Programming Handheld Systems

2D Graphics & Animation

Topics

- 2D Graphics
  - ImageView
  - Canvas
- View Animation
- Property Animation

Drawing 2D Graphics

Draw to a View

- Simple graphics, little or no updating

Draw to a Canvas

- More complex graphics, with regular updates

Drawable

Something that can be drawn, such as a bitmap, color, shape, etc.

Examples:

BitmapDrawable

ShapeDrawable

ColorDrawable

Drawing to Views

Can set Drawable objects on Views

Can do this via XML or programmatically

GraphicsBubble

Applications display a single ImageView

ImageView holds an image of a bubble


16:01
GraphicsBubbleXML

Demonstration of the GraphicsBubbleXML and GraphicsBubbleProgram projects in the IDE

ShapeDrawable

Used for drawing primitive shapes

Shape represented by a Shape class

PathShape – lines

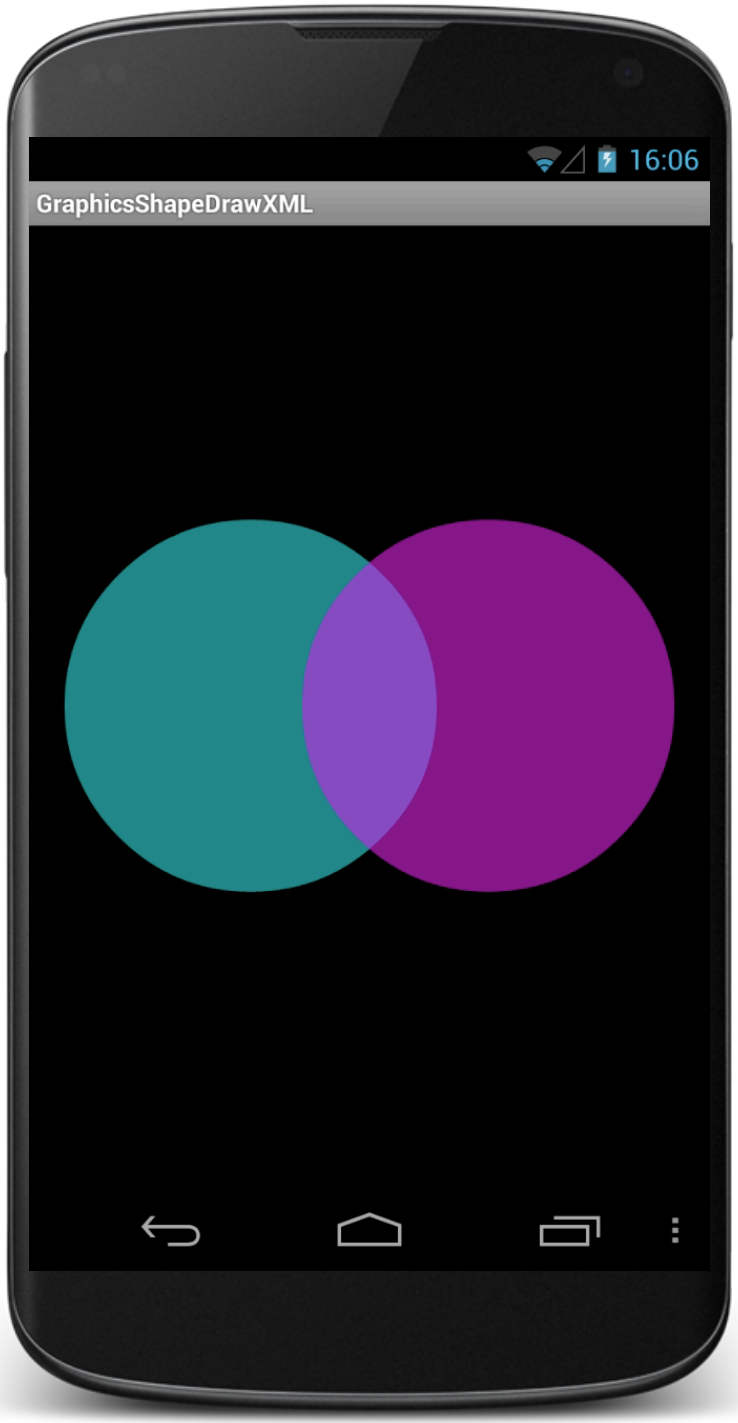
RectShape – rectangles

OvalShape – ovals & rings

GraphicsShapeDraw

Applications display two Shapes within a RelativeLayout

The two shapes are partially overlapping and semi-transparent


16:06
GraphicsShapeDrawXML

Demonstration of the GraphicsShapeDraw project in the IDE

Drawing with a Canvas

A Bitmap (a matrix of Pixels)

A Canvas for drawing to the underlying Bitmap

A Drawing Primitive (e.g. Rect, Path, Text, Bitmap)

A paint object (for setting drawing colors & styles)

Drawing Primitives

Canvas supports multiple drawing methods

drawText()

drawPoints()

drawColor()

drawOval()

drawBitmap()

Paint

Specifies style parameters for drawing, e.g.,

setStrokeWidth()

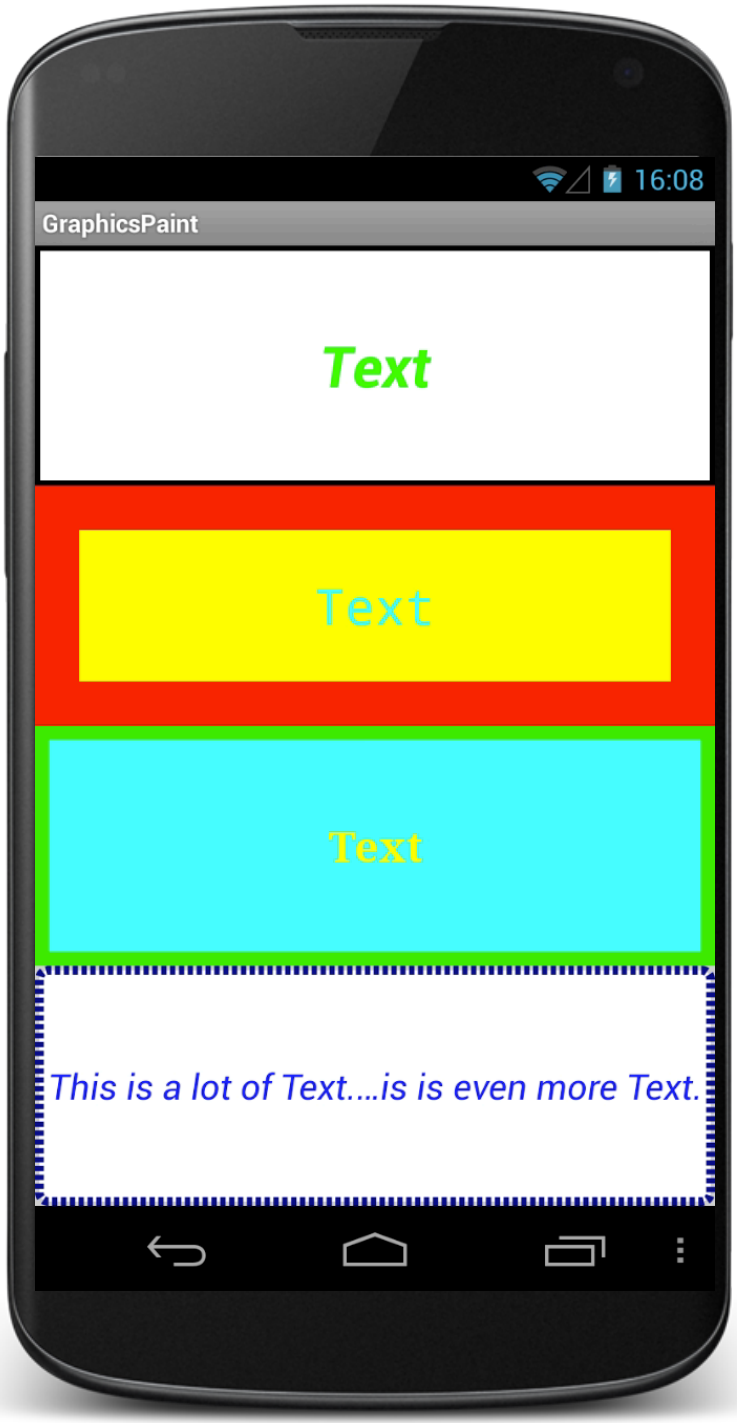
setTextSize()

