JavaFX Layout SECRETS

January 13, 2010

amy.fowler@sun.com

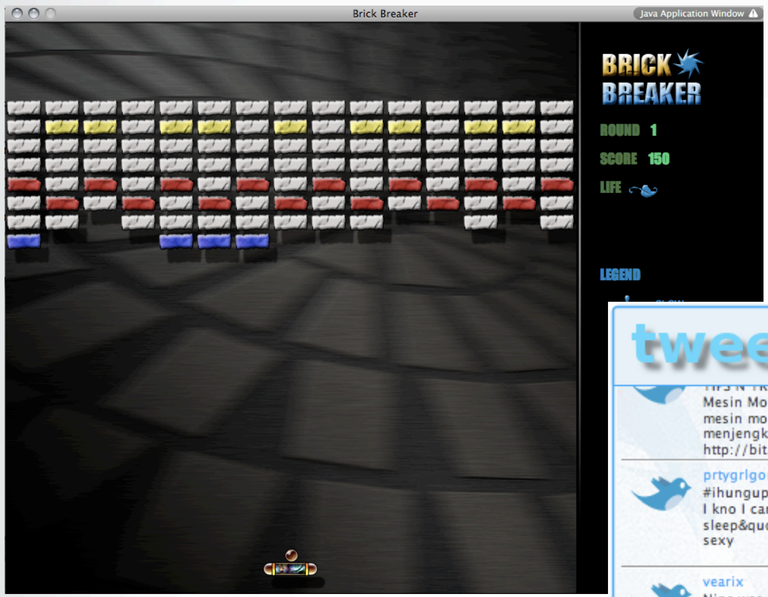
AGENDA

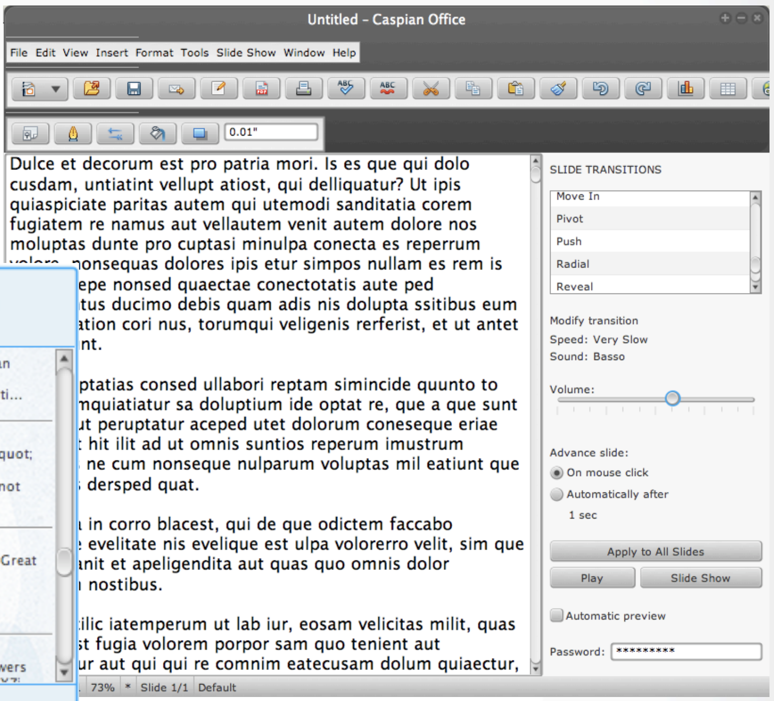
JavaFX Layout Fundamentals

*Changes for 1.3 (in blue)

** we reserve the right to change our minds (at least until we ship)*

INTERFACES, 2010

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SLIDE TRANSITIONS

- Move In
- Pivot
- Push
- Radial
- Reveal

Modify transition
Speed: Very Slow
Sound: Basso

Volume:

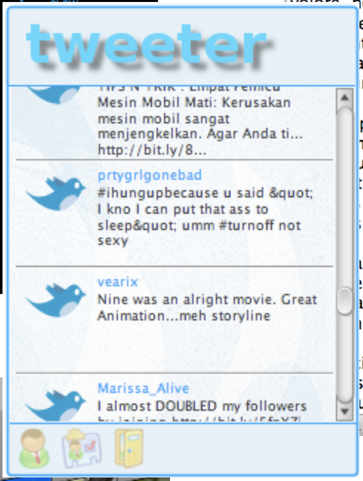
Advance slide:
[✓ On mouse click]
Automatically after
1 sec

