Mobile Device Architecture

CS 4720 – Mobile Application Development

The Way Back Time

- When a phone was a phone…
- Plus a story!

Oh yes… this was a phone…

The Motorola DynaTAC 8000X

- 1983
- 13 x 1.75 x 3.5
- 2.5 pounds
- $3,995
- + Monthly Fee
- + Pay per minute

Then there was the bag phone…

Nokia Invents Mobile Phone Gaming!

- Obviously I'm talking about the N-Gage!
- …
- Okay, remember Snake on the old Nokia phones?
- Other early apps include: basic contact apps, Pong, and Tetris

Third-Party Apps Begin

- Mobile phones stopped being a novelty
- Batteries got better, form factors improved, coverage improved, plans were… better…
- The handset manufacturers didn't want to write all the applications for these new phones
- However… they didn't want to open up their platform…
- The first mobile web platform was born

WAP

- Wireless Application Protocol
- Basically it's a stripped-down HTTP that was meant to be better at transmitting over the unreliable mobile network
- WAP used WML instead of HTML – used a "card" mentality
- Two popular WAP sites? CNN and ESPN

In-App Purchases Before Apps

- SMS…

When did it all change?

- With the Internet full of images and media…
- And other handheld devices selling like gangbusters (Game Boy)…
- What changed with phones?
- Phones started running known operating systems (Windows CE and Linux)
- Now bigger players were involved, and handset manufactures decided to open up

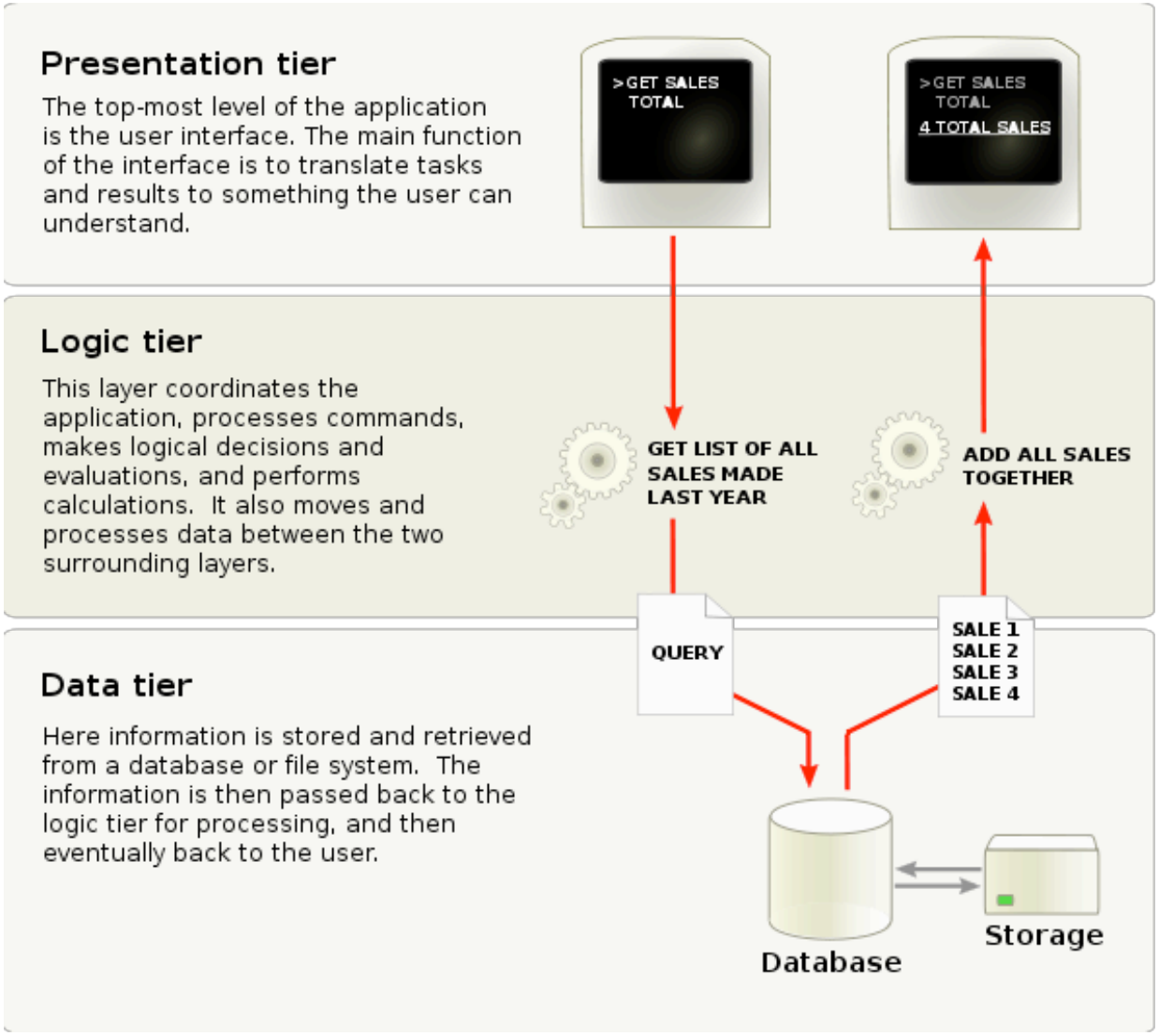
And what's happened since?

