Programmation Mobile

UI/UX Design

2024 - 2025

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Agenda

Interface Utilisateur (UI)

Expérience Utilisateur

Utilisabilité

Android et les Design Patterns

Optimisation des performances de UI

Challenge

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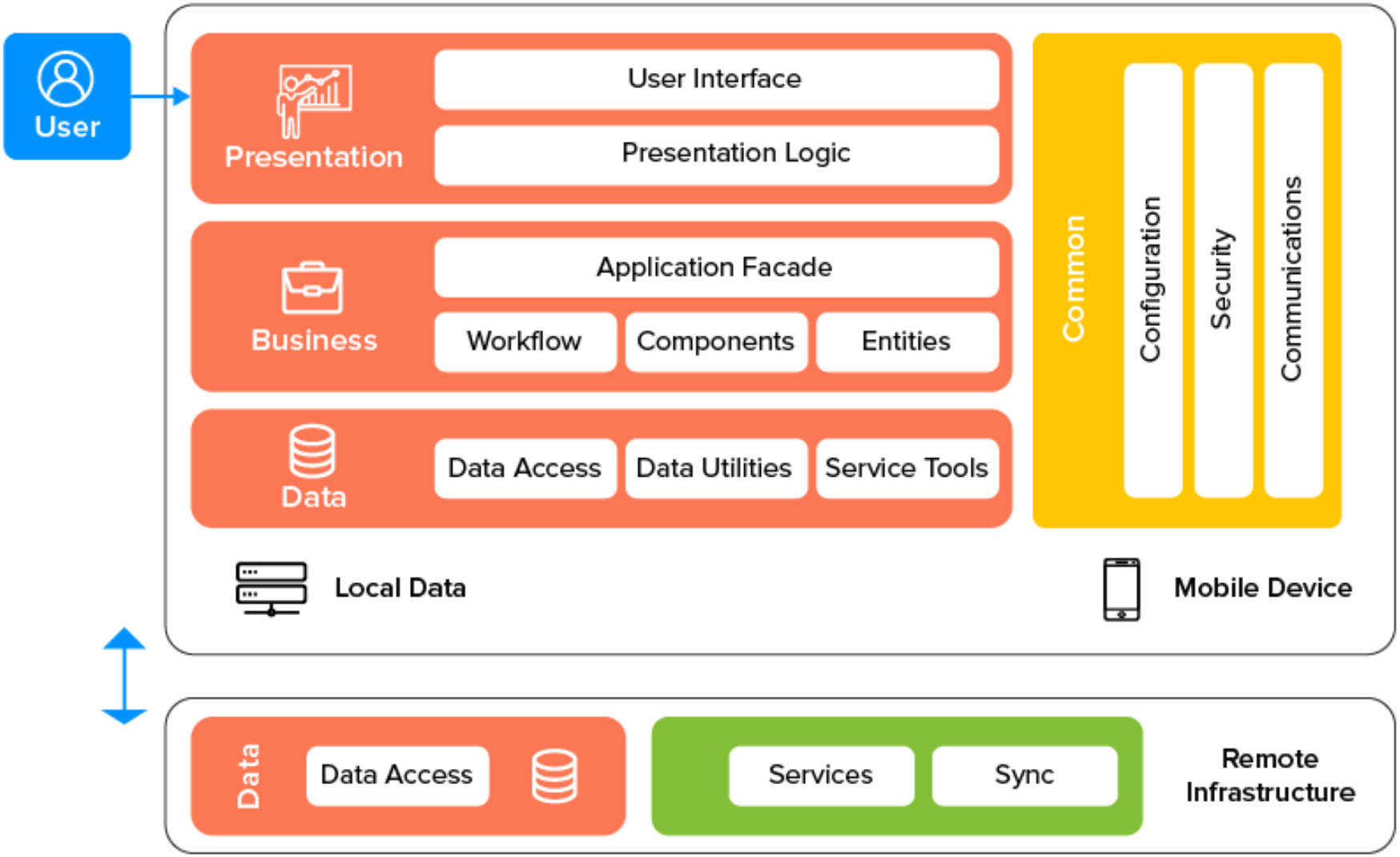
Interface Utilisateur (UI)

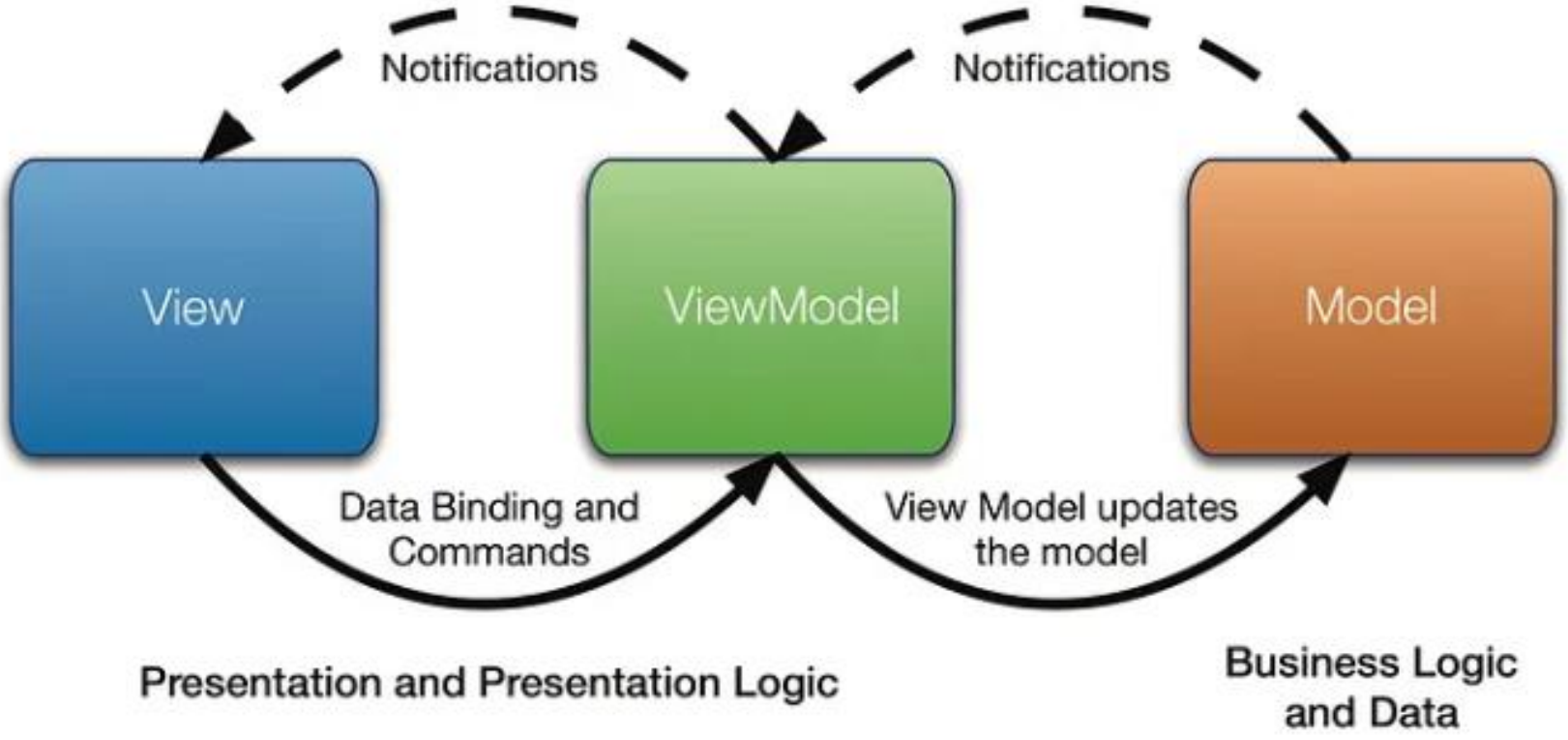
- Qu’est-ce que l’interface utilisateur Android ?
- Types d’interface utilisateur Android ?
- Qu'est-ce que ViewGroup et View ?
- Widgets
- Types de Layouts

Introduction

Qu’est-ce que l’architecture des applications mobiles ?

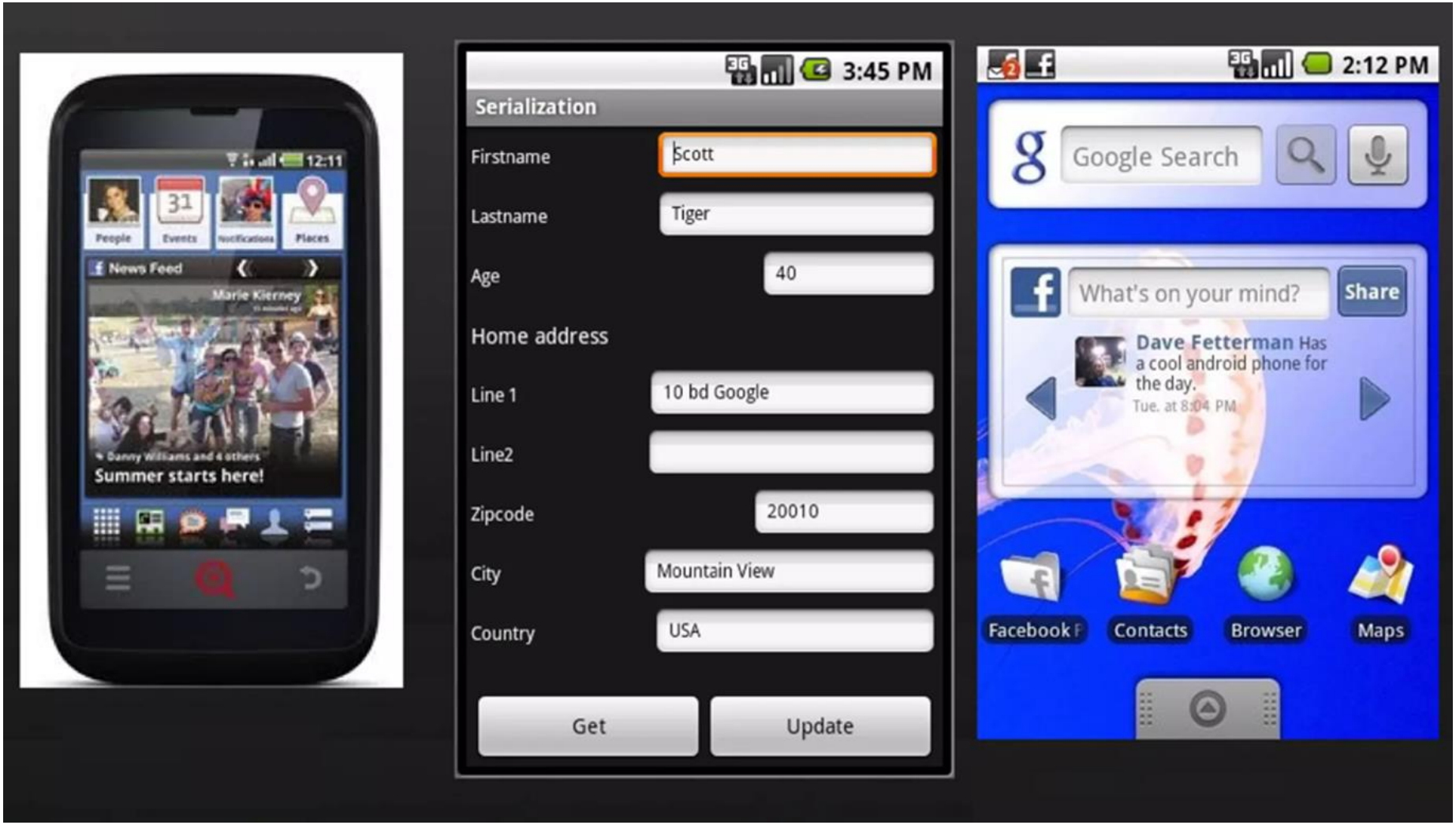


A mobile app architecture diagram of the MVP pattern



Qu’est-ce que l’interface utilisateur Android ?