Apply to All Slides
Play | Slide Show

Automatic preview

Password: *********

73% * Slide 1/1 Default

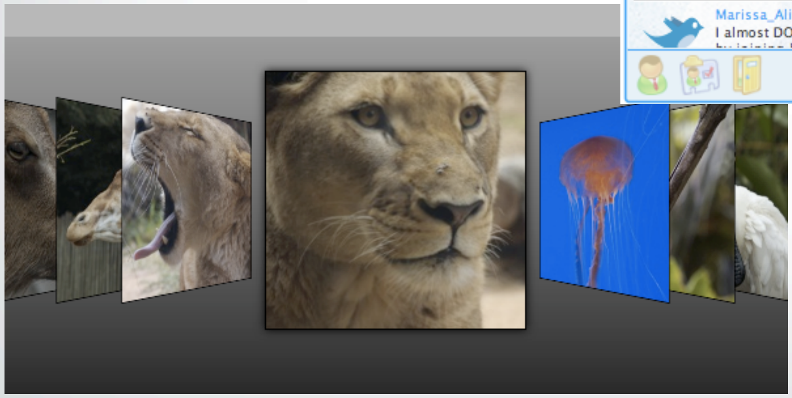


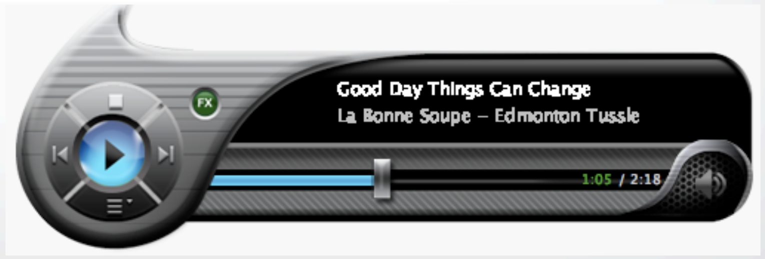
Mesin Mobil Mati: Kerusakan mesin mobil sangat menjengkelkan. Agar Anda ti... http://bit.ly/8...

prtygrlgonebad
#ihungupbecause u said &quot; I kno I can put that ass to sleep&quot; umm #turnoff not sexy

vearix
Nine was an alright movie. Great Animation...meh storyline

Marissa_Alive
I almost DOUBLED my followers





JAVAFX LAYOUT GOALS

- **Make common layout idioms easy**
  - rows/columns, forms, alignment, spacing, etc.
- **Don't get in the way of creativity**
  - animation - must allow things to move
  - free form shapes - no longer restricted by nested, clipped, rectangles!
- Performance a major focus for 1.3

LAYOUT MECHANISM

- **Scene graph layed out once per pulse, before rendering**
  - nodes call requestLayout() when preferred size changes
  - requests all ***coalesced*** for next layout pass
  - layout executes top-down (dirty branches only)
- **MUCH more efficient in 1.3**
  - fine-tuned calls to requestLayout
  - more efficient bounds calculations

RESIZABLE VS. NOT

- Resizable mixin class enables nodes to be resized externally:

```
public var width:Number
public var height:Number
public function getMinWidth():Number
public function getMinHeight():Number
public function getPrefWidth(height:Number):Number
public function getPrefHeight(width:Number):NUmber
public function getMaxWidth():Number
public function getMaxHeight():Number
```

