Super Bowl Internet Database

Inglorious Bashers

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I. Introduction

What is the Super Bowl?

The Super Bowl is the annual championship game of the National Football League (NFL) and takes place on the first Sunday in February of every year. The game features the two best teams from each conference, the American Football Conference and the National Football Conference, who square off to earn the title of “World Champions” while hoisting the famed Lombardi Trophy. The event is watched by millions of Americans each year and has become a *de facto* holiday in the United States. It has become so popular that many of the world’s most successful and well-known companies pay millions of dollars for a thirty second advertising segment during the game.

The Problem

Throughout the web there are plenty of sites which offer information and statistical analysis of Super Bowl history. This includes information about the Super Bowl, information about the team that competed in that super bowl and information about the Most Valuable Player (MVP) of that game. However, these sites fail to provide a cohesive set of data and a positive user experience. For example, many sites will provide the competing teams of each Super Bowl but fail to list the Most Valuable Player of the game. Furthermore, many of these sites have advertisements that distract from the main content provided by the website as well as track visitor's online activity without permission. In addition, some of the data provided by these sites are hidden behind pay walls that force a user to pay for a subscription to the website.

Our Solution

The goal of the Super Bowl Internet Database (SBIDB) is to present our data on Super Bowls in an elegant and accessible manner. The SBIDB features all forty eight Super Bowls with information about the competing teams and MVP. The SBIDB also provides its users with fan generated twitter content focused on the Super Bowl, competing teams, and players. In addition, the SBIDB provides a means of social interaction with NFL players and teams by linking their respective Facebook pages,twitter feeds. We also sought to provide YouTube highlight videos of each Super Bowl, team, and player. Lastly, we provide our data via a RESTful API to any external party under no constraints or conditions.

Architecture

The SBIDB is designed as a server-side Model-View-Controller (MVC) application that utilizes the Django framework to serve HTML5 pages. We use an Object-Relational mapper (ORM) to model and bind our database to objects automatically. Additionally, we provide a RESTful API for our data, which can be consumed by other entities (including us). By using AJAX we can integrate our content with other platforms such as Twitter, Facebook, YouTube, and Google Maps.

UI

Upon navigating to our site, the user arrives at a splash page and is given the opportunity to navigate to one of the main categories of SBIDB via the buttons or search function found inside the navigation bar. Super Bowls, Franchises, and MVPs provide the main content for the site, while the Analytics and API tabs show additional features of the data powering the site. Each respective main content page displays a list of those entities with a general overview and provides the user with the ability to navigate to the individual pages for additional information. The Super Bowl page presents the user a list of all the different Super Bowls to choose from with links to the two teams involved and the MVP. If the user chooses a Super Bowl they will be taken to the Super Bowl game page with the score, a hyperlinked photo to the MVP, an embedded google map of the stadium the game was played in, a highlights youtube video, links to the teams involved, and social media elements. If the user chooses a team page, they will be presented with team logo, social media elements, photos of the Owner, General Manager, and Head Coach, links to former MVPS, and other team information. Lastly, if a user chooses the MVP from either the Super Bowl game page or the team page, they will be taken to that player's page consisting of a photo of the player, personal information, a link to the team he received the MVP with and links to past Super Bowl MVP titles, video highlights, and social media concerning the player.

II. Tools

A wide variety of tools have been utilized in creating this web application due to complexity of this project.

Front End

At its core, the SBIDB is written in HTML utilizing Twitter Bootstrap for CSS styling and JavaScript modules. This gives the unified look and feel of each page in the SBIDB. Every page besides the contacts page is an extension of a root template HTML5 file.

The root template (template.html) includes the boilerplate <!DOCTYPE html>, <html>, <head>, and <body> HTML tags within which every child template (*-template.html) page extends to include their specific content. The root template includes links to our style and script files in the <head> element and the html for the navigation bar (seen at the top of every page) in the body. After the navigation bar begins the django template syntax for block content ({{% block content %}}). This is where html from the child template htmls is inserted. Lastly, every page of SBIDB includes a footer <div> element with group member names.

The children templates (*-template.html) represent each individual type of page of our site (/superbowls/, /superbowls/id, /franchises/, /franchises/id, /mvps/, /mvps/id, /analytics/, api-navigation) and include the logic for django to include content data from the database into the html, delimited by { } or {{ }}.