- The mobile market is seriously fractured
- Who do you develop for?
- How do you test for EVERY phone?
- Which market works best?
- How do you port your app between platforms?
- Which tools do you use? Can you use?

And Now Google

- The Open Handset Alliance is an attempt to effectively "get everyone on the same page"
- Open Source
- Familiar Environments and Tools
- Secure OS (Linux w/ app signing)
- No Royalties or Developer Fees

The Three-Tiered Architecture



The Three-Tiered Architecture

- For a web application…
  - The browser + dynamically generated HTML is the presentation layer
  - Middleware files (function-specific PHP, Java servlets on Tomcat) contain the business logic
  - The database server is the data layer

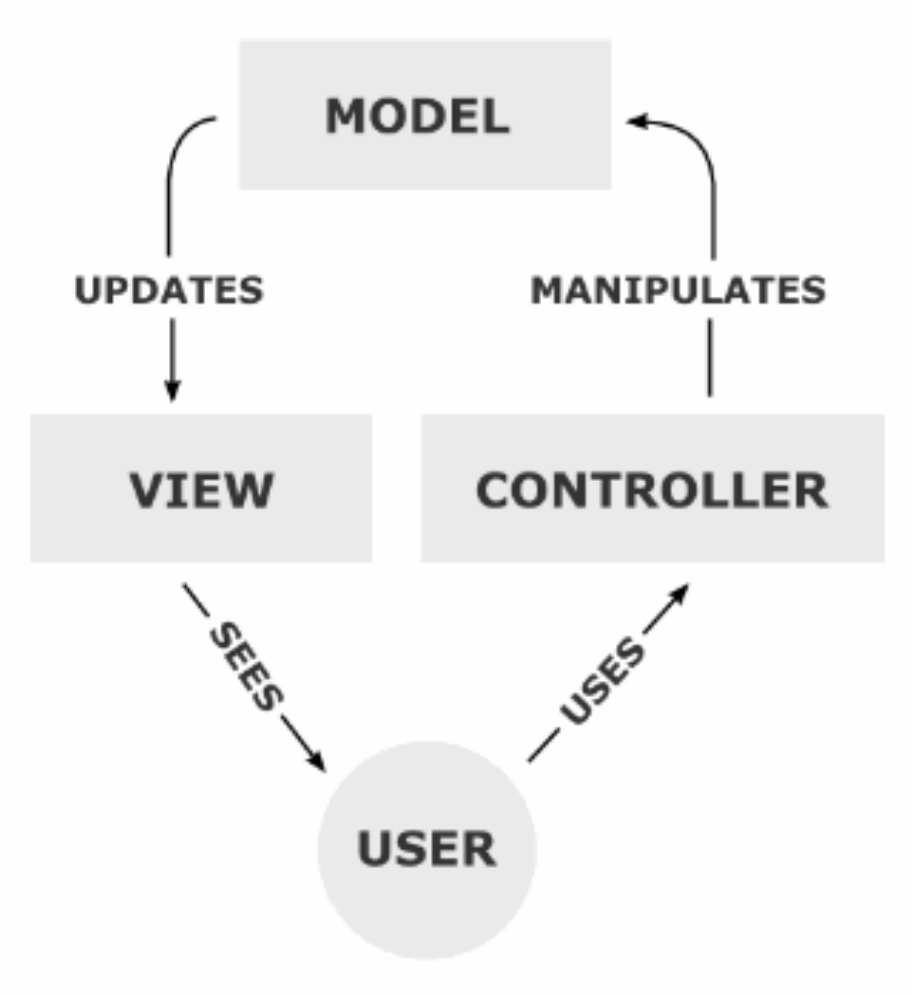
