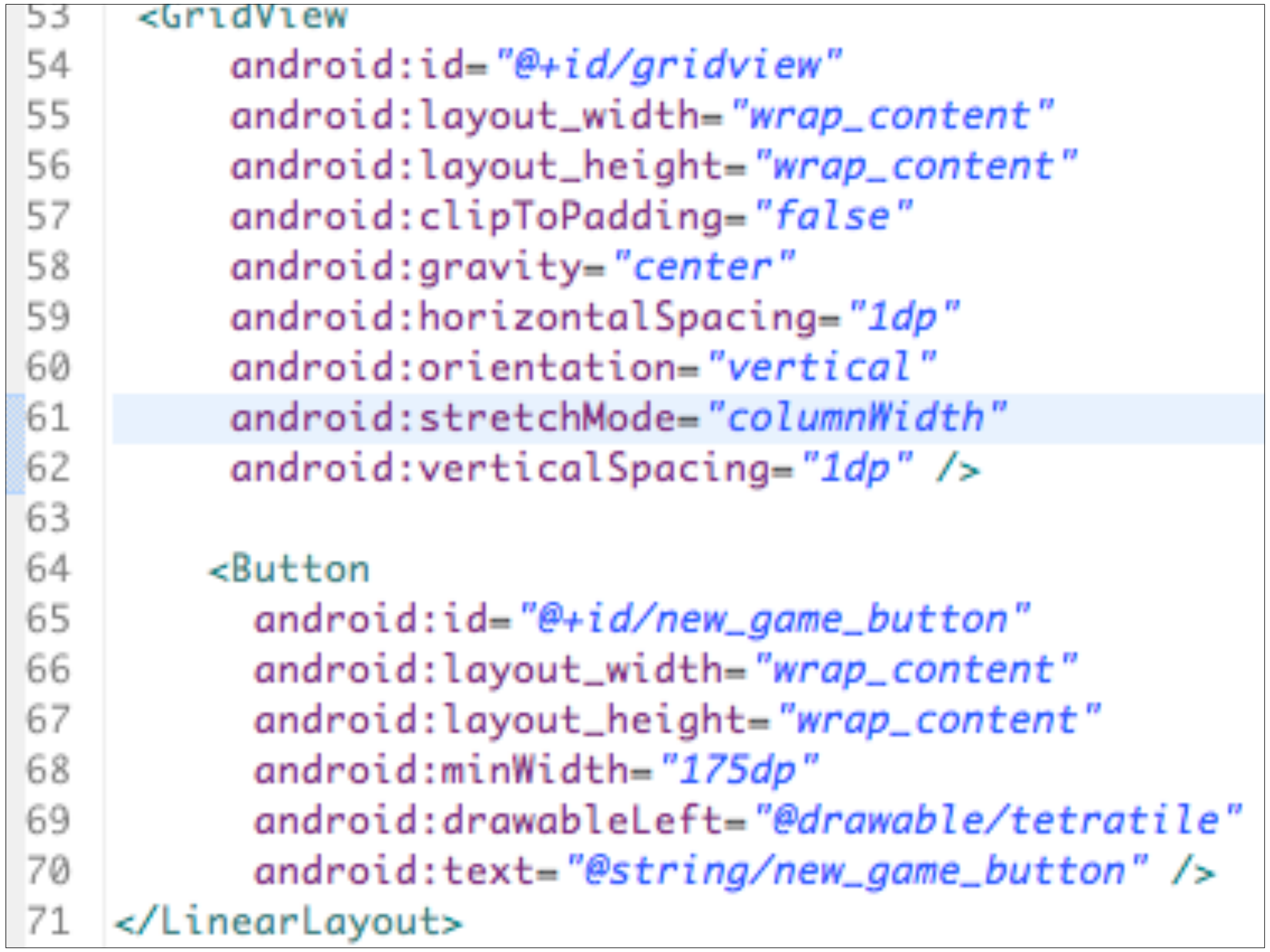
```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
    setRequestedOrientation(ActivityInfo.SCREEN_ORIENTATION_PORTRAIT);
```