Every page in the SBIDB references the same stylesheets (*.css) for organizing and formatting html elements in the pages: bootstrap.css and justified-nav.css (located in /static/bootstrap/css/). Bootstrap.css is the entire distribution of Twitter Bootstrap-3.1.1 that includes rules for many of the base elements of the page including paragraphs, headers, rows, tables, and most importantly, the logic that makes these elements resize in response to changing screen size or the type of screen medium (i.e., mobile or desktop). Justified-nav.css includes styles we desired beyond those provided in bootstrap.css, principally, the styling of the navigation bar, and improved dynamic scaling.

A JavaScript file (script.js), linked into every page via the root template, provides logic to correctly style the navigation buttons to provide the appearance that a button is depressed while on that specific page or when a user moves his mouse cursor over a button.

Back End

The SBIDB is served by Heroku, a cloud based web application host recommended to us for its free small scale offerings, which suited our particular needs perfectly.

For persistent data storage during development we used a SQLite database offered within the Django framework. For production deployment we are using a PostgreSQL database, which offers better scalability and search functionality, as well as suits the constraints of Heroku.

Framework

The Django framework is a good choice for our architecture because it provides a server-side MVC framework with a built-in ORM. Another advantage of using Django is that allows us to easily deploy and update our application on the Heroku application platform. Moreover, Python provides many modules and apps which are well suited to working with Django, including django-watson, which we used and modified for searching our database.

Git Workflow

The primary repository for the code is kept at https://github.com/samtipton/cs373-idb. The master branch contains the latest, stable state of the codebase with milestones idb1, idb2 and idb3 marking the release versions of the codebase. Experimental features and changes are stored in other branches until they are ready to be merged into the master branch. Merging into the master branch is done using a Github pull request since it allows us to code review the changes and make adjustments.

Search Functionality

For the search functionality our group used a Django application called Django-Watson which can be found at https://github.com/etianen/django-watson. Django-Watson allows you to index the text in your models easily by calling watson.register(name_of_model) at the bottom of the models.py file. One must sync the database after

Django-Watson is installed and then call python3 manage.py buildwatson in order to create the search index correctly. After indexing the data one can easily search this index by taking the query from the user and calling watson.search(user_query).

III. Models

Django models represent an underlying SQL database in such a way that allows for programmatic access through Python classes. This capability, provided for us by the Django framework through its ORM magic, allows us to concentrate on the manipulation of data and the relationships between them.

The models we chose for our first iteration of SBIDB were: Game, Team, Player, Venue and Roster. Moving forward in iterations, we chose to overhaul our models and changed to a simplified three table structure. We replaced Game with SuperBowl, Team with Franchise and Player with MVP, while discarding the unnecessary Venue and Roster tables. In our third iteration we added the Analytic model to store information describing different queries that can be executed against the database. This additional model allows us to continue to programmatically insert information into the web pages through Django templates, though has no relational ties to the content type models.

Each instance of the SuperBowl model uniquely represents a Super Bowl game by encapsulating the pertinent relative data that we use to create our dynamic web pages. Furthermore, each SuperBowl instance relates to two Franchise instances and one MVP instance. In addition to the general Super

Bowl information, our models fields for various social media IDs, URLs and, latitude and longitude. We use the general Super Bowl information from our database to upload text and images onto our page. The social media IDs are used to embed, via Django templates, external media onto our web pages. YouTube videos are similarly embedded but with a unique URL stored in the entity's corresponding ID field. The latitude and longitude fields are FloatFields and are entered into a JavaScript function that calls the Google Maps JavaScript API v3 to generate the embedded maps on each child web page based on its respective data.

Each instance of the Franchise model uniquely represents the Super Bowl history of a specific organization. We decided that a Franchise model would capture the history of the Super Bowl in a more efficient manner. For example, the Pittsburgh Steelers have appeared in three Super Bowls. In our original design, each team that appeared in the Super Bowl (ie: the '06, '09, '11, Steelers would have all had their separate pages). In our latest design, the pages for the '06, '09, '11 Super Bowls are all be connected to the Pittsburgh Steelers Franchise, resulting in a more efficient display of Super Bowl History. Each instance of a Franchise relates to the players who have won the Super Bowl MVP for that respective franchise. The Franchise model uses the same social media fields as the SuperBowl model, but with a Facebook plug-in to each team. The Facebook plug-in requires a similar ID as our YouTube videos, so this is stored in the models as a Facebook ID.