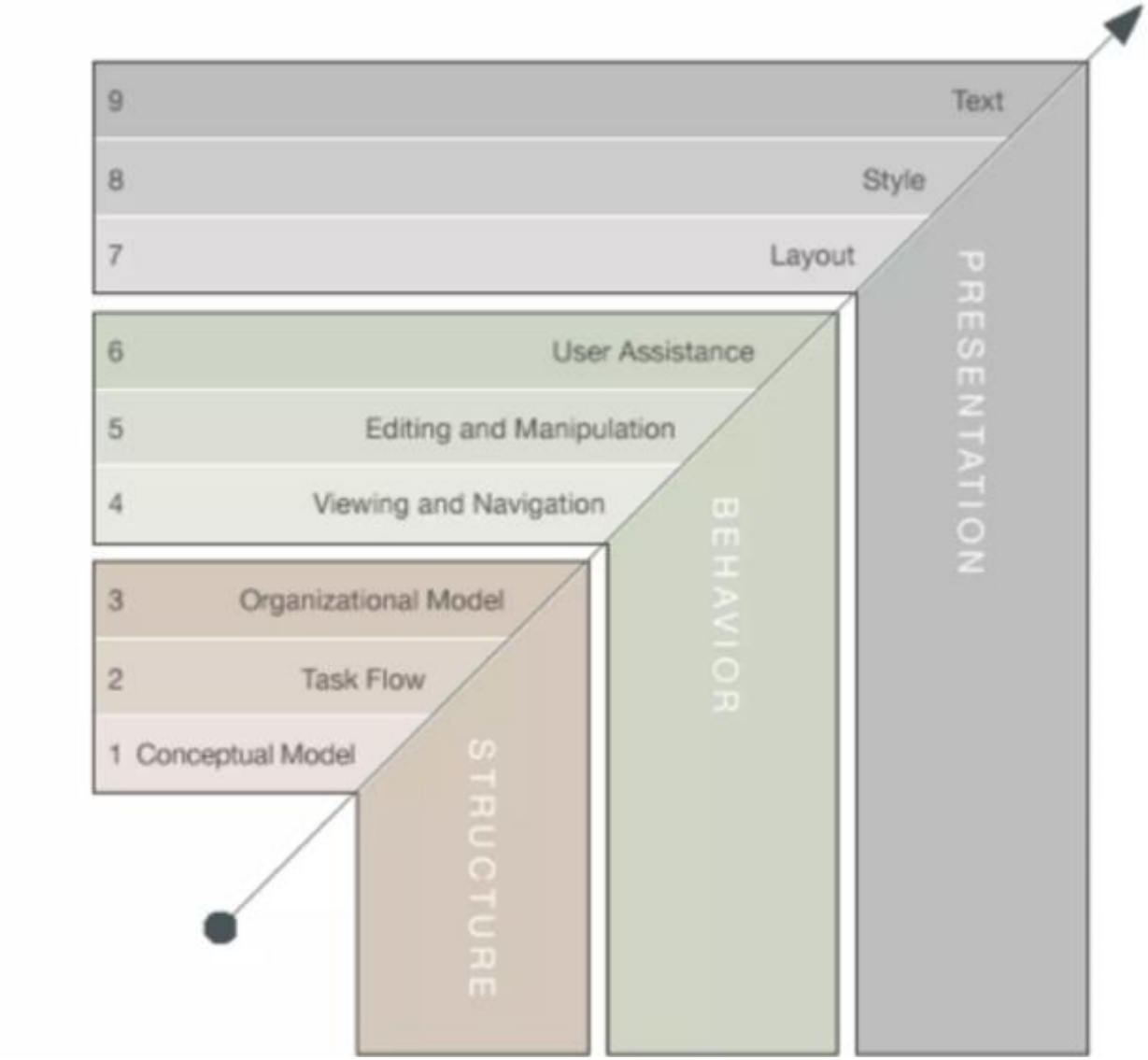
Interface utilisateur basée sur Android : quelques exemples



Qu'est-ce que l'interface utilisateur (UI) Android ?

- Une frontière ou surface commune entre le système interactif et l'utilisateur
- Tous les éléments qui assurent la communication entre le système interactif et l'utilisateur
- Interface utilisateur dans la plate-forme Android, tout comme les autres interfaces utilisateur basées sur Java

Éléments d'une interface utilisateur



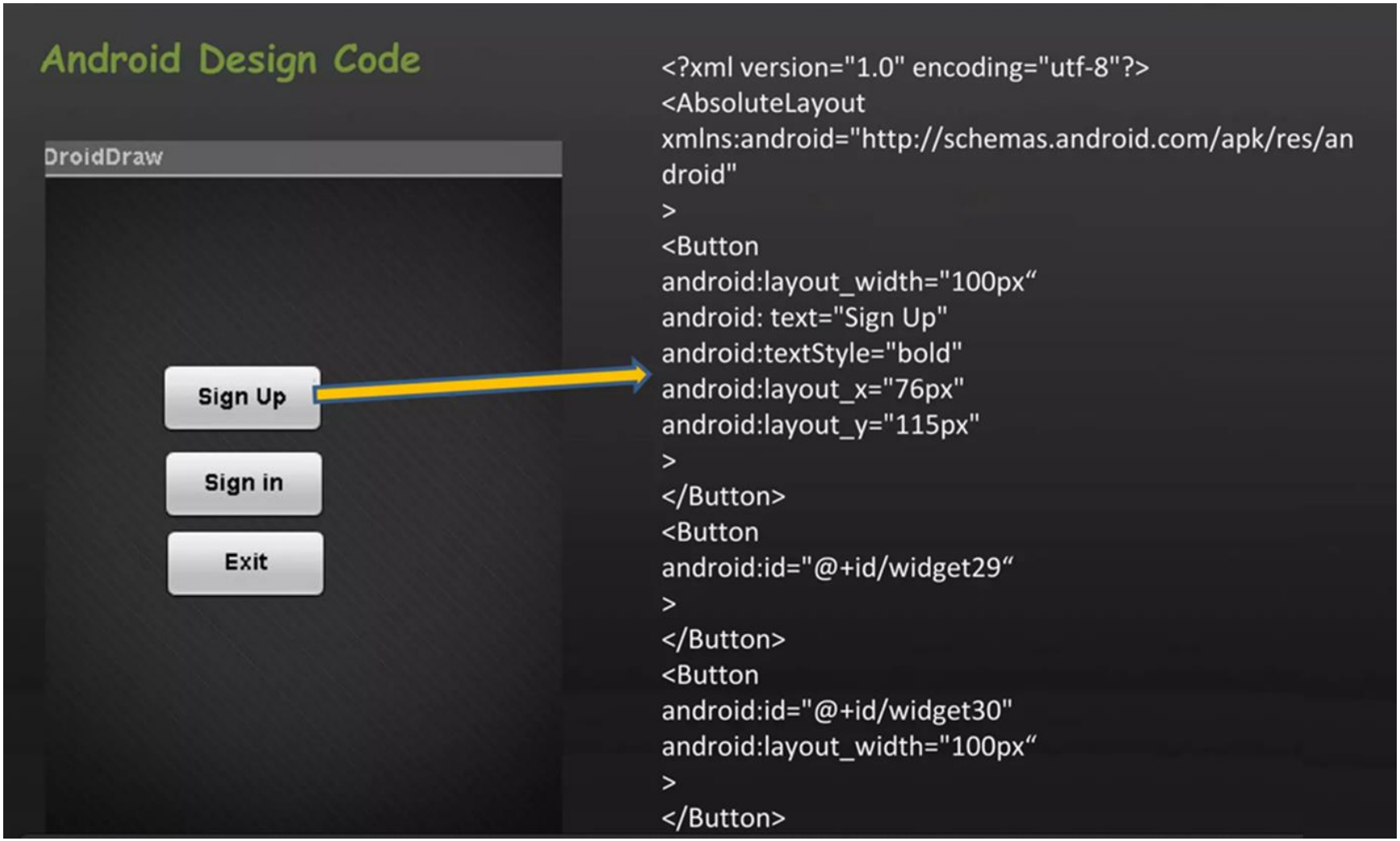
Création d'interface utilisateur des app mobile

- Création des interfaces utilisateur:
  - **Statique** [Drag and Drop]
  - **Dynamique** [Run time]

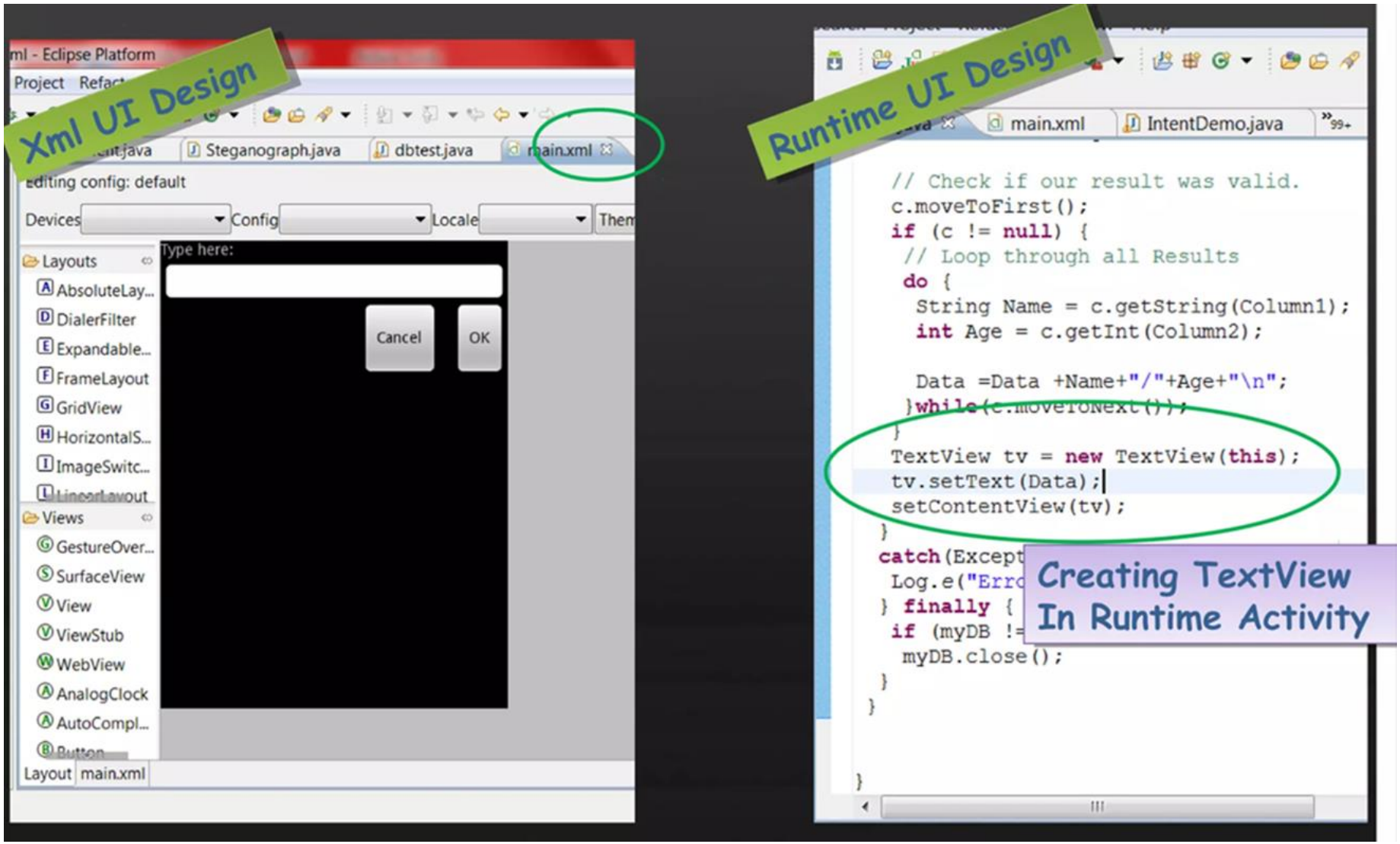
Interface utilisateur Java vs Interface utilisateur Android

