

PROGRAMMING HANDHELD SYSTEMS

2D GRAPHICS & ANIMATION

TOPICS

2D GRAPHICS

UIImageView

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

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



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



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



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()`



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 GRAPHICSHAPEDRAW APPLICATIONS

SHOWS CYAN SHAPE THEN FADES TO
MAGENTA SHAPE



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



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



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



GRAPHICSVIEWPROPERTYANIMATOR

SAME AS THE GRAPHICSTWEENANIMATION,
USES THE VIEWPROPERTYANIMATOR CLASS,
WHICH IS A SIMPLIFIED ANIMATOR FOR VIEWS



NEXT TIME

MULTITOUCH & GESTURES