Android Pre-requisites

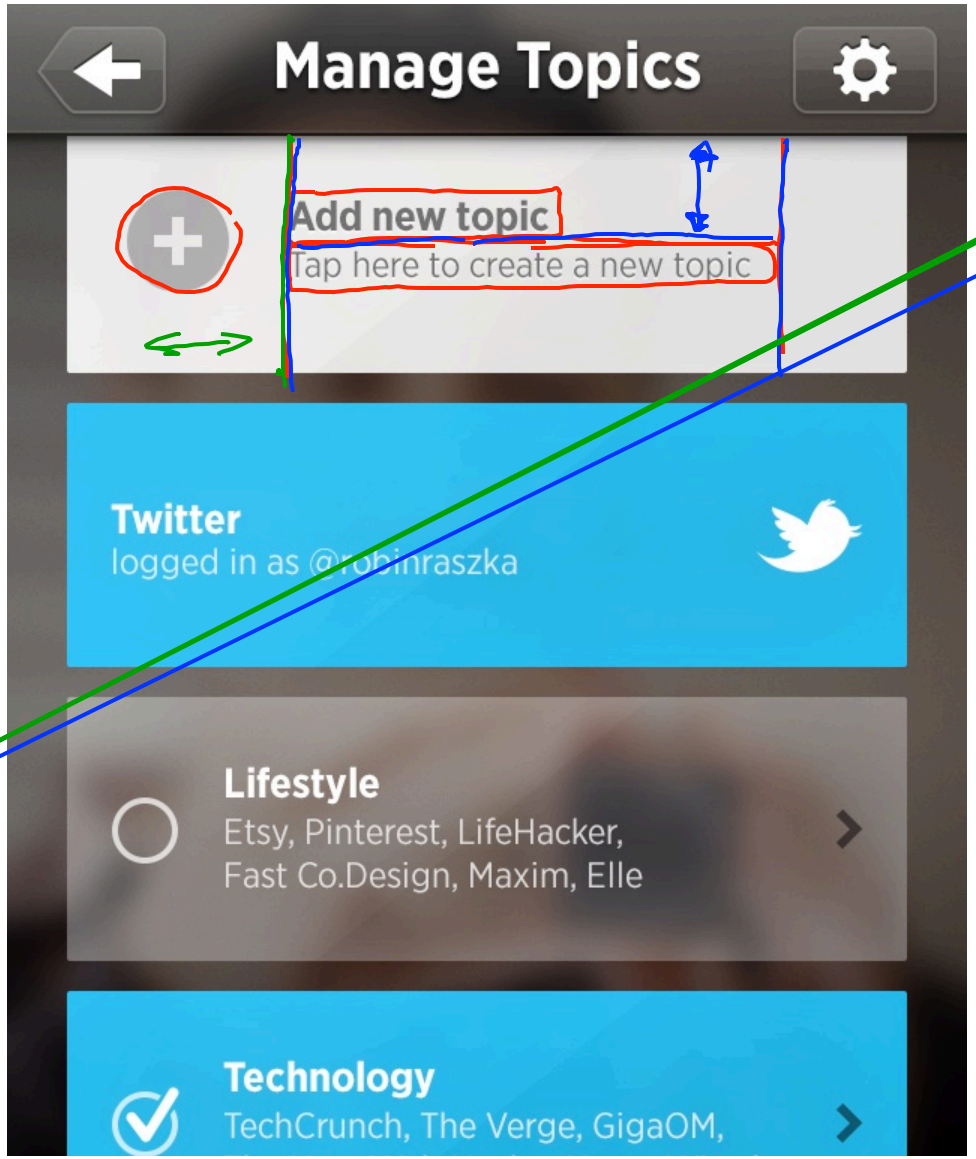
Android To Dos

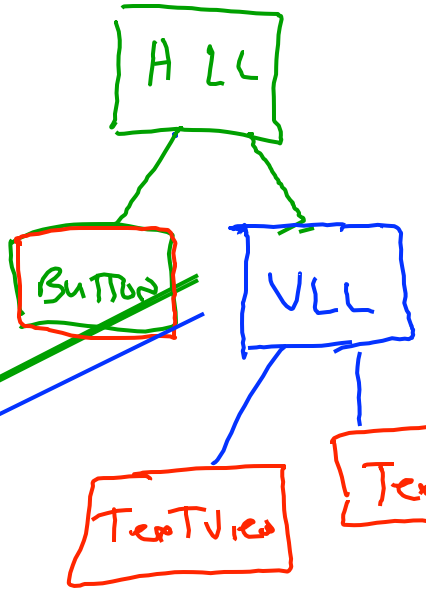
- **Make sure you have working install of Android Studio**
  - Make sure it works by running "Hello, world" App
    - On emulator or on an Android device
    - Kindle Fire only $50 from Amazon. Next day delivery.
- **Watch first lesson of Udacity "Developing Android Apps":**
  - https://www.udacity.com/course/new-android-fundamentals--ud851
    - MOOC created and maintained by Google engineers
    - FREE
  - Lesson 1: Create Project Sunshine
    - Gives some background on Android, builds a simple user interface
  - We'll have a quiz on Thursday; next assignment is Android

