WIDGETS

CMPT 381

Review

- Parts of a UI Toolkit:
  - Widgets and components
  - Layout management
  - Event handling
  - Model-View-Controller architecture
  - Graphics

Example UI toolkits

Toolkit	OS	Language
Tk	Multiple	Tcl, Perl, Python
JavaFX	Multiple	Java
MFC / WPF	Windows	C, C++, VB, C#
Aqua/Carbon	Mac OS X	Objective C
Gtk	Multiple	C, C++, Perl, Python
Qt	Multiple	C++

Widgets

Widget history

Widget interaction model

Simple widgets

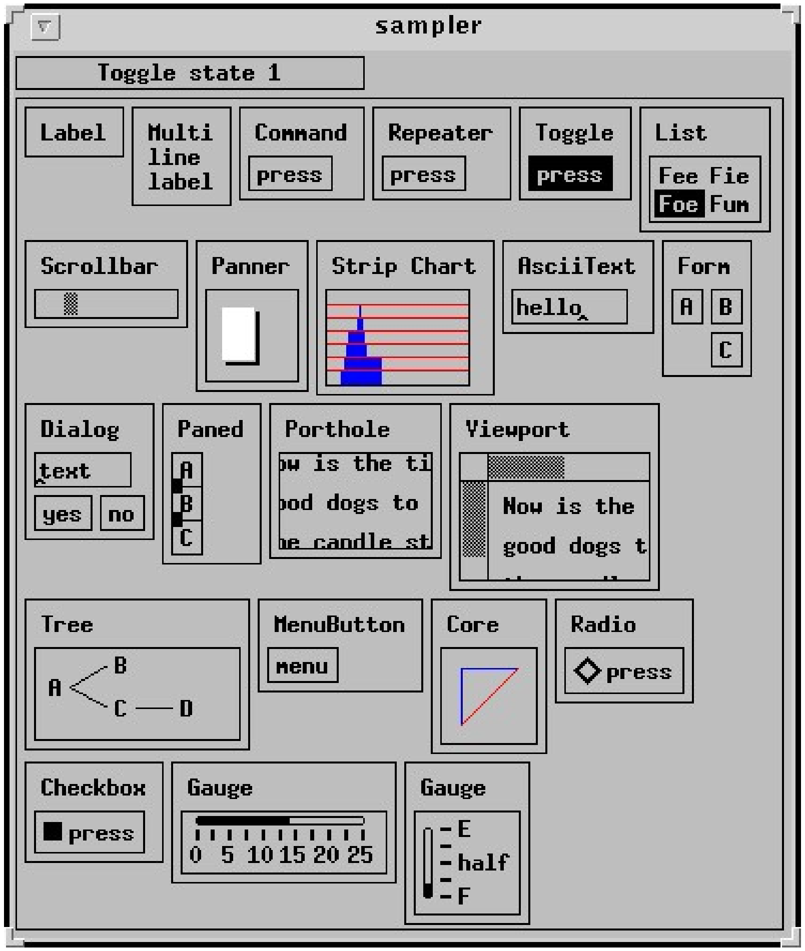
Containers

Abstract Model Widgets

Widgets History

- ‘Evolution’ of the GUI 1981 – 2009
  - http://www.youtube.com/watch?v=TZGGUrom1Mg
- 1981 Xerox Star:
  - https://www.youtube.com/watch?v=Cn4vC80Pv6Q
- 1983 Apple Lisa
- 1984 Apple Macintosh
  - https://www.youtube.com/watch?v=Z8ji0B98IMo
- 1984 Project Athena at MIT develops reusable components for interaction called “widgets”

Athena widgets



Widgets

- UI controls, components, and devices
  - E.g. buttons, menus, sliders, scrollbars
- Widgets are just packaged code
  - API for creation and run-time control
  - Run-time user interaction and behaviour
- Standardize look and feel
- Improve usability: learning and memory of how to use widgets, provide consistent aesthetics
- Provide more reliable implementation, easier design and more rapid development

Widgets in a typical UI toolkit

- Containers
  - Components that hold and organize other widgets
    - Top-Level Containers
    - Internal Containers
- Basic controls
  - Components to get input and show simple state
- Uneditable information displays
  - Components for providing the user with information
- Editable displays of formatted information
  - Components for editable formatted information

Widget interaction model

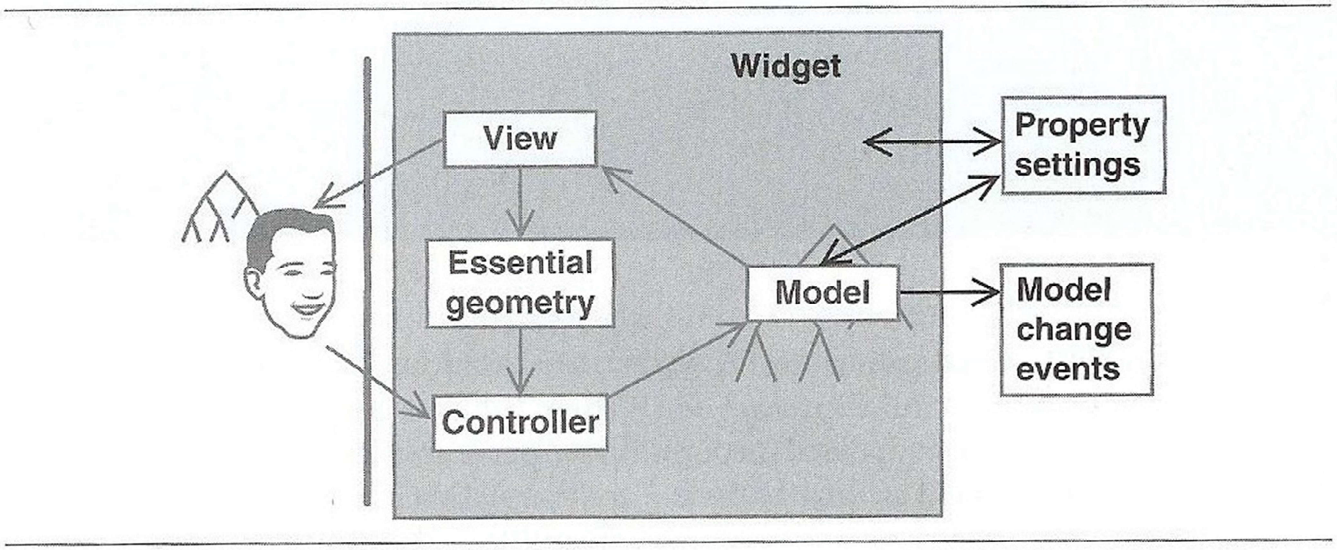


Figure 4.1 – Widget architecture

Widget interaction model

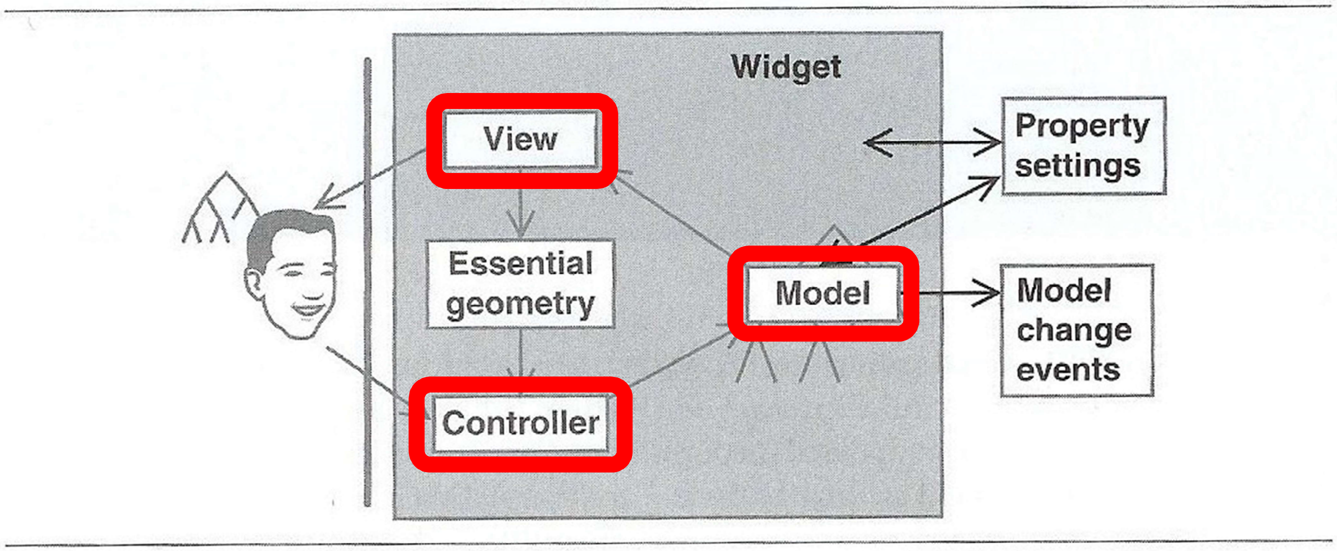


Figure 4.1 – Widget architecture

Widget overviews

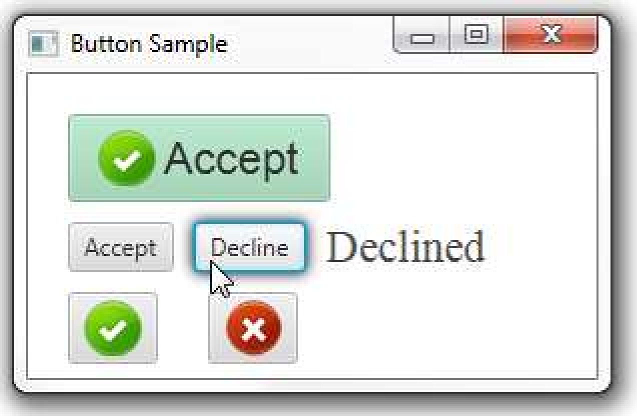
- http://docs.oracle.com/javase/8/javafx/user-interface-tutorial/ui_controls.htm
- http://developer.android.com/guide/topics/ui/index.html