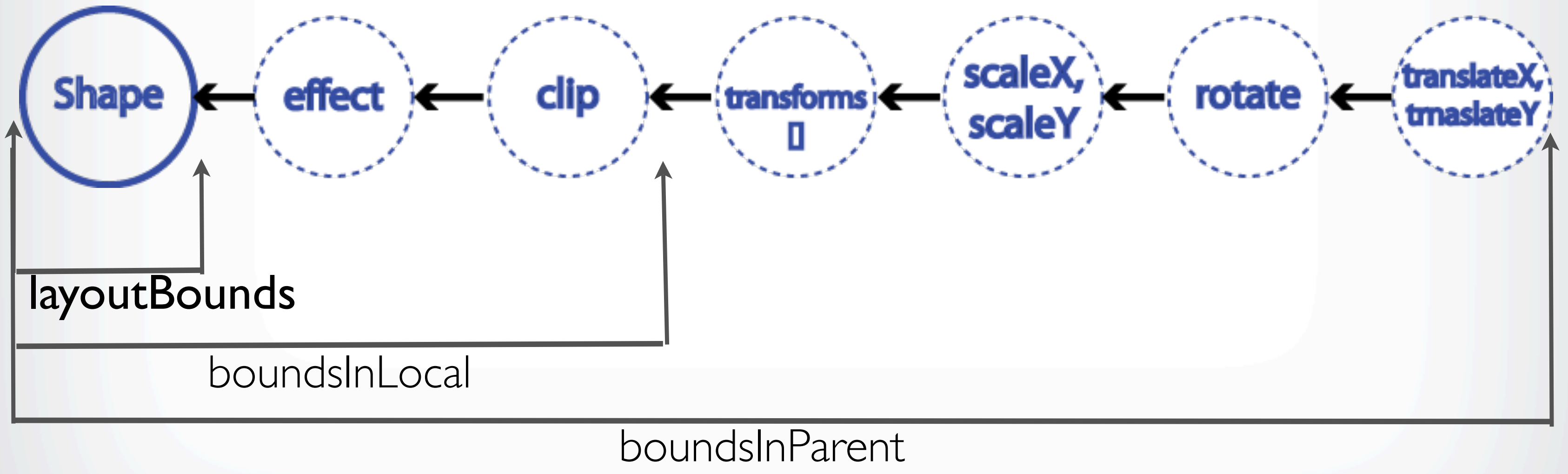
Resizable	Not Resizable
Containers	Group, CustomNode
Controls	Text, ImageView, Shapes

- Resizable & non-Resizable nodes can be freely mixed
    - non-Resizables treated as rigid (min = pref = max)
- Resize != Scale

LAYOUT BOUNDS

- Logical bounds used for layout calculations

```
public-read protected layoutBounds:Bounds
```



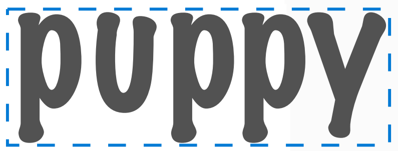
LAYOUT BOUNDS

CONTINUED

Node type	layoutBounds
Non-Resizable (Shapes, Text, etc.)	*geometry only* • *no effect/clip/transforms*
Resizable (Controls & Containers)	*0, 0 width x height* • *regardless of visual bounds*
Group	*union of childrens' boundsInParent* • *effects/clip/transforms on children* ***included*** • *effects/clip/transforms on Group* ***not included***

TEXT LAYOUT BOUNDS

- In 1.2, layoutBounds for Text was tight visual bounds
  - very expensive!
  - problematic for layout
  - doesn't include leading, trailing whitespace

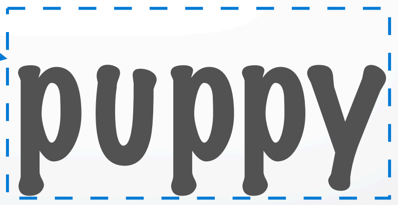


- 1.3 provides Text var for controlling how bounds calculated

```
public var boundsType:TextBoundsType
```

```
TextBoundsType.LOGICAL
TextBoundsType.VISUAL
```

(default)



LAYOUT APPROACHES

- **App-managed**
  - put nodes inside Groups
  - set translation to control positioning
  - use binding for dynamic layout behavior
- **Container-managed**
  - put nodes inside Containers
  - Containers control location, sizing, dynamic behavior
  - recommended for common layout idioms
- **Blend them *both***

APP MANAGED

POSITIONING

- Position nodes by setting translation
  - set **layoutX,layoutY** for general positioning
  - set **translateX,translateY** for animation or adjustments
    - Transition classes modify translateX, translateY
    - final tx,ty => (layoutX + translateX), (layoutY + translateY)
- translation != final location

```
node.layoutX = bind x - node.layoutBounds.minX
node.layoutY = bind y - node.layoutBounds.minY
```

APP MANAGED

SIZING

- Use binding to control dynamic sizing

```
Stage {
    var scene:Scene;
    scene: scene = Scene {
        width: 300
        height: 300
        content: HBox {
           width: bind scene.width
           height: bind scene.height
        }
    }
}
```