GUI terminology

- **window: A first-class citizen of the GUI.**
  - Also called a *top-level container*.
- **component: A GUI widget that resides in a window.**
  - Called a View in Android
  - examples: Button, CheckBox, TextView
- **container: A logical grouping for storing components.**
  - examples: LinearLayout, ListView,

GUI interface example

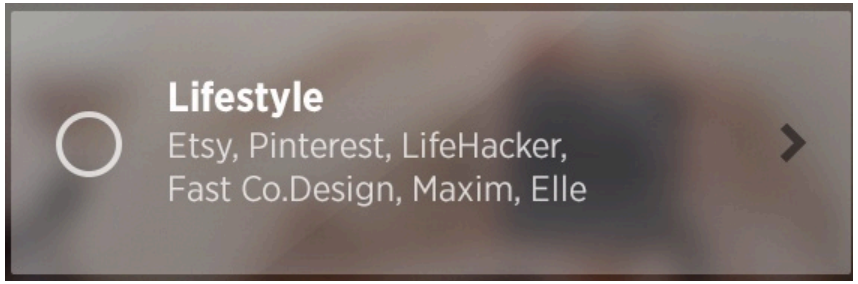




android.view.View

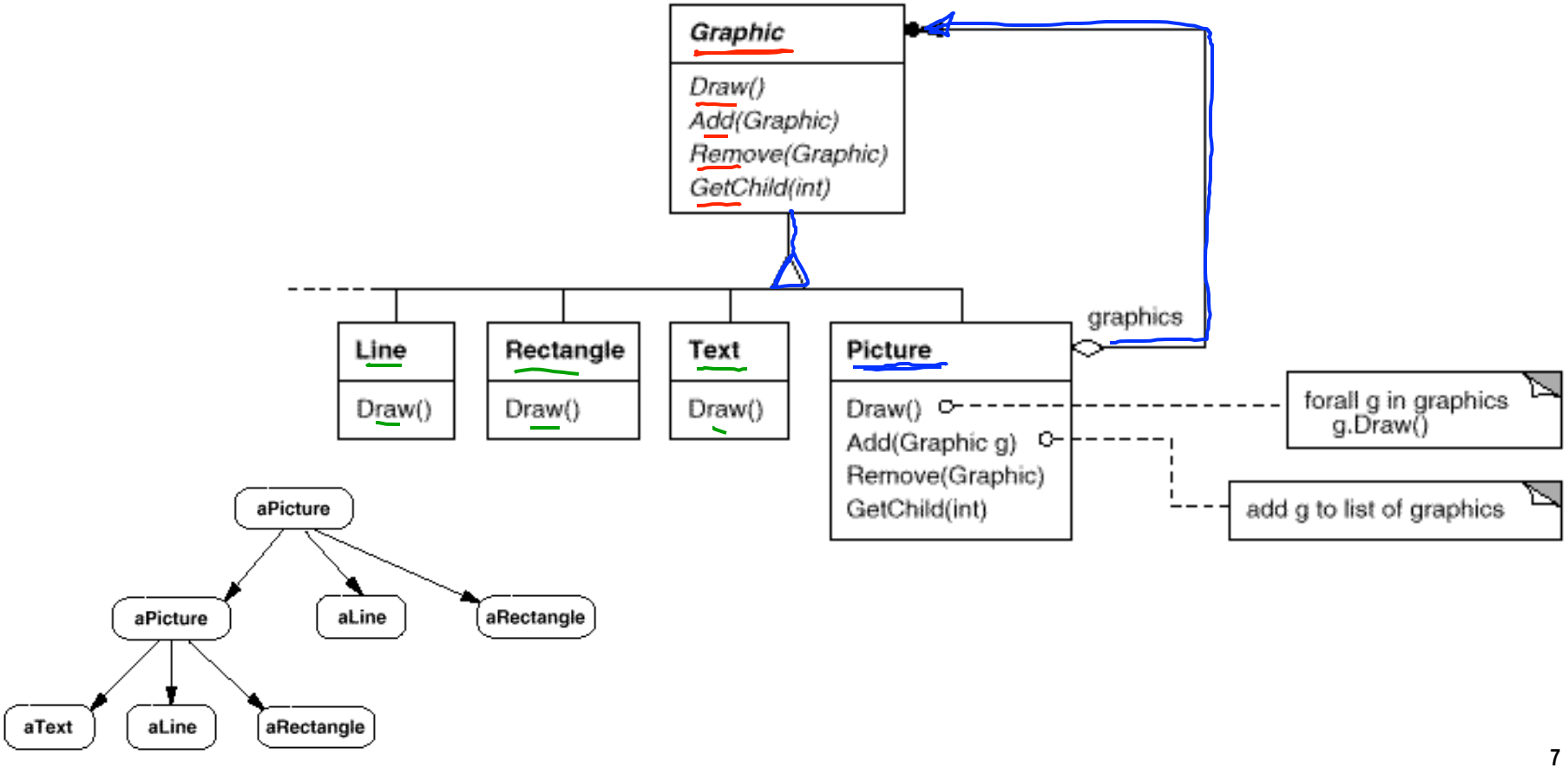
- https://developer.android.com/reference/android/view/View.html