Simple Widgets

Simple Widgets

- Virtual input devices
  - Buttons
    - No real model
    - Just generate events
  - Widgets with a minimal model
    - Model integrated with widget
    - e.g., a number or text string

Buttons



UI Toolkit interlude…

- What is a widget in terms of the UI toolkit?

JavaFX components

- JavaFX widgets are part of a class hierarchy
  - Control is the parent class of all JavaFX simple widgets
    - docs.oracle.com/javase/8/javafx/api/javafx/scene/control/Control.html
- Inheritance abstracts out common functionality:
  - Customizing appearance
  - Setting state
  - Handling events
  - Painting
  - Laying out interior components (if container)
  - Getting/setting size and position information

JavaFX Button API

- In Java, a button is an object and has a class
  - Run-time manipulation through method calls
    - docs.oracle.com/javase/8/javafx/api/javafx/scene/control/Button.html
- Sample constructors
  - Button()
    - Creates a button with an empty string for its label.
  - Button(String text)
    - Creates a button with the specified text as its label.
  - Button(String text, Node graphic)
    - Creates a button with the specified text and icon for its label.
- Example:

```
Button myButton = new Button("Click Me");
```

JavaFX Button API

- Sample methods (from several dozen)
  - (inherited from class ButtonBase):
  - void setOnAction(EventHandler<ActionEvent> value)
    - Adds an event handler to the button.
  - String getText()
    - Returns the button's text.
  - void setText(String text)
    - Sets the button's text.
  - void setDisabled(boolean b)
    - Enables/disables the button.
- Example:

```
myButton.setText(“Hello World”);
```

Widgets in Android

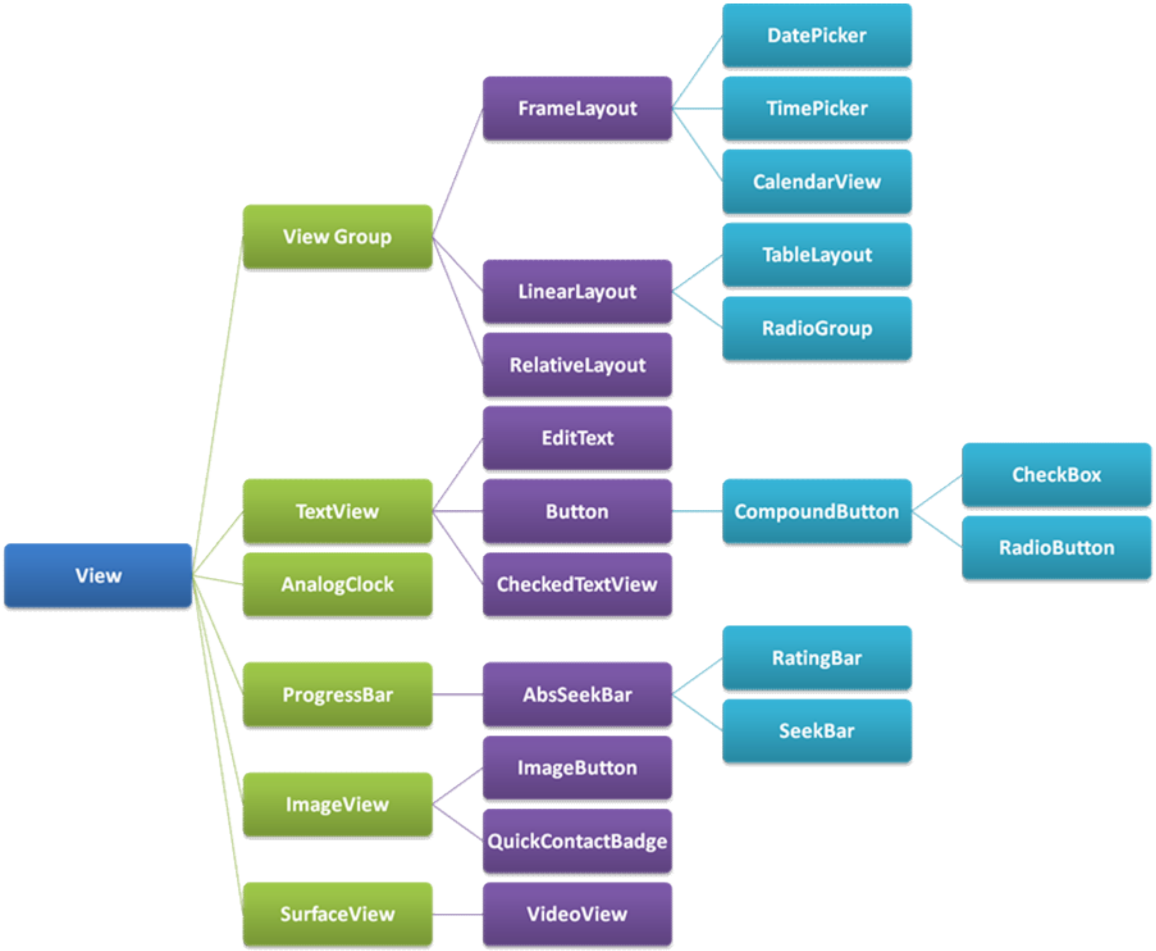
- Note: “App Widgets” are not the same as widgets
- All widgets in Android inherit from View
- Created either through code or XML

Declarative button (Android)

- Created either through code or XML
  - Attributes also specified in XML

```
<Button
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:drawableLeft="@drawable/button_icon“
        android:text="@string/button_text“
... />
```

Buttons in Android



Buttons in Android

- Working with the button in code:
  - There are equivalent toolkit methods for each XML attribute and event

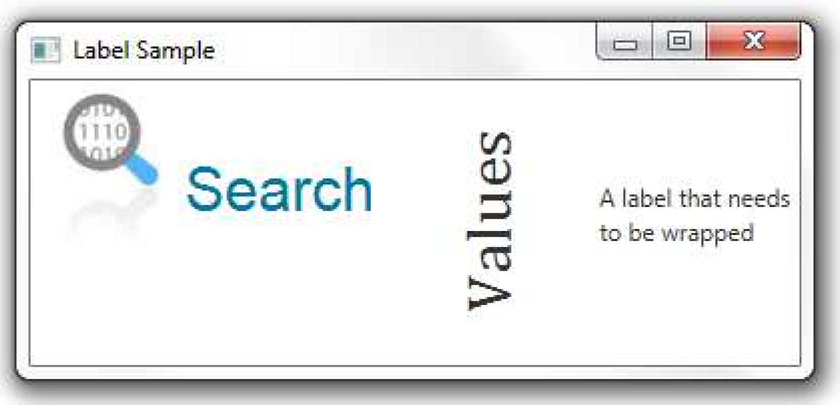
```
final Button button = (Button) findViewById(R.id.button_id);
button.setHeight(50);
button.setOnClickListener(new View.OnClickListener() {
      public void onClick(View v) {
          // Perform action on click
      }
});
```