Type d'application	Java [UI Design]	Android [UI Design]
Windows	Awt,Swings	XML JETPACK COMPOSE
Web based	Html,css,java script	

Création d'interface utilisateur des app mobile



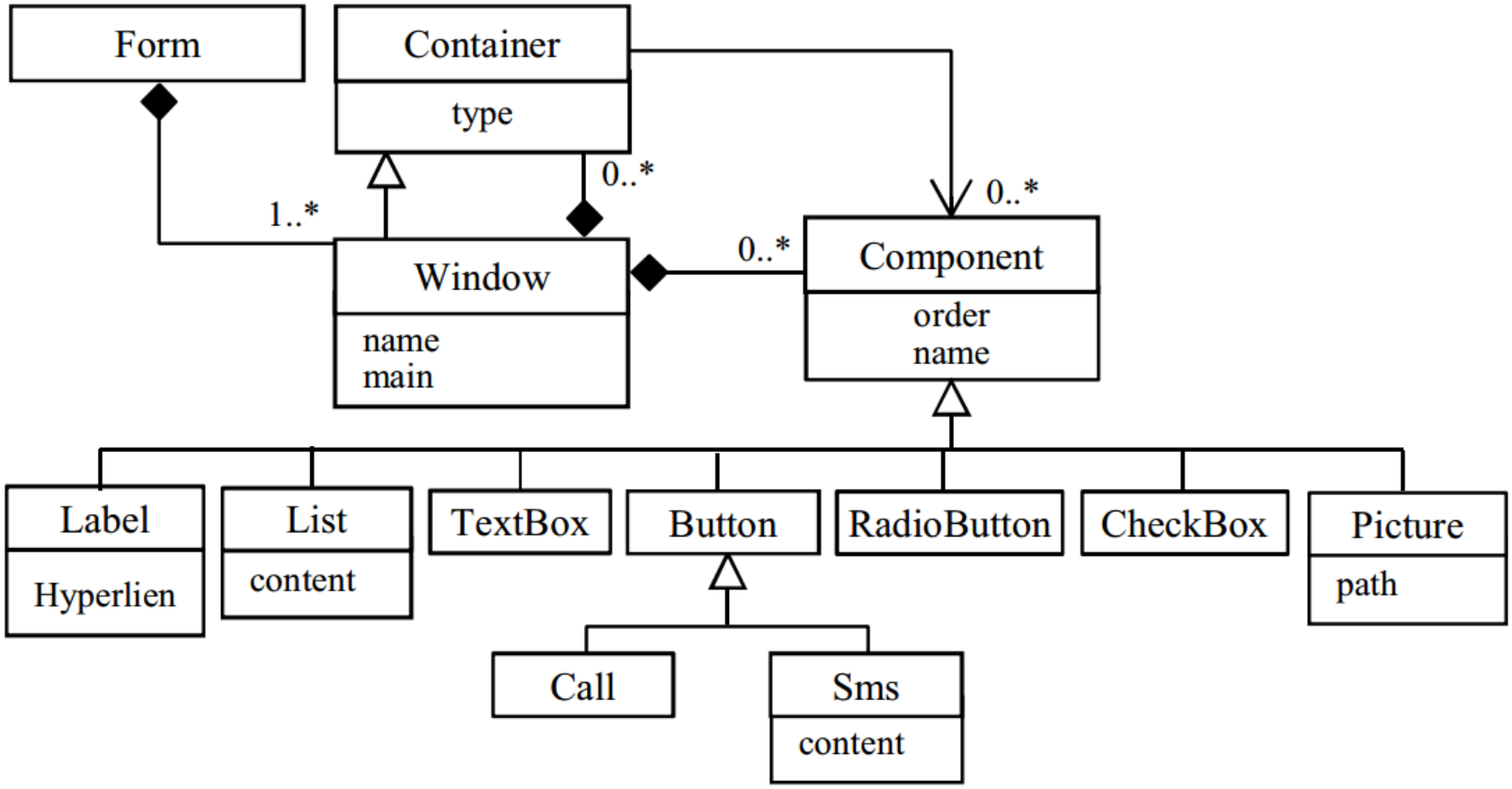
Création d'interface utilisateur des app mobile