Breakdown of a Layout



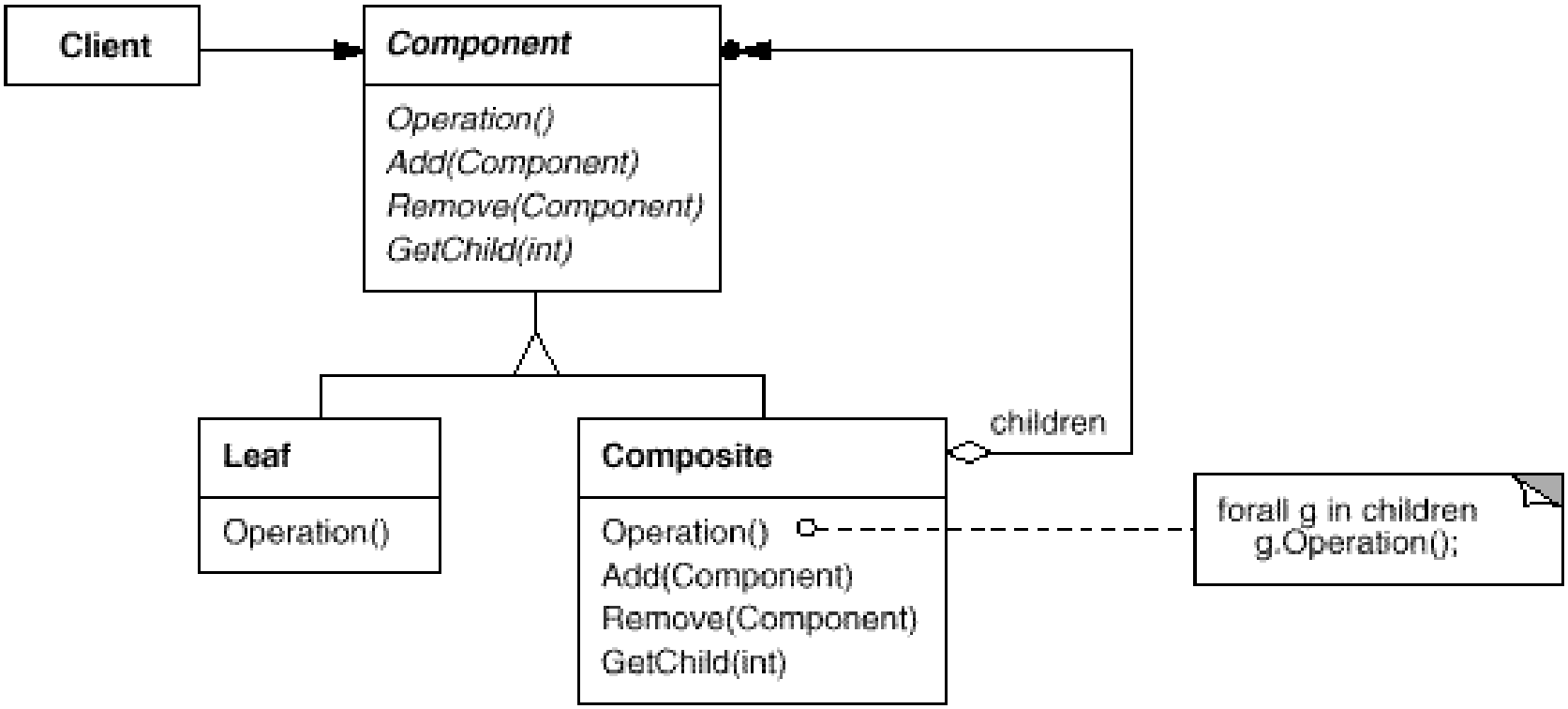
Design Pattern: Composite

- **Compose objects into tree structures to represent part-whole hierarchies. Composite lets clients treat individual objects and compositions of objects uniformly.**



Design Pattern: Composite (cont.)