onCreate

call super

Want portrait orientation even if the device is rotated

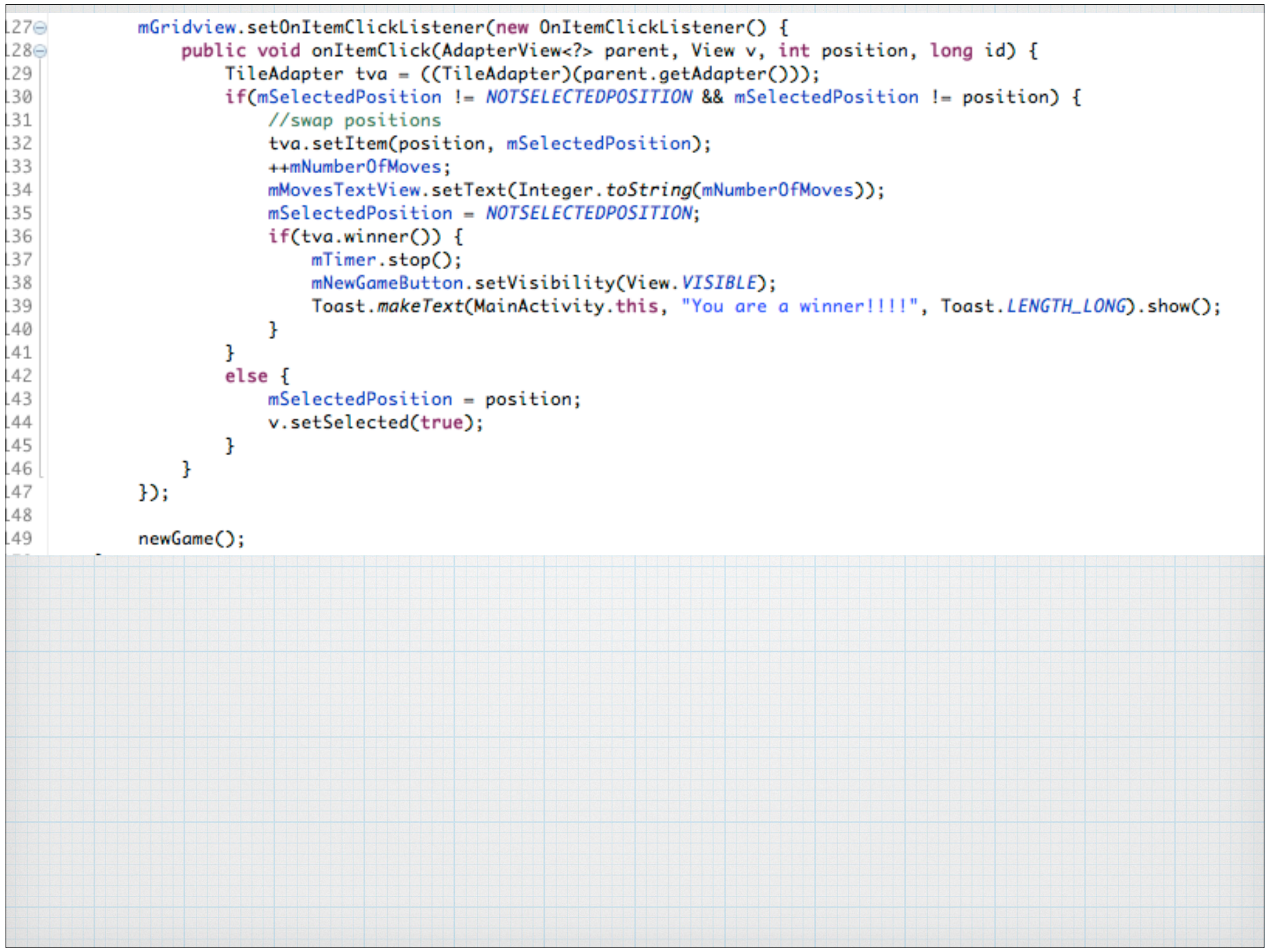
ctrl-F12 to change orientation in simulator