CONTAINER MANAGED

- **Put nodes inside Containers**
- **Containers control positioning on all "managed" content**
  - they set layoutX,layoutY (but don't touch translateX/Y)
  - base all layout calcs on layoutBounds (not visual bounds)
- **Containers resize only Resizable nodes**
  - treat non-Resizables (and nodes with bound width/height) as rigid

```
VBox {
    spacing: 10
    content: for (img in images)
        ImageView { image: img  }
    }
}
```

AUTO SIZING

- **1.2 dichotomy between Groups and Containers:**
  - Resizables inside Containers are resized automatically when their preferred size changes
  - Resizables inside Groups will NOT be resized when their preferred size changes
- **In 1.3, Groups will also automatically resize Resizable children when their preferred sizes change.**
- **Two ways to turn this off:**
  - set the child to "unmanaged"
  - bind the child's width/height

LAYOUT & TRANSFORMS

- For nodes inside Containers:
  - modifying effect, clip, transforms will NOT affect layout
  - TranslateTransition, ScaleTransition, RotateTransition will NOT affect layout
- Wrap node in Group if you want transforms to affect layout

```
Stack {
    content: Group {
        content: Rectangle {
            rotate: 45 // rotate will affect layout
        }
    }
}
```

CONTAINERS

- Container class mixes Resizable into Group
  - pondering change to extend directly from Parent
- Abstract base class for layout containers
- layoutBounds will always be (0, 0 width x height)
  - even if visual bounds differ

CONCRETE CONTAINERS

- Stack, HBox, VBox, Tile, Flow, Panel, Grid (in 1.3 preview)
- lay out both visible *and* invisible nodes
- do not clip contents to fit within layout bounds
- honor layout constraints set in LayoutInfo
- 1.3 adds var for adding white space around content:

```
public var padding:Insets;
```

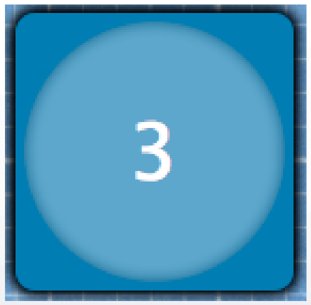
- 1.3 adds var for aligning on pixel boundaries:

```
public var snapToPixel:Boolean = false;
```

STACK

- Easy back-to-front layering
    - z-order matches order of content[] sequence
- Its preferred size is largest preferred width/height of children
- Resizes Resizables to "fill" stack (up to their max size limits)

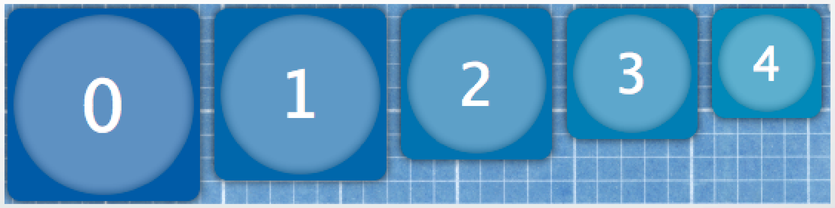
```
Stack {
    content: [
        Rectangle { ...  }
        Circle { ... }
        Label {
            text: "3"
        }
    ]
}
```



HBOX & VBOX

- Simple horizontal row or vertical column of nodes
- Configurable spacing & alignment
- Resizes Resizables to their preferred sizes

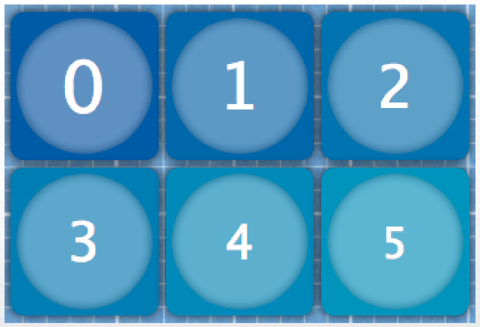
```
HBox {
     spacing: 4
     content: for (in in [0..4])
          Thing {
               text: “{i}”
          }
     ]
}
```



TILE

- Lays out nodes in grid of uniform-sized “tiles”
- Horizontal or vertical orientation
- Wraps tiles when Tile’s size changes
- Size of each “tile” defaults to largest preferred content
- Resizes nodes to “fill” tile (up to their max size limits)
- Configurable spacing & alignment

```
Tile {
    columns: 3
    hgap: 3 vgap: 3
    content: for (i in [0..5])
        Thing { text: “{i}” }
}
```