It's not news to you

- The concepts of the three-tiered architecture apply to many design scenarios
  - Keep the presentation separate so it's lightweight, easier to maintain, and can be tested separately
  - Keep the logic separate so you can change the logic as needed without having to change the presentation too much
  - Keep the data separate because you should NEVER build a system based on the current data values

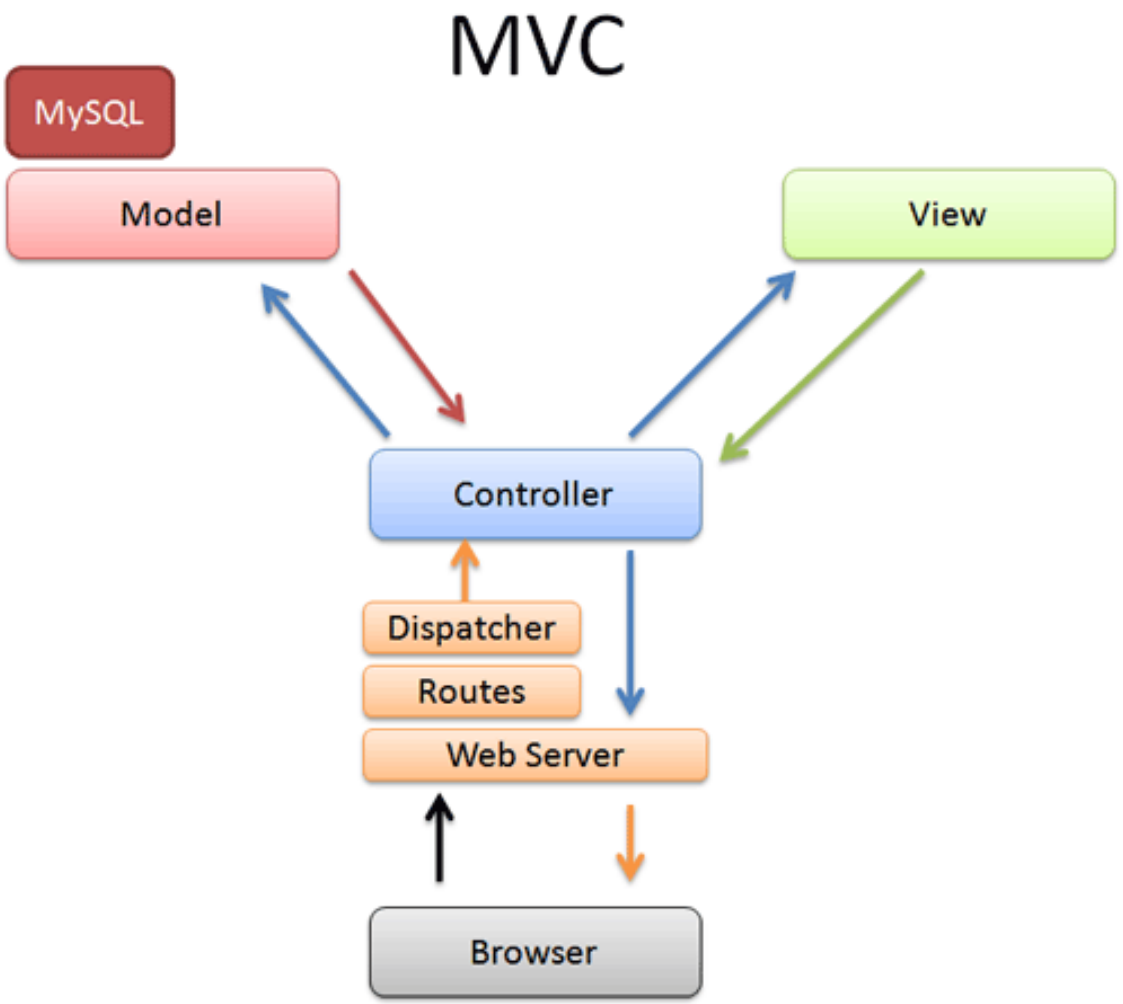
Model-View-Controller

- This is the definition of what MVC is
- The MVC pattern maps:
  - Identifies what the user is asking for
  - Loads a particular resource
  - Displays the pertinent info about that resource back to the user
- To Model, Controller, View (in that order)