Back to widgets…

- Widgets with simple state

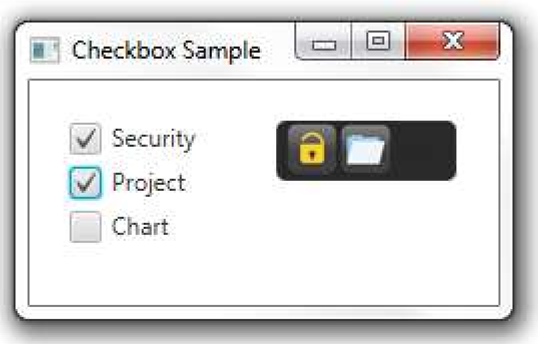
Information widgets

- Labels

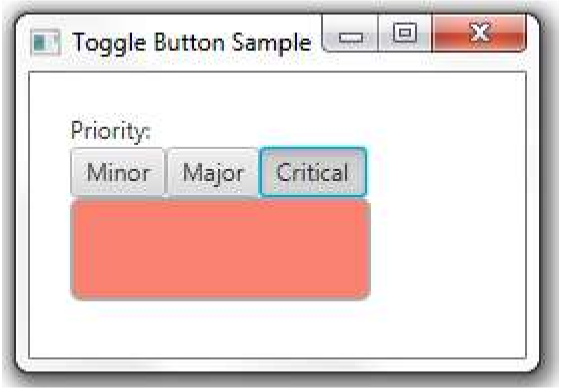


A label that needs to be wrapped

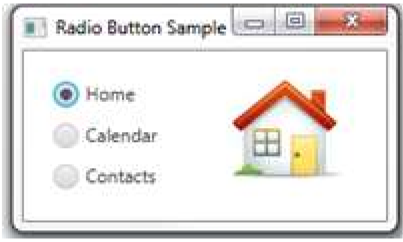
State values



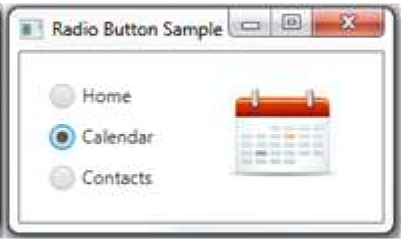
☑ Security
☑ Project
□ Chart



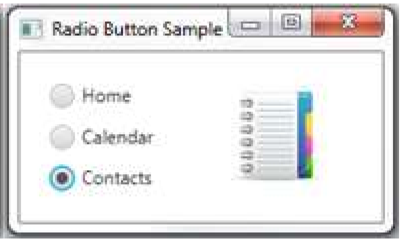
Priority:
Minor Major [✓ Critical]



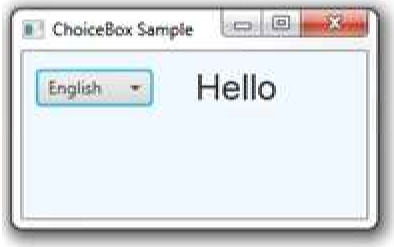
● Home
○ Calendar
○ Contacts



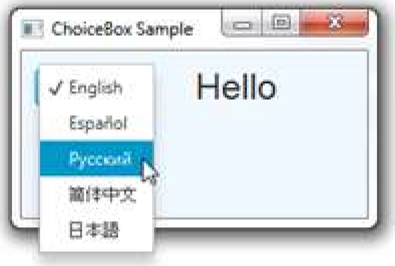
○ Home
● Calendar
○ Contacts



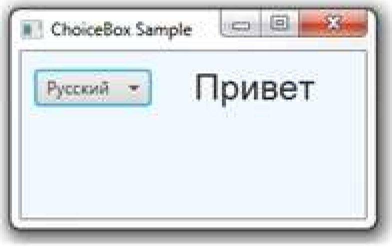
○ Home
○ Calendar
● Contacts



English
Hello

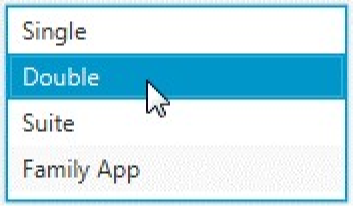


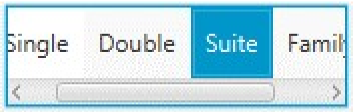
✓ English
Español
Русский
简体中文
日本語
Hello

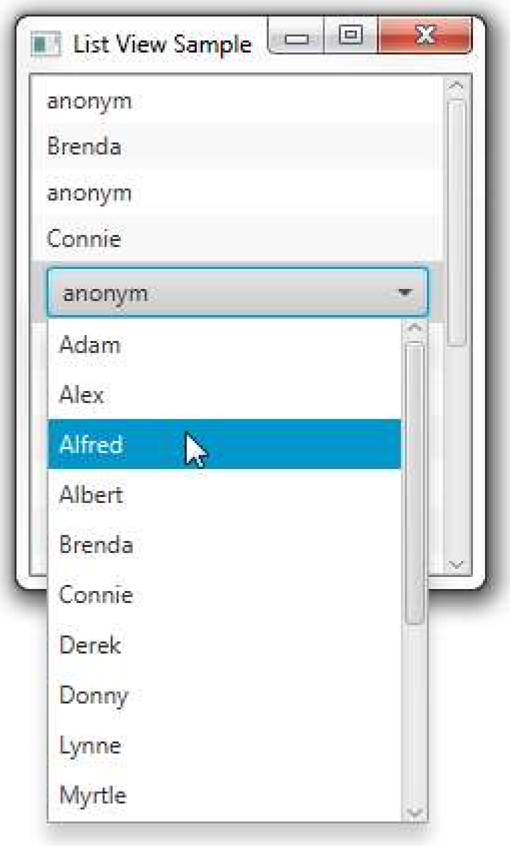


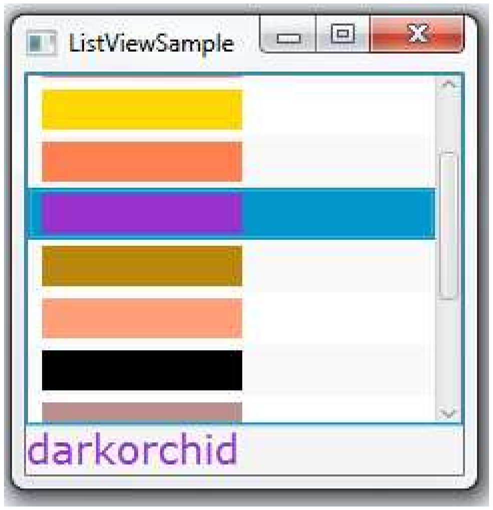
Русский
Привет

Selection(s) from a List

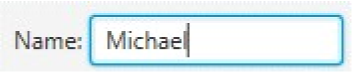




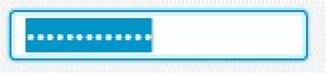




Text Widgets



Name: Michael



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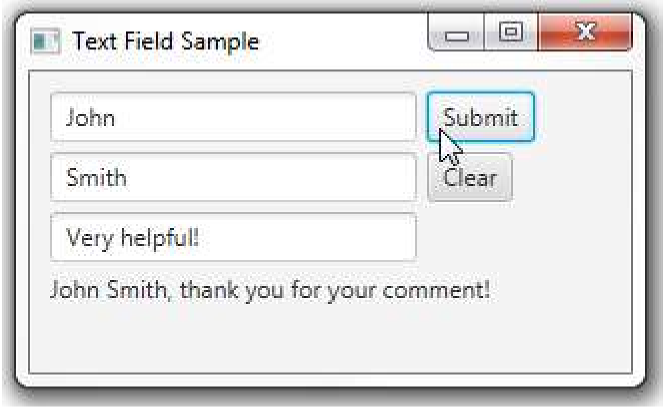
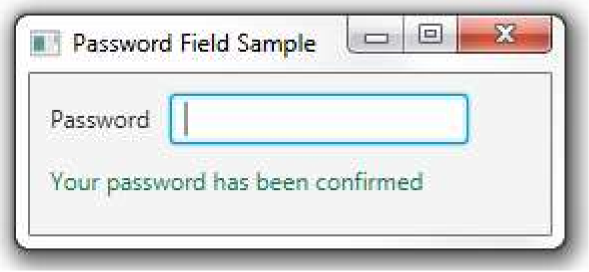


John

Smith

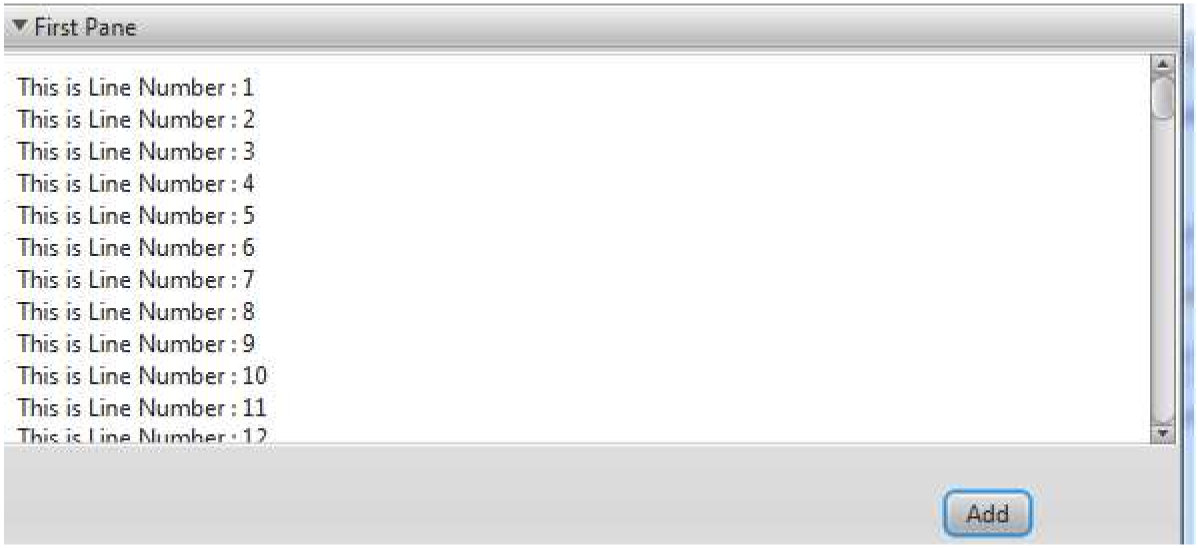
Very helpful!