TILE

CONTINUED

- In 1.3, columns var (horizontal) and rows var (vertical) used only to compute Tile’s preferred size
    - may not reflect actual rows/columns
- In 1.3, new var controls whether tile size is fixed or recomputed as content sizes change:

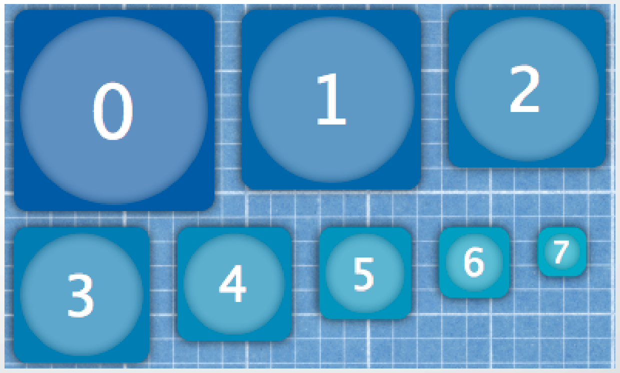
```
public var autoSizeTiles:Boolean = true;

Tile {
    columns: 10
    autoSizeTiles: false
    tileWidth: 150 tileHeight: 100
    content: for (i in (sizeof images))
        ImageView {image: Image { ... } }
}
```

FLOW

- Horizontal or vertical flow that wrap on width/height boundaries
- Always resizes Resizables to their preferred sizes
- Configurable spacing & alignment
- 1.3 adds var to control the preferred wrap dimension:

```
public var wrapLength:Number = 400;
```

```
Flow {
    wrapLength: 300
    hgap: 5  vgap: 10
    content: for (i in [0..7])
        Thing { ... }
}
```



PANEL

- Useful for custom layout on object literals
- Provides function variables for container behaviors:

```
public var minWidth:function():Number;
public var minHeight:function():Number;
public var prefWidth:function(h:Number):Number;
public var prefHeight:function(w:Number):Number;
public var maxWidth:function():Number;
public var maxHeight:function():Number;
public var onLayout:function():Void;


Panel {
    onLayout: function():Void {
        // position/resize content nodes
    }
}
```

IMPLEMENTING PANELS

- Use convenience functions from Container!

```
import javafx.scene.layout.Container.*;

getManaged(content:Node[]):Node[]
getNodePrefWidth(node)/getNodePrefHeight(node)
positionNode(node, x, y)
resizeNode(node, width, height)
layoutNode(node, areaX, areaY, areaWidth, areaHeight,
           baseline, hfill, vfill, hpos, vpos)
```

- They are smart...
    - handle subtracting minX, minY for positioning
    - deal with Resizable vs. non-Resizable nodes
    - honor LayoutInfo if set on node
    - swallow bind exceptions when width/height are bound

GRID

- Based on Grid from JFXtra's (thanks, Stephen!)
- Supports rich, row-oriented grid layout
  - spanning, growing, alignment, etc

```
Grid {
    hgap: 5 vgap: 8
    rows: [
        GridRow { cells: [
            Label{},
            ListView {
                layoutInfo: GridLayoutInfo { hspan:3 }
            }
        ]}
        GridRow { cells: [ ...] }
     ]
}
```

LAYOUT INFO

- Node hook to specify layout preferences:

```
public var layoutInfo:LayoutInfoBase
```

- Can be *shared* across nodes (values *not* copied)

```
def sliderLAYOUT = LayoutInfo { width: 100 }
def slider1 = Slider { layoutInfo: sliderLAYOUT }
def slider2 = Slider { layoutInfo: sliderLAYOUT }
```

- Should only be needed when customization is required
- 3rd parties can extend LayoutInfoBase or LayoutInfo to create custom constraints

LAYOUT INFO

```
public var managed:Boolean;
```

```
public var minWidth:Number;
public var minHeight:Number;
public var width:Number;
public var height:Number;
public var maxWidth:Number;
public var maxHeight:Number;
```

size preference overrides

```
public var hpos:HPos;
public var vpos:VPos;
```

alignment

```
public var margin:Insets;
```

space around

```
public var hgrow:Priority;
public var vgrow:Priority;
public var hshrink:Priority;
public var vshrink:Priority;
public var hfill:Boolean;
public var vfill:boolean;
```

dynamic resize behavior

MANAGED VS. UNMANAGED

- A managed node will have its layout managed by it parent

	Resizable child	non-Resizable child
Group	*resized to preferred*	*no action*
Container	*resized and positioned*	*positioned only*