MVC



MVC


MVC
MySQL
Model
View
Controller
Dispatcher
Routes
Web Server
Browser

Controller

- The role of the controller is basically traffic cop
- It takes the request from the user and (with the assistance of the server and routing rules) turns it into a method call of sorts
- It finds the appropriate model to load
- It finds the appropriate view to load
- It returns the whole thing back to the user

Model

- The model is the representation of the data
- This may or may not be directly linked to a database (but often is in larger apps)
- A model is often translated directly into a DB table, with the columns as its attributes
- Think “class definition w/ DB backend”
- Often contains relationship rules (a Student has many Classes, for instance)

View

- The closest thing to what you've been dealing with so far is the view
- It's effectively an HTML template that will be populated with the appropriate data from the loaded model
- It often has PHP (or whatever) embedded in it
- All UI components go here

Putting it all Together

- So, if you were building a blog, what might some of the models be?
- What are the resources that should have addresses to them?
- How do they relate to each other?

Non-shocker of the day

- We need to consider the same things for a mobile architecture
- Why? What added concerns do we have when we consider mobile applications?
  - Presentation Layer concerns
  - Logic Layer concerns
  - Data Layer concerns

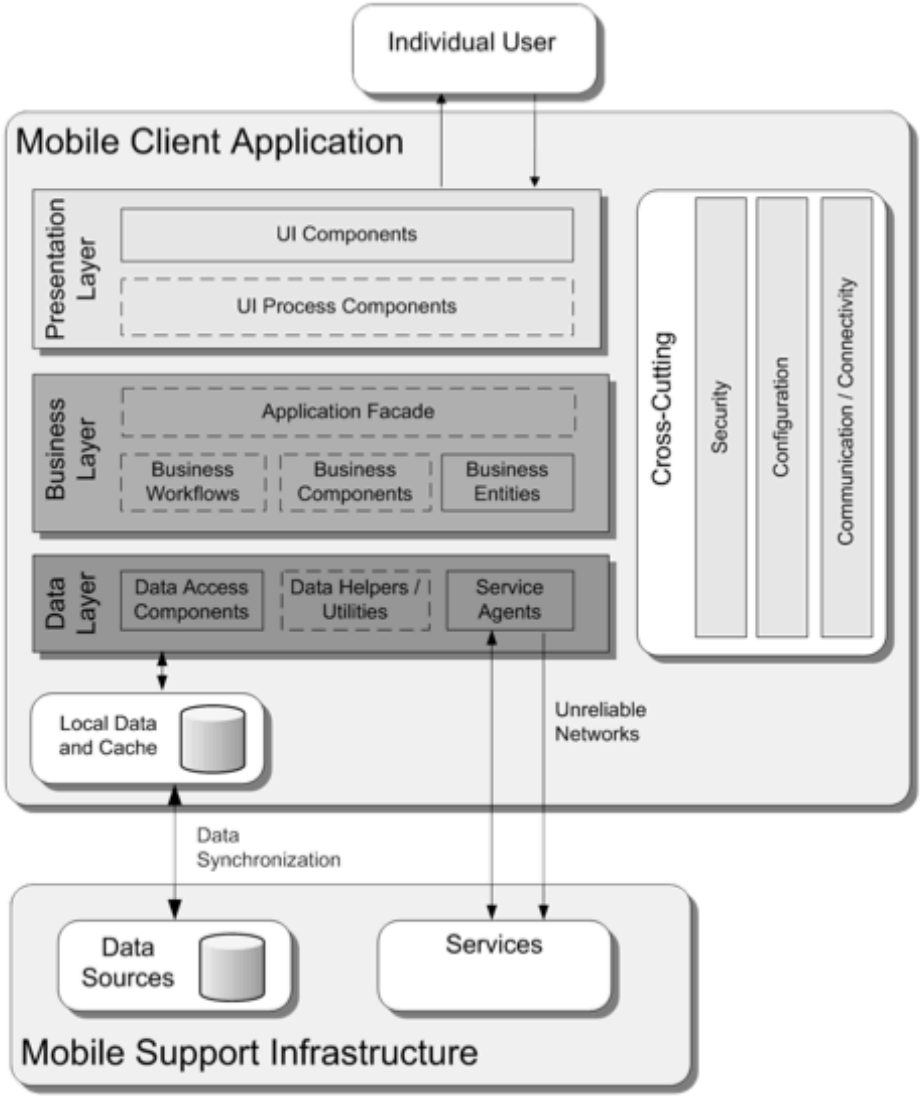
Mobile Architectures

- Rich Mobile Architecture
  - Business and some data services on the phone itself
  - Good for apps that have to run "off the grid"
- Thin Mobile Architecture
  - Most business and all data services on the server