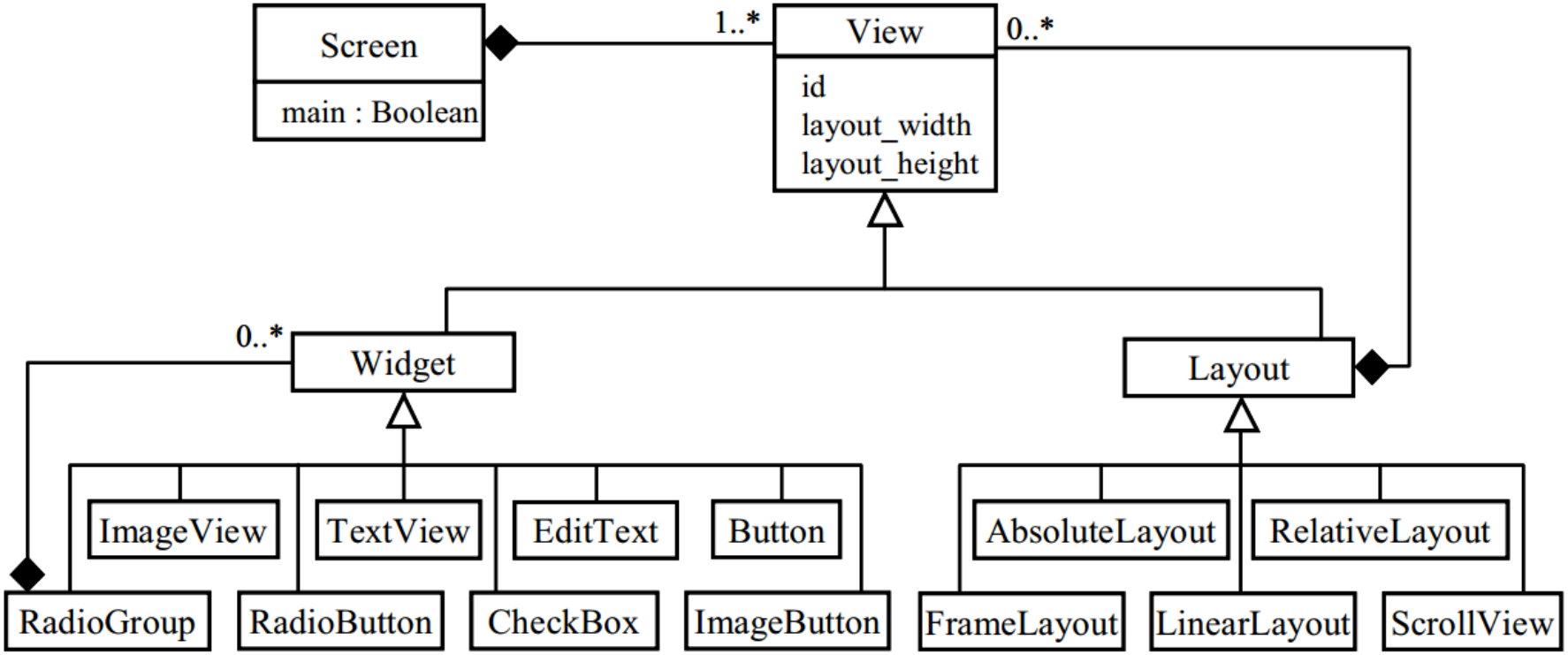
INTERFACE UTILISATEUR

- View/WIDGETS
- Layouts

Un métamodèle d'application mobile



Un extrait du métamodèle de l'application Android

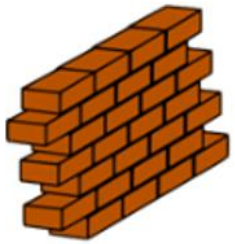


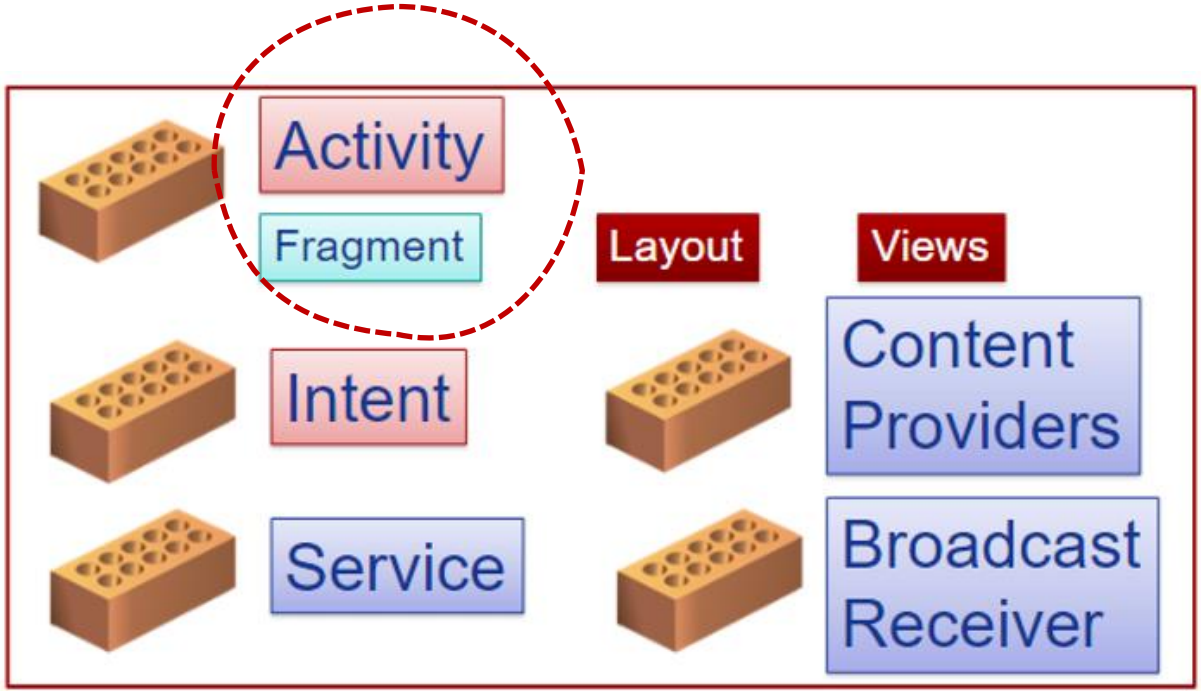
INTERFACE UTILISATEUR

- View/WIDGETS
- Layouts

Applications Android: Design

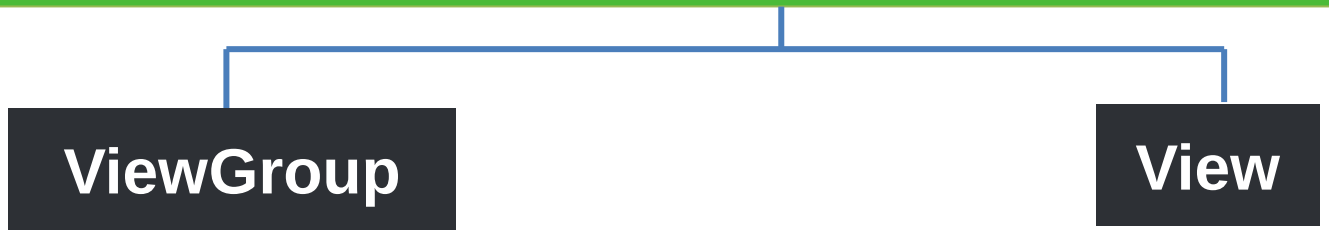
Développer une application Android, c'est utiliser de manière appropriée **les composants de base d'Android…**





Android: Views & Layout

Composants de **l'interface utilisateur (UI)** d'une activité



- **Conteneur** de View.
- Responsable du **placement** d'autres View sur l'écran
- Chaque layout doit étendre un **ViewGroup**

- **Composant de base (UI)**
- Peut gérer/produire des **événements**
- Nouveau composant: extension de **View**

Fichier XML ayant LinearLayout

Linear layout is a View Group that displays child View elements in a linear direction, either vertically or horizontally.

```
<?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" >

   <!-- More GUI components go here  -->

</LinearLayout>
```

Main.xml

Drap and Drop « Views »

Fichier XML ayant LinearLayout

```xml
<?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="This is a TextView" />

   <Button android:id="@+id/button"
      android:layout_width="wrap_content"
      android:layout_height="wrap_content"
      android:text="This is a Button" />

   <!-- More GUI components go here  -->

</LinearLayout>
```

Views

View Group

Une fois votre mise en page (**layout**) est créée, vous pouvez charger **ressource** de mise en page (**layout**) à partir du code de votre application, dans votre implémentation « **Activity.onCreate()** »

```
public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
}
```

Android: Views & Layout

Composants de **l'interface utilisateur (UI)** d'une activité

- **Conteneur** de View.
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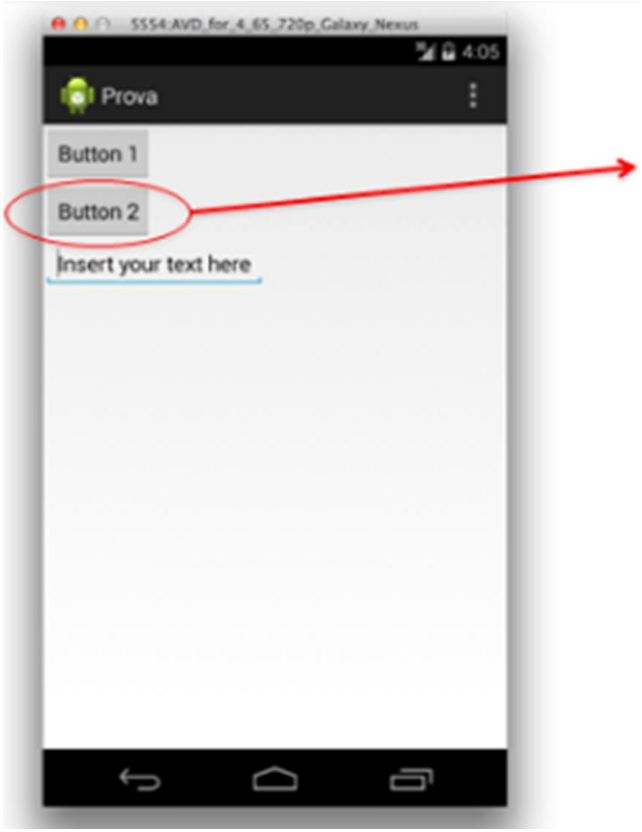
Android: Views objects

Views →éléments de base pour les composants de l'interface utilisateur



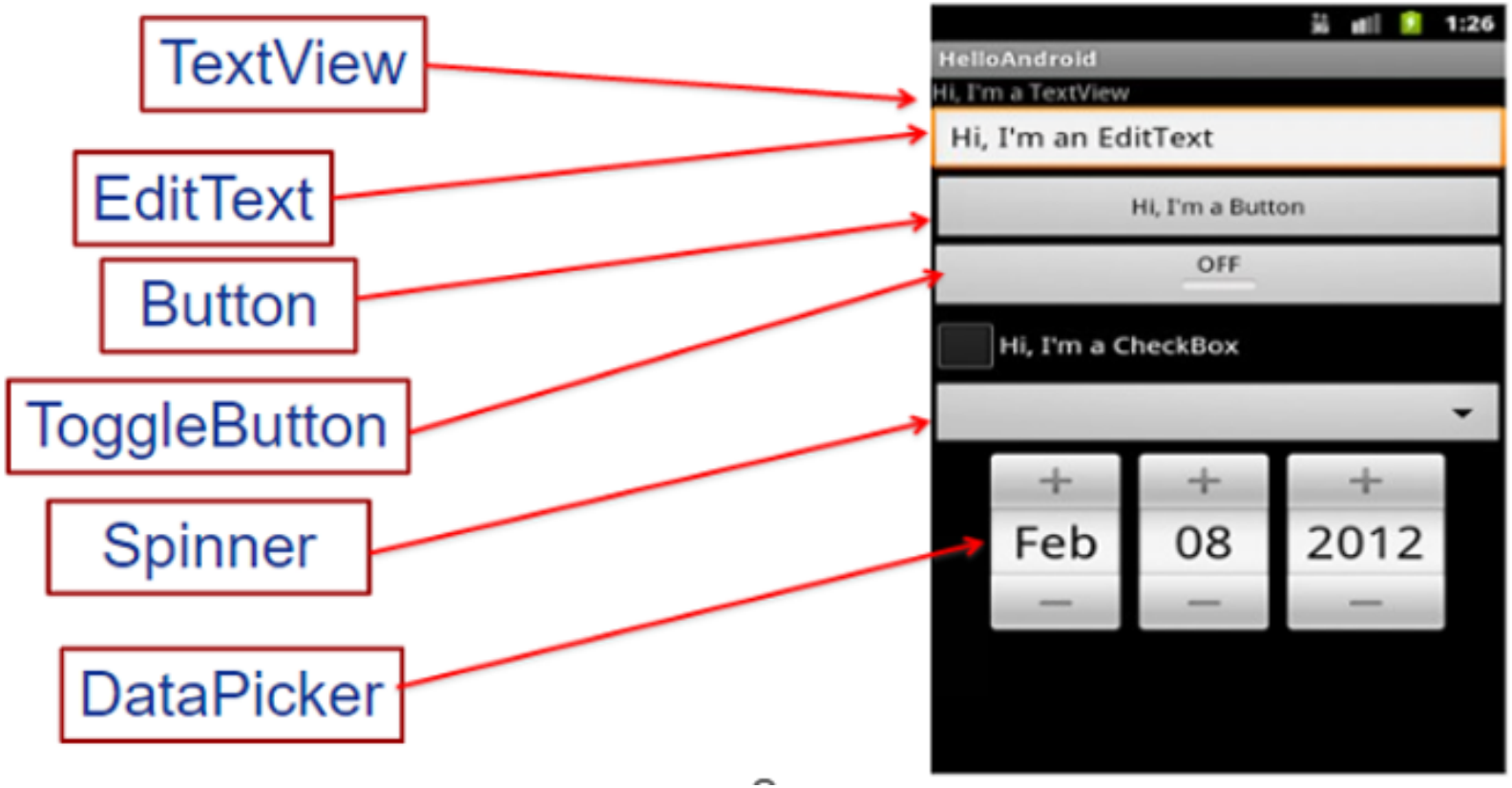
- ❖ Zone rectangulaire de l'écran
- ❖ Responsable du **dessin**
- ❖ Responsable de **la gestion des événements**

EXEMPLES d'objets **VIEWS** :

- GoogleMap
- WebView
- **Widgets** → sujet du jour
- User-defined Views

Android: Views objects

Widget → Composants d'interface utilisateur interactifs prédéfinis (android.view.widgets)



Widgets: code XML

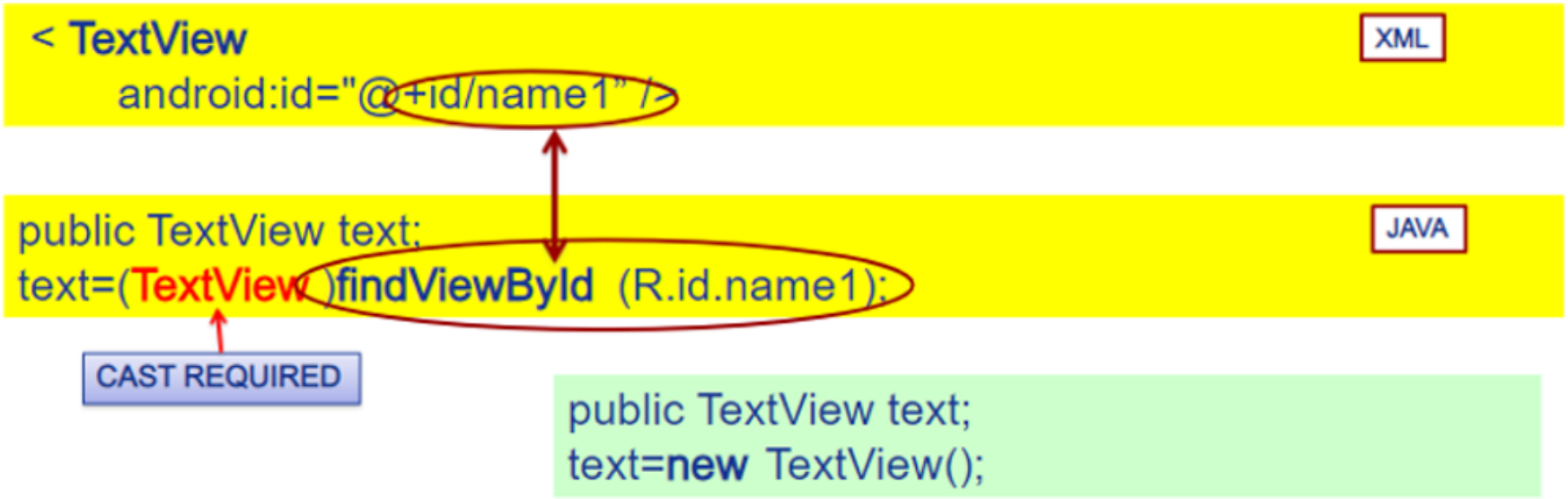
Widgets can be defined in the **XML layout files**

```
< TextView
    android:id="@+id/textLabel”
    android:layout_width="match_parent"
    android:layout_height="wrap_content”
    android:visibility="visible”
    android:enabled="true”
    android:scrollbars="vertical”
    android:text=“Hello World”
/>
```