setColor()

setAntiAlias()

GraphicsPaint

Application draws several boxes holding text, so using different paint settings each time


16:08
GraphicsPaint
Text
Text
Text
This is a lot of Text....is is even more Text.

Demonstration of the GraphicsPaint project in the IDE

Drawing with a Canvas

Can draw to generic Views, or to SurfaceViews

Drawing to Views

Use when updates are infrequent

Create a custom View class

System provides the canvas to the View when it calls the View's onDraw() method

Drawing to SurfaceViews

Create a Custom SurfaceView

Provide secondary thread for drawing

Application provides its own canvas and has greater control over drawing

GraphicsBubble

This application draws to custom View

It has an Internal Thread that periodically wakes up and causes the View to move and to be redrawn


16:12
GraphicsCanvasBubble

Demonstration of the GraphicsCanvasBubble project in the IDE

Canvas with SurfaceView

Used for more high-performance drawing outside the UI thread

SurfaceView

SurfaceView manages a low-level drawing area called a Surface

The Surface represent a drawing area within the View hierarchy

Defining a Custom SurfaceView

Subclass SurfaceView & implement SurfaceHolder.Callback

SurfaceHolder.Callback declares lifecycle methods that are called when the Surface changes

Using a SurfaceView

Set up SurfaceView

Draw to SurfaceView

Setup

Use SurfaceView's getHolder() to acquire Surface

Setup

Register for callbacks with SurfaceHolder's addCallback()

surfaceCreate()

surfaceChanged()

surfaceDestroyed()

Setup

Create the thread on which drawing operations will execute

Drawing

Acquire lock on Canvas

SurfaceHolder.lockCanvas()

Draw

Canvas.drawBitmap()

Unlock Canvas

SurfaceHolder.unlockCanvasAndPost()