  - Good for apps that require phone services, but does require Internet connectivity
- Rich Internet Application
  - Eschews the use of any phone resources other than a browser
  - Good for apps that can run on anything with a browser

Which are we doing?

- Rich Internet Application
  - Well, it's certainly not this one… why not?
- Rich app or Thin app?
- Do both follow the three-tiered architecture structure? Why or why not?

Rich Mobile Architecture



The Presentation Layer

- Remember: it's a phone!
  - Simple = good
  - People have different sized fingers
  - User actions call functions which execute features; user actions != features
  - Phones can have varying amounts of power/resources
  - Phones can be on or off the cellular grid at any point

Presentation Approach

- Remember your client type
- Determine how you will present data in a coherent, unified method
- Determine how you will guard against untrusted input
- Ensure you have factored out your business logic
- Determine how you will pass data between layers (i.e. how you will call the service, how you will get more info about a building, etc)

The Business Layer

- For the most part, these are your web services and related functionalities
  - Each of your three web services you are using

Business Approach

- Identify FEATURES that will exist at this level
- Build components that support a feature's execution
- Hide implementation details from the presentation layer
- Determine if (how) you will cache information on the device
- Map out use cases

The Data Layer

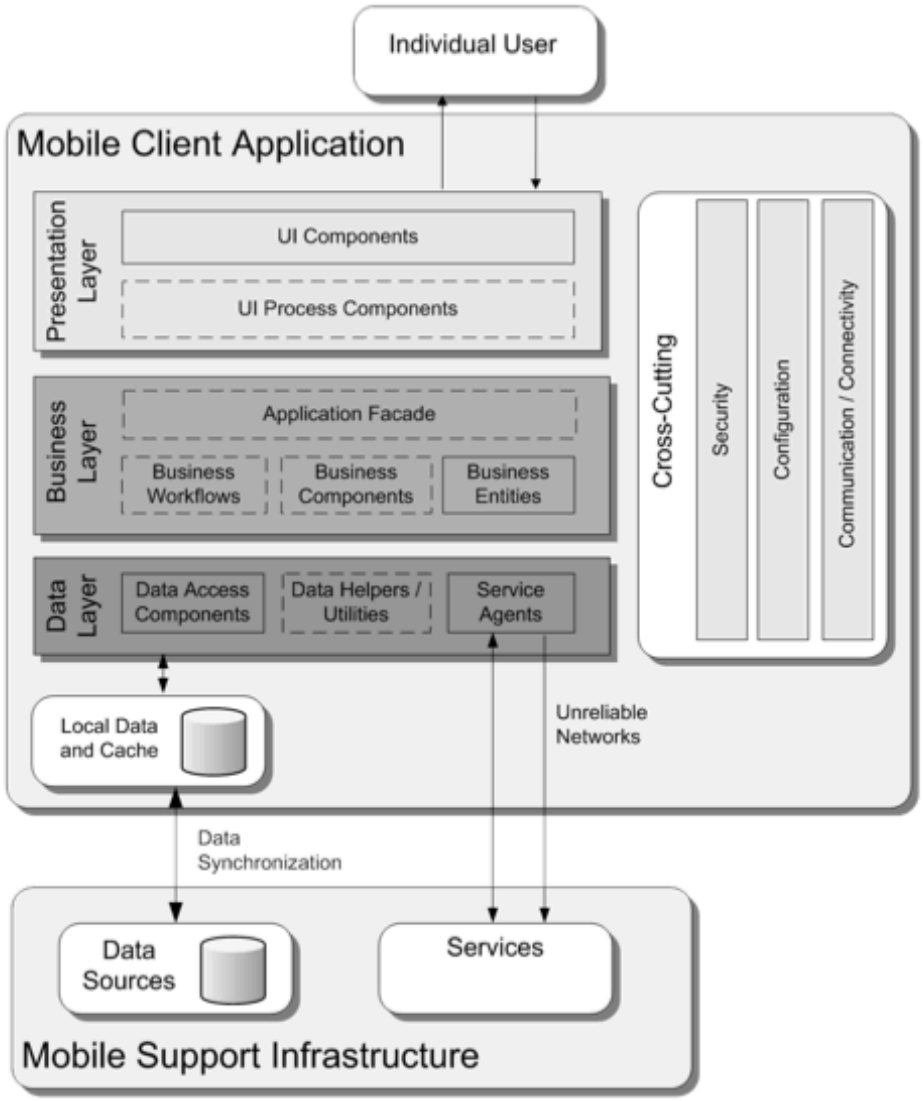
- This will be your module that talks to the database
- Will be intertwined with the business layer to some degree