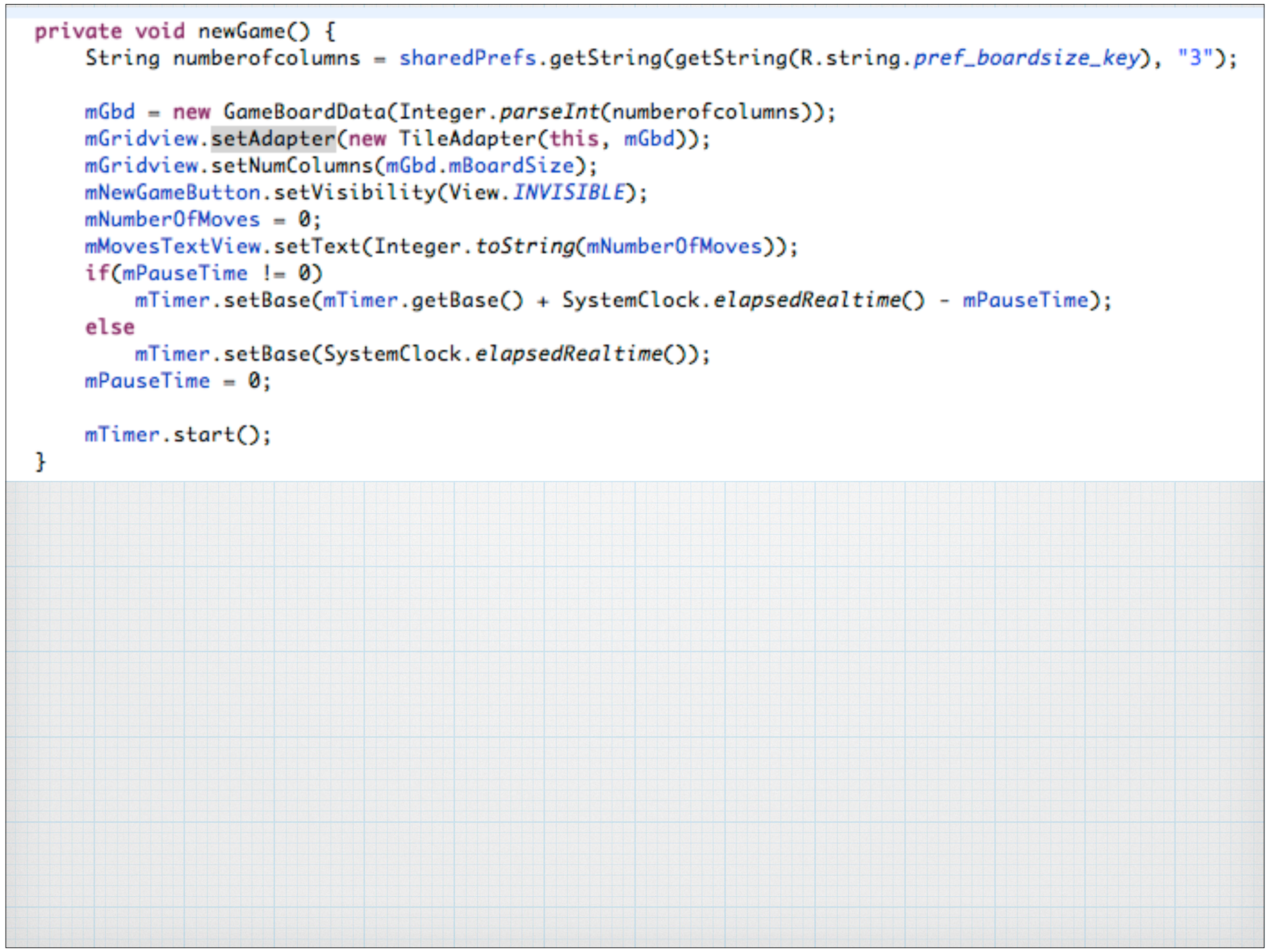
```
 <GridView
     android:id="@+id/gridview"
     android:layout_width="wrap_content"
     android:layout_height="wrap_content"
     android:clipToPadding="false"
     android:gravity="center"
     android:horizontalSpacing="1dp"
     android:orientation="vertical"
     android:stretchMode="columnWidth"
     android:verticalSpacing="1dp" />

    <Button
      android:id="@+id/new_game_button"
      android:layout_width="wrap_content"
      android:layout_height="wrap_content"
      android:minWidth="175dp"
      android:drawableLeft="@drawable/tetratile"
      android:text="@string/new_game_button" />
</LinearLayout>
```