Propriétés: définies via Android : … attributes

Widgets: Code Java et XML

Les **widgets** peuvent être définis en **XML** et accessibles depuis **Java/Koltlin**



Widgets: Code Java et XML

- Chaque widget peut avoir un **focus** et une **visibilité**, basés sur l'interaction de l'utilisateur.
  - L'utilisateur peut forcer le focus sur un composant spécifique via la méthode **requestFocus().**
  - L'utilisateur peut modifier la visibilité d'un composant spécifique via la méthode **setVisibility(int).**

```
public TextView text;
text=(TextView) findViewById(R.id.name1);
text.setVisibility(true)
text.requestFocus();
```

Widgets: TextView

- **XML tags: <TextView> </TextView>**
  - Peut être rempli de chaînes ou de **balises** HTML
  - Non directement modifiable par les utilisateurs
  - Habituellement utilisé pour afficher des informations **statiques**

```
<TextView
        android:text=”@string/textWelcome"
        android:id="@+id/textLabel"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content”
/>
```

Widgets: Méthods TextView

- **Méthodes pour placer certains textes dans un TextView**
  - public void **setText**(CharSequence text)
  - public **CharSequence getText**()
  - public void **setSingleLine**(boolean singleLine)
  - public void **setHorizontallyScrolling**(boolean enable)
  - public void **setLines**(int lines)
  - public void **setEllipsize**(TextUtils.TruncateAt where)
  - public void **setHints**(CharSequence hints)

- TextUtils.TruncateAt.**END**
- TextUtils.TruncateAt.**MARQUEE**
- TextUtils.TruncateAt.**MIDDLE**
- TextUtils.TruncateAt.**START**

Widgets: EditText

- **XML** tags: **<EditText> </EditText>**
  - Similaire à un TextView, mais **modifiable** par les utilisateurs
  - Un **clavier** approprié sera affiché

```
<EditText
        android:text=”@string/textDefault"
        android:id="@+id/editText”
        android:inputType= “textCapSentences” |
                           “textCapWords” |
                 “textAutoCorrect” |
         “textPassword” |
“textMultiLane” />
```

Widgets: Button

❖ **XML** tags: **< Button></Button>**

- Sous-classe d'un TextView, mais non directement **modifiable** par les utilisateurs
- Peut générer des événements liés au clic, au clic long, etc.

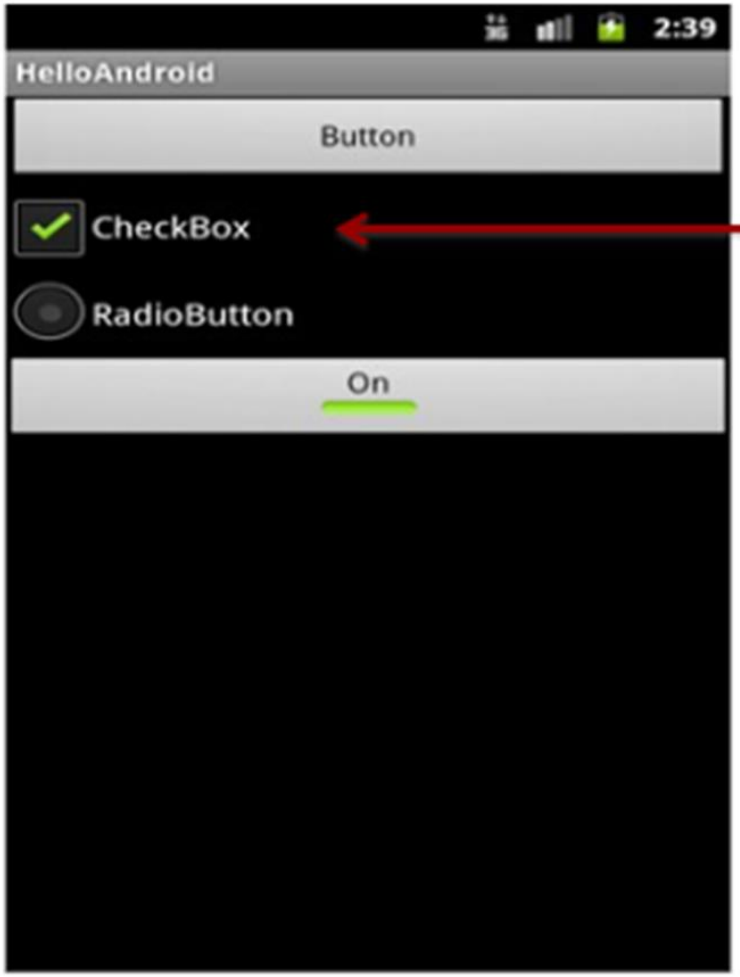
```
<Button
        android:text="@string/textButton"
        android:id="@+id/idButton"
        android:background="@color/blue”
/>
```

```
<selector>
<item
android:color="#ff819191”
android:state_pressed="true”>
</item>
</selector>
```

res/color/blue.xml

❖ **CompoundButton**: Button + *state* (checked/unchecked)

Widgets: Button and CompoundButton

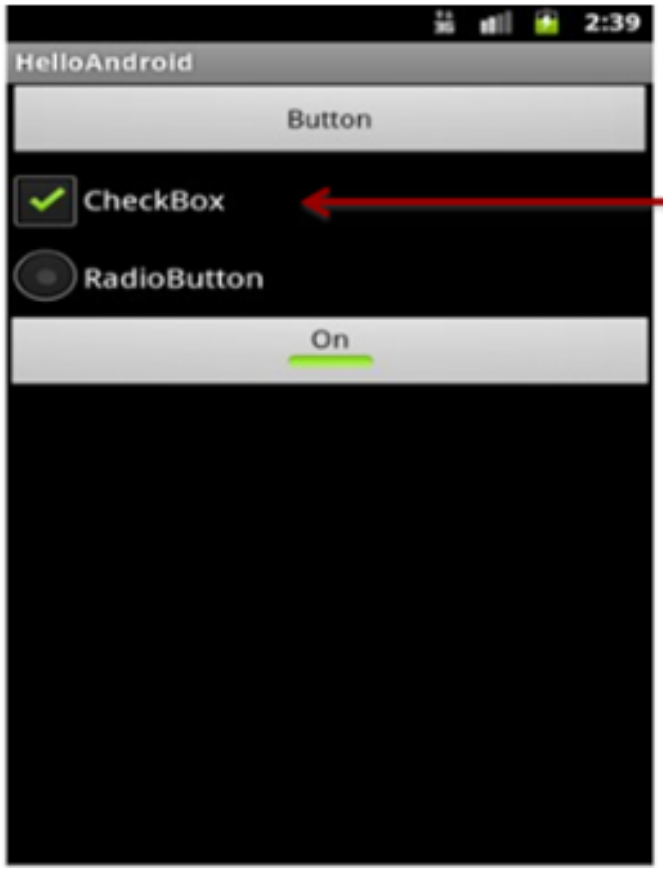


checkBox CompoundButton

XML tags: <**checkBox** >

```
<checkBox
android:layout_width="wrap_content”
android:layout_height="wrap_content”
android:id="@+id/buttonCheck”
android:text="CheckBox”
android:checked="true”
/>
```

Widgets: Button and CompoundButton



checkBox CompoundButton

- public boolean **isChecked**(): Returns true if the button is checked, false otherwise.
- public boolean **setChecked**(bool)

Listener:
onCheckedChangeListener

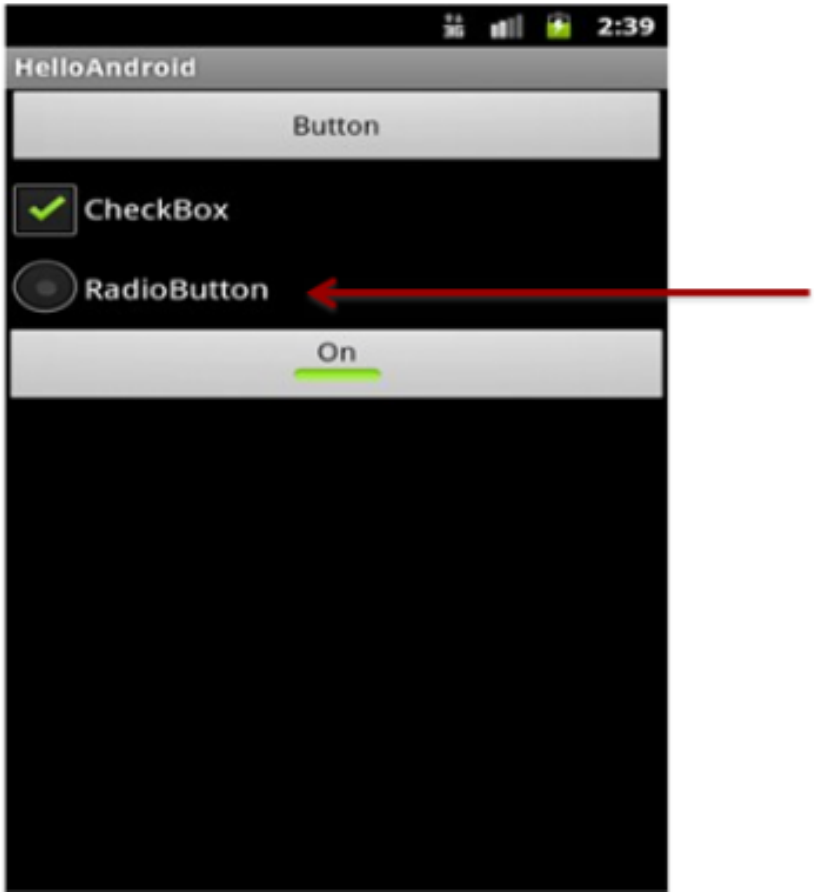
Widgets: Button and CompoundButton

radioButton CompoundButton

XML tags: <**RadioButton** >

```
<RadioButton
android:layout_width="wrap_content”
android:layout_height="wrap_content”
android:id="@+id/buttonRadio”
android:text="ButtonRadio”
android:checked="true”
/>
```