Each instance of the MVP model uniquely represents the player who won the MVP and encapsulates unique data for that individual. The MVP model used the same social media fields as our Franchise object, where each field was geared towards the player rather than the franchise.

Each instance of the Analytic model uniquely represents a SQL search query and encapsulates data for the search query. The Analytic model contains a name, query, and description attributes. The query attribute provides a SQL ready string that can be used to execute against the database and obtain results at any given time. The name and description attributes also help enrich the API by providing details of the analytic operation.

Relationships

SuperBowl - Franchise

We chose each property of the models to fundamentally describe each model while offering reasonable relationships between them. Each SuperBowl instance is linked to two franchises, the winning franchise and the losing franchise. Both SuperBowl - Franchise relationships follow a many-to-one relationship, where one franchise is related to many Super Bowls. This allows us to keep an extensive network of franchises and the Super Bowls they've played in regardless of the outcome. For example, consider the New York Giants, who have played in two of the last ten Super Bowls. To add the Giants franchise to our database, we need to relate them to both Super Bowls they played in. Thus a many-to-one association is ideal for this relationship. We modeled this relationship using the ForeignKey field. This relationship was included under the SuperBowl model due to the syntax of Django's ForeignKey field.

SuperBowl - MVP

A SuperBowl instance also describes a many-to-one relationship between instances of a SuperBowl and a MVP. Each SuperBowl instance is only linked to one MVP. However, each MVP is linked to many SuperBowl instances. Consider Eli Manning, a two-time Super Bowl MVP. If we wanted to add Eli Manning to our database, we would want to connect him to both Super Bowls where he was crowned as the MVP. Therefore, a many-to-one relationship is ideal for the SuperBowl - MVP relationship. Like the SuperBowl - Franchise relationship, the SuperBowl - MVP relationship was modeled using Django’s ForeignKey field. We put this relationship under the SuperBowl model due to the syntax of Django’s ForeignKey field.

Franchise - MVP

A Franchise instance describes a many-to-many relationship between instances of a Franchise and instances of a MVP. We chose a many-to-many relationship because a player can win multiple MVPs for multiple Franchises. Although this has not happened in the history of the Super Bowl to date, we left it as a many-to-many relationship in case it does happen in the near future. On the other hand, a Franchise can have multiple MVPs depending on its number of Super Bowl appearances. This is more common and seen consistently throughout the history of the Super Bowl.

IV. API

Representational State Transfer (REST) is an architectural pattern for exposing web resources as an Application Programming Interface (API) using the HyperText Transfer Protocol (HTTP). The Django framework provides the ability to implement the API using a single Python file, api.py.

Implementation Patterns

SBIDB has three entities SuperBowl, Franchise and MVP. We provide five types of API operations on these entities using the four HTTP verbs: GET, POST, PUT and DELETE.

For each of the three entities, we provide:

- A GET call to obtain a list of all data for each entry within a single entity.
- A POST call to create a new entry in a single entity.

For each entity, we provide separate calls to access specific entries:

- A GET call to obtain all data for a single entry.
- A PUT call to update data for a single entry.
- A DELETE call to remove a single entry from the parent entity list.

Motivations

The intent is to provide this API such that others can easily and freely access and update the dataset. Using REST allows us to expose our API to a variety of languages and platforms in addition to allowing our web front-end to use it. Additional benefits of building a REST interface over HTTP, we gain the advantage of using existing tools and technologies to easily scale the API to multiple consumers.

Documentation

The documentation for our API can be found at:

http://docs.idb.apiary.io/

Exercising the API

The API implements a HATEOAS-like navigation system using relative URL descriptors for each resource. These links can be followed to explore the API and obtain more information about a response. An example of this feature in action can be seen in the API navigation page. That demo uses AJAX to asynchronously GET results from the API and build tables to display the results. By using the resource links we can further traverse and discover without having the refresh or leave the page. More details can be found in the API documentation.