Density-independent Pixels - an abstract unit that is based on the physical density of the screen. one dp is one pixel on a 160 dpi screen

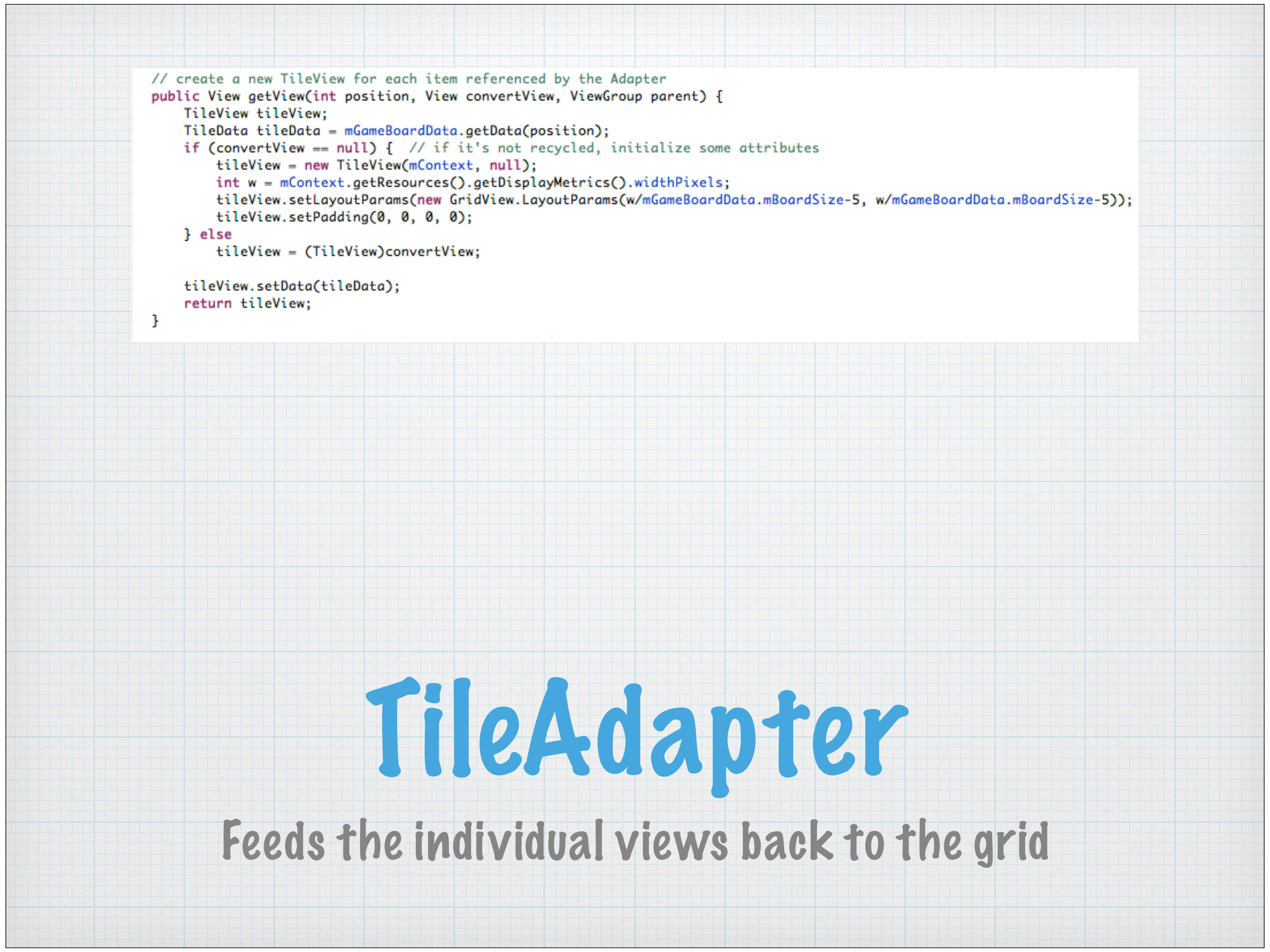
http://stackoverflow.com/questions/2025282/difference-between-px-dp-dip-and-sp-in-android



```
        mGridview.setOnItemClickListener(new OnItemClickListener() {
            public void onItemClick(AdapterView<?> parent, View v, int position, long id) {
                TileAdapter tva = ((TileAdapter)(parent.getAdapter()));
                if(mSelectedPosition != NOTSELECTEDPOSITION && mSelectedPosition != position) {
                    //swap positions
                    tva.setItem(position, mSelectedPosition);
                    ++mNumberOfMoves;
                    mMovesTextView.setText(Integer.toString(mNumberOfMoves));
                    mSelectedPosition = NOTSELECTEDPOSITION;
                    if(tva.winner()) {
                        mTimer.stop();
                        mNewGameButton.setVisibility(View.VISIBLE);
                        Toast.makeText(MainActivity.this, "You are a winner!!!!", Toast.LENGTH_LONG).show();
                    }
                }
                else {
                    mSelectedPosition = position;
                    v.setSelected(true);
                }
            }
        });

        newGame();
```



```
private void newGame() {
    String numberofcolumns = sharedPrefs.getString(getString(R.string.pref_boardsize_key), "3");

    mGbd = new GameBoardData(Integer.parseInt(numberofcolumns));
    mGridview.setAdapter(new TileAdapter(this, mGbd));
    mGridview.setNumColumns(mGbd.mBoardSize);
    mNewGameButton.setVisibility(View.INVISIBLE);
    mNumberOfMoves = 0;
    mMovesTextView.setText(Integer.toString(mNumberOfMoves));
    if(mPauseTime != 0)
        mTimer.setBase(mTimer.getBase() + SystemClock.elapsedRealtime() - mPauseTime);
    else
        mTimer.setBase(SystemClock.elapsedRealtime());
    mPauseTime = 0;

    mTimer.start();
}
```