- By default, all nodes are managed
- An unmanaged node will be ignored (for layout) by parent
- To unmanage, set bit in layoutInfo:

```
VBox {
    content: [
        Rectangle {
            layoutInfo: LayoutInfo.UNMANAGED // VBox will ignore
        }
        ...
```

OVERRIDING SIZE PREFS

- Resizables have intrinsic values for min, pref, max sizes
- Can use LayoutInfo to override values
- To set a specific size on a Resizable, override it’s preferred:

```
VBox {
    content: [
        Button {
            // VBox will resize button to 100x100
            layoutInfo: LayoutInfo {
                width: 100 height: 100
            }
        }...
    ]
}
```

- DO NOT set width/height directly on Resizable - parent will obliterate values! (unless Resizable is unmanaged)

NODE ALIGNMENT

- Sometimes node’s size is different from it’s allocated layout area
  - it cannot be resized (non-Resizable or has bound width/height)
  - it’s min or max size prevents it
- Containers have default alignment vars for this case

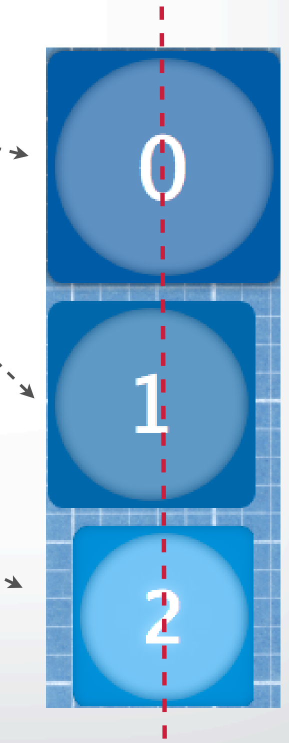
```
public var nodeHPos:HPos
public var nodeVPos:VPos

public enum HPos {  public enum VPos {
    LEFT,               TOP,
    LEADING,            PAGE_START,
    CENTER,             CENTER,
    RIGHT,              BASELINE
    TRAILING            BOTTOM,
}                       PAGE_END
                    }
```

NODE ALIGNMENT

CONTINUED

- LayoutInfo can be used to override alignment for specific nodes

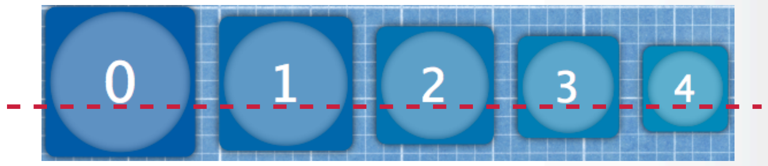
```
VBox {
     // nodeHPos defaults to HPos.LEFT
     content: [
          Thing { text: “0” }
          Thing { text: “1” }
          Thing { text: “2”
              layoutInfo: LayoutInfo {
                   hpos: HPos.CENTER
              }
          }
     ]
}
```



BASELINE ALIGNMENT

- 1.3 Containers supports roman baseline vertical alignment!

```
HBox {
     nodeVPos: VPos.BASELINE
     content: [ ... ]
}
```



- TextOffsets mixin must be implemented by classes that want to be aligned on baseline:

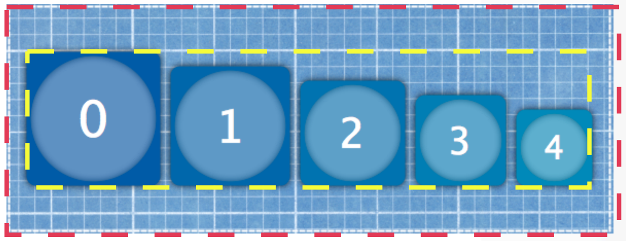
```
public var baselineOffset:Number
```

- Text, Container, and Controls all implement TextOffsets
- Classes that don't implement TextOffsets will be treated as if baseline was on bottom edge