John Smith, thank you for your comment!



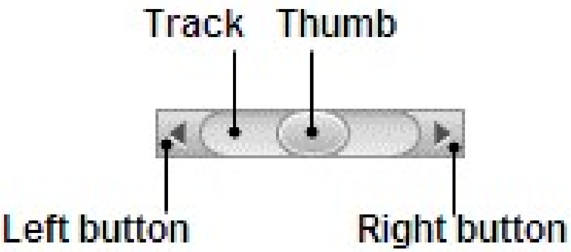
Password

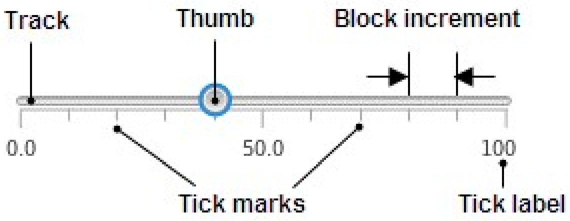
Your password has been confirmed

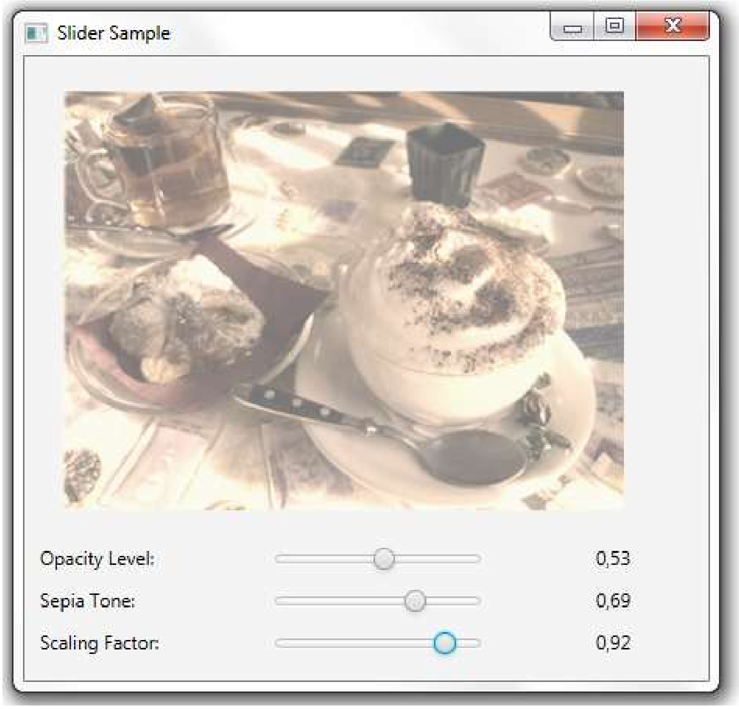


```
This is Line Number : 1
This is Line Number : 2
This is Line Number : 3
This is Line Number : 4
This is Line Number : 5
This is Line Number : 6
This is Line Number : 7
This is Line Number : 8
This is Line Number : 9
This is Line Number : 10
This is Line Number : 11
This is Line Number : 12
```

Number Widgets



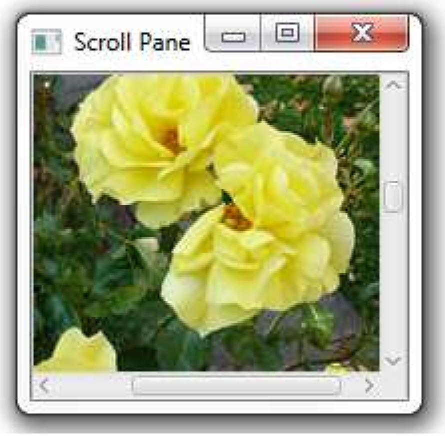


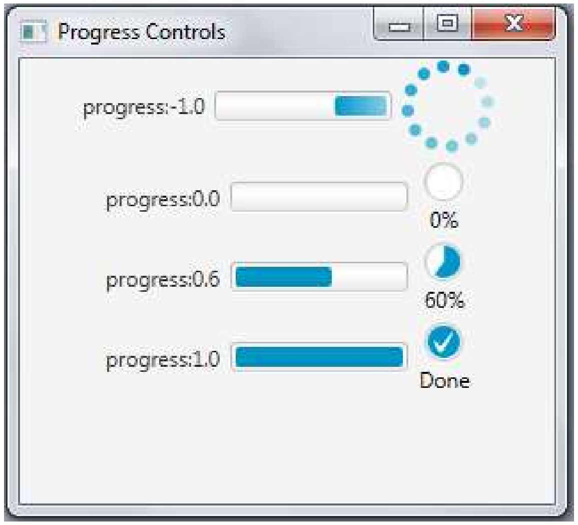


Opacity Level: 0,53

Sepia Tone: 0,69

Scaling Factor: 0,92





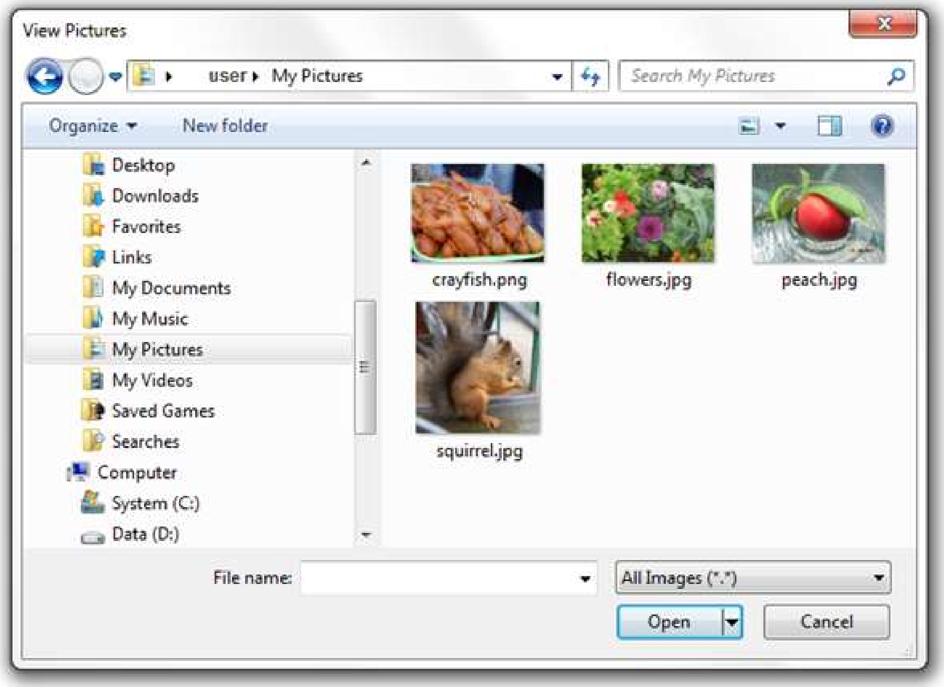
progress:-1.0

progress:0.0 0%

progress:0.6 60%

progress:1.0 Done

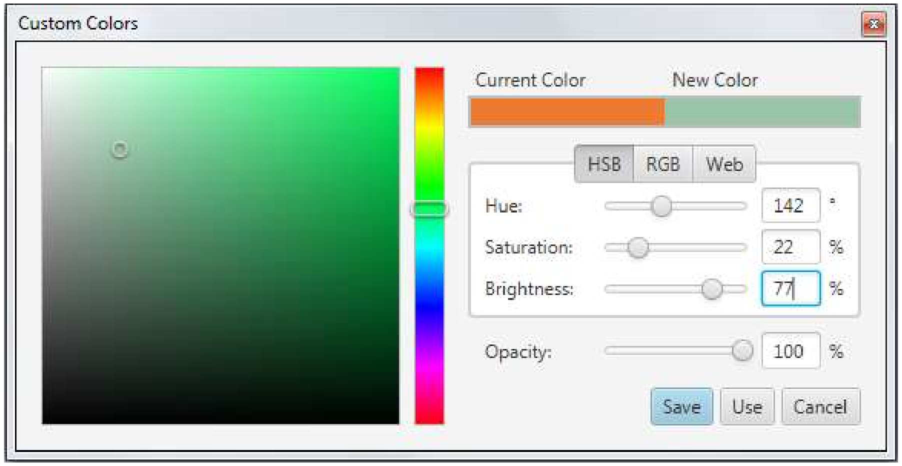
Large (but still simple) widgets



File name:

All Images (*.*)