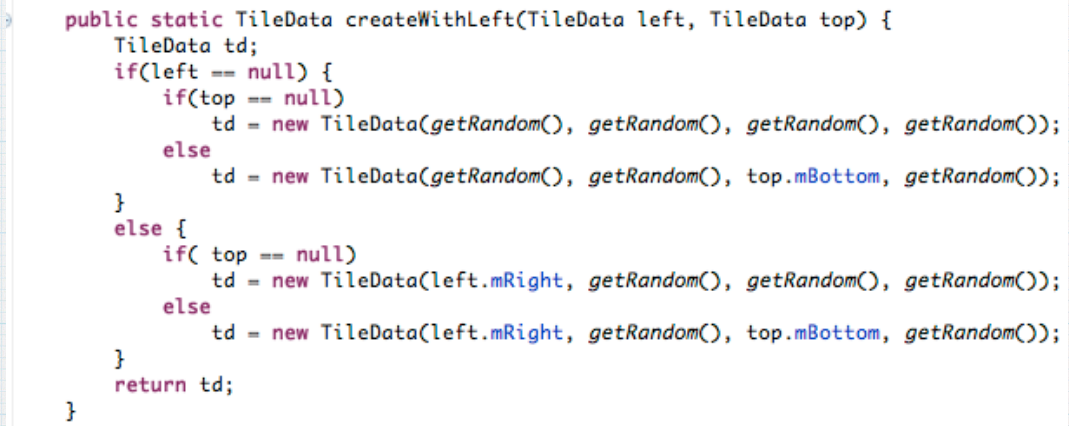


```java
// create a new TileView for each item referenced by the Adapter
public View getView(int position, View convertView, ViewGroup parent) {
    TileView tileView;
    TileData tileData = mGameBoardData.getData(position);
    if (convertView == null) {  // if it's not recycled, initialize some attributes
        tileView = new TileView(mContext, null);
        int w = mContext.getResources().getDisplayMetrics().widthPixels;
        tileView.setLayoutParams(new GridView.LayoutParams(w/mGameBoardData.mBoardSize-5, w/mGameBoardData.mBoardSize-5));
        tileView.setPadding(0, 0, 0, 0);
    } else
        tileView = (TileView)convertView;

    tileView.setData(tileData);
    return tileView;
}
```