V. Search Capability

Our goal was to allow a user to enter in the terms he/she wanted to search for, and we would perform a search presenting the AND results (if applicable) followed by the OR results. We took their search terms and stored it as a string. This string was then separated by whitespaces using the python split() function. If there were multiple white spaces, the query of an empty string returned nothing so we didn't have to worry about this case. Once we obtained the string, we performed a search using the function watson.search(user_query), which returns a SearchResult Query object that held the results of the AND search. Once we obtained this query object, we put it in a query list so we could append the OR search results. If an OR search result was necessary, we looped through the individual terms in the argument list and performed a search in a similar manner to the AND search. We then appended these results to our query list. After the query list was complete, we used this list to return an HTTPResponse object that would load the page. Luckily for us, Django-Watson provides custom template tags to use that make displaying search results an easy task.

One important thing to note is that if one wants to take a search query with multiple terms and perform an AND search followed by an OR search, one must be sure to go through results and remove redundancy if using this method. This is accomplished by a simple for loop checking for redundancy.

Additional functions of our search include contextualized results that highlight the user's search terms when the results are returned. Our search also links to the related pages to provide easy navigation for our user.

VI. Testing

We developed a set of unit tests to test each API call from our REST API. Django provides a test module, aptly named django.test to run these tests. Additionally, Django's Client class allows for us to create a local testing database, run a client, and test the calls to the API through the running client. We created helper functions in the test class to handle the basic API calls.

These functions take in the specific type of entity which we are creating the call against, and an optional id for the specific calls, as well as an optional request body for POST and PUT calls. The helper function then will create the actual request through the client module and then return the response back to the calling function in the form of the status code and response payload. The response payload is returned to us as a JSON object which we decode and load using an imported json module. Our API is set to return a response payload with two keys, a boolean of success, as well as a boolean with the data. The data key contains the value for the response content which we check for validity in each test.

Testing the GET call

For our GET requests we use testing helper methods to formulate a get call for each of the entities in our database/models. These helper methods return both the response payload, as well as the response code from the call. Using an external helper method we are able to replicate the expected response from the GET call, and check that against the actual response we received. For GET calls to retrieve an id specific response we use the ‘get’ helper method, but simply provide an id in the call, and follow the same procedure as with the generalized form.

Testing the POST call

POST calls are tested for each entity type in the Django models, and hence actual database. For each POST call we create a request by mimicking the format of an entity in our testing database with which to enter a new entity into the database. We place this request into a Python dictionary and send the request to the 'post' helper method which then makes the call via the client to the API. This again returns the status code as well as response payload which we are able to check for the correctly returned expected values. For POST we expect a status code of 201 for successful cases. The response payload that is received will indicate that a new id and url have been created for this new entity. After checking that the status code and response payload are returned as expected we then check that the newly added entity is present in the testing database. This shows that both the API is returning what we expect as well as modifying the database as it should be.

Testing the PUT call

PUT calls are similar to POST calls by nature, except that we expect to modify the values that currently exist in the database. Following a the pattern of POST, we create a Python dictionary this time with an object that mimics an entity in our current testing database, and we change some values in the fields. When we make the request to the API, we expect to receive back a response payload that shows that we have changed values. A successful POST call will return to us a status code of 200. After this, we again test that the changes to our testing database are evident.

Testing the DELETE call

DELETE calls are created using the delete helper methods in the testing class. We send the id of an entity which we would like to delete, along with its type to the helper method, and expect to receive a success code of 200 as well as a response payload that includes a null value for the data field.

Testing failure cases

We included additional test cases that were set up to deliberately fail. We did this to ensure that our tests were correct. For example, we changed some our content to make sure that our tests were comparing data and not type of the content. This would ensure us that our API calls were performing and responding correctly.