17:47
GraphicsCanvasBubbleSurfaceView

Demonstration of the GraphicsCanvasBubbleSurfaceView project in the IDE

View Animation

Changing the properties of a View over a period of time

Size

Position

Transparency

Orientation

View Animation Classes

TransitionDrawable

AnimationDrawable

Animation

TransitionDrawable

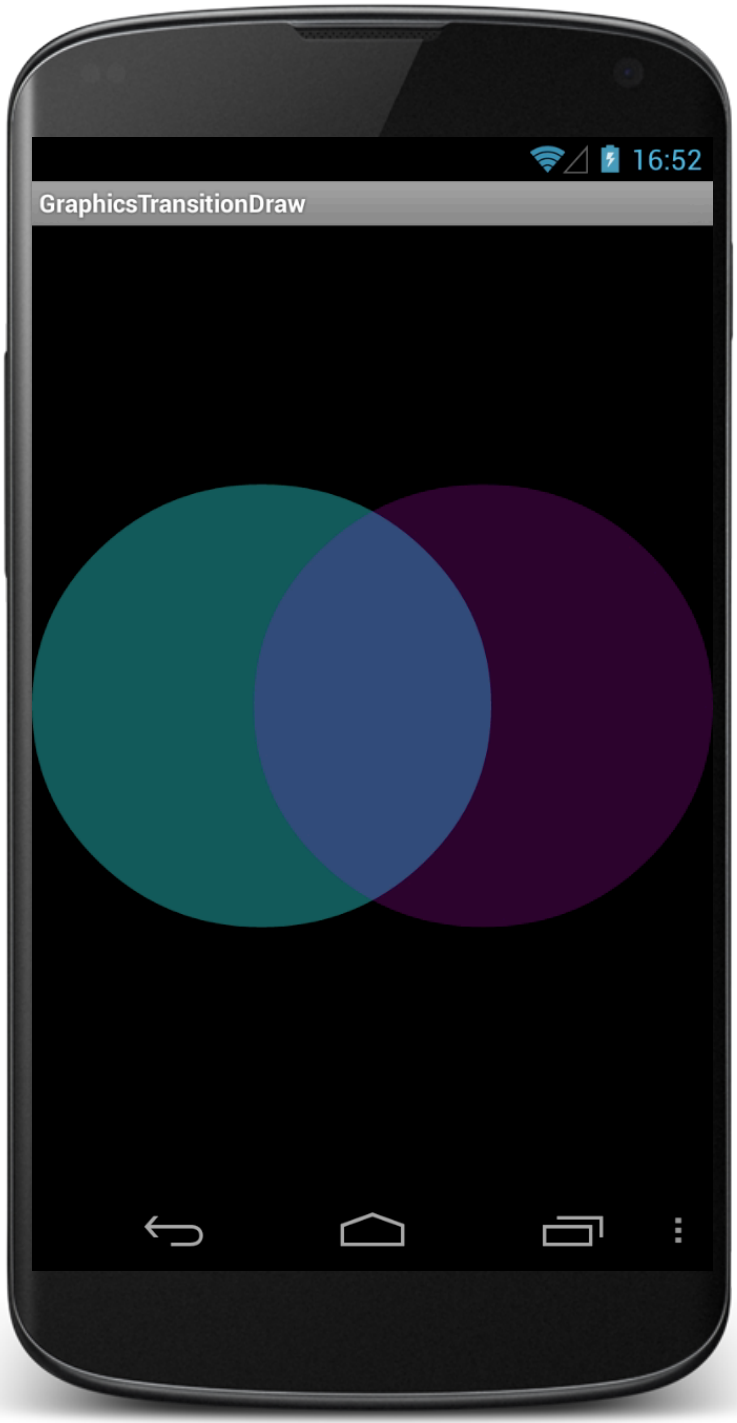
A 2-layer Drawable

Can fade between 1st & 2nd layers

GraphicsTransitionDrawable

This application uses the same shapes as the GraphicsShapeDraw applications

Shows Cyan shape then fades to Magenta shape


16:52
GraphicsTransitionDraw

Demonstration of the GraphicsTransitionDrawable project in the IDE

AnimationDrawable

Animates a series of Drawables

Each Drawable is shown for a specific amount of time

GraphicsFrameAnimation

Uses an Animation Drawable to present a frame by frame animation


16:54
GraphicsFrameAnimation

Demonstration of the GraphicsFrameAnimation project in the IDE

Animation

A series of transformations applied to the content of a View

Can Manipulate animation timing to give effect of sequential or simultaneous changes