TileAdapter

Feeds the individual views back to the grid

Reuse the view if one is provided

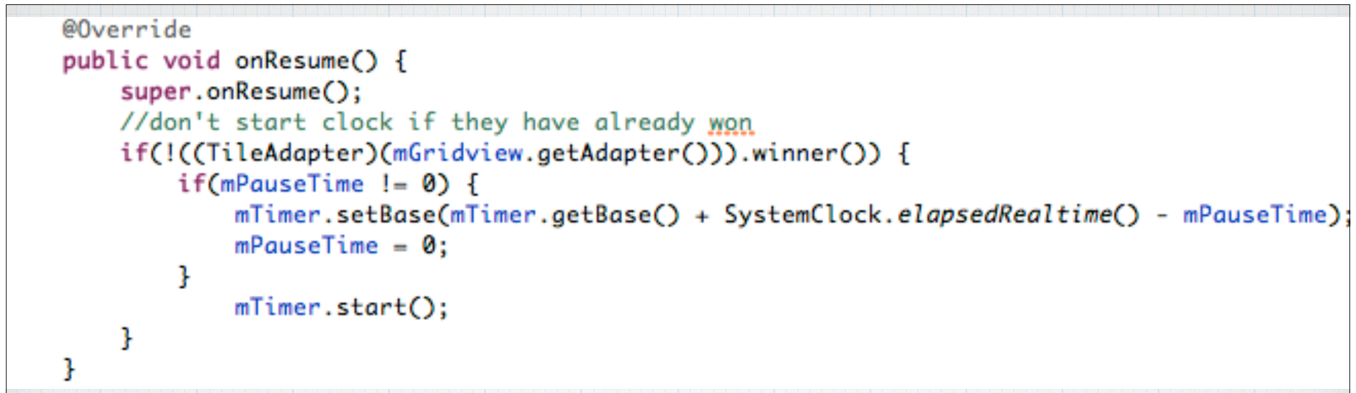


```java
public static TileData createWithLeft(TileData left, TileData top) {
    TileData td;
    if(left == null) {
        if(top == null)
            td = new TileData(getRandom(), getRandom(), getRandom(), getRandom());
        else
            td = new TileData(getRandom(), getRandom(), top.mBottom, getRandom());
    }
    else {
        if( top == null)
            td = new TileData(left.mRight, getRandom(), getRandom(), getRandom());
        else
            td = new TileData(left.mRight, getRandom(), top.mBottom, getRandom());
    }
    return td;
}
```