Widgets: Button and CompoundButton

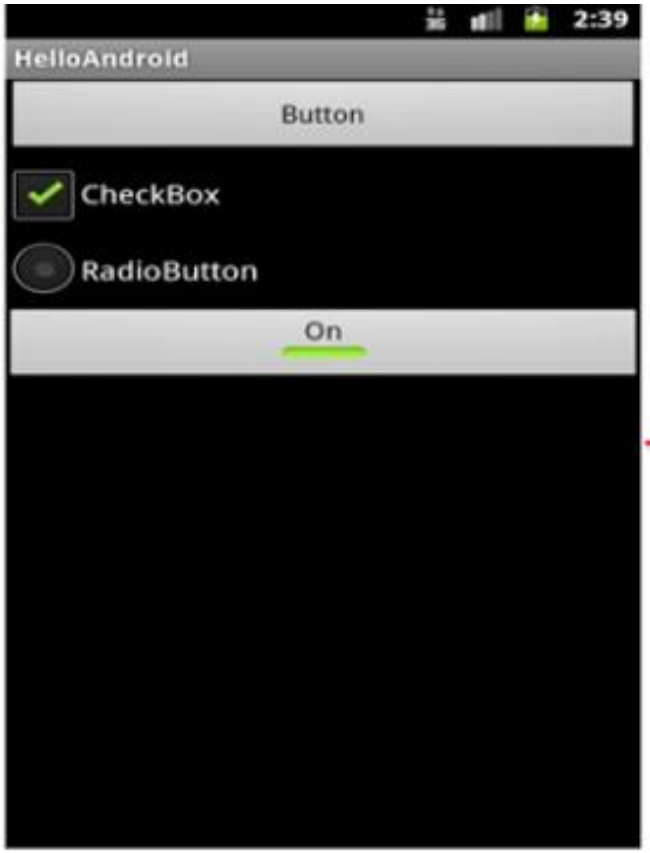


radioButton CompoundButton

- Define multiple (mutual-exclusive) options through a **<RadioGroup >** tag.
- Only one button can be checked within the same **RadioGroup** .

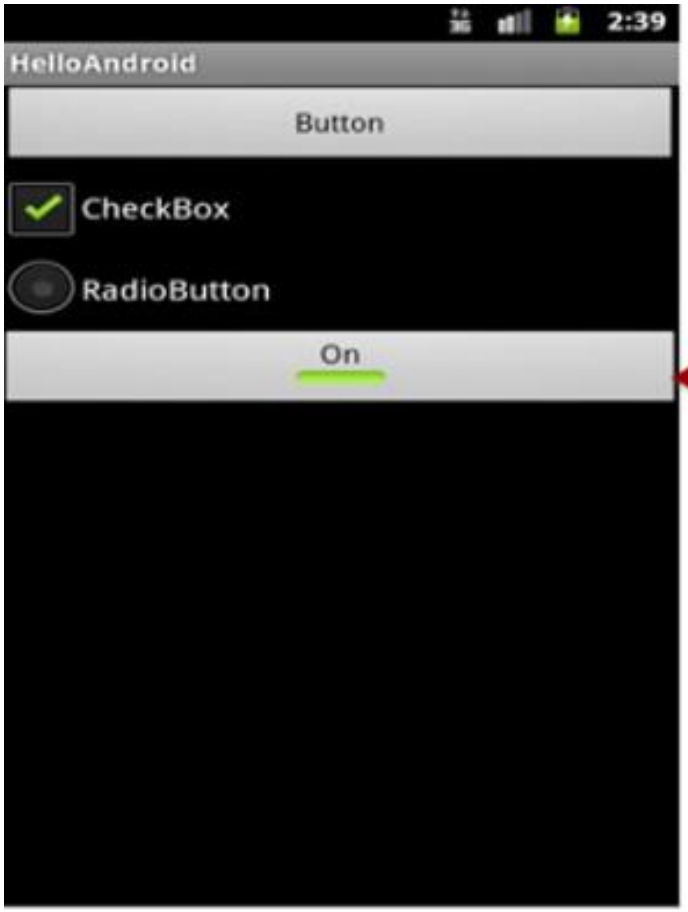
Listener:
OnCheckedChangeListener

Widgets: Button and CompoundButton




```
<RadioGroup
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:orientation="vertical">
    <RadioButton
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:id="@+id/buttonRadio1"
        android:text="Option 1"
        android:checked="true" />
    <RadioButton
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:id="@+id/buttonRadio2"
        android:text="Option 2" />
</RadioGroup >
```

Widgets: Button and CompoundButton



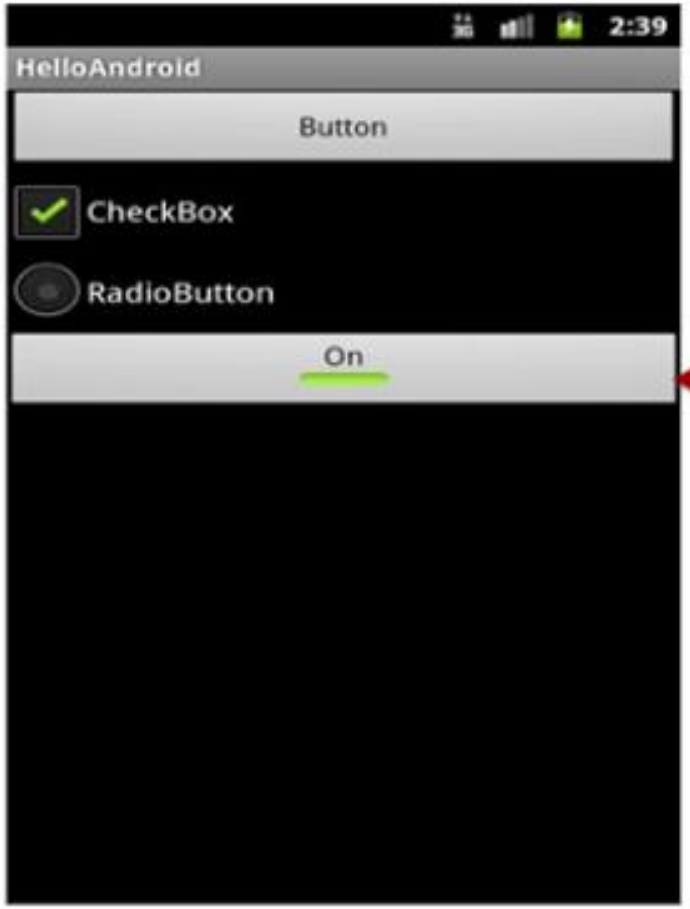
toggleButton CompoundButton

- It can assume only 2 states: checked/unchecked
- Different labels for the states with: **android:textOn** and **android:textOff** XML attributes.

Listener:

- OnCheckedChangeListener

Widgets: Button and CompoundButton

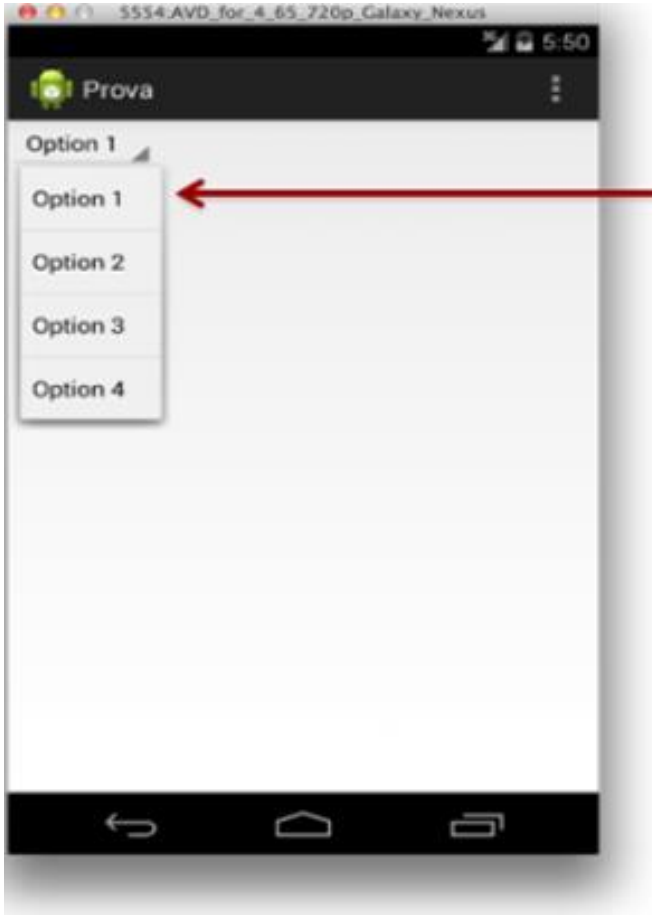


toggleButton CompoundButton

XML tags: **<ToggleButton>**

```
<ToggleButton
android:layout_width="wrap_content”
android:layout_height="wrap_content”
android:id="@+id/toggleButtonId”
android:textOn="Button ON”
android:textOff="Button OFF”
android:checked="false”
/>
```

Widgets: Spinners



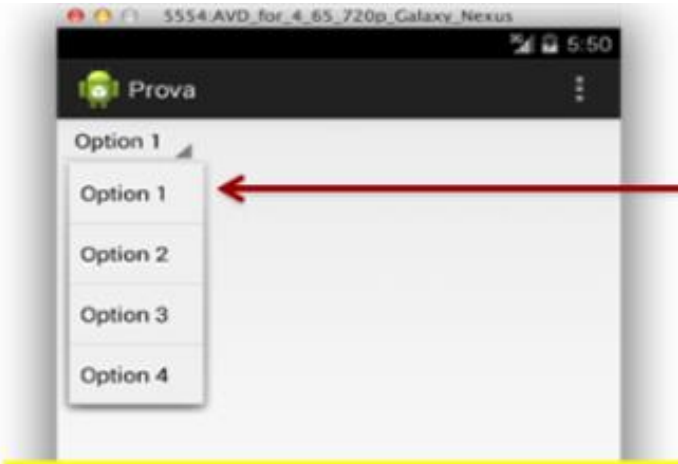
Spinner component

XML tags: **<Spinner>**

- Provides a quick way to select values from a specific set.
- The spinner value-set can be defined in XML (through the **entries** tag) or through the *SpinnerAdapter* in Java