CONTENT ALIGNMENT

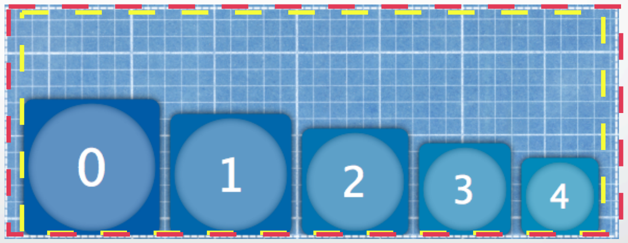
- Container’s content sometimes doesn’t fit it’s size
- Containers have vars for overall content alignment

```
public var hpos:HPos = HPos.LEFT;
public var vpos:VPos = VPos.TOP;

HBox {
    hpos: HPos.CENTER
    vpos: VPos.CENTER
    nodeVPos: VPos.BOTTOM
    ...
```



- In 1.3, HBox/VBox get var for content fill instead of align

```
public var vfill:Boolean = false;

HBox {
    vfill: true
    nodeVPos: VPos.BOTTOM
    ...
```



FILLING

- “Filling” defines behavior when Resizable’s allocated layout area is larger than its preferred size

fill = false	fill = true
keep node to preferred size	expand node to fill layout area (up to max limit)

- Stack and Tile do filling by default
- HBox, VBox, Flow, and Grid do not fill by default
- In 1.3 LayoutInfo can be used to change node’s fill behavior:

```
Stack {
    content: [
        Button {
            layoutInfo: LayoutInfo { vfill: false }
        }...
    ]
}
```

GROWING & SHRINKING

- “Growing” is priority mechanism used by Container to assign extra space when multiple nodes compete for that space
  - applies to increasing layout area assigned to a node, NOT resizing node to fill the larger area (filling controls that)
- “Shrinking” is priority mechanism for taking away space when there is less than needed

```
public enum Priority {
     NEVER, SOMETIMES, ALWAYS
}
```

- HBox supports horizontal grow/shrink
- VBox supports vertical grow/shrink
- Grid supports horizontal and vertical grow/shrink
- Stack, Tile, Flow do not directly support grow/shrink, however...

GROWING & SHRINKING

- Grow/shrink priorities are propagated up scene-graph
    - if Container has child with a grow of ALWAYS, then its grow value will be ALWAYS
    - enables powerful default behavior without heavy customization

```
HBox {
   content: [
      Button{},
      Button{},
      TextBox {
         layoutInfo: LayoutInfo {
               hfill: true
               hgrow: Priority.ALWAYS
               hshrink: Priority.ALWAYS
         }
      }
      Label{}
   ]
}
```

1.3 WORK IN PROGRESS

- **Support for layout roots**
  - enable scene-graph branches to be laid out without affecting ancestors
  - useful for clipped content (scroll panes, viewports, etc)
- **Default LayoutInfo for Controls**
  - sensible resizing "just works" out of the box
- **More efficient min/pref/max size calculations during layout**
  - currently recalculated (for nested containers) at every level of layout pass

10 LAYOUT COMMANDMENTS

1. Freely mix both app-managed and container-managed layout approaches
2. If you create a Node in a Group, then you must set its position ~~and size~~, ~~as Groups don't do layout.~~
3. If you create a Node in a Container, you are handing control of that node's position (and size, if its Resizable) to the Container.
4. Use layoutBounds as the basis of all layout-related calcs.
5. If a node's effect, clip, or transforms should be factored into its layout, then wrap it in a Group.

