Mobile Application Architecture, Implementation for a Local Gas Prices with Community Participation, and Gas Station Location

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Abstract

The objective of this article is to establish the fundamental components of a mobile architecture model that enables the development of a production-graded solution for local (Puerto Rico) gas prices and gas station locations. It will establish this model by identifying each component based on the responsibilities of the system. Components will be identified by looking at the basic needs and desired features of the proposed system, from a high-level point of view. The approach is to match the system expected behavior with technologies that enable those functionalities. Finally, it will consider how the technology developed here can be expanded into other areas/solutions.

Introduction

This article is part of an initiative from the engineering services company *Empresas O'Neill, LLC* to enter the mobile development and application business [1]. This company is currently looking into a local advertisement business model using mobile application. One of the areas of services been considerate by the company is the facilitation of local gas prices with user participation, and near gas station location with minimal list sorting criteria as a value added for the potential mobile app users.

More importantly, the article focuses in encapsulating all the concepts, technology and further information that enables a mobile application architecture.

Problem Statement

As per every application development, this article starts by gathering all the needed capabilities and expected behaviors of the mobile application. This is done by establishing a list of use cases and desired features.

Is expected for that application to:

- Create a basic model for a mobile application infrastructure
- Be a mobile application that can be used from a cellphone
- To obtain near gas stations with single touch
- Get/Submit gas prices for a gas stations
- Sorting gas station per criteria
- Use Google Map integration for GPS
- Provide a space for advertisement
- User identification

All the previously describe capabilities can be assigned to the following components:

- **Mobile Application** - Be a mobile application that can be used from a cellphone, provide a space for advertisement, sorting gas station per criteria, obtain near gas stations with single touch
- **Web Server** - Get/Submit gas prices for a gas stations
- **Third Party Services** - Use Google Map integration for GPS, User identification

With this exercise, the basic model of a mobile infrastructure starts to take shape.

Design

The design is developed by expanding and completing the existing identified components by taking into consideration all technical aspects that are required to build the mobile architecture.

There are three more functionalities that from a technical aspect are required to complete the mobile infrastructure, and those are:

- **Inter Component Communication** - individual components needs to have a common way to communicate with each other.
- **Data Storage** – need to store all prices submitted by the users and provide them back to the users.
- **Security** – the infrastructure needs to provide the basic principle of security: confidentially, integrity and availability (CIA).

From now on all the components are identified from the ground up starting from what will host each component of the mobile infrastructure, up to which technologies are used to implement them.

To run a **web server**, we need to select an Infrastructure-as-a-Service (IaaS) provider [2]. Over this IaaS a **Web Stack** can be installed to support all the Web Server functionalities, **Data Storage**, **Security** and part of the **Inter Component Communication**. Nowadays there are a lots of options as Web Stack, but for this project a Linux-Apache-MySQL-PHP (**LAMP**) Web Stack will be implemented as it covers all the necessities of the mobile architecture in a relative simple way [3].

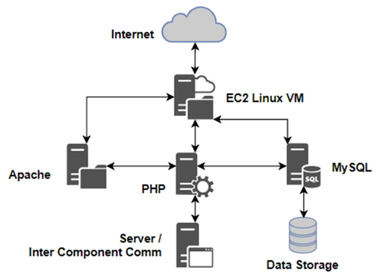

Figure 1
Web Server

The remainder of the responsibility for a mobile architecture falls under the Mobile Client. The **Mobile Client** will provide the users the mobility meaning that the service will be available from anywhere where there is a mobile carrier data signal. For this project it will be used the well-established Android Operative System (OS) environment.

Finally, the **inter component communication** will be implemented using a RESTful API. The **RESTful API** make use of the HTTP technology to establish communication between web and mobile components [4].

Implementation

The **web server** is divided and implemented into the following groups:

- database management
- security and access
- third party services
- support

The **database management** control the access to the database management system and the stored data for internal (mobile app authentication) and external (app data) requests. The **security and access** from the web server point of view are related to getting access to the web server services, and which http protocols are used to communicate securely with the server. Between the application specific functionalities there is the capability to find gas stations near to the user. To accomplish this, the system make use of a **third party service** from Google that enables this functionality at a server level called Places API. Finally, there is a **support** function to calculate distance between the coordinates of the user location and the gas stations near him.

The **RESTAPI** is used in order to enable a standardize way from which two different components can communicate with each other. This communication is done with the use of the http verb POST. The two components that will make used of it in the mobile architecture are the Wed Server and the Mobile Application. The mobile application will always be the requester and the web server will be the responder.
At the web server side, the RESTAPI make available the following endpoints (urls):

- (domain)/get_gas_stations.php
- (domain)/set_gas_prices.php
- (domain)/get_price_ranges.php
- (domain)/get_ads.php

To complete the RESTAPI all the http calls were defined within and Android library. Within this library various java classes were defined to enable communication through the RESTAPI.

The **mobile application** can be divided into two major areas: its **code** and the **graphical user interface** (GUI). Also, the application code can be divided as well into its functional blocks as follow:

- View Controllers: SplashScreen, MainActivity, DetailsPopUp, SortPopUp
- Managers: AdsManager, RegionValidator, GoogleSignInManager,
- Data Modeling: AdItem, Region
- Support: ListAdapter, MyComparator, Locator
- (It also makes use of the Android library mentioned before)

This second part of the mobile application implementation is allocated to illustrate the **GUI**. The application starts with the presentation view which shows the application (Fule73alo) and the company names. After the user passes the location validation where his current location is evaluated against an authorized region, the user is taken to the user principal view the main activity.

Implementation (Cont.)

The main activity offers the following GUI interactions:
(1) Ads – a link related to what is advertise. (2) Long Row Click – showing more detailed information of that gas station and further options. (3) GPS Icon – transition to Google Maps to illustrate the gas station. (4) Drag List Down – request again the list of gas station near. (5) Three Vertical Dots Icon – it present the user an option to logging. (6) Sort Icon – it select a criterion for sorting the presented list.

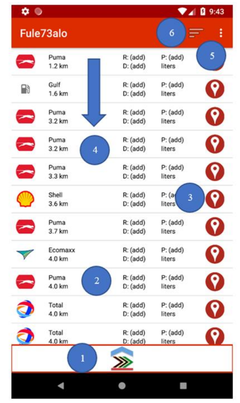

Figure 2
Main Activity

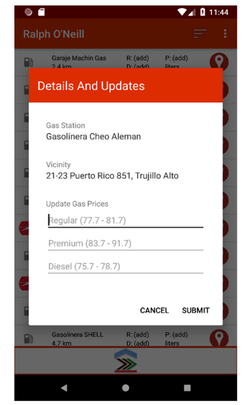

Figure 3
Gas Station details and submit prices

To be able to submit gas prices the user needs to login using its Google account. Once logged in, it can perform a long click over the gas station row for which it wants to provide/update gas prices. On the text input fields, the DACO's defined prices ranges are shown.

Future Work and Conclusion

Looking into the future, other important aspects of a mobile architecture to develop are the **database maintenance** and **expansion of computing resources**. Also, the application can expand its functionality into more complex services like a travel assistance service for finding hotels, car rentals and others.

In conclusion, the information gathered through the design and implementation of the mobile architecture can be used to implement future mobile architecture solutions.

References

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