Listener:
OnItemSelectedListener

Widgets: Spinners



Spinner component

XML tags: **<Spinner>**

```
<Spinner
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:id="@+id/spinnerId"
    android:entries="@array/stringOptions">
/>
```

```
<resources>
  <string-array  name="stringOptions">
        <item>Option 1</item>
        <item>Option 2</item>
        <item>Option 3</item>
        <item>Option 4</item>
</string-array>
</resources>
```

res/values.xml

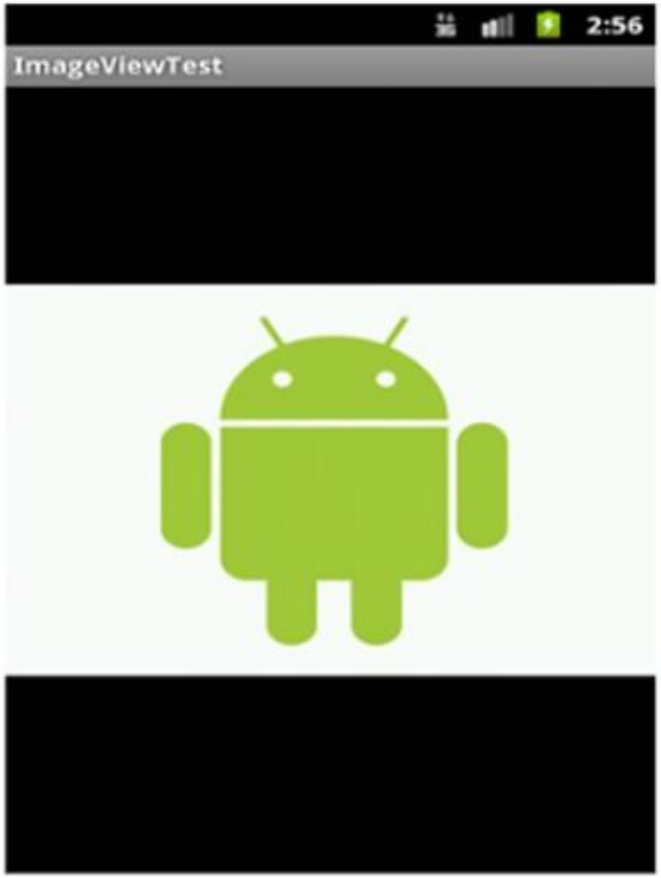
Widgets: Button and CompoundButton

DataPicker component

XML tags: <DatePicker>

```
<DatePicker
android:layout_width="wrap_content”
android:layout_height="wrap_content”
android:id=“@+id/datePickerId”
android:endYear="1990”
android:startYear="2014”
android:maxDate="10/10/2014”
/>
```

Widgets: ImageView



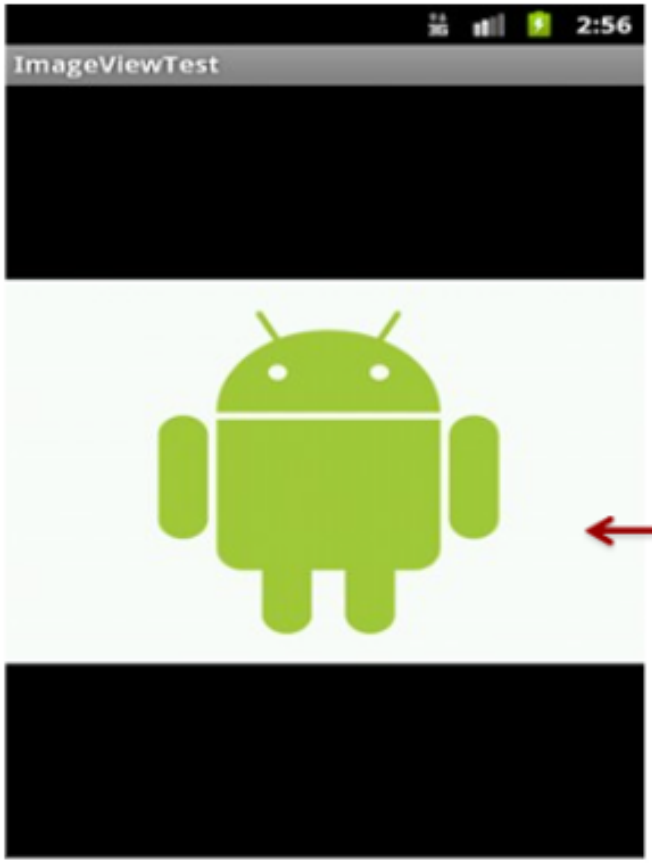
ImageView: subclass of View object**.**

Some methods to manipulate an image:

- void **setScaleType** (enum scaleType)
- void **setAlpha** (double alpha)
- void **setColorFilter** (ColorFilter color)

CENTER, CENTER_CROP, CENTER_INSIDE,
FIT_CENTER, FIT_END, FIT_START, FIT_XY, MATRIX

Widgets: ImageView



ImageView component

XML tags: <ImageView>

```
<ImageView
android:layout_width="wrap_content”
android:layout_height="wrap_content”
android:id="@+id/imageId”
android:src="@drawable/android”
/>
```

Source: **android** .jpg in drawable/

View & Events

View & Events

Les vues/Widgets sont des composants **interactifs** → Lors de certaines actions de l'utilisateur, un événement approprié sera déclenché

clic, clic long, focus, éléments sélectionnés, éléments cochés, glisser,…

Comment gérer les événements générés par une View ?

1. Directement depuis **XML**
2. Via **Event Listeners** (général, recommandé)

View and Events

Pour un ensemble limité de composants, il est possible de gérer les événements via des **rappels** indiqués dans la mise en page XML.

```
<Button
android:text="@string/textButton”
android:id="@+id/idButton”
android:onClick=”doSomething”
/>
```

XML Layout File

Java code

```
public void doSomething(View w) {
   // Code to manage the click
event
}
```

View & Events

Les vues/Widgets sont des composants **interactifs** → Lors de certaines actions de l'utilisateur, un événement approprié sera déclenché

clic, clic long, focus, éléments sélectionnés, éléments cochés, glisser,…

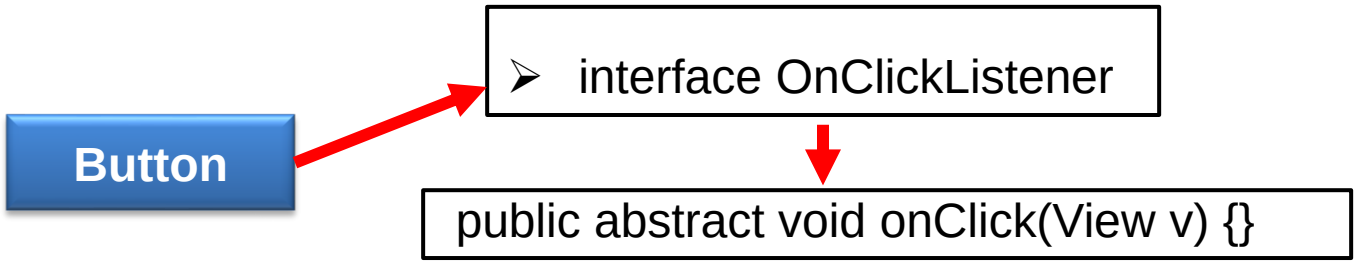
Comment gérer les événements générés par une View ?

1. Directement depuis **XML**
2. Via **Event Listeners** (général, recommandé)

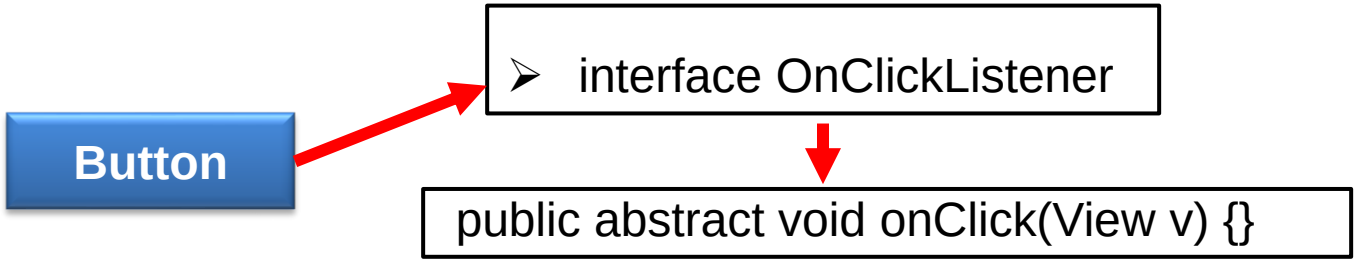
View & Events

Chaque View contient une collection d'interfaces imbriquées (listeners).

- Chaque listener gère un seul **event** …
- Chaque listener contient une seule méthode de rappel…
- Le rappel est invoqué lors de l'apparition de l'événement.



View & Events




```
…
Button button=(Button)findViewById(R.id.buttonNext);
button.performClick();
…
```

```
// Callback method
public void onClick(View v) {
        ….
}
```

View & Events: ActionListener

LISTE DES INTERFACES ACTIONLISTENER

- interface OnClickListener
  abstract method: *onClick()*
- interface OnLongClickListener
  abstract method: *onLongClick()*
- interface OnFocusChangeListener
  abstract method: *onFocusChange()*
- interface OnKeyListener
  abstract method: *onKey()*
- interface OnCheckedChangeListener
  abstract method: *onCheckedChanged()*

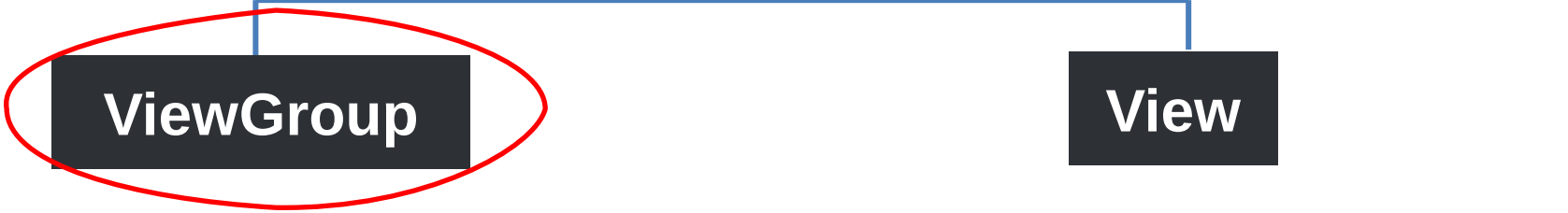
- interface OnItemSelectedListener
  abstract method: *onItemSelected()*
- interface OnCheckedChangeListener
  abstract method: *onCheckedChanged()*
- interface OnItemSelectedListener
  abstract method: *onItemSelected()*
- interface OnTouchListener
  abstract method: *onTouch()*
- interface OnCreateContextMenuListener
  abstract method: *onCreateContextMenu()*

INTERFACE UTILISATEUR

- View/WIDGETS
- Layouts

Android: Views & Layout

Composants de **l'interface utilisateur (UI)** d'une activité



- **Conteneur** de View.
- Responsable du **placement** d'autres View sur l'écran
- Chaque layout doit étendre un **ViewGroup**

- **Composant de base (UI)**
- Peut gérer/produire des **événements**
- Nouveau composant: extension de **View**

Android: ViewGroups

ViewGroup → définir **l'emplacement** des vues.