GraphicsTweenAnimation

Application displays a single ImageView and animates several of its properties


13:26
GraphicsTweenAnimation

Demonstration of the GraphicsFrameAnimation project in the IDE

Property Animation

Animation – Changing properties of an Object over a period of time

Property Animation Architecture

ValueAnimator – Timing engine

TimeInterpolator – defines how values change as a function of time

AnimatorUpdateListener – called back at every animation frame change

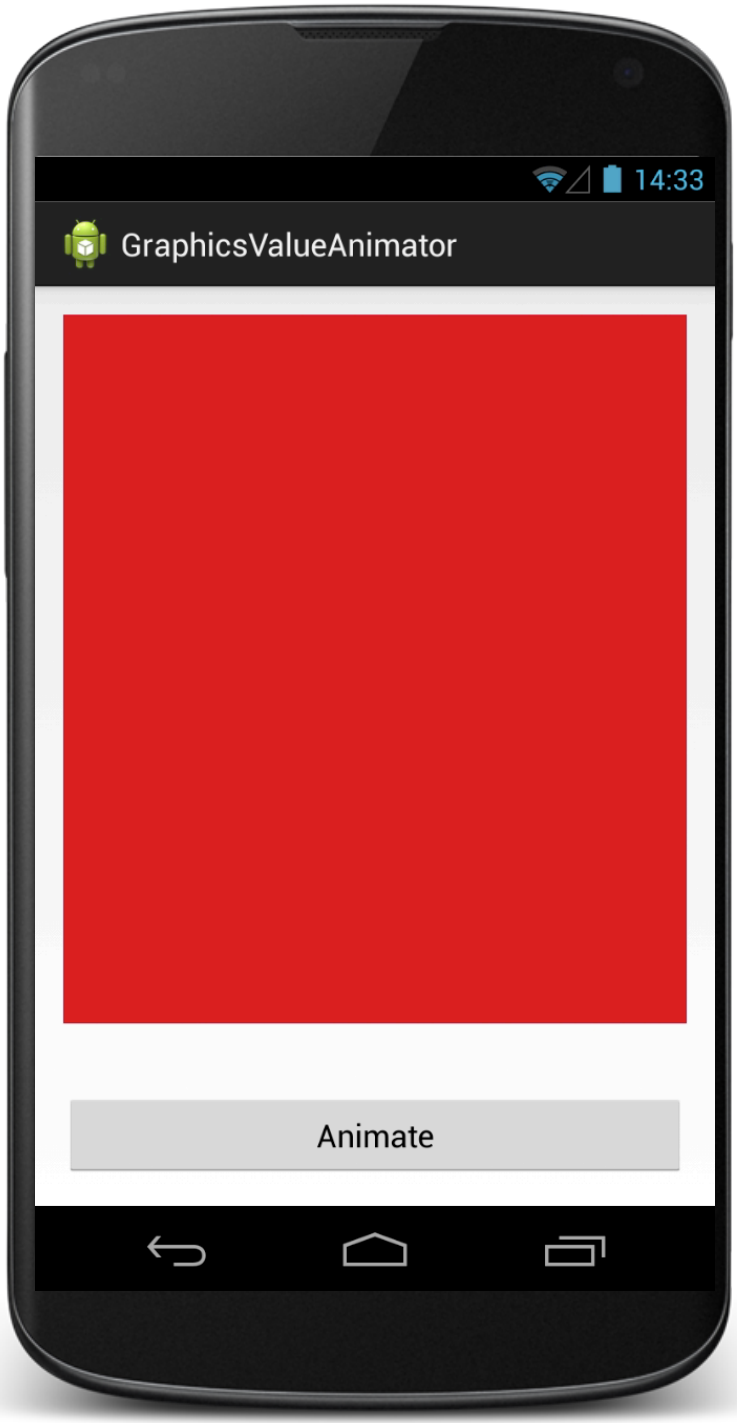
TypeEvaluator – Calculates a property's value at a given point in time

Property Animation Architecture

AnimatorSet – combines individual animations to create more complex animations

GraphicsValueAnimator

Uses a ValueAnimator to animate changing an ImageView's background color


14:33
GraphicsValueAnimator
Animate

Demonstration of the GraphicsValueAnimator project in the IDE

GraphicsViewPropertyAnimator

Same as the GraphicsTweenAnimation,

Uses the ViewPropertyAnimator class,
which is a simplified animator for Views


17:08
GraphicsViewPropertyAnimator

Demonstration of the GraphicsViewPropertyAnimator project in the IDE

Next Time

MultiTouch & Gestures