Testing our search capability

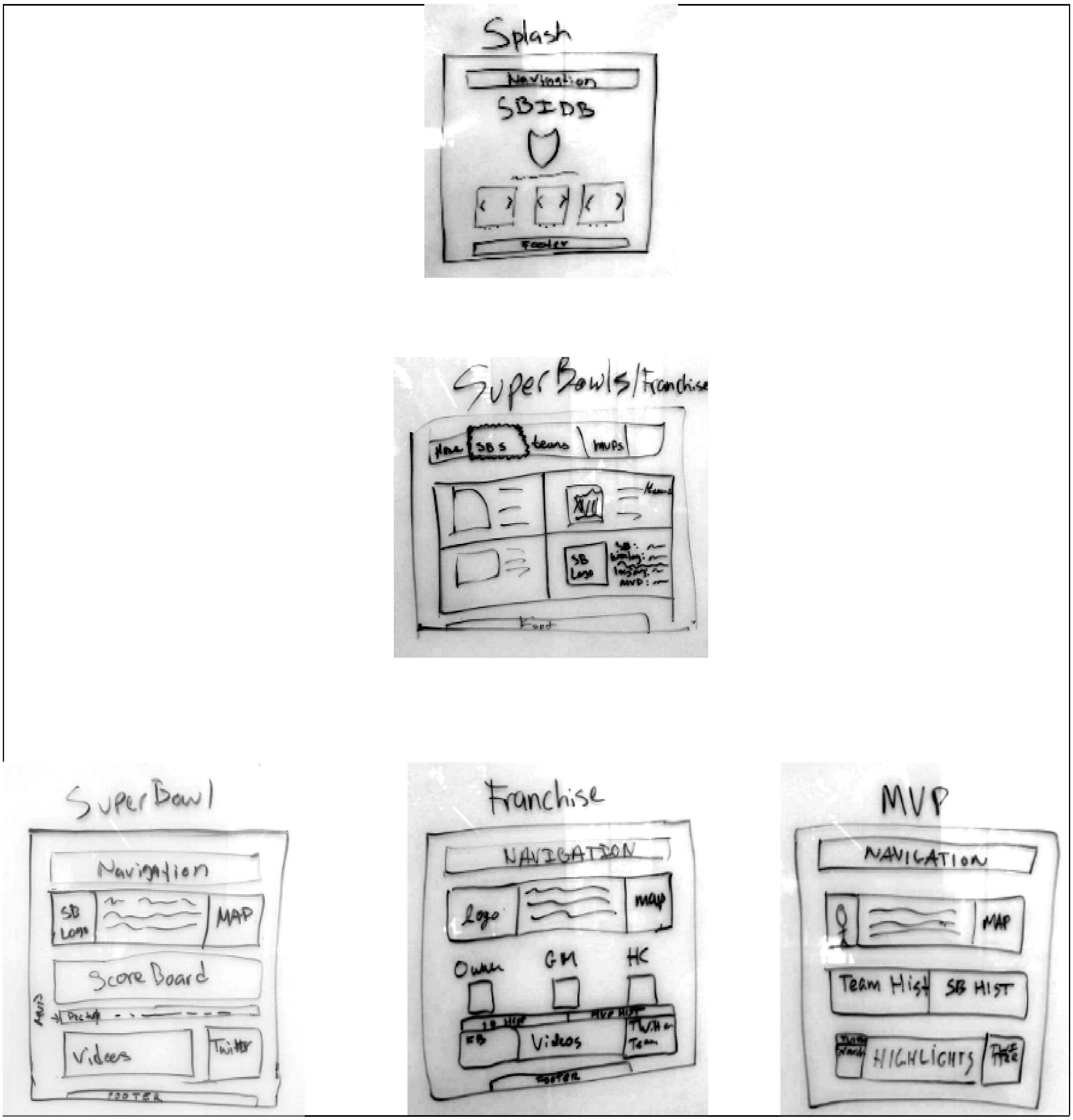
To test our search capability we first created a string to represent a search query. Then the string was fed into the watson search method and the results of the query were tested against known data persisted in our database. These tests ensure watson is finding the correct data in our index