- **Client doesn't need to know whether an object is a leaf or a composite**

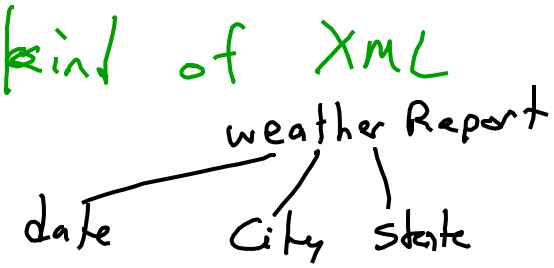


Code vs. Resources

- **Android represents many things in a *declarative* form**
  - Describe the result, not the process of their generation
  - Easier for tools (E.g., IDE) to work with
  - Use different resources in different circumstances
    - Different strings for different locales, and
    - Different layouts for different device sizes/orientations
  - Encoded in XML

XML (eXtensible Markup Language)

- **For "marking up" data so it can be processed by computers**
  - Much like JSON in purpose




```
<?xml version="1.0"?>
<weatherReport>
  <date>7/14/97</date>
  <city>North Place</city>, <state>NX</state>
  <country>USA</country>
  High Temp: <high scale="F">103</high>
  Low Temp: <low scale="F">70</low>
  Morning: <morning>Partly cloudy, Hazy</morning>
  Afternoon: <afternoon>Sunny &amp;amp; hot</afternoon>
  Evening: <evening>Clear and Cooler</evening>
</weatherReport>
```

XML vs. HTML

- **HTML and XML look similar, because they are both SGML languages (SGML = Standard Generalized Markup Language)**
  - Both HTML and XML use elements enclosed in tags (e.g. <body>This is an element</body>)
  - Both use tag attributes (e.g., <font face="Verdana" size="+1" color="red">)
  - Both use entities (<, >, &, ", ')
- **More precisely:**
  - HTML is defined in SGML; XML is a (small) subset of SGML
- **Differences:**
  - XML describes content; HTML describes structure & presentation
  - HTML has fixed set of tags; XML you define your own tags

XML Structure

- **An XML document may start with one or more processing instructions (PIs) or directives:**

```
<?xml version="1.0"?>
<?xml-stylesheet type="text/css" href="ss.css"?>
```

- **Following the directives, there must be exactly *one* root element containing all the rest of the XML:**

```
<weatherReport>
    ...
</weatherReport>
```

XML building blocks

- **Aside from the directives, an XML document is built from:**
  - tags, in pairs: <high scale="F">103</high>
  - elements: high in <high scale="F">103</high>
  - attributes: <high scale="F">103</high>
  - entities: <afternoon>Sunny & hot</afternoon>
  - character data, which may be:
    - parsed (processed as XML)--this is the default
    - unparsed (all characters stand for themselves)
  - comments: <!-- anything <in> & here is comment -->

Elements and attributes

- **Attributes and elements are somewhat interchangeable**
- **Example using just elements:**

```
<name>
   <first>David</first>
   <last>Matuszek</last>
</name>
```

- **Example using attributes:**

```
<name first="David" last="Matuszek"></name>
```

- **You will find that elements are easier to use in your programs -- this is a good reason to prefer them**
- **Attributes often contain metadata, such as unique IDs**
- **Generally speaking, browsers display only elements (values enclosed by tags), not tags and attributes**

Well-formed XML

- **Every element must have *both* a start tag and an end tag, e.g. <name> … </name>**
  - But empty elements can be abbreviated: <break />.
  - XML tags are case sensitive
  - XML tags may not begin with the letters xml, in any combination of cases
- **Elements must be properly nested, e.g. *not* bold and italic**
- **Every XML document must have one and only one root element**
- **The values of attributes must be enclosed in single or double quotes, e.g. <time unit="days">**
- **Character data cannot contain < or &**

Entities

- **Five special characters must be written as entities:**

  & for & (almost always necessary)

  < for < (almost always necessary)

  > for > (not usually necessary)

  " for " (necessary inside double quotes)

  ' for ' (necessary inside single quotes)