File dialog



Hue: 142 °

Saturation: 22 %

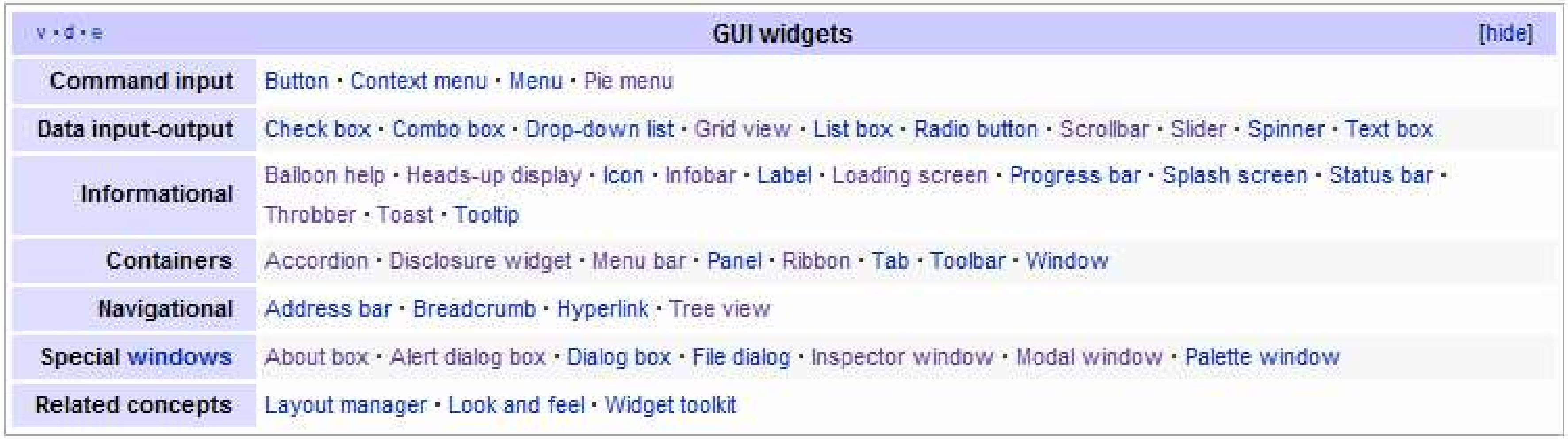
Brightness: 77 %

Opacity: 100 %

Colour picker

Other simple widgets

- http://en.wikipedia.org/wiki/GUI_widget



v • d • e GUI widgets [hide]

Command input	Button • Context menu • Menu • Pie menu
Data input-output	Check box • Combo box • Drop-down list • Grid view • List box • Radio button • Scrollbar • Slider • Spinner • Text box
Informational	Balloon help • Heads-up display • Icon • Infobar • Label • Loading screen • Progress bar • Splash screen • Status bar • Throbber • Toast • Tooltip
Containers	Accordion • Disclosure widget • Menu bar • Panel • Ribbon • Tab • Toolbar • Window
Navigational	Address bar • Breadcrumb • Hyperlink • Tree view
Special windows	About box • Alert dialog box • Dialog box • File dialog • Inspector window • Modal window • Palette window
Related concepts	Layout manager • Look and feel • Widget toolkit

Interaction with simple widgets

- Interaction model is built into the widget
- The API specifies how you can interact
  - …and so specifies what the user can *do*
- Where do the interaction models come from?
  - Are we stuck with what we've got?

Add-on widget toolkits

- FX Experience
  - http://fxexperience.com/controlsfx/features/
- Droid UX
  - http://droidux.com/android-ui-components-controls/

Advanced widget interaction

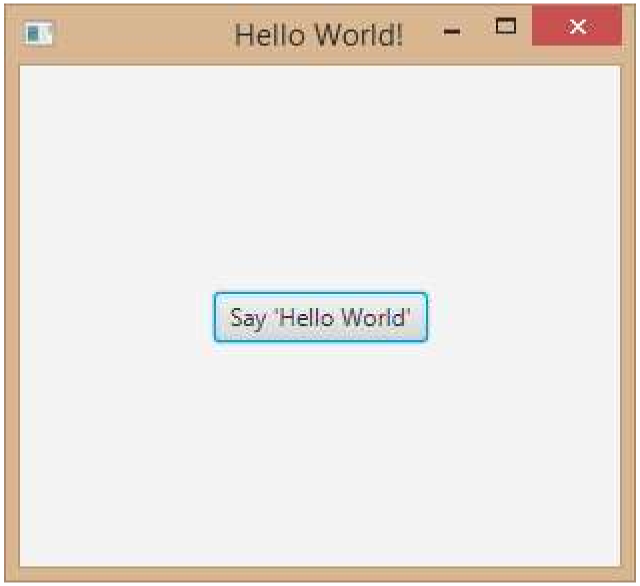
- Tomer Moscovich
  - Contact Area Interaction with Sliding Widgets
    - http://www.moscovich.net/tomer/papers/moscovich-sliding-uist09.wmv
- Patrick Baudisch
  - Phosphor Widgets
    - http://www.patrickbaudisch.com/publications/2006-Baudisch-UIST06-Phosphor.avi
- Jared Cechanowicz
  - Augmented Interactions
    - http://hci.usask.ca/uploads/143-chiaugmentedwidgets_0004.wmv

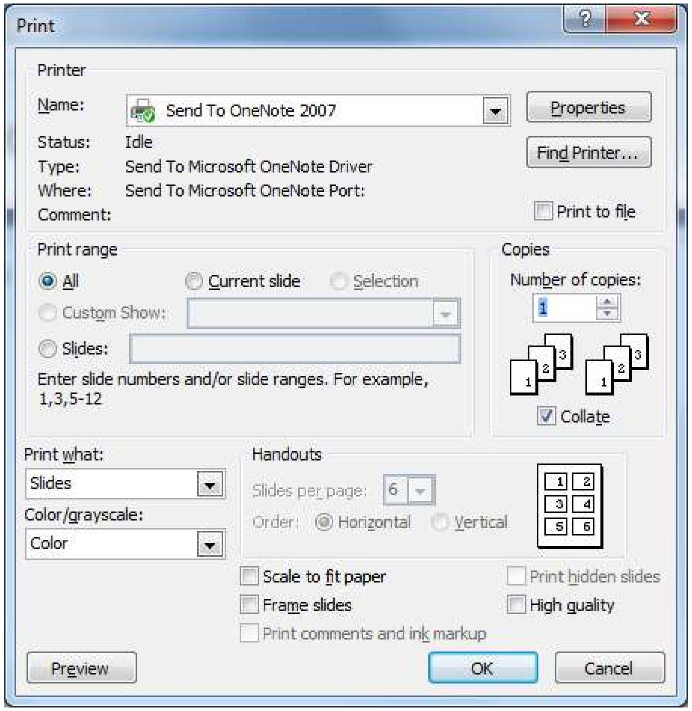
Containers

Container Widgets

- The widget’s model contains a list of other widgets
- Generally do not generate events
- Can control layout for contained widgets
- Used both for top-level windows and for organization within windows

Top-level windows





Printer

Name: Send To OneNote 2007

Status: Idle

Type: Send To Microsoft OneNote Driver

Where: Send To Microsoft OneNote Port:

Comment:

□ Print to file

Print range

● All ○ Current slide ○ Selection

○ Custom Show:

○ Slides:

Enter slide numbers and/or slide ranges. For example, 1,3,5-12

Copies

Number of copies: 1

☑ Collate

Print what: Slides

Color/grayscale: Color

Handouts

Slides per page: 6

Order: ● Horizontal ○ Vertical

□ Scale to fit paper

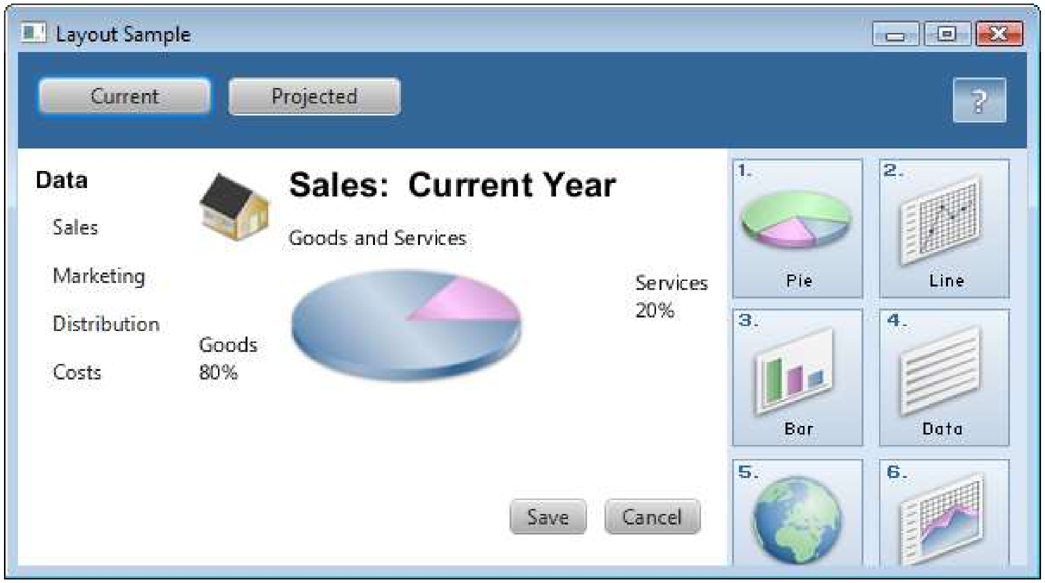
□ Frame slides

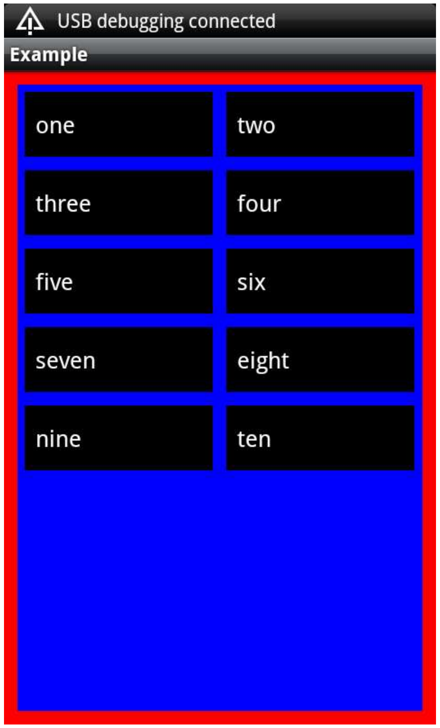
□ Print comments and ink markup

□ Print hidden slides

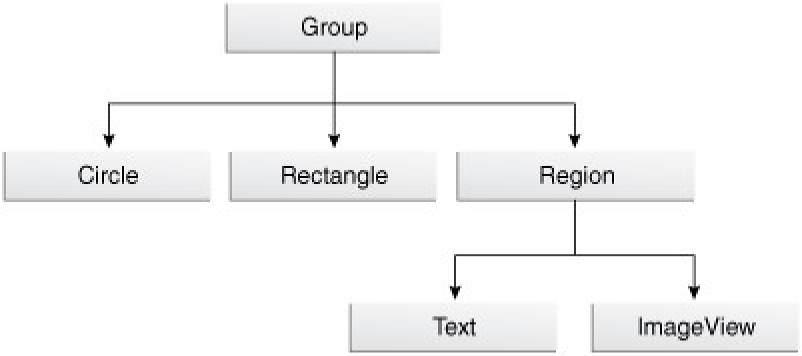
□ High quality

Internal containers



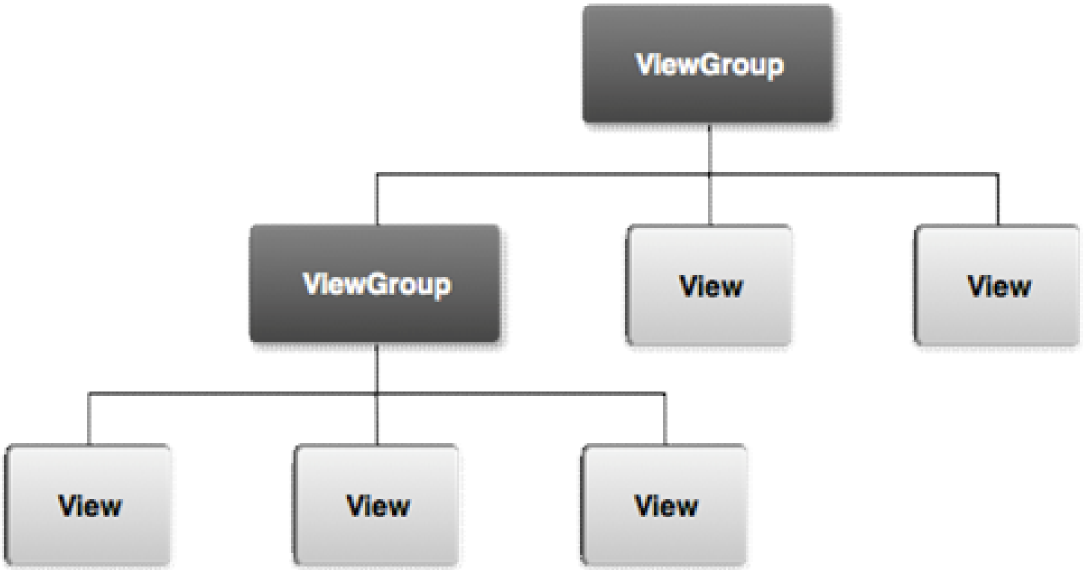


Containment hierarchy in JavaFX



The “scene graph”
http://docs.oracle.com/javase/8/javafx/scene-graph-tutorial/scenegraph.htm

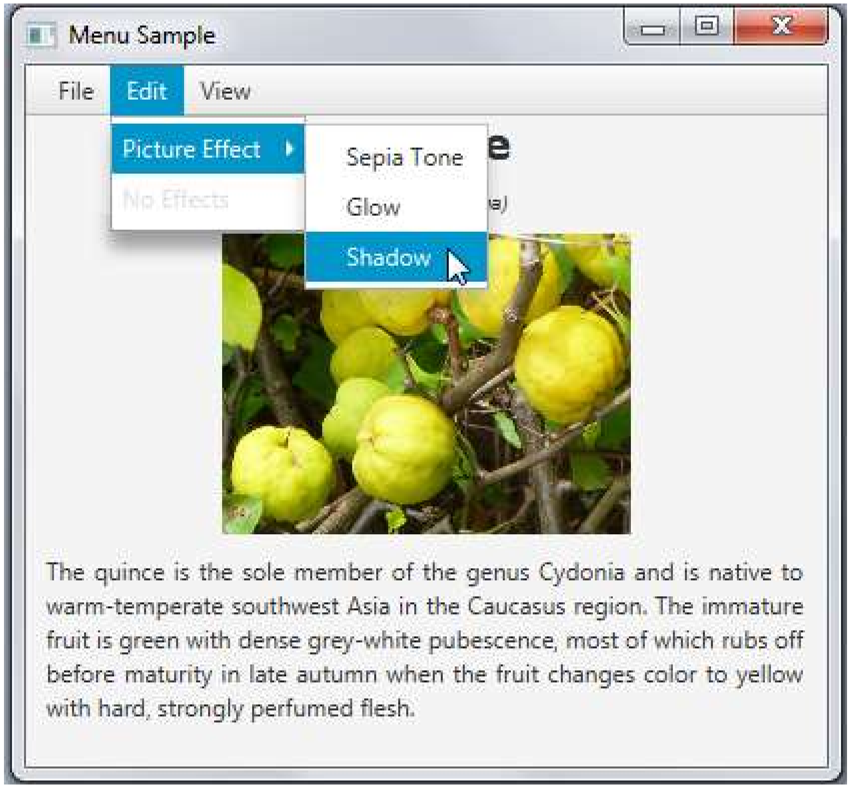
Containment hierarchy in Android



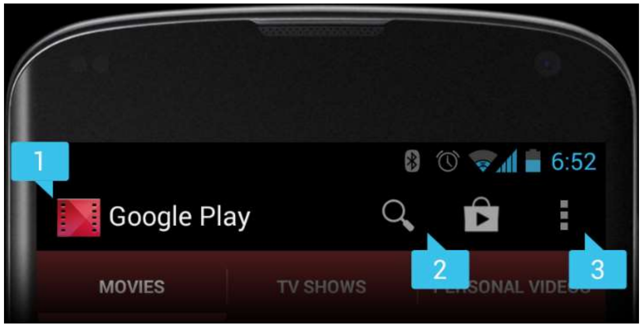
Containment hierarchy in Android

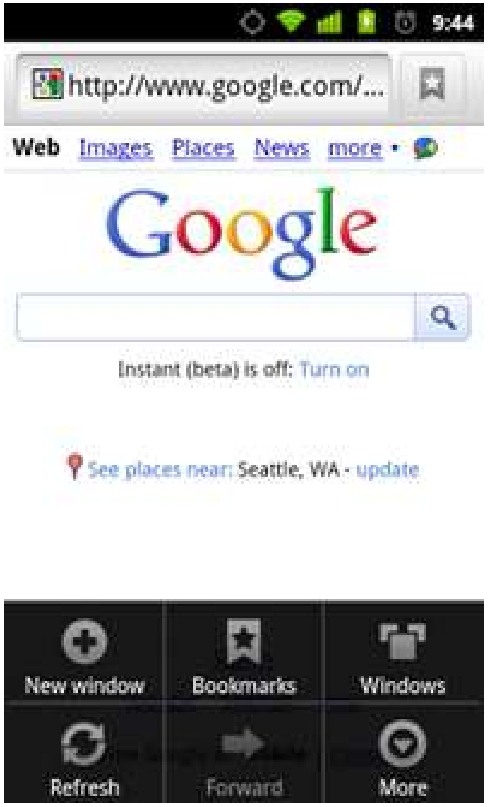
```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
xmlns:android=http://schemas.android.com/apk/res/android
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  android:orientation="vertical" >
<TextView
  android:id="@+id/text"
  android:layout_width="wrap_content"
  android:layout_height="wrap_content"
  android:text="I am a TextView" />
<Button android:id="@+id/button"
  android:layout_width="wrap_content"
  android:layout_height="wrap_content"
  android:text="I am a Button" />
</LinearLayout>
```

Menus



The quince is the sole member of the genus Cydonia and is native to warm-temperate southwest Asia in the Caucasus region. The immature fruit is green with dense grey-white pubescence, most of which rubs off before maturity in late autumn when the fruit changes color to yellow with hard, strongly perfumed flesh.