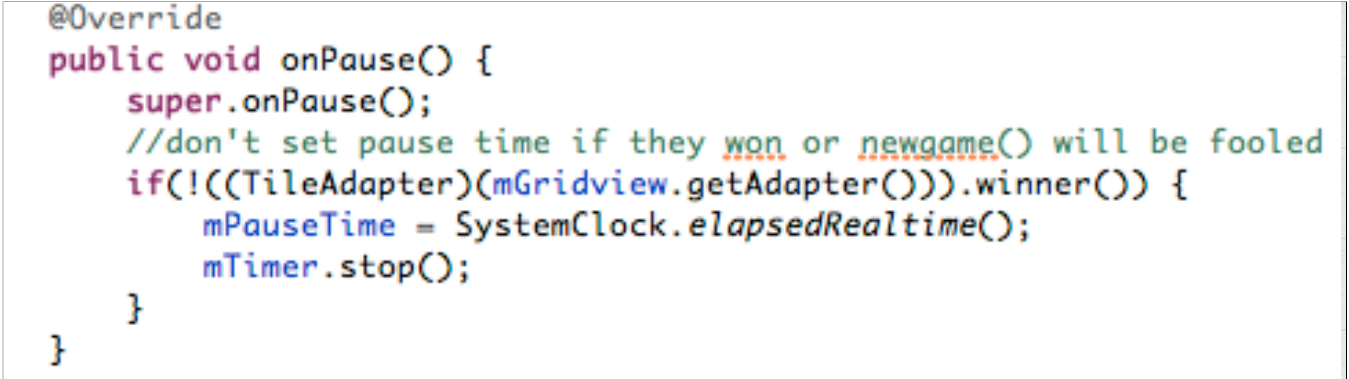
TileData

Create function

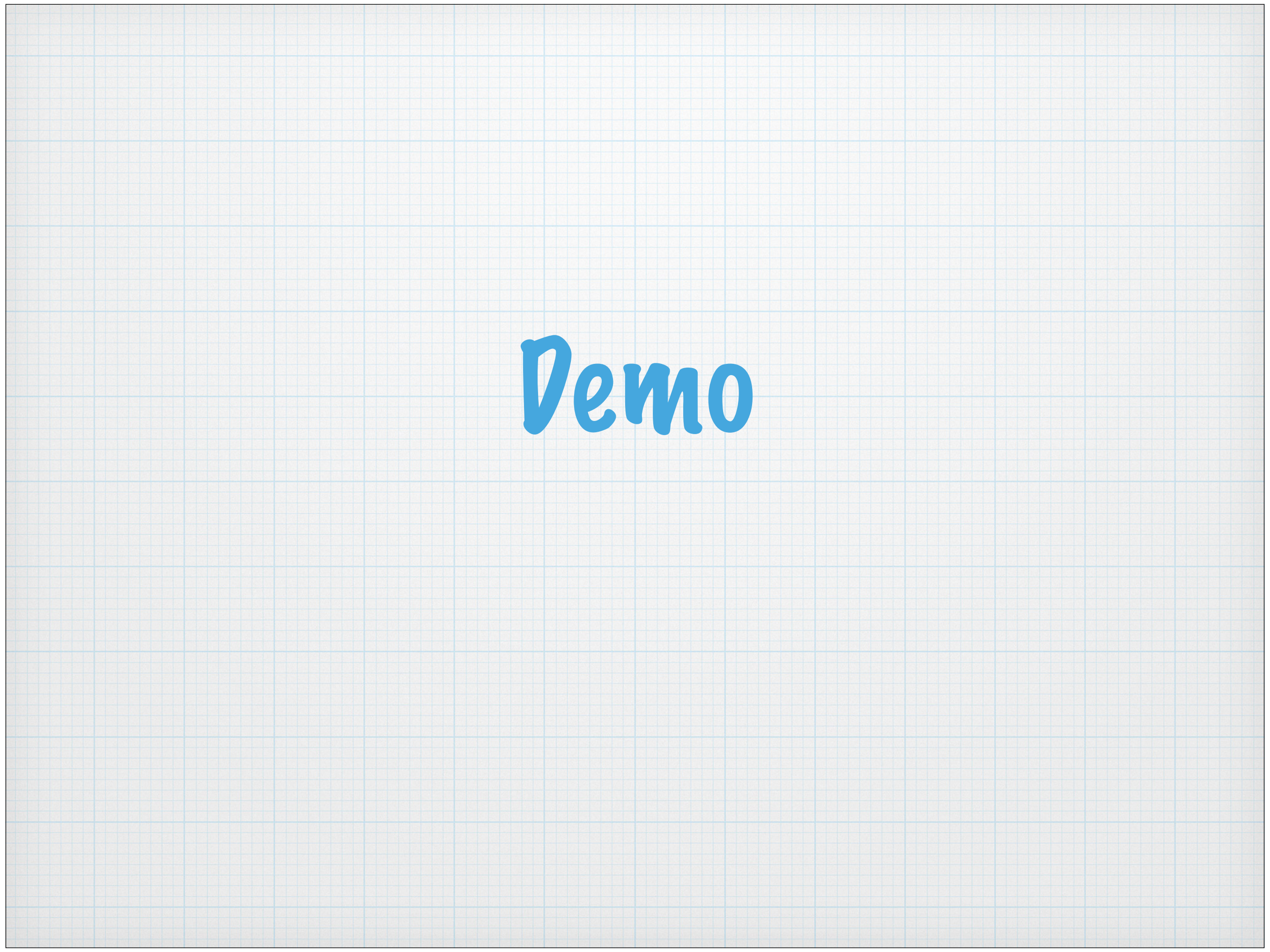
Uses the tiles to the left and top of it to determine the already determined values.



```
@Override
public void onResume() {
    super.onResume();
    //don't start clock if they have already won
    if(!((TileAdapter)(mGridview.getAdapter())).winner()) {
        if(mPauseTime != 0) {
            mTimer.setBase(mTimer.getBase() + SystemClock.elapsedRealtime() - mPauseTime);
            mPauseTime = 0;
        }
            mTimer.start();
    }
}
```



```
@Override
public void onPause() {
    super.onPause();
    //don't set pause time if they won or newgame() will be fooled
    if(!((TileAdapter)(mGridview.getAdapter())).winner()) {
        mPauseTime = SystemClock.elapsedRealtime();
        mTimer.stop();
    }
}
```