Data Approach

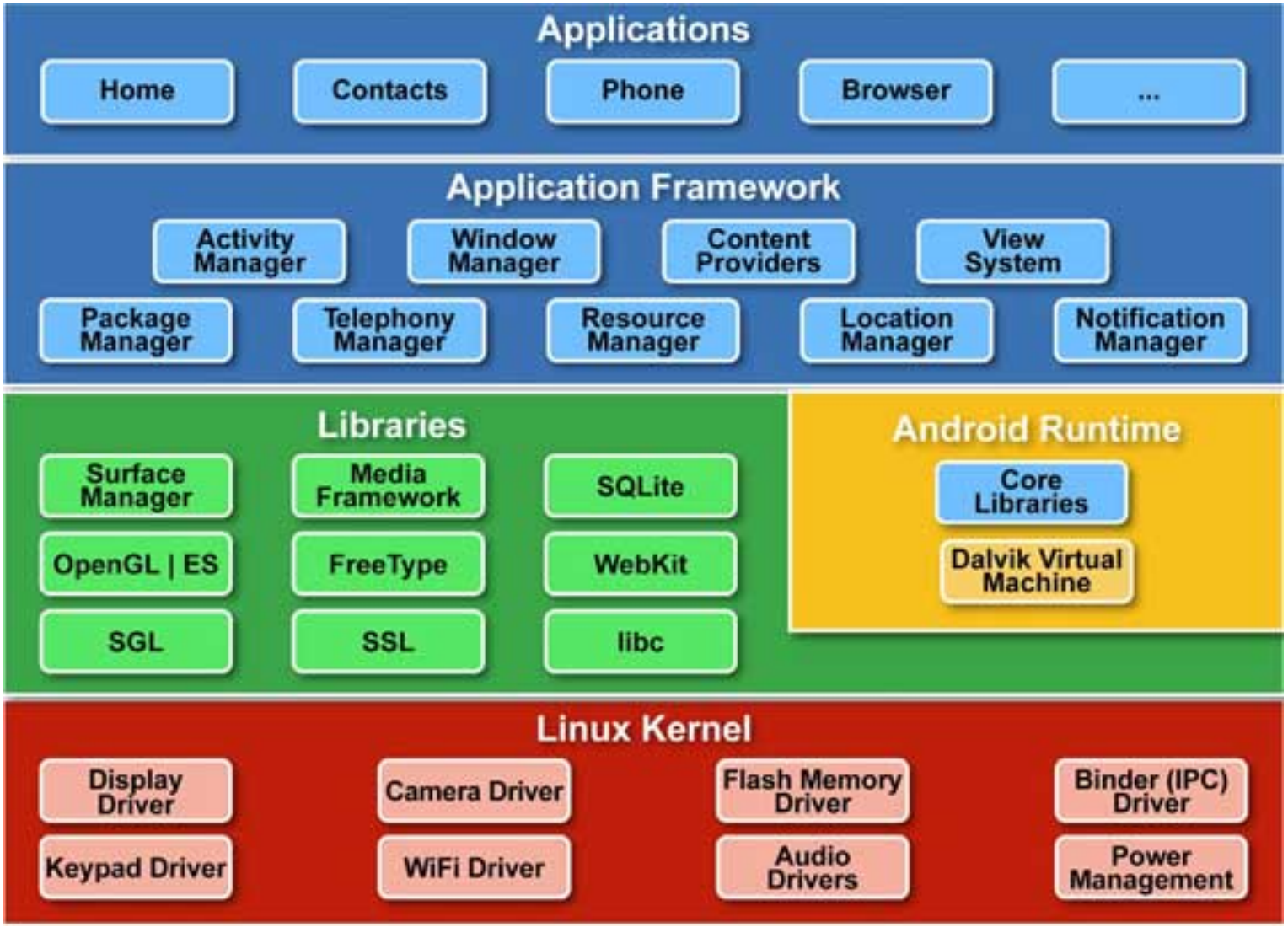
- For each feature, determine what data is required
- Build SQL queries around the features
- Ensure that you are using prepared statements to guard against incorrect data entry (or injection)
- Determine how you will manage connections
- Determine if you will batch up commands into one big command