VII. Future Enhancements

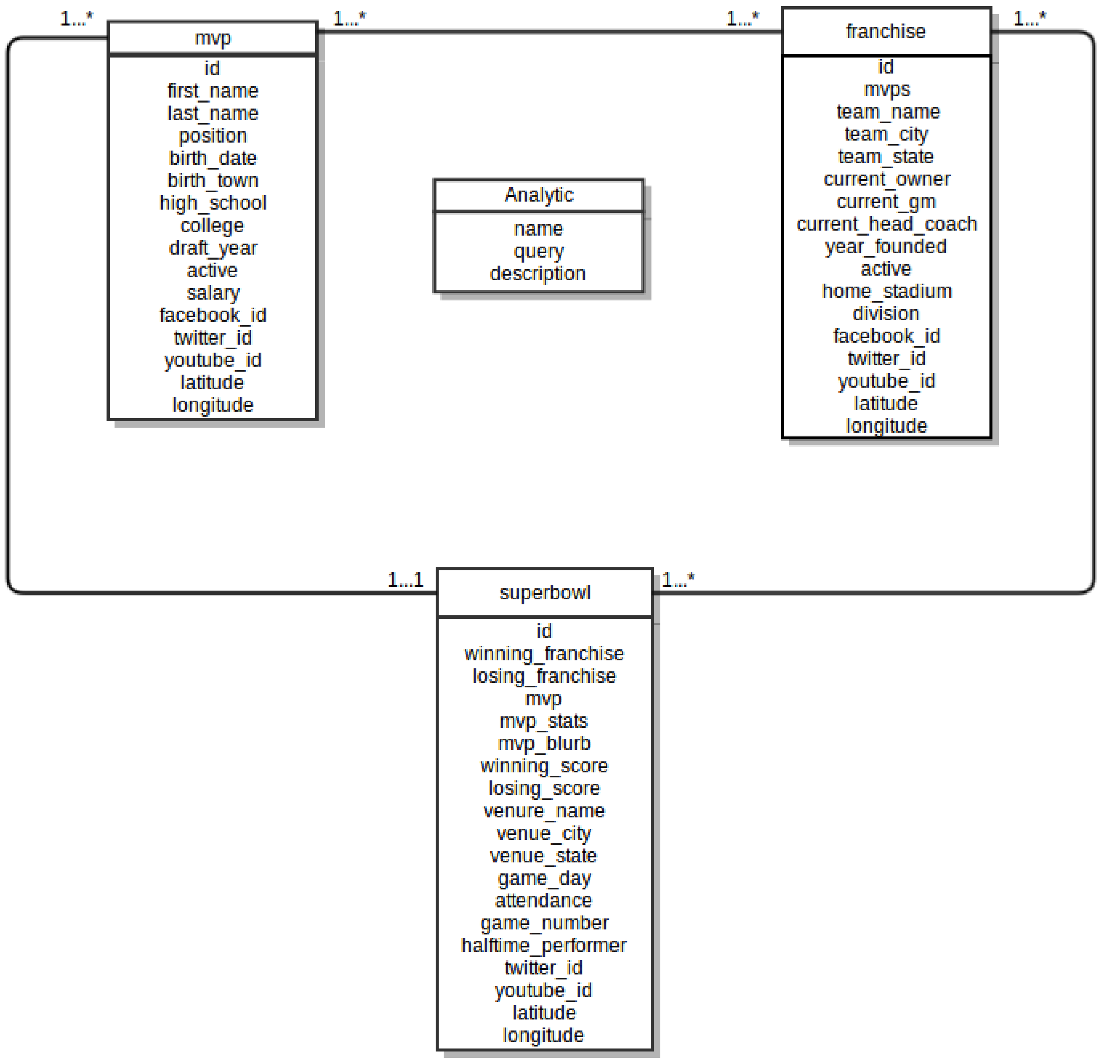
Our site leaves much to be desired for sport junkies. We acknowledge that massive amounts of player and team statistics are generated each season that our database is currently unequipped to handle. Our site should ideally evolve each year as the next Super Bowl is played and be robust enough to answer any statistical question that could be asked about it. In order to provide this capability, we would need introduce many new data models and re-evaluate our relationship topology between those models. These potential models might include a venue model. We found that our data relating to Super Bowl venues was highly repetitive suggesting that it should have its own database model. Additional models we would like to include would be a Stats model for the MVP that would make for interesting queries, and an Entertainer model so we could expand our site to feature information about the world's greatest halftime show. Furthermore, our site is somewhat incomplete in that the only player data associated with each Super Bowl is just about one player: the most valuable player. We would like to expand the MVP model to a player model to hold data about every player on each team which we could associated by a many-to-one relationship to a roster model which holds statistical data about the team as a whole. These enhancements would put a higher strain on the poor soul who is responsible for data entry into the database. An important enhancement at this stage would be to write a reliable data-collection script in the form of a web-crawler, html/xml scraper to intelligently search the web and insert valid data into the correct tables of our database. It would save a lot of time that we spent manually entering our data.

VIII. Reference Images

UI Mockups



UML Class Diagram



Relationship Diagram