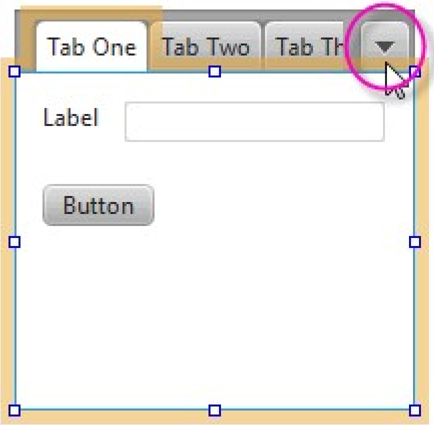


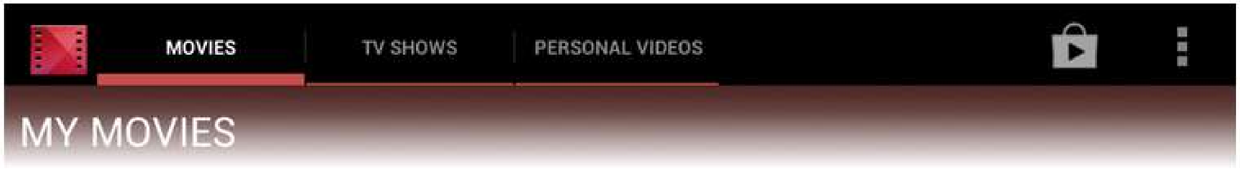

9:44
http://www.google.com/...
Web
Images
Places
News
more
Google
Instant (beta) is off: Turn on
See places near: Seattle, WA - update
New window
Bookmarks
Windows
Refresh
Forward
More

Menus

- …and if you thought there was nothing more you could do with menus:
- Pourang Irani
  - Improving Selection in Cascading Menus
    - http://hci.cs.umanitoba.ca/PubSummary/tanvir08

Tabs


Tab One
Tab Two
Tab Th
Label
Button


MOVIES
TV SHOWS
PERSONAL VIDEOS
MY MOVIES

Advanced container widgets

- Problem: what if the toolbar contains only half of the tools you need for a specific task?
  - How to support user customization of the UI?
  - Current customization mechanisms are tedious
- Wolfgang Stuerzlinger and Olivier Chapuis
  - User interface facades
    - http://www.cse.yorku.ca/~wolfgang/facades/
- Florian Block
  - VoodooSketch
    - https://www.youtube.com/watch?v=9kXdQw23ubY

Abstract Model Widgets

Abstract Model Widgets

- More complex widgets require a detailed model of what is to be displayed
  - Interaction is still defined in the widget, but model can be manipulated and populated separately

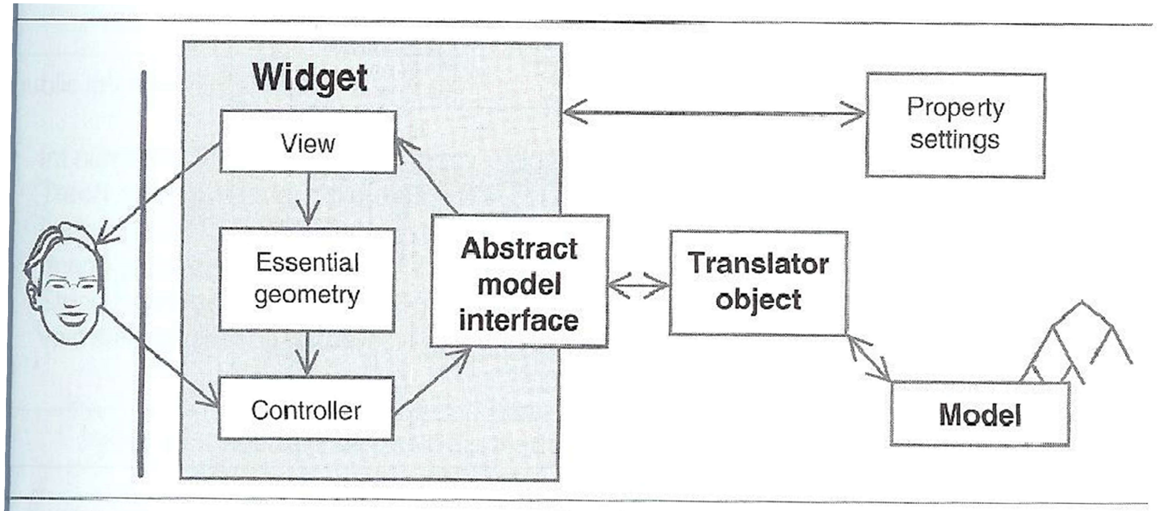
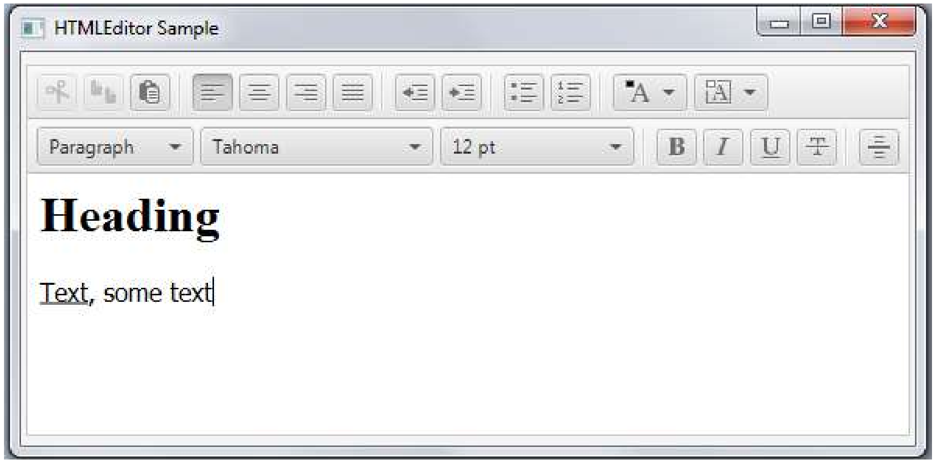


Figure 7.4 – Translator object for the widget/model interface

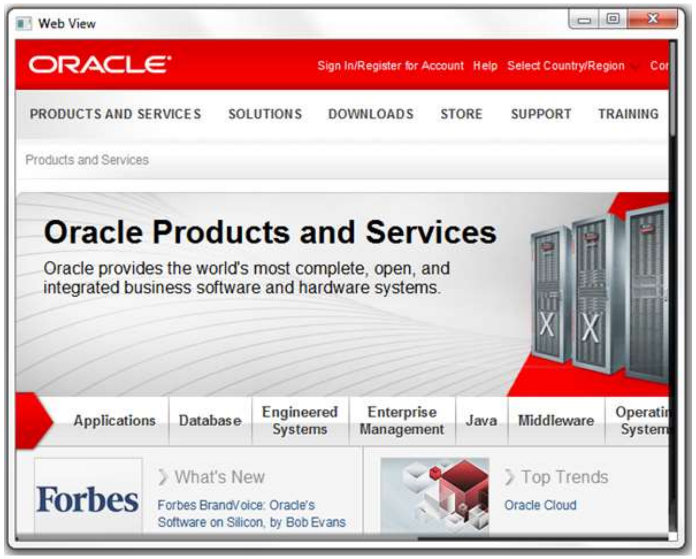
More Complex Text/Web Widgets



Paragraph
Tahoma
12 pt

Heading

Text, some text

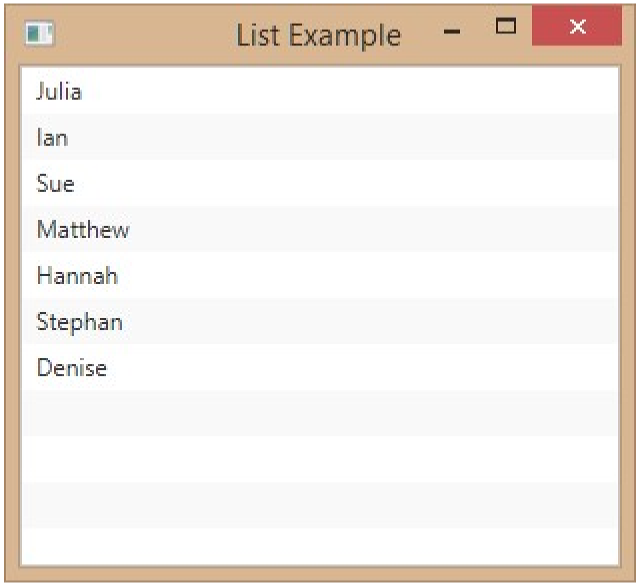


Oracle Products and Services

Oracle provides the world's most complete, open, and integrated business software and hardware systems.