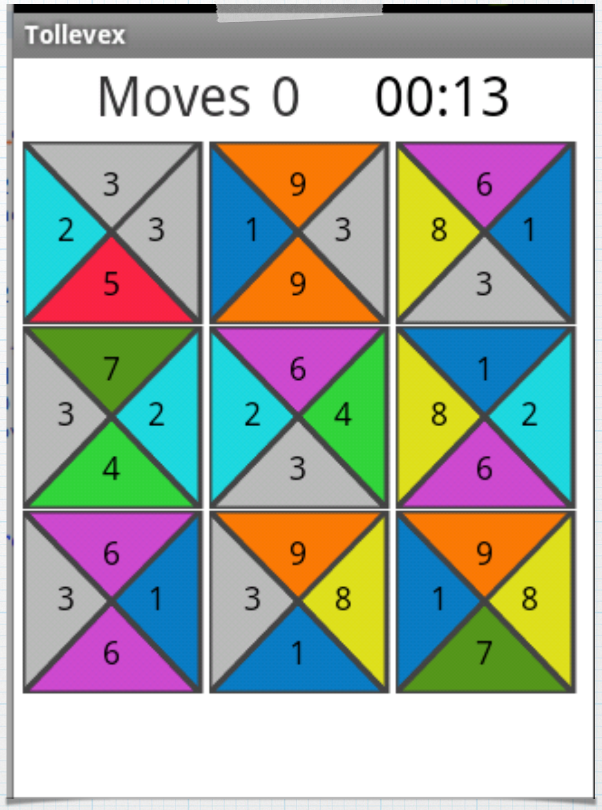


Demo

Launch game on virtual device and a real device

Show TileView, SettingsActivity, MainActivity(Settings code), GameBoardData

Game Started



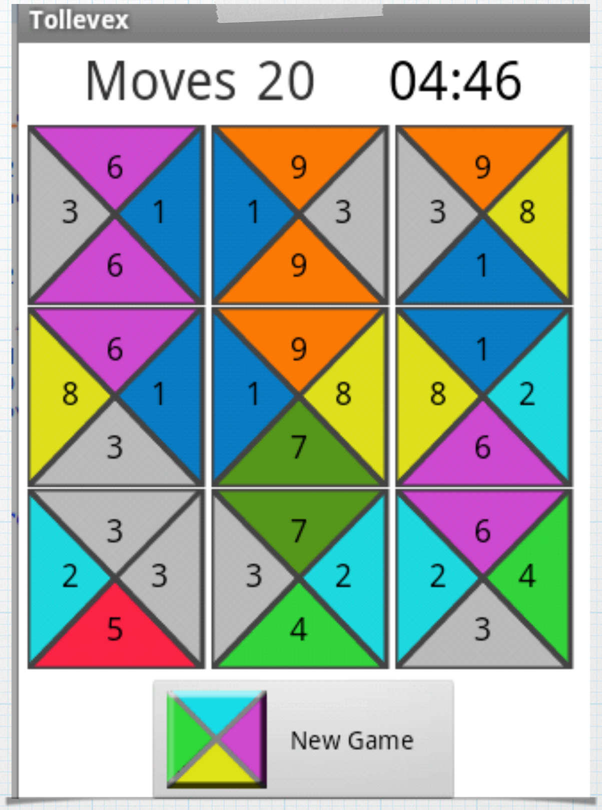
Tollevex

Moves 0 00:13

Game Won

New Game button appears after a winning move

Tiles are no longer moveable



Conclusions

- https://github.com/tollefson/tollevex
- Cool factor with my kids was great
- Makes learning Android app programming more FUN
- Test with real devices

References

- https://github.com/tollefson/tollevex
- http://www.eclipse.org/egit/
- http://developer.android.com/training/basics/activity-lifecycle/starting.html
- http://developer.android.com/design/style/iconography.html
- http://stackoverflow.com/questions/2025282/difference-between-px-dp-dip-and-sp-in-android