- Défini en code Java/kotlin (activity file)

- Défini en XML (layout file)

↓

- Utiliser des **balises XML** pour placer un ViewGroup
- Placez une View dans ViewGroup en utilisant ces **attributs XML**

android:layout_width

android:layout_height

} **match_parent I wrap_content**

Android: ViewGroups

Liste des **Layouts** les plus courantes fournies par Android

Nom	XML Tag	Description
LinearLayout	<LinearLayout> </LinearLayout>	arrange Views by aligning them on a single row or column
RelativeLayout	<RelativeLayout> </RelativeLayout>	arrange Views through relative positions
TableLayout	<TableLayout> </TableLayout>	arrange Views into rows and columns
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- Un Layout peut être déclaré dans un autre layout

Android: ViewGroups

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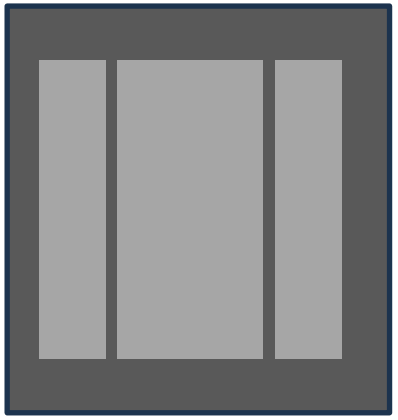
- Un Layout peut être déclaré dans un autre layout

Android: ViewGroups

LinearLayout → view group that aligns all children in a single direction, vertically or horizontally



- **Orientation** can be declared through XML tag

  android:orientation= HORIZONTAL|VERTICAL

- **Orientation** can also be declared in Java through

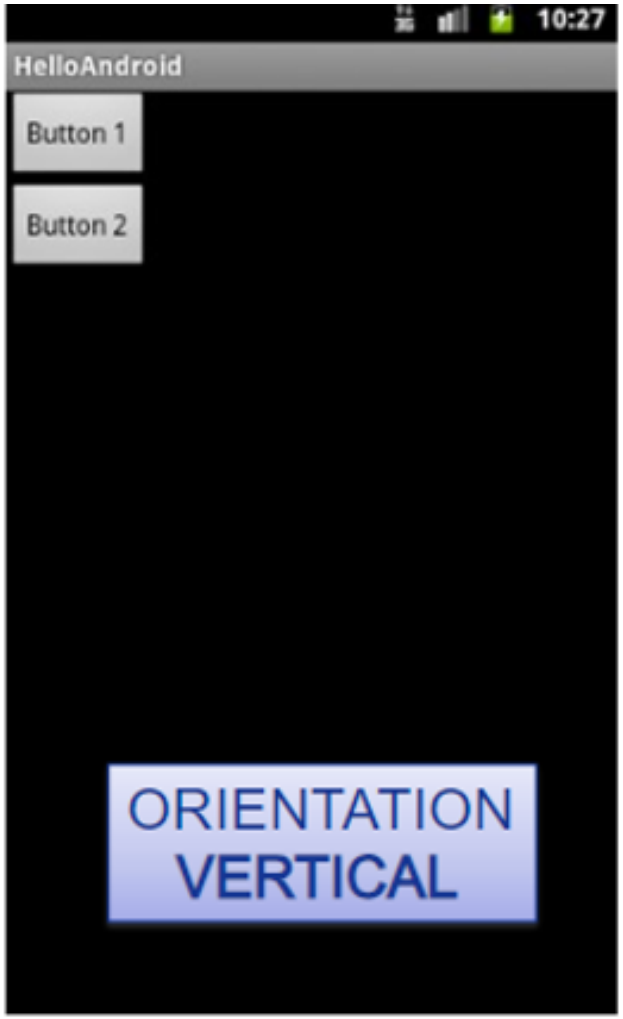
  setOrientation(int orientation)

- Views has also other two attributes:

  gravity → Align the View with its parent

  weigth → How much space is assigned to the View

Android: ViewGroups



Android: ViewGroups

```
<?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" >        <!-- Also horizontal →
    <Button
        android:id="@+id/button1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/buttonString1" />
    <Button
        android:id="@+id/button2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/buttonString2" />
</LinearLayout>
```

Android: ViewGroups

❖ For each **View** in a LinearLayout, we can set the

android:weight XML property (integer value)

Importance of a View, how much it can **expand**

```
<LinearLayout>
<Button
…android:layout_width=match_parent
  android:weight=1/>
<Button …
  android:layout_width=match_parent
  android:weight=1/>
</LinearLayout>
```

Android: ViewGroups

❖ For each **View** in a LinearLayout, we can set the **layout_gravity** XML property

Align a View with its parent (LinearLayout)

```
<LinearLayout>
<Button  …
android:layout_width=match_parent
android:weigth=1/>
<Button …
android:layout_width=match_parent
android:layout_gravity=“center_vertical”
android:weight=2/>
</LinearLayout>
```

Android: ViewGroups

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- Un Layout peut être déclaré dans un autre layout

Android: ViewGroups

RelativeLayout → View group that displays all **Views** based in **relative** positions.

RELATIVE= **COMPARED** to the **PARENT LAYOUT**

```
android:alignParentBottom="true|false"
android:alignParentTop="true|false"
android:alignParentLeft="true|false"
android:alignParentRight="true|false"
android:alignParentStart="true|false"
android:alignParentEnd="true|false"
...
```

Android: ViewGroups

RelativeLayout → View group that displays all **Views** based in relative positions.

RELATIVE= **COMPARED** to **SIBLING VIEWs**

```
android:toLeftOf=   ID
android:toRightOf=  ID
android:toStartOf=  ID
android:toEndOf=    ID
...
```

XML Identifier
of the View
used as reference
point

Android: ViewGroups

ACTIVITY_MAIN.XML

```
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"    android:layout_height="match_parent" >

    <EditText
        android:id="@+id/username"        android:text="username"
        android:inputType="text"
        android:layout_width="wrap_content"        android:layout_height="wrap_content"
        android:layout_alignParentRight="true"
        android:layout_toRightOf="@+id/usernameLabel" >
    </EditText>

    <TextView
        android:id="@+id/usernameLabel"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignBaseline="@+id/username"
        android:text="Username" />
```

CONTINUE

Android: ViewGroups

```
<EditText
    android:id="@+id/password"        android:text="password"
    android:inputType="textPassword"
    android:layout_below="@+id/username"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_alignLeft="@+id/username"
    android:layout_alignParentRight="true"
    android:layout_toRightOf="@+id/usernameLabel" >
</EditText>

<TextView
    android:id="@+id/passwordLabel"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_alignBaseline="@+id/password"
    android:text="Password" />
</RelativeLayout>
```

ACTIVITY_MAIN.XML

Android: ViewGroups

Liste des **Layouts** les plus courantes fournies par Android

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ConstraintLayout	<ConstraintLayout> </ConstraintLayout>	arrange views through constraints in ConstraintLayout:

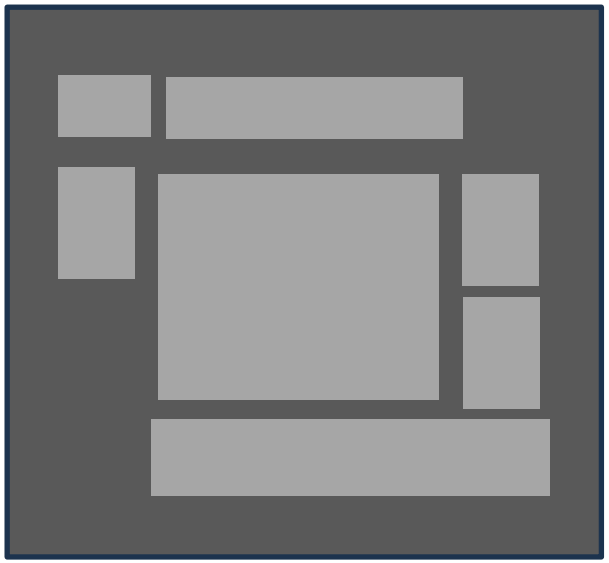
- Un Layout peut être déclaré dans un autre layout

Android: ViewGroups

TableLayout → View group that arranges all **Views** into rows and columns (as an HTML table)

PROPERTIES

1.Consists of a list of **TableRaw** objects, each defining a raw of the Table.
2.The **width** of a column is defined by the row with the **widest** cell in that column.
3.Cells can be **empty**, or can **span** multiple columns (like in HTML).
4.Border lines of the cells are not displayed.
PROPERTIES Android: ViewGroups



Android: ViewGroups

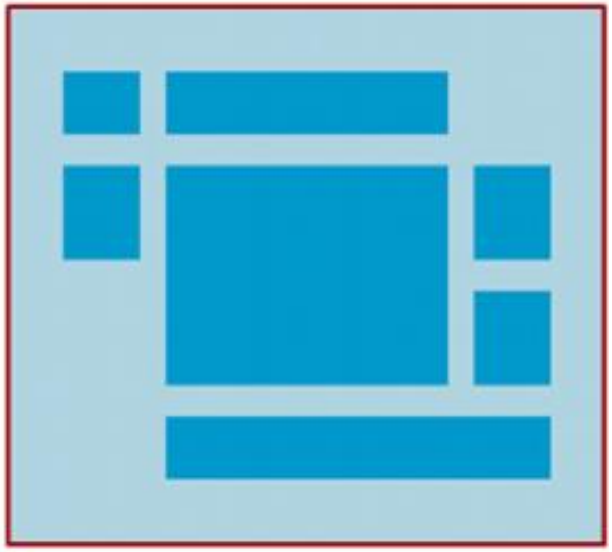
TableLayout → View group that arranges all **Views** into rows and columns (as an HTML table)

ADDITIONAL XML attributes

```
android:layout_column
android:layout_span
android:collapsecolumn
android:shrinkColumns
android:stretchColumns
```

Apply only to **width**

`layout_width` is always **WRAP_CONTENT**
`layout_height` is **WRAP_CONTENT** (default)



Android: ViewGroups

ACTIVITY_MAIN.XML

```
<?xml version="1.0" encoding="utf-8"?>
<TableLayout android:layout_width="fill_parent"
    android:layout_height="fill_parent" xmlns:android=schemas.android.com/apk/res/android
     android:id="@+id/tableLayout">
    <TableRow android:layout_width="wrap_content" android:layout_height="wrap_content" android:id="@+id/firstRow">
    <Button
          android:id="@+id/button1"
          android:layout_width="wrap_content"
          android:layout_height="wrap_content"
               android:text="Button" />
    <Button android:id="@+id/button2"
               android:layout_width="match_parent"
               android:layout_height="match_parent"
               android:text="Button" />
    <Button android:id="@+id/button3"
               android:layout_width="match_parent"
               android:layout_height="match_parent"
               android:text="Button" />
    </TableRow>
```

CONTINUE

Android: ViewGroups

```
<TableRow
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:id="@+id/secondRow">

            <Button
            android:layout_column="1"
            android:layout_span="2"
                android:id="@+id/button4"
             android:layout_width="wrap_content"
                android:layout_height="wrap_content"
                android:text="Button">
            </Button>
</TableRow>
</TableLayout>
```

ACTIVITY_MAIN.XML

Android: ViewGroups

Liste des **Layouts** les plus courantes fournies par Android

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ConstraintLayout	<ConstraintLayout> </ConstraintLayout>	arrange views through constraints in ConstraintLayout:

- Un Layout peut être déclaré dans un autre layout

Android: ViewGroups

FrameLayout → Block out an area on the screen to display a single item (i.e. a single View).

- It should be used to display a **single View** within the Layout
- Multiple views can be controlled through **android:layout_gravity**

AbsoluteLayout → Arrange Views on the screen by specifying absolute x-y positions of each View.

- **Deprecated**, since it is dependant of the **screen resolution**

Agenda

Interface Utilisateur (UI)

Expérience Utilisateur

Utilisabilité

Android et les Design Patterns

Optimisation des performances de UI

Challenge

Thank you !

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