Your Mobile Architecture

- Your Approach:
- Android/iOS UI which calls…
- … your "business logic" cope
- … that connects to some data store (local or remote)



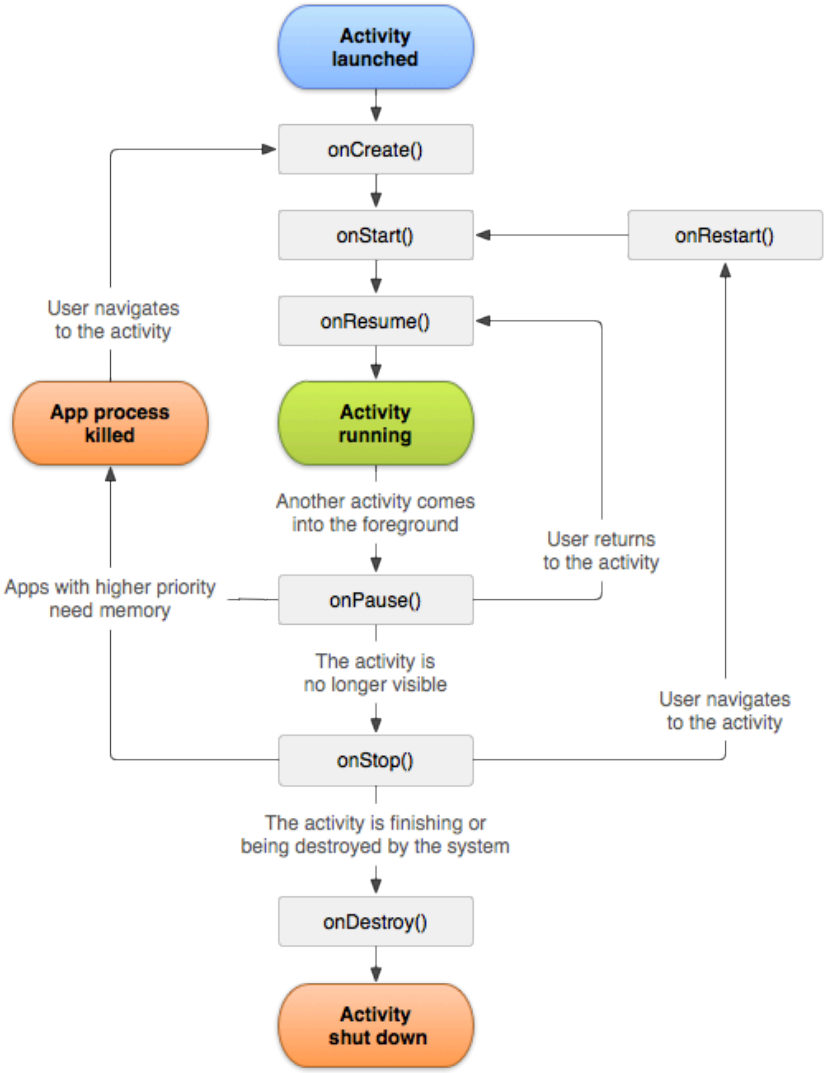
The Android Architecture



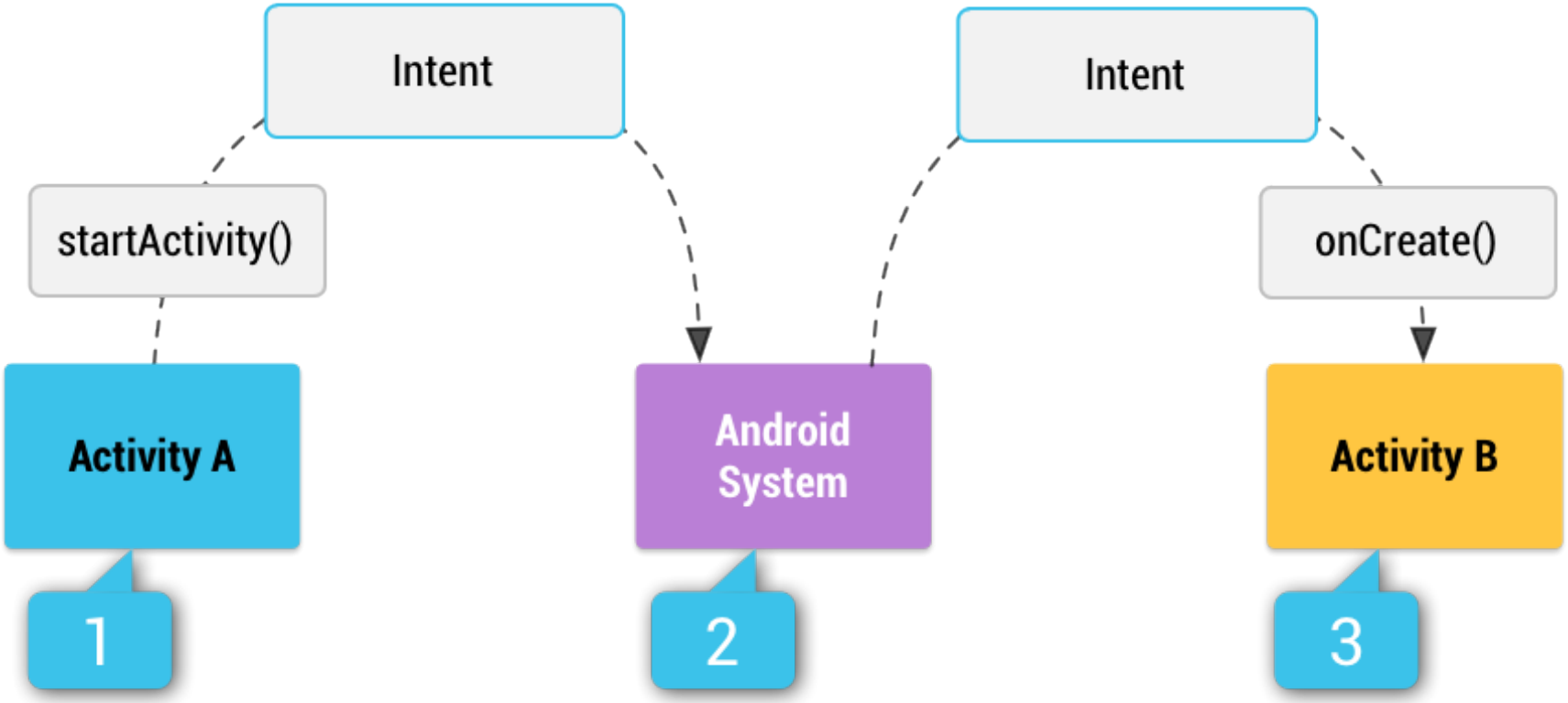
Your Main Components

- Activities – represent a single screen with a UI
- Services – represents a process running in the background
- Content Provider – a link back to the data
- Broadcast Receiver – listens for system-wide messages to respond to
- Application – a set of Activities that make up a cohesive unit
- Intent – a message to be passed

The Activity



The Intent


Intent
Intent
startActivity()
onCreate()
Activity A
Android System
Activity B
1
2
3