7.5 ~~10~~ LAYOUT COMMANDMENTS

6. Set layoutX/layoutY for stable layout position and translateX/translateY for animation or adjustments.

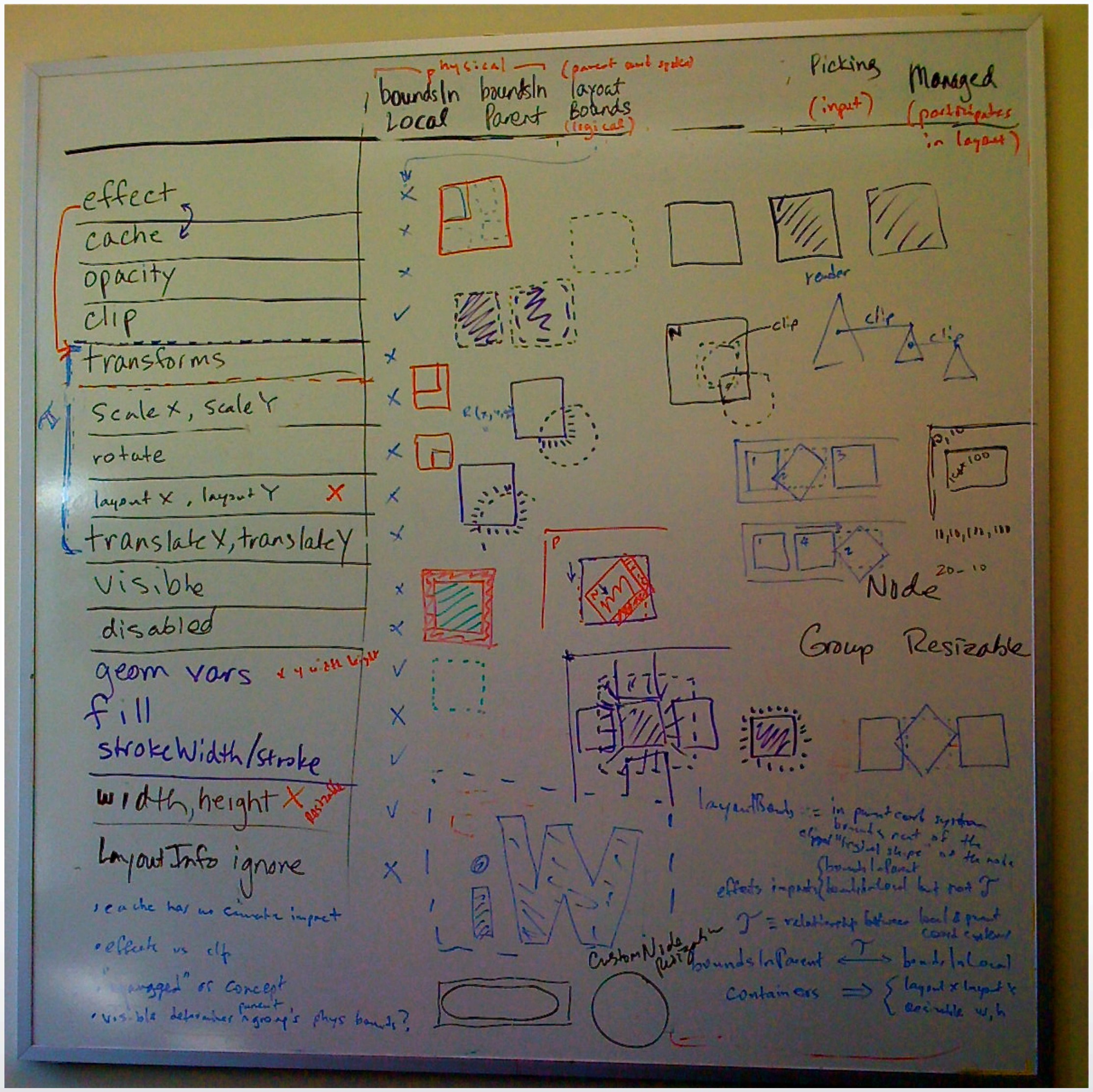
7. Remember layoutX/layoutY are offsets, not final location.

8. ~~LayoutInfo is only relevant when set on a Node that has a Container as its parent, otherwise it's ignored.~~

9. If you need to control the size of a Resizable ~~inside a Container~~, then either bind its width/height or override its preferred size using LayoutInfo. or unmanage it.

10. ~~If you want a Resizable to automatically resize when its preferred size changes, then place it in a Container.~~

TEAM EFFORT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boundsIn Local
boundsIn Parent
layout Bounds
(logical)
Picking
(input)
Managed
(participates in layout)
effect
cache
opacity
clip
transforms
scale X, scale Y
rotate
layout X, layout Y
translate X, translate Y
visible
disabled
geom vars
fill
strokeWidth/stroke
width, height
LayoutInfo ignore
render
clip
Node
Group
Resizable
CustomNode
containers

JOIN THE TEAM

We're hiring!

Senior Software Engineer/*Text/UI-Controls*
contact: `brian.beck@sun.com`

Senior Software Engineer/*Graphics/OpenGL/shaders*
Senior Software Engineer/*Text/Unicode/bi-di/OpenType*
contact: `srividhya.Narayanan@sun.com`

THE END.