Forbes BrandVoice: Oracle's Software on Silicon, by Bob Evans

List widgets



List Example

Julia

Ian

Sue

Matthew

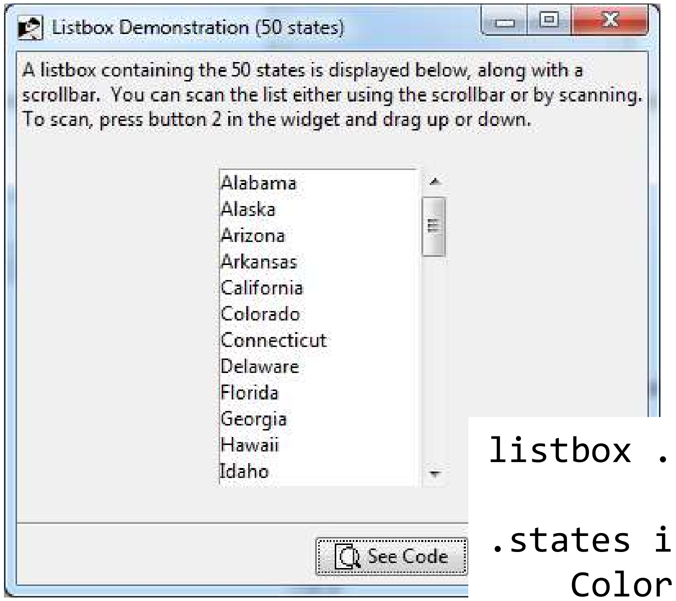
Hannah

Stephan

Denise

```
ObservableList<String> names = FXCollections.observableArrayList(
    "Julia", "Ian", "Sue", "Matthew", "Hannah", "Stephan", "Denise");
ListView<String> listView = new ListView<String>(names);
```

…compare with Tcl/Tk:



A listbox containing the 50 states is displayed below, along with a scrollbar. You can scan the list either using the scrollbar or by scanning. To scan, press button 2 in the widget and drag up or down.

```
Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
Florida
Georgia
Hawaii
Idaho
```

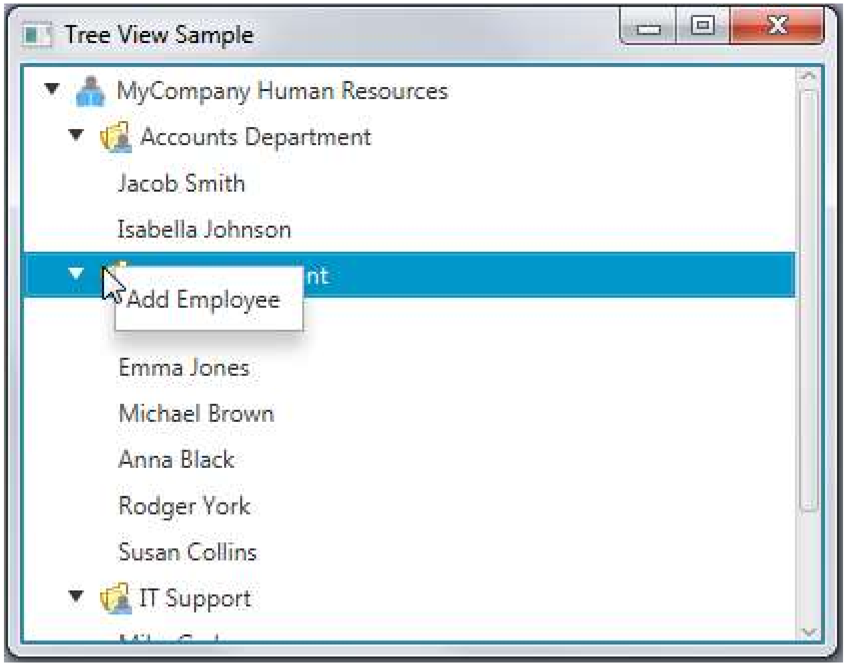
```
listbox .states -height 12

.states insert 0 Alabama Alaska Arizona Arkansas California \
    Colorado Connecticut Delaware Florida Georgia Hawaii Idaho \
    Indiana Iowa Kansas Kentucky Louisiana Maine Maryland \
    Massachusetts Michigan Minnesota Mississippi Missouri \
    Montana Nebraska Nevada "New Hampshire" "New Jersey" \
    "New York" "North Carolina" "North Dakota" \
    Ohio Oklahoma Oregon Pennsylvania "Rhode Island" \
    "South Carolina" "South Dakota" \
    Tennessee Texas Utah Vermont Virginia Washington \
    "West Virginia" Wisconsin Wyoming
```

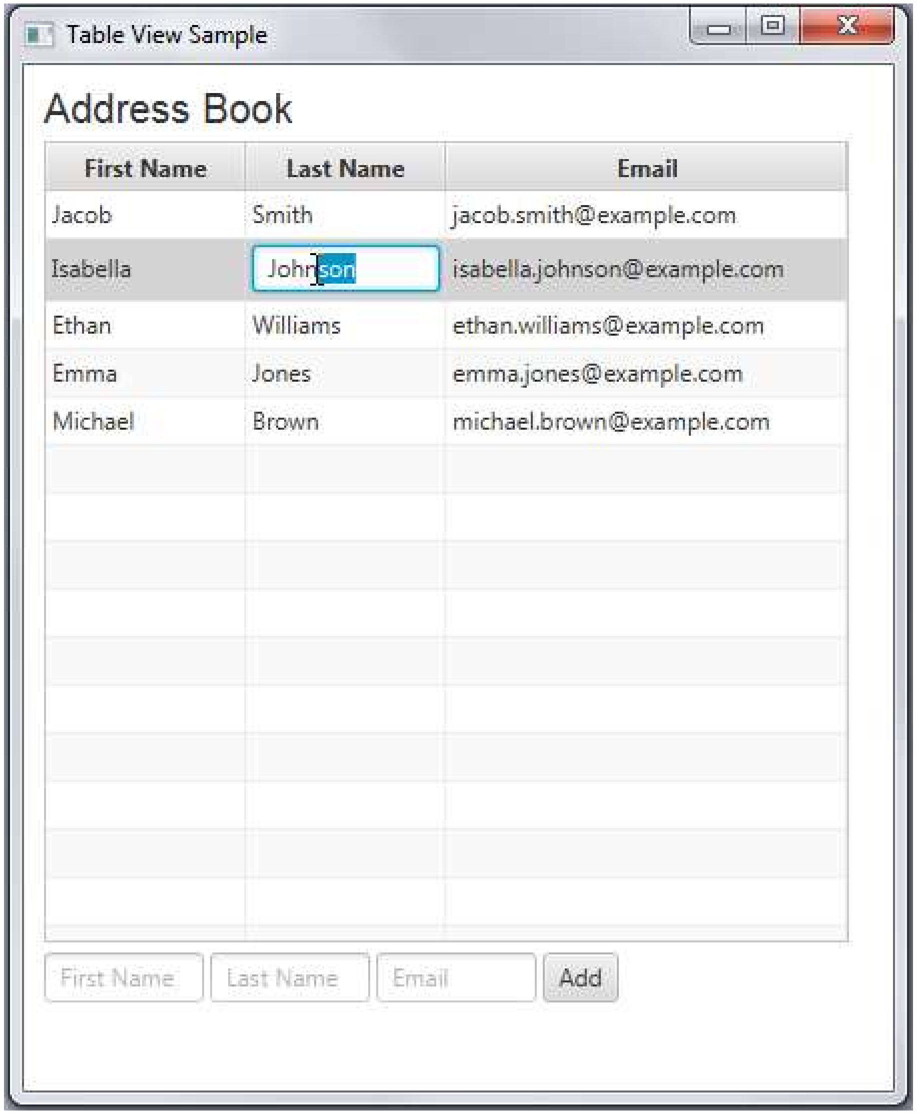
Interaction with lists

- Carl Gutwin and Andy Cockburn
  - Improving List Revisitation with ListMaps
    - http://hci.usask.ca/publications/2006/listmap.mov

Trees and Tables



- MyCompany Human Resources
  - Accounts Department
    - Jacob Smith
    - Isabella Johnson
  -
    - Emma Jones
    - Michael Brown
    - Anna Black
    - Rodger York
    - Susan Collins
  - IT Support



Address Book

First Name	Last Name	Email
Jacob	Smith	jacob.smith@example.com
Isabella	Johnson	isabella.johnson@example.com
Ethan	Williams	ethan.williams@example.com
Emma	Jones	emma.jones@example.com
Michael	Brown	michael.brown@example.com

For more information:

- Chapter 7 in textbook

Next…

- Events
  - Chapter 3 in the text
- Get coding!