- **These entities can be used even in places where they are not absolutely required**
- **These are the *only* predefined entities in XML**

XML declaration

- **The XML declaration looks like this:**
  <?xml version="1.0" encoding="UTF-8" standalone="yes"?>
  - The XML declaration is not required by browsers, but *is* required by most XML processors (so include it!)
  - If present, the XML declaration must be first--*not even whitespace* should precede it
  - Note that the brackets are <? and ?>
  - version="1.0" is required (this is the *only* version so far)
  - encoding can be "UTF-8" (ASCII) or "UTF-16" (Unicode), or something else, or it can be omitted
  - standalone tells whether there is a separate DTD

Names in XML

- **Names (as used for tags and attributes) must begin with a letter or underscore, and can consist of:**
  - Letters, both Roman (English) and foreign
  - Digits, both Roman and foreign
    - . (dot)
    - - (hyphen)
    - _ (underscore)
    - : (colon) should be used only for namespaces
  - Combining characters and extenders (not used in English)

Comments

- <!-- This is a comment in both HTML and XML -->
- **Comments can be put anywhere in an XML document**
- **Comments are useful for:**
  - Explaining the structure of an XML document
  - Commenting out parts of the XML during development and testing
- **Comments are not elements and do not have an end tag**
- **The blanks after <!-- and before --> are optional**
- **The character sequence -- cannot occur in the comment**
- **The closing bracket *must* be -->**
- **Comments are not displayed by browsers, but can be seen by anyone who looks at the source code**

Document Type Definitions

- **You can make up your own XML tags and attributes, *but...***
  - ...any program that *uses* the XML must know what to expect!
- **A DTD (Document Type Definition) defines what tags are legal and where they can occur in the XML**
- **An XML document *does not require* a DTD**
- **XML is well-structured if it follows the rules given earlier**
- **In addition, XML is valid if it declares a DTD and conforms to that DTD**
- **A DTD can be included in the XML, but is typically a separate document**
- **Errors in XML documents will *stop* XML programs**
- **Some alternatives to DTDs are XML Schemas and RELAX NG**

Reivew of XML rules

- Start with <?xml version="1"?>
- XML is case sensitive
- You must have exactly one root element that encloses all the rest of the XML
- Every element must have a closing tag
- Elements must be properly nested
- Attribute values must be enclosed in double or single quotation marks
- There are only five pre-declared entities

Event-Driven Programming

- **A programming paradigm**
- **Program flow is determined by events**
  - E.g., user actions (mouse clicks, key presses), sensor outputs, or messages from other programs/threads.
- **Dominant paradigm used in graphical user interfaces**
- **Main loop listens for events**
  - Triggers a callback function when event is detected.
  - Framework provides the event loop
  - We write and register the callbacks

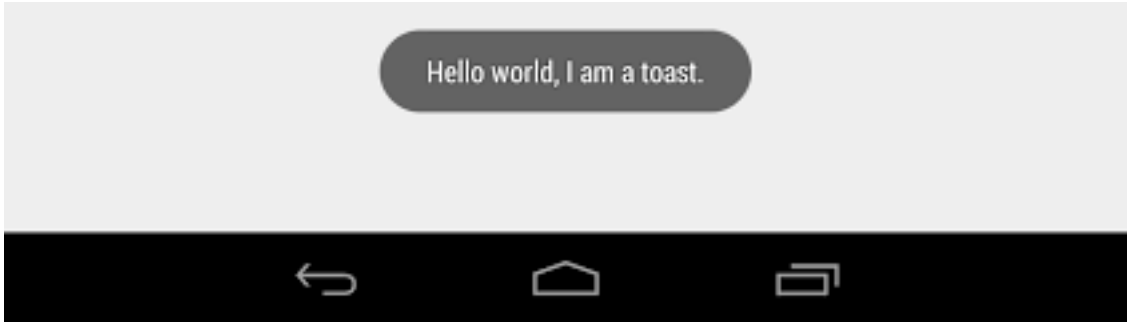
Context Object

- **An app has application state/environment data and resources**
  - E.g., assets, resources, package manager, preferences
  - It needs access to these to perform some operations

- **Android organizes these in a *Context* object**
  - Context is an abstract base class
  - Activity, Service, etc. **isA** Context
  - You will mostly use the Context indirectly
    - E.g., pass it as an argument to other function calls

Toasts

- **Messages that are temporarily drawn over the UI**



- **Useful for user notifications and during development**
- ***Toast.makeText(view.getContext(),***
  "Hello world, I am a toast",
  Toast.LENGTH_LONG).show();